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DISSERTATION

ANNUAL CYCLES OF MAJOR IONS, LEVOGLUCOSAN AND CELLULOSE IN ATMOSPHERIC AEROSOL SAMPLES

ausgeführt zum Zwecke der Erlangung des Akademischen Grades eines Doktors der technischen Wissenschaften/der Naturwissenschaften

unter der Leitung von
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am
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KURZFASSUNG

Diese Arbeit beruht auf Ergebnissen, die im Rahmen der Projekte ‚Backgroundmessungen Sonnblick' und ‚CARBOSOL' gewonnen wurden. Beide Forschungsprojekte befaßten sich mit der Untersuchung des atmosphärischen Aerosols.

Im Projekt ‚Backgroundmessungen Sonnblick' wurden am Sonnblick Observatorium (3106 m Seehöhe) die Aerosolkomponenten Sulfat, Nitrat, Oxalat, Chlorid, Ammonium, Kalzium, Magnesium, Natrium und Kalium sowie die Spurengase Schwefeldioxid, Salpetersäure und Ammoniak mit zwei parallel installierten In-Line Filterpacks gemessen. Im Zeitraum von Dezember 2002 bis Oktober 2004 wurden täglich Proben genommen. Das Projekt ‚CARBOSOL' wurde an sechs Meßstellen durchgeführt. In der Zeit von Sommer 2002 bis Herbst 2004 wurden Hi-Vol Wochenproben auf Quarzfaserfiltern gesammelt. Für diese Arbeit wurden nur die Messungen von Cellulose und Levoglucosan ausgewertet. Die Meßstellen können in Bodenstationen und Bergstationen eingeteilt werden. Bodenstationen sind auf den Azoren (maritime Hintergrundstation, 50 m Seehöhe), in Aveiro (Portugal, ländliche Station in Küstennähe, 40 m Seehöhe) und K-Puszta (Ungarn, ländliche Station 136 m Seehöhe). Bergstationen sind Schauinsland (Deutschland, ländliche Station 1205 m Seehöhe), Puy de Dome (Frankreich, kontinentale Hintergrundmeßstelle 1405 m Seehöhe) und Sonnblick (kontinentale Hintergrundmeßstelle, Einfluß der freien Troposphäre, 3106 m Seehöhe).

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Konzentrationswerte auf. Die höchsten Konzentrationswerte für Cellulose wurden an den ländlichen Meßstationen Schauinsland und K-Puszta gemessen. In K-Puszta wurden die höchsten Konzentrationen gemessen und es sind kaum jahreszeitliche Änderungen zu sehen.
Der mittlere Beitrag von Levoglucosan-C und Cellulose-C zu OC (Organischer Kohlenstoff) lag bei 1,2 bis 2,3 % für Levoglucosan und 0,5 bis 2,7 % für Cellulose. Für Levoglucosan wurde der höchste Beitrag auf den Azoren gemessen, obwohl dort die absolut geringsten Konzentrationswerte bestimmt wurden. Die Luft an der maritimen Hintergrundmeßstelle ist sehr sauber. Daher wirkt sich ein möglicher Einfluß einer Holzverbrennung besonders stark aus. Für Cellulose wurde der höchste Beitrag an der kontinentalen Hintergrundmeßstelle Sonnblick gemessen.

Verwendet man Levoglucosan und Cellulose als ‚Makro-Tracer', so kann der Beitrag der Holzverbrennung und Pflanzenabbrieb am Organischen Material einer Aerosolprobe bestimmt werden. Der Beitrag der Holzverbrennung liegt bei 21 bis 39 %, während der Einfluß des Pflanzenabrieb geringer ist und im Bereich von 3 bis 16 % liegt. Wie bereits oben erwähnt wird der stärkste Einfluß der Holzverbrennung auf den Azoren und der des Pflanzanabriebs am Sonnblick bestimmt. In Summe liegt der Beitrag beider Quellen am Organischen Material bei 37 bis 50 %.

Die Bestimmung der Größenverteilung von Cellulose und Levoglucosan wurde an Impaktorproben aus Aveiro vorgenommen und zeigte, daß bei der Mehrheit der Proben der Hauptanteil von Levoglucosan und Cellulose im Größenbereich unter 3 µm a.d. lag.

ABSTRACT

This work contains input from two projects: "Backgroundmeasurements Sonnblick" and "CARBOSOL". Atmospheric aerosol samples were collected for both projects. In "Backgroundmeasurements Sonnblick" the aerosol compounds sulphate, nitrate, oxalate, chloride, ammonium, calcium, magnesium, sodium and potassium as well as the trace gases sulphur dioxide, nitric acid and ammonia were collected with two parallel in-line system filter packs at Sonnblick Observatory (3106 m a.s.l.). Daily samples were collected during the period between December 2002 and October 2004. The "CARBOSOL" project was carried out in six sampling sites across Europe. With a High-Volume sampler, weekly aerosol samples were collected during two years (2002 – 2004) on quartz fiber filters. Here the determination of the organic compounds cellulose and levoglucosan for all the six sampling sites was carried out. The sites can be classified into low elevation and high elevation sampling sites. Low level sampling sites are at Azores (Portugal), maritime background site 50 m a.s.l., at Aveiro (Portugal), rural coastal site with maritime influence at 40 m a.s.l. and K-Puszta (Hungary), rural continental site at 136 m a.s.l. High elevation sampling sites are at Schauinsland (Germany), rural mountain site at 1205m a.s.l., at Puy de Dôme (France), continental background mountain site 1405m a.s.l. and at Sonnblick (Austria), continental background / free tropospheric site at 3106m a.s.l.

Aerosol compounds as well as ammonia and acid nitric (collected within "Backgroundmeasuraments Sonnblick") show pronounced annual cycles with high values in summer and low in winter. That is typical for a high mountain sampling site such as Sonnblick. For sulphur dioxide the situation was different and no variation was observed comparing summer and winter values. The concentration values for oxalate are much lower (approx. one order of magnitude) than the major inorganic aerosol compounds, but they still show a very pronounced annual cycle.

For aerosol compounds as nitrate, sulphate and ammonia the average concentration values of the whole period range between 5,5 and 15 nmol/m^3 and for the trace gases nitric acid, sulphur dioxide and ammonium 2,9 and 19 nmol/m^3.

Concerning "CARBOSOL" the average concentrations of the whole period for the six sampling sites in Europe range between 14 and 273 ng/m^3 for levoglucosan and between

13,5 and 133 ng/m³ for cellulose. The highest values for levoglucosan were obtained at the low elevation sites, Aveiro and K-Puszta. Especially Aveiro presents very high concentrations during the winter seasons. The highest values for cellulose were determined at the rural sampling sites, Schauinsland and K-Puszta. K-Puszta, presents the highest concentrations without very high differences between summer and winter. The average contribution values of levoglucosan-C and cellulose-C to OC (Organic Carbon) range between 1,2 and 2,3 % for levoglucosan and 0,5 and 2,7 % for cellulose. For levoglucosan the highest contribution corresponds for Azores, where the lowest concentration values were determined. As here the air is very clean and there is no influence of other sources of pollutes. For cellulose the highest contribution was obtained at Sonnblick, the other background site.

Using levoglucosan and cellulose as macrotracers for "wood smoke" and "plant debris" it is possible to calculate the contribution to OM. The contribution of wood smoke to OM ranges between 21 and 39 %, while the contribution of plant debris to OM is between 3 and 16 %. The highest percentage for wood smoke is obtained at Azores due to the same reasons as mentioned before; for plant debris it is Sonnblick. The contribution of both of these sources to OM range between 37 and 50 %.

Furthermore the size distributions (10-7,2 μm, 7,2-3,0μm, 3,0-1,5μm, 1,5-0,95μm, 0,95-0,49μm, <0,49μm) of cellulose, levoglucosan were determined with a cascade impactor at AVE. In most of the samples, the major fraction of levoglucosan and cellulose was associated with the fine particle fraction (< 3μm a.d.).

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1. INTRODUCCION

The seasonal concentrations and the vertical distribution of atmospheric aerosols and trace gases depend on the strength and variability of their emission sources, their air chemistry behaviour and meteorological conditions. To get information about the vertical distribution of air constituents sampling sites at higher elevations are needed in addition to ground based measeurements. These sampling platforms can either be airborne (e.g. airplane measurements) or they can be situated at mountain slopes or even mountain tops. The Sonnblick Observatory is located in the Austrian Alps at an elevation of 3106 m and provides such a sampling platform. During the last three years two projects called 'Backgroundmeasurements Sonnblick' and 'CARBOSOL' investigated the seasonalities of inorganic and organic air constituents at Sonnblick.

Sampling within '**Backgroundmeasurements Sonnblick**' was carried out at the Sonnblick only and comprised the aerosol compounds sulphate, nitrate, oxalate, chloride, ammonium, calcium, magnesium, sodium and potassium as well as the trace gases sulphur dioxide, nitric acids and ammonia.

Large quantities of sulphur dioxide enter the atmosphere each year from anthropogenic sources, mainly the combustion of fossil fuels and the smelting of metals. Sulphur dioxide indisputably ranks as a prominent pollutant, although emissions have been reduced drastically during the last decades. Research of the past years dealing with atmospheric sulphur has concentrated on problems such as the dispersal of sulphur dioxide from industrial emission sources (e.g. power stations) and urban centres, its conversion to sulphuric acid, the formation of sulphate aerosols, and the deposition of sulphate and sulphur dioxide at the ground surface. Natural sources of atmospheric sulphur include volcanic emissions of sulphur dioxide and reduced sulphur compounds such as H_2S), aeolian generation of particulate sulphate (e.g. in the form of sea salt), and the emanation of reduced sulphur compounds from the biosphere.

Atmospheric nitric acid is the oxidation product of NO_x and is therefore found in areas with influence of high emissions of NO_x. The main sources of NO_x are combustion processes which transform nitrogen from air and fuel into nitrogen oxides. A natural source for the formation of nitric oxides is lightning (sparkle discharges). By this process nitrogen oxides and nitric acid are not only formed at ground level, but also in the free troposphere. Gaseous nitric acid is in equilibrium with particulate nitrate. The equilibrium between particulate nitrate and nitric acid depends on the composition of the gas phase and aerosols, as well as aerosol water content and the temperature. Aerosol nitrate is formed from nitric acid, which can dissolve directly in an aqueous aerosol solution or react with ammonia to form particulate ammonium nitrate

Ammonia is the most abundant alkaline gas in the atmosphere. The significant sources of NH_3 are animal waste, ammonification of humus followed by emissions from soils, losses of NH_3-based fertilizers from soils and industrial emissions. The trace gas ammonia reacts to particulate ammonium with nitric acid and sulphur dioxide. The ammonium ion is an important component of the continental troposphere aerosols. Because ammonia is readily absorbed by surfaces such as water and soil, its residence time in the lower atmosphere is quite short. Wet and dry depositions of NH_3 are the main atmospheric removal mechanisms for NH_3. In fact the deposition of atmospheric NH_3 and NH_4^+ may represent an important nutrient to the biosphere in some areas.

While nitrate, sulphate and ammonium were generated predominantly in the atmosphere by gas-particle reaction, the other named aerosol compounds, aside from oxalate, were primarly emitted. They can be formed by erosion processes from stones and ground material (mineral aerosol), but also by combustion process. Oxalate and oxalic acid can be formed by both pathways, by atmospheric reaction from organic precursors or be direct emission during combustion processes.

The project had its main focus on the determination of these compounds since:

- they are precursor substances of "acid rain"
- they are cloud condensation nuclei, which influence cloud formation
- the big part of inorganic and soluble in water aerosols is collected with the determination of nitrate, sulphate and ammonium.

The experimental work for the project '**CARBOSOL**: Present and retrospective state of organics versus inorganic aerosol over Europe, implications for climate' was not only performed at Sonnblick, but at six different sites across Europe. The sites can be classified into low level and high level sampling sites. Low level sampling sites are at Azores (Portugal), maritime background site 50 m a.s.l., at Aveiro (Portugal), rural coastal site with maritime influence at 40 m a.s.l. and K-Pusta (Hungary), rural continental site at 136 m a.s.l. High level sampling sites are at Schauinsland (Germany), rural mountain site at 1205m a.s.l., at Puy de Dôme (France), continental background mountain site 1405m a.s.l. and at Sonnblick (Austria), continental background / free tropospheric site at 3106m a.s.l. Here the determination of the organic compounds cellulose and levoglucosan is described for all the six sampling sites over Europe.

Several studies have been conducted to identify and quantify individual organic species in atmospheric aerosols. Generally these studies concentrated on the soluble fraction of the organic aerosol. Rogge et al. (1993a) have shown that about 30-50% of the organic fraction of fine particulate urban aerosol comprises insoluble organic species. Likely candidates for this group are polymeric substances either primary or secondary and of anthropogenic or biogenic origin. The most frequently occurring biopolymer in terrestrial environments is cellulose, as green plants contain around 50% of dry weight cellulose in leaves (Butler and Baily, 1973). Due to the seasonal cycles of the canopies of decidous trees in temperate regions and the decay processes of the leaf litter, large fluxes of the decay products to the atmosphere are likely to occur (Brimlecombe, 1986).

Cellulose in green plants occurs as a macromolecule with a polymerisation degree generally in the range of 300-3000; in some cases, e.g. in fibres of cotton seeds up to 15,000 (Kürschner, 1966). The cellulose molecules are formed from D-glucose units in β-

(1,4)-glucosidic bonding. The linear macromolecules form micelles via hydrogen bonding, which then associate to micro fibrils (Denffer, 1978). In many plant seeds the visible white fibres are pure cellulose. This type of cellulose is referred to as "free cellulose", as it is directly accessible to saccharification. The cellulose micelles in leaves and wooden material are to a certain extent encapsulated by lignin and in bark also by suberin. Lignin, a mixed polymer of phenylpropane, adds pressure strength of the fibrous cellulose (Kirk and Obst, 1988). Green leaves and wooden parts of plants contain free as well as encapsulated cellulose.

In leaves of terrestrial plants the content of cellulose is around 50%, while lignin amounts to <20% and hemicelluloses 20-30% (Butler and Bailey, 1973). As we assume that the major fraction of cellulose in continental aerosol originates from decomposition processes of leaves, the portion of plant debris in aerosols has been proposed (Kunit and Puxbaum, 1996) to be estimated according to the concentration of cellulose by:

"plant debris" = 2* cellulose

Plant debris appears to be an important contributor to OC in atmospheric aerosols (Kunit and Puxbaum, 1996).

Traditionally, fossil charcoal and black (soot) carbon, which are carbonaceous residues derived from the incomplete combustion of plant tissues, are the indicators used most frequently to trace forest fires over geological time (e.g., Schmidt and Noack, 2000). However, Elias and Simoneit, 2000 report that levoglucosan (1,6-anhydro-β-D-glucopyranose) can also be used as a specific molecular indicator to trace biomass combustion in sediments.

Levoglucosan is a dehydrated glucose containing an intramolecular glycoside bond. This monosaccharide derivative is formed from the thermal breakdown of cellulose during combustion (pyrolysis). It is emitted in fine smoke particulate matter and can consequently be utilized as a specific and general tracer for the presence of emissions from this source in atmospheric particulate matter (Simoneit et al., 1999).

Cellulose decomposes on heating or on exposures to an ignition source by two alternative pathways. The first, which dominates at temperatures < 300°C, involves depolymerization, water elimination, fragmentation and oxidation leading finally to char formation. The second pathway occurs at temperatures > 300°C and involves bond cleavage by transglycosylation, fission and disproportionation reactions yielding tarry anhydrosugars and volatile products. This pathway (summarized in Fig. 1) gives rise to the source specific molecular traces, i.e., mainly the 1,6-anhydride of glucose called levoglucosan and minor amounts of other monosaccharide dehydration derivatives (e.g. galactosan, mannosan).

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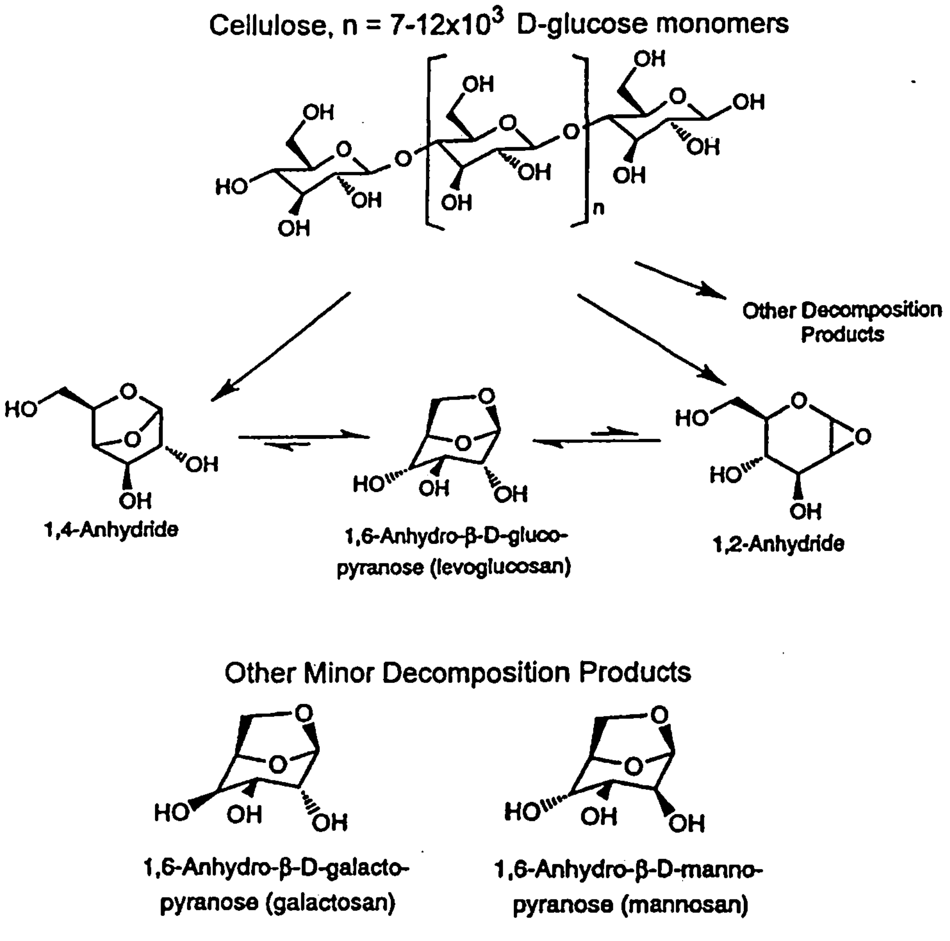


Fig 1,#: Schematic showing the major decomposition products during the pyrolisis (T > 300°C) of cellulose and hemicellulose (adapted from shafizadeh, 1984).

Levoglucosan is accompanied by other minor stereoisomeric monosaccharide anhydrides in atmospheric aerosols, with mannosan and galactosan. These compounds results from the pyrolisis of hemicellulose, although the emitted amounts are substantially lower than those of levoglucosan. This is consistent with the lower content of hemicellulose in wood as well as with the lower content of mannose and galactose as compared with glucose residues in hemicelluloses (Shafizadek et al. 1984)

The determination of the concentration values of cellulose and levoglucosan in combination with the overall sampling programm of the EU-project 'CARBOSOL' had its main focus on:

- the investigation of the seasonal cycles at different sampling sites across Europe
- the determination of the contribution of the macro-tracers cellulose and levoglucosan to the organic matter of atmospheric aerosols and their temporal and spatial variations
- to provide a basis for further evaluations relating aerosol concentrations to concentrations in precipitation samples

2. EXPERIMENTAL

2.1 Sites

The experimental work for the project "Backgroundmessungen Sonnblick" was performed at the Sonnblick Observatory (SBO). The experimental work for the project "CARBOSOL" was performed in six sampling sites across Europe. Ones was Sonnblick, already described, and the other sites were at Azores (Portugal), Background Oceanic 50m a.s.l., at Aveiro (Portugal), Rural Coastal Maritime 40m a.s.l., and K-Pusta (Hungary), Continental Rural 136m a.s.l., at Shauinsland (Germany), Rural Mountain 1205m a.s.l. and at Puy de Dôme (France), Continental Background Mountain 1405m a.s.l.

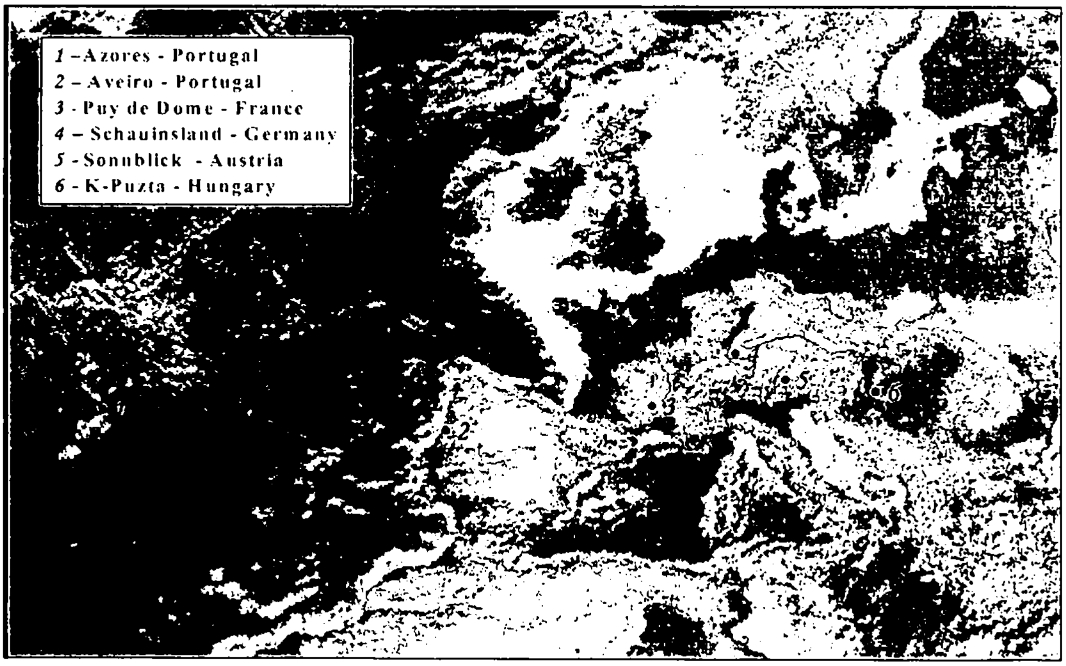


Fig. 2.1. Situation of the six sampling sites over Europe

Austrian site

The SBO is located at the summit of Mt. Sonnblick at an altitude of 3106 m. Mt. Sonnblick is situated in the main ridge of the Austrian Alps (Hohe Tauern, 12°57'E, 47°03'N). As Mt. Sonnblick is among the highest peaks in the area, it is exposed to air masses from all directions. The Observatory is surrounded by large glacier fields. Towards the northeast, a steep wall descends over 800 m down to a sparsely populated valley. There are no noticeable local emission sources. Since the Observatory is supplied with electricity, it has no local sources of exhaust fumes. Hence the Observatory has the ideal characteristics of a high alpine background station for air chemistry measurements. The SBO is situated in the centre of Europe, surrounded by regions with large emission densities at distances of a few hundred kilometres. The site was operated by ZAMG and TU Vienna.

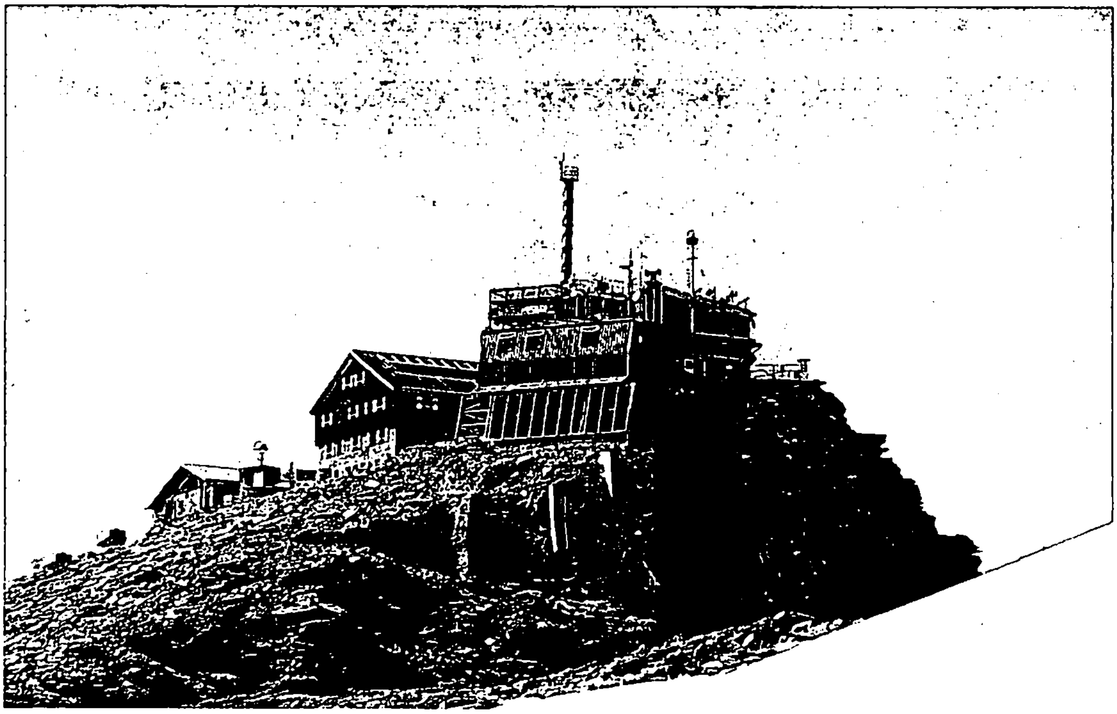


Fig. 2.2. Sonnblick Observatory (Austria)

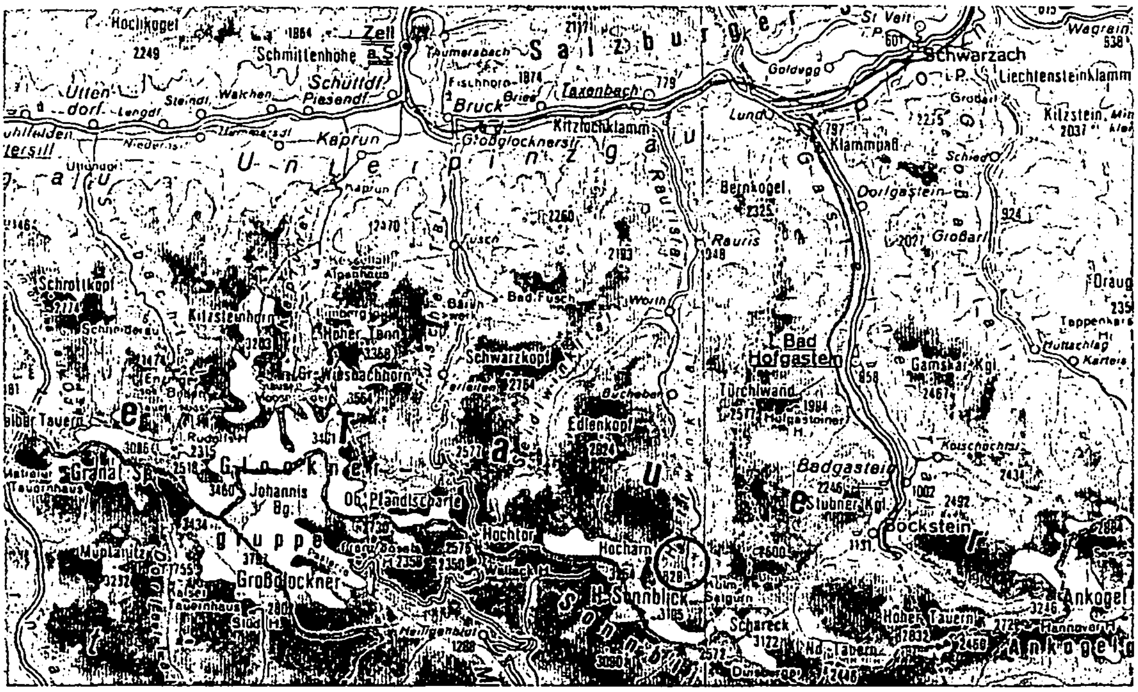


Fig. 2.3. Situation of sampling site Sonnblick (Austria)

Portugal sites

The experimental work for the CARBOSOL PROJECT was preformed at Moitinhos – Ílhavo (40° 34’37’’N; 8°39’29’’W) and at Terceira Island Azores (38° 38’N;27°02’W), Portugal. These sites were prepared specially for this project. They represent a rural coastal maritime atmosphere (Moitinhos) and a background oceanic atmosphere (Azores).

The sampling site at Moitinhos (AVE) was located, near a small village and was surrounded by agricultural fields (mainly maize culture) and forested area (mainly pine and eucalyptus). The area is influenced by local sources (eg. wood- burning for heating purposes, agricultural activities, vehicular exhaust) and distant sources (eg. Aveiro is located 11 km North of the sampling site).

The sampling site at Azores (AZO) was located near a high cliff and was surrounded by grass fields. The area has limited human activity and has a great ocean influence.

The sites were operated at Aveiro and Azores by University of Aveiro and University of Azores, respectively.

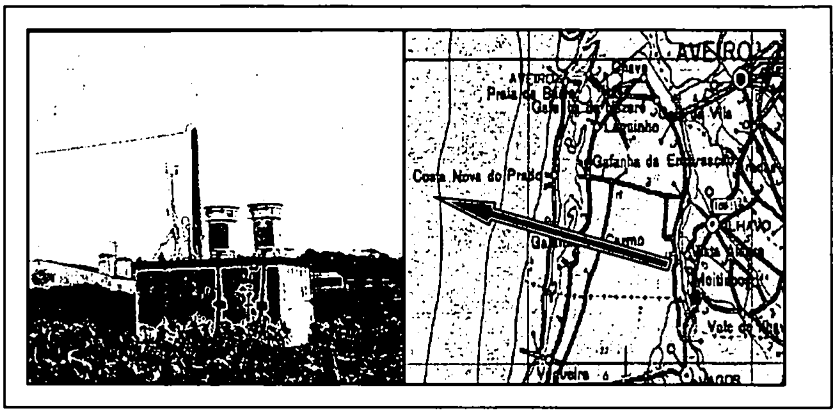
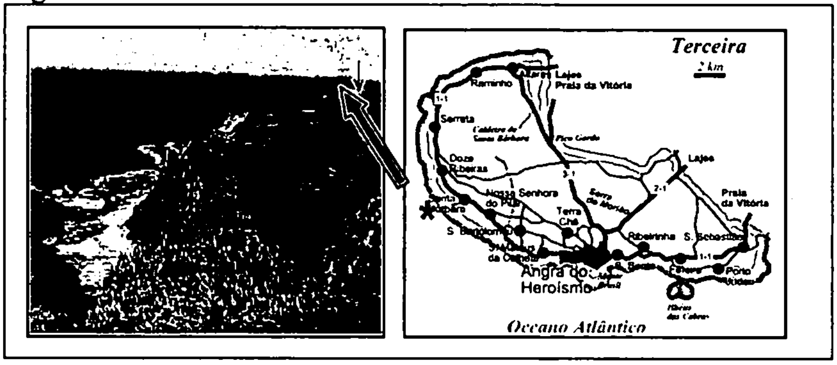


Fig. 2.4. Moitinhos Site



Figures 2.5. Terceira Island Site

France site

Puy de Dome (PDD) is situated in the Massif central in france (45° 75' N, 3° E). Its height is 1450m a.s.l. The station is an Observatory which is attached to the "Observatoir du Physique du Globe de Clermont Ferrand".

The Puy de Dom is the highest moutain in the Massif Central. Since the Observatory is supplied with electricity it has no local sources of exhaust fumes. The surrounding of PDD is rural aerea with forest; the biggest city is Clermont Ferrans at a distance of about 20 km east to the side. Meteorological conditions consist often in westerly flows especially in winter.

The site was operated by "Laboratoire de Glaciologie et Géophysique de l'Environnement in Grenoble.

Germany site

The German sampling site (SIL) is a mountain sampling site located at the Schauinsland (47° 55' N, 7° 55' E) at 1205 m above sea level. The station is operated all year round by the German Umweltbundesamt (http://www.umweltbundesamt.de/).

The station is located on the highest most westerly mountain of the Schwarzwald. The surroundings of the station consist of forest (mostly coniferous forest), pastures and farmland. The station is located approximately 10 km southeast of Freiburg (approx. 200.000 inhabitants) and the Oberreihngraben (300 m above sea level). During stationary temperature inversions quite often prevail around the site with fog and low temperatures in the Oberrheingraben and Freiburg and sun at the mountain site. Thus boundary layer air from the urban regions is not transported to the site by convection as usual in summer.

The High Volume Sampler operated within this Projekt by the University of Heidelberg is located close to the main building (distance approx. 10 m). The sampling height is at 3,7 m, the immediate vincinity of the sampler is grassland. Quarz fiber filters were changed every Thursday, wrapped in aluminium foil and stored in the refrigerator until they were sent to Heidelberg. In Heidelberg they were stored in the deep freezer.

Hungary site

K-Puszta (KPZ) sampling site is situated in a mixed forest clearing on the Great Hungary Plain (46° 58' N, 19° 33' E) about 80 Km SE of Budapest. Its height is 136 m a.s.l. Because of the lack of nearby anthropogenic pollution sources, the location is representative of a continental, rural background air. The site was operated by University of Veszprem.

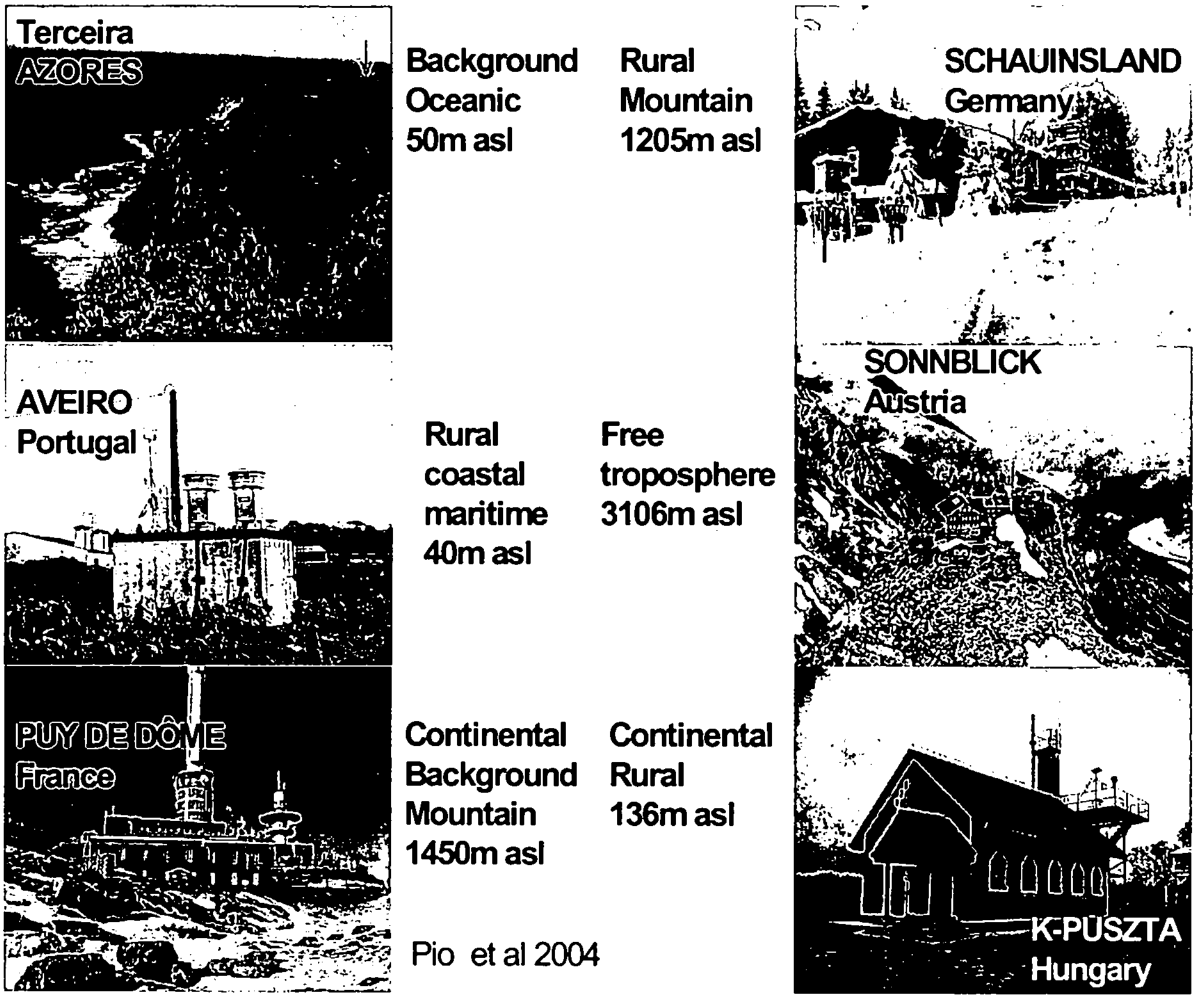


Fig. 2.5. The six sampling sites of "Carbosol" Project

2.2 Sampling system

2.2.1 Filter pack

The filter pack sampling within the project "Background measurements Sonnblick" comprised sulphate, ammonium, nitrate, oxalate, calcium, sodium, potassium, chloride, dioxide sulphur, nitric acid and ammonia. Two parallel In-Line filter packs (A & B) were used. Filter holders were made from polycarbonate and were supplied by NILU (Norwegian Institute for Air Research). Filter pack "A" contains a teflon filter and an oxalic acid filter. Filter pack "B" contains a teflon filter, a nylon filter and a potassium hydroxide filter. Table 2.1 gives a summary description about the used filters as well as the compounds determinate and analysis method. All filters had a diameter of 47 mm.

Table 2.1: Summary description of In-Line filter-packs

Filter	manufacturer, details	Coating	Compounds	Elution solution	Analysis
Teflon	Pall Zeflour 1µm	----	Aerosol	Ethanol, H_2O dest.	IC: Cl,NO_3, SO_4, Na, NH_4, K, Ca, Oxalat
Nylon	Pall Nylasorb 1µm	----	HNO_3, SO_2	H_2O_2, $Na_2CO_3/NaHCO_3$	IC: NO_3, SO_4
KOH	Schleicher&Schüll Schwarzband	KOH	SO_2	H_2O_2, H_2O dest.	IC: SO_4
Oxalic acid	Schleicher&Schüll Schwarzband	Oxalic acid Glycerin	NH_3	H_2O dest.	IC: NH_4

IC: Ion Chromatography

The filter pack method used was based on the system described by Kasper (1994). It is a version of the method by Fellinger (1991). They used a filter pack consisting of a PTFE front filter, a nylon filter and a potassium carbonate impregnated filter. In addition, there was a fourth filter, which was coated with oxalic acid/glycerine for the collection of gaseous ammonia (Wiebe et al. 1990, Williams et al. 1992). The addition of glycerine to the coating solution prevented the total drying up of filters and produced reactive superficies. Thus the collection efficiency of ammonia could be improved (Kasper, 1994). Furthermore, a potassium hydroxide impregnated filter was used instead of the potassium carbonate impregnated filter. Since potassium hydroxide converts to potassium carbonate during contact with air, the potassium hydroxide filters are replacement equivalents for the potassium carbonate filters.

The sampling with two filter packs was necessary to determine particulate oxalate. As the filter pack "A" had an impregnated oxalic acid filter to determine ammonia, the front teflon filter could not be used to determine particulate oxalate because of high blank readings. The filter pack "B" did not contain oxalic acid, thus the teflon front filter could be used to determine particulate oxalate.

Assembling and shipping of filter packs

The coating, assembling and extraction of the filters were performed in the laboratory in Vienna. Usually the filter packs were shipped to the SBO in sets of 15 filters holder (15 "A" and 15 "B") in aluminium box. From these 15 filters, 3 were used like blanks to control the contamination during the shipping and the storage if the filters at the site.

Sampling

At the Sonnblick Observatory, the sampling time of a filter pack was 24 hours. The daily exchange of samples was carried out by the observatory staff every day in the morning approx. at 8 a.m.

Until February 2003 the air flow was approximately 35 l/min (at 1013mbar and 273K). After the installation of new tubing, the air flow was reduced to 25 l/min (at 1013mbar and 273K).

In the last sampling months the sampling volume was further decreasing, to approximately 20 l/min (at 1013mbar and 273K), most probably due to membrane pump wear.

The sample volume was determined with a gas meter. Pump, gas meter and manometer reside in the pump house.

The sampling equipment is installed of the upper platform of the Observatory (see figure 2.1).

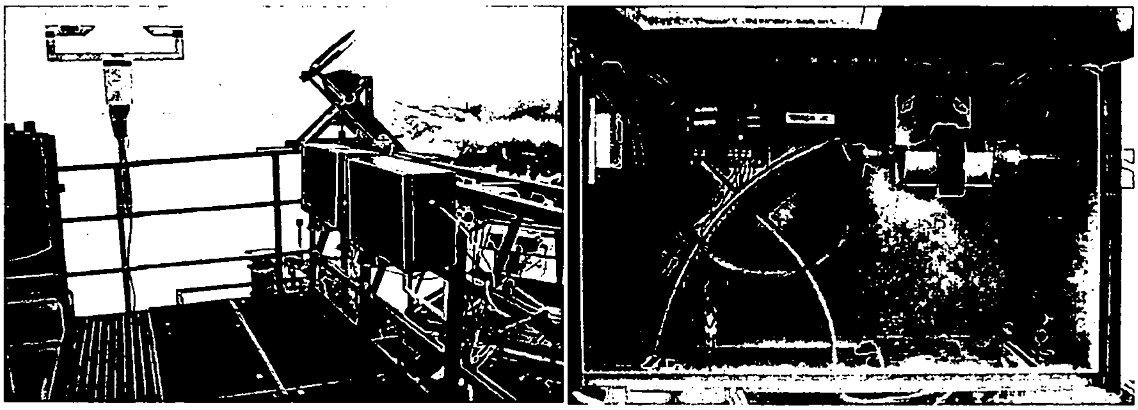


Fig. 2.1: Filter pack- sampling of the upper platform of the Sonnblick Observatorium.

2.2.2 High-Volume Sampler

In the "CARBOSOL" project the following parameters were determined: PM2,5 mass, Total-, Organic-, and Black Carbon, HULIS, Water Soluble Organic Carbon (WSOC), Cellulose, Anhydro sugars, Inorganic ions, Water Soluble Organic Acids (WSOAc),^{210}Pb and ^{7}Be. To determine these compounds, every sampling site was equipped with a High-Volume sampler PM 2,5 with quartz fiber filters weekly aerosol samples were collected. The sampling sites were operated by different groups from Portugal, France, Germany, Austria and Hungary. Concerning analyses every group was in charge for only one or a group of parameters as listed below. Table 2.2 (compiled by Pio et al. 2004) gives the information about the analysis conducted in every laboratory.

Table 2.2: Distribution of the different parameters and their respectively analytical methods in the different laboratories.

Parameters	Analytical method	Laboratory
PM 2,5 mass	Weighting at 50% RH	University of Aveiro, Univesity of Azores
TC/OC/BC	Thermalprogramming/Optical Control by transmittance	University of Aveiro
HULIS	SPO Extraction/ Micro combustion	University of Vezsprem
WSOC	Water extraction; water analysis	University of Vezsprem
Cellulose	Enzymatic conversion; UV detection of D-glucose	Tech. University of Vienna
Anhydrosugars	HPLC with electrochemical	Tech. University of Vienna

	detection	
Inorganic Ions	Ion chromatography	Lab. Environ. Glaciol. and Géophysique.
Water sol. Organic Acids.	Ion chromatography	Lab. Environ. Glaciol. and Géophysique.
^{210}Pb, ^{7}Be	Radioactive emission / detection	Karls-University of Heidelberg

Sampling at SBO

At the Sonnblick Observatory weekly aerosol samples were collected with a High-Volume Sampler PM 2,5 (DH-77) on quartz fiber glass filters (Pallflex^{TM} 2500QAT-UP-150, 150 mm diameter). The filters were mounted in filter holders in Vienna and subsequently transported to Sonnblick Observatory in air tight stainless steel containers. Every Thursday morning the observatory staff changed the filters. Since we had problems with the software of the High-Volume sampler, the sampler volume varied quite a lot and sometimes we did not receive the sampling protocol properly. In this case we had to calculate an estimated volume for these samples. Generally these problems were caused by humidity (rain, snow cloud water) entering the sampling line and clogging the filter. The resulting high pressure drop stopped the sampler and occasionally led to a reset of the controlling software. The average sampling volume for the whole period was 3151 m^3 (at 1013 mbar and 273 K). The sampling head of the High-Vol sampler is installed at the upper platform of the Observatorium. The filter holder unit as well as the control unit (see figure 2.2) is located below in the pump house.

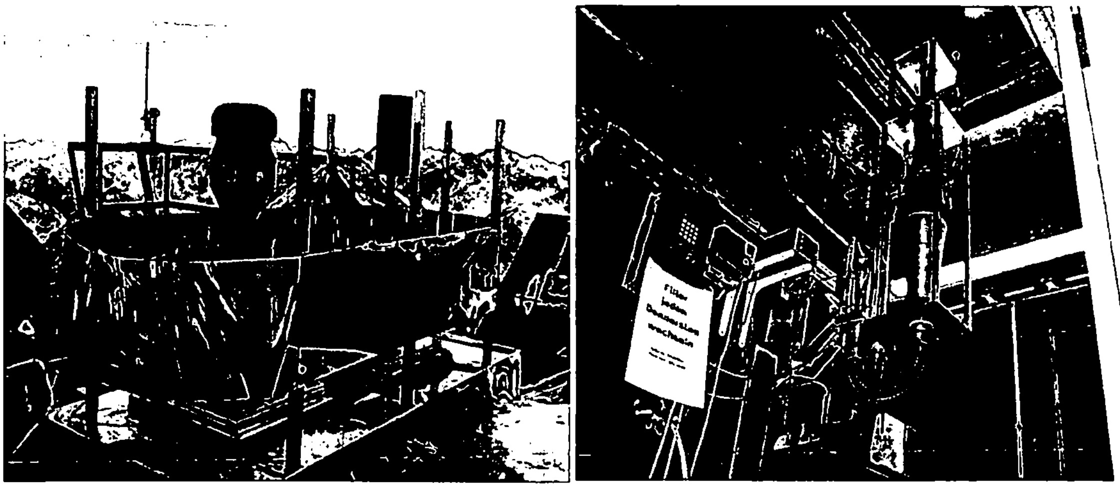


Fig. 2.2: High-Volume sampler at the SBO.

2.3 Analytical Method

2.3.1 Inorganic ions & organic acids

Now the description of the preparation and analyses of each filter follows. Extraction of the filters was performed in 5ml polyethylene vials in an ultrasonic bath (30min).

Teflon filter

For sampling of aerosol compounds, teflon filters were used to avoid the possible sorption of reactive gases (e.g. nitric acid). The collection of nitric acid on the teflon filter would result in an overestimation of particulate nitrate (positive artifact) and, consequently, lead to an underestimation of nitric acid concentrations determined with the nylon filter. For extraction PTFE (Pall "Zefluor", 1µm pore size) filters were soaked with acetone (0,2ml). Then Milli-Q water (3,4ml) was added. The extracts were analyzed for anions (chloride, nitrate, sulphate and the organic acids acetate, formiate, malate, malonate, maleate and oxalate) and cations (sodium, potassium, ammonium, magnesium and calcium) with ion chromatography.

Nylon filter

Nylon filters collect nitric acid and sulphur dioxide (Anlauf et al. 1985, Chan et al. 1986, Cadle 1987). The collection of nitric acid is quantitative. Unfortunately this is not the case for sulphur dioxide. No relationship could be found between the collection efficiency and either the relative humidity, the air temperature or the absolute concentration of nitric acid or sulphur dioxide (Hicks et al. 1993) in the ambient air. Nylon filters (Pall "Nylasorb", 1µm pore size) were extracted in 1% H_2O_2 (0,2ml) and carbonate buffer solution (3,4ml) (2,6mM Na_2CO_3-3,3mM $NaHCO_3$). This buffer solution was later on used as on elute for ion chromatography. Addition of H_2O_2 was necessary as nylon filters retain SO_2 as SO_3^{2-} and SO_4^{2-} ions. H_2O_2 oxidizes SO_3^{2-} quantitatively. Thus, the extracts of the nylon filters were analyzed for NO_3^- and SO_4^{2-} with ion chromatography.

KOH-filter

Cellulose filters coated with potassium hydroxide were used for the quantitative collection of sulphur dioxide. The total sulphur dioxide concentration was calculated as the sum of sulphate recovered from the potassium hydroxide and nylon filters. Impregnation of the filter paper (Schleicher & Schüll, Schwarzband, 47mm diameter) with potassium hydroxide solution was performed at the laboratory with an aqueous of 1% w/v potassium hydroxide (KOH-pellets p.a. Merck Nr 5033).

The filters were covered with Milli-Q water in a glass, which was placed in an ultrasonic bath (10 min). Afterwards the water was decanted. The filters were washed three times with Milli-Q water, then washed three times with a 1:5 diluted coating solution. Finally, they were washed three times with a concentrated 1% potassium hydroxide solution. Several filters could be impregnated at the same time, without a deterioration of the blanks. At the end, the filters were put in petri dishes above (Polystyrol, Fa. Nunc) and dried in a dessicator over silica gel. If the dried filter showed blank readings of sulphate, then the whole procedure of washing and coating solution was repeated with a new coating solution. The filter can be kept in a box in the refrigerator for several weeks, with an increase of the blank readings.

The extraction of the potassium hydroxide coated filters was performed with 1% H_2O_2 (0,2ml) and Milli-Q water (3,4ml). Again addition of H_2O_2 was necessary to oxidize SO_3^{2-} to SO_4^{2-}. The extracts were analyzed for SO_4^{2-} with ion chromatography.

Oxalic acid filter

For sampling of ammonia, cellulose filters (Schleicher & Schüll, Schwarzband, 47mm diameter) coated with oxalic acid and glycerine were used. As coating solution on aqueous solution of an oxalic acid (containing 3% w/w oxalic acid in 5%w/w glycerine) was used.

The procedure of washing and impregnation was the same as for potassium hydroxide filters. Afterwards the filters were dried in the dessicator, and the filters were checked for ammonium blanks.

The filters were extracted with Milli-Q water (3,6ml). Extracts were analysed for NH_4^+ with ion chromatography.

Ion chromatography

The determination of inorganic anions, Cl^-, NO_3^-, SO_4^{2-}, and the cations, Na^+, NH_4^+, K^+, Mg^{2+} and Ca^{2+} was carried out with an isocratic ion chromatography system from Dionex.

The tables 2.3 to 2.6 show the analytical parameters as well as the detection limit of this ion chromatography system (IC).

Table 2.3: Analytical parameters of inorganic anions

Column and guard column	AS 12A-4mm und AG 12A
Eluent	2,6 mM Na_2CO_3/3,3 mM $NaHCO_3$
Flow	2,3 ml /min
Suppressor	ASRS-ULTRA 4 mm
Detector	Sensitivity 30 µS
Injection volume	50 µl

Table 2.4: Detection limit IC (inorganic anions)

	[µg/l]
Chloride	25
Nitrate	17
Sulphate	22

Table 2.5: Analytical parameters of cations

Column and guard column	CS 12A-4mm und CG 12A
Eluent	12 mM Methan sulfonic acid
Flow	1,1 ml /min
Suppressor	CSRS-ULTRA 4 mm
Detector	Sensitivity 30 µS
Injection volume	90 µl

Table 2.6: Detection limit IC (cations)

	[µg/l]
Sodium	10

Ammonium	5
Potassium	7
Magnesium	4
Calcium	15

The determination of organic anions (oxalate, malate, malonate, maleate, formiate, acetate and pyruvate) was carried out with gradient ion chromatography (KOH-Gradient). Tables 2.7 and 2.8 summarize the IC system and the detection limit of the gradient ion chromatography system.

Table 2.7: IC-Gradient analysis (organic anions)

Column and guard column	AS 17 und AG 17 sowie ATC-1
Eluent	KOH Gradient
Flow	1,8 ml /min
Suppressor	ASRS-ULTRA 4 mm
Detector	Sensitivity
Injection volume	100 µl

Table 2.8: Detection limit IC (organic anions)

	[µg/l]
Acetate	3
Formiate	3
Pyruvate	4
Chloride	23
Nitrate	4
Malate	7
Malonate	4
Maleate	4
Sulphate	6
Oxalate	6

2.3.2 Levoglucosan

The filters were put in 5 ml polyethylene vials and were eluted with 3ml Milli-Q water. The extraction took place in an ultrasonic bath (20min). The determination of levoglucosan was carried out with a HPLC with electrochemical detection (ED40, Dionex). Gradient elution was performed with deionized water as solvent D and sodium hydroxide (250mM) as solvent C. The binary gradient had a flow rate of 1 mL min^{-1}. It started with 30mM sodium hidroxide (88% D (water) and 12% C (NaOH)). For the detection (amperometry) we used a gold working electrode. The column was a CarboPac PA 10, and the eluent was a NaOH gradient from 30 to 40 mM for each sample. Eluent flow was 1 ml/min. For cleaning the analytical system is rinsed with 250 mM NaOH during 5 min. after every sample. To prevent contamination from carbonate an Ionpac ATC guard column is installed which has to be cleaned regularly. Before the analysis the eluent is purged with a helium degassing system for approx. 10 min.

For determining Levoglucosan a Bio LC from Dionex was used with a NaOH-Gradient from 30mM to 40mM. In table 2.9 are the analytical parameters.

Table 2.9: Analytical parameters Bio LC (anhydrosugars)

Column and guard column	Carbopac PA 10 and Amminopac(*)
Eluent	NaOH Gradient
Flow	1,0 ml /min
Electrodes	Ag/AgCl reference electrode and Au working electrode
Detector	Amperometry
Injection volume	100 µl

Table 2.10: Detection limit Bio LC (anhydrosugars)

	[µg/l]
Levoglucosan	10
Galactosan	10
Mannosan	10
Glucose	10
Fructose	10

2.3.3 Cellulose

To determine atmospheric cellulose we used the method of Kunit and Puxbaum 1996. The authors mentione three steps for the cellulose determination: In the first step, samples are subjected to a delignification treatment to liberate cellulose associated with lignin and hemicellulose. In the second step, the "free" cellulose is enzimatically hydrolysed to D-glucose (saccharification). In the third step, D-glucose is determined with a test-combination by Boehringer Mannheim GmbH with a UV-VIS spectrophotometer.

We determined the "free cellulose" from the aerosol samples only, thus we did not use the delignification step. "Free cellulose" is a fraction of "total cellulose", thus the amount of "total cellulose" can be estimated by applying the conversion factor from previous work of Puxbaum et al. 2003.

a) Reagents

- *Citric acid buffer (0,05 M pH 4.8):* 210 g citric acid monohydrate (Merk extra pure) was dissolved in 750 ml ultrapure water, NaOH was added to obtain pH 4.3, and filled to 1000 ml (stock solution, 1M citrate buffer pH 4,5). The buffer was diluted to 0,05 M prior to use, and Thymol (Merk cryst. Puriss.) was added to obtain a 0,05% solution for conserving and sterilising the incubate.
- *D-Glucose test kit (Boehringer-Mannheim). Cellulose Hydrolysing enzymes:* Celluclast 1,5L and Novozym 188 fom Novo Nordisk. Celluclast 1,5L is a *Thricoderma reesei* cellulose for technical use (e.g. saccharification of straw). The optimum enzyme activity is reported to be 50-60°C, and a pH of 4,5-6,0. Novozym 188 is a cellobiase suspension obtained from *Aspergillus niger*. The optimum enzyme activity is around 50°C, at pH 4,8. Hydrolysis of cellulose with cellulose yields D-glucose and cellobiose. The cellobiase then hydrolyses the cellobiose and increases the total yield of D-glucose in the assay. The producer recommends the following amounts of enzymes relative to cellulose: 1-2% Celluclast 1,5L; 0,2% Novozym 188. The enzyme suspensions are stored frozen as obtained. For analytical use the suspensions are diluted (1:10 for Celluclast 1,5L and 1:100 for Novozym 188). Cellulase and Cellubiase enzymes may contain D-glucose from the production process and for stabilisation. Enzymes

from several suppliers were tested (kunit and Puxbaum 2003) and above mentioned products showed the lowest blank value of D-glucose.

- *Enzymes preparation:* As the enzymes contain glucose they have to be precleaned by dialysis. For the dialysis a solution of 22.6 g of Citric acid monohydrate and 38.9 g of Tri-Sodium Citrate in 5L of Milli-Q water were prepared. The dialysis tubes pieces (length as needed) were cut and placed in Milli-Q water for 1 hour. One end was closed with a knot; the tubes were filled with enzymes. Then the other end was closed with a knot as well. The dialysis tubes filled with enzymes were put in the Citric acid/Tri-Sodium Citrate solution, which was previously placed in an ice bath (the solution temperature must then be lower than 10°C), with agitation. After about 12 hours (all day long), the bucket was put in the refrigerator at 2-6°C for about 15 hours (overnight). Finally, it was one end of the dialysis tube was cut open and small aliquots of the enzymes (about 300 µL for Cellulase and 100 µL for Cellobiase) were transferred to plastic sample vials; 5% (v/v) of Glycerin were added and the solutions were stored in the freezer.

b) Analytical method

- *Saccharification of cellulose:* The filters were put in one-way 5 ml polyethylene vials. They were mixed with a solution of 3ml 0,05 M citric acid containing 0.05% thymol at pH 4,8. These samples were incubated with 100µl of cellulase and 100µl of cellobiase. As mentioned before the enzyme suspensions had to be diluted before use (1:10 for Celluclast 1,5L and 1:100 for Novozym 188), which resulted in an actual addition of 1µl cellobiase and 10µl cellulose. The extraction took place in an ultrasonic bath (20min).The aerosol samples were incubated for 24h at 45°C.The enzymatic saccharification reaction was stopped by heating the vial to 80°C then cooling during 10 min and centrifuging for 15 min. After 10 min of centrifugation the supernatant fluid was taken for glucose determination.
- *Determination of D-glucose:* The Boehringer-Mannheim (BM) test kit contains two "solutions" and a glucose standard. Solution 1 contains a triethanolamin buffer pH 7.6, NADP, ATP and magnesium sulphate; Solution 2 contains an enzyme suspension of hexokinase and glucose-6-phosphate-dehydrogenase. The

prescribed assay was modified with regard to the volumes of sample and solutions. The pipetting scheme is indicated in table 2.11. Reagent blank and samples were prepared according to the pipetting scheme. The components were mixed in a disposable cuvette (1 cm). For each of these vials the absorbance before the reaction (Absorvance$_1$) was determined at 340 nm, 3 min after the last addition. Then the solution 2 was added, and after 10min the developed colour of NADH at 340nm was determined (Absorbance$_2$). To check that the reaction is complete, another measurement of the absorbance was performed after 15 min. If the result was the same as after 10 min, the reaction was finished. If it did not remain constant, the absorbance was measured again every 5min until a constant value was reached. Results were derived from the differences between the Absorbance$_2$ and Absorbance$_1$ readings for each measured vial.

Table 2.11: Pipetting scheme for D-glucose determination

	Blank	Sample
BM solution 1	0,5 ml	0,5 ml
Samle solution	-----	0,5 ml
bidest. water	1,0 ml	0,5 ml
	Determination of Absorbance 1	
BM solution 2	0,01 ml	0,01 ml
After 15 min	*Determination of Absorbance 2*	

To determine Cellulose, an UV-Vis spectrophotometer (Unicam 5625) was used. The absorption (340 λnm) of the samples inside disposable cuvettes (Plastibrand, 1,5ml semi micro), was measured. At the beginning of each batch, the zero absorbance was set with bi-distilled water and checked during the measuring session.

3. RESULTS

3.1 Filter packs

3.1.1 Detection limit

To determine the detection limits and to regularly check the samples for impurities, field blanks were included in every series of filter. A blank was analyzed every six samples. The preparation, storage, and analysis were the same for samples as well as for blanks. At SBO, the samples were collected during 24 hours, while blanks were installed for a few minutes only. Therefore it is possible to control the sample contamination, which took place during the storage, shipping, sampling, assembling or disassembling of the filter holders.

The variation of the field blanks limits the detection limit of the measurement procedure. The detection limit was determined by calculating three times the blank standard deviation and relating this number to the mean of the sampled volumes. To avoid outliers the field blanks were controlled using the "Nalimov-test". In the time period from December 2002 until July 2003, the sampling had a mean volume of 17,4 m^3 (1013 mbar and 273 K). Due to the decreased sampling volume (as previously noted) since January 2004 an average sample volume of 13 m^3 (with 1013 mbar and 273 K), has to be used. Hence different detection limits have to be reported from January 2004. In addition elevated field blanks were observed for nitrate and nitric acid, as well as for ammonium and ammonia starting with April 2004. This led to the definition of a third set of detection limits. As an alternative the highest detection limit could have been used for the whole sampling period (December 2002 – December 2003). However in this case a lot of information would have been lost for the winter periods, when several of the daily averages were close to the limits of detection.

The detection limit for trace gases, nitric acid, sulphur dioxide and ammonia, as well as aerosol components, nitrate, sulphate, ammonium, calcium, chloride, sodium, potassium and oxalate are listed in Tables 3.1, 3.2 and 3.3. In addition the number of field blanks (FB) which were used to determinate the detection limit are given. Because filter pack "A" and filter pack "B" have a teflon filter, the amount of field blanks is higher for aerosol compounds than for gases. The exception is for oxalate. Here we cannot use filter pack "A" because the installation of the ammonia impregnate oxalic acid paper filter produced notable blank readings (0,31 – 0,54 µg/ml) on the teflon filter.

The detection limits of nitric acid, sulphur dioxide, nitrate, sulphate and ammonium are also low enough for the extremely small air concentrations at Sonnblick.

Problems occured mainly with the determination of ammonia during the winter months, when most ambient concentration values were below the detection limit of 2,1 nmol/m³. This relatively high detection limit for ammonia is due to the elevated variation of the blanks observed in every filter series. This contamination is most likely because of shipping and storage. The determination of ammonia is very sensitive to errors as the ammonia concentration values inside the room, are clearly much higher than ambient air concentrations at Sonnblick.

Table 3.1: Detection limits determined from the field blanks (from December 02 to December 03)

	Cl^-	NO_3^-	SO_4^{2-}	$C_2O_4^{2-}$	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}	HNO_3	SO_2	NH_3
DL (nmol m^{-3})	0,6	0,8	0,3	0,2	1,1	0,6	0,5	0,2	0,9	0,9	1,6	2,1
Ammount of FB	84	79	79	39	86	79	85	55	75	35	79	37

Table 3.2: Detection limits determined from the field blanks (from January 04 to March 04)

	Cl^-	NO_3^-	SO_4^{2-}	$C_2O_4^{2-}$	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}	HNO_3	SO_2	NH_3
DL (nmol m^{-3})	0,3	1,3	0,6	0,6	1,2	0,4	0,2	0,5	0,9	0,4	0,7	1,7
Ammount of FB	18	14	19	7	18	16	20	20	15	9	21	9

Table 3.3: Detection limits determined from the field blanks (from April 04 to September 04)

	Cl^-	NO_3^-	SO_4^{2-}	$C_2O_4^{2-}$	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}	HNO_3	SO_2	NH_3
DL (nmol m^{-3})	0,3	3,6	0,5	0,7	1,0	0,9	0,2	0,6	1,3	3,0	2,0	2,1
Ammount of FB	66	57	64	24	64	61	65	64	55	34	67	30

For compounds like chloride, potassium, and magnesium, most of the winter day values were below the detection limit. In summer a quantitative measurement is possible. Similar problems occurred for oxalate. Also calcium often cannot be quantified. In summer we observed a marked increase of the concentration values for calcium. An influence due to building activity which took place at SBO during the summer months in 2003 and 2004 could not be eliminated, although the measurements were carried out only during the night.

For the compounds chloride, sodium, potassium, calcium and magnesium, most of the daily values were determined close to or below the calculated detection limit. (Table 3.4)

Table 3.4: Percent of Cl^-, Na^+, K^+, Mg^{2+} and Ca^{2+} values below the detection limit (DL)

	Cl^-	Na^+	K^+	Ca^{2+}	Mg^{2+}
Value< DL	98%	85%	59%	35%	62%

Ambient air concentrations below the detection limit were replaced with half the detection limit to allow for the calculations with these numbers. All compounds at least showed a limited number of these readings, especially during winter months. (Annex Tables)

3.1.2 Intercomparison of the filter packs

In the period from 10.12.2002 to 23.12.2003 (13 sampling days), from 16.05.2003 to 27.05.2003 (12 sampling days) and from 3.07.2004 to 17.07.2004 (10 sampling days), intercomparisons between the In-line filter packs (A&B) and the Open- face filter pack (C) were carried out. The intercomparisons were carried out in the cold as well as in the warm seasons. As it is expected, the winter concentration values were smaller than the concentrations in May and July. The small values in summer mostly occurred during days with snowfall or rainfall.

Generally, measurements with the filter packs could be influenced by "filter errors". "Positive" errors are all the effects which cause an overestimation of the aerosol fraction – e.g. gases were collected on the particulate filters and therefore attributed to the particulate phase. "Negative" errors include all the effects which cause an underestimation in the aerosol sampling –e.g. the evaporation of semivolatile compounds from the teflon filter. The filter errors are determined by the composition of the air sample and parameters such as air temperature and humidity or their changes during the sampling. Also, the filter material used and the construction of the sampling line are important. The use of an in-line filter pack with a heated inlet is different compared to an open-face filter pack. The heated inlet and sampling line will shift the occurrence of semivolatile compounds to the gas phase.

During a previous project (Kasper and Puxbaum, 1998) an open-face filter pack has been used. At times when the sampling site was within clouds, rime or snow deposits could occur on the front filter. Usually these deposits ("snow caps") were removed during filter change. Trace amounts of rime or snow were allowed to remain on the filters. Although the "snow-caps" observed at the Sonnblick did not cover and block the whole front filter, they may act as a prefilter and scavenge gaseous components as well as aerosols. To estimate their influence the ionic concentrations of several deposits were determined and compared with data from snow and cloud water samples. No enrichment of ionic constituents were observed in the "snow-caps" compared with average snow samples. However artifacts, especially for reactive and highly soluble gases are likely.

To avoid these influences in this work in-line measurement have been performed.

3.1.2.1. Intercomparison of in-line system "A" and "B"

To start the intercomparison we compare the results of the in-line system. Both systems comprise a teflon filter as a front filter. Thus the aerosol concentrations can be compared. Regarding trace gases no comparison is possible as either ammonia or sulphur dioxide and nitric acid are collected by systems "A" and "B" respectively. The illustrations 3.1 to 3.4 show the comparison of daily aerosol concentrations and systems "A" and "B".

For particulate sulphate and ammonium, the seasonal trends determined by filter packs A and B show good agreement. Also the direct comparison of data shows the good agreement of system A and B. In case of sulphate one sample was excluded because of an extremely high concentration value pointing to a contamination of one filter. Without this measurement (25.05.2003) the linear regression of sulphate gives the relationship of A = 1,1448 * B (r^2 = 0,9155). The calculated regression with all the measurement values is A = 1,2426 * B (r^2 = 0,8551). For ammonium, the linear regressions has a relationship of A = 1,11741 * B (r^2 = 0,6452), if the measurement of 5.07.2004 is eliminated. Under consideration of all samples, A = 1,3329 * B (r^2 = 0,7711) is obtained. The large deviation determined on 24.05 and 25.05.2003 cause the rather low value for r^2.

On basis of these comparisons we can assume, that the systems A and B, which are operated in parallel deliver comparable data.

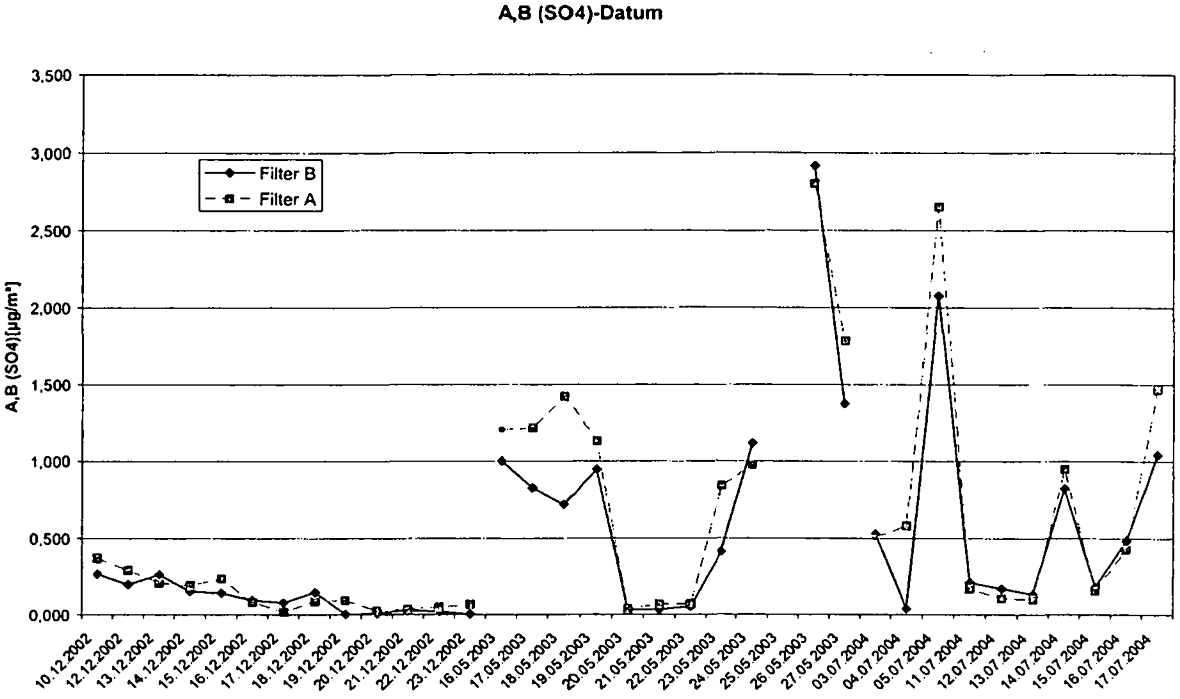


Fig. 3.1: Comparison of In-line filter packs "A" and "B" determined concentration values of particulate sulphate during seasonal variation.

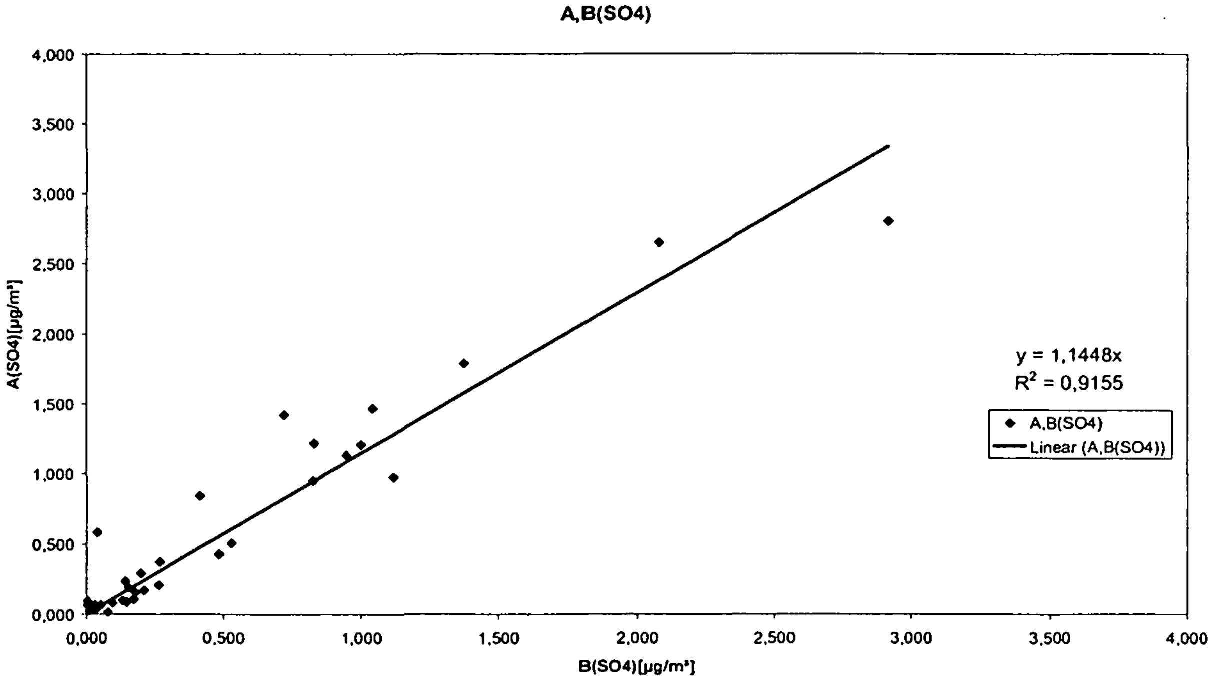


Fig. 3.2: Comparison of data for particulate sulphate.

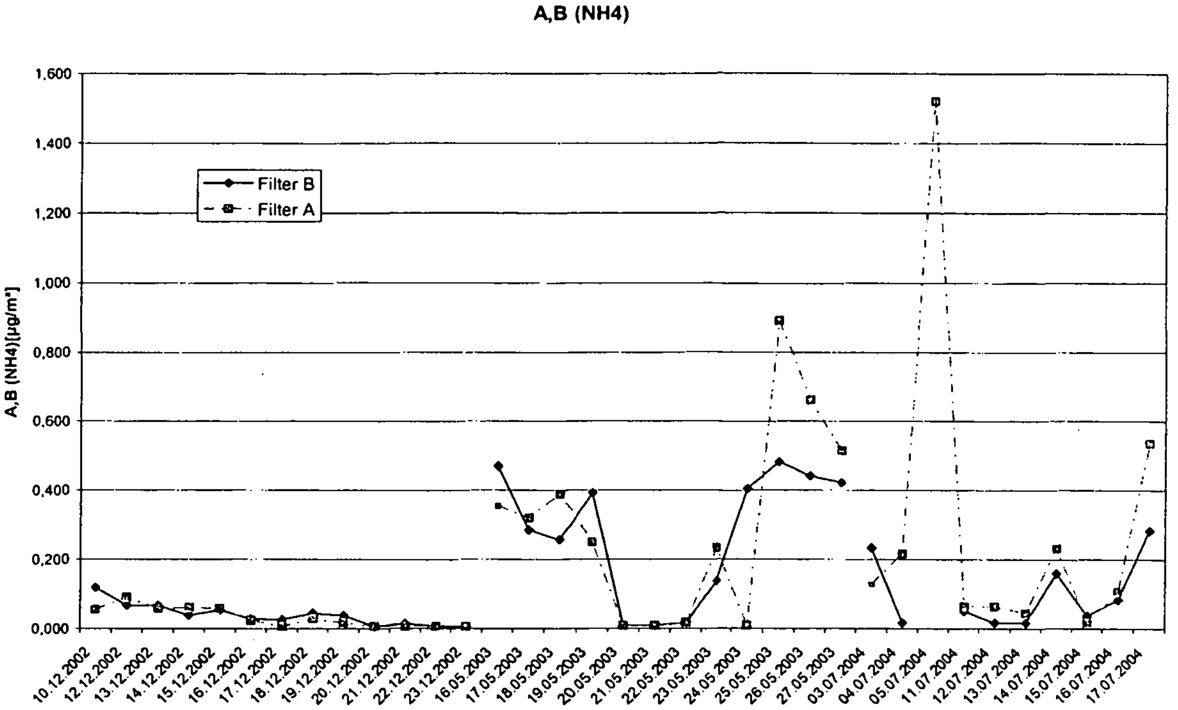


Fig. 3.3: Comparison of In-line filter packs "A" and "B" determined concentration values of particulate ammonium during seasonal variation.

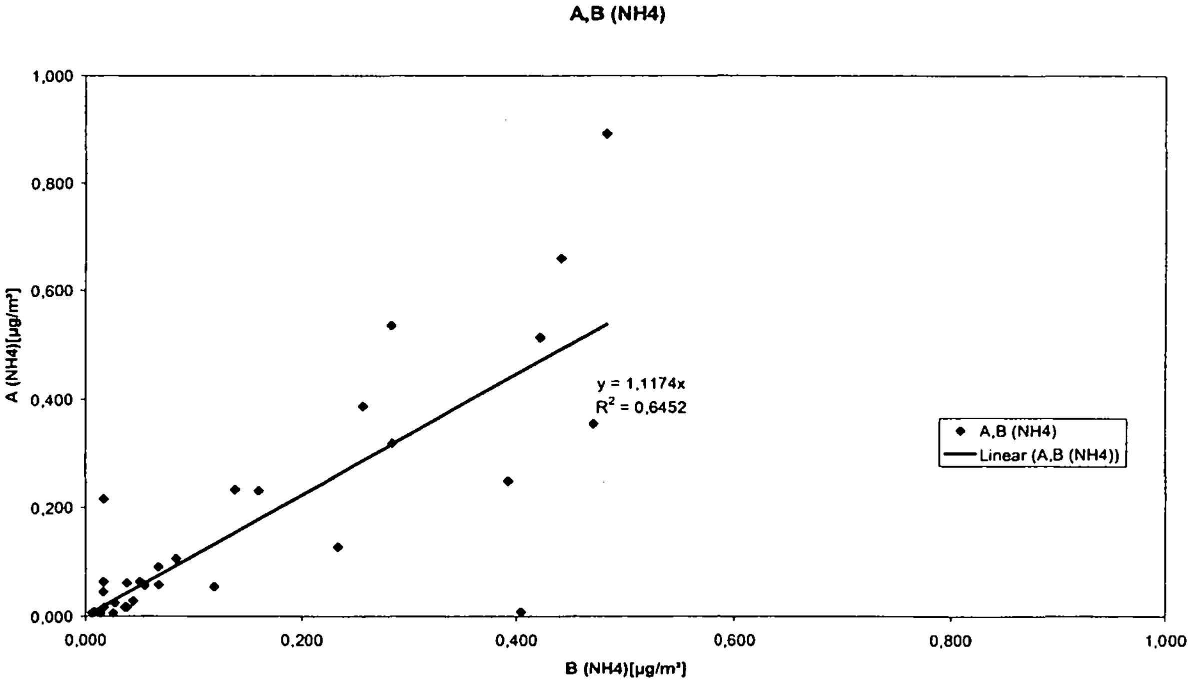


Fig. 3.4: Comparison of data for particulate ammonium.

3.1.2.2. Intercomparison of in-line system "A" and "B" with the open-face filter pack "C"

The best agreement between in-line and open-face sampling filters was determined for sulphate.

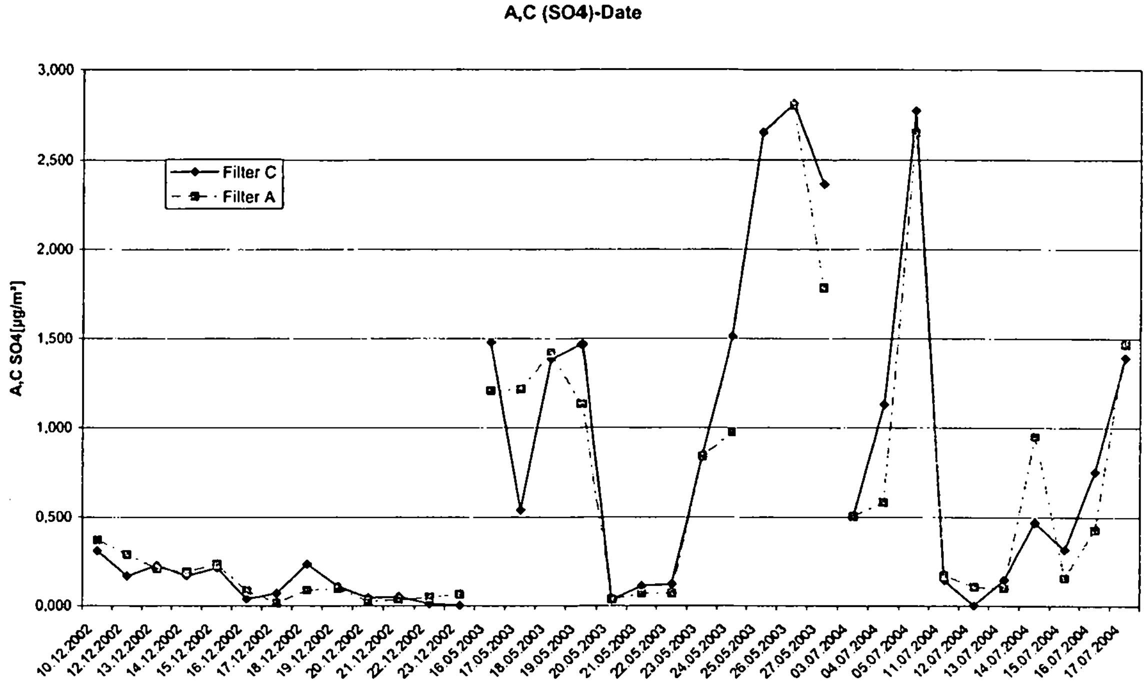


Fig. 3.5: Comparison of In-line filter packs "A" and the Open-face filter pack "C" determined concentration values of particulate sulphate during seasonal variation.

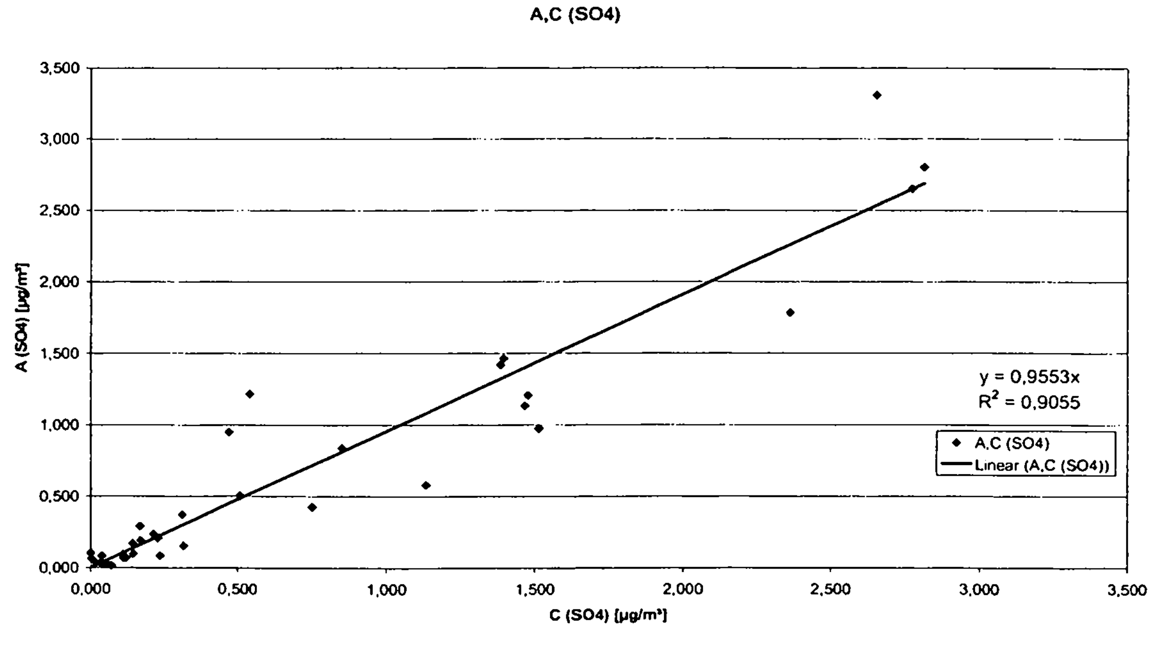


Fig. 3.6: Comparison of data for particulate sulphate.

For ammonium and nitrate the differences were greater because of the semi volatile behaviour of ammoniumnitrate.

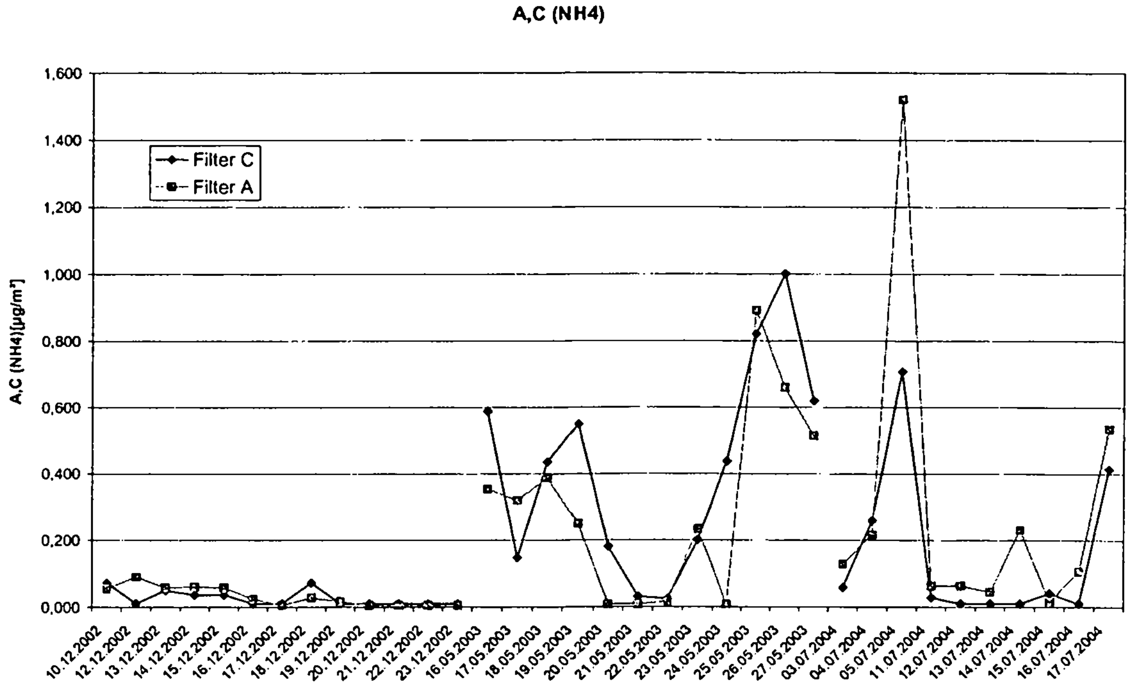


Fig. 3.7: Comparison of In-line filter packs "A" and the Open-face filter pack "C" determined concentration values of particulate ammonium during seasonal variation.

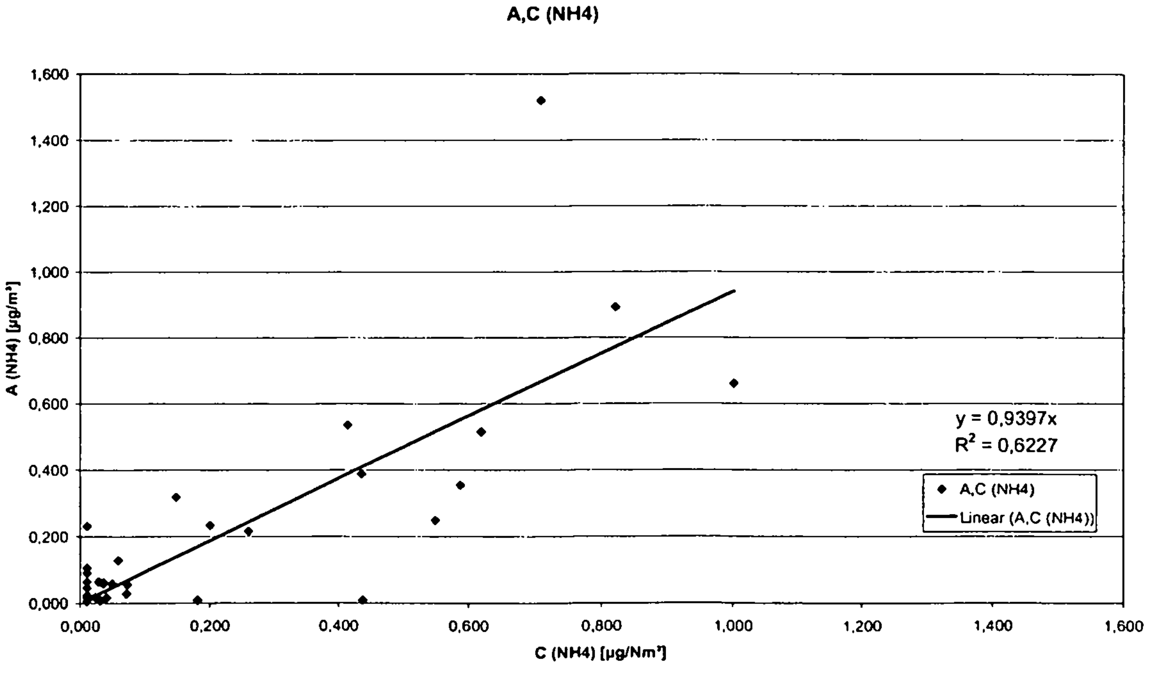


Fig. 3.8: Comparison of data for particulate ammonium.

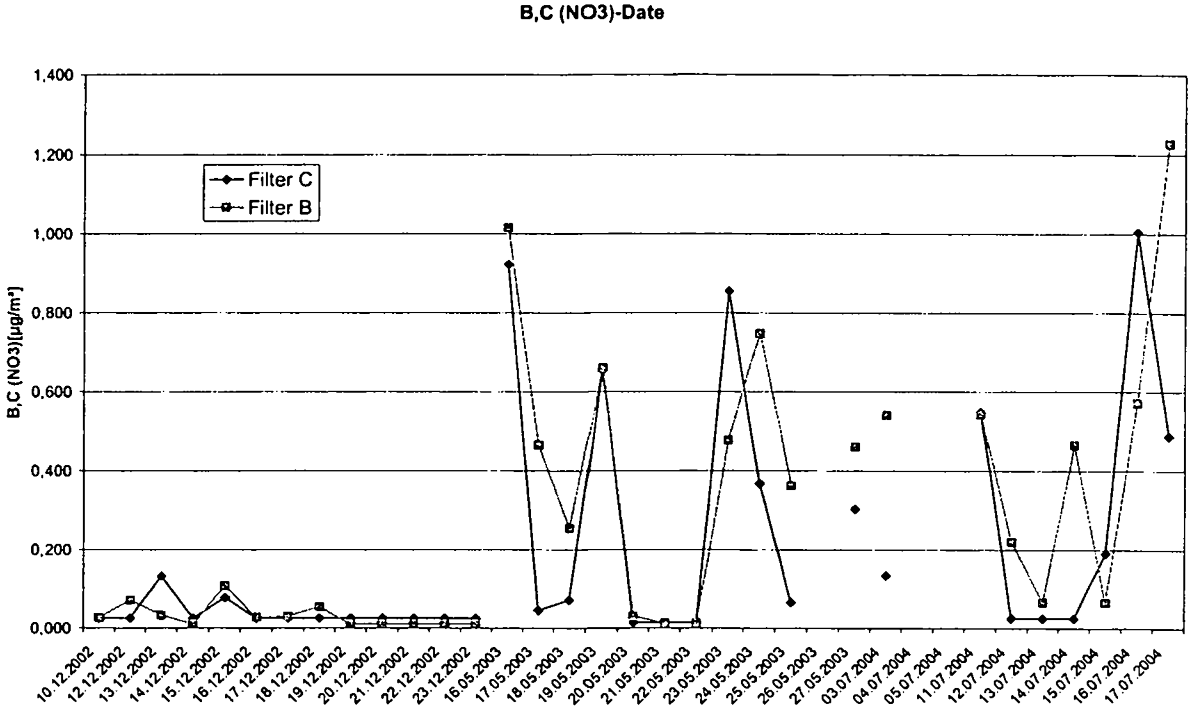


Fig. 3.9: Comparison of In-line filter packs "B" and the Open-face filter pack "C" determined concentration values of particulate nitrate during seasonal variation.

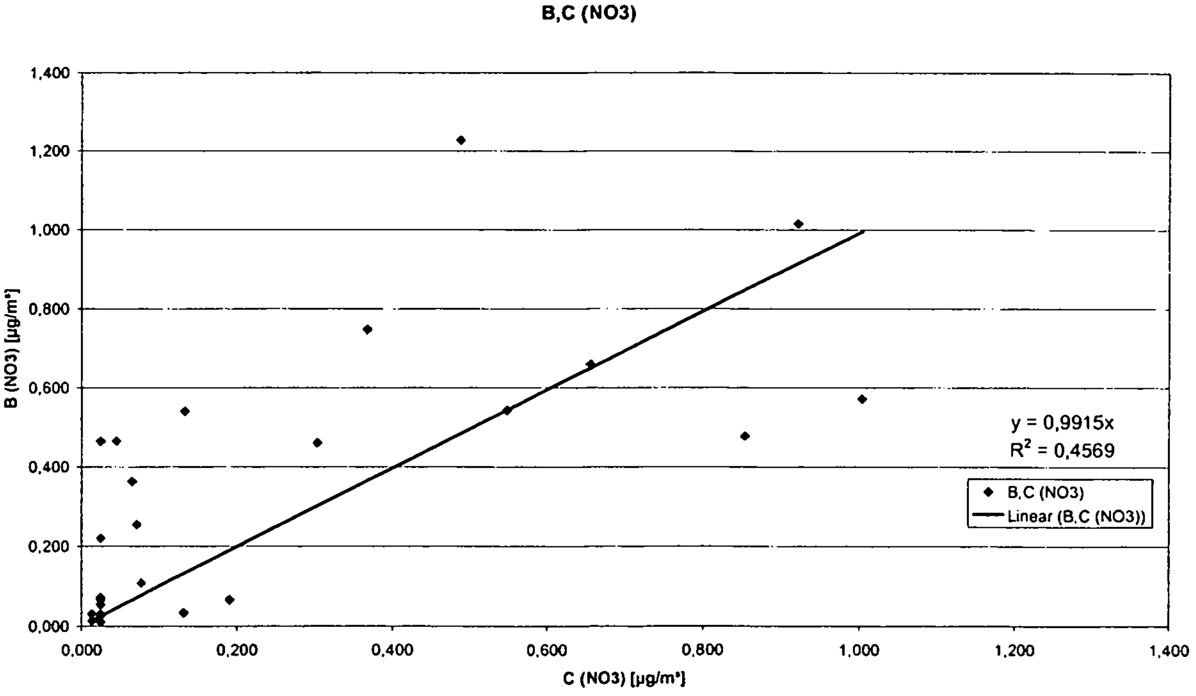


Fig. 3.10: Comparison of data for particulate nitrate.

In winter a very good agreement of the measurement systems was obtained for sulphur dioxide. Unfortunately in summer 2003, the results were clearly worse. That was the main reason to repeat the intercomparison in summer 2004. The repetition of the comparison yielded improved results; however, 2 out of the 10 measurements again showed large deviations. At present, a methodical explanation for this behaviour cannot be given. A humidity film in the heated inlet line of the in-line filters could be the reason for the small concentration values of the in-line system, but this effect would be independent of the season and, should give even stronger deviations for the others gases since both nitric acid and ammonia are more reactive and better water soluble than sulphur dioxide. However this effect is not found for ammonia and nitric acid.

For ammonia, the concentration values were below the detection limit during the winter months. In spring 2003 a quite good agreement was obtained, although certain fluctuations are visible. During this period the in-line system “A” constantly showed higher concentration values than the Open-face filters “C”. The linear regression result shows a relationship of $A = 1{,}4928 * C$ and $r^2 = 0{,}8668$. This trend is the opposite of the behaviour for ammonium, and is most likely caused by the heated inlet line. The results of sum ammonium and ammonia determination agree well. Unfortunately the good agreement of systems A and C was not confirmed in July 2004. Here the measurement systems showed clear difference in both directions.

In December 2002 and May 2003 the intercomparison for nitric acid gives reasonable results. In July 2004, in-line filter measurement values are clearly above the values of Open-face filters. During this period elevated field blanks were observed. Therefore we expected some contamination and do not discuss the differences further. Generally the measurement system for nitric acid showed the highest deviation. Days with elevated results of nitric acid in the In-line system “B” (predominantly during the summer measurements) corresponds to the above mentioned effect (see ammonia/ammonium) of semivolatile compounds in heated inlet lines. In this case, it is useful to compare the sum of particulate nitrate and gas phase nitric acid (Figure 3.16). Here the agreement of both filter packs is clearly better. The linear regression of $\Sigma(NO_3^-+HNO_3)$ for December 2002 and May 2003 is B = 1,0806 * C (r^2 = 0,546). The small value for r^2 shows that even for the sum or nitric acid and nitrate marked differences of the measurement systems are determined. Nitric acid is an especially reactive and very good water soluble compound, thus show – ice deposits on the open-face filter- can have a strong influence on the results.

Basically, the agreement of filter measurements for the gases is not as good as for particulate matter.

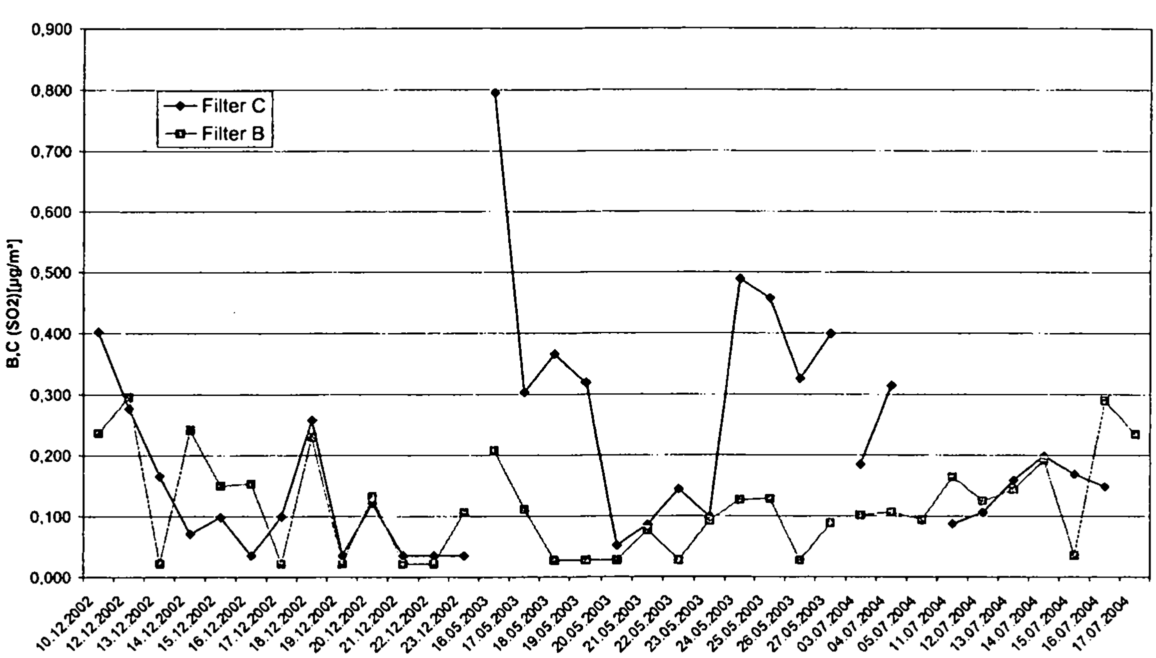


Fig. 3.11: Comparison of Filter pack "B" and Filter pack "C" for SO_2 during the same time period

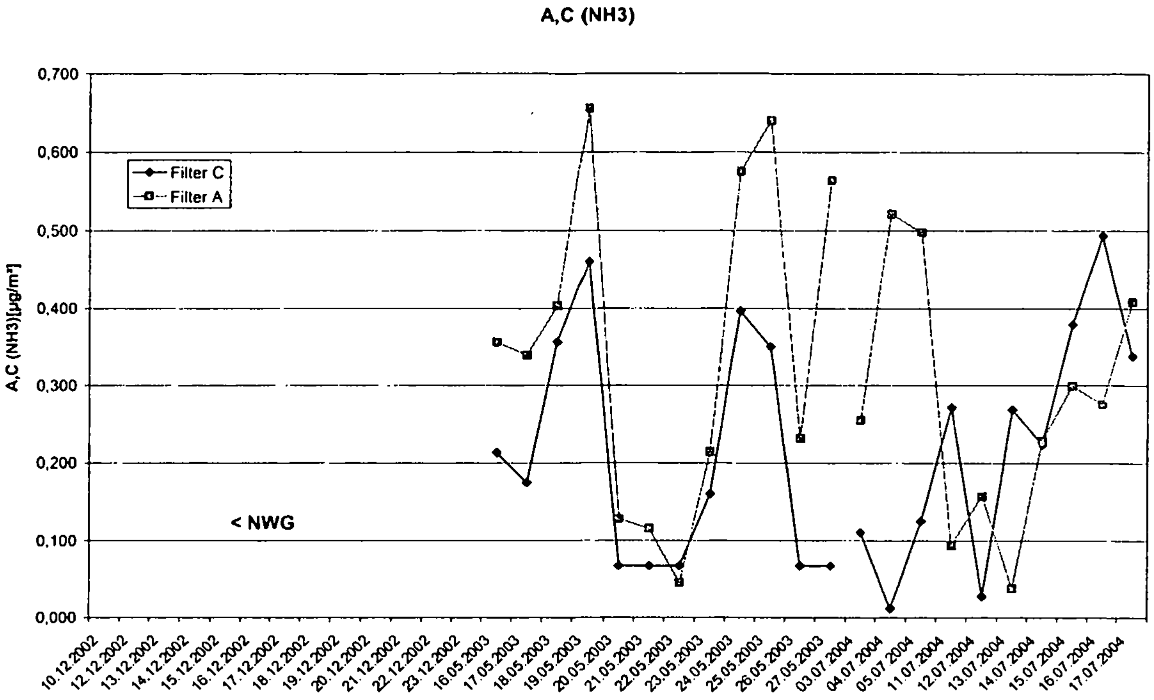


Fig. 3.12: Comparison of Filterpack ‚A' and Filterpack ‚C' for NH_3 during the same time period.

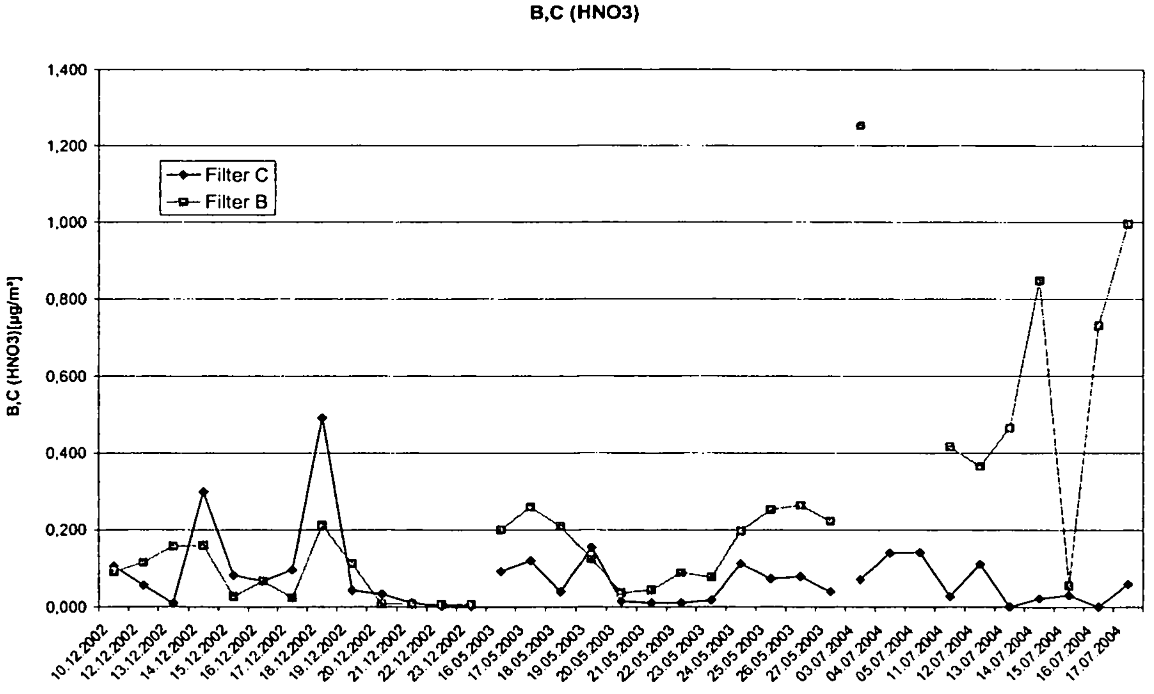


Fig. 3.13: Comparison of Filter pack "B" and Filter pack "C" for HNO_3 during the same time period

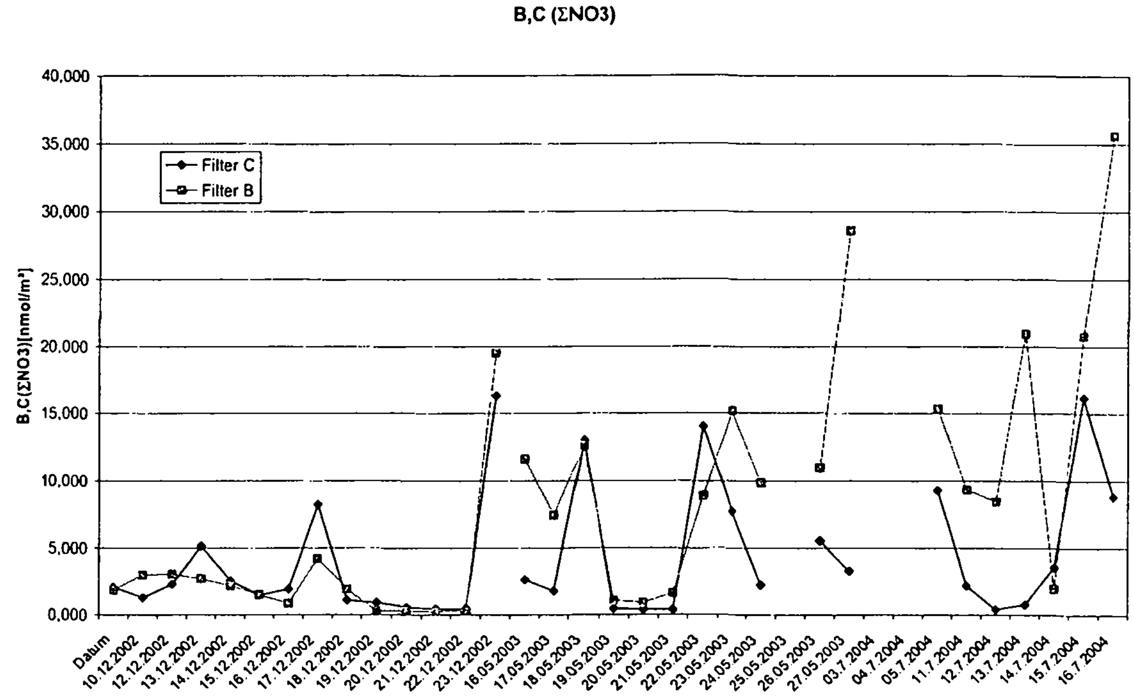


Fig. 3.14: Comparison of the In-line Filter pack "B" and the "Open-face" Filter pack "C" determined concentration values for the sum of particulate nitrate and gaseous nitric acid during the same time period.

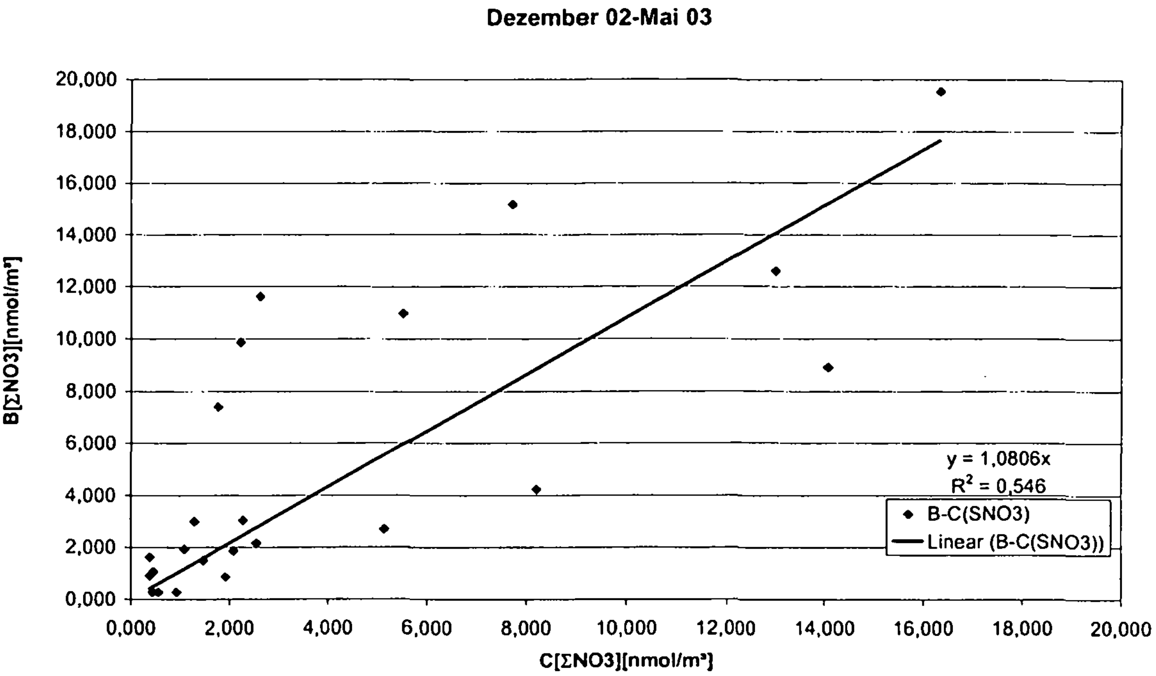


Fig. 3.15: Comparison of data for the sum of particulate nitrate and gaseous nitric acid.

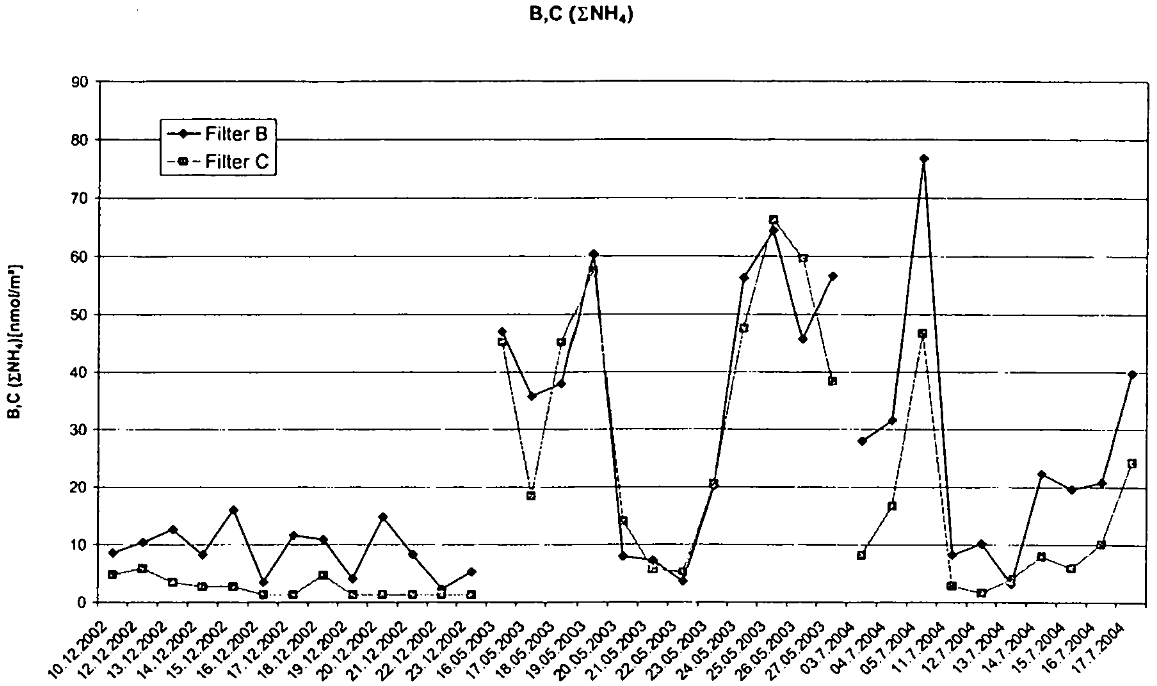


Abb. 3.16: Comparison of the In-line Filter pack "B" and the "Open-face" Filter pack "C" determined concentration values for the sum of particulate ammonium and gaseous ammonia during the same time period.

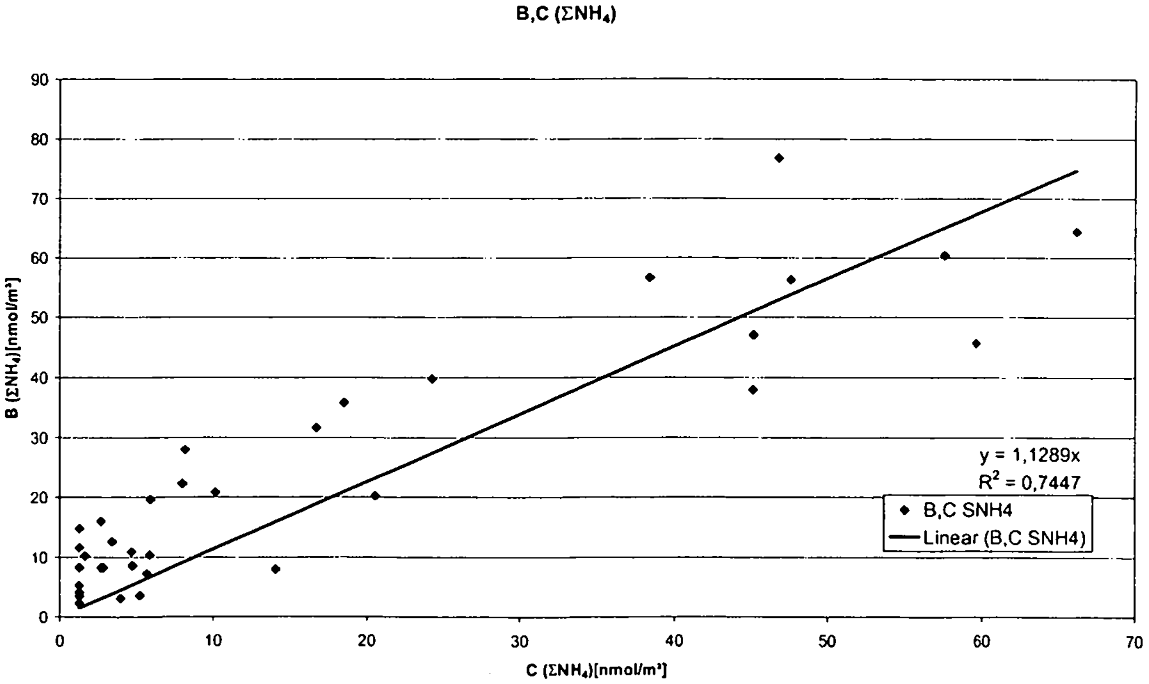


Abb. 3.17: Comparison of data for the sum of particulate ammonium and gaseous ammonia.

3.1.3. Annual cycles of SO_4^{2-}, NO_3^- and NH_4^+ as well as SO_2, HNO_3 and NH_3

The filter measurements began in December 2002 and continued until October 2004. During the entire period of this project daily samples were taken. Some day are missing because of filter packs shipping delays, i.e. problems to reach the Observatory in time. Regarding individual months 20 % (October 2004) to 93 % (February 2003) of the days could be evaluated. The amount of day samples per month is given in table 3.5. Overall 472 samples (i.e. 70 %) and 91 field blanks have been evaluated.

Seasonal cycles

The trace gases nitric acid and ammonia as well as the aerosol components nitrate, sulphate, and ammonium, showed lower concentration values in the winter months (November till January), than during the summer months (June till August). In comparison with previous measurements at Sonnblick (Kasper and Puxbaum, 1993), the increase of nitric acid concentrations occurred slightly later and is less pronounced. The concentration values for sulphur dioxide do not show marked difference between winter and summer. Except for these differences, the results of the recent measurements correspond widely with the trends of the years 1991 till 1993. In chapter (3.1.7) the time series will be compared. In the Figures 3.18 and 3.19, the seasonal trend (monthly average) of major inorganic compounds in trace gases and the soluble aerosols, respectively, are represented.

In table 3.5, concentrations of nitric acid, sulphur dioxide, ammonia, nitrate, sulphate and ammonium are summarized according to the monthly averages, as calculated from the single days (arithmetic average). Furthermore medians, maximum and minimum concentrations, standard deviations and the number of samples (n) taken per month are given. Figures 3.20 to 3.25 give a visual layout of the concentration values in each month, the median, and the minimum and maximum values. In the winter only very small concentration values were determined while in the summer both, very small as well as very high individual measurement values were possible.

All daily average values are listed in the appendix.

Table 3.5: Monthly averages,median concentrations, minimum (min) and maximum (max) values, standar deviation (s) and number of sample taken per month (n), in (nmol/m³)

	(nmol m^{-3})	NO_3^-	SO_4^{2-}	NH_4^+	HNO_3	SO_2	NH_3
Dec. 02	**Average**	0,5	0,9	1,9	0,9	1,6	7,1
n = 20	**Median**	0,3	0,7	1,6	0,4	1,3	6,1
65%	**min.**	0,2	0,03	0,3	0,1	0,3	2,0
	max.	1,7	2,8	6,2	3,4	3,8	16,1
	s (±)	0,4	0,9	1,6	1,0	1,4	4,7
Jan. 03	**Average**	1,2	1,7	2,5	0,7	1,8	2,6
n = 13	**Median**	0,5	1,9	1,8	0,7	0,5	2,0
42%	**min.**	0,4	0,3	0,8	0,1	0,3	2,0
	max.	10,0	3,3	6,8	0,7	9,9	10,2
	s (±)	2,6	0,9	1,7	3,2	2,9	2,3
Feb.03	**Average**	0,6	4,6	5,7	1,6	2,1	3,1
n = 26	**Median**	0,2	4,3	5,1	1,2	0,7	2,6
93%	**min.**	0,2	0,05	0,4	0,2	0,5	2,6
	max.	2,3	18,6	18,5	7,3	8,7	13,5
	s (±)	0,6	4,4	4,3	1,5	2,4	2,1
March 03	**Average**	2,5	3,3	6,3	1,9	1,8	17,7
n = 16	**Median**	1,3	2,2	5,4	1,2	1,2	15,7
52%	**min.**	0,2	0,05	0,4	0,2	0,5	2,6
	max.	13,4	19,6	17,6	5,4	5,5	53,0
	s (±)	3,7	4,7	5,3	1,7	1,7	16,2
Apr.03	**Average**	13,3	10,8	28,6	3,4	3,7	28,8
n = 27	**Median**	8,0	9,2	23,7	2,2	2,3	22,0
90%	**min.**	0,2	0,7	1,5	0,5	0,5	2,6
	max.	44,3	27,4	80,0	15,4	15,8	83,5
	s (±)	13,9	8,9	24,4	3,5	3,8	22,1
May 03	**Average**	8,1	9,6	16,9	2,3	1,2	24,6
n = 14	**Median**	7,3	9,2	19,4	2,5	0,8	22,3
45%	**min.**	0,2	0,3	0,4	0,5	0,5	2,4
	max.	27,9	30,4	32,1	4,2	3,2	55,1
	s (±)	7,3	7,8	10,7	1,4	0,9	15,3
June 03	**Average**	8,7	13,7	25,6	5,6	3,0	40,7
n = 19	**Median**	5,7	11,5	20,7	5,2	2,5	37,1
63%	**min.**	0,8	2,0	1,1	0,2	0,5	21,3
	max.	27,7	42,7	61,9	10,8	10,2	68,9
	s (±)	7,1	9,8	17,2	3,0	2,0	13,2
July 03	**Average**	3,2	10,8	19,7	16,6	3,9	40,6
n = 25	**Median**	2,4	8,0	15,4	12,1	3,8	36,9
81%	**min.**	0,2	0,05	0,5	0,2	1,2	17,7
	max.	11,7	31,3	59,5	49,2	13,4	96,3
	s (+)	3,0	9,2	16,8	14,8	2,5	16,2

Continued Table 3.5

	(nmol m^{-3})	NO_3^-	SO_4^{2-}	NH_4^+	HNO_3	SO_2	NH_3
Aug.03	**Average**	9,0	19,8	38,5	20,6	4,9	54,6
n = 26	**Median**	5,5	16,2	35,1	16,5	3,4	51,7
84%	**min.**	0,2	0,1	1,4	0,2	0,4	20,4
	max.	31,1	72,7	124,8	79,3	16,3	134,1
	s (±)	9,4	17,4	32,7	16,4	3,8	28,5
Sep.03	**Average**	1,2	6,2	14,8	13,6	2,4	21,3
n = 16	**Median**	1,0	4,8	12,9	12,0	2,0	17,8
53%	**min.**	0,2	0,4	0,8	0,2	0,4	2,2
	max.	3,0	16,2	33,6	42,0	5,6	42,3
	s (±)	0,9	4,6	10,4	10,5	1,3	12,0
Oct. 03	**Average**	0,8	3,4	6,2	6,7	2,5	6,6
n = 26	**Median**	0,3	3,4	5,1	5,2	2,0	2,2
84%	**min.**	0,2	0,1	0,8	1,0	0,5	2,2
	max.	4,0	7,7	17,2	22,5	10,1	39,9
	s (±)	0,9	2,2	4,8	4,9	2,2	8,9
Nov.03	**Average**	1,2	4,6	7,0	5,4	2,0	3,5
n = 26	**Median**	0,9	3,0	4,8	4,8	1,1	2,3
84%	**min.**	0,2	0,2	0,6	0,9	0,5	2,3
	max.	5,1	14,2	24,3	13,5	7,9	18,7
	s (±)	1,3	4,1	6,6	3,6	2,1	3,5
Dec. 03	**Average**	1,2	2,4	4,2	2,9	1,5	2,9
n = 23	**Median**	1,0	2,2	3,1	1,8	1,1	2,3
74%	**min.**	0,2	0,4	0,6	0,7	0,5	2,3
	max.	5,0	6,9	10,4	15,5	6,3	17,8
	s (±)	1,2	1,6	3,0	3,0	1,6	3,2
Jan. 04	**Average**	1,3	2,8	4,9	3,9	3,7	1,8
n = 22	**Median**	1,1	2,2	4,1	3,8	2,8	1,8
71%	**min.**	0,4	0,6	1,1	0,9	0,2	1,8
	max.	3,9	7,1	14,4	6,5	8,9	1,8
	s (±)	0,8	2,0	3,5	1,6	2,6	0,0
Feb.04	**Average**	2,4	6,0	10,9	5,0	6,7	4,0
n = 15	**Median**	1,5	2,2	4,8	3,6	1,9	1,5
52%	**min.**	0,4	0,1	0,4	1,0	0,8	1,8
	max.	7,1	28,6	52,2	25,0	31,1	20,5
	s (±)	2,4	8,4	14,8	6,0	8,7	5,0
March 04	**Average**	10,1	6,0	16,4	8,4	3,3	8,1
n = 25	**Median**	7,0	4,7	13,6	6,0	2,3	3,9
83%	**min.**	0,4	0,3	2,4	1,9	0,2	1,8
	max.	43,4	17,3	67,5	34,5	12,3	53,9
	s (±)	11,7	4,2	15,6	8,9	3,0	11,6
Apr.04	**Average**	4,2	7,6	12,4	8,4	2,0	12,1
n = 27	**Median**	2,2	6,6	9,3	5,7	1,5	6,7
90%	**min.**	1,1	0,4	0,9	0,9	0,6	2,2
	max.	19,3	27,4	44,0	24,8	11,6	44,9
	s (±)	4,8	6,2	11,7	7,4	2,2	12,9

Continued table 3.5

	(nmol m^{-3})	NO_3^-	SO_4^{2-}	NH_4^+	HNO_3	SO_2	NH_3
May 04	**Average**	11,1	7,8	14,8	14,4	1,6	27,2
n = 24	**Median**	6,6	3,4	7,5	8,5	1,0	15,4
77%	**min.**	1,1	0,1	0,9	0,9	0,6	2,2
	max.	44,0	42,2	88,9	58,7	4,8	80,4
	s (±)	13,6	11,0	22,3	15,0	1,4	24,7
June 04	**Average**	9,4	9,9	17,7	19,8	1,9	24,8
n = 20	**Median**	5,2	7,8	15,2	21,8	1,7	24,6
65%	**min.**	1,1	0,1	0,9	3,8	0,6	2,2
	max.	32,4	33,5	51,2	34,4	5,2	54,7
	s (±)	9,1	8,4	14,2	8,9	1,3	14,7
July 04	**Average**	13,1	12,9	24,5	23,6	3,1	26,4
n = 16	**Median**	8,1	7,0	12,8	19,1	2,5	20,8
53%	**min.**	1,1	0,4	0,1	0,9	0,6	2,2
	max.	97,2	37,9	79,8	50,4	12,3	72,9
	s (±)	23,0	13,9	27,3	17,1	2,7	18,9
Aug.04	**Average**	11,3	30,6	61,5	43,5	2,9	38,2
n = 10	**Median**	6,8	33,0	63,5	45,3	2,7	36,6
32%	**min.**	1,1	0,5	17,6	11,2	0,6	16,2
	max.	58,2	50,5	118,7	71,8	8,0	65,9
	s (±)	16,9	16,7	32,1	18,7	2,1	18,2
Sep.04	**Average**	6,3	6,1	10,8	11,7	2,2	16,0
n = 27	**Median**	1,1	3,9	5,4	9,0	1,6	11,8
90%	**min.**	1,1	0,1	0,9	0,9	0,6	2,2
	max.	64,0	21,9	38,5	29,5	8,8	49,1
	s (±)	13,0	6,0	12,0	8,6	2,1	14,0
Oct. 04	**Average**	3,1	13,9	26,9	18,3	0,6	19,2
n = 6	**Median**	1,1	13,5	25,8	18,5	0,6	18,1
20%	**min.**	1,1	4,8	5,8	10,7	0,6	4,8
	max.	10,7	24,7	51,6	24,7	0,6	33,6
	s (±)	3,9	6,7	15,0	5,6	0,0	9,4

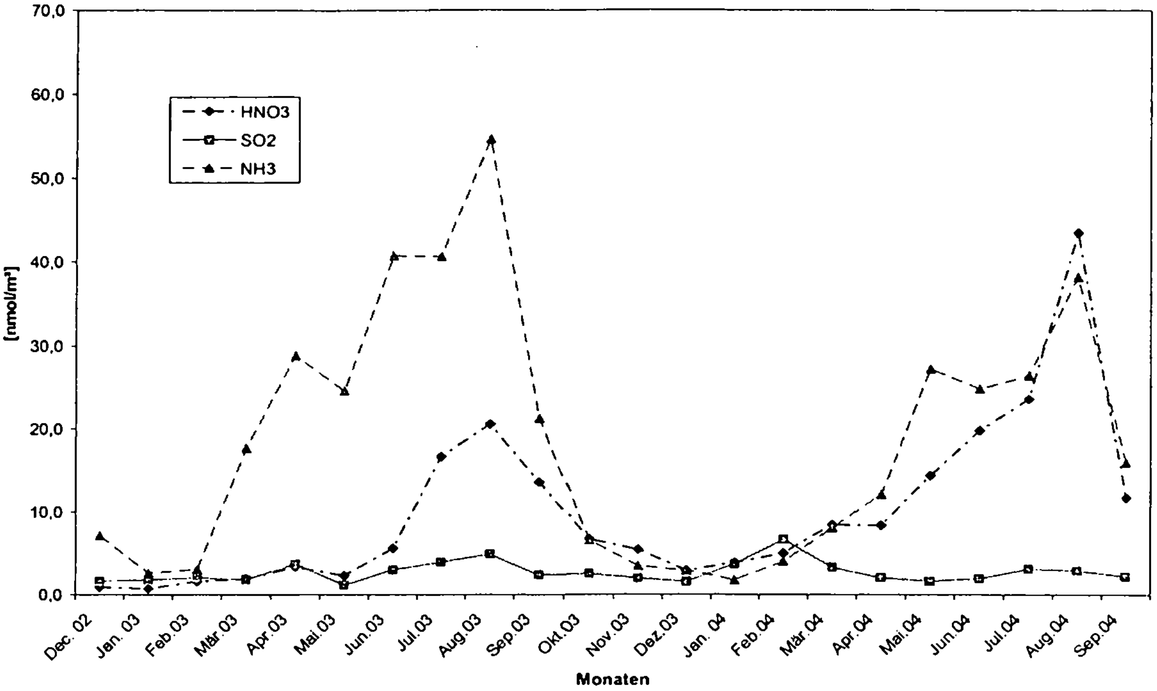


Fig. 3.18: Annual cycle of the measured values of trace gases.

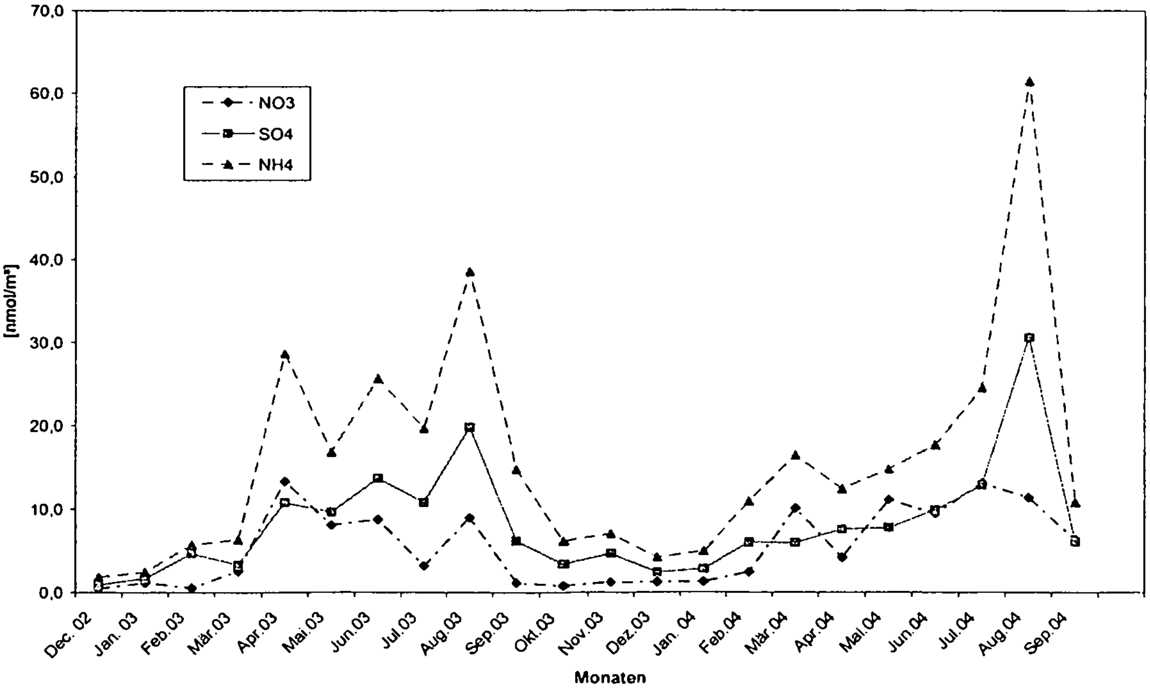


Fig. 3.19: Annual cycle of the measured values of particulate aerosols.

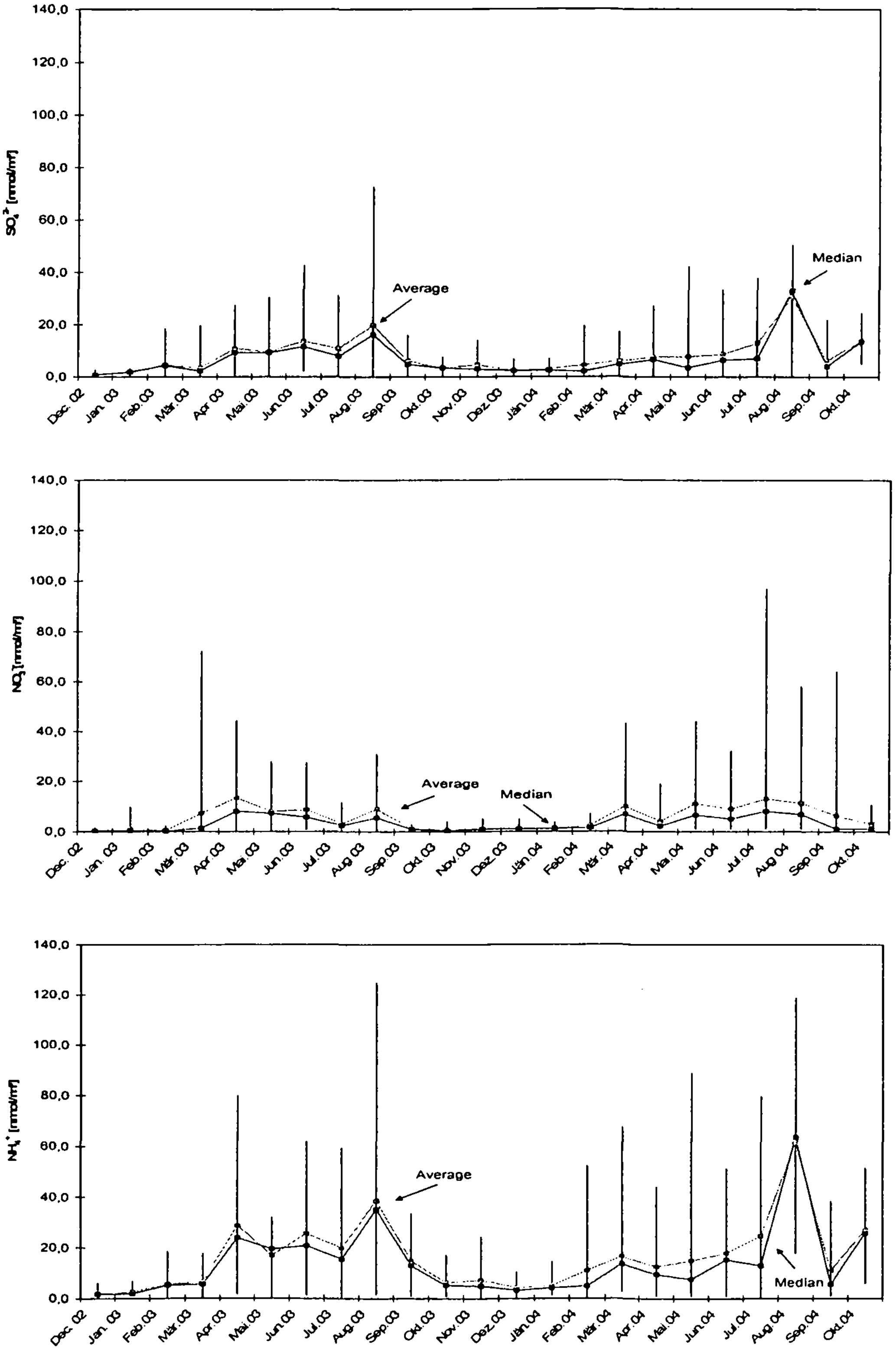


Fig. 3.20 - 22: Average-, median-, maximum- and minimum values for SO_4^{2-}, NO_3^- and NH_4^+

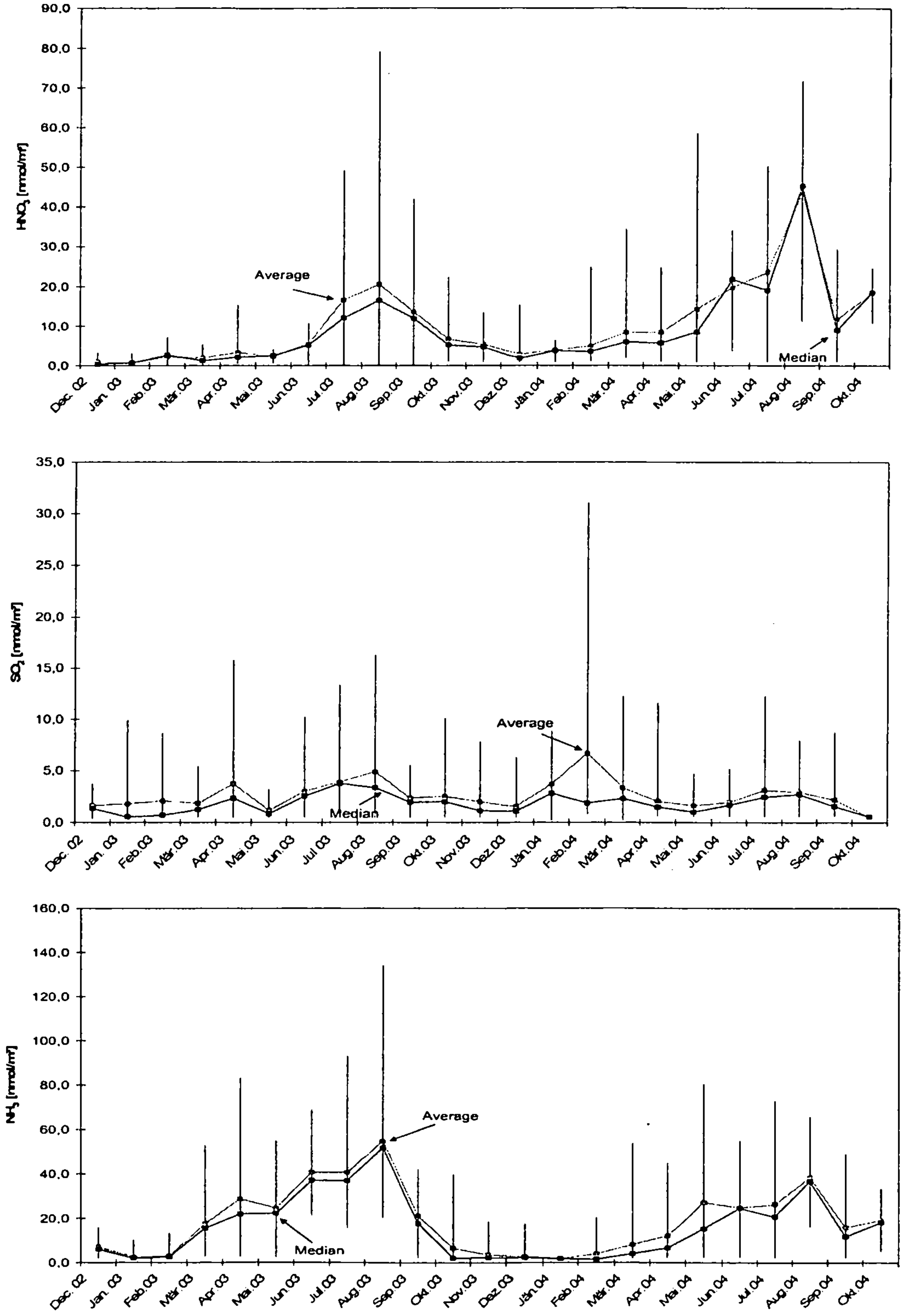


Fig. 3.23-25: Average-, median-, maximum- and minimum values for HNO_3, SO_2 and NH_3

Comparison between summer and winter averages

The period of November, December, and January was averaged as winter, while the months of June, July, and August were summarized as summer period. The calculation of a summer / winter ratio represents the seasonal changes of the concentration values of the individual compounds at the background site Hoher Sonnblick. These data are summarized in Tables 3.6 and 3.7.

Table 3.6: Arithmetic average (x) and Standard deviation (s) for the summer and winter periods and the entire sampling period (December 02 to October 04)

	NO_3^-	SO_4^{2-}	NH_4^+	HNO_3	SO_2	NH_3
[nmol/m³]	x (s)	x (s)	x (s)	x (s)	x (s)	x (s)
Dec. 02 – Oct. 04	5,5 (10)	7,9 (10)	15 (20)	9,6 (12)	2,9 (4)	19 (21)
Winter (Dec.-Jan.)	1,1 (1)	2,7 (3)	4,4 (4)	3 (3)	2,5 (3)	3,6 (4)
Summer (Juny – Aug)	8,4 (12)	15 (14)	28 (27)	20 (16)	3,4 (3)	38 (22)

Table 3.7: Summer / winter ratios calculated from monthly average

	NO_3^-	SO_4^{2-}	NH_4^+	HNO_3	SO_2	NH_3
Summer / Winter	8	5	6	7	1	11

Summer and winter average values can also be calculated based on median values of the single months. Summer/winter ratios based on these data are given in table 3.8.

Table 3.8: Summer / winter ratios calculated from the median

	NO_3^-	SO_4^{2-}	NH_4^+	HNO_3	SO_2	NH_3
Summer / Winter	7	6	8	7	2	15

3.1.4. Neutralization ratio

The compounds sulphate and ammonium show, as expected, very similar annual cycles. Since the SBO is a background measurement site both compounds appear mainly in the form of ammonium sulphate. Normally, it can be expected that at a background site the aerosols are totally neutralized. At a background site at an elevation of 3 km, this is not always the case. In free tropospheric air masses more there is a sulphate source but no source for ammonia and/or ammonium. Thus aerosol gets more acidic. Regarding monthly averages at Sonnblick, the aerosol neutralization ratio (calculated as NH_4^{2+} [nmol/m³] / 2*SO_4^{2-} [nmol/m³]) is always below 1. The ratio of 1 represents a completely neutralized aerosol. Values above 1 show an excess of ammonium and therefore point to the existence of other ammonium salts like ammonium nitrate.

Considering the daily averages, it is possible to note that low neutralization ratio are mainly determined in winter and during days with a lower aerosol concentrations. If the measurement site is influenced less from ground level air masses, the influence of ammonia is smaller and, consequently, also the aerosol neutralization ratio. Aerosols collected within the free troposphere show low neutralization ratios (Georgii 1978, Galasyn et al. 1987, Huebert and Lazrus 1980). At SBO during the months November 2003 till January 2004 the neutralization ratio is 0,8 on average.

During summer maximum aerosol concentrations were determined. The neutralization ratio is generally about 1, while during individual summer months the monthly average increases to a value of 1,2.

During the winter months some days show ammonium concentrations below the detection limit. As the detection limit for ammonium is higher than for sulphate, is the neutralization ratio gets overestimated during these days. Furthermore the presence of other ammonium salts (such as ammonium nitrate) would give a neutralization ratio above 1. The scale in figure 3.26 was arbitrarily defined with a neutralization grade of 2. There are other sporadic data points, which are above this value.

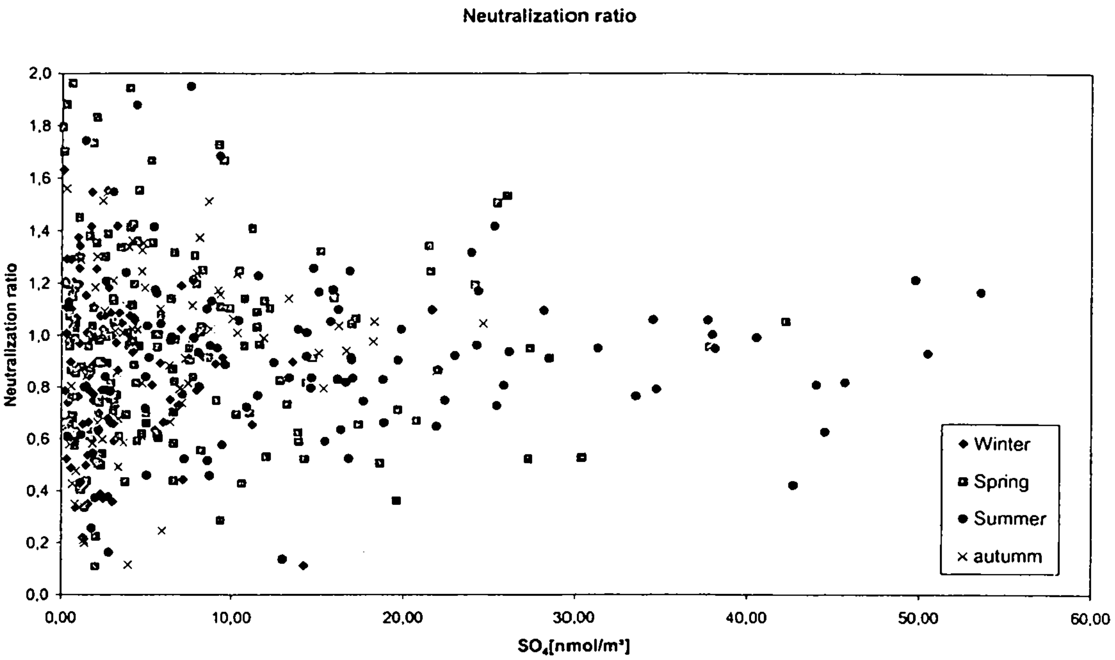


Fig. 3.26: Comparison of neutralization grades (NH_4^{2+} [nmol/m³]/2*SO_4^{2-}[nmol/m³]) and sulphate concentrations (daily samples).

3.1.5. Aerosol fraction

Table 3.9 shows, based on monthly averages, the relative contribution of the particle phase fraction to the sum of aerosol compounds and trace gas. The calculations were performed only for sulphate and nitrate. For ammonium it is not reasonable to calculate this fraction, as the detection limit for ammonia is clearly above the detection limit for ammonium. As ammonia concentrations were frequently below the detection limit in winter, the relationship would give a systematic error.

Figure 3.27 shows the aerosol fraction for sulphate and nitrate compared to the aerosol concentration. Based on daily values, the aerosol fraction for sulphate (SO_4^{2-} / (SO_4^{2-} + SO_2)) has an annual average of about 64%. In summer this value is about 71% and in winter about 52%. These points to the special conditions prevailing at Sonnblick. In summer, the measurement site is influenced by the mixing layer. Being not directly influenced by emission sources the boundary layer below the sites contains more particulate sulphate, a secondary polluted, than the precursor substance sulphur dioxide. In winter the influence of the mix layer decreases. Therefore, the sulphate concentration decreases more than the sulphur dioxide concentration.

For nitrate no big difference between winter (33%) and summer (31%) was determined. The annual average is about 35%. The concentration of particulate nitrate in comparison with the reactive gas nitric acid is controlled mainly by the semivolatile behavior of ammonium nitrate both in the mix layer and the free troposphere.

Table 3.9: Monthly averge of Aerosol fraction for sulphate and nitrate

Months	$SO_4^{2-}/\Sigma(SO_2+SO_4^{2-})$	$NO_3^-/\Sigma(HNO_3+NO_3^-)$
December 02	0,3	0,4
January 03	0,6	0,5
Februayr 03	0,7	0,3
March 03	0,5	0,6
April 03	0,7	0,7
May 03	0,8	0,7
June 03	0,8	0,6
July 03	0,6	0,2
August 03	0,7	0,3
September 03	0,6	0,1
October 03	0,5	0,1
November 03	0,7	0,2
December 03	0,5	0,3
January 04	0,5	0,3
Februayr 04	0,4	0,3
March 04	0,6	0,5
April 04	0,7	0,3
May 04	0,7	0,4
June 04	0,8	0,3
July 04	0,7	0,3
August 04	0,8	0,2
September 04	0,6	0,3
October 04	1,0	0,1

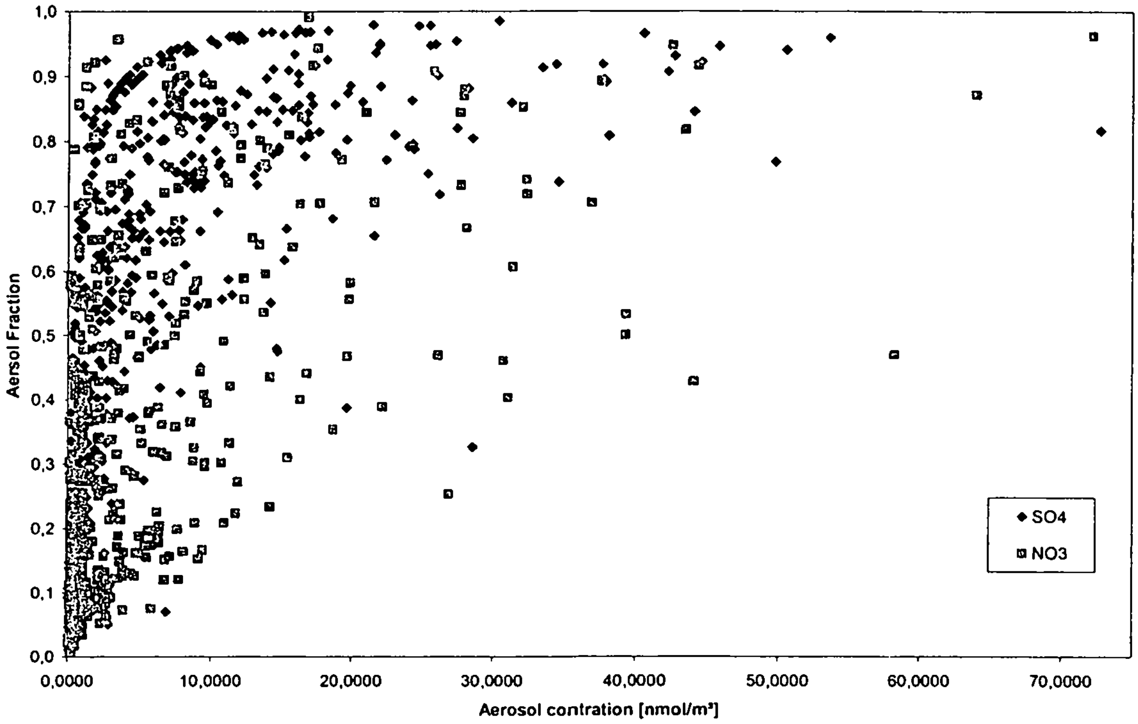


Fig. 3.27: Comparison of the "Aerosol Fraction" versus the aerosol concentration determined at SBO.

3.1.6. Annual cycles of minor inorganic and organic aerosol constituents

Seasonal cycles

The concentrations of chloride, oxalate, sodium, potassium, calcium and magnesium are clearly lower than the values for sulphate, nitrate and ammonium. Table 3.10 summarizes the monthly arithmetic averages, medians, minimum and maximum concentrations, standard deviations, and the number of samples taken per month (n).

In Figure 3.28, the seasonal cycles of the aerosol compounds chloride, oxalate, sodium, potassium, calcium and magnesium are given based on monthly averages (arithmetic average of the daily samples).

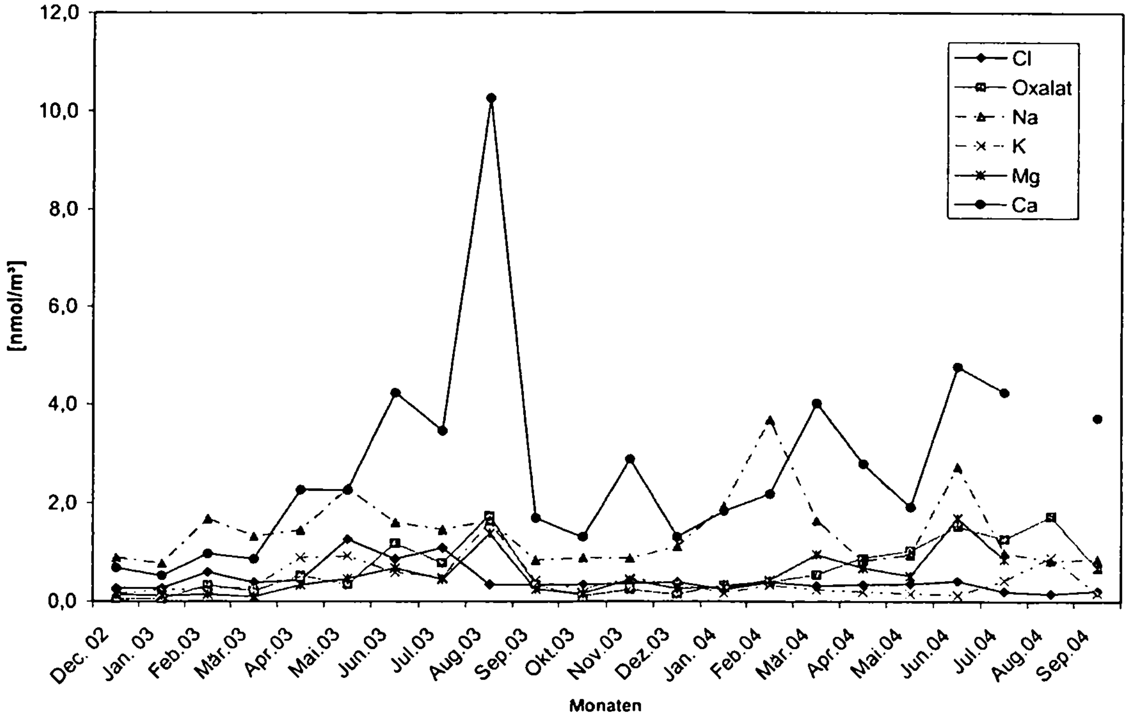


Fig 3.28: Seasonal cycle of concentration values for chloride, oxalic, sodium, potassium, magnesium and calcium.

Table 3.10: Monthly averages,median concentrations, minimum (min) and maximum (max) values, standar deviation (s) and number of sample taken per month (n), in (nmol/m^3)

	(nmol m^{-3})	Cl$^-$	$C_2O_4^{2-}$	Na$^+$	K$^+$	Mg^{2+}	Ca^{2+}
Dec. 02	**Average**	0,3	0,05	0,9	0,2	0,1	0,7
n = 20	**Median**	0,3	0,02	0,8	0,2	0,1	0,4
65%	**min.**	0,3	0,02	0,8	0,2	0,1	0,2
	max.	0,3	0,1	3,1	0,2	0,7	3,3
	s (±)	0,0	0,04	0,5	0,0	0,1	0,7
Jan. 03	**Average**	0,3	0,1	0,8	0,2	0,1	0,4
n = 13	**Median**	0,3	0,02	0,8	0,2	0,1	0,2
42%	**min.**	0,3	0,02	0,8	0,2	0,1	0,2
	max.	0,3	0,1	0,8	1,1	0,4	1,1
	s (±)	0,0	0,04	0,0	0,0	0,0	0,3
Feb.03	**Average**	0,6	0,2	1,2	0,3	0,1	1,0
n = 26	**Median**	0,4	0,1	1,0	0,2	0,1	0,3
93%	**min.**	0,4	0,03	1,0	0,2	0,1	0,3
	max.	6,5	0,5	2,3	0,9	0,4	4,6
	s (±)	1,2	0,1	0,4	0,2	0,1	1,1
March 03	**Average**	0,4	0,2	1,3	0,3	0,1	0,9
n = 16	**Median**	0,4	0,1	1,0	0,2	0,1	0,7
52%	**min.**	0,4	0,03	1,0	0,2	0,1	0,3
	max.	0,8	1,6	3,4	0,7	0,1	2,1
	s (±)	0,1	0,4	0,8	0,2	0,0	0,6
Apr.03	**Average**	0,4	0,5	1,3	0,9	0,3	1,4
n = 27	**Median**	0,4	0,4	1,0	0,8	0,1	1,0
90%	**min.**	0,4	0,03	1,0	0,2	0,1	0,3
	max.	2,0	1,4	6,4	2,3	1,9	5,1
	s (±)	0,3	0,5	0,6	0,7	0,4	1,5
May 03	**Average**	0,6	0,3	1,3	0,6	0,3	1,4
n = 14	**Median**	0,4	0,3	1,0	0,7	0,1	0,7
45%	**min.**	0,4	0,03	1,0	0,2	0,1	0,3
	max.	1,7	1,1	4,4	1,5	3,2	5,8
	s (±)	0,5	0,3	0,9	0,4	0,2	1,5
June 03	**Average**	0,9	1,2	1,6	0,6	0,7	4,2
n = 19	**Median**	0,4	1,1	1,0	0,5	0,6	3,5
63%	**min.**	0,4	0,4	1,0	0,2	0,1	0,7
	max.	3,2	3,0	4,1	1,3	1,7	8,9
	s (±)	0,8	0,8	1,1	0,4	0,5	2,8
July 03	**Average**	1,1	0,8	1,5	0,5	0,4	3,5
n = 25	**Median**	0,4	0,5	1,0	0,2	0,3	2,9
81%	**min.**	0,4	0,03	1,0	0,2	0,1	0,3
	max.	5,6	2,1	4,6	1,8	2,3	10,5
	s (±)	1,5	1,1	2,2	0,8	0,9	4,0

Continued table 3.10

	(nmol m^{-3})	Cl^-	$C_2O_4^{2-}$	Na^+	K^+	Mg^{2+}	Ca^{2+}
Aug.03	**Average**	0,3	1,7	1,6	1,6	1,4	10,3
n = 26	**Median**	0,3	1,5	0,9	1,0	1,0	8,4
84%	**min.**	0,4	0,0	0,9	0,2	0,3	0,3
	max.	0,4	6,1	4,7	6,3	4,7	25,1
	s (±)	0,0	1,6	1,2	1,6	1,2	8,8
Sep.03	**Average**	0,3	0,3	0,8	0,4	0,3	1,7
n = 16	**Median**	0,3	0,3	0,8	0,2	0,3	1,3
53%	**min.**	0,3	0,04	0,8	0,2	0,3	0,4
	max.	0,3	0,9	0,8	1,7	0,3	4,9
	s (±)	0,0	0,3	0,0	0,5	0,0	1,4
Oct. 03	**Average**	0,3	0,1	0,9	0,2	0,2	1,3
n = 26	**Median**	0,3	0,1	0,9	0,2	0,1	0,9
84%	**min.**	0,3	0,0	0,8	0,2	0,1	0,4
	max.	0,7	0,3	1,8	0,8	0,4	4,1
	s (±)	0,1	0,1	0,2	0,1	0,1	2,8
Nov.03	**Average**	0,4	0,2	0,9	0,5	0,4	2,9
n = 26	**Median**	0,3	0,2	0,9	0,2	0,1	1,7
84%	**min.**	0,3	0,0	0,9	0,2	0,1	0,4
	max.	1,2	1,7	0,9	4,1	3,1	10,6
	s (±)	0,2	0,4	0,0	0,8	0,6	3,0
Dec. 03	**Average**	0,4	0,1	1,1	0,4	0,3	1,3
n = 23	**Median**	0,3	0,1	0,9	0,2	0,1	0,4
74%	**min.**	0,3	0,0	0,9	0,2	0,1	0,4
	max.	1,9	0,5	2,8	1,8	1,2	7,9
	s (±)	0,3	0,1	0,5	0,4	0,3	1,7
Jan. 04	**Average**	0,2	0,3	1,9	0,2	0,3	1,8
n = 22	**Median**	0,2	0,1	0,9	0,1	0,1	1,2
71%	**min.**	0,2	0,1	0,9	0,0	0,1	0,3
	max.	0,5	1,8	7,4	0,5	1,0	6,3
	s (±)	0,2	0,5	1,6	0,1	0,3	1,8
Feb.04	**Average**	0,4	0,4	3,7	0,3	0,4	2,2
n = 15	**Median**	0,2	0,1	0,9	0,2	0,1	1,8
52%	**min.**	0,2	0,1	0,9	0,0	0,1	0,3
	max.	1,7	1,6	29,2	1,2	1,8	9,5
	s (±)	0,5	0,5	7,3	0,4	0,5	2,3
March 04	**Average**	0,3	0,5	1,6	0,2	1,0	4,0
n = 25	**Median**	0,2	0,5	0,9	0,2	0,4	3,2
83%	**min.**	0,2	0,1	0,9	0,1	0,4	0,4
	max.	1,9	1,8	13,9	1,1	3,1	10,5
	s (±)	0,4	0,4	2,6	0,3	0,8	2,8
Apr.04	**Average**	0,3	0,9	0,8	0,2	0,7	2,8
n = 27	**Median**	0,3	0,6	0,8	0,1	0,4	2,7
90%	**min.**	0,2	0,2	0,8	0,1	0,4	0,6
	max.	0,9	3,8	0,8	0,5	2,2	13,0
	s (±)	0,2	0,9	0,0	0,1	0,5	2,4

Continued table 3.10

	(nmol m^{-3})	Cl^-	$C_2O_4^{2-}$	Na^+	K^+	Mg^{2+}	Ca^{2+}
May 04	**Average**	0,4	1,0	0,9	0,2	0,5	1,9
n = 24	**Median**	0,2	0,8	0,8	0,1	0,4	1,8
77%	**min.**	0,2	0,2	0,8	0,1	0,4	0,6
	max.	2,6	2,5	3,7	0,8	1,0	5,2
	s (±)	0,5	0,8	0,6	0,2	0,2	1,4
June 04	**Average**	0,4	1,5	2,7	0,1	1,7	4,8
n = 20	**Median**	0,2	1,3	0,8	0,1	0,4	0,6
65%	**min.**	0,2	0,2	0,8	0,1	0,4	0,6
	max.	4,1	6,9	38,8	0,3	14,5	39,5
	s (±)	0,9	1,4	8,5	0,1	3,1	8,8
July 04	**Average**	0,2	1,3	1,0	0,4	0,9	4,2
n = 16	**Median**	0,2	1,2	0,8	0,2	0,4	2,5
53%	**min.**	0,2	0,2	0,8	0,1	0,4	0,6
	max.	0,5	2,5	3,4	1,7	2,0	18,1
	s (±)	0,1	0,8	0,6	0,5	0,6	4,8
Aug.04	**Average**	0,2	1,7	0,8	0,9	n.a	n.a
n = 10	**Median**	0,2	1,8	0,8	0,8	n.a	n.a
32%	**min.**	0,2	0,2	0,8	0,4	n.a	n.a
	max.	0,2	2,6	0,8	1,7	n.a	n.a
	s (±)	0,0	0,8	0,0	0,5	n.a	n.a
Sep.04	**Average**	0,2	0,7	0,9	0,2	0,7	3,7
n = 27	**Median**	0,2	0,4	0,8	0,1	0,4	0,6
90%	**min.**	0,2	0,2	0,8	0,1	0,4	0,6
	max.	0,8	3,1	1,7	0,9	1,5	15,9
	s (±)	0,2	0,7	0,2	0,2	0,8	4,7
Oct. 04	**Average**	0,2	0,7	0,8	0,5	0,4	2,8
n = 6	**Median**	0,2	0,7	0,8	0,4	0,4	0,9
20%	**min.**	0,2	0,2	0,8	0,1	0,4	0,6
	max.	0,2	1,2	0,8	1,1	0,4	9,2
	s (±)	0,0	0,4	0,0	0,4	0,0	3,5

n.a. = not analized

As for the major aerosol compounds chloride, oxalate, sodium, potassium, magnesium and calcium, show some annual cycles, although they are less pronounced. At the same time, it is important to point to the small concentration values and that, especially in the cold season, a clear portion of the measurement values are below or in the range of the detection limit. To determine monthly average and median values, the measurement values below the detection limit were replaced with half of the detection limit. Especially noticeable is the pronounced seasonal cycle for calcium. Here the influence of construction activity for renovation at the top of Sonnblick cannot be neglected.

Comparison of oxalate and sulphate concentrations

In attempting to characterize an aerosol sample with the individual substances contained in organic carbon, organic acids represent a significant contribution, in the range of 10% (Limbeck and Puxbaum 2000). Oxalic acid, a dicarboxilic acid (C2) that is very water soluble, is most frequently found in aerosol samples and often shows elevated concentration values (Löflund et al. 2002). With respect to oxalic acid formation in the atmosphere, different mechanisms were discussed in the literature. The biomass combustion represents an emission source, whereas both the direct emission and the photochemical formation of this acid in an exhaust-gas plume are possible. Also anthropogenic sources are considered for the oxalic acid emission, whereas here the photochemical formation from hydrocarbon of antecedence is important. Because of its relatively high concentration values and good determinability (the sampling and analysis of teflon filter are possible), oxalate was taken as a tracer for the determination of organic acids and consequently organic carbon in aerosol samples.

Figure 3.29 compares the seasonal cycle of sulphate and oxalate at SBO. The annual cycles of both compounds show good agreement, although oxalate concentrations are generally more than one order of magnitude lower than sulphate concentrations.

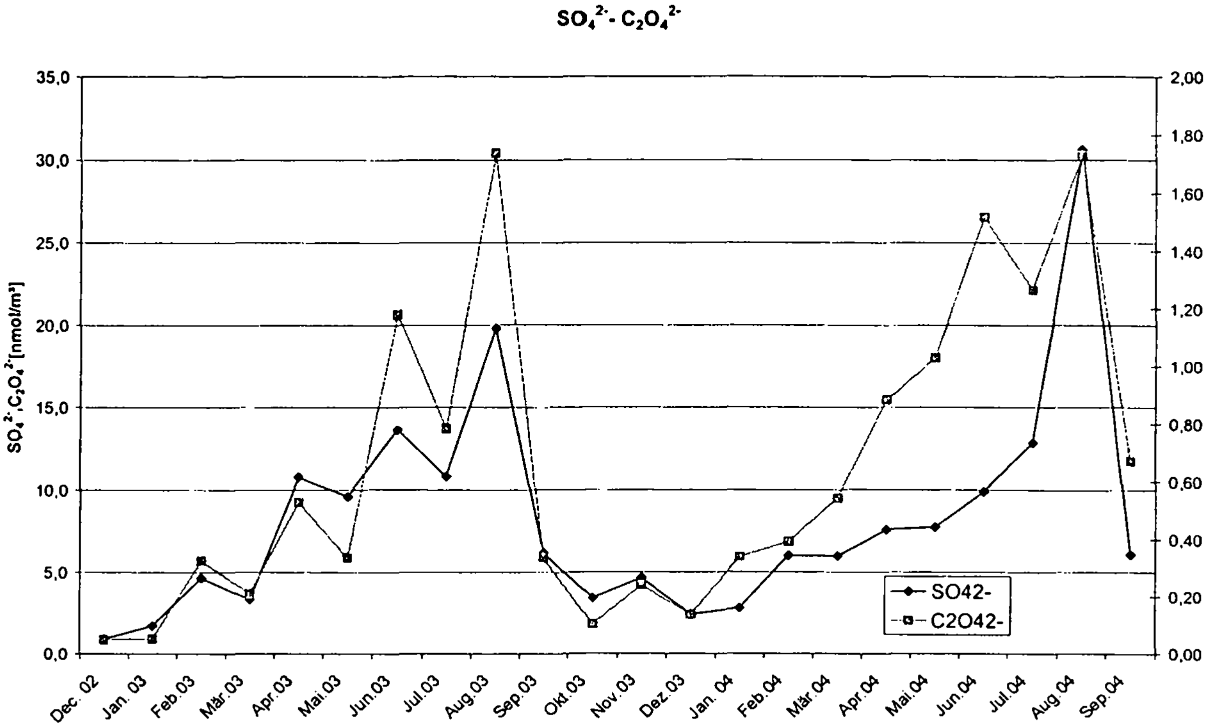


Fig. 3.29: Seasonal cycle of concentration values for sulphate and oxalate.

Analysis also included the determination of the organic acids acetate, formate, pyruvate, malate, malonate and maleate. For these compounds daily average values over the detection limit could be scarcely quantified. Hence the detection limit can be given only (see table 3.11) as on "upper concentration range" usually not reached at the site.

Table 3.11: Detection limit of the determination of organic acids

	Acetate	Formiate	Pyruvate	Malate	Malonate	Maleate
DL [nmol/m³]	0,4	0,1	0,1	0,1	0,1	0,1

3.3.7. Comparison of the measurement series 2002-2004 with the measurement series 1991-199

Figures from 3.30 to 3.35 show a comparison between the measurement series described here and the measurements at the beginning the 1990's (Kasper and Puxbaum, 1998). So the seasonal cycles of the measurement series were overlaid with each other. Of course, an optimal agreement of the values was not expected. The comparison shows similarities in the concentration range and general temporal trends but also differences of the annual cycles.

Basically, both the measured concentration range and the annual cycle are very similar, especially in the winter months. That is the time when Sonnblick is influenced by the free troposphere. The maximum monthly average values in the summer months show some differences. In summer 2003 and especially in early summer 2004, the concentration values of aerosol compounds ammonium and sulphate are clearly below the results of the previous measurements. For nitrate this effect does not appear.

The summer period in 2003 was rather hot, while in 2004 winterly conditions were prevailing of the site until middle of July.

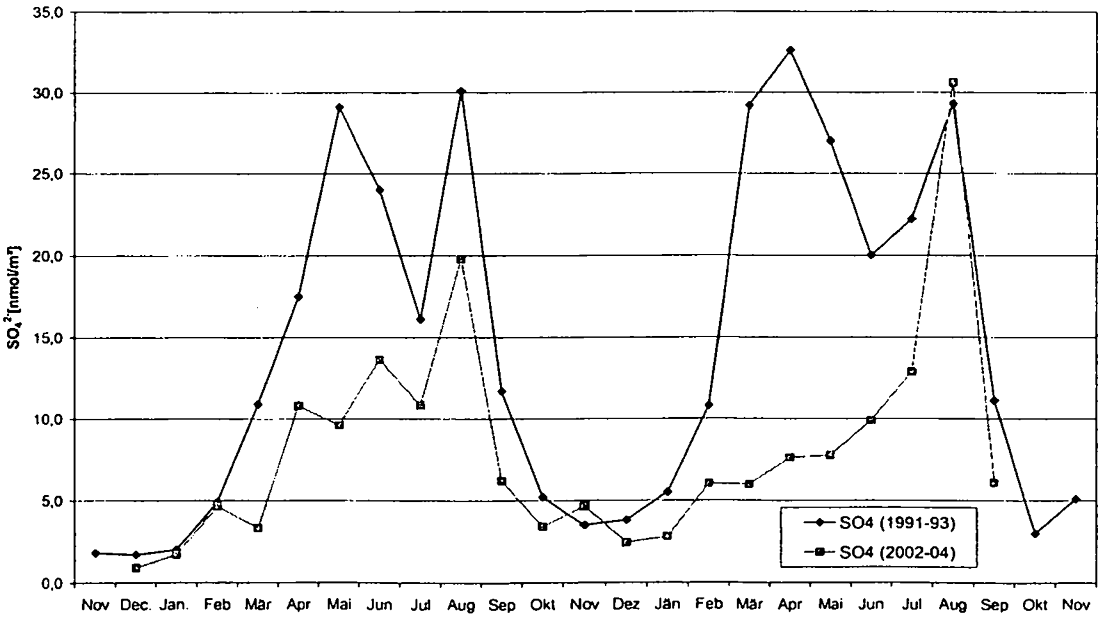


Fig. 3.30: Comparison of the filter measurement in 1991-1993 with the measuremet in series 2002-2004 for sulphate

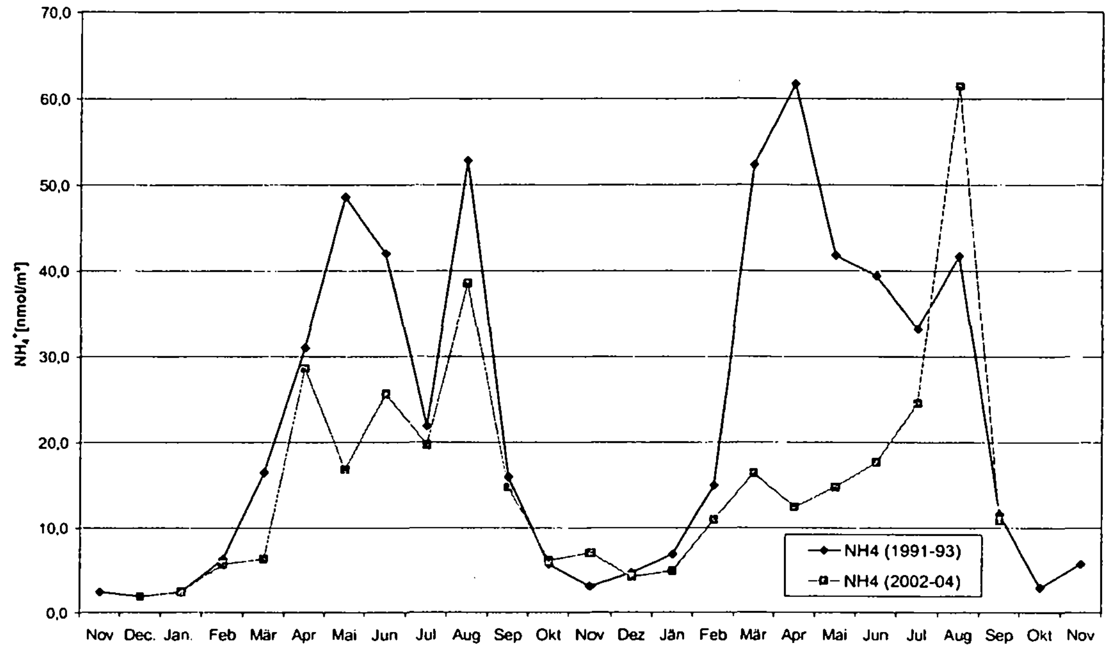


Fig. 3.31: Comparison of the filter measurement in 1991-1993 with the measurement series in 2002-2004 for ammonium.

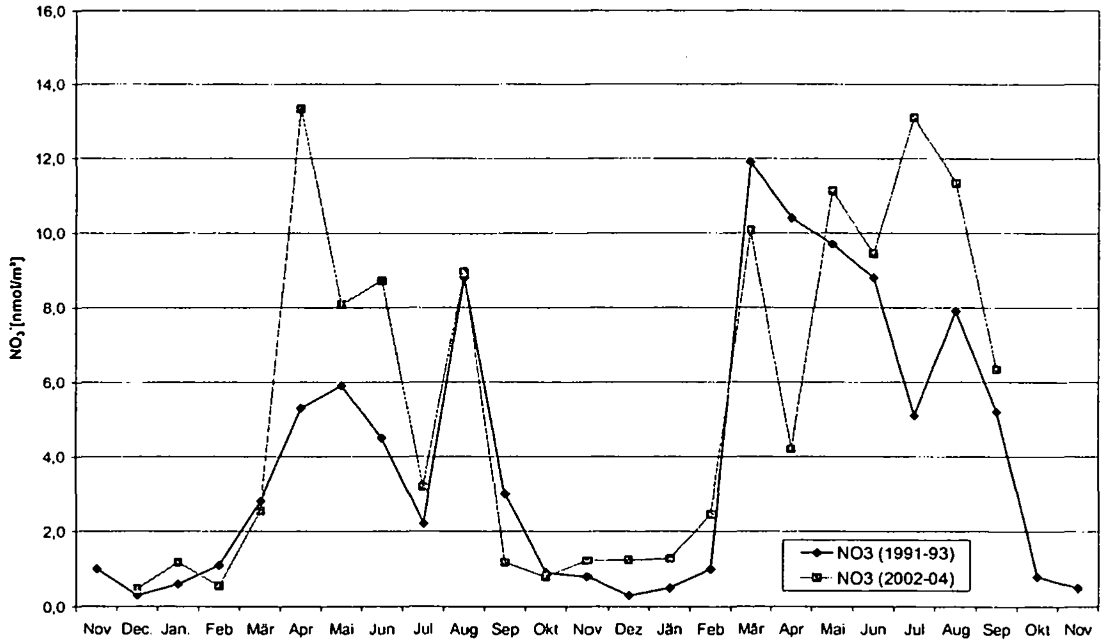


Fig. 3.32: Comparison of the filter measurement in 1991-1993 with the measurement series in 2002-2004 for nitrate.

The evaluation of trace gases showed major differences, although the basic trends remained. Sulphur dioxide showed during both sampling periods only a weakly pronounced seasonal cycle. The maximum monthly average values are not driven by the air status at the site (like it is the case for the aerosol compounds). Sulphur dioxide concentrations are apparently determined by long-distance transport and cloud events (Tscherwenka et al. 1998). Ammonia concentrations are higher in the 2002-2004 period than at the beginning of the 1990's. Here a methodic effect (adjustment the equilibrium ammonium / ammonia) by the heating of the suction line can not be eliminated. This is valid also for the clearly higher concentration values for nitric acid, which were measured in summer months 2003 and 2004.

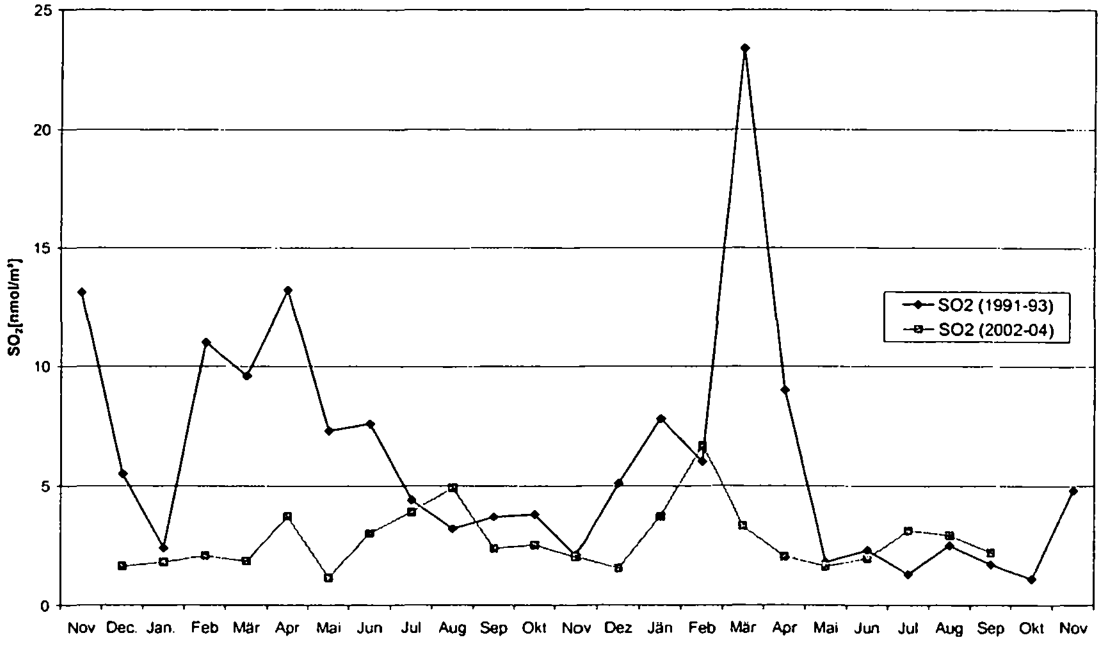


Fig. 3.33: Comparison of the filter measurement in 1991-1993 with the measurement series in 2002-2004 for Sulphur dioxide

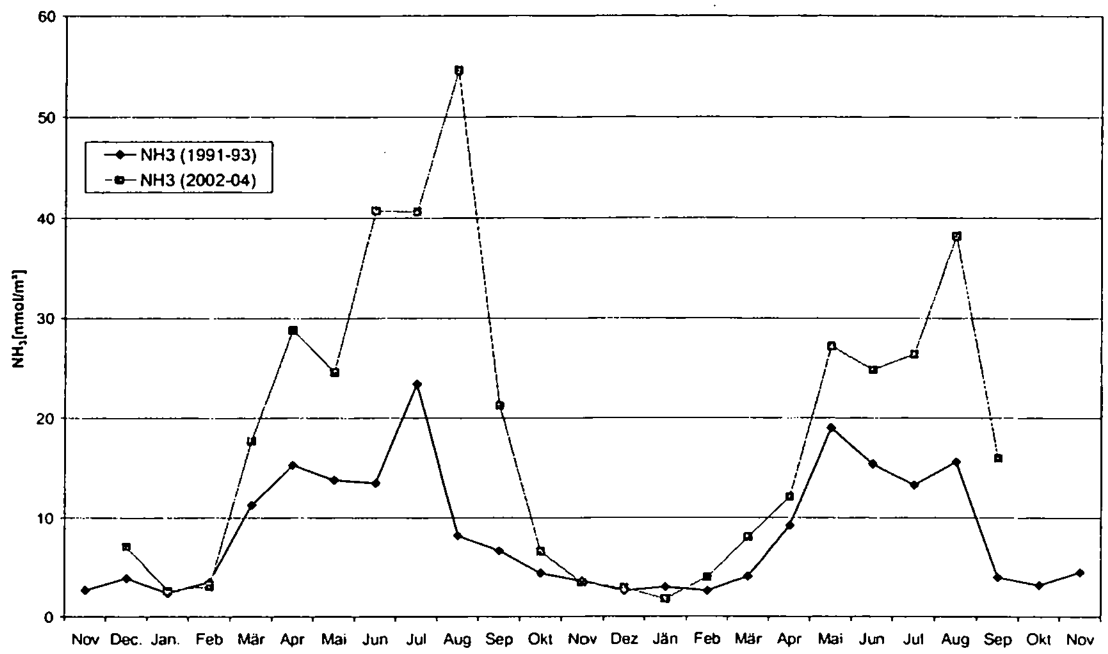


Fig. 3.34: Comparison of the filter measurement in 1991-1993 with the measurement series in 2002-2004 for ammonia

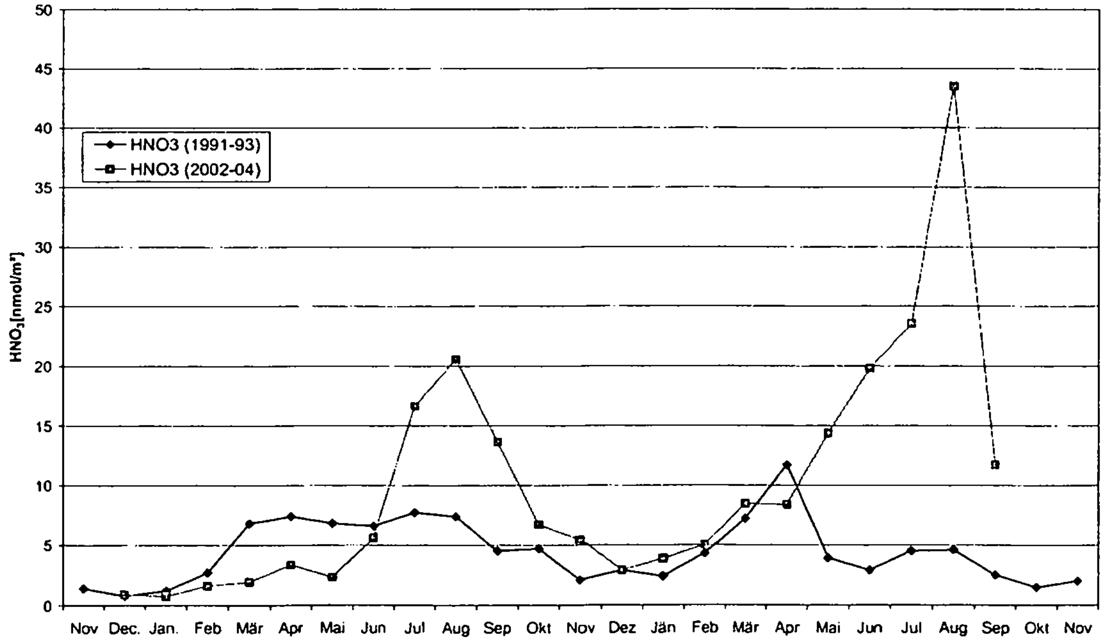


Fig. 3.35: Comparison of the filter measurement in 1991-1993 with the measurement series in 2002-2004 for nitric acid

3.1.8. Comparison of aerosol data and gas phase concentrations and precipitation data

During the filter measurements snow samples were collected with a WADOS (Wet and Dry Only Sampler). These measurements are continually carried out since 1987 in cooperation with the Local Authority of Salzburg. The precipitation samples are collected daily at 8 a.m. Thus it is possible to compare precipitation and filter pack data.

Table 3.12 lists the monthly average values of precipitation measurements. Table 3.13 contains the annual average values and average values for the summer and winter periods of snow measurements at Sonnblick.

Table 3.12: Monthly average of precipitations [µg/l]

	SO_4^{2-}	NO_3^-	NH_4^+
Dec. 02	375	508	50
Jan. 03	125	247	31
Feb.03	32	81	37
Mar.03	305	717	153
Apr.03	1261	1265	614
May 03	1131	1261	616
Jun.03	1052	1156	658
Jul.03	1050	1208	575
Aug.03	1107	1096	553
Sep.03	1026	1408	436
Okt.03	184	227	60
Nov.03	170	166	10
May 04	749	1420	458
Jun.04	720	1184	441
Jul.04	775	998	384
Aug.04	879	1051	382
Sep.04	459	820	301

Table 3.13: Annual and period average of precipitations [µg/l]

	SO_4^{2-}	NO_3^-	NH_4^+
Summer period	931	1116	499
Winter period	223	307	31
Annual average	671	871	339

The concept of scavenging ratios is based on the simplified assumption that the concentration of a component in precipitation is related to the concentration of the respective compound in the air (Engelmann, 1971).

$$\omega i = Cp,i / Ca,i$$

ωi Scavenging Ratio of compound i
Cp,i Concentration of compound i in snow
Ca,i Concentration of compound i the gas phase (or in aerosol)

Thus scavenging ratios can be calculated on a volume basis:

$$\omega i = (Cp,i\ [\mu equ/l] / Ca,i\ [nequ/m^3]) * 10^6$$

Using this approach it has to be held in mind that the transfer of airborne compounds into the liquid phase and further to snow or rain is extremely complex (Slinn, 1984). Aerosol particles can act primarily as condensation nuclei. Thus they are already included in the cloud water drops when they form. Furthermore aerosol particles can be collected by the existing droplets via both, impaction and diffusion processes. Trace gases can also be dissolved in droplets. Especially nitric acid is very well soluble and reactive. In case of sulphur dioxide the uptake in the liquid phase does not depend only on the compound concentration in the gas and liquid phase, but also on another reaction partners (e.g. oxidation of sulphite to sulphate by hydrogen peroxide).

Sulphate, nitrate and ammonium determined in precipitation samples can be related to aerosol phase sulphur, nitrate and ammonium (aerosol scavenging) and to the trace gases sulphur dioxide, nitric acid and ammonia (gas phase scavenging).

Due to the air concentrations of particulate matter and trace gases at Sonnblick and the different reactivity of the trace gases following scavenging ratios were calculated:

$$\omega_{SO4} = C_{p,\ SO4} / C_{a,\ SO4}$$

$$\omega_{NH4} = C_{p,\ NH4} / C_{a,\ NH4}$$

$$\omega_{NO3} = C_{p,\ NO3} / (C_{a,\ NO3} + C_{a,\ HNO3})$$

Scavenging ratios represent a summarizing parameter, which contains all the different processes of scavenging. Nevertheless average scavenging ratios have proven to be an useful tool to relate airborne concentrations to concentrations in precipitation and they are used in large-scale models of wet depositions. Another field of application is the use of scavenging ratios to calculate concentrations of past atmospheres based on liquid phase concentrations from ice cores. The results of scavenging ratios determined at different locations and from different viewpoints (e.g. Harrison and Allen 1991, Davidson et al. 1985, Davidson et al. 1987, Barrie 1985, Chan and Chung 1986, Baltensberger et al. 1993) show the usability of this strong simplified approach.

The calculation of concentration values in snow from aerosol phase measurements gives data for wet deposition for sampling sites where only gas and aerosol measures are available.

The figures from 3.36 to 3.38 show the annual cycle of concentrations in gas phase and in snow. Unfortunately, between November 2003 and May 2004 there was a longer loss of snow measurements because of a failure of the WADOS instrument. Even so, the regular trend of the concentration values for the single compounds in Aerosol as well as in snow is possible to recognize.

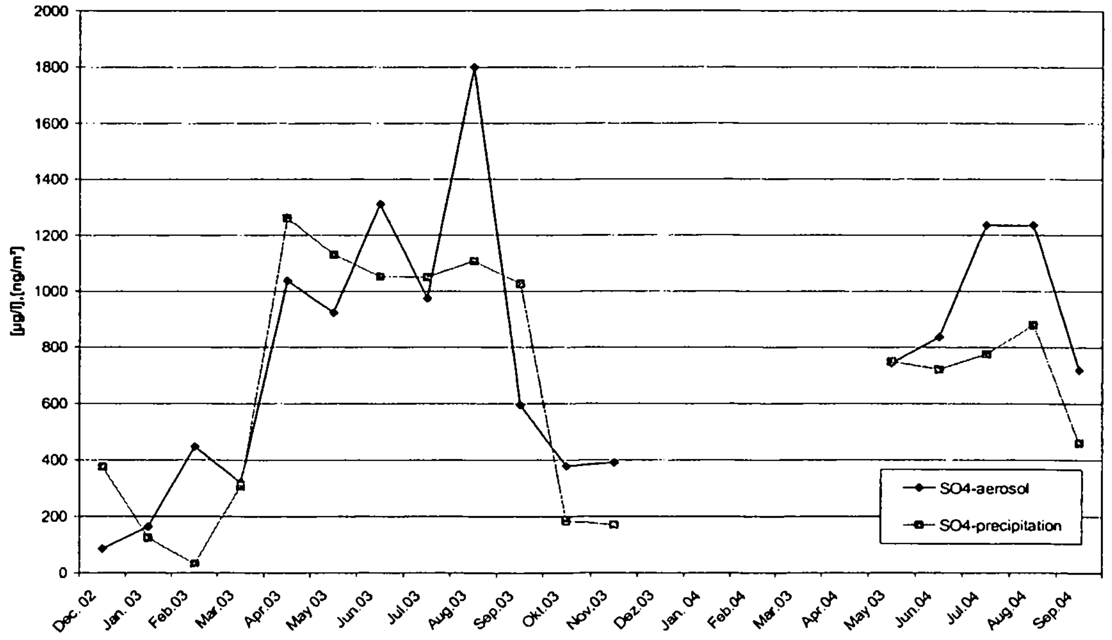


Fig.3.36: Annual cycle for sulphate in aerosol and in precipitation

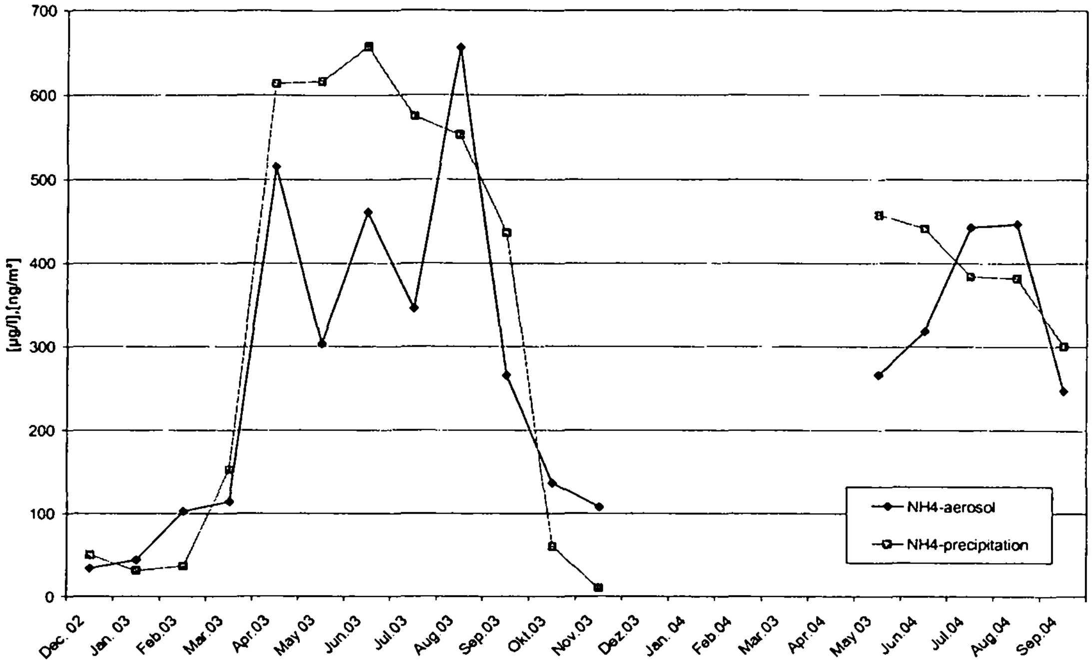


Fig.3.37: Annual cycle for ammonium in aerosol and in precipitation

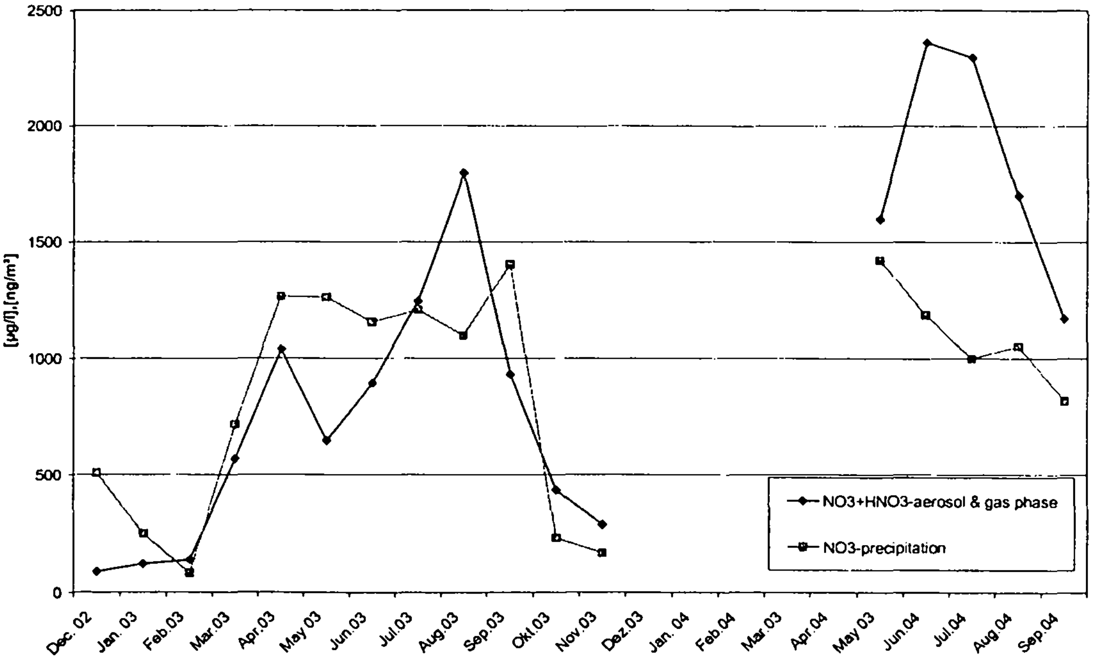


Fig.3.38: Annual cycle for nitrate in sum of aerosol & gas phase and in precipitation

Table 3.14 summarizes the monthly average values of the calculated scavenging ratios. As previous measurements showed the tendency to high scavenging rations during the cold annual cycles, additionally to the yearly averages the average for the summer (June-August) and winter period (November- January) are given. Also here it is possible to compare the results with the calculation of scavenging ratios for the measurements in the beginning 1990's. For the measure period from 1991 to 1993 the annual average values of scavenging ratios are 2,6 $*$ 10^6 for the sum nitrate, 1,4 $*$ 10^6 for sulphate and 1,8 $*$ 10^6 for ammonium.

Table 3.14: Annual and period average of the scavenging ratios

	SO_4^{2-} (10^6)	NO_3^-+HNO_3 (10^6)	NH_4^+ (10^6)
Summer period	0,8	1,3	1,2
Winter period	1,8	5,0	0,8
Annual average	1,0	2,9	1,1

3.2 High-Volume - Levoglucosan and cellulose

3.2.1. Literature comparison for levoglucosan

The major organic components of smoke particles from biomass burning are monosaccharide derivates from the breakdown of cellulose, accompanied by generally lesser amounts of straight-chain, aliphatic and oxygenated compounds and terpenoids from vegetation waxes, resins/gums, and other biopolymers. Levoglucosan and the related degradation products from cellulose can be utilized as specific and general indicator compounds for the presence of emissions from biomass burning in samples of atmospheric fine particulate matter (Simoneit et al. 1999). Some previous works have obtained the same conclusion about levoglucosan. It is emitted in large amounts, is sufficiently stable and is specific to burning cellulose-containing substances. Thus, it meets all important criteria to serve as an ideal molecular marker of biomass burning. Table 3.15 shows a compilation of reported concentration ranges and contribution of levoglucosan in wood burning to OC. All these works were performed using a quartz fibber filter for sampling.

The highest concentration values of levoglucosan are observed in Kuala Lumpur (Malaysia). The episode of biomass smoke pollution, locally known as haze, which struck Southeast Asia in 1997 has been claimed as one of the world's worst ever pollution events in terms of its intensity, extent, duration, and the number of people affected (Nichol et al. 1998). In urban atmosphere like Kuala Lumpur, the particles during a haze event are expected to be comprised of both input from biomass combustion as well as vehicular emissions. In this work, Nichol and collaborators reported the results of a study of the extractable organic components of air particles sampled during day- and nighttimes (daytime from 07:31 to 19:30 local time, and nighttime from 19:31 to 07:30) over a 5-day period (from 15 to 19 September) during the smoke-haze episode of 1997 (Simoneit et al. 2004). The dominant biomass burning component is comprised of levoglucosan, the concentration value for daytime is 40240 ng/m^3 and for nighttime is 33600 ng/m^3. The difference between day and night is not very pronounced, that is because of the stability during the haze episodes. The other sampling place in this work, used as background, presents also very high concentration values during the day as well as during the night. The values are 3780 and 1400 ng/m³, respectively, but these values are at least 10 times lower than the urban place.

Zbynek and collaborators work was based on the analysis of aerosol samples were analyzed from two different regions of the globe, a Brazilian tropical rainforest and a Belgian urban site (Zbynek et al. 2000). Samples were collected during episodes that were characterized by a different biomass combustion activity (winter vs. summer in Belgium, dry vs. wet season in Brazil). The highest concentrations are observed in Rondônia (Brasil) during the dry period (2006 ng/m³, ranging between 446 and 4106 ng/m³). This is almost 400 times higher than during the wet (nonburning) season (4,40 n/m³, ranging between 0,4 and 13,2 ng/m³). Urban total aerosols collected in Gent (Belgium) present an average atmospheric concentration of levoglucosan of 477 ng/m³, with a range of 121-1133 ng/m³, for the winter season, which is a factor of 20 higher than for the summer season (19,4 ng/m³, with a range of 4,1-34,6 ng/m³).

Table 3.15 contains a work from James et al. 2000. The sampling was performed in USA for two urban sites, Fresno and Backersfield, and one background site, Kern Wildlife Refuge, during the periods: December 26-28, 1995, and January 4-6, 1996. In the first sampling period (26-28 December 1995) should be noted the very high average concentration of levoglucosan in Fresno (7590 ng/m³), indicating the significant influence of wood combustion at that time. In the same sampling period the average concentration in Bakersfield was 1100 ng/m³, and for the background sampling site 25,3 ng/m³. For Bakersfield and Kern Wildlife the difference between both sampling periods were very small in comparison with Fresno. In the second sampling period the average concentration of levoglucosan was 2130 ng/m³, less than in the first sampling period by almost a factor of four.

Atmospheric particulate matter from three sites in the city of Campos dos Goytacazes (Brasil) were analyzed for biomass burning emissions (Santos et al. 2002). Levoglucosan has been detected at three sites (LC, CB and UENF), analyzed during a one-year bimonthly investigation (six times). From May to November (1997), sugarcane and bagasse burnings (used as fuel by the sugar mills) were observed all around the city. On the other hand, from December 1996 to March 1997, only sporadic burnings occurred.

Concentrations of levoglucosan ranged from 0,15 to 1,65 ng/m^3, 0,36 to 6,83 ng/m^3 and 0,19 to 28,42 ng/m^3 for CB, UENF and LC, respectively. The LC site, surrounded by sugarcane plantations is at face value a non-polluted countryside area, scarcely impacted by vehicular pollution. The greatest concentrations of levoglucosan were detected at this site, considered as an ideal ecological area.

In the work done by Simoneit et al. 2004, aerosol samples were collected during the ACE-Asia campaign in 2001 spring to autumn at island sites: Gosan on Cheju (Jeju) Island (Korea), and Sapporo on Hokkaido Island. Aerosol samples from Chichi-jima (Japan) were collected over the western North Pacific, the East of China Sea and the Sea of Japan during the cruise of the R/V Ronald H. Brown in the same time period. Ground stations were located in Gosan, Sapporo and Chijima. Levoglucosan was determine in all the samples, for Gosan the concentration values ranged from 8,0 to 74,0 ng/m^3 and in Sapporo from 6,4 to 54 ng/m^3. Chimi-jima is located to the southeast of the major dust outflow trajectories from Asia, but is still impacted. Ten years before (1990-1991) the concentration values ranged from 0,5 to 1,4 ng/m^3. Marine aerosols over the North Pacific collected during the cruise of the R/V Ronald H. Brown from Hawaii to the East Asia region changed from solely marine to dominantly terrestrial sources. Levoglucosan is detectable in all the samples (0,2-40 ng/m^3), indicating biomass burning smoke is spread over the western North Pacific.

During the Asian Pacific Regional Aerosol Characterization Experiment (ACE-Asia), samples of carbonaceous aerosols were collected on board the Center for Interdisciplinary Remotely Piloted Aircraft Studies (CIRPAS) De Havilland DHC-6 Twin Otter aircraft (Mader et al. 2004). A total of 19 Research Flights (RFs) were conducted between 31 March and 1 May 2001. The center of aircraft operations was located at the Marine Corps Air Station (MCAS) Iwakuni, Japan, and the sampling area included portions of the Sea between China, Japan and Korea, and the Philippine Sea south of Japan. The different Flights collected the filter between several altitudes. The minimum altitude registered was 25 meter and the maximum 3826m. Levoglucosan was determined in all the samples (7,0 – 78,5 ng/m^3).

In the present work atmospheric aerosol samples were collected from six remote places over Europe: Azores and Averio (Portugal), Puy de Dôme (France), Schauinsland

(Germany), Sonnblick (Austria), and K-Puszta (Hungary). The sampling period was between July / October 2002 and June / September 2004. Levoglucosan has been detected in all this sampling sites and concentration values, depending the site showed different results; the lower concentration values were determined in both background sampling sites, AZO and SBO with average concentration of 13,9 and 19 ng/m^3, respectively. These results are followed for PDD (48 ng/m^3) and SIL (57 ng/m^3). The highest concentration of levoglucosan were determined in AVE (273 ng/m^3) and KPZ (239 ng/m^3), the two low levels and with more influence of biomass burning.

All these recent studies over the world manifest that levoglucosan is generally present in atmospheric aerosol samples in major or minor quantities. These studies collected samples in rural, urban, suburban areas as well as Background, marine and aircraft measurements. Levoglucosan was always present in these different samplings, indicating the influence of biomass burning in the atmosphere and confirming that levoglucosan is a good tracer for wood smoke.

Table 3.15 Recent studies of levoglucosan determination in atmospheric samples

Sampling site		Levoglucosan [ng/m^3]	Levoglucosan/OC in wood burning emissions %C	Date	Reference
Rondônia, Brazil 110m asl	Rural	4,4 (0,4 - 13,2)	0,34 (0,02 - 1,30)	10 April - 21 May 1999	Zbynek Z. et al. 2002
		2006 (446 - 4106)	4,79 (2,10 - 7)	3 Sept.- 31 Oct. 1999	
Gent, Belgium	Urban	19,4 (4,1 - 34,6)	0,22 (0,8 - 2)	10 June - 21 Aug. 1998	Zbynek Z. et al. 2002
		477 (121-1133)	1,52 (0,05 - 0,37)	12 Jan. - 11 March 1998	
Lake de Cima (LC), Brazil	Rural	0,19 - 28,42		Dec. 1996 - Nov. 1997	Santos et al. 2002
"Corpo do Bombeiros" (CB)	Urban	0,15 - 1,65		Dec. 1996 - Nov. 1997	Santos et al. 2002
Universidade Estadual do Norte Fluminense (UENF)	suburban area	0,36 - 6,83		Dec. 1996 - Nov. 1997	Santos et al. 2002
Fresno (USA)	rural-urban	7590		26-28 December 1995	James et al. 2000
		2130		4-6 January 1996	
Bakersfield (USA)	Urban	1100		26-28 December 1995	James et al. 2000
		1370		4-6 January 1996	
Kern Wildlife (USA)	Background	25,3		26-28 December 1995	James et al. 2000
		22,5		4-6 January 1996	
Gosan, Jeju Island (Korea)	Ground marine	8,0 - 74,0	0,29 (0,14 - 0,49)	8 April - 17 May 2001	Simoneit et al. 2004
Sapporo Island, (Japan)	Ground marine	6,4 - 54	0,44 (0,07 - 0,78)	8 April - 12 Jan. 2002	Simoneit et al. 2004
Chichi-jima Island, (Japan)	Ground marine	0,5 - 1,4	0,06 (0,04 - 0,08)	9 April 1990 - 20 Sept. 1991	Simoneit et al. 2004
Western North Pacific	Board marine	0,2 - 40	0,18 (0,003 - 0,37)	16 March - 20 April 2001	Simoneit et al. 2004
Sea of Japan south east of the Korea Peninsula east china sea	Aircraft measurements	31,4 (7,0 - 78,5)	2,0 - 10	31 March- 1 May 2001	Mader et al. 2004
Kuala Lumpur, Malaysia					
UMG day	Urban, Haze	40240		15-19 Sept. 1997 (7:31-19:30)	Simoneit et al. 2004
UMG night	Urban, Haze	33600		15-19 Sept. 1997 (19:31-7.30)	
SP day	Suburban	3780		15-19 Sept. 1997 (7:31-19:30)	Simoneit et al. 2004
SP night	Suburban	1400		15-19 Sept. 1997 (19:31-7 30)	
Azores, Portugal	Oceanic Background	13,9 (<0,1 - 79,6)	1,02 (0,1 - 5,8)	8 July 2002 - 2 July 2004	this work
Aveiro, Portugal	Rural coastal maritime	273 (1,8 - 1478)	20,06 (0,1 - 108,6)	1 July 2002 - 17 June 2004	this work
Puy de Dôme, France	Continental Background	48 (<0,1 - 321)	3,5 (0,2 - 23,6)	25 Sept. 2002- 15 Sept. 2004	this work
Schauinsland, Germany	Rural mountain	57 (<0,1 - 470)	4,2 (0,5 - 34,5)	19 Sept. 2002 - 16 Sept. 2004	this work
Sonnblick, Austria	Free Troposphere	19 (<0,1 - 166)	1,42 (0,1 - 12,2)	3 Oct. 2002 - 7 Oct. 2004	this work
K-Puszta, Hungary	Continental rural	239 (2 - 684)	17,56 (0,1 - 50,2)	4 July 2002 - 23 May 2004	this work

3.2.2. Literature comparison for cellulose

Atmospheric cellulose is a main constituent of the insoluble organic aerosol and a "macrotracer" for plant debris. The method to determine cellulose in atmospheric aerosol samples is relative new, only two papers (Kunit and Puxbaum, et al. 1996, and Puxbaum and Kunit, et al. 2003) have presented results about cellulose determination. Kunit and Puxbaum developed a new analytical method for the quantitave determination of cellulose in aerosols. The first results of cellulose determination were obtained from samples acquired during autumn and winter of 1994 in Vienna. The values range between 0,10 μg/m^3 and 0,94 μg/m^3.

The second work was carried out also in Vienna. The aerosol samples were collected in downtown Vienna during 9 months (September 1994 to June 1995). The grand average of the monthly data is 0,374 μg/m^3 total cellulose. The highest monthly average of the atmospheric cellulose concentration was observed in September (0,63 μg/m^3). The occurrence of higher values during autumn is consistent with the production of leaf litter during fall.

Thus "Carbosol" project is the first work where during a long time of sampling (2 years) cellulose concentrations were determined. After two years of sampling it is possible to describe an annual cycle for atmospheric cellulose. The publications mentioned above give information about cellulose concentration values at an urban site (Vienna), but with this work it is possible to know more about the distribution of atmospheric cellulose concentrations over Europe at remote sites. As we described before the sampling sites (chapter 2.1) at different see levels can give us an idea about the distribution of "free cellulose", in the atmosphere.

3.2.3 Detection limit

To determine the detection limits and to check for contamination during the shipping, storage, sampling and assembling of the filter holder, field blanks were sent with the samples for every sampling site.

The detection limits were determined by dividing three times the standard deviation of the field blanks by the average air volume collected for the weekly samples. This volume varies with the sampling sites. The following Table 3.16 shows the average volume sampled for every sampling site.

Table 3.16: Average sampled volumes of all the sampling sites

[Nm³]	Azores	Aveiro	Puy de Dome	Sonnblick	Schauinsland	K-Pusta
Aver. Vol. sampled	10081	10691	8025	3019	7380	4457

First the detection limits were calculated for all sites separately to check whether it is possible to combine then to one detection limit for all the sites. The following table 3.17 summarizes the detection limit for cellulose and levoglucosan.

Table3.17: Detection limit for Cellulose and Levoglucosan

DL [ng/m³]	Azores	Aveiro	Puy de Dome	Sonnblick	Schauinsland	K-Pusta
Cellulose	5,2	7,7	3,4	22,1	6,4	32,7
Levoglucosan	0,3	0,7	0,3	0,3	0,7	1

Concerning cellulose, the field blanks for AVE, KPZ and SBO showed strong variations, and consequently the detection limits for these sites are higher than the others. As stated before, these high field blanks can be attributed to the shipping, storage, sampling, etc, during the sampling period. Regarding AZO, PDD and SIL conditions were much better and quite similar. An overall detection limit calculated for those three sites is 5,6 ng/m³. In a next step another calculation was made with all six sites, disregarding the extremely several high blanks. In this case the detection limit was 6,6 ng/m³. As an approximation the overall detection limit was set to 5 ng/m³ for cellulose for the six sampling sites. This approximation does not create problems for KPZ as only a limited number of samples show concentrations between 5 and 33 ng/m³ (4 samples). However for SBO this compromise does make a change and it has to be kept in mind that a number of samples are close to the detection limit. As the detection limit is often calculated according to a 1s criteria (instead of "3 s- criteria") we nevertheless took the approach of one detection limit of 5 ng/m³ for all six sites.

In case of levoglucosan generally no blank reading was obtained in the field blanks. Thus the detection limit was calculated according to the detection limit of the analytical method. As the sampled air volume and the filter aliquots areas used were different for the six sites, the detection limits change as well. Just for simplicity, we decided to use one detection limit, i.e. 1 ng/m³. Since concentration levels for levoglucosan were generally high enough, this approximation does not lead to data loss compared to the values given in Table 3.17. The following Table 3.18 shows the percentage of samples below the detection limit for every site.

Table 3.18: Amount of samples (%) below the detection limit

	Levoglucosan	Cellulose
Azores	3%	44%
Aveiro	0%	2%
Puy de Dome	2%	13%
K-Pusta	0%	0%
Sonnblick	7%	9%
Schauinsland	3%	0%

AZO shows a notable amount of cellulose samples below the detection limit (44%); it is followed by PDD (13%) and SBO (9%). For levoglucosan, SBO shows several samples below the detection limit (7%), but still this percentage is not very high. For the rest of sampling sites hardly only samples were below the detection limit.

3.2.4 Average concentrations for levoglucosan and cellulose

Levoglucosan

The impact from biomass combustion has been shown to affect atmospheric chemistry after transport periods of several days and thousands of kilometres (Swap et al. 1996), meaning that the effect of biomass combustion can be seen also in great distances from the source region. In order for a molecular marker to be useful in tracing long-range transport from source region to receptor locations, the compounds must be conserved in transport (Fraser et al. 2000). Previous work has shown that levoglucosan does not undergo decomposition reactions when exposed to ambient levels of gaseous photochemical oxidants such as ozone or nitrogen dioxide (Locke et al 1988). However, if one reviews the chemistry of levoglucosan, one reaction pathway that might selectively remove levoglucosan above and beyond the possible reactions of other molecular markers in the acid-catalyzed hydrolysis of levoglucosan to form β-D-glucose. Frasser et al. 2000 presented a work with a test of levoglucosan stability. The simulations in this test were designed to simulate the possible composition of atmospheric liquid droplets that could catalyze the hydrolysis of levoglucosan to produce β-D-glucose. The concentrations of levoglucosan during the time period of 10 days do not show preferential degradation of the levoglucosan due to acid-catalyzed hydrolysis. This suggests that levoglucosan does not undergo acid-catalyzed hydrolysis over the transport time of several days. Another test from Simoneit et al. 2004 also confirmed this experiment. They tested the hydrolysis of standard levoglucosan in water and in acid (pH ~ 2) solutions and found recoveries after 1, 3, 5, and 15 days of 99% for both cases. Table 3.19 summarize the average, median, minimum and maximum values of all six sampling sites.

The concentration values of levoglucosan in the different sampling sites change considerably. At the background sampling sites, AZO and SBO, as is expected, the concentrations are very small in comparison with the other sites. At AZO the average concentration is 13,9 ng/m^3 with a range of <1,0-79,6 ng/m^3. At SBO an average of 19 ng/m^3 was determined with a range of <1,0-166 ng/m^3. PDD and SIL present very similar average concentrations of 48 ng/m^3 with a range of <1,0-321 ng/m^3 and 57 ng/m^3 with a range of <1,0-470 ng/m³, respectively. KPZ presents a high average concentration of levoglucosan, 239 ng/m³ with a range of 2,0-684 ng/m³. The highest average concentration is for AVE, 273 ng/m³, with a range of 1,8-1478 ng/m³.

Table 3.19: Average, median, minimum and maximum values of the six sampling sites

Levoglucosan [ng/m³]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Pusta
Average	13,9	273	48	53	19	239
Median	9,2	171	31	48	9	226
Min	<1.0	1,8	<1,0	<1,0	<1,0	2,0
Max	79,6	1478	321	142	166	684

Table 3.20 shows the average concentration of summer and winter periods and the ratio between summer-winter periods. As in "Backgrounmessungen Sonnblick" project, the summer period is defined as June, July and August and for winter period November, December and January.

Table 3.21: Arithmetic average and ratio between summer and winter periods

Levoglucosan [ng/m³]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Puzta
Summer	13,4	40,1	115	55,1	20,2	147
Winter	17,0	525	20,6	44,7	19,0	362
Summer/winter	1	0,08	6	1	1	0,4

As was expected, at the background sampling sites there are no differences between summer and winter periods, therefore the ratio between both these periods was only 1 for AZO as well as SBO. If we regard AZO and SBO as maritime and continental background sites, we see that especially winter concentrations are quite similar. At PDD and SIL, the average concentrations of summer period are higher than winter period. It is observed that for PDD the difference is more pronounced. With a summer-winter ratio of six, average concentrations in summer are six times higher than in winter. For SIL the proportion is not so marked, the average concentration in summer is only two times higher than in winter.

AVE and KPZ, present opposite seasonal cycles with low levels during summer. This ratio is obtained below 0. If we calculate the ratio of winter- summer periods we obtain at AVE the ratio of 13 and for KPZ only 2. As it can be seen in figure 3.40, the difference between summer and winter for AVE is very abruptly. For KPZ this difference is not very pronounced.

Cellulose

Atmospheric cellulose is a main constituent of the insoluble organic aerosol and a “macrotracer” for plant debris. The average concentration values of cellulose as well as the median, minimum and maximum values for the six sampling sites are summarized in Table 3.22 At AZO, a background sampling site, it was expected to find the lowest average concentration values of cellulose (13,5 ng/m^3, with range of <5,0-68,6 ng/m^3). SBO is a background mountain sampling site, but especially in winter representative for the free troposphere. The observed concentration values of cellulose consequently might be lower than PDD and SIL. In this sampling site an average concentration value of 33 ng/m^3 was found with a range of <5,0-155 ng/m^3. At PDD, an average concentration value of 60 ng/m^3 is found with a range of <5,0-226 ng/m^3. SIL, a rural mountain sampling site, presents also an average concentration values of cellulose of 60 ng/m^3, with a range of 6,4-369 ng/m^3. AVE is a low level site, but the average concentration is not as high as at KPZ. The difference is that AVE is close to the urban area and to the coast maritime. This sampling site has an average concentration value of 52 ng/m^3, with a range of <0,5-213 ng/m^3. The highest average value is for KPZ (133 ng/m^3, with a range of 22,3-436 ng/m^3). At KPZ there are two factors to influence this high value. One is a low level site, and it is more affected by other emission sources of pollutants. Furthermore it is a rural site and the contribution of cellulose in the air is higher than for example in an urban site. Table 3.22 shows the results of average concentration values and median as well as minimum and maximum values for the six sampling sites.

Table 3.22:Average, median, minimum and maximum values of the six sampling sites

Cellulose [ng/m³]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Pusta
Average	13,5	52	60	89	33	133
Median	8,9	44	56	62	25	114
Min	<5.0	<5.0	<5.0	6,4	<5.0	22,3
Max	68,6	213	226	369	155	436

Table 3.23 presents the average of summer and winter periods and the ratio between both seasons. For all the sampling sites the averages of summer were higher than winter concentration values, except for AVE. Here, the average of winter concentration values is higher.

Table 3.23: Arithmetic average and ratio between summer and winter period

Cellulose [ng/m³]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Puzta
Summer	13,6	33,9	98,0	113,6	43,7	168,2
Winter	10,1	61,9	28,6	38,7	20,8	94,8
Summer/winter	1	0,5	3	3	2	2

3.2.5. Annual cycles of levoglucosan and cellulose

Within the framework of the "CARBOSOL" project aerosol samples were collected during two years (2002-2004). At AVE and AZO the sampling began in July 2002 and until July 2004. At KPZ sampling began in July 2002 but it is finalized continued already at the end of May 2004. At PDD, SIL and SBO the collection started in October 2002 and continued until October 2004. At AVE, SIL and SBO more than 90 % of the overall sampling period could be evaluated (AVE 98 %, SIL 97 % and SBO 91%). For PDD, KPZ and AZO the overall sampling period, which has been evaluated was 83 %, 73 % and 72%, respectively. The Tables with the final results of all sampling sites are summarized in annex.

Levoglucosan

Levoglucosan is emitted in large amounts, is suffiently stable, is specific to burning of cellulose containing substances, and thus meets all important criteria to serve as an ideal molecular marker of biomass burning (Zbynek et al. 2002).

Levoglucosan is the most abundant sugar derivative emitted from wood combustion, and was determined in all sampling sites.

As AZO is a maritime background site with hardly any emission sources, the concentrations were low and no seasonality is observed in the annual cycles. Nevertheless there are a considerable number of "spikes" throughout the year; which most likely point to local effects.

For KPZ, the evaluation of the annual cycle is not straightforward, as there are values only until May 2004. The highest concentration values for levoglucosan were found in winter months, but unfortunately only one summer period was monitored.

At SIL hardly any seasonal cycle was observed for levoglucosan. For PDD low concentrations were found during winter and elevated concentrations during summer. This is typical for a mountain site because it might be above the mixing layer during winter time and will be influenced more effectively by boundary layer air masses during summer.

The annual cycle at SBO shows, what is expected for a mountain station and has been discussed for PDD. In December 2002 very high concentrations were observed that were not typical for this time season. We can hypothesize about a local effect from the valley under Sonnblick Observatorium, where there are a few guest houses.

At AVE sampling site the highest concentration values of levoglucosan were determined. AVE is a coastal maritime place, and the major concentration values were obtained in winter. Here, the contribution of wood combustion is also observed for heating during these winter months. The seasonal variation at AVE is very strong; the difference between winter and summer months is really very pronounced.

The annual cycles of levoglucosan at the different sites are represented in the following Figures from 3.39 to 3.44.

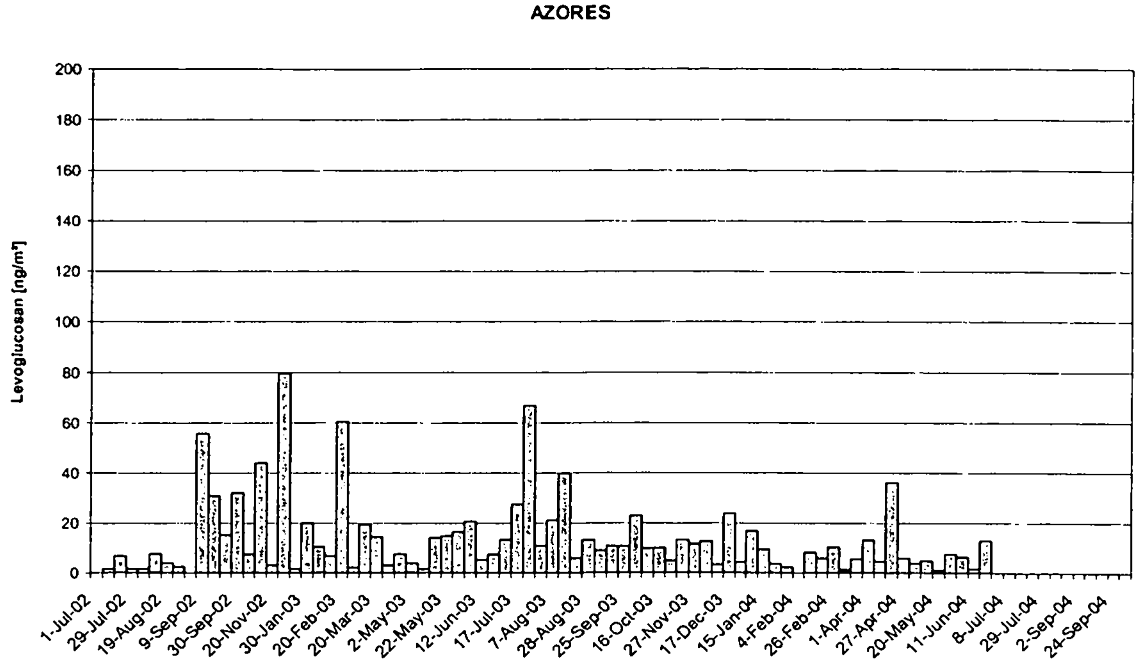


Fig 3.39: Annual cycles for Levoglucosan at Azores

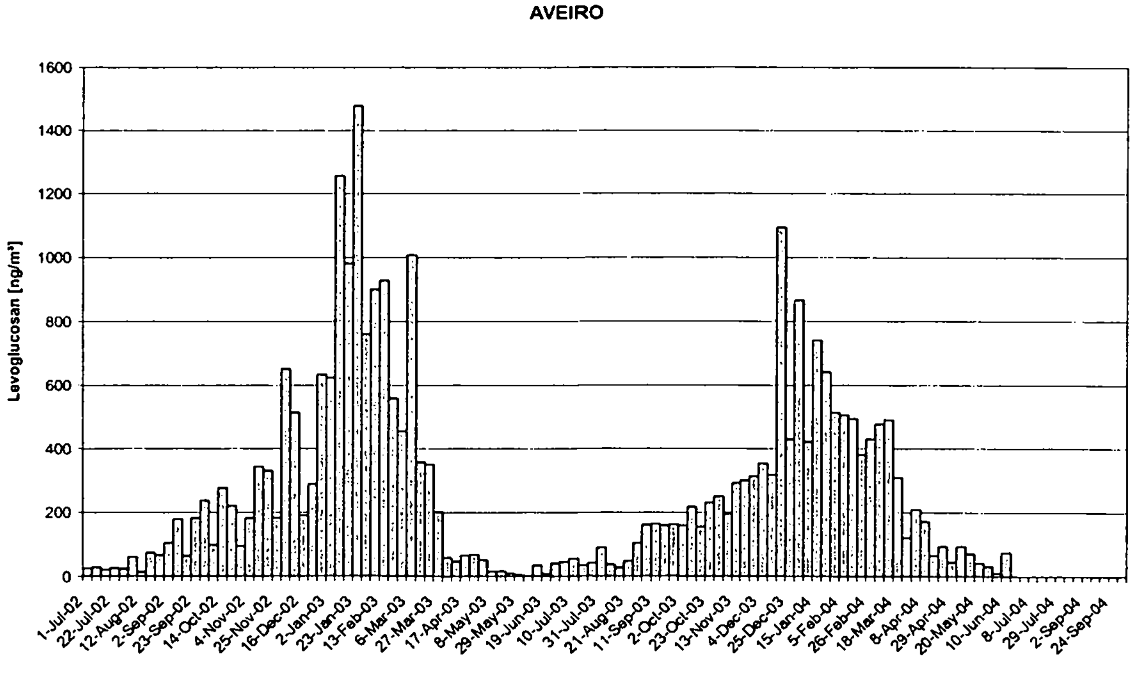


Fig 3.40: Annual cycles for levoglucosan at Aveiro.

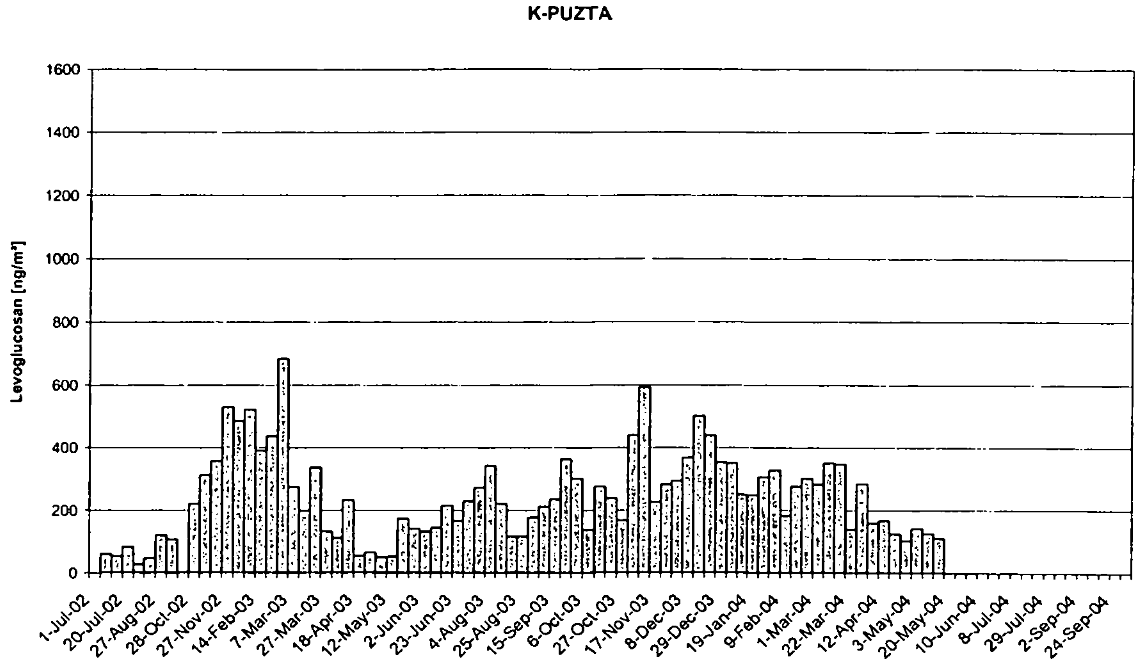


Fig 3.41: Annual cycles for levoglucosan at K-Puzta.

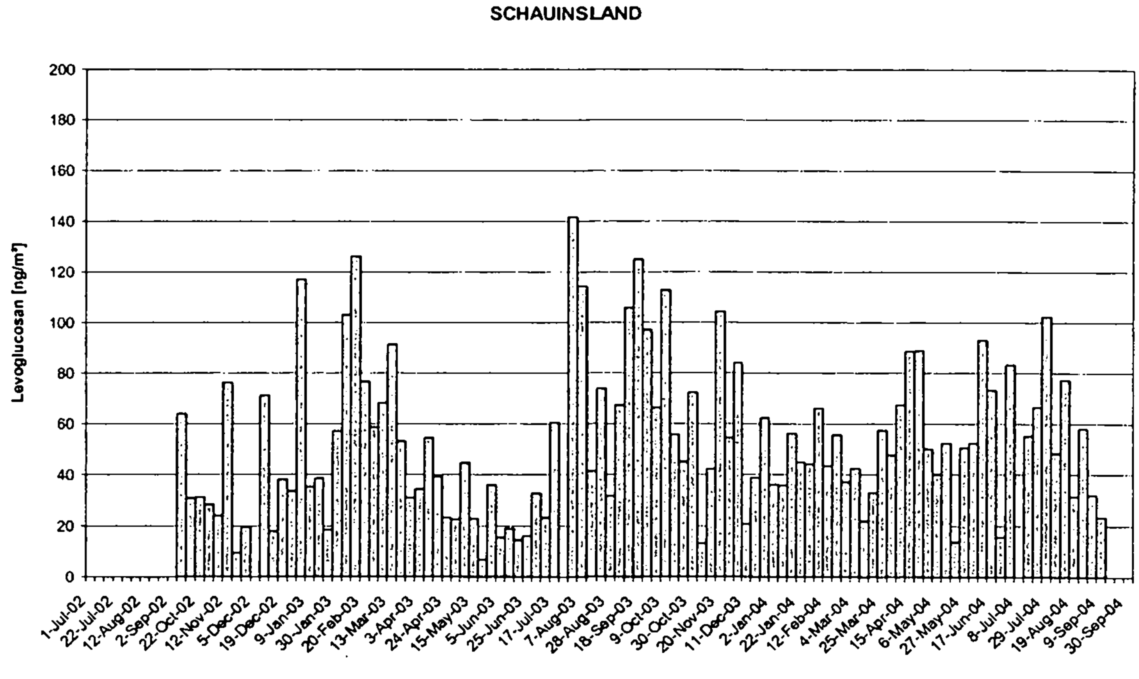


Fig 3.42: Annual cycles for levoglucosan at Schauinsland.

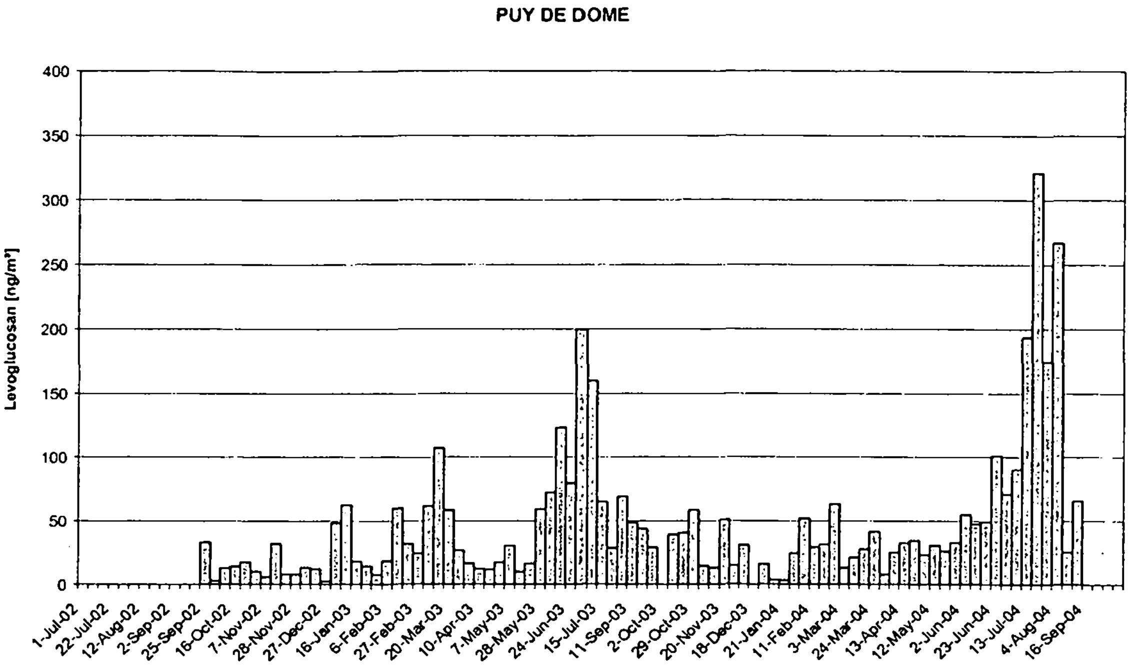


Fig 3.43: Annual cycles for levoglucosan at Puy de Dôme.

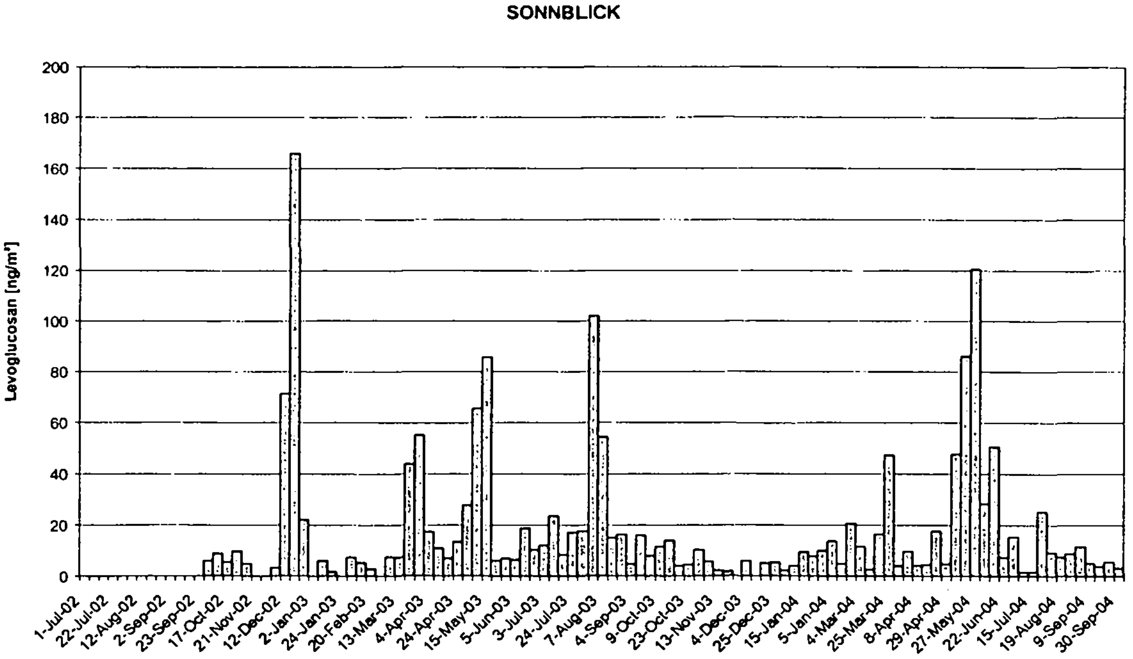


Fig 3.44: Annual cycle for levoglucosan at Sonnblick.

Cellulose

The seasonal variation of cellulose depends on the situation of the sampling sites. If the sampling site is a background place like AZO, then small concentration values are obtained and it is not really possible to observe a seasonal cycle. A significant number of samples were below the detection limit. Thus it is not possible to define seasonality for cellulose at AZO.

Thinking of "living biomass", i.e. plant debris, as the major source of cellulose, a typical seasonal variation of cellulose would show high concentration values during the growing season, especially during spring and fall. At SIL, KPZ, PDD, and SBO, this variation can be observed. Looking into more detail SIL and KPZ show similar patterns and PDD and SBO are comparable. As SIL is a rural mountain site and the difference between spring and autumn in comparison with summer and winter is very pronounced. At KPZ, a rural site, the concentration values during spring and autumn are also high but the difference between seasons is not so pronounced as at SIL. PDD and SBO are two mountain sites; although the sea level of the observatories is still different. Especially the sampling site at SBO is frequently located in the free troposphere during winter, and it can be used as a background continental sampling site.

At PDD the concentration values are lower than in SIL and KPZ and even lower concentrations can be observed at SBO. As already explained for levoglucosan and earlier for the inorganic aerosol constituents, mountain sites are influenced by boundary layer air masses during summer, while in winter air masses are prevailing at the site are decoupled from the mixing layer and can be representative for free troposphere conditions. This effect even enhances the seasonal cycle which can be expected for cellulose.

For AVE a different seasonal cycle was observed as expected. High concentrations of cellulose are observed in the winter months, just like for levoglucosan. It could be possible that this concentration of cellulose in the winter months is the part of wood that does not undergo the pyrolisis of cellulose. However, first measurements of the emission of cellulose during wood combustion do not point to marked emissions of cellulose (Schmid, 2005).

The annual cycles of cellulose at the different sampling sites are represented in the following Figures from 3.45 to 3.50.

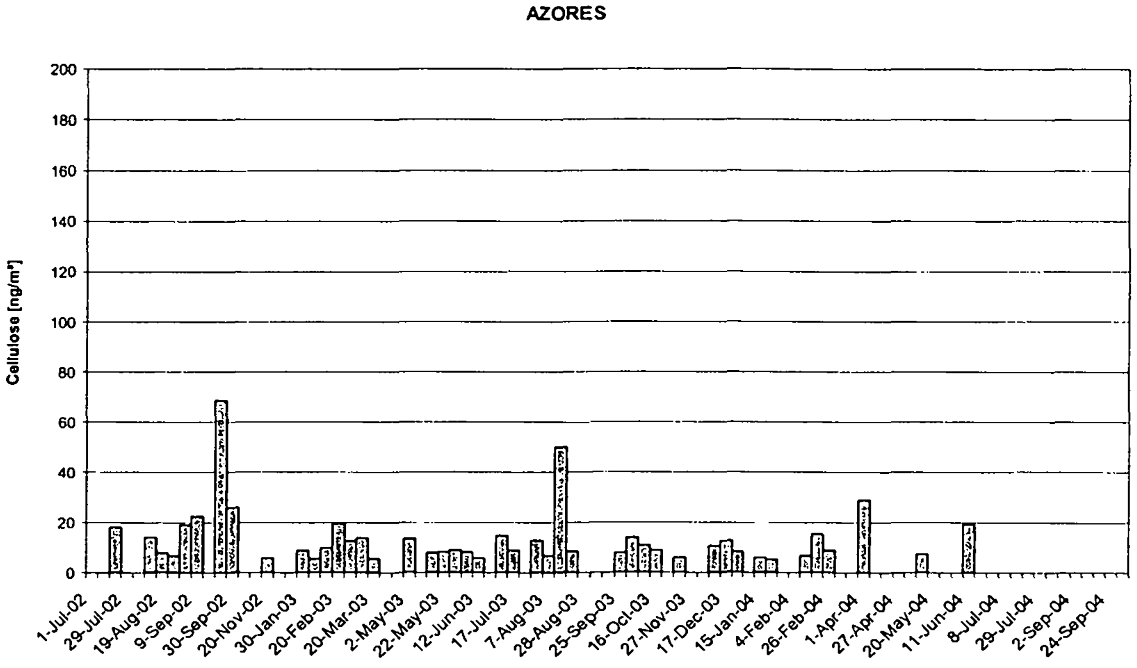


Fig 3.45: Annual cycles for cellulose at Azores.

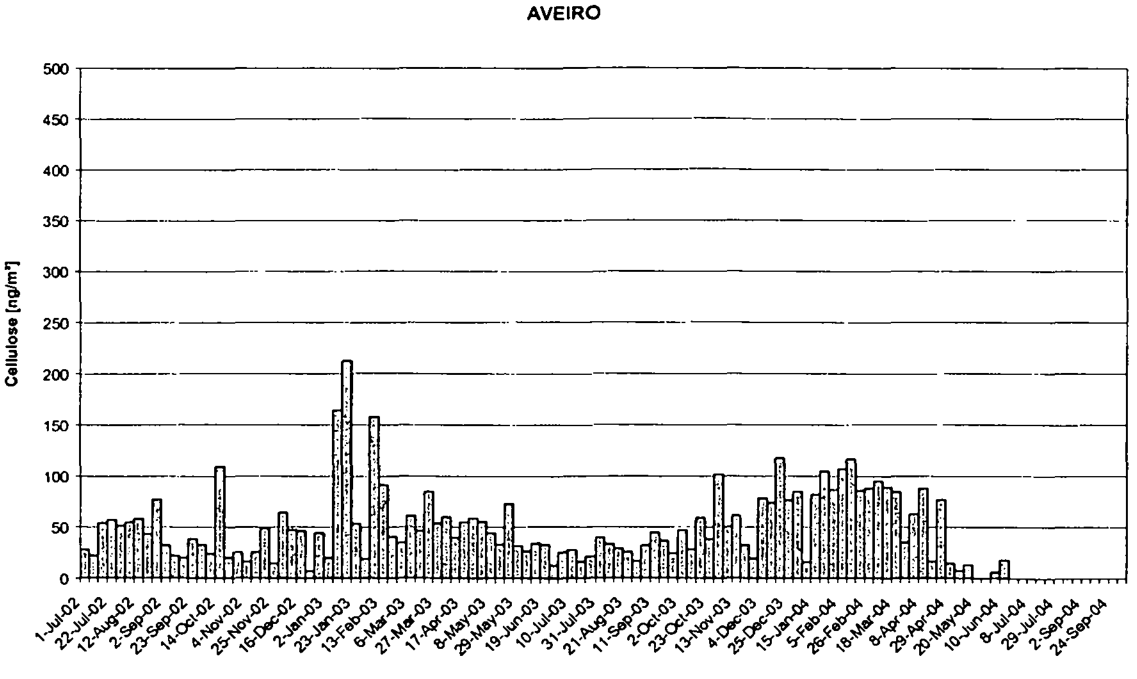


Fig 3.46: Annual cycles for cellulose at Aveiro.

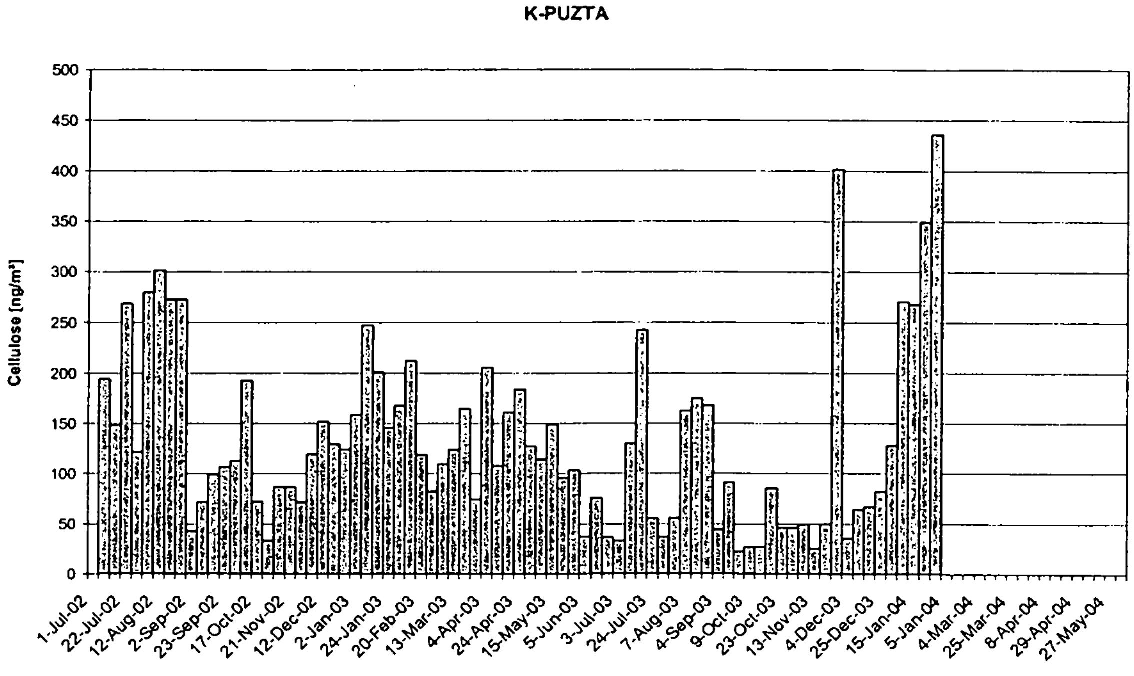


Fig 3.47: Annual cycles for cellulose at K-Puzta.

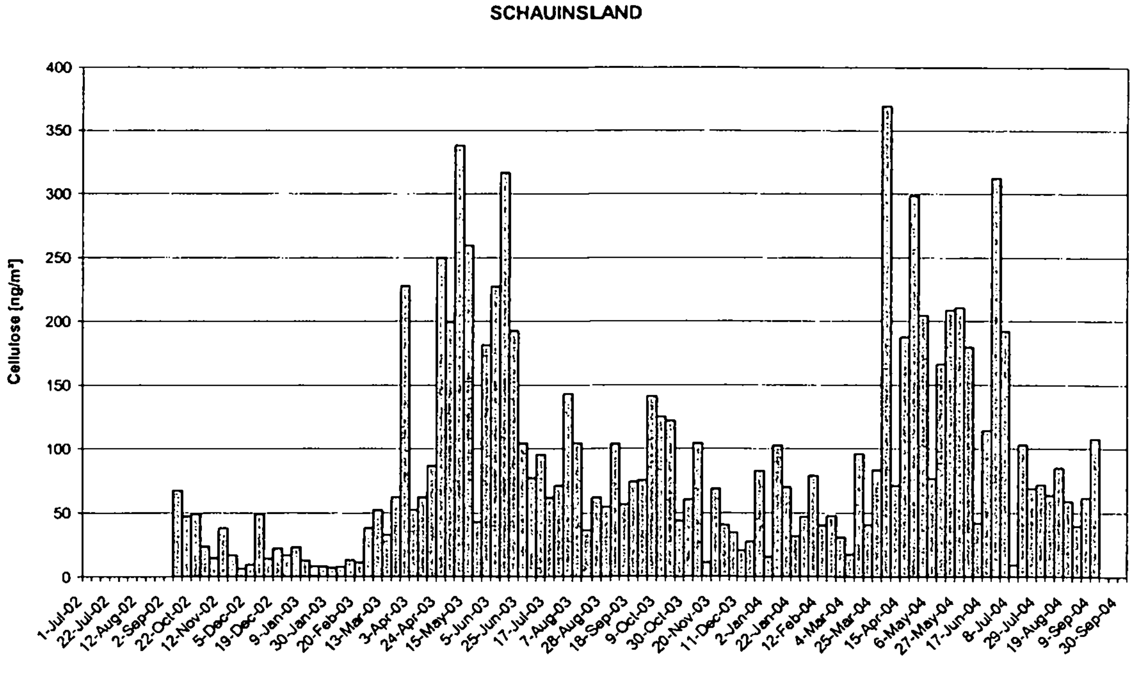


Fig 3.48: Annual cycles for cellulose at Schauinsland.

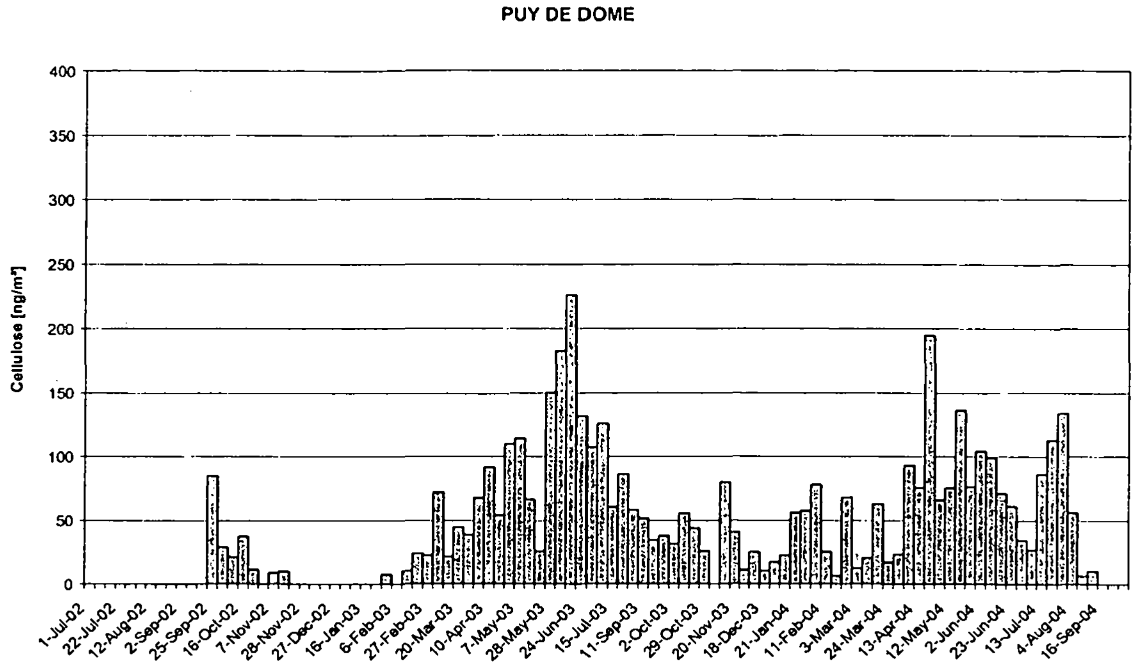


Fig 3.49: Annual cycles for cellulose at Puy de Dôme.

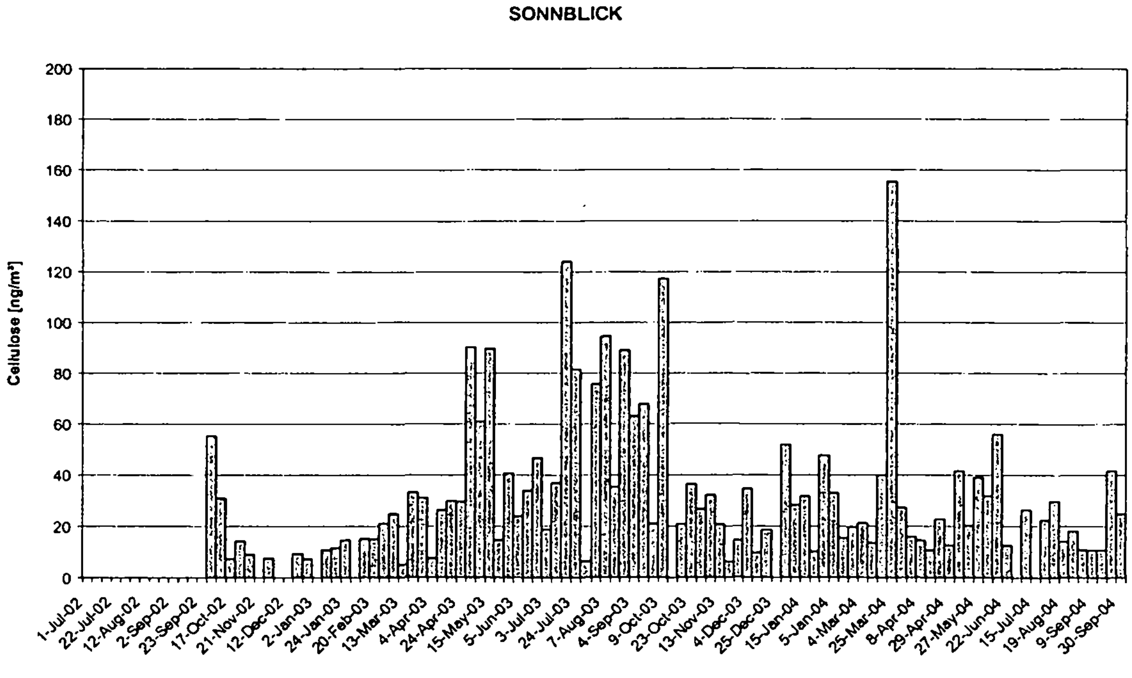


Fig. 3.50: Annual cycles for cellulose at Sonnblick.

Comparison levoglucosan versus cellulose.

The comparison of the annual cycles (monthly average) of levoglucosan and cellulose show some differences between the different sampling sites (Fig. 3.51- 56). At AZO, both levoglucosan and cellulose concentrations did not show a seasonality and had very small concentration values. As this sampling site is a maritime background site, the determined concentrations of levoglucosan and cellulose most likely reflect background conditions.

The annual cycles at SBO show higher monthly averages of cellulose compared to levoglucosan for most of the monthly concentration values than for levoglucosan, with maximum values during spring and summer. Only during two months (December 2002 and March 2004) levoglucosan average concentration levels exceed cellulose concentrations.

The first year at PDD, the monthly average concentrations of cellulose were slightly predominating over levoglucosan, especially in April, May and June 2003. The second year, the monthly average concentrations of cellulose in spring was higher than levoglucosan, as it can be expected that concentrations of levoglucosan in summer at ground level are lower.

During almost the entire annual cycle in SIL, the monthly average of cellulose and levoglucosan are quite similar. Big differences can only be observed in spring months, which the monthly averages for cellulose being almost a factor of 10 higher than the monthly averages for levoglucosan. As SIL is a rural mountain place, these maximums in spring might originate from seed production and from repulsing of other cellulose containing plant material.

In KPZ the monthly averages of levoglucosan are higher than cellulose, but they do not show such pronounced differences as for AVE. As expected for cellulose in spring and summer, the monthly average observed for cellulose is higher than levoglucosan.

At AVE both compounds show similar seasonal cycle with elevated concentrations during winter. However the increase determined for levoglucosan is much more pronounced (a factor of 9) compared to the concentration values of cellulose. During the summer period the concentrations of both compounds were very similar.

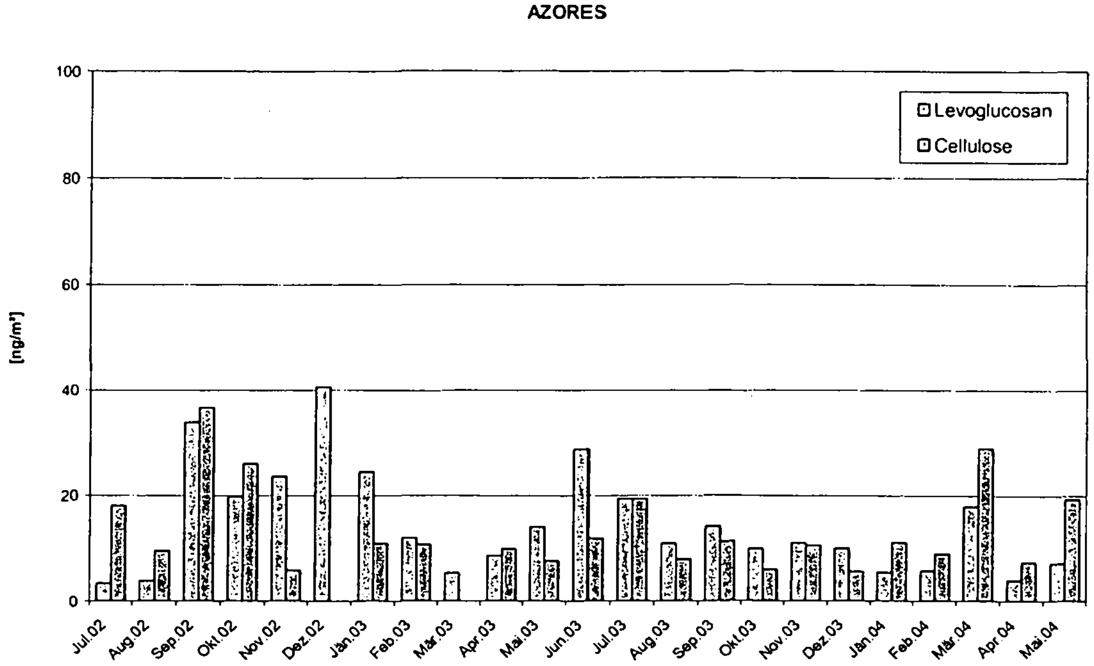


Fig. 3.51: Monthly average of annual cycles at Azores for levoglucosan and cellulose.

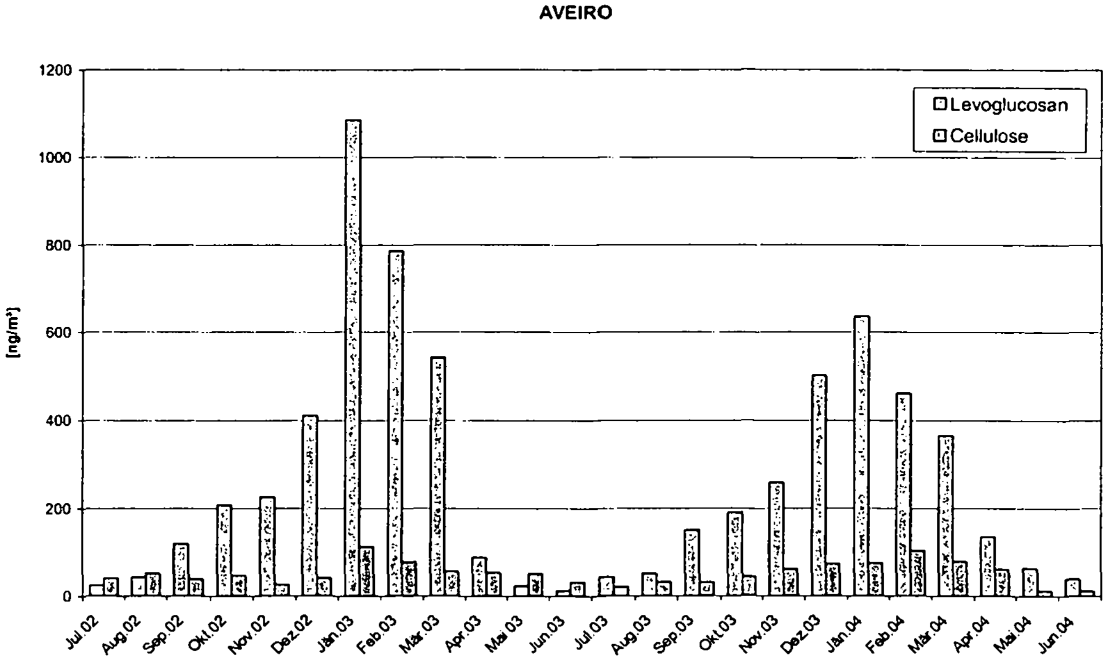


Fig. 3.52: Monthly average of annual cycles at Aveiro for levoglucosan and cellulose.

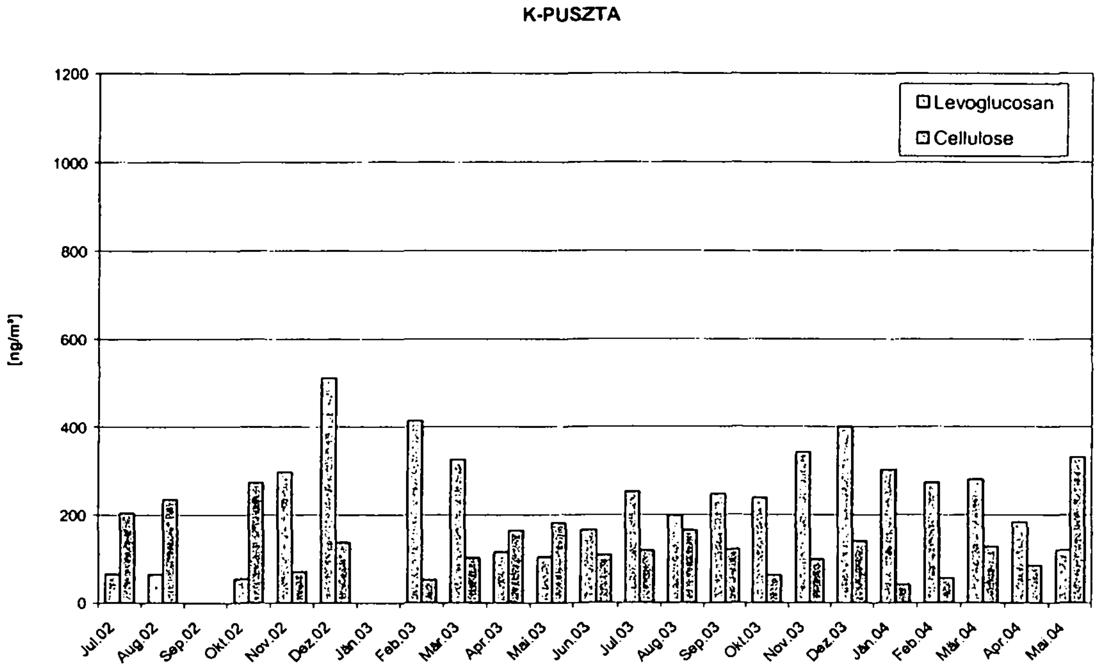


Fig. 3.53: Monthly average of annual cycle at K-Puszta for levoglucosan and cellulose.

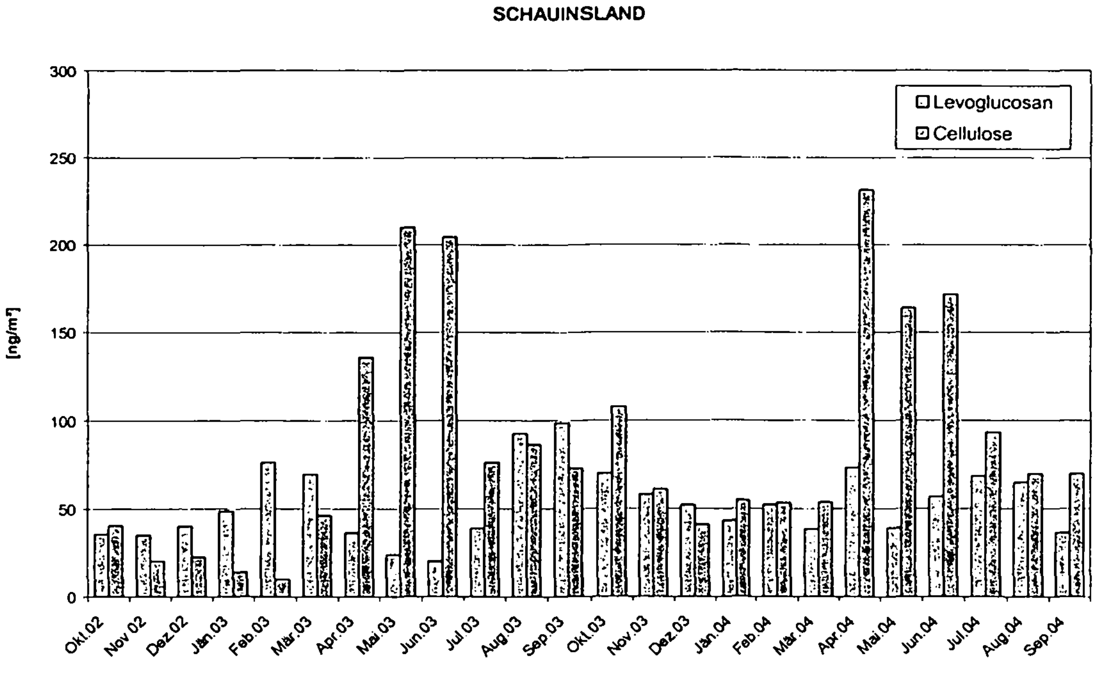


Fig. 3.54: Monthly average of annual cycles at Schauinsland for levoglucosan and cellulose.

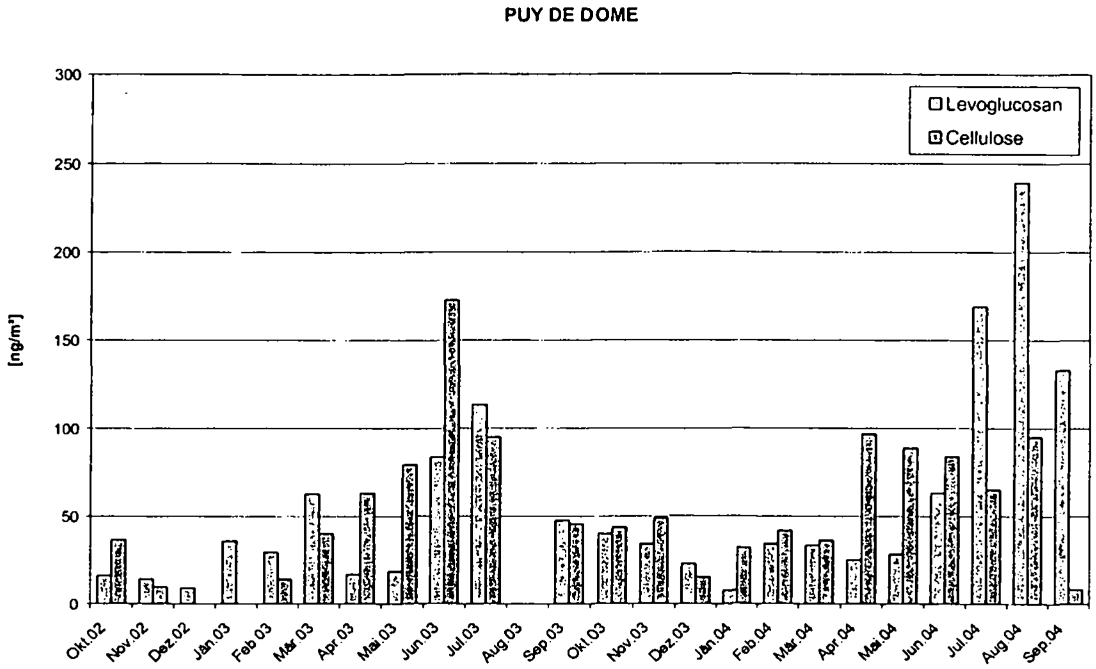


Fig. 3.55: Monthly average of annual cycles at Puy de Dome for levoglucosan and cellulose.

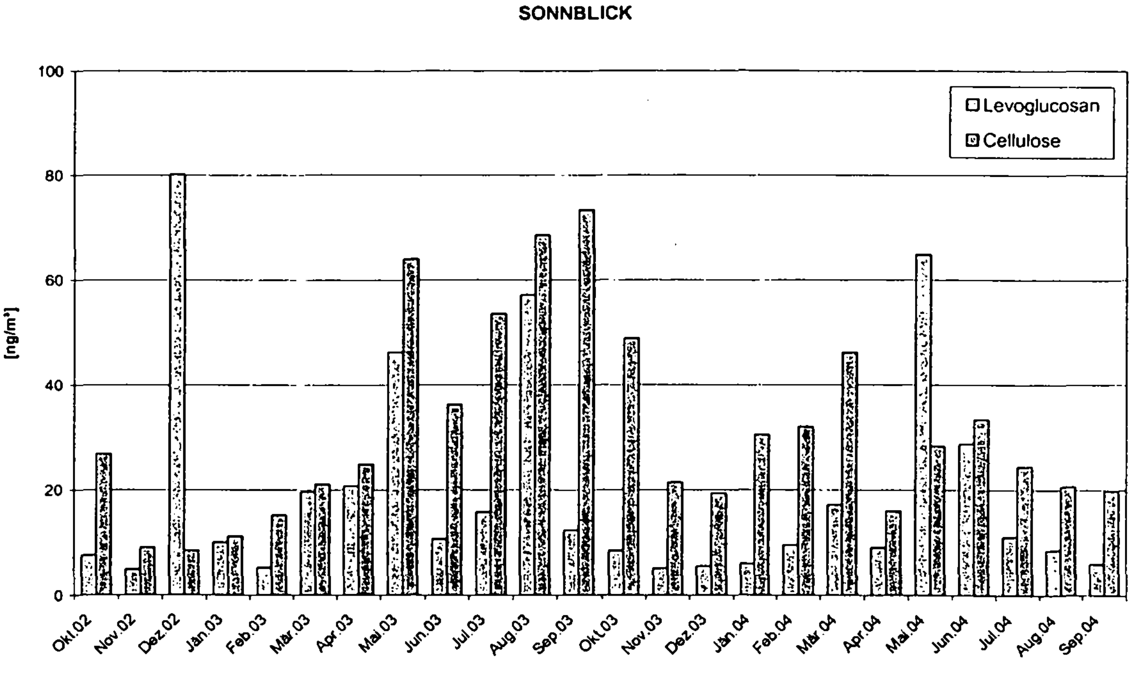


Fig. 3.56: Monthly average of annual cycle at Sonnblick for levoglucosan and cellulose.

3.2.6 Comparison of levoglucosan and Organic Carbon (OC)

Since the late 1990s levoglucosan has been found in atmospheric particulate matter over the ocean (Simoneit and Elias et al. 2000), in sediments (Elias et al. 2001), in samples from the burning of specific plant species (Simoneit et al. 1999), in different types of wood (Fine et al. 2001), and in particulate matter over urban areas.

As mentioned earlier levoglucosan (1,6-anydro-β-D-glucopyranose) is an ideal molecular marker of biomass burning [Zbynek et al. 2002; Frasser and Lakschaman et al. 2000]. It is emitted at such high concentrations that it can be detected at considerable distances from the original combustion source, and it is found as a major organic component in the particulate matter of ambient aerosols (Simoneit et al. 1999). Thus it is straightforward to compare concentration of levoglucosan and OC, the fraction this major organic component belongs to.

3.2.6.1. Annual cycles of levoglucosan-C and OC

The Figures from 3.57 to 3.62 represent the comparison of annual cycles between levoglucosan-C and organic carbon (monthly average) for each sampling site. The annual cycle variation of organic carbon (OC) is very similar to the levoglucosan-C for most of the sampling sites. Only some differences are observed in SIL, where in May and June 2003 low concentration values of levoglucosan-C were obtained and for OC a maximum was found. At SBO in December 2002 and May 2004 two maximum monthly average concentrations for levoglucosan were observed that do not correspond with the corresponding values of OC in these months.

As already listed in Table 2.2 the filters collected within CARBOSOL are analyzed for organic carbon (OC) as well, this analysis was performed at the University of Aveiro.

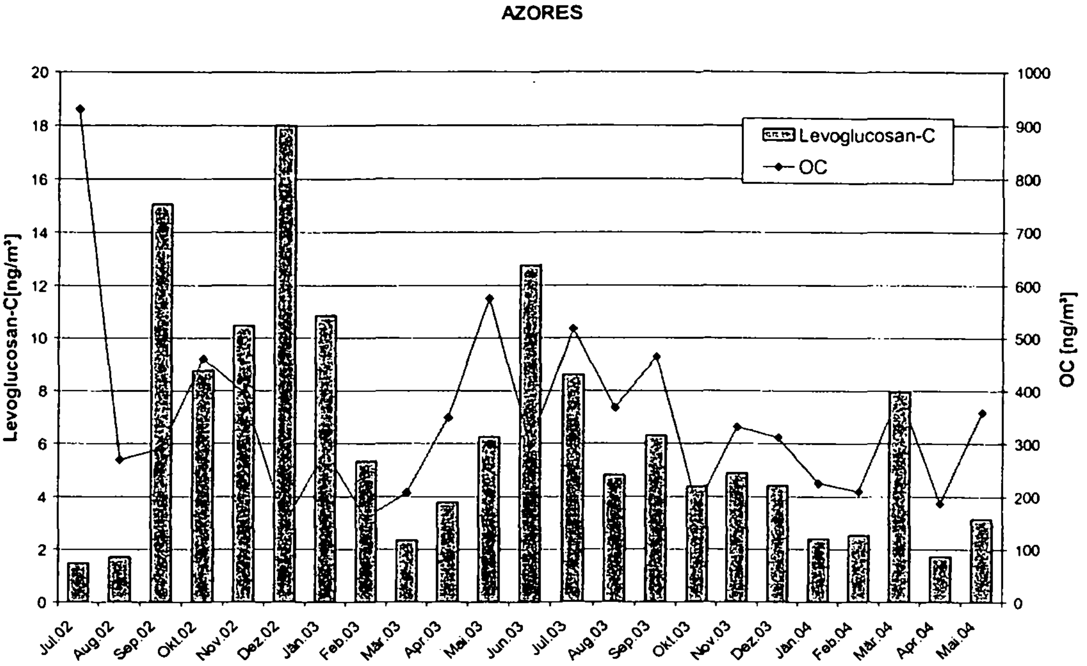


Fig. 3.57: Relation at Azores between levoglucosan-C and OC

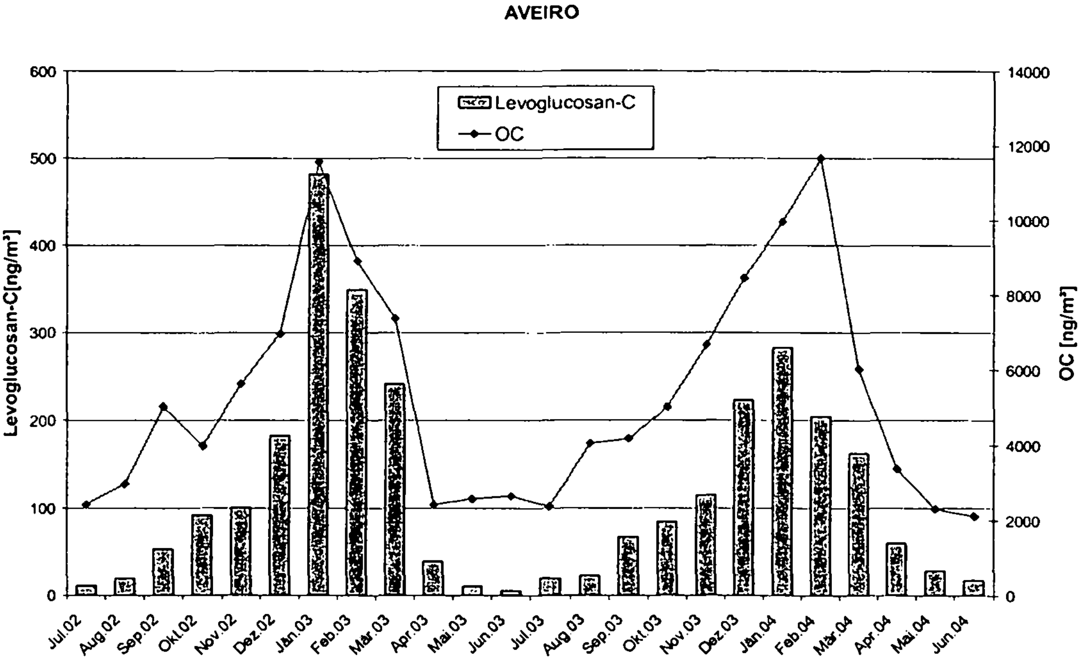


Fig. 3.58: Relation at Aveiro between levoglucosan-C and OC

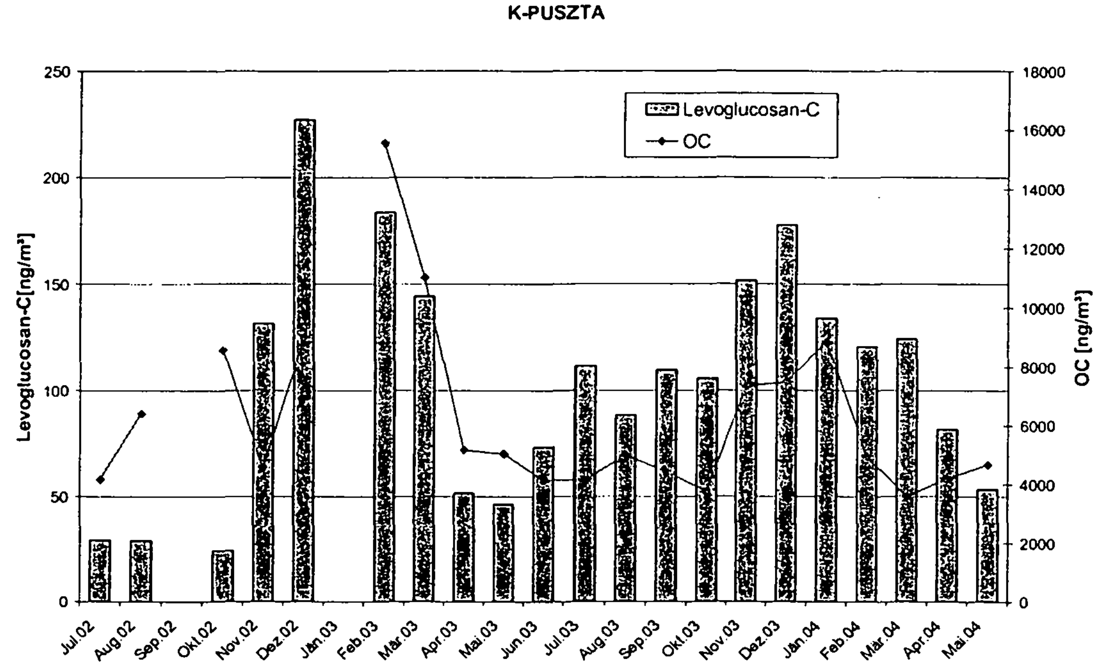


Fig. 3.59: Relation at K-Puzta between levoglucosan-C and OC

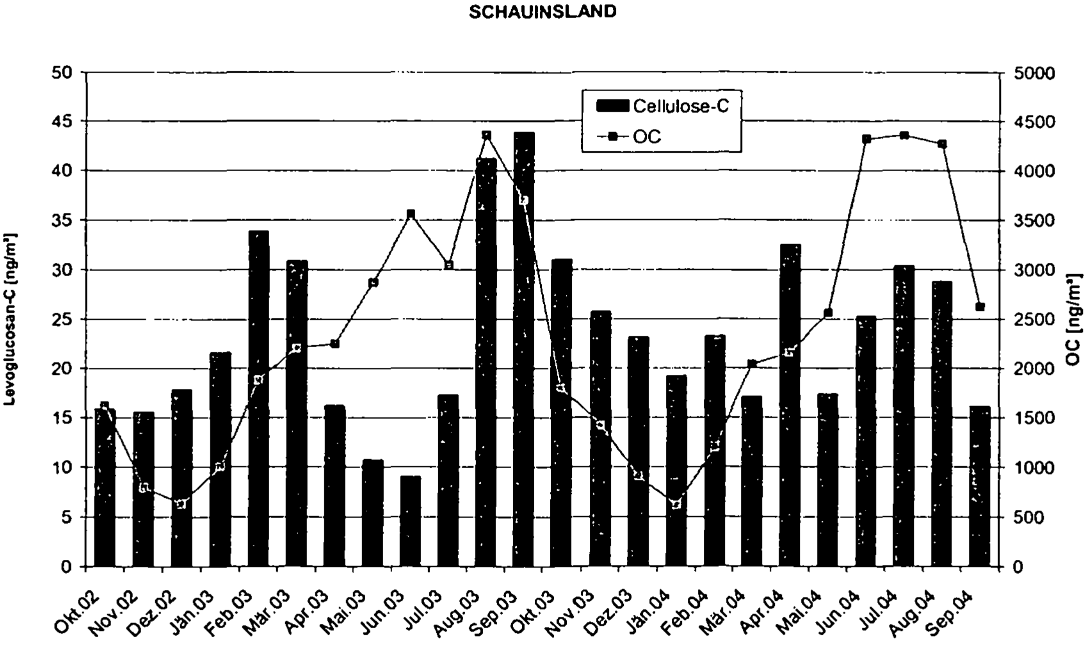


Fig. 3.60: Relation at Schauinsland between levoglucosan-C and OC

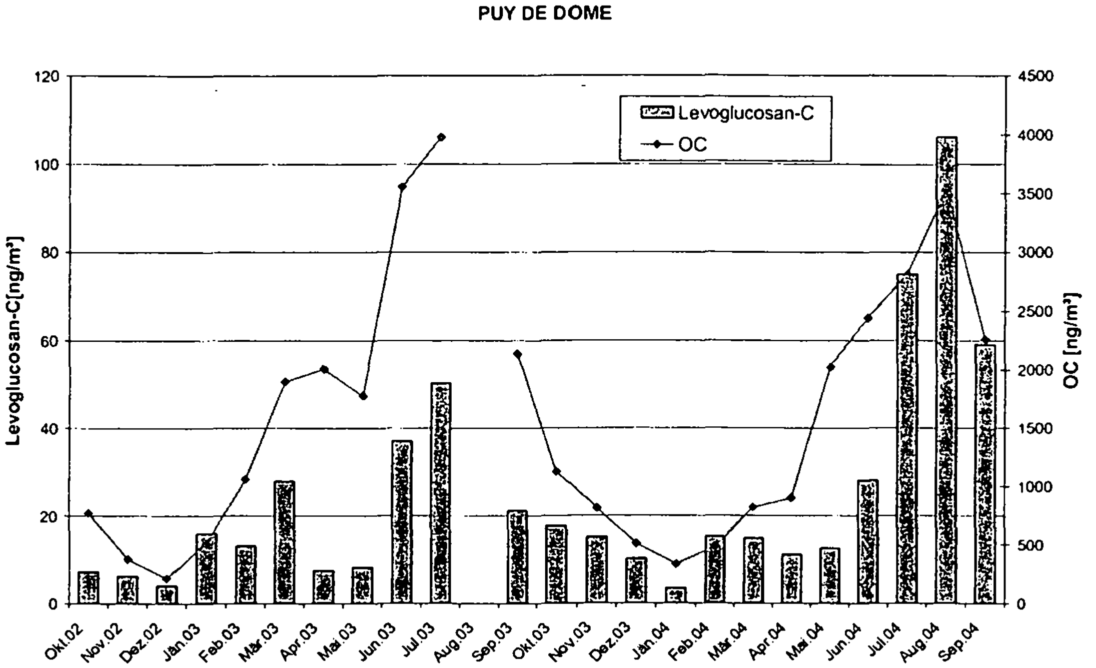


Fig. 3.61: Relation at Puy de Dome between levoglucosan-C and OC

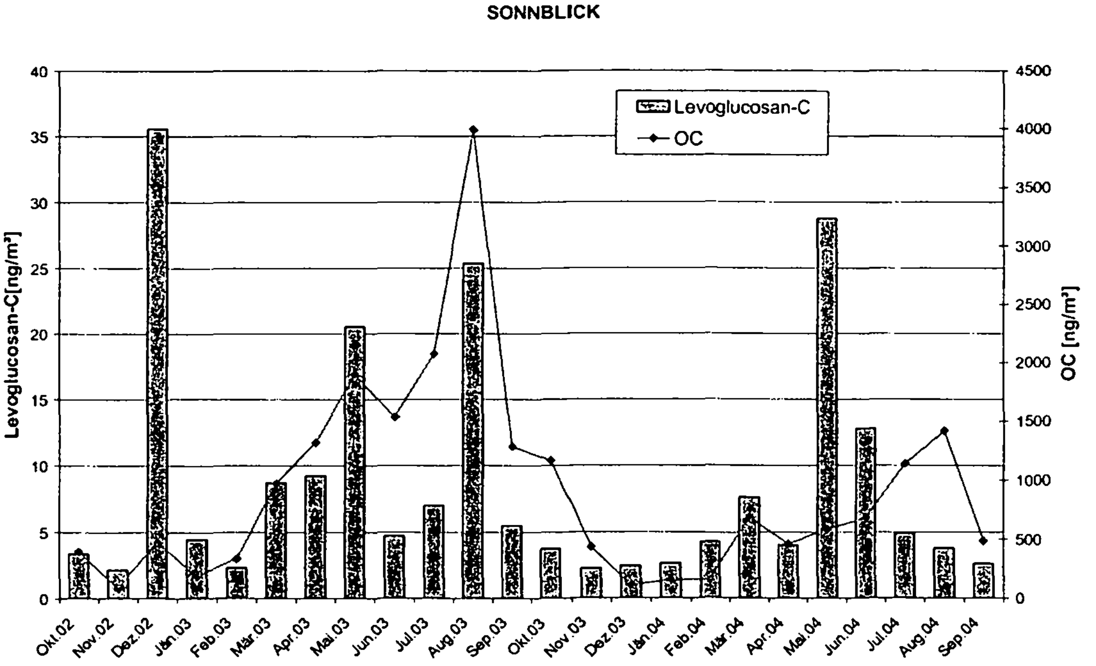


Fig. 3.62: Relation at Sonnblick between levoglucosan-C and OC

3.2.6.2. Contribution of levoglucosan-C to OC

The average contribution (overall average across the whole sampling period) of levoglucosan-C to OC for all the sampling sites varies between 1,2 and 2,3 %. The highest contribution is observed at AZO, the maritime background site although the lowest concentration values of levoglucosan were found at AZO. This contribution is 2,3 % and ranged between 0,1 and 16,5 % based on weekly averages. Therefore it is obvious that OC levels at AZO are very low as well. Thus, here the air is very clean and there is no influence of other sources of pollutes like road traffic, industry emissions, etc. It is different for AVE; in this sampling site the highest concentration of levoglucosan were found. The concentration values of levoglucosan were much higher in comparison with the other sampling sites. Nevertheless the contribution of levoglucosan-C to OC in AVE is not very high and very similar to the other sampling sites, especially in winter, where the concentrations of levoglucosan are very high. The contribution of levoglucosan-C to OC is 2,0 %, ranging between 0,04 and 6,8 %. Here, it can be assumed that AVE has a strong influence on other sources of pollutes like road traffic, industry emissions, etc. At KPZ, the second site with elevated levels for levoglucosan contribution is high (2,1 %, range between 0,01 and 16,4%) similar to AZO. It is a continental rural sampling site and it is probable that the influences of other pollutes are lower in comparison of AVE, as it is not a place close to the city or road traffic.

At the mountain sites, a very similar contribution of levoglucosan-C to OC was observed, especially in PDD and SIL, where the averages were 1,8 % (ranging between 0,2 and 6,7%) in case of PDD and 1,5 % (ranging between 0,1 and 5,1 %) in case of SIL. At SBO, the average contribution is similar to PDD and SIL, 1,2%, but it shows much more variation (with a range of 0,0 and 10,5 %). Thus the average contribution at the continental background site SBO is only half as much as at the maritime background site AZO.

The Table 3.24 summarizes the average contribution of levoglucosan to OC of the whole sampling period for all the sampling sites. The Figures from 3.63 to 3.68 represent the monthly average of this contribution for all the sampling sites.

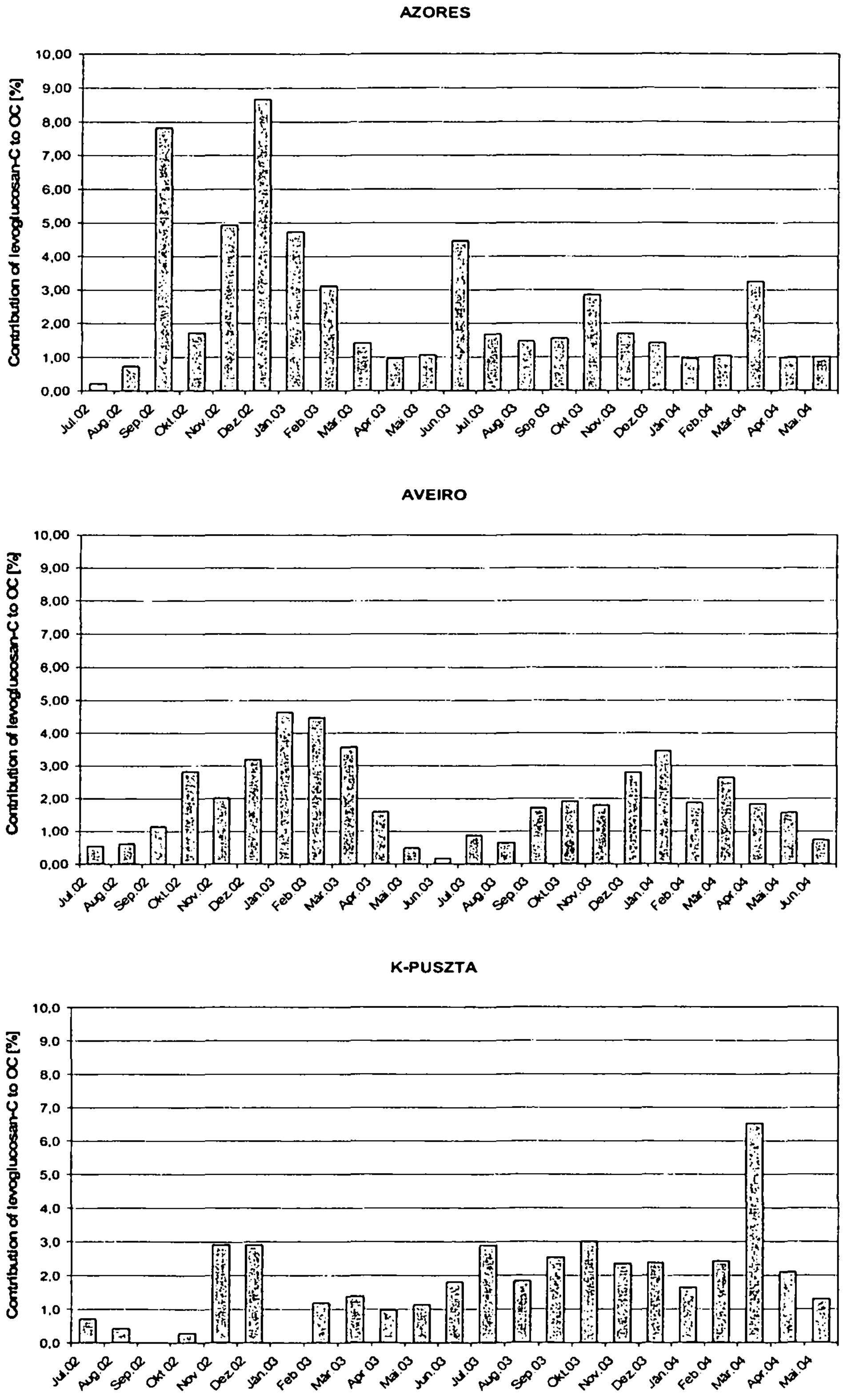


Fig. 3.63 - 65 Contribution of levoglucosan-C to OC [%] at Azores, Aveiro, and K-Puszta

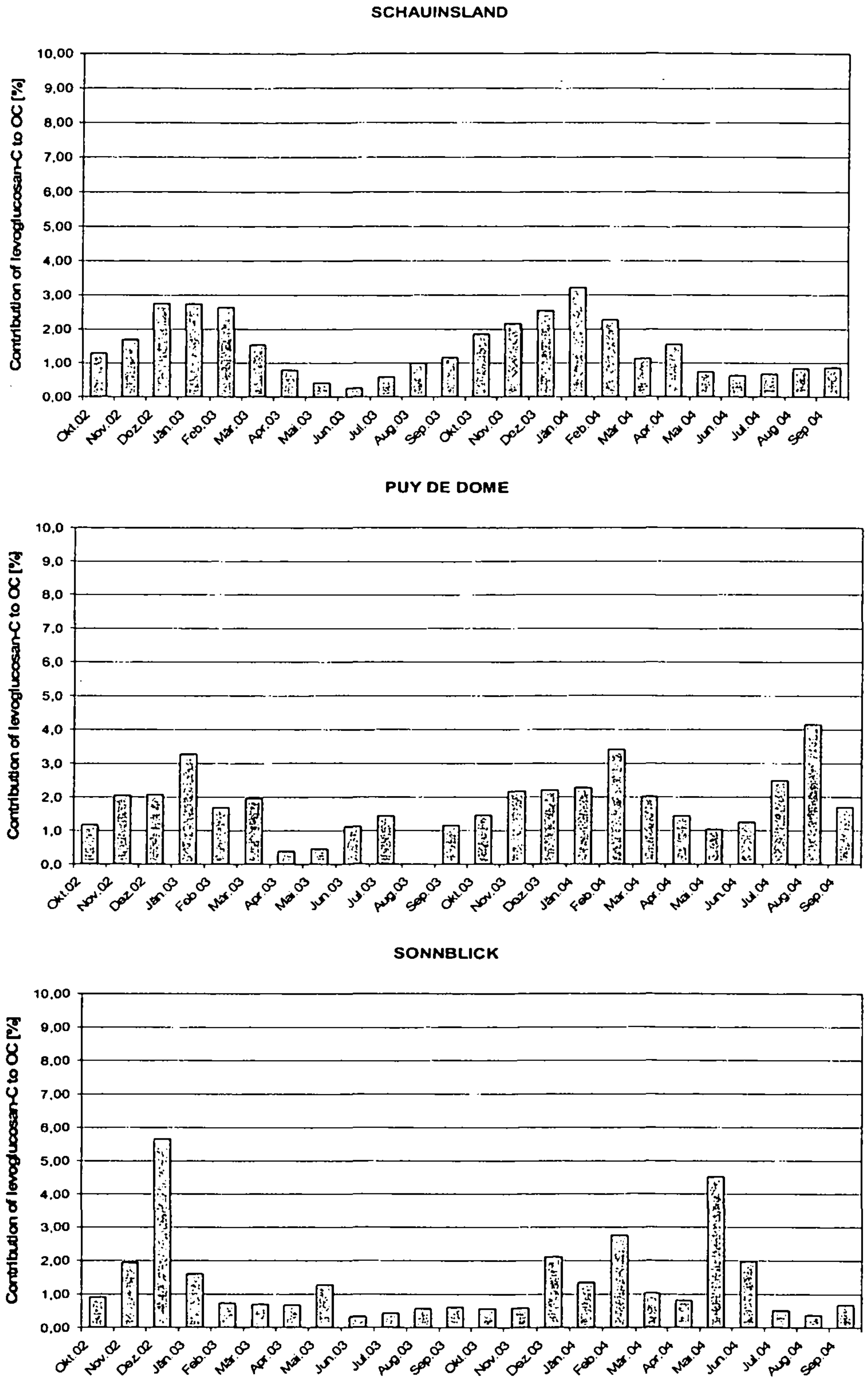


Fig. 3.66 - 68 Contribution of levoglucosan-C to OC [%] at Schauinsland, Puy de Dôme and Sonnblick

Table 3.25 Average, minimum and maximum values of the six sampling sites

Levoglucosan-C/OC [%]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Pusta
Average	2,3	2,0	1,8	1,5	1,2	2,1
Min	0,1	0,04	0,2	0,1	0,04	0,01
Max	16	6,8	6,7	5	11	16

The Table 3.26 shows the average of summer and winter periods as well as the ratio between these periods. For all the sampling sites the contribution in winter is higher than in summer. The maximum winter/ summer ratio was calculated for AVE, where the contribution in winter is 5 times higher than in summer, due to the elevated concentration values of levoglucosan, as mentioned earlier (ratio between winter and summer concentration values of levoglucosan is 13).

Table 3.26 Average of summer and winter period and ratio between summer and winter period

Levoglucosan-C/OC [%]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Puzta
Summer	1,6	0,6	1,8	0,7	0,7	1,5
Winter	3,0	3,2	2,3	2,4	2,3	2,3
Winter/Summer	2	5	1	4	3	2

3.2.6.3 Contribution of wood smoke to Organic matter

Concentrations of levoglucosan in fine particle ($PM_{2.5}$) emissions from fireplace combustion of wood in the northeastern and southern United States were reported by Fine et al. (2001a, 2001b). The results of these papers are summarized in Table 3.27. If we assume that the composition of the emission of wood burning emissions in our sampling sites are roughly similar to that from the fireplaces in the northeastern and southern United States, we can derive a first, rough estimate for the contribution of wood combustion to the OC. Table 3.28 shows the results of this estimation for our sampling sites in Europe.

Table 3.27: Resume of results in Fine et al. 2001 works

Sampling site		Levoglucosan [mg/g OC]	Levoglucosan/OC in wood burning emissions %C	Date	Reference
Northeastern United States	Hardwoods	128,767 (108,509 - 168,254)	11 - 17		Fine et al. 2001a
	Softwoods	76,40 (52,330 - 81,445)	5,2 - 9,5		
Southern United States	Hardwoods	136,28 (98,9 - 159,18)	9,9 - 15,9		Fine et al. 2001b
	Softwoods	42,6 (36,373 - 46,942)	3,6 - 4,7		

The approximation value calculated from this works was 7,35. To calculate the concentration value of wood smoke, the concentration of levoglucosan is multiplied by 7,35:

Wood smoke = Levoglucosan * 7,35

Table 3.28: Concentrations of wood smoke (OC) for all the sampling sites [ng/m³]

	AZO		AVE		PDD		SIL		SBO		KPZ	
	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
Entire period	104	8-585	2006	13-10864	352	21-2360	389	50-1041	142	12-1219	1756	15-5024
Summer period	98	12-491	294	13-766	845	188-2360	405	106-1041	149	12-750	1078	204-2515
Winter period	125	11-585	3860	691-10864	151	21-458	328	70-766	139	13-1219	2660	1234-4347

The site with the lowest wood smoke (OC) concentrations is AZO (104 ng/m³, with a range of 8 to 585 ng/m³), that is followed for SBO (142 ng/m³, with a range of 12-1219 ng/m³). PDD and SIL present very similar average concentration of wood smoke, 352 ng/m³, ranging between 21 and 2360 ng/m³ and 389 ng/m³, ranging between 50 and 1041 ng/m³, respectively. As expected, at KPZ and AVE, where the highest concentrations of levoglucosan were observed, then the average concentrations of wood smoke were also very high. At KPZ the average is 1756 ng/m³, ranging between 15 and 5024 ng/m³, and for AVE it is 2006 ng/m³, ranging between 13 and 10864 ng/m³.

If we want to calculate the contribution of wood smoke to OM it is necessary to use some conversion factors. The conversion from organic carbon mass to total organic compound mass or organic matter is using a factor that accounts for the hydrogen, oxygen, and sometimes nitrogen and sulphur content of the organic compounds present (Fine et al. 2001). Fine calculated a scale factor typically ranging between 1,2 and 1,4 for typical atmospheric samples or higher depending primarily on the oxygen content of the compound. We use a scale factor of 1,7 (Puxbaum et al. 2004), as it was assumed that these compounds involve more oxygenation of the compounds after long-range transport. We show here the scheme of the contribution value of wood smoke to OM calculation:

$$\text{Wood smoke (OM)/OM (\%)} = [(\text{levoglucosan} * 7{,}35 * 1{,}7) / (\text{OC} * 1{,}7)] * 100$$

Tables 3.29 and 3.30 present the average contribution of wood smoke to OM, maximum and minimum values, as well as the average of summer and winter periods and the ratio between winter-summer periods.

The average contribution of wood smoke to OM for all the sites ranges between 21 and 39 %. As was expected, the major contributions were observed at AZO, for the same reason which was explained before. AZO is followed by KPZ (35 %) and AVE (34 %), both low level sites with higher concentrations of levoglucosan. For the high levels sites, the contribution is minor. For PDD it is 30 %, SIL is 24 %, and for SBO 21%.

In winter the contribution of wood smoke to OM is generally higher than in summer. Normally in this season the temperatures are very low, there is not much air mass exchange in the atmosphere and the transport of this air mass is very slow furthermore higher emissions can be expected during the cold season. These winter contributions range between 39% and 52%.

We can summarize that the contribution of wood smoke to OM is between 10 and 52% for all these sampling sites in Europe.

Table 3.29 Average of contribution of wood smoke to OM (%), and maximum and minimum values for all the sampling sites

Wood smoke/OM [%]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Pusta
Average	39	34	29	24	21	35
Min	2,4	0,7	2,6	2,0	1	0,2
Max	273	113	112	84	174	272

Table 3.30 Average and ratio for winter and summer period

Wood smoke/OM [%]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Puzta
Summer	27	10	30	11	11	25
Winter	50	52	39	40	41	39
Winter/Summer	2	5	1	4	4	2

3.2.7. Comparison of levoglucosan and K^+

Potassium has been already widely used as tracer element for the qualitative identification of biomass burning (Cachier et al. 1991) as well as for wood combustion. However the emission of this tracer element is highly variable and must be determined empirically for each situation (Sheffield et al. 1994). Thus Organic compounds are of particular interest to be used as tracers of Biomass burning. The problem in using organic compounds as tracers is that they can form and degrade in the atmosphere by chemical reactions. As mentioned before, some studies show that levoglucosan is a good tracer for wood combustion, specific for biomass burning and with a high stability in the atmosphere during a relative large period.

Potassium can also be related to aerosols originating from the Earth's crust. Iron concentrations were used to estimate contributions of the Earth's crust to observed K^+ concentrations (Lewis et al. 1988). Lewis and collaborators reasoned that soil should be the only one significant source of K^+ in coarse particles and that, therefore, the K/Fe ratio in coarse particles would be equivalent to that in those fine particles originating from soil.

They developed the following equation to calculate concentrations of non-crustal potassium (K') in fine particles:

$$[K'] = [K] - 0{,}45[Fe]$$

We cannot calculate this potassium concentration (K'), as in the project "Carbosol" concentration values of Fe were not determined. Potassium (and other ions) was analysed by the Laboratory Environment Glaciology and Géophysique (Grenoble). Figures 3.69 and 3.70 presents the annual cycles, based on monthly average of levoglucosan and K^+ for AVE and KPZ respectively. We choose the two sampling sites with higher concentrations of levoglucosan and thus high contribution of wood burning for this comparison.

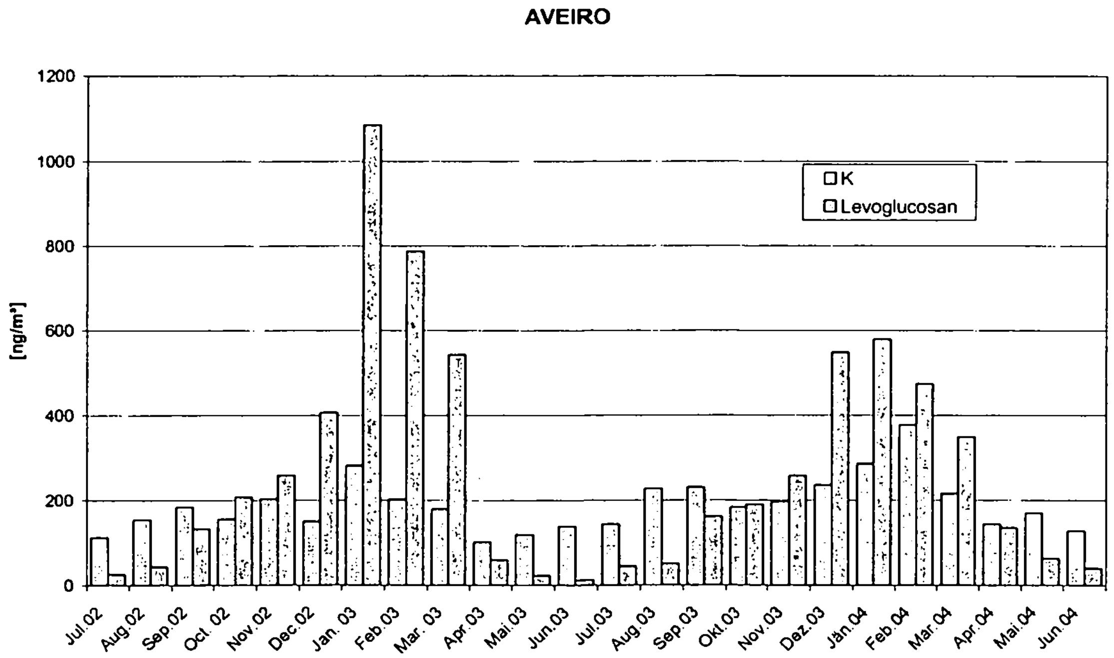


Fig. 3.69. Monthly average of annual cycles of levoglucosan and K^+ for Aveiro.

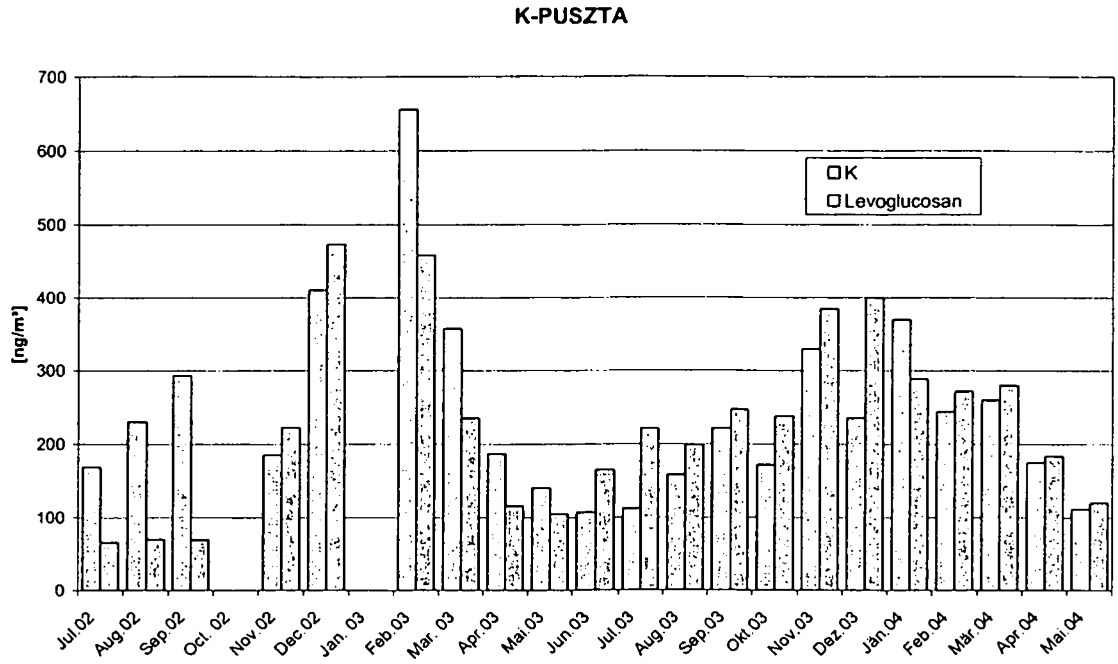


Fig. 3.70. Monthly average of annual cycles of levoglucosan and K^+ for K-Puszta.

Winter months for AVE showed higher concentration values of levoglucosan than K^+. For summer months it was the opposite, the concentration values of K^+ were higher than levoglucosan. While for AVE, levoglucosan presented a very pronounced annual cycle (high concentrations values in winter and lower in summer), the cycle for K^+ was much less pronounced. The differences between the winter and summer concentrations were very small. However, for KPZ we observed very similar annual cycles for levoglucosan and K^+. Only in summer and autumn two potassium concentrations were much higher than levoglucosan values.

Figures 3.71 and 3.72 show the ratio of levoglucosan and K^+ with OC for AVE and KPZ. For AVE, during the winter the levoglucosan contributions predominate over the K^+. During the summer is the contrary; the contributions of K^+ to OC are higher than levoglucosan. In KPZ the contribution of K^+ and levoglucosan to OC are very similar. A clear example is seems in March 2004 where the contribution was very high for both compounds.

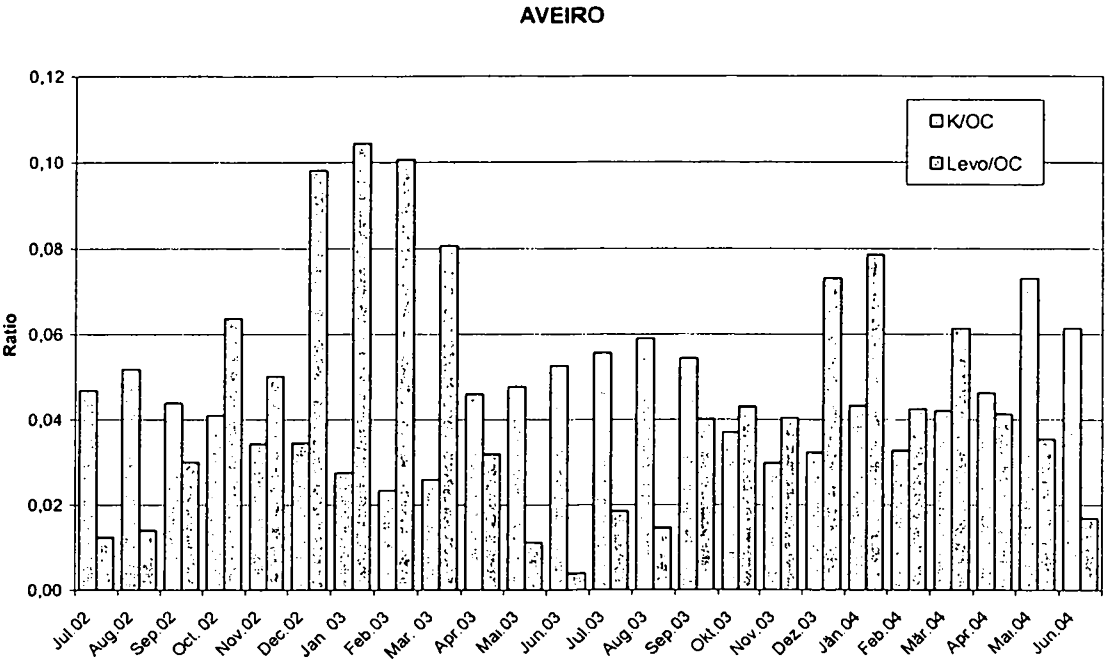


Fig. 3.71. Monthly average of K^+/OC and Levoglucosan/OC ratio for Aveiro.

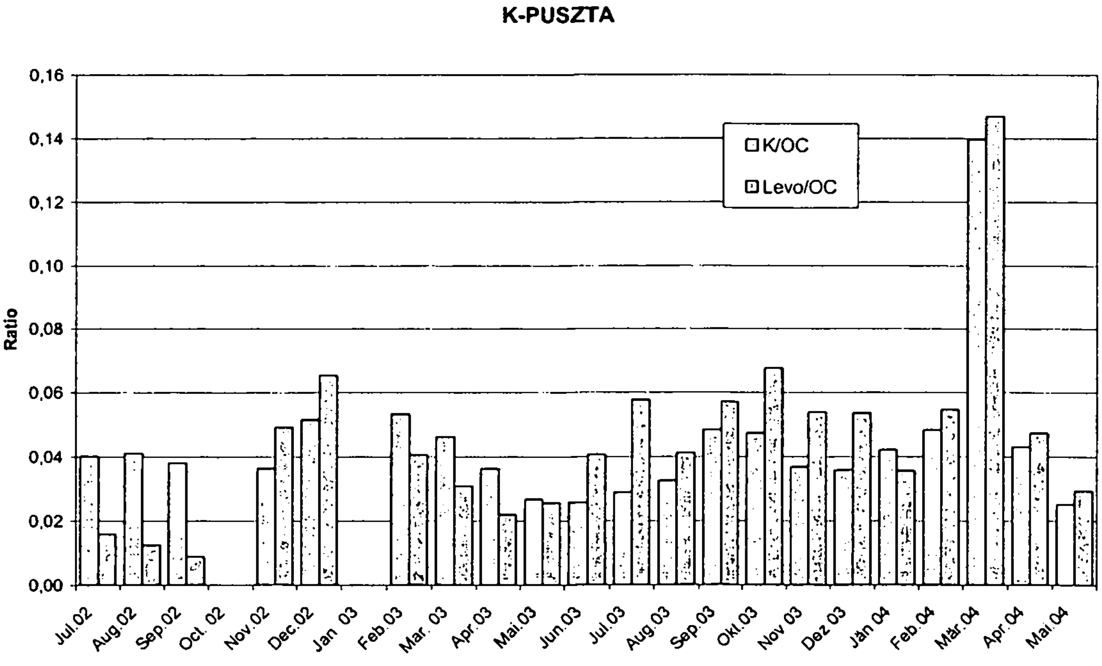


Fig. 3.72. Monthly average of K^+/OC and Levoglucosan/OC ratio for K-Puszta.

We performed regressions analysis to evaluate a possible quantitative relationship between K^+ and levoglucosan of both sampling sites. For AVE, regression analysis gave a correlation coefficient of $R^2 = 0,4012$ and for KPZ $R^2 = 0,4498$. This is somewhat surprising, especially since KPZ shows much better agreement between K^+ and levoglucosan annual cycles than AVE. Another regression analysis was performed between levoglucosan and K^+ with OC (Table 3.31). For AVE the regression between levoglucosan and OC was $R^2 = 0,8186$, a little better than for K^+ and OC ($R^2 = 0,7047$). At KPZ, although the annual cycle between levoglucosan and K^+ is very similar and also the annual cycle of the ratios levoglucosan/OC and K^+/OC, the regression analysis was very different; for levoglucosan/OC was obtained a very poor value $R^2= 0,2465$ and for K^+/OC was observed a very good regression $R^2 = 0,8368$. Disregarding the average months values from July to October 2002 correlation analysis yields $R^2 = 0,4143$ and 0,8876 for levoglucosan/OC and K^+/OC, respectively. Although the annual cycles in monthly average for levoglucosan and K^+ seem very similar, if we compare the annual cycles of levoglucosan and K^+ with OC for KPZ (weekly samples), it can observe some differences. The trend of weekly samples for K^+ and OC is very agreed, but for levoglucosan and OC is not so good.

Table 3.31: Regression analysis between levoglucosan, K^+ and OC for Aveiro and K-Puszta

R^2	Levoglucosan/K^+	Levoglucosan/OC	K^+/OC
AVEIRO	0,4012	0,8186	0,7047
K-PUSZTA	0,4498	0,2465	0,8368

Recent work from Brasil shows some regressions analysis between levoglucosan and K^+. The sampling was carried out during the day- and nighttime in Rôdonia, Brasil, during the deforestation fires season (Schoklnik et al. 2005). During daytime, levoglucosan/K^+ ratios were smaller than during the night. It was suggested that during daytime, when the deforestation fires were set, flaming combustion prevails, while at nighttime, when the fire has subside, smoldering processes were more dominant. Flaming combustion is a very exothermic gas-phase combustion, during which organic compounds are oxidized to a greater extent, thus leaving proportionally less levoglucosan. Another recent work from

Kawamoto et al. 2003 has reported that in 400 °C (as opposed to 250-300 °C) levoglucosan re-polymerizes into polysaccharides, which then further react to form organic solids containing conjugated double bonds and carbonyl groups, such as can be found in HULIS. Smoldering combustion, on the other hand, is a slow solid-phase oxidation process, which gives rise to more unbroken organic compounds, and possibly to less levoglucosan re-polymerization, increasing the levoglucosan concentration in comparison to inorganic species such as K^+.

This could be the answer why there is not so much correlation between levoglucosan and K^+ as expected.

3.2.8. Comparison of cellulose and Organic Carbon (OC)

3.2.8.1. Annual cycles of cellulose-C and OC

The annual cycles of the monthly average concentrations of cellulose-C and OC have a very similar trend for the AVE, PDD and SBO the corresponding trend of cellulose-C and OC was in agreement. Only at SBO the monthly average concentrations during the winter months in 2004 presented very high values for cellulose-C and not for OC. At AZO no trends for both components were observed. At KPZ, it showed some differences during winter, where the concentrations of OC present a maximum but not the concentration of cellulose-C. At SIL, it is possible to note two different trends, e.g. for OC the maximum monthly average concentration was observed during the summer months and for cellulose-C during the spring months. The figures from 3.73 to 3.78 represent these annual trends for the six sampling sites.

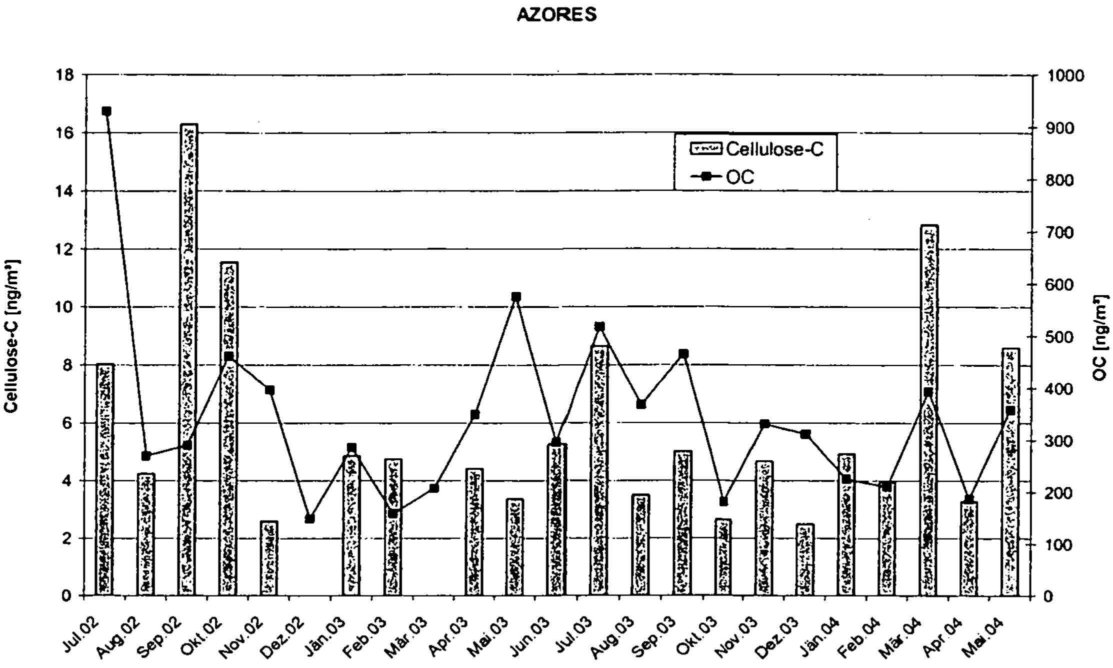


Fig. 3.73: Annual cycle of cellulose-C and OC at Azores

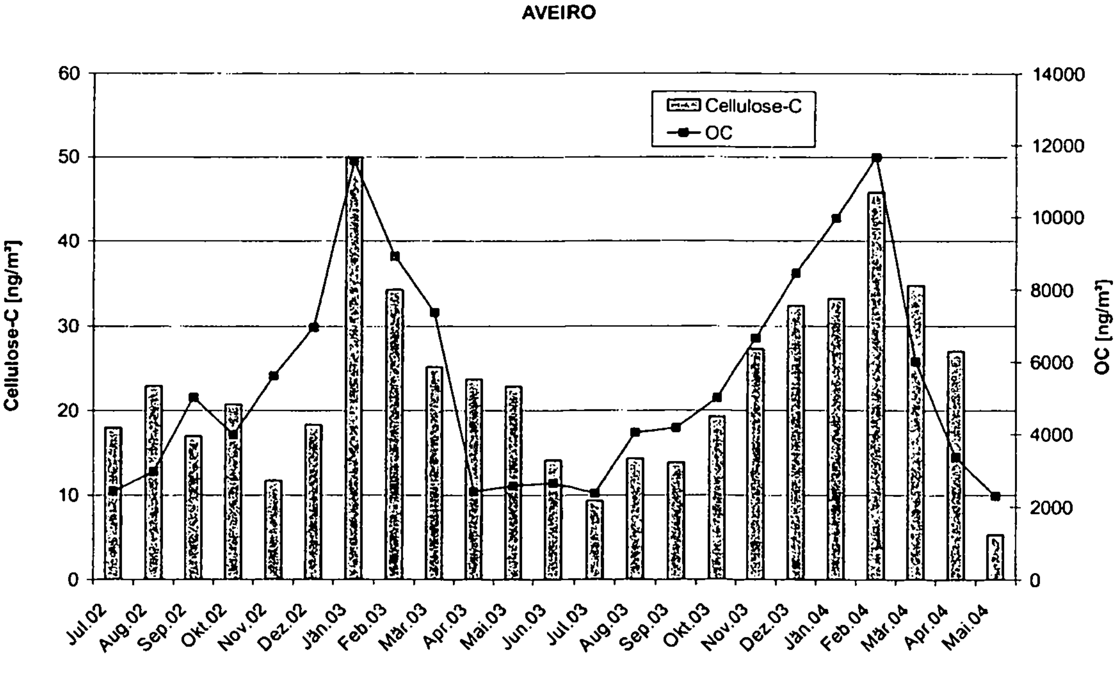


Fig. 3.74: Annual cycle of cellulose-C and OC at Aveiro

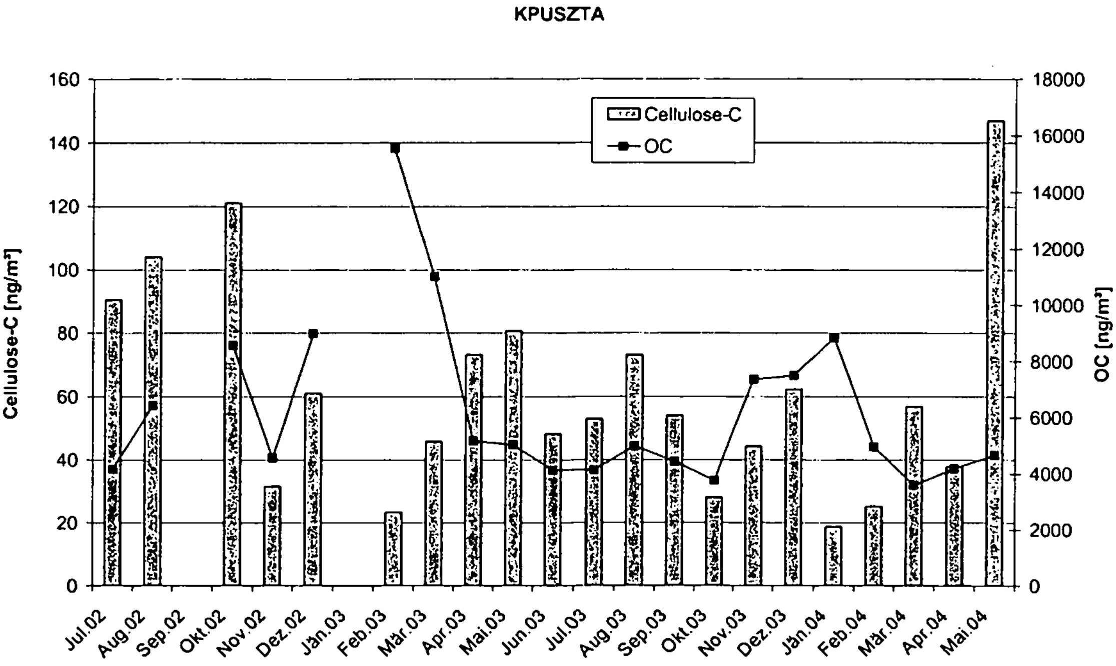


Fig. 3.75: Annual cycle of cellulose-C and OC at K-Puszta

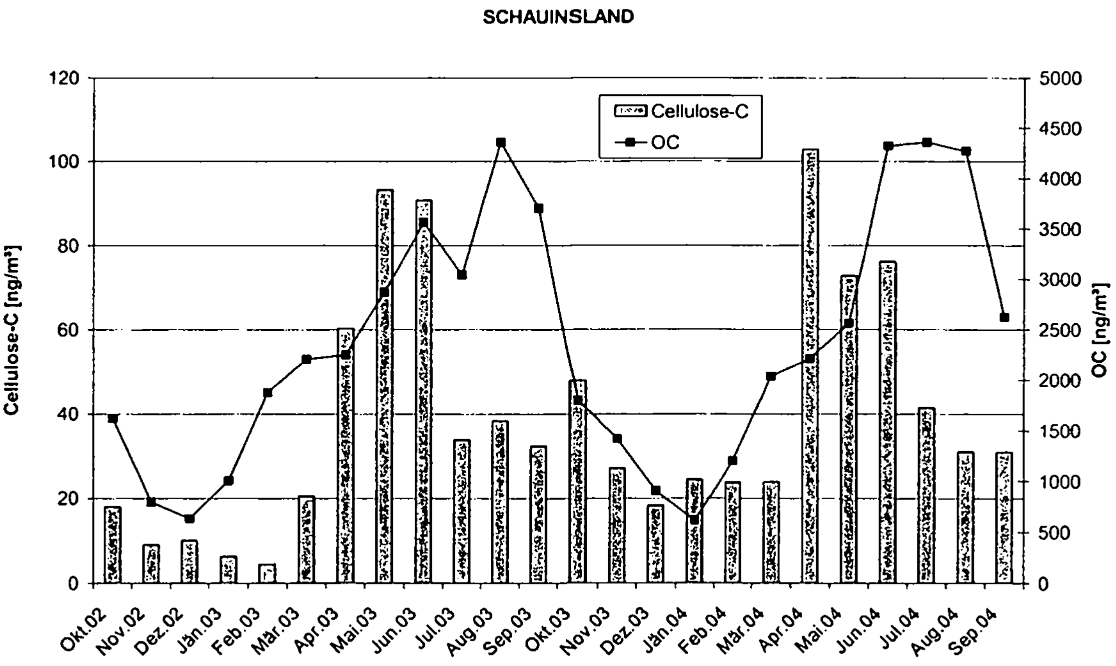


Fig. 3.76: Annual cycle of cellulose-C and OC at Schauinsland

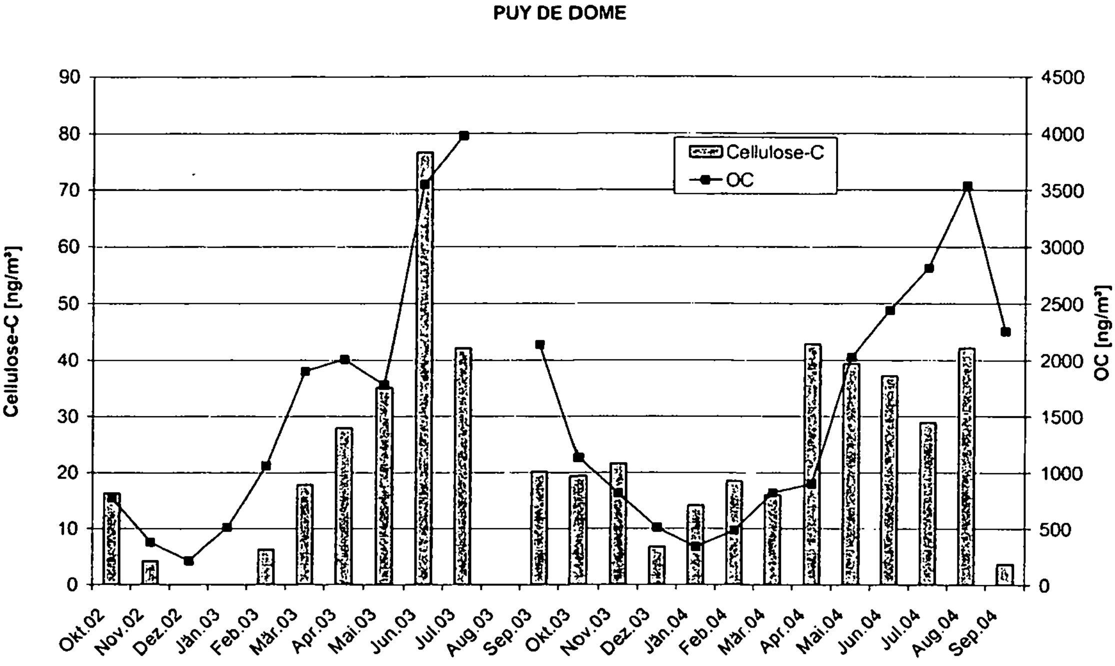


Fig. 3.77: Annual cycle of cellulose-C and OC at Puy de Dôme

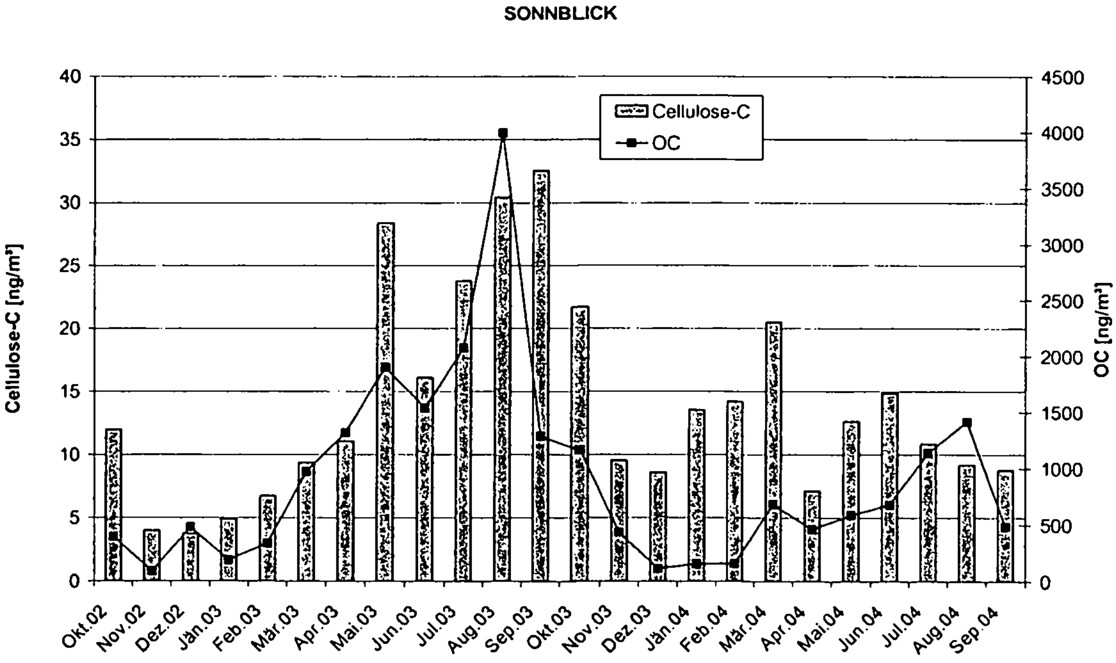
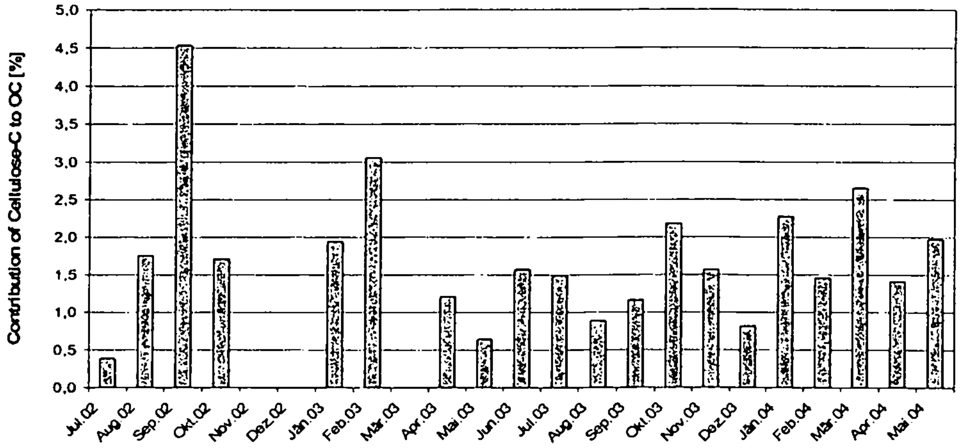


Fig. 3.78: Annual cycle of cellulose-C and OC at Sonnblick

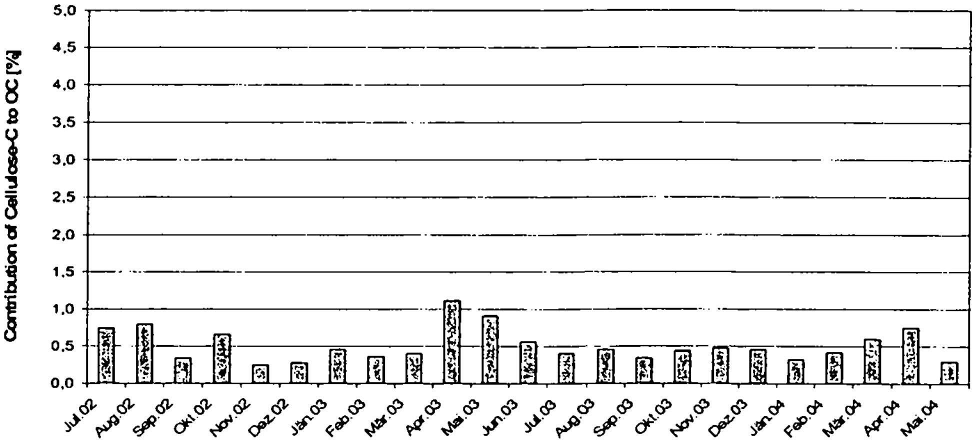
3.2.8.2. Contribution of cellulose-C to OC

The highest contribution of cellulose-C to OC is observed at the sampling site SBO (2,7 %, with a range of 0,3-18 %). The results at PDD were very similar to SBO (2,3 %, with a range of 0,3-17 %), that is followed by SIL (2,0 %, with a range of 0,3-16,8 %). Thus all the continental mountain sites show similar results, independent from the elevation of the site. At AZO the results are in the middle, no so high as the mountain sampling site but higher than the low level sites (1,7 %, with a range of 0,4-6,7 %). The lowest concentration values were obtained in KPZ and AVE, where the contribution of cellulose-C to OC is 1,2 %, with a range of 0,1-4,5 %, and 0,5 %, with a range of 0,1-1,8 %, respectively. The low contribution in these sampling sites, especially at AVE. Table 3.32 summarizes the results of the contribution of cellulose-C to OC, average concentration values, as well as maximum and minimum values. The figures from 3.79 to 3.84 represent these contributions for the six sampling sites.

AZORES



AVEIRO



K-PUSZTA

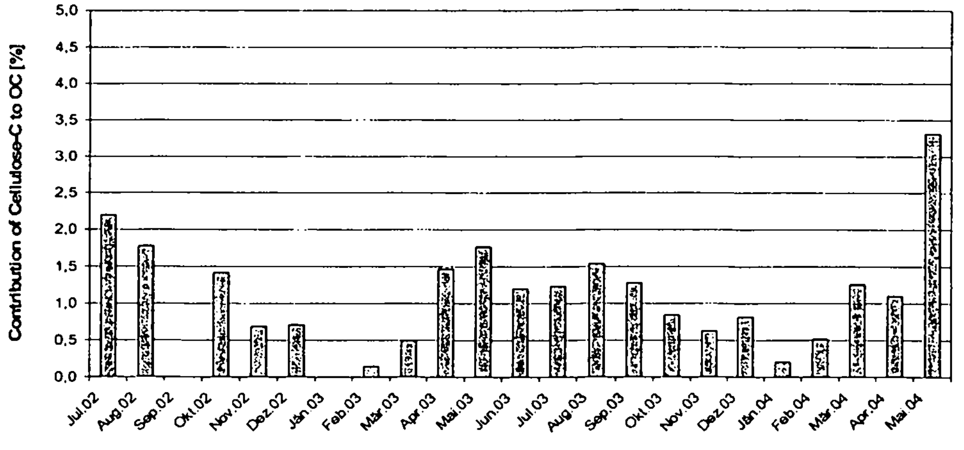
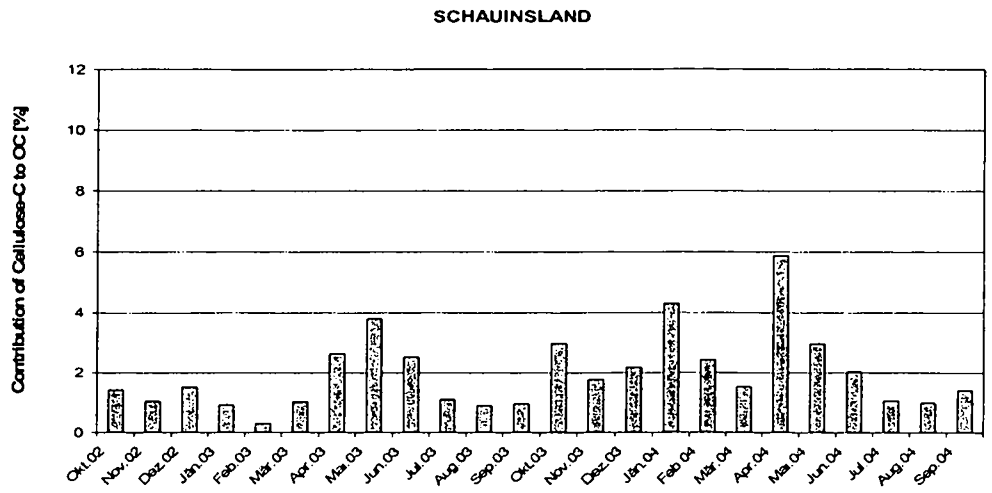
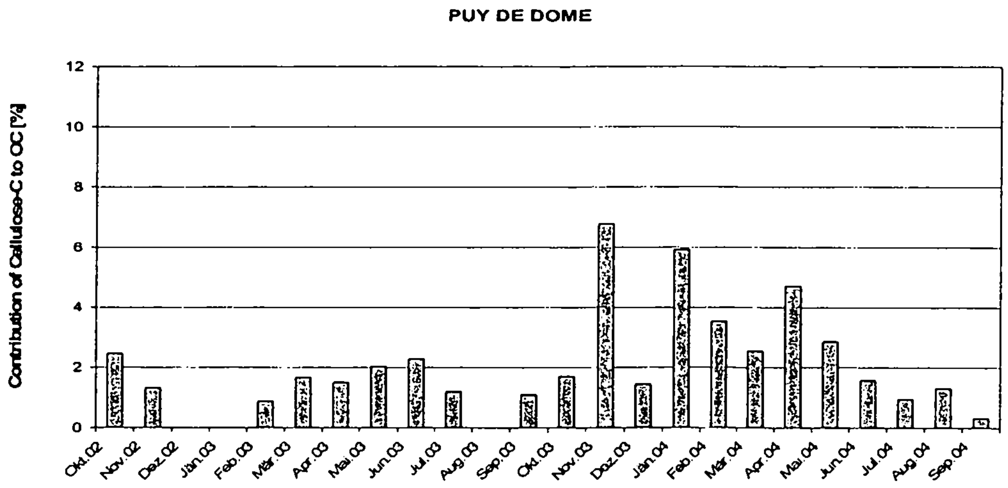


Fig. 3.79 – 81. Contribution of Cellulose-C to OC [%] for Azores, Aveiro,and K-Puszta





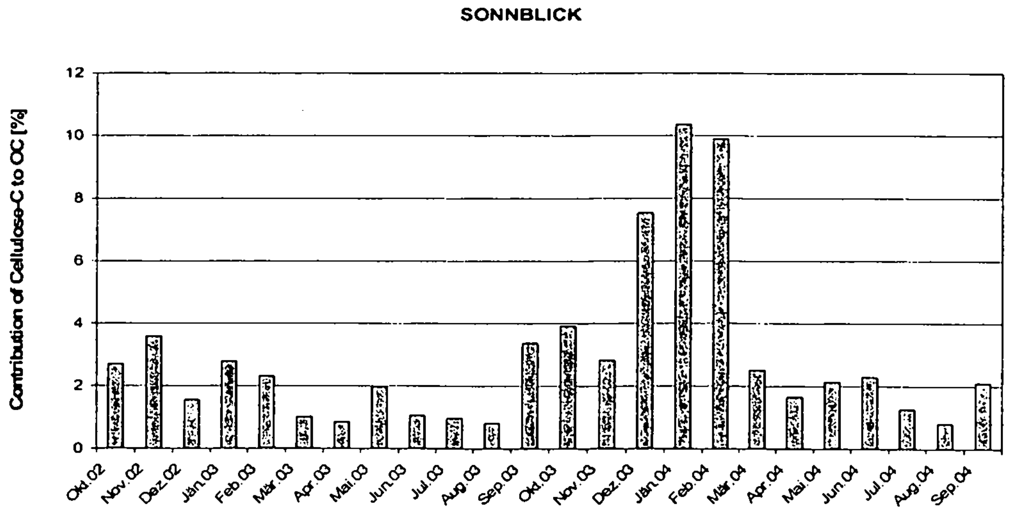


Fig. 3.82 - 84. Contribution of Cellulose-C to OC [%] for Schauinsland, Puy de Dôme and Sonnblick

Table 3.32: Average, minimum and maximum values of the six sampling sites

Cellulose-C/OC [%]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Pusta
Average	1,7	0,5	2,3	2,0	2,7	1,2
Min	0,4	0,1	0,3	0,1	0,3	0,1
Max	6,7	1,8	17	13	18	4,5

Table 3.33 shows the average contribution of cellulose-C to OC for summer and winter periods as well as the ratio between winter and summer for all the sampling sites. One might comment about the results of Table 3.33 that the major contribution of cellulose-C to OC was obtained during the winter. At KPZ during the summer period, the contribution was higher than the winter period; therefore, the winter/summer ratio is 0,4. If the ratio summer/ winter is calculated, the result is 2 and that means the contribution of cellulose during the summer period is double with respect to the winter period. Another important observation of this Table is the elevated winter/summer ratio for PDD and SBO, 3 and 4, respectively. It is observed that during the winter months, especially in the second year 2004 that the contribution of cellulose-C to OC is very high if it is compared with the winter 2003 for example. This coincident higher percentage of cellulose at both these mountain sites could be the result of long-range transport. Up to now trajectory analysis did not give evidence for any special events.

Table 3.33: Average summer and winter period and winter/summer ratio

Cellulose-C/OC [%]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Puzta
Summer	1,3	0,5	1,4	1,4	1,4	1,6
Winter	1,5	0,4	4,1	2,1	5,5	0,6
Winter/Summer	1	0,7	3	1	4	0,4

3.2.8.3. Contribution of Plant Debris to Organic matter (OM)

In leaves of terrestrial plants, the content of cellulose is around 50%, while lignin amounts to <20% and hemicellulose 20-30% (Butler and Baily, 1973). As we assume that the major fraction of cellulose in continental aerosol originates from decomposition processes of leaves, the portion of plant debris in aerosol is proposed to be estimated according to the mass fraction of cellulose in leaves by the following relation:
"Plant debris" = 2 $*$ cellulose.

Plant debris appears to be an important contributor to OC in atmospheric aerosols (Puxbaum and Kunit, 2003). Table 3.34 shows the average concentration values for whole sampling period as well as for summer and winter period for plant debris in all six sampling sites.

Table 3.34: Concentrations of plant debris for all the sampling sites [ng/m³]

	AZO		AVE		PDD		SIL		SBO		KPZ	
	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
Entire period	24,5	<10,5-100	103	12,6-425	121	13-425	178	13-739	65,6	<10,2-311	266	45-872
Summer period	27,2	11,5-100	67,8	12,6-154	196,0	13-452	227	19-633	87,5	13-248	336	149-603
Winter period	20,1	<10,5-52	124	15-425	57,2	15,4-159	77,4	13-208	41,5	12,5-104	190	45-485

At AZO and SBO the lowest annual average concentration values of plant debris were observed. At AZO the value is 24,5 ng/m³, ranging between < 10,5 and 100 ng/m³, and at SBO 65,6 ng/m³, ranging between < 10,2 and 311 ng/m³. AVE is the next sampling sites, regarding increasing concentrations of plant debris (103 ng/m³, ranging between 12,6 and 425 ng/m³). The value of PDD is 121 ng/m³, ranging between 13 and 425 ng/m³. The highest average concentrations were obtained at SIL and KPZ, although the average concentration value of KPZ is almost the double of SIL. The average concentration value of SIL is 178 ng/m³, ranging between 13 and 739 and for KPZ is 266, ranging between 45 and 872 ng/m³.

To convert the mass of organic carbon to an estimate of organic compound mass, it must be multiplied by a scale factor (generally 1,2-1,4 for atmospheric samples) to account for the oxygen, hydrogen, and other elemental content of the organic present (Fine et al

2001a, 2001b). In the present study, a scale of factor 1,7 is used (Puxbaum, et al. 2004), owing to the substantial number of oxygenated species. But for plant debris the conversion factor would be around 2,2, derived from stoichiometric considerations (Puxbaum et al. 2004). Thus, to calculate the concentration of plant debris to OM is the concentration value of cellulose is multiplied by 2 and that is plant debris in OC. If multiply again by 2,2 is obtained the concentration of plant debris expressed as OM. The contribution of plant debris on to OM, is obtained by dividing concentration of plant debris OM by OM (OC * 1,7, as mentioned before). The scheme of this calculation is as follows:

$$\text{Plant debris (OM)/OM (\%)} = (\text{Cellulose} * 2 * 2{,}2 / \text{OC} * 1{,}7) * 100$$

Table 3.35 shows the contribution of plant debris to organic matter (OM) for all the sampling sites.

The contribution of plant debris to OM at the background sampling site SBO), as it is expected, is the major contribution of all sampling sites. The monthly average result of SBO is 16 %, ranging from 1,7 to 106%. The following major contribution is observed at PDD, 14 %, ranging from 1,5 to 98%. At SIL the contribution of plant debris to OM is 12% (ranging from 0,8 to 75 %). At AZO is 11 %, ranging from 2,2 to 39 %, and for KPZ the highest concentration values of cellulose are found, but the contribution of plant debris to OM is not major (6,7 %, ranging from 0,6 to 26 %). Minor contributions are observed at AVE (3,0 %, ranging from 0,4 to 10 %); it is a low level sampling site, and it becomes influenced by other emission sources.

The season comparison of summer- winter shows that there are not many differences between summer and winter at AZO, AVE, and SIL (Table 3.36). However at SBO and PDD, major contribution values are observed in winter rather than summer period, and the ratio between winter-summer is 4 and 3 respectively. That is the time coincident of high concentration values of cellulose during winter, especially in winter 2004, has also a meaning to the contribution of plant debris to OM. At KPZ is the opposite, the contribution is higher in summer than winter, therefore, a ratio is calculated between summer-winter for KPZ, and this ratio is 3.

Table 3.35: Contribution of Plant Debris to OM for all the sampling sites

Plant debris/OM [%]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Pusta
Average	11	3,0	13,6	12	16	6,7
Min	2,2	0,4	1,5	0,8	1,7	0,6
Max	39	10	98	75	106	26

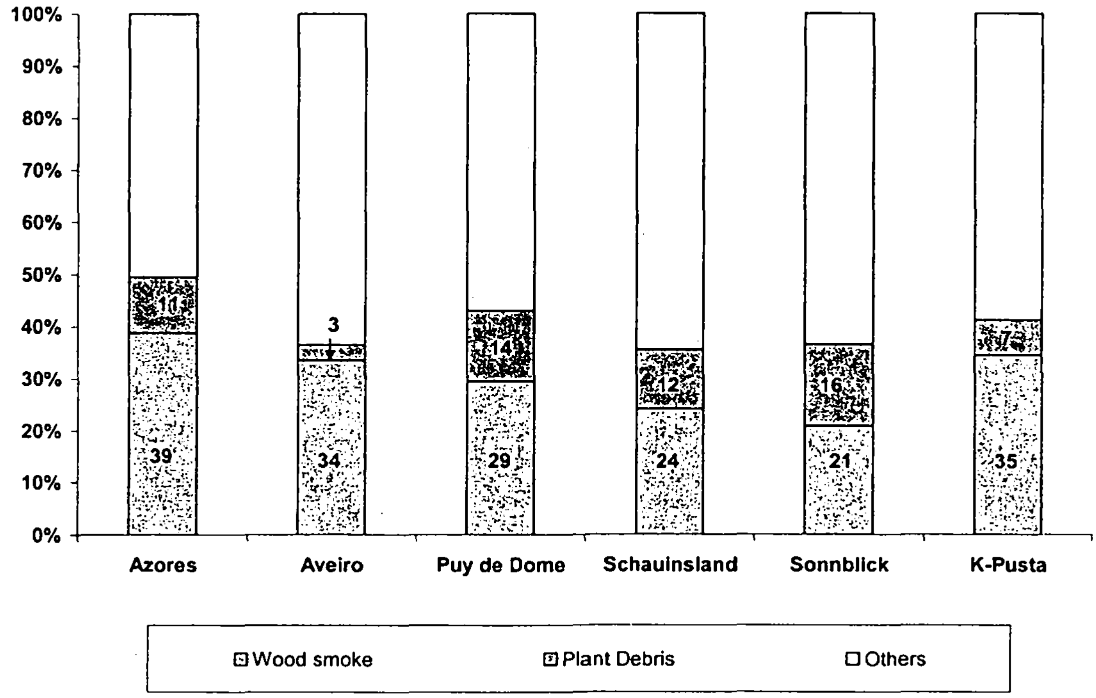
Table 3.36: Average summer and winter period and ratio winter/summer

Plant debris/OM [%]	Azores	Aveiro	Puy de Dome	Schauinsland	Sonnblick	K-Puzta
Summer	8,1	3,1	8,3	8,1	8,2	9,6
Winter	8,5	2,1	24	12	32	3,4
Winter/Summer	1	0,7	3	1,5	4	0,4

3.2.9. Mass balance of OM using levoglucosan and cellulose as macrotracers

The following diagram is a mass balance of OM using levoglucosan and cellulose as macrotracers. Levoglucosan is a macrotracer of "wood smoke" and cellulose for "plant debris", as we mentioned in other chapters before. This diagram gives a general overview of the importance of these macrotracers as organic species in atmospheric aerosols. The contributions of both sources to OM range between 37 and 50 %, with higher percentages for wood smoke (21 – 39 %) than for plant debris (3 – 16 %).

Thus the spatial differences of the contributions of the macrotracers to OM are less pronounced than the absolute concentrations of levoglucosan and cellulose.



3.3. Size classified measurements of levoglucosan and cellulose

To check the size distribution of cellulose and levoglucosan six impactor runs with a Sierra Series 230 High-Volume Cascade Impactor (first three samples with a PM 10 inlet; last three samples with a TSP inlet) were carried out. These impactor measurements were performed at the sampling site AVE, during the sampling period 2002-2003. The duration of the runs was 7 days each. Figures 3.85 to 3.96 show the histograms for levoglucosan and cellulose. For comparison the size distribution with the size distribution of levoglucosan and cellulose OC and K$^+$ is given as well.

The samples AVE 24 and 35 were collected during periods of rain. This might have led to condensation/deposition of liquid water onto the impaction surfaces causing a washing of the water soluble material to the borders of the filters. For AVE 24 the homogeneity is observed principally in the stages 3 and 4, and for AVE 53 in stages 1 and 2. For example, in AVE 24 sample concentration values of cellulose were not determined, and for levoglucosan very low concentration values were obtained.

Summarizing the size distribution of these compounds we propose as "fine particles" sizes which have < 3µm AD and as "coarse particles" size which have > 3µm AD. Table 3.37 represents the percentage of fine particles (< 3µm AD) determined with this cascade impactor for each compound in every sample.

Table 3.37 Percentage of fine particles size determined with the impactor at Aveiro.

<3µm (%)	AVE 11 [ng/m^3]	AVE 24 [ng/m^3]	AVE 35 [ng/m^3]	AVE 48 [ng/m^3]	AVE 53 [ng/m^3]	AVE 58 [ng/m^3]
Levoglucosan	34	97	93	69	59	55
Cellulose	28	0,0	89	93	95	94
OC	79	86	92	79	70	82
K$^+$	81	98	88	70	88	82

It is observed for cellulose and levoglucosan that only in the first sample higher concentrations were observed in the coarse particles. In the rest of the samples the fine particles predominate, for cellulose with a high percentage and for levoglucosan, especially in samples AVE 53 and 58, were approximately half of the mass was determined in the fine fraction.

For OC and K+ major percentages of fine particles sizes were determined.

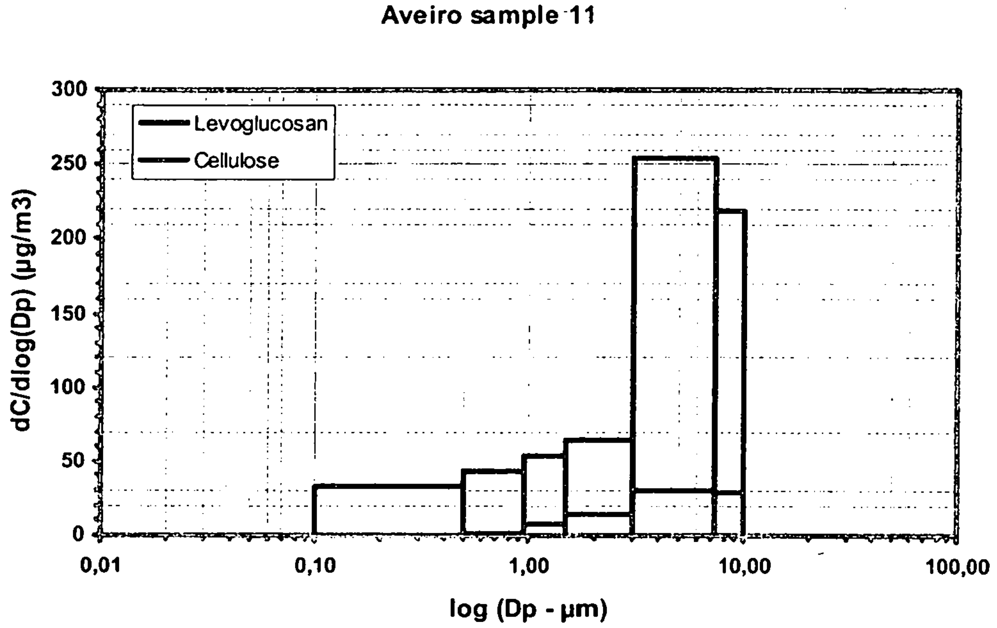


Fig. 3.85. Histogram of cellulose and levoglucosan for AVE 11 sample

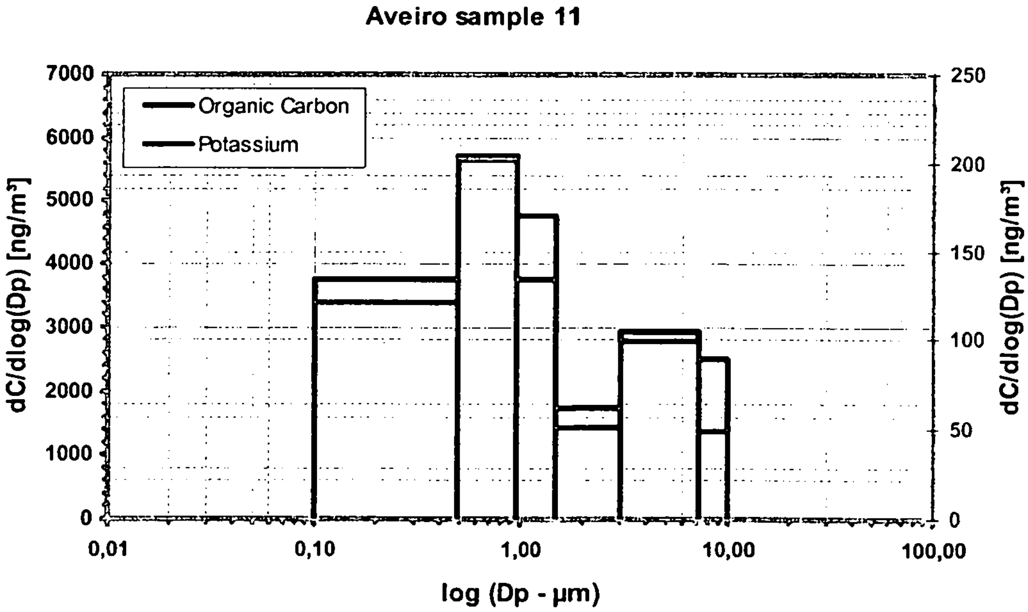


Fig. 3.86. Histogram of OC and K^+ for AVE 11 sample

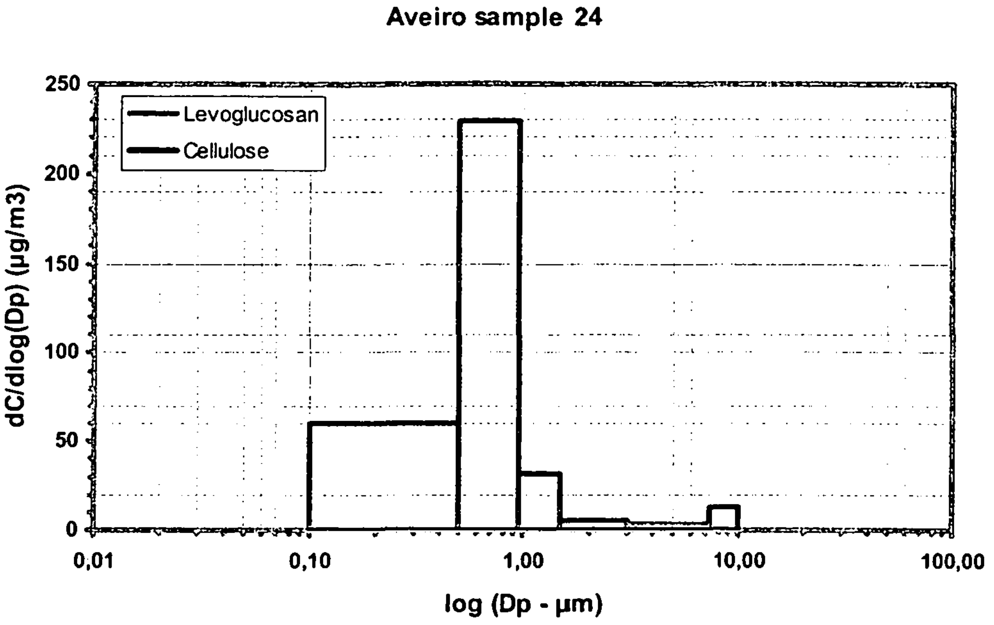


Fig. 3.87. Histogram of cellulose and levoglucosan for AVE 24 sample

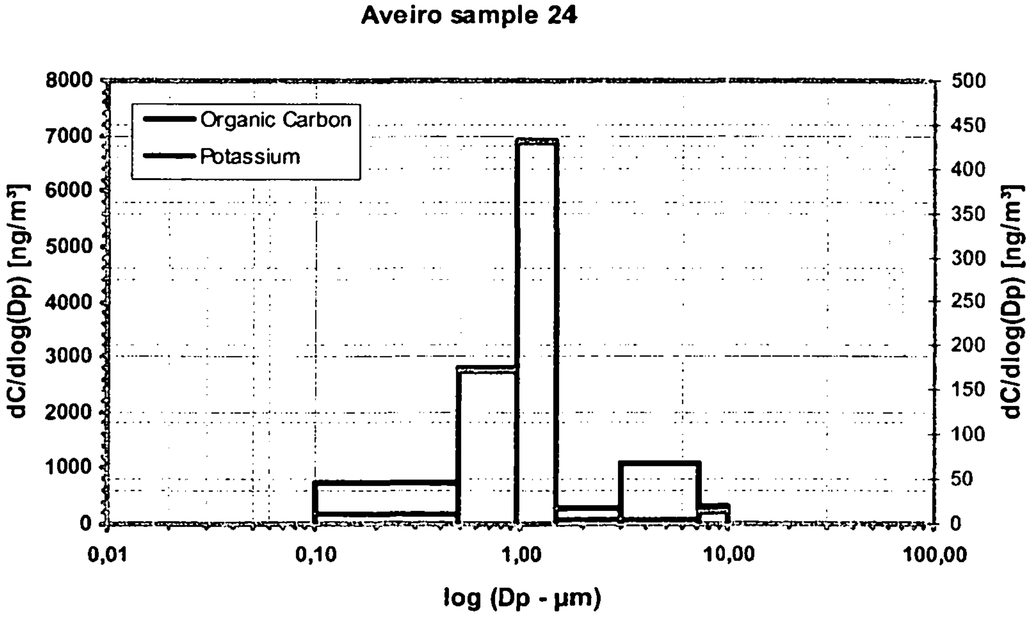


Fig. 3.88. Histogram of OC and K$^+$ for AVE 24 sample

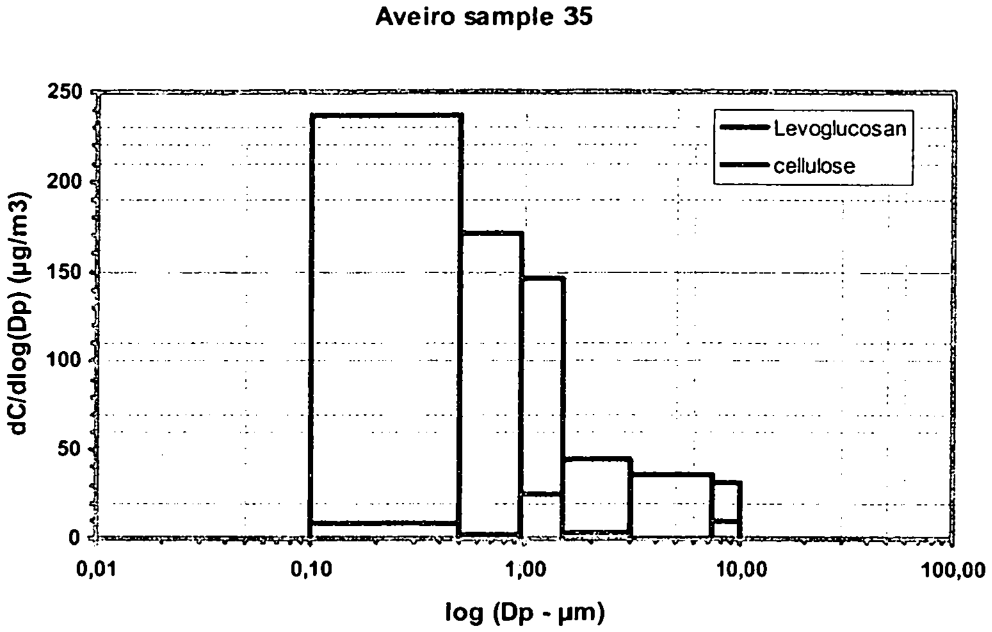


Fig. 3.89. Histogram of cellulose and levoglucosan for AVE 35 sample

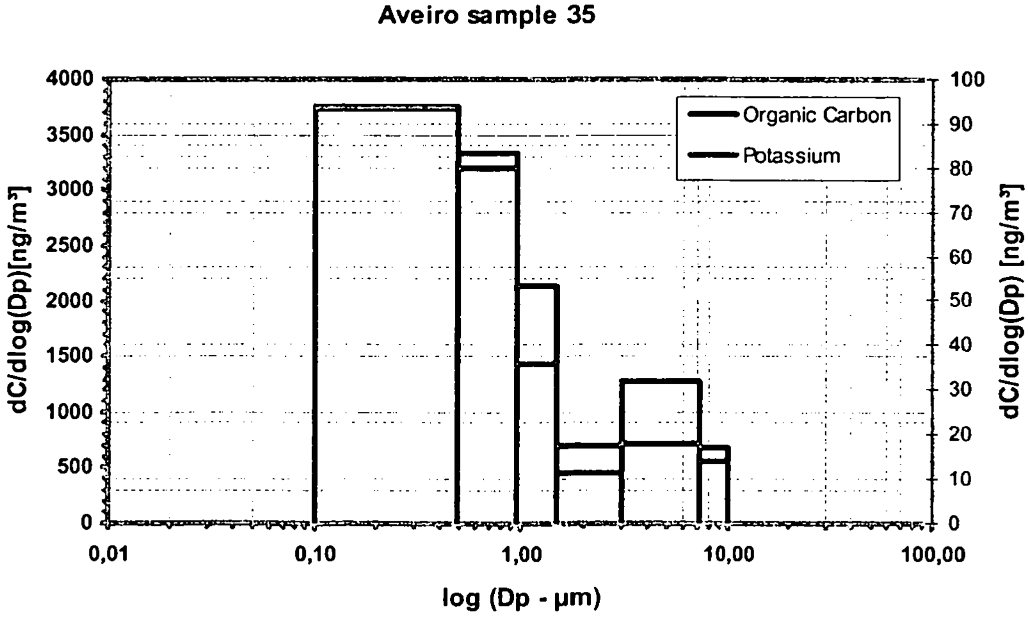


Fig. 3.90. Histogram of OC and K^+ for AVE 35 sample

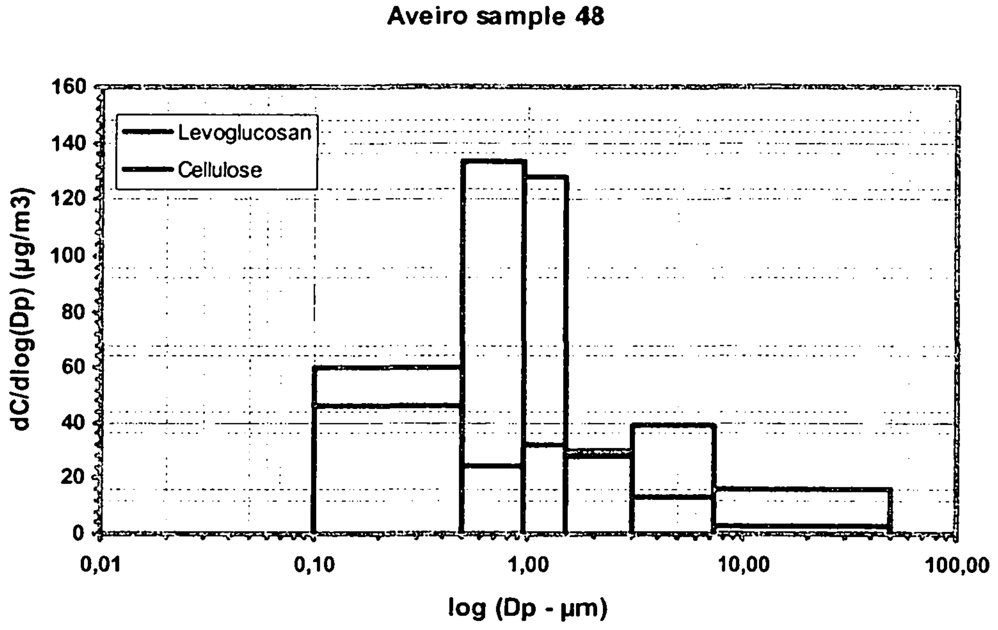


Fig. 3.91. Histogram of cellulose and levoglucosan for AVE 48 sample

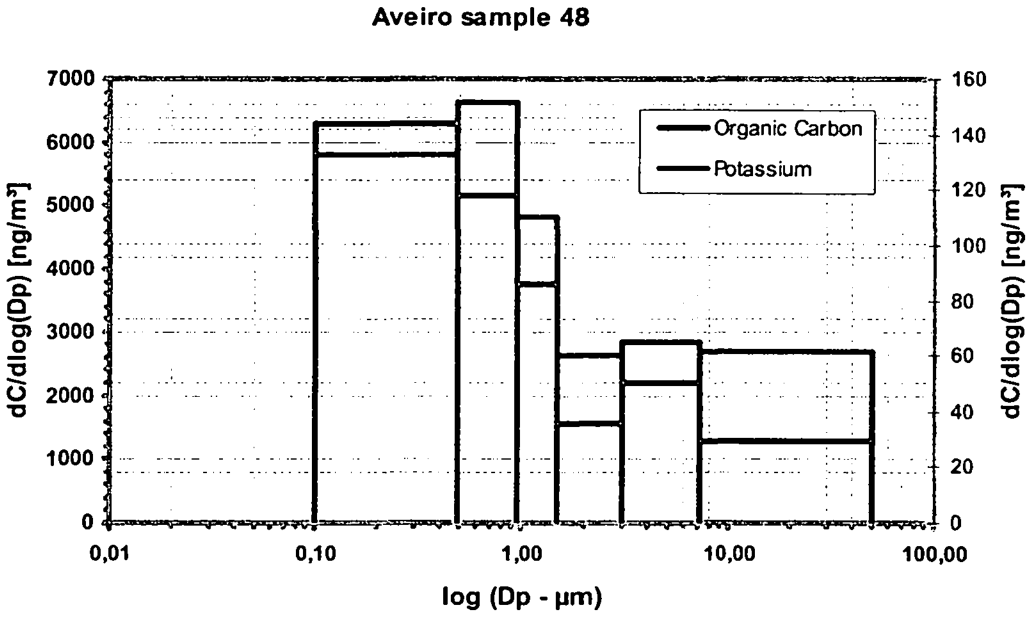


Fig. 3.92. Histogram of OC and K^+ for AVE 48 sample

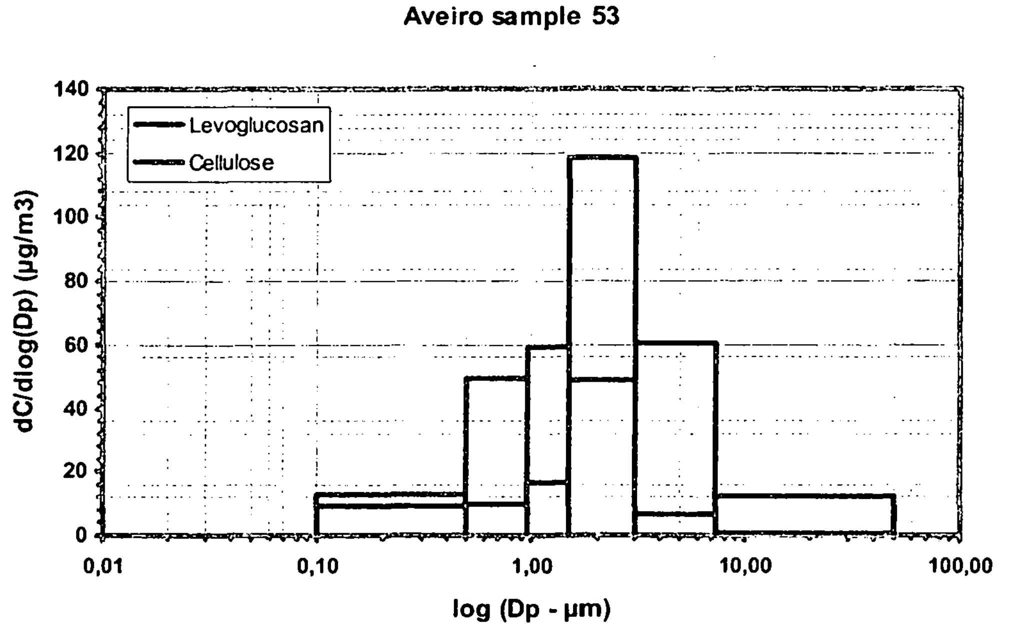


Fig. 3.93. Histogram of cellulose and levoglucosan for AVE 53 sample

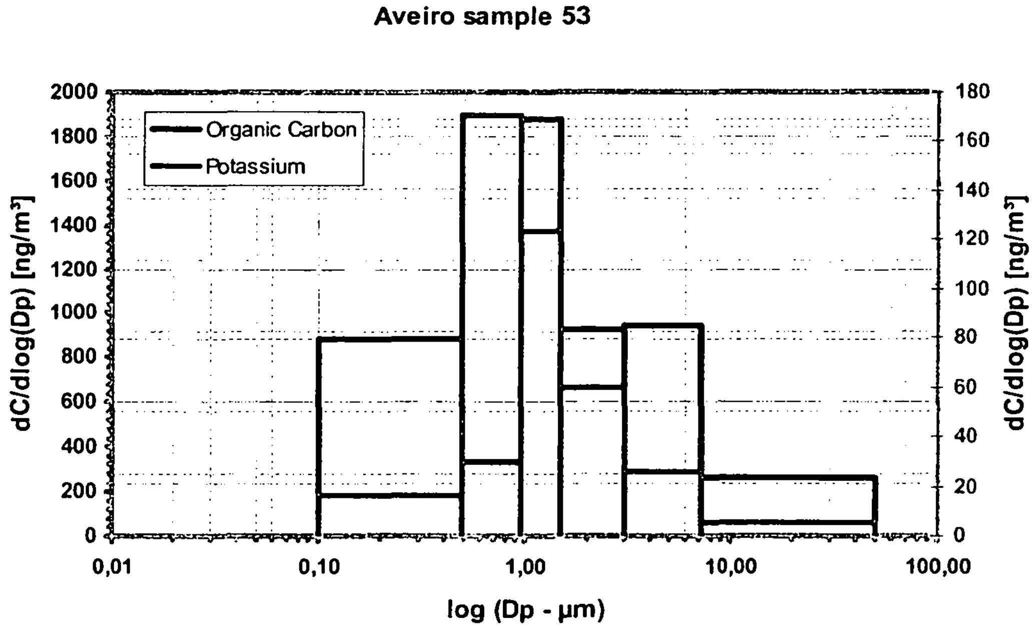


Fig. 3.94. Histogram of OC and K^+ for AVE 53 sample

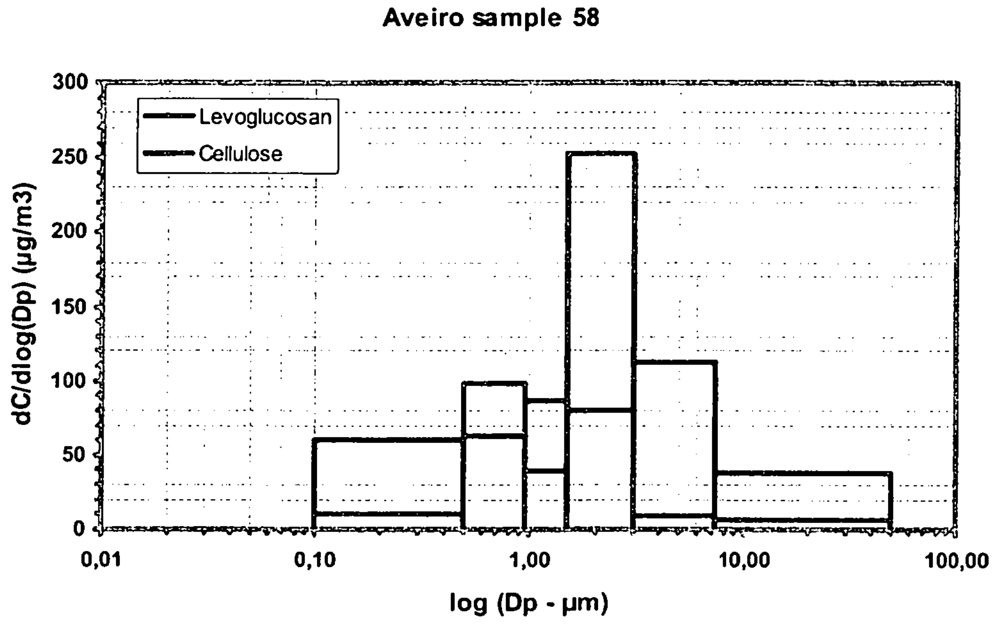


Fig. 3.95. Histogram of cellulose and levoglucosan for AVE 58 sample

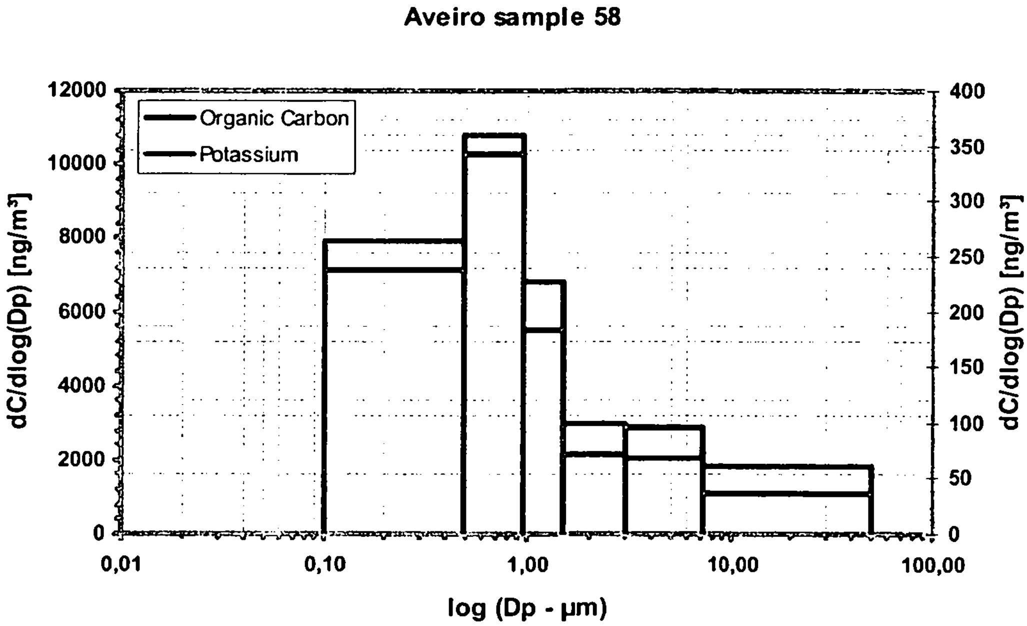


Fig. 3.96. Histogram of OC and K^+ for AVE 58 sample

The sample AVE 58 corresponds to a period with important forest fires in Portugal. Actually we expected high concentration values of levoglucosan as tracer of wood combustion, but in this period no especially high concentration values were observed. This phenomenon was also observed for filter samples collected during the time period of "Easter fires" in Austria (Bauer, personal communication). As mentioned before, some recent works [Schkolnik et al. 2005 and Kawamoto et al. 2003] determined that levoglucosan at 400 °C re-polymerizes into polysaccharides. That could be a reason why no higher are obtained. However, for K^+, another wood combustion tracer, the concentration values determined during this period are twice as much as obtained in the others samples. Here, the influence of forest fires in the atmospheric samples of AVE could be observed.

4. Summary

Within the framework of project "Backgroundmeasurements Sonnblick" the trace gases sulphur dioxide, nitric acid and ammonia as well as the aerosol compounds nitrate, sulphate, ammonium, oxalate and calcium, magnesium, sodium, potassium and chloride were collected during the sampling period from December 2002 to October 2004 at the Sonnblick Observatory. Daily samples were collected with a low-volume In-Line filterpack system.

The first part of the project included some intercomparisons with Open-Face Filterpacks, which already have been used earlier for aerosol sampling at SBO. The comparison between in-line and open-face sampling system show a very good agreement for sulphate (R^2 = 0,9055). Regarding the semivolatils compounds ammonium and nitrate more pronounced variations were observed. Both, the heated inlet of the in-line system and snow depostions on the front filter of the open-face system, caused some variations of the concentration data. The decision to use an in-line system presents a compromise to obtain representative values at an extreme sampling site, such as the Sonnblick Observatory at 3106 m a.s.l.. A comparison of the current measurements with the open-face data, obtained during the period of 1991 – 1993 at Sonnblick, showed that the concentration values agree quite well. Especially during the cold period, when the site is characteristic for free tropospheric conditions, the background concentration values are very similar.

For the aerosol compounds as well as for ammonia and acid nitric pronounced annual cycles, with high values in summer and low in winter were determined. The ratio between summer and winter periods (arithmetic average) ranges between 5 and 11. For sulphur dioxide the situation was different and no variation was observed comparing summer and winter values. To get information about the air concentrations and seasonalities of organic acids oxalate was determined. The concentration values for oxalate are much lower (approx. one order of magnitude) than the major inorganic aerosol compounds, but still they show a very pronounced annual cycle.

Aerosol compounds as well as trace gases are precursors for ionic constituents in wet deposition. The seasonal cycles of aerosol compounds are in accordance to the

seasonalities of ion concentrations in wet precipitation samples, although the summer / winter variation is more pronounced for aerosols than for precipitation. Thus higher scavenging ratios were calculated for the cold period than for the sumemr months.
Especially in winter the neutralization ratios, calculated from sulphate and ammonium equivalent concentration, are below 1. This points to the influence of free tropospheric air masses during this time period. During summer months absolute concentration values as well as neutralization ratio increase due to the predominant influence of boundary layer air.
Comparing aerosol concentrations and concentrations of trace gases, the system sulfate and sulphur dioxide showed high aerosol fractions during days with elevated concentration values. In case of particulate nitrate and nitric acid no dependency of the aerosol fraction on annual cycles of concentration trends could be observed.

Within the framework of "CARBOSOL" the organic compounds levoglucosan and cellulose were collected during two years (2002-2004) in six different sampling sites over Europe. High Volume aerosol samples were collected on a weekly basis.
The average concentrations of the whole period for these sampling sites in Europe range between 14 and 273 ng/m^3 for levoglucosan. The lowest value corresponds for AZO, as expected for a background site. SBO is the next sampling site with low concentration values, as correspond for a mountain background site. The other mountain sites, PDD and SIL, are the next sampling sites regarding increasing concentration of levoglucosan. The highest values are determined at KPZ and AVE. Especially AVE present very high concentration values during cold seasons, a site likely influenced from wood combustion for heating during the winter months. The annual cycles of levoglucosan change quite much depending on the sampling site. At the background sampling sites, AZO and SBO, no seasonality is observed. At the low levels sites, KPZ and AVE, the annual cycles show high values during winter and low values during summer, especially for AVE the difference between winter and summer is very pronounced (ratio of 13). At SIL a hardy seasonal cycles is determined and at PDD, the values during summer are higher than in winter, as expected for a typical mountain sampling site, which will be less influenced by boundary layer air masses during winter time.

For cellulose the average concentration values range between 13,5 and 133 ng/m^3. The lowest values correspond also for AZO, followed for SBO. AVE and PDD are the next sampling site regarding increasing of concentration of cellulose. The highest values are for SIL and KPZ, as rural sites. Especially KPZ presents very high values, as a low level rural site. Just as for levoglucosan no seasonality of cellulose concentrations could be determined at the background sites AZO and SBO. PDD and SIL show the expected annual variations with high values during spring and sommer months and lower concentration levels during the cold season. This is typical for a mountain site because it might be above the mixing layer during winter time and will be influenced more effectively by boundary layer air masses during summer. At AVE the highest values of cellulose are determined during the winter, just like for levoglucosan but still with much lower concentration values. At KPZ the concentration values during spring and autumn are very high but the difference between winter and summer seasons is not very pronounced.

The annual cycles of levoglucosan-C and cellulose-C with OC were compared. For the most the sampling sites the annual trends agreed quite well. The contribution of levoglucosan-C and cellulose-C to OC (%) were also calculated. The average values of these calculations range between 1,2 and 2,3 % for levoglucosan. There is almost no difference between these results obtained for the single sites. For cellulose this average contributions range between 0,5 and 2,7 %. For levoglucosan the highest contribution corresponds for AZO, where the lowest concentration values were determined. As here the air is very clean and there is no influence of other sources of pollutes like road traffic, industry emissions, etc., probably the contribution to OC of other source is minor. The lowest average contribution for levoglucosan corresponds to AVE, Where the highest concentration values of levoglucosan were determined. In opposite to AZO, AVE is very influenced for other sources of pollutes. For cellulose the highest contribution was obtained at SBO the other background site and the lowest average contribution was for AVE, as for levoglucosan.

Based on levoglucosan a wood smoke equivalent can be calculated, while cellulose can be used as an indicator for plant debris. The contributions of wood smoke to OM range between 21 and 39 %, while the contribution of plant debris to OM is 3 and 16 %. Here the highest percentage for wood smoke is for AZO due to the same reasons as mentioned before and for plant debris is SBO, especially during the cold seasons. Regarding the lowest contribution of wood smoke is at SBO obtained, although the difference of percentage with the highest value is not very high. Very low contributions of plant debris to OM correspond to AVE, which shows the lowest concentration values of cellulose.

Furthermore the size distribution (10-7,2 µm, 7,2-3,0µm, 3,0-1,5µm, 1,5-0,95µm, 0,95-0,49µm, <0,49µm) of cellulose, levoglucosan were determined with a cascade impactor at AVE. In most of the samples, the major fraction of levoglucosan and cellulose was associated with the fine particle fraction (< $3\mu g/m^3$).

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ANNEX

Aerosol and gases concentration values in µg pro Normcubicmeter Dec. 02-Oct. 04 Filter from 0 to 563

		Aerosol (Anions) [µg/Nm³]				Aerosol (Kations) [µg/Nm³]					Gas [µg/Nm³]		
Samples	Date	Chloride	Nitrate	Sulphate	Oxalate	Na	NH4	K	Mg	Ca	HNO_3	SO_2	NH3
B 0	10.12.2002	0,0097	0,0264	0,2674	0,0044	0,0178	0,1187	0,0061	0,0042	0,0336	0,0905	0,2362	0,0335
B 1	12.12.2002	0,0097	0,0717	0,1989	0,0050	0,0178	0,0670	0,0061	0,0042	0,0461	0,1155	0,2955	0,1130
B 2	13.12.2002	0,0097	0,0330	0,2640	0,0081	0,0178	0,0671	0,0061	0,0059	0,0325	0,1570	0,0219	0,1507
B 3	14.12.2002	0,0097	0,0097	0,1534	0,0050	0,0178	0,0382	0,0061	0,0018	0,0338	0,1596	0,2412	0,1041
B 4	15.12.2002	0,0097	0,1079	0,1430	0,0129	0,0178	0,0542	0,0061	0,0169	0,1316	0,0262	0,1495	0,2209
B 5	16.12.2002	0,0097	0,0268	0,0945	0,0044	0,0178	0,0270	0,0061	0,0018	0,0211	0,0668	0,1534	0,0335
B 7	17.12.2002	0,0097	0,0303	0,0788	0,0050	0,0178	0,0256	0,0061	0,0067	0,0401	0,0234	0,0219	0,1725
B 8	18.12.2002	0,0097	0,0543	0,1475	0,0081	0,0178	0,0439	0,0061	0,0048	0,0523	0,2112	0,2298	0,1434
B 9	19.12.2002	0,0097	0,0097	0,0033	0,0020	0,0711	0,0380	0,0061	0,0018	0,0413	0,1117	0,0219	0,0335
B 10	20.12.2002	0,0097	0,0097	0,0097	0,0020	0,0178	0,0059	0,0061	0,0018	0,0089	0,0072	0,1320	0,2455
B 11	21.12.2002	0,0097	0,0097	0,0285	0,0020	0,0178	0,0138	0,0061	0,0018	0,0089	0,0072	0,0219	0,1281
B 13	22.12.2002	0,0097	0,0097	0,0201	0,0115	0,0178	0,0059	0,0061	0,0018	0,0089	0,0072	0,0219	0,0335
B 14	23.12.2002	0,0097	0,0097	0,0033	0,0020	0,0178	0,0059	0,0061	0,0018	0,0089	0,0072	0,1056	0,0844
B 15	24.12.2002	0,0097	0,0097	0,0131	0,0020	0,0178	0,0059	0,0061	0,0018	0,0089	0,0072	0,0219	0,1049
B 16	25.12.2002	0,0097	0,0097	0,0523	0,0020	0,0178	0,0176	0,0061	0,0018	0,0259	0,0170	0,1230	0,0676
B 17	26.12.2002	0,0097	0,0424	0,0908	0,0020	0,0178	0,0469	0,0061	0,0018	0,0089	0,0183	0,0627	0,2894
B 19	27.12.2002	0,0097	0,0097	0,0302	0,0020	0,0178	0,0059	0,0061	0,0018	0,0089	0,0227	0,1129	0,0978
B 20	28.12.2002	0,0097	0,0750	0,0033	0,0020	0,0178	0,0407	0,0061	0,0018	0,0089	0,0072	0,0219	0,2468
B 21	29.12.2002	0,0097	0,0264	0,0667	0,0020	0,0178	0,0302	0,0061	0,0018	0,0089	0,0072	0,0667	0,0814
B 22	30.12.2002	0,0097	0,0097	0,0618	0,0020	0,0178	0,0239	0,0061	0,0018	0,0089	0,0780	0,0219	0,0335
A 23	17.01.2003	0,0097	0,0299	0,1242	0,0058	0,0178	0,0305	0,0061	0,0018	0,0089	0,0416	0,0405	0,0335
A 24	18.01.2003	0,0097	0,0280	0,3155	0,0056	0,0178	0,0865	0,0061	0,0018	0,0344	0,0366	0,0920	0,0335
A 25	19.01.2003	0,0097	0,6173	0,0274	0,0020	0,0178	0,1218	0,0061	0,0018	0,0089	0,0803	0,0462	0,0335
A 26	20.01.2003	0,0097	0,0097	0,1656	0,0020	0,0178	0,0389	0,0061	0,0018	0,0089	0,0960	0,0202	0,0335
A 27	21.01.2003	0,0097	0,0430	0,0693	0,0076	0,0178	0,0175	0,0061	0,0018	0,0191	0,0072	0,0202	0,1737
A 28	23.01.2003	0,0097	0,0097	0,2156	0,0020	0,0178	0,0560	0,0061	0,0018	0,0089	0,0072	0,3128	0,0335
A 30	24.01.2003	0,0097	0,0248	0,1796	0,0054	0,0178	0,0308	0,0061	0,0018	0,0089	0,0204	1,5009	0,0335
A 31	26.01.2003	0,0097	0,0273	0,1849	0,0101	0,0178	0,0315	0,0061	0,0018	0,0452	0,0350	0,0202	0,0335
A 32	27.01.2003	0,0097	0,0097	0,0333	0,0020	0,0178	0,0139	0,0061	0,0018	0,0089	0,0072	0,0202	0,0335
A 33	28.01.2003	0,0097	0,0462	0,1803	0,0108	0,0178	0,0357	0,0061	0,0018	0,0089	0,0273	0,0462	0,0335
A 34	29.01.2003	0,0097	0,0419	0,1558	0,0020	0,0178	0,0280	0,0061	0,0018	0,0089	0,0072	0,0202	0,0335
A 36	30.01.2003	0,0097	0,0248	0,1837	0,0020	0,0178	0,0294	0,0061	0,0018	0,0089	0,0445	0,1190	0,0335
A 37	31.01.2003	0,0097	0,0350	0,2992	0,0020	0,0178	0,0534	0,0061	0,0018	0,0089	0,2025	0,6359	0,0335
A 38	09.02.2003	0,0130	0,0572	0,6368	0,0167	0,0239	0,1181	0,0082	0,0024	0,0577	0,1229	0,1298	0,0335
A 39	10.02.2003	0,0130	0,1112	0,7284	0,0212	0,0239	0,1240	0,0359	0,0057	0,0921	0,0174	0,0202	0,0335
A 40	11.02.2003	0,0130	0,0130	0,4798	0,0101	0,0239	0,0955	0,0082	0,0024	0,0403	0,0418	0,1442	0,0335
A 42	12.02.2003	0,0130	0,1429	1,2286	0,0160	0,0239	0,2120	0,0082	0,0108	0,1137	0,0784	0,1724	0,0335
A 43	13.02.2003	0,0130	0,0456	0,7375	0,0325	0,0239	0,1700	0,0082	0,0024	0,0587	0,0714	0,1056	0,0335
A 44	01.02.2003	0,0130	0,0292	0,4411	0,0020	0,0239	0,1053	0,0082	0,0024	0,0339	0,4605	0,4942	0,0335
A 45	02.02.2003	0,0130	0,0130	0,5612	0,0020	0,0239	0,1178	0,0082	0,0024	0,0119	0,0527	0,0606	0,0335
A 46	03.02.2003	0,2379	0,0779	0,3906	0,0111	0,0239	0,0888	0,0082	0,0024	0,1050	0,0330	0,0202	0,0335
A 48	04.02.2003	0,0130	0,0266	0,5498	0,0066	0,0239	0,1153	0,0082	0,0024	0,0119	0,0786	0,3226	0,0335
A 49	05.02.2003	0,0130	0,0130	0,5324	0,0182	0,0239	0,1909	0,0082	0,0024	0,0119	0,1005	0,0202	0,0335
A 50	06.02.2003	0,0130	0,0130	0,2477	0,0197	0,0239	0,0637	0,0082	0,0024	0,0119	0,0785	0,0202	0,0335
A 51	07.02.2003	0,0130	0,0130	0,1742	0,0042	0,2278	0,0454	0,0082	0,0024	0,0272	0,1989	0,0202	0,0335
A 52	14.02.2003	0,0130	0,1343	1,0598	0,0259	0,0239	0,2231	0,0082	0,0129	0,1854	0,0596	0,1500	0,0449
A 54	15.02.2003	0,0130	0,0308	0,5440	0,0144	0,0239	0,1547	0,0082	0,0024	0,0119	0,0951	0,3286	0,0449
A 55	16.02.2003	0,0130	0,0130	1,7887	0,0098	0,0239	0,3333	0,0304	0,0024	0,0119	0,0460	0,5585	0,0449
A 56	17.02.2003	0,0130	0,0130	0,6290	0,0087	0,1225	0,1461	0,0082	0,0024	0,0241	0,1247	0,3438	0,0449
A 57	18.02.2003	0,0130	0,0130	0,1662	0,0061	0,0239	0,0628	0,0082	0,0024	0,0537	0,0603	0,0271	0,0449
A 58	19.02.2003	0,0130	0,0130	0,1803	0,0027	0,0536	0,0662	0,0082	0,0024	0,0119	0,0346	0,0271	0,0449
A 60	20.02.2003	0,0130	0,0130	0,0719	0,0027	0,0510	0,0262	0,0082	0,0024	0,0119	0,0487	0,0271	0,0449
A 61	21.02.2003	0,0130	0,0130	0,0474	0,0027	0,0239	0,0255	0,0082	0,0024	0,0119	0,0615	0,0271	0,0449
A 62	22.02.2003	0,0130	0,0130	0,0749	0,0027	0,0239	0,0355	0,0082	0,0024	0,0119	0,0724	0,0271	0,0449
A 64	24.02.2003	0,0130	0,0130	0,0784	0,0027	0,0483	0,0273	0,0082	0,0024	0,0119	0,0862	0,0271	0,0449
A 66	25.02.2003	0,0130	0,0130	0,0435	0,0027	0,0239	0,0079	0,0082	0,0024	0,0119	0,0096	0,0553	0,0449
A 67	26.02.2003	0,0130	0,0130	0,0460	0,0252	0,0239	0,0318	0,0082	0,0024	0,0119	0,1239	0,0271	0,0449
A 68	27.02.2003	0,0130	0,0279	0,1601	0,0390	0,0239	0,0807	0,0082	0,0058	0,0476	0,2671	0,0919	0,0449
A 69	28.02.2003	0,0130	0,0130	0,0045	0,0448	0,0239	0,0079	0,0082	0,0024	0,0119	0,2439	0,1654	0,2289
B 70	01.03.2003	0,0130	0,8307	0,3851	0,0327	0,0681	0,2807	0,0254	0,0024	0,0477	0,2095	0,0271	0,2661
B 72	02.03.2003	0,0130	0,0387	0,0731	0,0027	0,0239	0,0272	0,0082	0,0024	0,0119	0,0317	0,0271	0,3131
B 73	03.03.2003	0,0130	0,0130	0,1952	0,0027	0,0239	0,0079	0,0082	0,0024	0,0782	0,0096	0,0271	0,0449
B 74	04.03.2003	0,0130	0,0649	0,0776	0,0027	0,0239	0,0306	0,0082	0,0024	0,0263	0,0719	0,0664	0,1730
B 75	05.03.2003	0,0130	0,0130	0,0045	0,0027	0,0239	0,0079	0,0082	0,0024	0,0119	0,0096	0,0271	0,2826
B 76	06.03.2003	0,0130	0,0263	0,0633	0,0027	0,0239	0,0273	0,0082	0,0024	0,0119	0,0780	0,0940	0,3561
B 78	07.03.2003	0,0130	0,1484	0,2621	0,0108	0,0239	0,0980	0,0082	0,0024	0,0320	0,3397	0,3499	0,1957
B 79	08.03.2003	0,0130	0,0935	0,2978	0,0067	0,0785	0,1179	0,0082	0,0024	0,0119	0,1644	0,0271	0,1006
B 80	09.03.2003	0,0130	0,0412	0,3015	0,0065	0,0239	0,1188	0,0082	0,0024	0,0402	0,0771	1,4370	0,0449

Aerosol and gases concentration values in µg pro Normcubicmeter **Dec. 02-Oct. 04** Filter from 0 to 563

		Aerosol (Anions) [µg/Nm³]				Aerosol (Kations) [µg/Nm³]					Gas [µg/Nm³]		
Samples	Date	Chloride	Nitrate	Sulphate	Oxalate	Na	NH4	K	Mg	Ca	HNO_3	SO_2	NH3
B 81	11.03.2003	0,0130	0,0821	0,2141	0,0128	0,0239	0,0788	0,0082	0,0024	0,0319	0,3324	0,1665	0,1550
B 82	12.03.2003	0,0130	0,1170	0,1973	0,0127	0,0239	0,1002	0,0082	0,0024	0,0119	0,0777	0,2263	0,2798
B 84	13.03.2003	0,0130	0,0733	0,0983	0,0027	0,0239	0,0535	0,0082	0,0024	0,0119	0,0096	0,0271	0,1489
B 85	28.03.2003	0,0302	4,4751	1,8817	0,1391	0,0239	0,2542	0,0209	0,0024	0,0288	0,1762	0,3076	0,7657
B 86	30.03.2003	0,0130	0,4803	0,5065	0,0312	0,0239	0,3164	0,0262	0,0024	0,0824	0,1086	0,1734	0,9010
B 87	31.03.2003	0,0130	0,1817	0,2343	0,0094	0,0239	0,1946	0,0082	0,0024	0,0769	0,1308	0,0919	0,4855
B 88	01.04.2003	0,0130	0,9596	0,8848	0,0336	0,0239	0,5735	0,0332	0,0100	0,0724	0,2279	0,2189	0,4418
B 90	02.04.2003	0,0130	0,0130	0,0632	0,0027	0,0239	0,0274	0,0082	0,0024	0,0119	0,0447	0,1500	0,0972
B 91	03.04.2003	0,0130	0,1844	0,0999	0,0027	0,0620	0,0487	0,0395	0,0024	0,0119	0,0681	0,2172	0,1649
B 92	04.04.2003	0,0130	0,4961	0,1972	0,0124	0,0239	0,1355	0,0082	0,0024	0,0606	0,0551	0,1026	0,3697
B 93	05.04.2003	0,0130	0,2330	0,2162	0,0212	0,0239	0,0600	0,0082	0,0059	0,1025	0,0850	0,0637	0,1649
B 94	06.04.2003	0,0130	0,2271	0,4112	0,0061	0,0239	0,1847	0,0229	0,0024	0,0119	0,0534	0,1293	0,4196
B 96	07.04.2003	0,0130	0,0621	0,4011	0,0027	0,0239	0,1472	0,0082	0,0024	0,0119	0,0503	0,1313	0,1315
B 97	08.04.2003	0,0130	2,2886	1,4020	0,0477	0,0239	1,1156	0,0599	0,0058	0,0359	0,9695	1,0122	0,2626
B 98	09.04.2003	0,0282	2,0099	0,8845	0,0371	0,0239	0,9131	0,0527	0,0024	0,0524	0,7967	0,7169	0,4823
B 99	10.04.2003	0,0130	0,2313	0,3367	0,0176	0,0239	0,1689	0,0200	0,0024	0,0119	0,1367	0,1296	0,4223
B 100	13.04.2003	0,0130	0,0974	0,3992	0,0126	0,0239	0,1674	0,0082	0,0024	0,0289	0,3833	0,1913	0,2508
B 102	14.04.2003	0,0130	0,4735	1,0303	0,0435	0,0239	0,4411	0,0337	0,0050	0,0643	0,1791	0,1106	0,3738
B 103	15.04.2003	0,0130	0,0707	0,3831	0,0099	0,0239	0,1384	0,0312	0,0024	0,0425	0,1277	0,1446	0,0449
B 104	16.04.2003	0,0130	0,6908	2,6332	0,0920	0,0239	0,9380	0,0538	0,0024	0,0119	0,2509	0,3842	0,3513
B 105	17.04.2003	0,0130	1,3016	2,0719	0,1120	0,0239	0,9679	0,0764	0,0103	0,0874	0,2433	0,7282	0,2787
B 106	18.04.2003	0,0130	1,0643	1,4556	0,0439	0,0239	0,7224	0,0315	0,0024	0,0119	0,0981	0,6018	1,2157
B 108	19.04.2003	0,0130	0,1063	0,4298	0,0182	0,0239	0,2195	0,0082	0,0024	0,0119	0,1036	0,1533	0,2594
B 109	20.04.2003	0,0130	0,0130	0,2630	0,0061	0,0239	0,1370	0,0082	0,0024	0,0119	0,0775	0,2881	0,2834
B 110	21.04.2003	0,0130	0,0668	1,1013	0,0498	0,0239	0,4267	0,0325	0,0024	0,0119	0,2452	0,0271	0,0449
B 111	22.04.2003	0,0130	1,5978	2,3227	0,1092	0,0666	1,0396	0,0627	0,0226	0,2029	0,1645	0,2455	0,5991
B 112	24.04.2003	0,0130	2,6352	2,4458	0,1191	0,0724	1,3811	0,0897	0,0234	0,2010	0,1461	0,0900	1,1173
B 113	25.04.2003	0,0130	2,7444	2,5029	0,1379	0,0239	1,4399	0,0839	0,0232	0,2009	0,2533	0,1820	1,4193
B 115	26.04.2003	0,0130	0,5860	0,7616	0,0408	0,0239	0,3420	0,0211	0,0073	0,0584	0,0733	0,1164	0,6422
B 116	27.04.2003	0,0130	0,0835	0,1736	0,0128	0,0239	0,0675	0,0082	0,0024	0,0119	0,0321	0,0271	0,6276
B 117	28.04.2003	0,0130	1,0097	1,0751	0,0539	0,0239	0,5682	0,0222	0,0091	0,0491	0,4308	0,0271	0,8337
B 118	29.04.2003	0,0130	1,9924	2,0614	0,0903	0,0239	1,0378	0,0412	0,0150	0,0963	0,3497	0,0271	0,7603
B 119	30.04.2003	0,0728	1,0873	1,9905	0,1213	0,1462	0,5000	0,0688	0,0463	0,9535	0,0659	0,2149	1,1654
B 120	01.05.2003	0,0130	0,4398	1,1422	0,0448	0,0239	0,4851	0,0199	0,0079	0,0252	0,0410	0,0271	0,6381
B 121	02.05.2003	0,0130	0,3404	0,7866	0,0270	0,0239	0,3055	0,0230	0,0081	0,0644	0,0291	0,0271	0,9429
B 122	16.05.2003	0,0130	1,0153	1,0019	0,0343	0,0239	0,4694	0,0366	0,0084	0,0614	0,1996	0,2074	0,3560
B 123	17.05.2003	0,0565	0,4653	0,8285	0,0278	0,0239	0,2842	0,0580	0,0024	0,0297	0,2586	0,1108	0,3395
B 126	18.05.2003	0,0130	0,2540	0,7205	0,0216	0,0239	0,2567	0,0082	0,0024	0,0119	0,2081	0,0271	0,4028
B 127	19.05.2003	0,0130	0,6598	0,9472	0,0235	0,0239	0,3920	0,0299	0,0024	0,0246	0,1231	0,0271	0,6555
B 128	20.05.2003	0,0130	0,0302	0,0338	0,0027	0,0239	0,0079	0,0082	0,0024	0,0119	0,0363	0,0271	0,1280
B 129	21.05.2003	0,0130	0,0130	0,0319	0,0027	0,0239	0,0079	0,0082	0,0024	0,0119	0,0439	0,0766	0,1158
B 130	22.05.2003	0,0130	0,0130	0,0528	0,0027	0,0239	0,0171	0,0082	0,0024	0,0119	0,0887	0,0271	0,0449
B 132	23.05.2003	0,0618	0,4774	0,4130	0,0169	0,1007	0,1374	0,0300	0,0193	0,2325	0,0765	0,0918	0,2139
B 133	24.05.2003	0,0130	0,7472	1,1158	0,0581	0,0239	0,4037	0,0332	0,0158	0,1108	0,1965	0,1263	0,5751
B 134	25.05.2003	0,0130	0,3630	1,5503	0,0239	0,0239	0,4816	0,0256	0,0024	0,0448	0,2523	0,1285	0,6396
B 135	26.05.2003	0,3841	1,7299	2,9165	0,0982	0,3520	0,5774	0,1847	0,0779	0,5610	0,2628	0,0271	0,2317
B 136	27.05.2003	0,0130	0,4605	1,3751	0,0307	0,0239	0,4214	0,0307	0,0049	0,0625	0,2223	0,0888	0,5641
B 138	12.06.2003	0,0130	0,3476	1,4042	0,1212	0,0239	0,4409	0,0179	0,0097	0,1228	0,5794	0,1921	0,7846
B 139	13.06.2003	0,0130	0,5979	1,3997	0,1042	0,0656	0,4183	0,0338	0,0349	0,6236	0,4972	0,1440	0,5208
B 140	14.06.2003	0,0914	0,8629	1,5678	0,0903	0,0664	0,3733	0,0313	0,0419	0,7275	0,2326	0,2575	0,9311
B 141	15.06.2003	0,0130	0,5780	1,1047	0,0838	0,0239	0,3183	0,0082	0,0177	0,2484	0,1914	0,1584	0,5953
B 142	16.06.2003	0,0401	0,5007	1,3303	0,1208	0,0239	0,5109	0,0170	0,0152	0,1603	0,4454	0,1616	0,9075
B 143	17.06.2003	0,0130	0,3451	0,9230	0,1065	0,0239	0,3071	0,0172	0,0171	0,2553	0,3627	0,1188	0,9187
B 144	18.06.2003	0,0558	0,0487	0,2759	0,0102	0,0918	0,0813	0,0082	0,0024	0,0293	0,1042	0,0271	0,4712
B 145	19.06.2003	0,0130	0,0945	0,1916	0,0319	0,0239	0,0267	0,0082	0,0024	0,0641	0,0750	0,0766	0,3928
B 146	20.06.2003	0,0130	0,2247	0,4862	0,0420	0,0239	0,1892	0,0082	0,0067	0,0480	0,3220	0,1521	0,6313
B 147	21.06.2003	0,0130	0,1234	0,5385	0,0357	0,0239	0,2347	0,0208	0,0055	0,0546	0,3291	0,1062	0,4272
B 148	22.06.2003	0,0280	0,1822	0,7418	0,0743	0,0239	0,3375	0,0082	0,0077	0,0867	0,6814	0,2502	0,6079
B 150	23.06.2003	0,0130	0,3526	1,1068	0,1432	0,0239	0,5101	0,0183	0,0139	0,3255	0,0096	0,1705	0,7428
B 151	24.06.2003	0,0316	1,3386	2,7104	0,2260	0,0480	1,1143	0,0284	0,0298	0,3561	0,5655	0,2422	1,2243
B 152	25.06.2003	0,0130	0,7459	1,4185	0,1066	0,0947	1,1600	0,0485	0,0411	0,5452	0,2213	0,2492	0,8904
B 153	26.06.2003	0,0502	1,7152	4,0944	0,2629	0,0239	0,6478	0,0393	0,0220	0,2640	0,3197	0,2012	0,7382
B 154	27.06.2003	0,0408	0,8546	1,5106	0,1000	0,0239	0,5971	0,0489	0,0182	0,2427	0,2658	0,1809	0,5288
B 155	28.06.2003	0,1156	0,1969	0,8177	0,0560	0,0239	0,3378	0,0287	0,0024	0,0759	0,5601	0,1549	0,4197
B 157	29.06.2003	0,0130	0,3084	0,7724	0,0555	0,0239	0,2708	0,0082	0,0024	0,0810	0,3598	0,1548	0,5392
B 158	30.06.2003	0,0130	0,8562	2,5151	0,2011	0,0239	0,8833	0,0396	0,0215	0,2899	0,5906	0,6551	0,8807
B 159	01.07.2003	0,1490	0,4737	0,8373	0,0407	0,0239	0,3020	0,0253	0,0024	0,2499	0,0825	0,0917	0,6411
B 160	02.07.2003	0,0328	0,0531	0,1100	0,0027	0,0239	0,0178	0,0082	0,0024	0,4199	0,0535	0,2547	0,5788

Aerosol and gases concentration values in µg pro Normcubicmeter **Dec. 02-Oct. 04** Filter from 0 to 563

		Aerosol (Anions) [µg/Nm³]				Aerosol (Kations) [µg/Nm³]					Gas [µg/Nm³]		
Samples	Date	Chloride	Nitrate	Sulphate	Oxalate	Na	NH4	K	Mg	Ca	HNO_3	SO_2	NH3
B 161	*03.07.2003*	0,0130	0,0130	0,1283	0,0027	0,0239	0,0386	0,0082	0,0024	0,1132	0,7559	0,2128	0,5283
B 163	*05.07.2003*	0,0130	0,0130	0,0045	0,0027	0,0239	0,1027	0,0082	0,0024	0,0381	0,5865	0,0939	0,3013
B 164	*06.07.2003*	0,0130	0,0628	0,7500	0,0342	0,0239	0,2791	0,0082	0,0024	0,0401	0,9001	0,2719	0,7510
B 165	*07.07.2003*	0,1893	0,3942	1,5948	0,0653	0,1054	0,4897	0,0689	0,0078	0,1144	1,8447	0,3046	0,5133
B 166	*08.07.2003*	0,2059	0,7281	2,3318	0,1335	0,0698	0,8419	0,0620	0,0102	0,0831	2,5675	0,3966	0,5727
B 167	*09.07.2003*	0,0447	0,1682	1,6277	0,0458	0,0239	0,5528	0,0225	0,0061	0,1760	2,4978	0,2596	0,5093
B 169	*11.07.2003*	0,0130	0,4196	2,7388	0,1174	0,0239	0,9370	0,0411	0,0118	0,1936	3,1139	0,4424	0,5832
B 170	*12.07.2003*	0,0130	0,4210	3,0045	0,1886	0,0239	1,0710	0,0244	0,0186	0,1493	2,3911	0,3276	0,8052
B 171	*13.07.2003*	0,0391	0,1875	1,8856	0,1573	0,0880	0,6394	0,0426	0,0191	0,1629	1,8635	0,1808	0,7209
B 172	*14.07.2003*	0,0704	0,3861	1,3760	0,1329	0,0624	0,4747	0,0317	0,0558	4,2276	1,3428	0,2572	0,9830
B 173	*15.07.2003*	0,0130	0,2105	1,8026	0,1668	0,0239	0,5612	0,0082	0,0219	0,2617	0,0096	0,2009	1,1046
B 175	*17.07.2003*	0,0130	0,0261	0,2484	0,0216	0,0239	0,0784	0,0082	0,0024	0,0119	0,5041	0,1754	0,8632
B 176	*18.07.2003*	0,0130	0,0840	0,5616	0,0345	0,0239	0,2202	0,0082	0,0075	0,0696	0,6417	0,0764	0,5848
B 177	*19.07.2003*	0,0130	0,0725	0,5214	0,0502	0,0239	0,2769	0,0082	0,0175	0,1027	0,8490	0,1467	0,8579
B 178	*20.07.2003*	0,0130	0,2211	1,6243	0,1747	0,0239	0,5575	0,0178	0,0260	0,2529	1,6053	0,2490	1,6379
B 179	*21.07.2003*	0,0130	0,2397	0,6821	0,0429	0,0239	0,1976	0,0082	0,0024	0,2034	1,6845	0,2326	0,7285
B 180	*22.07.2003*	0,0130	0,1276	0,7773	0,0647	0,0239	0,2339	0,0082	0,0166	0,2109	0,3568	0,1727	0,6746
B 182	*24.07.2003*	0,0130	0,0130	0,0347	0,0027	0,0239	0,0079	0,0082	0,0024	0,0650	0,1710	0,1194	0,3908
B 183	*25.07.2003*	0,0130	0,1353	0,6946	0,0433	0,0239	0,1362	0,0082	0,0061	0,0786	0,4104	0,3121	0,5040
B 184	*26.07.2003*	0,0130	0,2132	1,2799	0,0989	0,0239	0,4017	0,0082	0,0130	0,1311	0,0096	0,2673	0,6148
B 185	*27.07.2003*	0,0130	0,0475	0,2494	0,0174	0,0239	0,0739	0,0082	0,0024	0,0282	0,7667	0,8594	0,7357
B 186	*28.07.2003*	0,0130	0,0305	0,0751	0,0122	0,0239	0,0166	0,0082	0,0024	0,0257	0,1644	0,1216	0,3890
B 187	*29.07.2003*	0,0130	0,1544	0,3913	0,0252	0,0239	0,4250	0,0082	0,0024	0,0277	1,9323	0,1589	0,1313
B 189	*30.07.2003*	0,0130	0,0130	0,0045	0,0111	0,0239	0,0494	0,0082	0,0024	0,0119	0,3331	0,1141	0,2893
B 190	*01.08.2003*	0,0125	0,0130	0,1335	0,0031	0,0204	0,0873	0,0087	0,0069	0,0282	0,1188	0,3273	0,4957
B 191	*02.08.2003*	0,0125	0,0460	0,7269	0,0225	0,0204	0,5316	0,0238	0,0069	0,0788	0,5627	0,1581	0,6496
B 192	*03.08.2003*	0,0125	0,0130	0,2509	0,0106	0,0204	0,1138	0,0087	0,0069	0,0413	0,1734	0,1450	0,9477
B 193	*04.08.2003*	0,0125	0,1079	0,8445	0,0779	0,0204	0,3585	0,0087	0,0225	0,2231	0,5007	0,1840	0,9183
B 194	*05.08.2003*	0,0125	0,7623	1,4129	0,1141	0,0204	0,6665	0,0450	0,0328	0,5319	0,6185	0,2575	0,5646
B 196	*07.08.2003*	0,0125	1,3736	2,4319	0,2217	0,0965	1,2934	0,1543	0,0546	1,3291	2,1910	0,5372	2,0873
B 197	*09.08.2003*	0,0125	1,2189	2,3398	0,1929	0,0555	1,0270	0,1006	0,0388	0,5605	1,4067	0,4192	0,8793
B 198	*10.08.2003*	0,0125	1,9267	4,7747	0,4267	0,1004	2,1720	0,2447	0,0718	0,8036	2,9008	0,9581	1,5301
B 199	*11.08.2003*	0,0125	0,0130	0,0163	0,0031	0,0204	0,0273	0,0087	0,0069	0,0127	1,5912	0,4721	1,2399
B 200	*12.08.2003*	0,0125	1,6676	6,9805	0,5356	0,0204	0,4718	0,0270	0,0069	0,1267	4,9940	1,0426	0,6233
B 201	*13.08.2003*	0,0125	0,6775	3,3098	0,3364	0,0501	1,3162	0,1582	0,0742	1,0039	2,6156	0,1962	1,4536
B 202	*14.08.2003*	0,0125	0,5296	2,1522	0,1289	0,0204	0,6052	0,0622	0,0208	0,3288	0,9344	0,4237	0,9442
B 203	*15.08.2003*	0,0125	0,7608	1,6938	0,0966	0,0538	0,4740	0,0481	0,0533	0,7378	0,5397	0,2561	0,7946
B 204	*16.08.2003*	0,0125	0,6023	2,2079	0,1529	0,0447	0,7637	0,0835	0,0403	0,4930	0,9416	0,3455	0,6604
B 205	*17.08.2003*	0,0125	0,5905	3,6585	0,2256	0,0534	1,3020	0,1484	0,0248	0,3358	1,4286	0,5756	0,9446
B 206	*18.08.2003*	0,0125	0,0985	0,8350	0,0331	0,0204	0,1436	0,0087	0,0069	0,0597	0,4542	0,1855	0,4057
B 207	*19.08.2003*	0,0125	1,7441	5,1413	0,4085	0,0869	2,2470	0,1768	0,1023	0,9046	0,8842	0,1433	0,3691
B 208	*20.08.2003*	0,0125	0,0987	1,9040	0,1192	0,0204	0,7311	0,0375	0,0248	0,3659	1,0419	0,1630	0,5663
B 210	*21.08.2003*	0,0125	0,2322	1,5537	0,1536	0,0204	0,6407	0,0298	0,0213	0,3364	0,8693	0,0285	0,3683
B 211	*22.08.2003*	0,0125	0,2271	1,2461	0,1649	0,0204	0,0640	0,0087	0,0069	0,0262	1,3158	0,2785	0,3460
B 212	*23.08.2003*	0,0125	0,1573	1,5233	0,1355	0,0204	0,6716	0,0381	0,0155	0,1428	1,5149	0,0713	2,2801
B 213	*24.08.2003*	0,0125	0,3563	1,6177	0,1742	0,0204	0,7561	0,0512	0,0251	0,1664	1,4764	0,1988	1,1602
B 215	*25.08.2003*	0,0125	0,3370	1,4443	0,1637	0,0204	0,6317	0,0314	0,0544	0,6890	1,6357	0,1717	0,9571
B 216	*26.08.2003*	0,0125	1,0467	2,3007	0,1656	0,1076	1,1371	0,1124	0,1132	2,6382	0,0097	0,4015	0,7543
B 217	*27.08.2003*	0,0125	0,3430	0,4237	0,0425	0,0204	0,2986	0,0438	0,0513	0,7197	1,8899	0,2151	0,9365
B 218	*28.08.2003*	0,0125	0,0130	0,2921	0,0071	0,0204	0,1697	0,0087	0,0069	0,0894	0,6881	0,1474	0,8704
B 219	*29.08.2003*	0,0125	0,0299	0,1109	0,0081	0,0204	0,0256	0,0087	0,0069	0,5340	1,6969	0,1846	1,3300
B 221	*30.08.2003*	0,0125	0,0528	0,3654	0,0115	0,0204	0,1702	0,0087	0,0069	0,0388	1,0612	0,2077	0,5719
B 222	*31.08.2003*	0,0125	0,2300	0,4769	0,0444	0,0204	0,1284	0,0087	0,0069	0,3973	0,7474	0,0808	0,3076
B 223	*01.09.2003*	0,0124	0,0483	0,4561	0,0112	0,0195	0,2269	0,0082	0,0061	0,0731	0,0826	0,0283	0,4214
B 224	*03.09.2003*	0,0124	0,0344	0,2024	0,0324	0,0195	0,0989	0,0082	0,0061	0,1971	0,4634	0,1437	0,2914
B 225	*04.09.2003*	0,0124	0,0140	0,1892	0,0110	0,0195	0,0841	0,0082	0,0061	0,1163	0,6777	0,1050	0,1872
B 227	*05.09.2003*	0,0124	0,1239	0,7632	0,0775	0,0195	0,3538	0,0082	0,0061	0,0764	1,0893	0,2394	0,6028
B 228	*06.09.2003*	0,0124	0,1854	1,2767	0,0573	0,0195	0,5464	0,0674	0,0061	0,1180	1,4376	0,1531	0,6721
B 229	*07.09.2003*	0,0124	0,1117	1,5547	0,0688	0,0195	0,6050	0,0527	0,0061	0,0535	1,3791	0,1739	0,2709
B 230	*08.09.2003*	0,0124	0,0320	0,0400	0,0073	0,0195	0,0148	0,0082	0,0061	0,0174	0,3860	0,1268	0,3001
B 231	*09.09.2003*	0,0124	0,0140	0,0831	0,0032	0,0195	0,0148	0,0082	0,0061	0,0174	0,4695	0,1245	0,2470
B 233	*10.09.2003*	0,0124	0,0140	0,7783	0,0073	0,0195	0,4008	0,0082	0,0061	0,0174	0,0097	0,0997	0,4822
B 234	*11.09.2003*	0,0124	0,0355	0,3133	0,0207	0,0195	0,1007	0,0082	0,0061	0,1693	0,3867	0,1243	0,0366
B 235	*25.09.2003*	0,0124	0,0140	0,2321	0,0417	0,0195	0,1320	0,0082	0,0061	0,0174	0,3452	0,1873	0,0366
B 236	*26.09.2003*	0,0124	0,0716	0,3978	0,0242	0,0195	0,2033	0,0082	0,0061	0,0463	0,8286	0,1013	0,3035
B 237	*27.09.2003*	0,0124	0,1478	0,9904	0,0431	0,0195	0,4588	0,0249	0,0061	0,0584	1,2501	0,1051	0,5404
B 239	*28.09.2003*	0,0124	0,0776	0,4663	0,0144	0,0195	0,2365	0,0082	0,0061	0,0499	1,1421	0,3553	0,4088
B 240	*29.09.2003*	0,0124	0,0962	0,8966	0,0298	0,0195	0,3888	0,0082	0,0061	0,0174	1,1446	0,0646	0,2597

Aerosol and gases concentration values in µg pro Normcubicmeter Dec. 02-Oct. 04 Filter from 0 to 563

		Aerosol (Anions) [µg/Nm³]				Aerosol (Kations) [µg/Nm³]					Gas [µg/Nm³]		
Samples	Date	Chloride	Nitrate	Sulphate	Oxalate	Na	NH4	K	Mg	Ca	HNO_3	SO_2	NH3
B 241	30.09.2003	0,0124	0,1438	0,8803	0,0240	0,0195	0,3874	0,0185	0,0061	0,0376	2,6431	0,3001	0,7198
B 242	01.10.2003	0,0117	0,0812	0,3812	0,0096	0,0196	0,1913	0,0082	0,0034	0,0939	0,6645	0,3176	0,3100
B 243	02.10.2003	0,0117	0,2503	0,7387	0,0212	0,0411	0,3093	0,0304	0,0073	0,1636	0,6205	0,1085	0,6790
B 245	03.10.2003	0,0117	0,1712	0,3694	0,0139	0,0196	0,1544	0,0082	0,0108	0,5735	0,4903	0,1866	0,4519
B 246	04.10.2003	0,0117	0,0914	0,0622	0,0032	0,0196	0,0100	0,0082	0,0034	0,0571	0,2269	0,1741	0,0366
B 247	05.10.2003	0,0117	0,0547	0,1334	0,0203	0,0196	0,0100	0,0082	0,0034	0,1536	0,1473	0,1173	0,0366
B 248	06.10.2003	0,0117	0,0142	0,1087	0,0032	0,0196	0,0526	0,0082	0,0034	0,0171	0,3489	0,0872	0,1453
B 249	07.10.2003	0,0117	0,0478	0,1405	0,0104	0,0196	0,0444	0,0082	0,0034	0,0792	0,6391	0,2080	0,0366
B 251	08.10.2003	0,0117	0,0455	0,1261	0,0114	0,0196	0,0100	0,0082	0,0034	0,0858	0,2624	0,2535	0,0366
B 252	09.10.2003	0,0412	0,0719	0,1782	0,0032	0,0196	0,0388	0,0082	0,0034	0,0171	0,2467	0,2822	0,0795
B 253	10.10.2003	0,0117	0,0376	0,2494	0,0032	0,0196	0,0835	0,0082	0,0034	0,1071	0,7918	0,4498	0,0813
B 254	11.10.2003	0,0117	0,0790	0,4535	0,0095	0,0196	0,2121	0,0082	0,0034	0,0617	0,9338	0,1873	0,0366
B 255	12.10.2003	0,0117	0,0142	0,4717	0,0158	0,0196	0,2092	0,0082	0,0034	0,0679	0,2980	0,1678	0,1271
B 257	13.10.2003	0,0117	0,0438	0,2943	0,0032	0,0196	0,1337	0,0082	0,0034	0,0655	0,4285	0,1490	0,1282
B 258	14.10.2003	0,0117	0,0142	0,2465	0,0130	0,0196	0,1012	0,0082	0,0034	0,0560	0,1159	0,0283	0,1449
B 259	16.10.2003	0,0117	0,0142	0,6796	0,0131	0,0196	0,2018	0,0191	0,0034	0,0513	0,1631	0,0292	0,0366
B 260	17.10.2003	0,0117	0,0142	0,6115	0,0032	0,0196	0,2025	0,0082	0,0034	0,0171	0,2458	0,0292	0,0366
B 261	18.10.2003	0,0117	0,0285	0,4600	0,0032	0,0196	0,1409	0,0082	0,0034	0,0171	0,2834	0,0693	0,0366
B 262	19.10.2003	0,0117	0,0142	0,0053	0,0120	0,0196	0,0100	0,0082	0,0034	0,0347	0,0713	0,0292	0,0366
B 263	20.10.2003	0,0117	0,0142	0,3042	0,0032	0,0196	0,1162	0,0082	0,0034	0,0375	0,3844	0,1141	0,0844
B 264	21.10.2003	0,0117	0,0142	0,0460	0,0032	0,0196	0,0100	0,0082	0,0034	0,0171	0,0621	0,6495	0,0366
B 265	22.10.2003	0,0117	0,0938	0,5579	0,0289	0,0196	0,2305	0,0082	0,0034	0,0171	1,4176	0,0753	0,0366
B 266	23.10.2003	0,0117	0,0142	0,4298	0,0032	0,0196	0,1650	0,0082	0,0034	0,0171	0,6784	0,1955	0,0366
B 267	24.10.2003	0,0117	0,0142	0,6984	0,0175	0,0196	0,2386	0,0082	0,0034	0,0171	0,4632	0,0852	0,0366
B 269	27.10.2003	0,0117	0,0142	0,3515	0,0032	0,0196	0,1331	0,0082	0,0034	0,0171	0,5397	0,0292	0,0366
B 270	28.10.2003	0,0271	0,0142	0,3510	0,0032	0,0196	0,0771	0,0082	0,0034	0,0171	0,3117	0,1397	0,1375
B 271	29.10.2003	0,0117	0,0142	0,0762	0,0032	0,0196	0,0100	0,0082	0,0034	0,0171	0,1526	0,0292	0,0366
B 272	05.11.2003	0,0118	0,3173	1,2989	0,1534	0,0201	0,4371	0,1607	0,0105	0,1439	0,5881	0,0294	0,3179
B 273	06.11.2003	0,0118	0,1555	0,7637	0,0356	0,0201	0,2258	0,0345	0,0168	0,3492	0,8492	0,0720	0,0386
B 275	07.11.2003	0,0118	0,0142	1,0741	0,0035	0,0201	0,2639	0,0083	0,0034	0,0590	0,3640	0,5038	0,0386
B 276	08.11.2003	0,0118	0,0306	0,2909	0,0261	0,0201	0,0389	0,0083	0,0034	0,1319	0,3162	0,2024	0,1024
B 277	09.11.2003	0,0118	0,0583	0,2865	0,0130	0,0201	0,1074	0,0180	0,0034	0,0173	0,7151	0,0738	0,0386
B 278	10.11.2003	0,0118	0,0142	0,1642	0,0035	0,0201	0,0483	0,0083	0,0034	0,0173	0,2897	0,0294	0,0386
B 279	11.11.2003	0,0118	0,0611	0,3209	0,0145	0,0201	0,1043	0,0083	0,0034	0,0173	0,4412	0,0294	0,1603
B 281	12.11.2003	0,0118	0,0947	0,3871	0,0185	0,0201	0,1563	0,0083	0,0034	0,0923	0,5101	0,0294	0,1058
B 282	13.11.2003	0,0118	0,0142	0,2280	0,0035	0,0201	0,0675	0,0083	0,0034	0,0475	0,8512	0,2575	0,0386
B 283	14.11.2003	0,0118	0,0142	0,5298	0,0086	0,0201	0,1260	0,0083	0,0034	0,0567	0,6153	0,0849	0,0386
B 284	15.11.2003	0,0118	0,0142	0,2084	0,0283	0,0201	0,0392	0,0083	0,0034	0,0910	0,3458	0,0917	0,0386
B 285	16.11.2003	0,0118	0,0533	0,8013	0,0241	0,0201	0,2751	0,0185	0,0034	0,0983	0,0895	0,0671	0,0386
B 287	17.11.2003	0,0118	0,0590	0,2966	0,0657	0,0201	0,0731	0,0083	0,0068	0,1184	0,2599	0,0294	0,0386
B 288	18.11.2003	0,0118	0,0142	0,0802	0,0174	0,0201	0,0101	0,0083	0,0034	0,0485	0,1628	0,1139	0,0386
B 289	19.11.2003	0,0118	0,0581	0,1391	0,0035	0,0201	0,0421	0,0083	0,0034	0,2158	0,2715	0,1008	0,0386
B 290	20.11.2003	0,0423	0,2699	1,3631	0,0139	0,0201	0,0579	0,0083	0,0034	0,0389	0,2723	0,0294	0,0386
B 291	21.11.2003	0,0118	0,2004	0,9070	0,0170	0,0201	0,3112	0,0347	0,0235	0,4225	0,2353	0,2128	0,0386
B 292	22.11.2003	0,0118	0,1089	0,6744	0,0083	0,0201	0,3012	0,0405	0,0196	0,3806	0,1423	0,0294	0,0386
B 293	23.11.2003	0,0118	0,1033	0,2597	0,0035	0,0201	0,1513	0,0083	0,0034	0,0173	0,0568	0,2566	0,0386
B 294	24.11.2003	0,0118	0,0650	0,1714	0,0035	0,0201	0,0995	0,0083	0,0034	0,0369	0,3350	0,0294	0,0386
B 295	25.11.2003	0,0118	0,0358	0,1227	0,0035	0,0201	0,0101	0,0083	0,0034	0,0173	0,2075	0,0294	0,0386
B 296	26.11.2003	0,0118	0,0469	0,0222	0,0146	0,0201	0,0101	0,0083	0,0215	0,0759	0,0981	0,0294	0,0386
B 297	27.11.2003	0,0118	0,0524	0,0551	0,0474	0,0201	0,0101	0,0083	0,0747	0,2887	0,0918	0,0294	0,0386
B 298	28.11.2003	0,0118	0,0142	0,0267	0,0035	0,0201	0,0101	0,0083	0,0034	0,0173	0,0614	0,2337	0,0386
B 299	29.11.2003	0,0118	0,0874	0,2393	0,0035	0,0201	0,0331	0,0083	0,0324	0,1561	0,4389	0,2716	0,0386
B 300	30.11.2003	0,0118	0,0142	0,8679	0,0098	0,0201	0,2897	0,0083	0,0122	0,0368	0,3096	0,4798	0,0386
B 301	01.12.2003	0,0118	0,0321	0,1214	0,0100	0,0201	0,0299	0,0083	0,0299	0,1557	0,1040	0,0294	0,0386
B 302	02.12.2003	0,0118	0,1309	0,2787	0,0035	0,0640	0,1136	0,0370	0,0034	0,0173	0,2595	3,5002	0,0386
B 303	03.12.2003	0,0118	0,0142	0,6602	0,0035	0,0201	0,1808	0,0083	0,0034	0,0173	0,9772	5,8230	0,0386
B 304	04.12.2003	0,0118	0,3100	0,5582	0,0256	0,0409	0,1872	0,0699	0,0259	0,3153	0,3575	0,4046	0,3021
B 305	05.12.2003	0,0118	0,0505	0,1809	0,0245	0,0201	0,0524	0,0083	0,0034	0,0690	0,1276	0,2529	0,0386
B 306	07.12.2003	0,0118	0,2190	0,2651	0,0292	0,0201	0,0377	0,0197	0,0034	0,1396	0,1166	0,0900	0,0386
B 307	08.12.2003	0,0118	0,0142	0,1157	0,0035	0,0201	0,0382	0,0083	0,0034	0,0173	0,1046	0,0976	0,0386
B 308	09.12.2003	0,0118	0,0891	0,2110	0,0235	0,0201	0,0402	0,0083	0,0089	0,0788	0,1512	0,0901	0,0386
B 309	10.12.2003	0,0118	0,0142	0,1393	0,0035	0,0201	0,0260	0,0083	0,0034	0,0173	0,1037	0,3080	0,0386
B 311	11.12.2003	0,0118	0,0142	0,0363	0,0035	0,0201	0,0101	0,0083	0,0034	0,0173	0,0795	0,0294	0,0386
B 312	12.12.2003	0,0118	0,0293	0,2772	0,0035	0,0201	0,0689	0,0083	0,0034	0,0173	0,2718	0,1143	0,0386
B 313	13.12.2003	0,0118	0,0142	0,1019	0,0035	0,0201	0,0371	0,0083	0,0034	0,0173	0,1907	0,0294	0,0386
B 314	14.12.2003	0,0704	0,0935	0,0880	0,0123	0,0424	0,0208	0,0400	0,0034	0,0484	0,0846	0,0294	0,0386
B 315	15.12.2003	0,0118	0,0142	0,0837	0,0035	0,0201	0,0335	0,0083	0,0034	0,0173	0,1024	0,0709	0,0386
B 317	16.12.2003	0,0118	0,0309	0,1380	0,0035	0,0201	0,0597	0,0083	0,0034	0,0173	0,0459	0,1496	0,0386

Aerosol and gases concentration values in µg pro Normcubicmeter Dec. 02-Oct. 04 Filter from 0 to 563

		Aerosol (Anions) [µg/Nm³]				Aerosol (Kations) [µg/Nm³]					Gas [µg/Nm³]		
Samples	Date	Chloride	Nitrate	Sulphate	Oxalate	Na	NH4	K	Mg	Ca	HNO_3	SO_2	NH3
B 318	18.12.2003	0,0118	0,0737	0,4040	0,0148	0,0201	0,1419	0,0083	0,0034	0,0513	0,1070	0,1050	0,0386
B 319	19.12.2003	0,0118	0,0865	0,4111	0,0456	0,0462	0,1647	0,0083	0,0067	0,0418	0,1485	0,0294	0,0386
B 320	20.12.2003	0,0118	0,0587	0,3276	0,0072	0,0201	0,1335	0,0083	0,0034	0,0173	0,2143	0,0294	0,0386
B 321	21.12.2003	0,0118	0,0478	0,0528	0,0118	0,0201	0,0218	0,0083	0,0034	0,0173	0,0897	0,0294	0,0386
B 323	22.12.2003	0,0118	0,0778	0,2793	0,0035	0,0201	0,0846	0,0083	0,0034	0,0173	0,1046	0,0294	0,0386
B 324	23.12.2003	0,0118	0,1264	0,2205	0,0259	0,0201	0,0890	0,0083	0,0072	0,0173	0,0935	0,0611	0,0386
B 325	24.12.2003	0,0118	0,0853	0,3098	0,0119	0,0417	0,1129	0,0083	0,0069	0,0173	0,1154	0,0294	0,0386
B 326	25.12.2003	0,0118	0,1477	0,2285	0,0107	0,0201	0,0849	0,0083	0,0080	0,0678	0,1606	0,0663	0,0386
B 327	26.12.2003	0,0118	0,0695	0,0998	0,0035	0,0201	0,0448	0,0083	0,0034	0,0364	0,2863	0,1010	0,0386
B 329	03.01.2003	0,0058	0,0649	0,5131	0,0488	0,0217	0,1556	0,0028	0,0091	0,0950	0,0984	0,9009	0,0306
B 330	04.01.2003	0,0175	0,2028	0,5774	0,1595	0,0217	0,1439	0,0060	0,0240	0,2523	0,2308	0,2949	0,0306
B 331	05.01.2003	0,0371	0,1287	0,3061	0,1254	0,0581	0,0835	0,0178	0,0182	0,1776	0,1046	0,1455	0,0306
B 332	06.01.2004	0,0058	0,0709	0,2130	0,0717	0,0217	0,0558	0,0028	0,0091	0,1455	0,2380	0,1167	0,0306
B 333	07.01.2004	0,0058	0,0973	0,1968	0,0518	0,1693	0,0926	0,0066	0,0091	0,1031	0,2613	0,0843	0,0306
B 335	15.01.2004	0,0058	0,0584	0,0990	0,0104	0,0796	0,0467	0,0028	0,0091	0,0158	0,2048	0,2414	0,0306
B 336	16.01.2004	0,0170	0,0764	0,2342	0,0104	0,0900	0,0900	0,0162	0,0091	0,0662	0,3938	0,3565	0,0306
B 337	17.01.2004	0,0058	0,0246	0,0953	0,0104	0,0503	0,0467	0,0145	0,0091	0,0478	0,2930	0,1213	0,0306
B 338	18.01.2004	0,0058	0,0790	0,1717	0,0211	0,0217	0,0385	0,0028	0,0091	0,0671	0,3253	0,2496	0,0306
B 339	19.01.2004	0,0058	0,0246	0,0550	0,0104	0,0217	0,0267	0,0028	0,0091	0,0158	0,3625	0,1744	0,0306
B 341	20.01.2004	0,0119	0,1347	0,2239	0,0104	0,0217	0,0325	0,0028	0,0091	0,0444	0,1825	0,4355	0,0306
B 342	21.01.2004	0,0058	0,2440	0,6747	0,0329	0,0846	0,2593	0,0189	0,0091	0,2071	0,3452	0,3986	0,0306
B 343	22.01.2004	0,0058	0,0246	0,1485	0,0104	0,0217	0,0298	0,0028	0,0091	0,0158	0,0543	0,0131	0,0306
B 344	23.01.2004	0,0058	0,1273	0,2966	0,0104	0,0691	0,0657	0,0028	0,0091	0,1577	0,2031	0,1652	0,0306
B 345	24.01.2004	0,0058	0,0631	0,1341	0,0104	0,0217	0,0213	0,0028	0,0091	0,0158	0,1240	0,1795	0,0306
B 347	25.01.2004	0,0058	0,0511	0,4157	0,0104	0,0217	0,1649	0,0074	0,0091	0,0158	0,1752	0,4695	0,0306
B 348	26.01.2004	0,0058	0,1019	0,6863	0,0104	0,0217	0,1142	0,0028	0,0091	0,0158	0,4080	0,0580	0,0306
B 349	27.01.2004	0,0058	0,0246	0,2448	0,0104	0,0217	0,0989	0,0108	0,0091	0,0158	0,1068	0,4241	0,0306
B 350	28.01.2004	0,0058	0,0832	0,6158	0,0104	0,0217	0,1737	0,0088	0,0091	0,0158	0,3195	0,5686	0,0306
B 351	29.01.2004	0,0058	0,0877	0,3413	0,0228	0,0645	0,1341	0,0057	0,0091	0,0580	0,2180	0,3151	0,0306
B 353	30.01.2004	0,0058	0,0246	0,1023	0,0104	0,0217	0,0515	0,0028	0,0091	0,0158	0,1779	0,0131	0,0306
B 354	31.01.2004	0,0058	0,0619	0,1508	0,0104	0,0217	0,0197	0,0028	0,0091	0,0158	0,2531	0,1435	0,0306
B 355	01.02.2004	0,0407	0,1399	0,3678	0,0104	0,0757	0,0956	0,0142	0,0091	0,0612	0,2257	0,0639	0,0306
B 356	02.02.2004	0,0058	0,0583	0,1527	0,0104	0,0217	0,0549	0,0061	0,0091	0,0763	0,2225	0,0783	0,0306
B 357	03.02.2004	0,0203	0,0956	0,1885	0,0104	0,0542	0,0445	0,0028	0,0091	0,0728	0,2390	0,1081	0,0306
B 359	18.02.2004	0,0058	0,0246	0,0117	0,0104	0,0217	0,0075	0,0028	0,0091	0,0158	0,3094	0,6947	0,3488
B 360	19.02.2004	0,0058	0,0667	1,8856	0,0397	0,0217	0,5034	0,0409	0,0091	0,0158	0,3824	1,9880	0,0306
B 361	20.02.2004	0,0058	0,0246	0,1116	0,0104	0,0217	0,0368	0,0028	0,0091	0,0158	0,1630	0,0550	0,0893
B 362	21.02.2004	0,0058	0,0533	0,0117	0,0104	0,0217	0,0075	0,0028	0,0091	0,0158	0,0703	0,0488	0,1090
B 363	22.02.2004	0,0123	0,0246	0,0331	0,0254	0,0217	0,0075	0,0028	0,0091	0,0447	0,0739	0,0960	0,0652
B 365	23.02.2004	0,0211	0,2965	0,4311	0,0104	0,0217	0,0957	0,0214	0,0091	0,0777	0,0603	0,7122	0,0306
B 366	24.02.2004	0,0058	0,4389	0,2157	0,0845	0,6707	0,1781	0,0065	0,0444	0,1454	0,0661	0,1313	0,0306
B 367	25.02.2004	0,0058	0,0246	0,0581	0,0104	0,0217	0,0428	0,0028	0,0091	0,0339	0,2366	0,0702	0,0670
B 368	26.02.2004	0,0058	0,0938	0,2803	0,0104	0,0217	0,0857	0,0060	0,0091	0,1589	0,1648	0,1704	0,1153
B 374	27.02.2004	0,0058	0,1926	1,4108	0,0276	0,0217	0,4833	0,0236	0,0091	0,1108	0,3827	1,0380	0,0306
B 375	28.02.2004	0,0058	0,3494	0,7530	0,1438	0,1818	0,3688	0,0135	0,0091	0,0980	0,5732	0,7187	0,0306
B 376	29.02.2004	0,0625	0,3974	2,7442	0,1082	0,0822	0,9392	0,0456	0,0357	0,3795	1,5737	3,7843	0,0306
B 377	01.03.2004	0,0058	0,0246	1,0305	0,0104	0,0217	0,3711	0,0060	0,0091	0,0347	0,6399	0,5484	0,0306
B 379	02.03.2004	0,0058	0,1182	0,4546	0,0247	0,0775	0,1057	0,0028	0,0091	0,0333	0,2070	0,2105	0,0306
B 380	03.03.2004	0,0058	0,1405	0,4831	0,0234	0,0217	0,1195	0,0028	0,0091	0,1960	0,3233	0,0352	0,0306
B 381	04.03.2004	0,0058	0,4606	0,4382	0,0449	0,3200	0,2556	0,0104	0,0189	0,0939	0,4675	0,1481	0,0306
B 382	05.03.2004	0,0058	0,0618	0,2447	0,0104	0,0692	0,0928	0,0028	0,0091	0,1383	0,1175	0,0131	0,0306
B 383	06.03.2004	0,0058	0,0246	0,1805	0,0104	0,0217	0,1173	0,0028	0,0091	0,0158	0,3781	0,0487	0,0306
B 385	07.03.2004	0,0134	0,7165	0,2915	0,0614	0,0217	0,1249	0,0072	0,0315	0,2278	0,1610	0,0712	0,0306
B 386	08.03.2004	0,0058	0,4650	1,1010	0,0532	0,0217	0,4504	0,0131	0,0091	0,0722	0,4375	0,5693	0,1020
B 387	09.03.2004	0,0058	2,6897	0,9127	0,1550	0,0217	0,5708	0,0110	0,0743	0,3357	0,6065	0,1316	0,0306
B 388	10.03.2004	0,0058	0,5875	0,7811	0,0615	0,0217	0,2971	0,0058	0,0242	0,1050	0,8653	0,3329	0,0306
B 389	11.03.2004	0,0058	0,2123	0,2951	0,0217	0,0217	0,0785	0,0028	0,0091	0,1164	0,2331	0,1490	0,0669
B 391	12.03.2004	0,0058	0,6721	0,5185	0,1143	0,0217	0,2636	0,0061	0,0294	0,1328	0,7074	0,2016	0,0306
B 392	13.03.2004	0,0682	0,8318	1,6648	0,0786	0,0217	0,4086	0,0426	0,0666	2,2701	0,4738	0,1004	0,1376
B 393	14.03.2004	0,0058	0,5550	0,7211	0,0583	0,0217	0,2448	0,0089	0,0212	0,3449	0,3997	0,0543	0,1809
B 394	15.03.2004	0,0187	0,2422	0,3003	0,0307	0,0217	0,0833	0,0028	0,0091	0,0681	0,1943	0,2670	0,0787
B 395	16.03.2004	0,0058	0,0545	0,2795	0,0104	0,0217	0,0801	0,0028	0,0091	0,0158	0,2179	0,1536	0,1050
B 397	17.03.2004	0,0150	0,2926	0,2592	0,0414	0,0217	0,0870	0,0060	0,0213	0,2698	0,2624	0,0765	0,2061
B 398	18.03.2004	0,0121	0,7983	0,4082	0,0655	0,0217	0,2185	0,0161	0,0390	0,2954	0,4338	0,1228	0,4505
B 399	19.03.2004	0,0058	2,4373	0,5980	0,0425	0,0217	1,2154	0,0408	0,0304	0,2111	2,1725	0,4218	0,9167
B 400	20.03.2004	0,0058	1,1588	1,3331	0,0771	0,0217	0,2939	0,0152	0,0091	0,0914	2,1570	0,2808	0,1853
B 401	21.03.2004	0,0237	1,9484	0,6376	0,0784	0,0217	0,3150	0,0094	0,0564	0,2703	1,2812	0,1048	0,3922
B 403	22.03.2004	0,0058	0,0747	0,0257	0,0104	0,0217	0,0181	0,0028	0,0091	0,0712	0,1213	0,1263	0,1399

Aerosol and gases concentration values in µg pro Normcubicmeter **Dec. 02-Oct. 04** Filter from 0 to 563

		Aerosol (Anions) [µg/Nm³]				Aerosol (Kations) [µg/Nm³]					Gas [µg/Nm³]		
Samples	Date	Chloride	Nitrate	Sulphate	Oxalate	Na	NH4	K	Mg	Ca	HNO$_3$	SO$_2$	NH3
B 404	23.03.2004	0,0234	0,4151	0,1423	0,0668	0,0217	0,0234	0,0057	0,0472	0,4194	0,1628	0,1399	0,0996
B 405	24.03.2004	0,0058	0,1993	0,3274	0,0104	0,0217	0,0749	0,0028	0,0091	0,1768	0,1236	0,7848	0,0306
B 406	25.03.2004	0,0153	0,4310	0,8982	0,0329	0,0217	0,0963	0,0028	0,0091	0,1219	0,1376	0,1923	0,0306
B 407	03.04.2004	0,0150	1,0424	2,6258	0,1229	0,0190	0,5152	0,0168	0,0343	0,5188	1,3410	0,0839	0,5504
B 409	04.04.2004	0,0056	0,1629	0,8943	0,0379	0,0190	0,3724	0,0122	0,0105	0,1080	1,0805	0,1162	0,3329
B 410	05.04.2004	0,0125	1,1946	0,7876	0,0528	0,0190	0,1637	0,0031	0,0105	0,1149	0,3586	0,0356	0,2434
B 411	06.04.2004	0,0335	0,0653	0,1092	0,0134	0,0190	0,0165	0,0031	0,0105	0,1807	0,0555	0,0356	0,1000
B 412	07.04.2004	0,0127	0,0653	0,3137	0,0358	0,0190	0,0907	0,0031	0,0105	0,1443	0,2364	0,0356	0,0774
B 413	08.04.2004	0,0056	0,3699	0,5438	0,0134	0,0190	0,1949	0,0031	0,0105	0,0245	0,8031	0,1963	0,0378
B 415	09.04.2004	0,0056	0,0653	0,8733	0,0285	0,0190	0,2453	0,0076	0,0105	0,1105	0,5488	0,2079	0,0378
B 416	10.04.2004	0,0240	0,0653	0,5495	0,0399	0,0190	0,1241	0,0098	0,0105	0,0727	0,2859	0,1626	0,0378
B 418	12.04.2004	0,0056	0,1361	1,1531	0,0540	0,0190	0,2296	0,0031	0,0105	0,0796	0,2669	0,1068	0,0378
B 419	13.04.2004	0,0125	0,0653	1,3648	0,0357	0,0190	0,2670	0,0031	0,0105	0,1310	0,3847	0,7414	0,0378
B 421	14.04.2004	0,0056	0,0653	1,2669	0,0411	0,0190	0,3483	0,0098	0,0105	0,0883	0,4233	0,3071	0,0378
B 422	15.04.2004	0,0260	0,2202	0,2109	0,1903	0,0190	0,0399	0,0031	0,0334	0,1267	0,1284	0,0356	0,0378
B 423	16.04.2004	0,0157	0,0653	0,1970	0,0134	0,0190	0,0165	0,0074	0,0105	0,0776	0,1246	0,1949	0,1518
B 424	17.04.2004	0,0166	0,4284	0,6367	0,1084	0,0190	0,1048	0,0031	0,0348	0,1638	0,3018	0,0803	0,6569
B 425	18.04.2004	0,0143	0,2630	0,0368	0,3351	0,0190	0,0165	0,0031	0,0540	0,1657	0,0555	0,1331	0,1162
B 427	19.04.2004	0,0142	0,0653	0,1064	0,0134	0,0190	0,0165	0,0031	0,0105	0,0558	0,0555	0,0356	0,0378
B 428	20.04.2004	0,0135	0,0653	0,4224	0,0734	0,0190	0,1294	0,0031	0,0105	0,1069	0,4387	0,0356	0,2197
B 429	21.04.2004	0,0149	0,0653	0,6362	0,0307	0,0190	0,1680	0,0100	0,0105	0,0662	0,3601	0,1031	0,0378
B 430	22.04.2004	0,0056	0,5444	0,6417	0,0486	0,0190	0,2367	0,0150	0,0105	0,0245	1,1480	0,2349	0,7640
B 431	23.04.2004	0,0056	0,2989	0,7415	0,1215	0,0190	0,2335	0,0100	0,0212	0,0786	1,5651	0,0960	0,4608
B 433	24.04.2004	0,0056	0,0653	0,2212	0,0701	0,0190	0,0749	0,0031	0,0105	0,0245	0,2621	0,0896	0,2336
B 434	25.04.2004	0,0056	0,0653	0,2542	0,0134	0,0190	0,0732	0,0031	0,0105	0,0245	0,1309	0,0356	0,0378
B 435	26.04.2004	0,0056	0,3908	1,6290	0,1452	0,0190	0,6374	0,0142	0,0224	0,1127	0,6260	0,0356	0,1392
B 436	27.04.2004	0,0229	0,7033	1,5299	0,2212	0,0190	0,6563	0,0210	0,0253	0,1109	0,9832	0,0356	0,5851
B 437	28.04.2004	0,0056	0,2419	0,9261	0,0789	0,0190	0,7914	0,0173	0,0105	0,0759	1,5590	0,1316	0,3967
B 439	29.04.2004	0,0056	0,0653	0,9845	0,0134	0,0190	0,2563	0,0031	0,0105	0,0245	0,6840	0,1790	0,1137
B 440	30.04.2004	0,0330	0,1877	0,0645	0,0702	0,0190	0,0165	0,0031	0,0105	0,0603	0,0555	0,0356	0,0378
B 441	01.05.2004	0,0056	0,2136	0,2810	0,1193	0,0190	0,0796	0,0031	0,0105	0,0490	0,4713	0,1061	0,0378
B 442	02.05.2004	0,0056	0,0653	1,0166	0,0524	0,0190	0,1636	0,0031	0,0105	0,0245	0,6050	0,2026	0,0378
B 443	03.05.2004	0,0056	0,3382	0,3627	0,1115	0,0190	0,0592	0,0031	0,0105	0,0720	0,2003	0,1168	0,1301
B 444	04.05.2004	0,0056	0,0653	0,0577	0,0134	0,0190	0,0165	0,0031	0,0105	0,0245	0,0555	0,3043	0,1532
B 445	05.05.2004	0,0056	0,0653	0,0459	0,0134	0,0190	0,0165	0,0031	0,0105	0,1205	0,1242	0,0946	0,2011
B 446	06.05.2004	0,0056	0,0653	0,2335	0,0134	0,0190	0,0475	0,0031	0,0105	0,0245	0,2135	0,0356	0,1220
B 447	07.05.2004	0,0304	0,0653	0,2255	0,0432	0,0190	0,0420	0,0071	0,0105	0,1026	0,2696	0,0934	0,0378
B 448	08.05.2004	0,0141	0,0653	0,1595	0,0300	0,0190	0,0366	0,0031	0,0105	0,1323	0,4008	0,0356	0,0378
B 449	09.05.2004	0,0056	0,0653	0,0754	0,0611	0,0849	0,0334	0,0031	0,0105	0,0245	0,2478	0,1193	0,2352
B 451	10.05.2004	0,0056	0,0653	0,6230	0,0304	0,0190	0,2291	0,0031	0,0105	0,0245	0,9565	0,0356	0,0378
B 452	12.05.2004	0,0056	0,4266	0,6385	0,0505	0,0190	0,1968	0,0031	0,0105	0,0245	0,9545	0,0356	0,5810
B 453	13.05.2004	0,0056	0,4153	0,0637	0,0698	0,0190	0,0165	0,0031	0,0105	0,0245	0,4460	0,0356	0,5330
B 454	14.05.2004	0,0056	0,4072	0,2978	0,0925	0,0190	0,1268	0,0031	0,0105	0,0686	0,8911	0,0356	0,8363
B 455	15.05.2004	0,0957	2,3273	0,0093	0,2183	0,0190	0,1587	0,0031	0,0245	0,1803	0,2842	0,0356	1,1718
B 457	16.05.2004	0,0056	0,4390	0,0768	0,0640	0,0190	0,0165	0,0031	0,0105	0,0952	0,3165	0,0356	0,3243
B 458	17.05.2004	0,0056	0,4078	0,3754	0,0516	0,0190	0,1426	0,0031	0,0105	0,0245	0,7327	0,0356	1,0532
B 459	18.05.2004	0,0056	1,9052	1,6512	0,1901	0,0190	0,6589	0,0126	0,0105	0,1042	2,2620	0,1839	0,8785
B 460	19.05.2004	0,0148	2,7273	4,0515	0,2172	0,0190	1,6005	0,0305	0,0211	0,1150	3,6980	0,2759	0,9920
B 461	20.05.2004	0,0056	2,4353	3,6256	0,2311	0,0190	1,2985	0,0220	0,0227	0,1422	2,4648	0,2804	0,8549
B 463	21.05.2004	0,0056	0,4436	1,1726	0,1564	0,0190	0,4855	0,0072	0,0105	0,1165	2,4117	0,0356	1,3672
B 464	22.05.2004	0,0056	0,5062	0,0713	0,0318	0,0190	0,0165	0,0031	0,0105	0,0245	0,4154	0,0356	0,2287
B 465	23.05.2004	0,0284	1,7186	0,6209	0,1016	0,0190	0,2653	0,0031	0,0238	0,2078	0,6353	0,0356	0,7690
B 466	24.05.2004	0,0056	0,8487	0,7920	0,1331	0,0190	0,3716	0,0102	0,0105	0,0840	0,7462	0,1879	0,1891
B 467	25.05.2004	0,0268	0,4757	1,3292	0,0794	0,0190	0,3116	0,0077	0,0105	0,0245	1,9479	0,1022	0,2878
B 469	05.06.2004	0,0056	0,3206	0,2666	0,1084	0,8933	0,2044	0,0031	0,0427	0,3321	0,6537	0,1162	0,2109
B 470	06.06.2004	0,0056	0,0653	0,2704	0,0629	0,0190	0,0165	0,0031	0,0105	0,0245	0,5561	0,1194	0,0378
B 471	07.06.2004	0,0056	0,1325	0,4959	0,1120	0,0190	0,1701	0,0031	0,0105	0,0245	0,9817	0,0356	0,0997
B 472	08.06.2004	0,0056	0,2400	0,8779	0,1640	0,0190	0,3131	0,0105	0,0105	0,0245	1,6128	0,1424	0,2725
B 473	09.06.2004	0,0056	0,5490	0,9978	0,1904	0,0190	0,3959	0,0130	0,0105	0,1077	2,1119	0,2967	0,0378
B 475	10.06.2004	0,0056	0,0653	1,8076	0,0134	0,0190	0,4490	0,0151	0,0105	0,0687	1,9204	0,3350	0,8080
B 476	11.06.2004	0,0138	1,0119	1,6358	0,2354	0,0190	0,5125	0,0031	0,0518	0,2677	1,5416	0,1628	0,9297
B 477	12.06.2004	0,0056	2,0080	0,1756	0,1910	0,0190	0,1481	0,0031	0,0629	0,2816	0,7095	0,0356	0,4237
B 478	13.06.2004	0,1501	11,6574	0,0230	0,6046	0,0190	0,8632	0,0031	0,3516	1,5788	0,4538	0,0356	0,2615
B 479	14.06.2004	0,0056	0,2899	0,6167	0,0698	0,0190	0,2271	0,0031	0,0105	0,0245	0,7501	0,1021	0,4324
B 481	15.06.2004	0,0056	0,6999	1,4799	0,1170	0,0190	0,3277	0,0031	0,0251	0,1413	1,4296	0,0979	0,4473
B 482	16.06.2004	0,0112	0,5912	0,4765	0,0134	0,0190	0,1503	0,0031	0,0368	0,1664	1,3864	0,0356	0,4657
B 483	22.06.2004	0,0056	0,1745	0,9055	0,0658	0,0190	0,1960	0,0031	0,0105	0,0245	1,5820	0,0992	0,3956
B 484	23.06.2004	0,0056	0,3118	0,6237	0,0869	0,0190	0,2327	0,0031	0,0105	0,0245	1,3641	0,0356	0,5665

Aerosol and gases concentration values in µg pro Normcubicmeter **Dec. 02-Oct. 04** Filter from 0 to 563

		Aerosol (Anions) [µg/Nm³]				Aerosol (Kations) [µg/Nm³]					Gas [µg/Nm³]		
Samples	**Date**	**Chloride**	**Nitrate**	**Sulphate**	**Oxalate**	**Na**	**NH4**	**K**	**Mg**	**Ca**	**HNO_3**	**SO_2**	**NH3**
B 485	24.06.2004	0,0056	1,7330	0,0093	0,0408	0,0190	0,0401	0,0031	0,0414	0,3364	0,2388	0,2347	0,7024
B 487	25.06.2004	0,0209	1,2311	0,4254	0,1364	0,0190	0,3255	0,0070	0,0909	0,3804	0,9006	0,0754	0,8069
B 488	26.06.2004	0,0056	0,1347	1,1951	0,0624	0,0190	0,4015	0,0091	0,0105	0,0245	1,5600	0,1168	0,4768
B 489	27.06.2004	0,0269	0,9559	3,2167	0,1307	0,0190	0,9223	0,0031	0,0267	0,1169	2,1645	0,2025	0,4141
B 490	28.06.2004	0,0056	0,2453	2,1037	0,1058	0,0190	0,5115	0,0065	0,0105	0,0245	1,2768	0,0768	0,2373
B 491	29.06.2004	0,0056	0,3646	1,3770	0,1601	0,0190	0,5222	0,0111	0,0105	0,0245	1,7532	0,1389	0,4097
B 493	01.07.2004	0,0056	0,1674	0,8930	0,0755	0,0190	0,5642	0,0085	0,0105	0,0245	1,8641	0,1750	0,6971
B 494	02.07.2004	0,0056	0,8774	0,1092	0,0134	0,0190	0,2282	0,0031	0,0483	0,3312	1,1556	0,1496	0,2329
B 495	03.07.2004	0,0056	0,5408	0,5286	0,0879	0,0780	0,2331	0,0031	0,0215	0,1815	1,2527	0,1013	0,2551
B 496	04.07.2004	0,0056	6,0266	0,0391	0,1072	0,0190	0,0165	0,0672	0,0105	0,0245	3,5848	0,1059	0,5213
B 497	05.07.2004	0,0056	0,2919	2,0779	0,1127	0,0190	0,8553	0,0211	0,0105	0,0937	2,0433	0,0937	0,4976
B 499	11.07.2004	0,0056	0,5433	0,2106	0,0564	0,0190	0,0500	0,0031	0,0233	0,1863	0,4159	0,1643	0,0939
B 500	12.07.2004	0,0056	0,2195	0,1718	0,0422	0,0190	0,0165	0,0031	0,0105	0,1074	0,3649	0,1240	0,1575
B 501	13.07.2004	0,0056	0,0653	0,1318	0,0134	0,0190	0,0165	0,0031	0,0105	0,0245	0,4643	0,1429	0,0378
B 502	14.07.2004	0,0056	0,4648	0,8244	0,1152	0,0190	0,1595	0,0078	0,0105	0,3182	0,8474	0,1911	0,2285
B 503	15.07.2004	0,0056	0,0653	0,1785	0,0432	0,0190	0,0364	0,0031	0,0105	0,0245	0,0555	0,0356	0,2997
B 505	16.07.2004	0,0137	0,5717	0,4832	0,1119	0,0190	0,0833	0,0072	0,0474	0,7255	0,7298	0,2895	0,2754
B 506	17.07.2004	0,0175	1,2276	1,0425	0,1636	0,0190	0,2829	0,0031	0,0475	0,2917	0,9958	0,2340	0,4081
B 507	18.07.2004	0,0056	0,2411	3,6397	0,2241	0,0190	1,3684	0,0239	0,0105	0,0245	3,0966	0,2947	0,8351
B 508	19.07.2004	0,0122	0,7368	3,3278	0,2020	0,0190	0,9886	0,0251	0,0395	0,3099	1,9961	0,7882	0,6082
B 509	30.07.2004	0,0056	0,5645	2,4856	0,1971	0,0190	0,7519	0,0316	0,0105	0,0245	3,1743	0,0878	0,7904
B 511	31.07.2004	0,0056	0,3925	3,6146	0,2158	0,0190	1,4355	0,0525	0,0105	0,0245	1,6976	0,2123	1,2401
B 512	01.08.2004	0,0056	3,6067	0,0492	0,0134	0,0190	2,1367	0,0156	0,0105	0,0245	4,1266	0,1115	0,6671
B 513	02.08.2004	0,0056	0,4811	3,8896	0,2196	0,0190	1,4484	0,0594	0,0105	0,0245	3,5441	0,0903	0,8312
B 514	03.08.2004	0,0056	0,5824	4,2711	0,2280	0,0190	1,0041	0,0517	0,0105	0,0245	2,9577	0,2392	1,1209
B 515	04.08.2004	0,0056	0,1996	2,4456	0,1345	0,0190	0,6682	0,0232	0,0105	0,0245	0,7063	0,0356	0,2933
B 517	05.08.2004	0,0056	0,0653	1,5498	0,0761	0,0190	0,4835	0,0153	0,0105	0,0245	1,4246	0,1099	0,3305
B 518	06.08.2004	0,0056	0,3627	4,8456	0,2199	0,0190	1,6920	0,0673	0,0105	0,0245	4,5245	0,2033	0,9906
B 519	07.08.2004	0,0056	0,8792	4,2216	0,2043	0,0190	1,2814	0,0451	0,0105	0,0245	2,9242	0,5137	0,9390
B 520	08.08.2004	0,0056	0,4991	4,3846	0,1818	0,0190	1,3469	0,0398	0,0105	0,0245	2,5760	0,1652	0,4693
B 521	09.08.2004	0,0056	0,1715	2,1118	0,1379	0,0190	0,6861	0,0166	0,0105	0,0245	2,7839	0,1833	0,2749
B 523	10.08.2004	0,0056	0,1867	1,6131	0,1076	0,0190	0,3169	0,0153	0,0105	0,0245	1,8394	0,2209	0,5776
B 524	03.09.2004	0,0056	0,0653	1,7467	0,0908	0,0190	0,6401	0,0192	0,0105	0,0245	1,4655	0,0928	0,6578
B 525	04.09.2004	0,0056	1,6181	0,8276	0,0290	0,0190	0,4692	0,0031	0,0105	0,0245	1,8576	0,0356	0,2009
B 526	05.09.2004	0,0056	0,0653	1,7522	0,0645	0,0190	0,6922	0,0123	0,0105	0,0245	0,0555	0,0356	0,3581
B 527	06.09.2004	0,0056	0,0653	0,3211	0,0134	0,0190	0,0816	0,0031	0,0105	0,0245	0,3790	0,1509	0,1168
B 529	07.09.2004	0,0056	0,0653	0,7168	0,0328	0,0190	0,2189	0,0132	0,0105	0,5377	1,0536	0,1567	0,4168
B 530	08.09.2004	0,0056	0,3095	1,4700	0,0313	0,0190	0,4392	0,0102	0,0105	0,2033	1,6342	0,4919	0,7958
B 531	09.09.2004	0,0056	0,0653	0,3213	0,0134	0,0190	0,0593	0,0031	0,0105	0,0245	0,6988	0,2347	0,8350
B 532	10.09.2004	0,0056	0,2214	0,8385	0,0293	0,0190	0,3222	0,0088	0,0105	0,3259	0,9663	0,2084	0,4863
B 533	11.09.2004	0,0056	0,3506	2,1066	0,1002	0,0190	0,6828	0,0342	0,0105	0,3104	1,4452	0,0733	0,3675
B 535	12.09.2004	0,0056	0,0653	0,6794	0,0806	0,0190	0,1882	0,0079	0,0105	0,0245	0,8419	0,0356	0,5513
B 536	13.09.2004	0,0056	0,0653	0,6161	0,0134	0,0190	0,1535	0,0031	0,0105	0,0245	1,1595	0,2097	0,2539
B 537	14.09.2004	0,0056	0,0653	0,0093	0,0334	0,0190	0,0165	0,0031	0,0105	0,0245	0,4475	0,5612	0,1462
B 538	15.09.2004	0,0152	3,9651	0,0565	0,2694	0,0190	0,0973	0,0031	0,1058	0,5149	0,5953	0,1285	0,0378
B 539	16.09.2004	0,0056	1,0973	0,1297	0,1194	0,0190	0,0165	0,0031	0,0369	0,1631	0,4661	0,1201	0,0378
B 541	17.09.2004	0,0056	0,9770	0,2591	0,1979	0,0190	0,1505	0,0031	0,0341	0,1275	0,5652	0,1386	0,2866
B 542	18.09.2004	0,0056	0,4235	0,4019	0,1093	0,0190	0,1545	0,0031	0,0105	0,1139	0,0555	0,1008	0,1511
B 544	19.09.2004	0,0056	0,0653	0,5717	0,0572	0,0190	0,0524	0,0031	0,0105	0,0245	1,0959	0,3708	0,4919
B 545	20.09.2004	0,0056	0,2745	0,9639	0,0398	0,0190	0,3848	0,0031	0,0105	0,0245	1,8496	0,1277	0,3603
B 547	21.09.2004	0,0269	0,1333	0,6678	0,0285	0,0190	0,1990	0,0077	0,0105	0,2948	0,8615	0,0740	0,2444
B 548	22.09.2004	0,0307	0,1908	0,3785	0,0134	0,0387	0,0165	0,0061	0,0105	0,6366	0,3289	0,1023	0,1177
B 549	23.09.2004	0,0056	0,0653	0,0547	0,0134	0,0190	0,0165	0,0031	0,0105	0,0245	0,3063	0,0810	0,1401
B 550	24.09.2004	0,0056	0,0653	0,0651	0,0134	0,0190	0,0165	0,0031	0,0105	0,0245	0,1340	0,0356	0,0378
B 551	25.09.2004	0,0056	0,0653	0,0282	0,0134	0,0190	0,0165	0,0031	0,0105	0,0245	0,1930	0,0843	0,0378
B 553	26.09.2004	0,0056	0,0653	0,1076	0,0134	0,0190	0,0165	0,0031	0,0105	0,0245	0,3278	0,0356	0,0378
B 554	27.09.2004	0,0056	0,0653	0,2078	0,0134	0,0190	0,0541	0,0031	0,0105	0,0245	0,3168	0,0356	0,0378
B 555	29.09.2004	0,0056	0,0653	0,2337	0,0134	0,0190	0,0523	0,0031	0,0105	0,0245	0,4525	0,0356	0,0893
B 556	30.09.2004	0,0056	0,0653	0,2056	0,0134	0,0190	0,0511	0,0031	0,0105	0,0245	0,3869	0,0356	0,0378
B 557	01.10.2004	0,0056	0,0653	0,4572	0,0134	0,0190	0,1044	0,0031	0,0105	0,0245	0,6772	0,0356	0,3189
B 559	02.10.2004	0,0056	0,0653	1,1360	0,0586	0,0190	0,4216	0,0133	0,0105	0,0245	1,2824	0,0356	0,2980
B 560	03.10.2004	0,0056	0,0653	1,4469	0,0651	0,0190	0,5054	0,0155	0,0105	0,0245	1,4949	0,0356	0,2840
B 561	04.10.2004	0,0056	0,0653	0,9896	0,0479	0,0190	0,3751	0,0171	0,0105	0,0507	0,8498	0,0356	0,0812
B 562	05.10.2004	0,0056	0,2148	1,5984	0,0847	0,0190	0,5644	0,0350	0,0105	0,1747	1,0517	0,0356	0,4042
B 563	06.10.2004	0,0056	0,6646	2,3687	0,1070	0,0190	0,9290	0,0448	0,0105	0,3678	1,5591	0,0356	0,5704

Aerosol and gase monthly average in µg pro Normcubicmeter **Dec 02-Oct04** Filter from 0 to 563

	Aerosol (Anions) [µg/Nm^3]				Aerosol (Kations) [µg/Nm^3]					Gas [µg/Nm^3]		
Months	**Chlorid**	**Nitrat**	**Sufat**	**Oxalat**	**Na**	**NH4**	**K**	**Mg**	**Ca**	**HNO_3**	**SO_2**	**NH3**
Dec. 02	0,010	0,030	0,087	0,004	0,020	0,034	0,006	0,003	0,027	0,057	0,104	0,121
Jan. 03	0,000	0,000	0,000	0,005	0,000	0,000	0,000	0,000	0,000	0,047	0,223	0,044
Feb.03	0,000	0,000	0,000	0,013	0,000	0,000	0,000	0,000	0,000	0,103	0,131	0,047
March 03	0,014	0,445	0,319	0,019	0,030	0,114	0,011	0,002	0,034	0,122	0,205	0,301
Apr.03	0,016	0,827	1,037	0,047	0,033	0,515	0,035	0,008	0,090	0,212	0,238	0,490
May 03	0,046	0,501	0,923	0,030	0,053	0,303	0,036	0,011	0,090	0,146	0,073	0,418
Jun.03	0,031	0,541	1,311	0,104	0,037	0,461	0,023	0,016	0,242	0,353	0,192	0,692
Jul.03	0,038	0,189	0,974	0,065	0,033	0,346	0,018	0,010	0,287	1,055	0,242	0,654
Aug.03	0,013	0,527	1,799	0,144	0,036	0,656	0,059	0,032	0,474	1,269	0,303	0,895
Sep.03	0,012	0,073	0,595	0,030	0,019	0,266	0,016	0,006	0,068	0,858	0,152	0,361
Oct. 03	0,013	0,026	0,377	0,009	0,020	0,137	0,009	0,003	0,033	0,409	0,125	0,064
Nov.03	0,014	0,075	0,390	0,017	0,020	0,108	0,013	0,014	0,129	0,211	0,127	0,039
Dec. 03	0,014	0,077	0,233	0,012	0,026	0,076	0,014	0,006	0,052	0,183	0,479	0,050
Jan. 04	0,009	0,084	0,295	0,031	0,044	0,088	0,007	0,010	0,072	0,231	0,267	0,031
Feb.04	0,014	0,152	0,577	0,035	0,085	0,197	0,013	0,013	0,088	0,316	0,651	0,071
March 04	0,012	0,624	0,573	0,048	0,038	0,240	0,009	0,023	0,245	0,531	0,211	0,137
Apr.04	0,013	0,261	0,730	0,075	0,019	0,224	0,007	0,016	0,106	0,528	0,130	0,206
May 04	0,013	0,690	0,744	0,091	0,022	0,266	0,006	0,013	0,076	0,906	0,104	0,462
Jun.04	0,015	1,113	0,836	0,134	0,063	0,318	0,005	0,041	0,191	1,247	0,125	0,422
Jul.04	0,007	0,812	1,235	0,111	0,023	0,443	0,017	0,021	0,170	1,484	0,199	0,449
Aug.04	0,007	0,437	1,235	0,078	0,019	0,447	0,015	0,014	0,106	1,262	0,137	0,367
Sep.04	0,007	0,356	0,719	0,056	0,020	0,247	0,009	0,015	0,131	0,814	0,121	0,281

Average, median, maximun and minimun Dec 02-Oct04

NO_3	max.	min.	Average	Median	SO_4^{2}	max.	min.	Average	Median	[illegible]	max.	min.	Average	Median
Dec. 02	1,7	0,2	0,5	0,3	*Dec. 02*	2,8	0,0	0,9	0,7	*Dec. 02*	6,2	0,3	1,9	1,6
Jan. 03	10,0	0,4	1,2	0,5	*Jan. 03*	3,3	0,3	1,7	1,9	*Jan. 03*	6,8	0,8	2,5	1,8
Feb.03	2,3	0,2	0,6	0,2	*Feb.03*	18,6	0,0	4,6	4,3	*Feb.03*	18,5	0,4	5,7	5,1
Mär.03	72,2	0,2	7,2	1,3	*Mär.03*	19,6	0,0	3,3	2,2	*Mär.03*	17,6	0,4	6,3	5,4
Apr.03	44,3	0,2	13,3	8,0	*Apr.03*	27,4	0,7	10,8	9,2	*Apr.03*	80,0	1,5	28,6	23,7
Mai.03	27,9	0,2	8,1	7,3	*Mai.03*	30,4	0,3	9,6	9,2	*Mai.03*	32,1	0,4	16,9	19,4
Jun.03	27,7	0,8	8,7	5,7	*Jun.03*	42,7	2,0	13,7	11,5	*Jun.03*	61,9	1,1	25,6	20,7
Jul.03	11,7	0,2	3,2	2,4	*Jul.03*	31,3	0,0	10,8	8,0	*Jul.03*	59,5	0,5	19,7	15,4
Aug.03	31,1	0,2	9,0	5,5	*Aug.03*	72,7	0,1	19,8	16,2	*Aug.03*	124,8	1,4	38,5	35,1
Sep.03	3,0	0,2	1,2	1,0	*Sep.03*	16,2	0,4	6,2	4,8	*Sep.03*	33,6	0,8	14,8	12,9
Okt.03	4,0	0,2	0,8	0,3	*Okt.03*	7,7	0,1	3,4	3,4	*Okt.03*	17,2	0,8	6,2	5,1
Nov.03	5,1	0,2	1,2	0,9	*Nov.03*	14,2	0,2	4,6	3,0	*Nov.03*	24,3	0,6	7,0	4,8
Dez.03	5,0	0,2	1,2	1,0	*Dez.03*	6,9	0,4	2,4	2,2	*Dez.03*	10,4	0,6	4,2	3,1
Jän.04	3,9	0,4	1,3	1,1	*Jän.04*	7,1	0,6	3,1	2,4	*Jän.04*	14,4	1,1	4,9	4,1
Feb.04	7,1	0,4	2,4	1,5	*Feb.04*	19,6	0,1	4,4	2,1	*Feb.04*	52,2	0,4	10,9	4,8
Mär.04	43,4	0,4	10,1	7,0	*Mär.04*	17,3	0,3	6,0	4,7	*Mär.04*	67,5	2,4	16,4	13,6
Apr.04	19,3	1,1	4,2	2,2	*Apr.04*	27,4	0,4	7,6	6,6	*Apr.04*	44,0	0,9	12,4	9,3
Mai.04	44,0	1,1	11,1	6,6	*Mai.04*	42,2	0,1	7,8	3,4	*Mai.04*	88,9	0,9	14,8	7,5
Jun.04	32,4	1,1	9,0	5,0	*Jun.04*	33,5	0,1	8,7	6,5	*Jun.04*	51,2	0,9	17,7	15,2
Jul.04	97,2	1,1	13,1	8,1	*Jul.04*	37,9	0,4	12,9	7,0	*Jul.04*	79,8	0,1	24,5	12,8
Aug.04	58,2	1,1	11,3	6,8	*Aug.04*	50,5	0,5	30,6	33,0	*Aug.04*	118,7	17,6	61,5	63,5
Sep.04	64,0	1,1	6,3	1,1	*Sep.04*	21,9	0,1	6,1	3,9	*Sep.04*	38,5	0,9	10,8	5,4
Okt.04	10,7	1,1	3,1	1,1	*Okt.04*	24,7	4,8	13,9	13,5	*Okt.04*	51,6	5,8	26,9	25,8

HNO_3	max.	min.	Average	Median	SO_2	max.	min.	Average	Median	NH_3	max.	min.	Average	Median
Dec. 02	3,4	0,1	0,9	0,4	*Dec. 02*	3,8	0,3	1,6	1,3	*Dec. 02*	16,1	2,0	7,1	6,1
Jan. 03	3,2	0,1	0,7	0,7	*Jan. 03*	9,9	0,3	1,8	0,5	*Jan. 03*	10,2	2,0	2,6	2,0
Feb.03	7,3	0,2	2,2	2,7	*Feb.03*	8,7	0,5	2,1	0,7	*Feb.03*	13,5	2,6	3,1	2,6
Mär.03	5,4	0,2	1,9	1,2	*Mär.03*	5,5	0,5	1,8	1,2	*Mär.03*	53,0	2,6	17,7	15,7
Apr.03	15,4	0,5	3,4	2,2	*Apr.03*	15,8	0,5	3,7	2,3	*Apr.03*	83,5	2,6	28,8	22,0
Mai.03	4,2	0,5	2,3	2,5	*Mai.03*	3,2	0,5	1,2	0,8	*Mai.03*	55,1	2,4	24,6	22,3
Jun.03	10,8	0,2	5,6	5,2	*Jun.03*	10,2	0,5	3,0	2,5	*Jun.03*	68,9	21,3	40,7	37,1
Jul.03	49,2	0,2	16,6	12,1	*Jul.03*	13,4	1,2	3,9	3,8	*Jul.03*	93,2	15,7	40,6	36,9
Aug.03	79,3	0,2	20,6	16,5	*Aug.03*	16,3	0,4	4,9	3,4	*Aug.03*	134,1	20,4	54,6	51,7
Sep.03	42,0	0,2	13,6	12,0	*Sep.03*	5,6	0,4	2,4	2,0	*Sep.03*	42,3	2,2	21,3	17,8
Okt.03	22,5	1,0	6,7	5,2	*Okt.03*	10,1	0,5	2,5	2,0	*Okt.03*	39,9	2,2	6,6	2,2
Nov.03	13,5	0,9	5,4	4,8	*Nov.03*	7,9	0,5	2,0	1,1	*Nov.03*	18,7	2,3	3,5	2,3
Dez.03	15,5	0,7	2,9	1,8	*Dez.03*	6,3	0,5	1,5	1,1	*Dez.03*	17,8	2,3	2,9	2,3
Jän.04	6,5	0,9	3,9	3,8	*Jän.04*	8,9	0,2	3,7	2,8	*Jän.04*	1,8	1,8	1,8	1,8
Feb.04	25,0	1,0	5,0	3,6	*Feb.04*	31,1	0,8	6,7	1,9	*Feb.04*	20,5	1,8	4,0	1,5
Mär.04	34,5	1,9	8,4	6,0	*Mär.04*	12,3	0,2	3,3	2,3	*Mär.04*	53,9	1,8	8,1	3,9
Apr.04	24,8	0,9	8,4	5,7	*Apr.04*	11,6	0,6	2,0	1,5	*Apr.04*	44,9	2,2	12,1	6,7
Mai.04	58,7	0,9	14,4	8,5	*Mai.04*	4,8	0,6	1,6	1,0	*Mai.04*	80,4	2,2	27,2	15,4
Jun.04	34,4	3,8	19,8	21,8	*Jun.04*	5,2	0,6	1,9	1,7	*Jun.04*	54,7	2,2	24,8	24,6
Jul.04	50,4	0,9	23,6	19,1	*Jul.04*	12,3	0,6	3,1	2,5	*Jul.04*	72,9	2,2	26,4	20,8
Aug.04	71,8	11,2	43,5	45,3	*Aug.04*	8,0	0,6	2,9	2,7	*Aug.04*	65,9	16,2	38,2	36,6
Sep.04	29,5	0,9	11,7	9,0	*Sep.04*	8,8	0,6	2,2	1,6	*Sep.04*	49,1	2,2	16,0	11,8
Okt.04	24,7	10,7	18,3	18,5	*Okt.04*	0,6	0,6	0,6	0,6	*Okt.04*	33,6	4,8	19,2	18,1

Field blanks of Filter pack A **Dec. 02- Oct. 04**

Teflon [µg/ml] Oxalic

	Cloride	Nitrate	Sulphate	Na	NH4	K	Mg	Ca	NH4	NH3
A 0-22	0,010	0,069	0,010	0,026	0,103	0,026	0,009	0,063	0,266	0,251
	0,018	0,078	0,024	0,102	0,037	0,070		0,084	0,517	0,488
	0,031	0,046	0,009	0,035	0,043	0,029		0,042	1,129	1,066
A 23-51		0,100	0,015	0,025	0,069	0,038		0,049	0,248	0,234
		0,199	0,023	0,019	0,038	0,041		0,041	0,271	0,256
		0,036	0,035	0,018	0,046	0,036		0,060	0,306	0,289
		0,033	0,026	0,024	0,104	0,039		0,033	0,402	0,380
A 52-84	0,028		0,030	0,138	0,038	0,039		0,044	0,318	0,300
	0,009	0,027	0,018	0,297	0,104	0,032			0,180	0,170
	0,007	0,021	0,028	0,276	0,100	0,035		0,039	0,220	0,208
	0,023	0,076	0,008	0,018	0,022	0,019		0,084	0,721	0,681
	0,067	0,043	0,029	0,104	0,047	0,080		0,110	0,369	0,349
	0,016	0,027	0,018	0,054	0,035	0,054		0,087	0,166	0,157
A 85-121	0,102	0,078	0,045	0,267	0,142	0,250	0,008	0,144	0,160	0,151
	0,140	0,093	0,085	0,065	0,085	0,075	0,021	0,264	0,198	0,187
	0,020	0,028	0,064	0,123	0,090	0,049	0,022	0,152	0,595	0,562
	0,050	0,073	0,095	0,128	0,046	0,058	0,030	0,233	0,534	0,504
A 122-152	0,083	0,179	0,041	0,070	0,026	0,028	0,003	0,162	0,615	0,581
	0,027	0,032	0,032	0,059	0,035	0,019	0,003	0,148	0,337	0,318
	0,036	0,046	0,050	0,072	0,144	0,034	0,003	0,104	0,480	0,453
	0,061	0,016	0,036	0,065	0,134	0,012	0,004	0,060	0,449	0,424
A 153-186	0,194	0,044	0,039	0,044	0,023	0,038	0,004	0,081	0,371	0,350
	0,043	0,030	0,034	0,132	0,084	0,088	0,005	0,091	0,694	0,655
	0,109	0,028	0,070	0,078	0,065	0,040	0,001	0,079	0,295	0,279
	0,114	0,036	0,031	0,174	0,026	0,061		0,097	0,475	0,449
	0,148	0,516	0,212	0,379	0,082	0,206	0,073	0,326	0,986	0,931
A 187-220	0,014	0,088	0,102	0,017	0,158	0,014	0,004	0,048	0,501	0,473
	0,034	0,062	0,043	0,087	0,214	0,022	0,016	0,120	0,426	0,402
	0,031	0,174	0,077	0,138	0,047	0,027	0,016	0,154	0,286	0,270
	0,068	0,212	0,403	0,121	0,164	0,071	0,046	0,870	0,378	0,357
	0,033	0,073	0,057	0,068	0,111	0,096	0,019	0,223	0,654	0,618
A 221-258	0,056	0,024	0,045	0,072	0,175	0,067	0,012	0,167	0,254	0,240
	0,052	0,078	0,048	0,067	0,071	0,063	0,014	0,209	0,347	0,328
	0,015	0,017	0,039	0,033	0,061	0,034	0,007	0,085	0,667	0,630
	0,031	0,020	0,033	0,065	0,101	0,058	0,013	0,131	1,735	1,639
	0,065	0,030	0,063	0,069	0,236	0,061	0,011	0,178	0,432	0,408
	0,029	0,005	0,025	0,034	0,141	0,036	0,005	0,054	0,186	0,176
A 259-294	0,068		0,022	0,054	0,046	0,018	0,008	0,145	0,443	0,419
	0,022	0,003	0,016	0,020	0,032	0,022	0,006	0,085	0,534	0,505
	1,372	0,059	1,051	0,586	0,044	0,020	0,005	0,076	0,293	0,277
	0,023	0,023	0,017	0,040	0,041	0,034	0,011	0,148	1,291	1,219
A 295-331	0,007	0,007	0,026	0,037	0,024	0,033	0,008	0,050	0,137	0,130
	0,011	0,009	0,030	0,131	0,064	0,032	0,010	0,056	0,180	0,170
	0,006	0,041	0,078	0,157	0,061	0,034	0,013	0,114	0,167	0,158
	0,033	0,039	0,031	0,179	0,084	0,030	0,017	0,168	0,401	0,379
A 332-366	0,016	0,065	0,078	0,118	0,114	0,028	0,030	0,160	0,198	0,187
	0,008	0,041	0,021	0,158	0,110	0,018	0,014	0,088	0,049	0,046
	0,012	0,060	0,073	0,323	0,162	0,025	0,029	0,216	0,084	0,080
	0,012	0,028	0,027	0,080	0,093	0,017	0,016	0,091	0,127	0,120
	0,057	0,241	0,706	0,181	0,086	0,024	0,021	0,139	0,296	0,279
	0,010	0,033	0,032	0,074	0,076	0,018	0,026	0,124	0,272	0,256
A 367-406	0,011	0,034	0,039	0,117	0,159	0,030	0,025	0,089	0,111	0,105
	0,007	0,054	0,041	0,110	0,097	0,036	0,016	0,128	0,283	0,267
	0,023	0,274	0,118	0,054	0,210	0,050	0,108	0,336	0,198	0,187
	0,009	0,085	0,065	0,032	0,114	0,032	0,031	0,128	0,249	0,235
	0,021	0,185	0,081	0,017	0,103	0,025	0,065	0,185	0,214	0,202
A 407-442	0,022	0,392	0,035	0,033	0,097	0,026	0,063	0,306	0,198	0,187
	0,045	0,247	0,068	0,029	0,098	0,033	0,125	0,432	0,259	0,244
	0,025	0,145	0,053	0,127	0,074	0,069	0,024	0,163	0,169	0,160
	0,035	0,117	0,056	0,096	0,046	0,042	0,022	0,092	0,094	0,089
	0,011	0,175	0,042	0,047	0,052	0,021	0,022	0,114	0,059	0,055
	0,031	0,225	0,055	0,043	0,097	0,038	0,077	0,276	0,234	0,221

Field blanks of Filter pack A **Dec. 02- Oct. 04**

	Teflon		[µg/ml]						Oxalic	
	Cloride	Nitrate	Sulphate	Na	NH4	K	Mg	Ca	NH4	NH3
A 443-478	0,009	0,038	0,047	0,110	0,050	0,021	0,016	0,094	0,255	0,241
	0,004	45,190	0,006						0,962	0,908
	0,017	0,376	0,038	0,031	0,045	0,023	0,016	0,098	0,126	0,119
	0,024	0,341	0,051	0,106	0,047	0,023	0,029	0,122	0,134	0,127
	0,017	0,369	0,048	0,018	0,111	0,011	0,069	0,278	0,139	0,131
A 479-513	0,027	1,078	0,037	0,019	0,116	0,008	0,083	0,281	0,385	0,364
										0,000
	0,012	0,545	0,073	0,042	0,154	0,010	0,091	0,353	0,161	0,152
	0,029	0,674	0,107	0,211	0,126	0,017	0,017	0,145	0,375	0,354
	0,010	0,377	0,042	0,044	0,139	0,024	0,020	0,126	0,065	0,062
	0,004	0,460	0,040	0,012	0,040	0,015	0,002	0,028	0,801	0,756
B 514-563	0,006	0,066	0,025	0,032	0,031	0,015	0,002	0,033	0,047	0,044
	0,005	0,217	0,011	0,035	0,009	0,012	0,002	0,044	0,134	0,126
	0,002	0,070	0,019	0,016	0,013	0,015	0,002	0,033	0,460	0,434
	0,002	0,075	0,013	0,027	0,014	0,013		0,017	0,561	0,529
	0,007	0,038	0,014	0,024	0,051	0,022	0,001	0,022	0,657	0,620
	0,010	0,038	0,012	0,010	0,079	0,007	0,001	0,007	0,210	0,199
	0,003	0,136	0,012	0,011	0,128	0,018	0,001	0,014	0,160	0,151
	0,011	0,026	0,016	0,009	0,055	0,008	0,001	0,009	0,280	0,264

Field blanks of Filter pack B **Dec. 02- Oct. 04**

Teflon **[µg/ml]**

	Acetate	Formiate	Chloride	Nitrate	Sulphate	Oxalate	Na	NH4	K	Mg	Ca
	0,106	0,014	0,014	0,139	0,019	0,019	0,071	0,031	0,036	0,013	0,115
	0,107	0,017	0,023	0,067	0,008	0,219	0,122	0,052	0,045	0,010	0,105
B 0-22	0,023		0,029	0,187	0,016	0,011	0,024	0,123	0,027	0,015	0,188
	0,145	0,042	0,009	0,212	0,014	0,006	0,038	0,080	0,065		0,077
	0,050	0,033	0,006	0,044	0,025	0,020	0,085	0,046	0,055		0,031
B 23-51	0,066	0,044	0,022	0,049	0,030	0,012	0,057	0,046	0,068		0,107
	0,111	0,048	0,012	0,029			0,123	0,049	0,045		0,060
	0,011	0,013	0,008	0,038	0,026	0,018	0,026	0,031	0,047		0,082
	0,078	0,016	0,014	0,029	0,011	0,005	0,133	0,025	0,057		0,043
B 52-84	0,039	0,015	0,017	0,115	0,050	0,018	0,222	0,036	0,059		0,072
	0,038	0,012	0,059	0,053	0,004		0,104	0,026	0,111		0,087
	0,031	0,010	0,047	0,065	0,012	0,028	0,050	0,023	0,067		0,042
	0,066	0,016	0,287	0,354	0,032	0,038	0,361	0,051	0,199		0,069
	0,069	0,017	0,084	0,066	0,036	0,009	0,083	0,017	0,060		0,068
	0,049	0,014	0,021	0,019	0,007	0,010	0,025	0,013	0,033		0,021
B 85-121	0,062	0,018	0,081	0,093	0,023	0,011	0,090	0,020	0,079		0,072
	0,077	0,018	0,021	0,081	0,078	0,017	0,226	0,035	0,128	0,020	0,096
	0,085	0,018	0,132	0,111	0,033	0,050	0,097	0,027	0,120		0,087
	0,128	0,023	0,036	0,145	0,025	0,013	0,069	0,031	0,009	0,000	0,045
	0,065	0,021	0,077	0,051	0,027	0,010	0,143	0,015	0,069	0,004	0,127
B 122-152	0,016	0,014	0,026	0,017	0,022		0,025	0,028	0,020	0,003	0,093
	0,126	0,016	0,083	0,010	0,012	0,007	0,050	0,035	0,035	0,002	0,039
	0,151	0,019	0,063	0,127	0,041	0,006	0,083	0,043	0,056	0,005	0,250
	0,116	0,017	0,141	0,041	0,037	0,009	0,315	0,036	0,151	0,006	0,149
B 153-186	0,098	0,018	0,130	0,077	0,046	0,030	0,200	0,043	0,170	0,008	0,202
	0,184	0,034	0,026		0,017	0,011	0,020	0,037	0,015	0,004	0,048
	0,213	0,034	0,037	0,075	0,029	0,009	0,037	0,016	0,020	0,007	0,101
B 187-220	0,213	0,029	0,019	0,086	0,027	0,008	0,027	0,134	0,024	0,021	0,275
	0,157	0,021	0,031	0,095	0,109	0,061	0,210	0,154	0,028	0,045	0,274
	0,157	0,020	0,024	0,153	0,127	0,057	0,157	0,150	0,026	0,037	0,417
	0,161	0,072	0,084	0,093	0,725	0,041	0,145	0,140	0,125	0,120	3,983
	0,115	0,018	0,010	0,009	0,013	0,004	0,046	0,133	0,084		0,084
B 221-258	0,015	0,016	0,086	0,066	0,055	0,020	0,073	0,022	0,073	0,010	0,176
	0,014	0,007	0,010	0,107	0,038	0,028	0,035	0,045	0,032	0,006	0,124
	0,017	0,006	0,030	0,134	0,048	0,011	0,034	0,032	0,036	0,008	0,147
	0,015	0,005	0,028	0,192	0,115	0,035	0,058	0,036	0,044	0,013	0,333
	0,015	0,006	0,019	0,319	0,055	0,015	0,094	0,024	0,076	0,009	0,165
B 259-294	0,029	0,010	0,060	0,043	0,022	0,020	0,036	0,016	0,040	0,014	0,132
	0,023	0,008	0,034	0,014	0,009	0,003	0,018	0,028	0,027	0,004	0,024
	0,023	0,006	0,034	0,029	0,015	0,007	0,020	0,026	0,031	0,005	0,103
	0,043	0,007	0,035	0,037	0,022	0,021	0,017	0,026	0,031	0,006	0,080
B 295-331	0,039	0,008	0,020	0,071	0,019	0,020	0,045	0,025	0,028	0,010	0,076
	0,071	0,013	0,027	0,160	0,026	0,033	0,100	0,069	0,019	0,022	0,114
	0,034	0,008	0,026	0,191	0,037	0,034	0,107	0,068	0,020	0,019	0,120
	0,044	0,007	0,024	0,128	0,026	0,024	0,113	0,064	0,014	0,014	0,092
B 332-366	0,042	0,015	0,084	0,213	0,072	0,044	0,278	0,118	0,057	0,034	0,208
	0,059	0,011	0,030	0,110	0,032	0,009	0,154	0,110	0,020	0,011	0,096
	0,056	0,014	0,030	0,149	0,064	0,022	0,335	0,152	0,018	0,020	0,087
	0,074	0,014	0,033	0,117	0,021	0,027	0,066	0,081	0,017	0,015	0,069
	0,073	0,013	0,033	0,191	0,092	0,039	0,186	0,090	0,022	0,027	0,199
	0,074	0,012	0,038	0,177	0,025	0,069	0,073	0,080	0,020	0,022	0,106
B 367-406	0,169	0,046	0,033	0,736	0,166	0,218	0,844	0,224	0,027	0,069	0,318
	0,229	0,090	0,046	2,788	0,076	0,358	0,037	0,115	0,021	0,088	0,464
	0,288	0,051	0,021	0,487	0,093	0,079	0,062	0,086	0,014	0,038	0,152
	0,195	0,053	0,042	1,212	0,074	0,160	0,027	0,144	0,010	0,072	0,262
	0,307	0,099	0,084	8,207	0,200	0,273	0,063	0,465	0,011	0,203	0,776
B 407-442	0,295	0,089	0,067	4,852	0,028	0,561	0,051	0,495	0,011	0,199	0,993
	0,206	0,045	0,034	0,275	0,032	0,026	0,058	0,035	0,020	0,017	0,074
	0,200	0,048	0,039	0,561	0,033	0,120	0,042	0,050	0,015	0,049	0,146
	0,183	0,034	0,043	0,531	0,047	0,038	0,073	0,048	0,020	0,022	0,098
	0,184	0,051	0,026	0,413	0,024	0,273	0,008	0,043	0,015	0,042	0,154
	0,205	0,059	0,042	1,227	0,050	0,434	0,046	0,063	0,016	0,057	0,203

Field blanks of Filter pack B **Dec. 02- Oct. 04**

Teflon **[µg/ml]**

	Acetate	Formiate	Chloride	Nitrate	Sulphate	Oxalate	Na	NH4	K	Mg	Ca
B 443-478	0,158	0,023	0,010	0,166	0,023	0,066	0,061	0,036	0,007	0,014	0,068
	0,370	0,044	0,018	0,538	0,045	0,094	0,026	0,042	0,009	0,018	0,094
	0,273	0,063	0,043	0,950	0,056	0,127	0,013	0,080	0,012	0,031	0,161
	0,228	0,037	0,040	2,771	0,047	0,214	0,013	0,076	0,010	0,053	0,251
B 479-513	0,185	0,040	0,039	1,738	0,034	0,195	0,009	0,071	0,009	0,075	0,310
	0,159	0,013	0,006	0,144	0,024	0,019	0,041	0,032	0,009	0,007	0,047
	0,186	0,024	0,017	0,383	0,053	0,071	0,022	0,051	0,011	0,026	0,127
	0,158	0,024	0,038	0,379	0,037	0,077	0,063	0,059	0,017	0,023	0,109
	0,171	0,021	0,006	0,158	0,018	0,019	0,034	0,023	0,007	0,009	0,075
	0,135	0,009	0,021	0,154	0,037	0,032	0,018	0,017	0,015	0,009	0,064
B 514-563	0,146	0,009	0,009	3,530	0,026	0,016	0,007	0,276	0,014	0,002	0,029
	0,155	0,009	0,009	0,221	0,036	0,024	0,014	0,013	0,014	0,002	0,028
	0,151	0,008	0,004	0,099	0,015	0,010	0,015	0,016	0,008	0,002	0,018
	0,146	0,008	0,009	0,164	0,012	0,009	0,018	0,011	0,021	0,002	0,024
	0,191	0,013	0,006	0,073	0,012	0,184	0,016	0,017	0,015	0,001	0,016
	0,191	0,008	0,014	0,116	0,110	0,010	0,044	0,031	0,014	0,002	0,037
	0,189	0,008	0,006	0,074	0,007	0,009	0,007	0,011	0,009	0,002	0,014
	0,180	0,009	0,016	0,029	0,018	0,014	0,033	0,011	0,012	0,003	0,031

Field blanks of Filter pack B **Dec. 02- Oct. 04**

	Nylon				KOH	
	NO_3	HNO_3	SO_4	SO_2	SO_4	SO_2
	0,045	0,046	0,203	0,135	0,401	0,267
	0,025	0,025	0,118	0,079	0,240	0,160
B 0-22	0,028	0,029	0,094	0,062	0,285	0,190
	0,040	0,041	0,143	0,095	0,254	0,169
	0,021	0,021	0,088	0,059	0,216	0,144
B 23-51	0,035	0,036	0,092	0,061	0,234	0,156
	0,020	0,020	0,070	0,047	0,058	0,039
	0,042	0,043	0,091	0,061	0,340	0,227
	0,020	0,020	0,096	0,064	0,165	0,110
B 52-84	0,029	0,029	0,080	0,053	0,149	0,099
	0,049	0,050	0,189	0,126	0,436	0,291
	0,067	0,068	0,099	0,066	0,394	0,263
	0,036	0,037	0,161	0,107	0,367	0,245
	0,068	0,069	0,189	0,126	0,281	0,187
	0,080	0,081	0,273	0,182	0,516	0,344
B 85-121	0,085	0,086	0,281	0,187	0,776	0,517
	0,082	0,083	0,241	0,161	0,318	0,212
	0,116	0,118	0,169	0,113	0,351	0,234
	0,229	0,233	0,360	0,240	0,055	0,037
	0,058	0,059	0,402	0,268	0,225	0,150
B 122-152	0,070	0,071	0,170	0,113	0,431	0,287
	0,212	0,215	0,125	0,083	0,524	0,349
	0,100	0,102	0,329	0,219	0,341	0,227
	0,074	0,075	0,540	0,360	0,622	0,415
B 153-186	0,125	0,127	0,354	0,236	0,441	0,294
	0,096	0,098	0,217	0,145	0,539	0,359
	0,070	0,071	0,508	0,339	0,866	0,577
B 187-220	0,279	0,284	0,214	0,143	0,260	0,173
	0,278	0,283	0,251	0,167	0,303	0,202
	0,424	0,431	0,406	0,271	0,478	0,319
	4,047	4,113	0,137	0,091	0,531	0,354
	0,085	0,087	0,225	0,150	0,458	0,305
B 221-258	0,089	0,090	0,076	0,051	0,282	0,188
	0,230	0,234	0,285	0,190	0,358	0,238
	0,280	0,284	0,627	0,418	0,657	0,438
	0,285	0,289	0,414	0,276	0,303	0,202
	0,240	0,244	0,613	0,409		
B 259-294		0,000	0,077	0,051	0,204	0,136
	0,163	0,166	0,184	0,123		
	0,133	0,135	0,248	0,165	0,082	0,055
	0,156	0,158	0,337	0,225	0,134	0,090
B 295-331	0,223	0,226	0,335	0,224	0,067	0,044
	0,194	0,197	0,290	0,194	0,067	0,045
	0,198	0,202	0,139	0,093	0,130	0,087
	0,162	0,164	0,139	0,092	0,090	0,060
B 332-366	0,209	0,212	0,260	0,173	0,125	0,125
	0,218	0,222	0,145	0,097	0,208	0,138
	0,037	0,038	0,082	0,055	0,080	0,080
	0,016	0,016	0,100	0,067	0,089	0,059
	0,018	0,019	0,116	0,078	0,156	0,104
	0,009	0,009	0,083	0,055	0,169	0,113
B 367-406	0,033	0,034	0,120	0,080	0,031	0,021
	0,037	0,038	0,125	0,084	0,058	0,038
	0,059	0,060	0,095	0,064	0,161	0,107
	0,054	0,055	0,096	0,064	0,171	0,114
	0,037	0,037	0,090	0,060	0,208	0,139
B 407-442		0,000	0,113	0,075	0,255	0,170
	0,020	0,021	0,122	0,081	0,243	0,162
	0,023	0,024	0,104	0,069	0,243	0,162
	0,028	0,028	0,114	0,076	0,192	0,128
	0,030	0,030	0,075	0,050	0,157	0,105
	0,048	0,048	0,127	0,085	0,181	0,121

Field blanks of Filter pack B Dec. 02- Oct. 04

	Nylon			KOH		
	NO_3	HNO_3	SO_4	SO_2	SO_4	SO_2
B 443-478	0,163	0,166	0,283	0,189	0,822	0,548
	0,366	0,372	0,291	0,194	0,070	0,047
	0,301	0,306	0,330	0,220	0,020	0,013
	0,263	0,268	0,455	0,303	0,088	0,059
	0,302	0,307	0,347	0,231	0,145	0,097
B 479-513	0,345	0,351	0,384	0,256	0,129	0,086
	0,291	0,296	0,334	0,222	0,282	0,188
	0,278	0,283	0,397	0,265	0,363	0,242
	0,380	0,386	0,500	0,333	0,562	0,375
	0,248	0,252	0,490	0,327	0,352	0,235
	0,269	0,273	0,344	0,229	0,212	0,142
B 514-563	0,577	0,586	0,481	0,321	0,061	0,041
	0,328	0,333	0,445	0,297	0,021	0,014
	0,270	0,274	0,363	0,242	0,146	0,097
	0,262	0,266	0,645	0,430	0,176	0,117
	0,273	0,277	0,502	0,335	0,178	0,119
	0,280	0,284	0,340	0,227	0,370	0,247
	0,221	0,224	0,398	0,266	0,228	0,152
	0,264	0,268	0,297	0,198	0,451	0,300

Percentage values above Detection limit

	Cl^-	NO_3^-	SO_4^{2-}	Oxalat	Na^+	NH_4^+	K^+	Mg^{2+}	Ca^{2+}	HNO_3	SO_2	NH_3
Dez.02	0	10	17	9	1	15	0	6	10	13	12	15
n =20	0%	50%	85%	45%	5%	75%	0%	35%	50%	65%	60%	75%
Jän.03	0	10	13	6	0	13	0	0	3	9	7	1
n =13	0%	77%	100%	46%	0%	100%	0%	0%	23%	69%	54%	8%
Feb.03	1	10	25	19	5	25	2	4	12	22	20	1
n =26	4%	38%	96%	73%	19%	92%	8%	15%	46%	85%	77%	4%
Mär.03	15	2	1	6	13	2	12	16	6	3	5	2
n =16	6%	87%	94%	62%	19%	92%	8%	15%	46%	85%	77%	4%
Apr.03	2	25	27	24	4	27	19	12	16	27	23	26
n =27	7%	93%	100%	92%	15%	100%	70%	44%	59%	100%	87%	96%
Mai.03	3	12	14	11	2	12	10	7	10	14	7	13
n =14	27%	86%	100%	79%	14%	86%	71%	50%	71%	100%	50%	93%
Jun.03	8	19	19	19	5	19	13	15	19	18	18	19
n =19	42%	100%	100%	100%	26%	100%	68%	79%	100%	95%	95%	100%
Jul.03	8	23	25	23	4	26	10	15	25	25	27	27
n =27	30%	85%	93%	85%	18%	96%	37%	55%	93%	93%	100%	100%
Aug.03	0	25	29	27	9	29	19	18	28	28	28	29
n =20	0%	86%	100%	93%	31%	100%	65%	62%	97%	97%	97%	100%
Sep.03	0	12	16	15	0	14	4	0	11	15	15	14
n =20	0%	75%	100%	94%	0%	88%	25%	0%	69%	94%	94%	88%
Okt.03	2	13	25	13	1	20	2	2	15	26	20	11
n =20	8%	50%	96%	50%	4%	77%	8%	8%	58%	100%	77%	42%
Nov.03	1	18	26	17	0	21	6	17	20	26	19	4
n =20	4%	70%	100%	65%	0%	81%	23%	65%	77%	100%	73%	15%
Dez.03	1	18	24	13	5	23	4	18	10	24	15	1
n =20	4%	75%	100%	54%	21%	96%	16%	75%	42%	100%	63%	4%
Jan. 04	4	17	22	8	8	22	10	2	12	22	20	0
n = 22	18%	77%	100%	36%	36%	100%	45%	9%	54%	100%	91%	0%
Feb.04	5	11	13	6	5	12	9	2	11	15	15	6
n =15	33%	73%	87%	40%	33%	80%	60%	13%	73%	100%	100%	40%
Mär.04	8	23	25	19	3	25	15	12	23	25	24	13
n = 25	32%	92%	100%	76%	12%	100%	60%	48%	92%	100%	96%	52%
Apr.04	15	14	27	21	0	22	12	7	22	23	17	16
n = 27	55%	52%	100%	78%	0%	81%	44%	26%	81%	85%	63%	59%
Mai.04	6	16	23	21	1	19	7	4	14	23	12	19
n = 24	25%	67%	96%	87%	4%	79%	29%	17%	58%	96%	50%	79%
Jun.04	5	18	19	18	1	19	7	9	11	20	15	18
n =20	25%	90%	95%	90%	5%	95%	35%	45%	55%	100%	75%	90%
Jul.04	3	14	16	14	1	13	9	6	9	15	15	15
n = 26	11%	54%	61%	54%	4%	50%	35%	23%	35%	58%	58%	58%
Aug.04	0	9	10	9	0	10	10	0	0	10	9	10
n = 10	0%	90%	100%	90%	0%	100%	100%	0%	0%	100%	90%	100%
Sep.04	3	11	26	16	1	20	9	3	10	25	19	20
n = 27	11%	41%	96%	59%	4%	74%	33%	11%	37%	93%	70%	74%

	Cl-	NO3-	SO42-	Oxalat	Na+	NH4+	K+	Mg2+	Ca2+	HNO3	SO2	NH3
	90	330	442	334	69	408	189	175	297	428	362	280
Above DL	2%	72%	96%	73%	15%	89%	41%	38%	65%	93%	79%	61%
Bellow DL	98%	28%	4%	27%	85%	11%	59%	62%	35%	7%	21%	39%

SCAVENGING RATIOS **Dec.02-Sep.04**

Aerosols [µg/m³]

Months	NO_3^-	SO_4^{2-}	NH4	HNO_3	NO3+HNO3	
Dec.02	29,6	86,5	34,1	57,4	87,0	
Jan.03	72,9	164,2	44,2	47,2	120,0	
Feb.03	34,3	446,3	102,9	102,6	136,9	
Mar.03	445,3	319,5	114,3	121,8	567,1	
Abr.03	826,9	1037,0	515,2	211,6	1038,4	
May 03	500,6	922,6	303,4	145,6	646,3	
Jun.03	540,7	1311,0	461,0	353,3	894,0	
Jul.03	188,8	974,5	345,5	1055,3	1244,1	
Ago.03	526,5	1798,9	656,1	1269,1	1795,6	
Sep.03	72,8	595,0	265,8	858,5	931,2	
Oct.03	26,0	377,3	137,0	409,4	435,3	
Nov.03	74,8	389,7	107,7	211,2	286,0	
May 03	689,9	744,0	266,3	906,3	1596,2	
Jun.04	1112,8	835,7	318,2	1247,4	2360,2	
Jul.04	812,3	1234,9	442,9	1483,7	2295,9	
Ago.04	436,8	1235,3	447,0	1261,9	1698,7	
Sep.04	356,0	719,2	247,2	813,8	1169,8	

Precipitations [µg/l] *Scavenging Ratios*

Months	NH_4^+	NO_3^-	SO_4^{2-}	W_{NO3}	W_{SO4}	W_{NH4}
Dec.02	50,3	507,8	375,3	8,8	4,3	1,5
Jan.03	31,3	247,1	124,7	5,2	0,8	0,7
Feb.03	37,0	80,8	31,9	0,8	0,1	0,4
Mar.03	152,9	717,0	305,4	5,9	1,0	1,3
Abr.03	613,5	1265,4	1260,6	6,0	1,2	1,2
May 03	616,2	1260,5	1130,7	8,6	1,2	2,0
Jun.03	657,6	1155,7	1051,8	3,3	0,8	1,4
Jul.03	574,7	1207,9	1049,8	1,1	1,1	1,7
Ago.03	552,6	1096,3	1106,5	0,9	0,6	0,8
Sep.03	436,3	1402,7	1026,2	1,6	1,7	1,6
Oct.03	59,6	227,1	184,0	0,6	0,5	0,4
Nov.03	10,0	166,1	170,2	0,8	0,4	0,1
May 03	457,7	1420,1	748,8	1,6	1,0	1,7
Jun.04	441,0	1184,1	720,1	0,9	0,9	1,4
Jul.04	384,0	998,4	775,3	0,7	0,6	0,9
Ago.04	381,6	1051,2	879,1	0,8	0,7	0,9
Sep.04	300,5	819,7	459,3	1,0	0,6	1,2

Aerosol and gases concentration values in µg pro Normcubicmeter **Dec.02/ May 03/ Jul.04**

		Aerosol (Anions) [µg/Nm^3]			Aerosol (Kations) [µg/Nm^3]					Gas [µg/Nm^3]		
Samples	Date	Chloride	Nitrate	Sulphate	Na	NH4	K	Mg	Ca	HNO$_3$	SO$_2$	NH3
C 0	***10.12.2002***	0,0020	0,0247	0,3111	0,0026	0,0728	0,0029		0,0654	0,1055	0,4021	0,0121
C 1	***12.12.2002***	0,0060	0,0247	0,1676	0,0098	0,0106	0,0010		0,0340	0,0556	0,2765	0,0903
C 2	***13.12.2002***	0,0121	0,1320	0,2284	0,8215	0,0494	0,0045		0,0834	0,0091	0,1657	0,0121
C 3	***14.12.2002***	0,0020	0,0247	0,1696	0,0054	0,0363	0,0010		0,0977	0,2982	0,0712	0,0121
C 4	***15.12.2002***	0,0020	0,0774	0,2137	0,0026	0,0360	0,0021		0,0802	0,0817	0,0980	0,0121
C 5	***16.12.2002***	0,0020	0,0247	0,0383	0,0055	0,0106	0,0010		0,0145	0,0672	0,0351	0,0121
C 7	***17.12.2002***	0,0020	0,0247	0,0699	0,0026	0,0106	0,0010		0,0145	0,0956	0,0991	0,0121
C 8	***18.12.2002***	0,0020	0,0247	0,2354	0,0026	0,0718	0,0051		0,0399	0,4914	0,2576	0,0121
C 9	***19.12.2002***	0,0045	0,0247	0,1098	0,0026	0,0106	0,0010		0,0673	0,0429	0,0351	0,0121
C 10	***20.12.2002***	0,0049	0,0247	0,0447	0,0026	0,0106	0,0040		0,0554	0,0329	0,1211	0,0121
C 11	***21.12.2002***	0,0348	0,0247	0,0513	0,0285	0,0106	0,0226		0,0145	0,0098	0,0351	0,0121
C 13	***22.12.2002***	0,0020	0,0247	0,0112	0,0026	0,0106	0,0010		0,0145	0,0028	0,0351	0,0121
C 14	***23.12.2002***	0,0069	0,0247	0,0024	0,0026	0,0106	0,0029		0,0145	0,0024	0,0351	0,0121
C 15	***16.05.2003***	0,0018	0,9220	1,4767	0,0180	0,5875	0,0405	0,0318	0,2336	0,0916	0,7952	0,2130
C 16	***17.05.2003***	0,0086	0,0448	0,5400	0,0180	0,1477	0,0276	0,0072	0,0571	0,1196	0,3030	0,1748
C 17	***18.05.2003***	0,0059	0,0714	1,3830	0,0180	0,4355	0,0589	0,0202	0,1122	0,0386	0,3660	0,3562
C 19	***19.05.2003***	0,0018	0,6547	1,4661	0,0180	0,5492	0,0678	0,0187	0,0892	0,1542	0,3188	0,4600
C 20	***20.05.2003***	0,0018	0,0135	0,0334	0,0180	0,1813	0,0082	0,0110	0,0600	0,0148	0,0516	0,0674
C 21	***21.05.2003***	0,0018	0,0135	0,1113	0,0366	0,0314	0,0235	0,0031	0,0222	0,0105	0,0854	0,0674
C 22	***22.05.2003***	0,0018	0,0135	0,1199	0,0180	0,0231	0,0082	0,0069	0,0226	0,0102	0,1438	0,0674
C 23	***23.05.2003***	0,0939	0,8545	0,8500	0,1630	0,2001	0,0578	0,0439	0,5624	0,0176	0,0985	0,1600
C 25	***24.05.2003***	0,0094	0,3676	1,5136	0,0180	0,4373	0,0598	0,0335	0,2176	0,1119	0,4890	0,3963
C 26	***25.05.2003***	0,0052	0,0654	2,6521	0,0180	0,8206	0,0679	0,0253	0,1096	0,0733	0,4574	0,3500
C 27	***26.05.2003***	0,0018	0,0135	2,8129	0,0180	1,0018	0,0400	0,0242	0,0871	0,0784	0,3252	0,0674
C 28	***27.05.2003***	0,0054	0,3030	2,3633	0,0180	0,6192	0,0660	0,0278	0,3116	0,0389	0,3992	0,0674
C 30	***01.07.2004***	0,0020	0,6379	2,2846	0,0145	0,3879	0,0077	0,0216	0,1028	0,1609	0,4437	0,1083
C 40	***02.07.2004***	0,0020	53,6212	0,1538	0,0026	1,1247	0,0010	0,0008	0,0145	0,0496	0,8277	0,2736
C 41	***03.07.2004***	0,0076	0,0247	0,5150	0,0170	0,0632	0,0100	0,0008	0,0145	0,0708	0,1847	0,1105
C 42	***04.07.2004***	0,0020	0,1653	1,1374	0,0335	0,2642	0,0150	0,0031	0,0901	0,1397	0,3141	0,0121
C 44	***05.07.2004***	0,0020	70,4590	2,7775	0,0061	0,8908	0,0028	0,0008	0,0145	0,1417	1,1470	0,1248
C 45	***06.07.2004***	0,0020	0,3014	1,0689	0,0202	0,2215	0,0142	0,0309	0,1992	0,1207	0,3613	0,0877
C 46	***11.07.2004***	0,0097	0,3649	0,1505	0,0108	0,0334	0,0050	0,0226	0,1896	0,0271	0,0871	0,2714
C 47	***12.07.2004***	0,0020	0,0247	0,0066	0,0062	0,0106	0,0035	0,0008	0,0145	0,1111	0,1058	0,0273
C 48	***13.07.2004***	0,0148	0,0247	0,1506	0,0093	0,0106	0,0113	0,0008	0,1307	0,0004	0,1585	0,2687
C 49	***14.07.2004***	0,0020	0,0247	0,4762	0,0196	0,0106	0,0168	0,0108	0,3495	0,0226	0,1988	0,2238
C 50	***15.07.2004***	0,0020	0,0247	0,3231	0,0766	0,0457	0,0203	0,0008	0,0145	0,0303	0,1688	0,3792
C 52	***16.07.2004***	0,0230	0,8324	0,7583	0,0755	0,0106	0,0396	0,0256	1,9286	0,0004	0,1481	0,4934
C 53	***17.07.2004***	0,0020	0,3268	1,3993	0,0334	0,4178	0,0425	0,0091	0,1341	0,0593	0,6223	0,3383

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT AZORES *Jul. 02 - Jul. 04*

Sample Code	Starting date of sampling	End date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP		
AZO 01	8.Jul2002	15.Jul2002	0,71		11,7	19,9			2,4	
AZO 02	15.Jul2002	22.Jul2002	3,01	8,03	49,9	84,8	36,2	79,6	2,4	2,2
AZO 03	29.Jul2002	5.Aug2002	0,72		11,9	20,3			5,7	
AZO 04	5.Aug2002	12.Aug2002	0,70		11,5	19,6			5,7	
AZO 05	12.Aug2002	19.Aug2002	3,37	6,24	55,8	94,9	28,1	61,8	30,2	19,6
AZO 06	19.Aug2002	26.Aug2002	1,70	3,50	28,2	47,9	15,8	34,7	7,2	5,2
AZO 07	26.Aug2002	2.Sep2002	1,07	2,98	17,8	30,2	13,4	29,6	6,0	5,9
AZO 08	2.Sep2002	9.Sep2002		8,46		0,0	38,1	83,8	0,0	39,1
AZO 09	9 Sep2002	16.Sep2002	24,78	9,96	410,1	697,2	44,9	98,7	97,1	13,7
AZO 10	16.Sep2002	24.Sep2002	13,67		226,3	384,7			39,8	
AZO 11	24.Sep2002	30.Sep2002	6,74	30,47	111,6	189,6	137,3	302,0	251,9	401,1
AZO 12	30.Sep2002	7 Okt2002	14,25	11,55	235,9	401,1	52,0	114,4	34,9	10,0
AZO 13	28.Okt2002	4.Nov2002	3,30		54,6	92,8			22,2	
AZO 14	11.Nov2002	18.Nov2002	19,56		323,8	550,5			81,6	
AZO 15	20.Nov2002	28.Nov2002	1,39	2,59	22,9	39,0	11,7	25,7		
AZO 16	5 Dez2002	12.Dez2002	35,33		584,9	994,3			273,1	
AZO 17	12.Dez2002	19.Dez2002	0,69		11,4	19,5			13,7	
AZO 22	30.Jän2003	6.Feb2003	8,88	3,92	146,9	249,8	17,7	38,9	55,5	8,6
AZO 23	6 Feb2003	13.Feb2003	4,67	2,42	77,4	131,5	10,9	24,0	48,9	8,9
AZO 24	13.Feb2003	20.Feb2003	3,02	4,39	50,0	85,0	19,8	43,5	10,1	5,1
AZO 25	20.Feb2003	27.Feb2003	26,86	8,68	444,6	755,9	39,1	86,1	198,8	22,6
AZO 26	6 Mär2003	13.Mär2003	0,96	5,59	15,9	27,0	25,2	55,4	12,4	25,4
AZO 27	13.Mär2003	20.Mär2003	8,60	6,20	142,4	242,1	27,9	61,5	74,9	19,0
AZO 28	20.Mär2003	27.Mär2003	6,43	2,46	106,4	180,9	11,1	24,4	67,2	9,1
AZO 29	27 Mär2003	4.Apr2003	1,36		22,6	38,4			8,3	
AZO 30	4.Apr2003	11.Apr2003	3,35		55,5	94,4			38,7	
AZO 32	2 Mai2003	8.Mai2003	1,67	6,04	27,7	47,0	27,2	59,8	8,7	11,1
AZO 33	8.Mai2003	15.Mai2003	0,65		10,8	18,3		0,0	4,5	
AZO 34	15.Mai2003	22 Mai2003	6,25	3,49	103,5	176,0	15,7	34,6	25,0	4,9
AZO 35	22.Mai2003	29.Mai2003	6,59	3,71	109,1	185,4	16,7	36,8	25,8	5,1
AZO 36	29.Mai2003	5.Jun2003	7,30	3,96	120,9	205,5	17,8	39,2	24,8	4,7
AZO 37	5.Jun2003	12.Jun2003	9,14	3,63	151,3	257,2	16,3	35,9	17,3	2,4
AZO 38	12 Jun2003	26.Jun2003	2,33	2,55	38,6	65,7	11,5	25,3	10,6	4,1
AZO 40	3.Jul2003	10.Jul2003	3,31		54,8	93,2			24,9	
AZO 41	10.Jul2003	17.Jul2003	5,86	6,56	97,1	165,0	29,5	65,0	23,3	9,2
AZO 42	17.Jul2003	24.Jul2003	12,21	3,98	202,2	343,7	17,9	39,4	79,7	9,1
AZO 43	24.Jul2003	31.Jul2003	29,66		490,9	834,6			167,6	
AZO 44	31.Jul2003	7.Aug2003	4,79	5,68	79,2	134,7	25,6	56,3	15,8	6,6
AZO 45	7.Aug2003	15.Aug2003	9,37	2,97	155,1	263,8	13,4	29,4	43,7	4,9
AZO 46	15.Aug2003	23.Aug2003	17,70	22,19	293,1	498,2	100,0	219,9	43,4	19,1
AZO 47	23.Aug2003	28.Aug2003	2,60	3,73	43,1	73,2	16,8	37,0	8,0	4,0
AZO 48	28.Aug2003	3 Sep2003	5,82		96,3	163,7			16,5	
AZO 49	3.Sep2003	18.Sep2003	3,97		65,7	111,7			34,3	
AZO 50	18.Sep2003	25.Sep2003	4,72		78,1	132,8			26,1	
AZO 51	25.Sep2003	2.Okt2003	4,77	3,51	79,0	134,3	15,8	34,8	19,9	5,2
AZO 52	2.Okt2003	9.Okt2003	10,16	6,23	168,2	286,0	28,0	61,7	48,4	10,4
AZO 53	9.Okt2003	16.Okt2003	4,36	4,84	72,1	122,6	21,8	47,9	11,8	4,6
AZO 54	16.Okt2003	23.Okt2003	4,41	3,95	73,0	124,1	17,8	39,1	16,7	5,3
AZO 56	13.Nov2003	20.Nov2003	2,15		35,6	60,5			34,5	
AZO 57	20.Nov2003	27.Nov2003	5,88	2,65	97,4	165,5	11,9	26,2	80,2	12,7
AZO 58	27.Nov2003	4 Dez2003	5,14		85,1	144,7			26,8	
AZO 59	4.Dez2003	11.Dez2003	5,62		93,0	158,2			29,2	
AZO 60	11.Dez2003	17.Dez2003	1,47	4,70	24,4	41,5	21,2	46,6	4,7	5,3
AZO 61	17.Dez2003	23.Dez2003	10,60	5,62	175,5	298,3	25,3	55,7	64,1	12,0
AZO 62	23.Dez2003	7.Jän2004	1,84	3,68	30,5	51,9	16,6	36,4	14,5	10,1
AZO 63	7.Jän2004	15.Jän2004	7,47		123,7	210,3			41,4	
AZO 64	15.Jän2004	22.Jän2004	4,18	2,64	69,3	117,7	11,9	26,1	17,7	3,9
AZO 65	22 Jän2004	29.Jän2004	1,63	2,34	26,9	45,8	10,5	23,2	11,0	5,6
AZO 66	29.Jän2004	4 Feb2004	1,01		16,8	28,5			5,1	
AZO 67	4.Feb2004	12.Feb2004				0,0			0,0	
AZO 68	12.Feb2004	20.Feb2004	3,61	2,98	59,7	101,5	13,4	29,5	20,1	5,9
AZO 69	20.Feb2004	26.Feb2004	2,60	6,87	43,0	73,1	30,9	68,0	22,2	20,6

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT AZORES *Jul. 02 - Jul. 04*

Sample Code	Starting date of sampling	En.a. date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke(OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP		
AZO 70	26.Feb2004	4.Mär2004	4,61	3,96	76,3	129,6	17,9	39,3	28,0	8,5
AZO 71	4.Mär2004	13.Mär2004	0,58		9,7	16,4			6,5	
AZO 73	26.Mär2004	1.Apr2004	2,44		40,3	68,5				
AZO 74	1.Apr2004	7.Apr2004	5,83	12,83	96,4	163,9	57,8	127,2	19,9	15,5
AZO 75	7.Apr2004	15.Apr2004	2,04		33,8	57,4				
AZO 76	15.Apr2004	27.Apr2004	16,04		265,5	451,4			87,7	
AZO 77	27.Apr2004	6.Mai2004	2,59		42,9	72,9				
AZO 78	6.Mai2004	14.Mai2004	1,69		28,0	47,7			30,5	
AZO 79	14.Mai2004	20.Mai2004	2,15	3,28	35,5	60,4	14,8	32,5	15,3	8,2
AZO 80	20.Mai2004	27.Mai2004	0,48		8,0	13,6			3,4	
AZO 81	27.Mai2004	3.Jun2004	3,33		55,1	93,7			13,1	
AZO 82	3.Jun2004	11.Jun2004	2,85		47,3	80,3			15,1	
AZO 83	11.Jun2004	22.Jun2004	0,74	8,59	12,3	20,9	38,7	85,1	2,8	11,5
AZO 84	22.Jun2004	2.Jul2004	5,72		94,7	161,0			36,0	

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT AVEIRO *Jul. 02 - Jul. 04*

Sample Code	Starting date of sampling	End. date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP
AVE 01	1.Jul2002	8.Jul2002	11,30	12,62	187,1	318,1	56,8	125,0	11,3	4,4
AVE 02	8.Jul2002	15.Jul2002	12,67	9,89	209,7	356,5	44,5	98,0	13,6	3,7
AVE 03	15.Jul2002	22.Jul2002	9,39	23,96	155,4	264,1	107,9	237,5	4,0	3,6
AVE 04	22.Jul2002	29.Jul2002	11,49	25,39	190,2	323,3	114,4	251,6	7,1	5,5
AVE 05	29.Jul2002	5.Aug2002	10,75	22,68	177,9	302,4	102,2	224,8	6,6	4,9
AVE 06	5.Aug2002	12.Aug2002	27,02	24,21	447,3	760,4	109,1	239,9	16,0	5,1
AVE 07	12.Aug2002	19.Aug2002	6,12	25,75	101,4	172,4	116,0	255,2	3,8	5,6
AVE 08	19.Aug2002	26.Aug2002	32,68	19,15	541,0	919,6	86,3	189,8	14,5	3,0
AVE 09	26.Aug2002	2.Sep2002	29,34	34,11	485,7	825,6	153,7	338,1	6,3	2,6
AVE 10	2.Sep2002	9.Sep2002	46,39	14,45	767,9	1305,4	65,1	143,2	19,0	2,1
AVE 11	9.Sep2002	16.Sep2002	79,57	9,95	1317,2	2239,2	44,8	98,6	23,2	1,0
AVE 12	18.Sep2002	23.Sep2002	28,28	9,20	468,1	795,7	41,5	91,2	21,5	2,5
AVE 13	23.Sep2002	30.Sep2002	80,75	17,11	1336,7	2272,5	77,1	169,5	24,3	1,8
AVE 14	30.Sep2002	7.Okt2002	105,06	14,63	1739,1	2956,5	65,9	145,0	24,4	1,2
AVE 15	7.Okt2002	14.Okt2002	43,49	10,82	720,0	1223,9	48,7	107,2	18,8	1,6
AVE 16	14.Okt2002	21.Okt2002	122,51	48,50	2028,0	3447,6	218,5	480,6	73,2	10,2
AVE 17	21.Okt2002	28.Okt2002	97,39	9,09	1612,2	2740,7	40,9	90,1	70,7	2,3
AVE 18	28.Okt2002	4.Nov2002	41,77	11,44	691,4	1175,4	51,5	113,4	19,6	1,9
AVE 19	4.Nov2002	11.Nov2002	80,60	7,29	1334,2	2268,2	32,8	72,3	12,5	0,4
AVE 20	11.Nov2002	18.Nov2002	152,47	11,44	2524,0	4290,8	51,6	113,4	54,0	1,4
AVE 21	18 Nov2002	25.Nov2002	146,53	21,80	2425,6	4123,5	98,2	216,0	50,8	2,7
AVE 22	25.Nov2002	2.Dez2002	81,09	6,69	1342,4	2282,1	30,1	66,3	30,2	0,9
AVE 23	2.Dez2002	9.Dez2002	288,81	28,34	4780,9	8127,6	127,7	280,9	35,9	1,2
AVE 24	9.Dez2002	16.Dez2002	228,16	21,14	3777,0	6420,9	95,2	209,5	47,6	1,6
AVE 25	16.Dez2002	23.Dez2002	84,82	20,52	1404,1	2387,0	92,4	203,4	32,1	2,7
AVE 26	23.Dez2002	26.Dez2002	128,01	3,33	2119,1	3602,4	15,0	33,0	96,1	0,9
AVE 27	26.Dez2002	2.Jän2003	280,75	19,65	4647,5	7900,8	88,5	194,7	112,5	2,8
AVE 28	2.Jän2003	9.Jän2003	276,72	8,91	4580,8	7787,4	40,1	88,3	105,6	1,2
AVE 29	9.Jän2003	16.Jän2003	557,74	72,97	9232,9	15695,9	328,7	723,2	58,3	2,7
AVE 30	16 Jän2003	23.Jän2003	435,46	94,45	7208,6	12254,6	425,4	936,0	79,1	6,0
AVE 31	23.Jän2003	30.Jän2003	656,28	23,65	10864,0	18468,8	106,5	234,4	64,0	0,8
AVE 32	30.Jän2003	6.Feb2003	337,25	8,50	5582,8	9490,8	38,3	84,2	83,6	0,7
AVE 33	6.Feb2003	13.Feb2003	399,66	70,16	6616,0	11247,2	316,0	695,3	46,0	2,8
AVE 34	13.Feb2003	20.Feb2003	412,00	40,56	6820,3	11594,4	182,7	402,0	64,5	2,2
AVE 35	20.Feb2003	27.Feb2003	247,56	17,97	4098,2	6966,9	81,0	178,1	102,0	2,6
AVE 36	27.Feb2003	6.Mär2003	201,91	15,54	3342,4	5682,0	70,0	154,0	97,9	2,7
AVE 37	6.Mär2003	13.Mär2003	447,24	26,95	7403,6	12586,1	121,4	267,1	52,7	1,1
AVE 38	13.Mär2003	20 Mär2003	158,52	20,51	2624,1	4461,0	92,4	203,3	44,0	2,0
AVE 39	20.Mär2003	27.Mär2003	155,52	37,60	2574,4	4376,5	169,4	372,6	42,4	3,6
AVE 40	27.Mär2003	3.Apr2003	89,27	23,84	1477,7	2512,2	107,4	236,3	38,8	3,6
AVE 41	3.Apr2003	10 Apr2003	25,97	26,59	429,9	730,9	119,8	263,5	12,7	4,6
AVE 42	10.Apr2003	17.Apr2003	20,83	17,70	344,7	586,1	79,8	175,5	21,2	6,3
AVE 43	17.Apr2003	24 Apr2003	29,03	24,42	480,5	816,9	110,0	242,0	27,0	8,0
AVE 44	24.Apr2003	1.Mai2003	30,16	26,03	499,3	848,9	117,3	258,0	32,7	9,9
AVE 45	1.Mai2003	8.Mai2003	22,99	24,54	380,5	646,9	110,6	243,2	20,3	7,6
AVE 46	8.Mai2003	15 Mai2003	7,13	19,73	118,0	200,6	88,9	195,5	4,9	4,8
AVE 47	15.Mai2003	22.Mai2003	7,33	14,81	121,3	206,2	66,7	146,8	5,5	3,9
AVE 48	22.Mai2003	29.Mai2003	4,10	32,41	67,9	115,4	146,0	321,2	1,8	4,9
AVE 49	29.Mai2003	5.Jun2003	2,09	14,28	34,7	58,9	64,3	141,6	1,7	4,1
AVE 50	5.Jun2003	12.Jun2003	0,78	11,88	12,9	21,9	53,5	117,7	0,7	3,7
AVE 51	12.Jun2003	19.Jun2003	15,22	15,42	252,0	428,4	69,5	152,9	7,2	2,6
AVE 52	19.Jun2003	26.Jun2003	3,87	14,82	64,0	108,8	66,8	146,9	2,0	2,7
AVE 53	26.Jun2003	3.Jul2003	18,04	5,82	298,6	507,7	26,2	57,6	18,3	2,1
AVE 54	3.Jul2003	10.Jul2003	20,28	11,35	335,7	570,7	51,1	112,5	9,9	2,0
AVE 55	10.Jul2003	17.Jul2003	25,03	12,47	414,4	704,5	56,2	123,6	21,0	3,7
AVE 56	17.Jul2003	24.Jul2003	15,54	7,32	257,2	437,3	33,0	72,6	12,3	2,0
AVE 57	24.Jul2003	31.Jul2003	18,78	9,54	310,9	528,5	43,0	94,5	11,1	2,0
AVE 58	31.Jul2003	7.Aug2003	40,13	17,72	664,3	1129,2	79,8	175,6	8,4	1,3
AVE 59	7.Aug2003	14.Aug2003	16,43	14,84	272,0	462,5	66,9	147,1	6,2	2,0
AVE 60	14.Aug2003	21.Aug2003	12,17	13,03	201,4	342,4	58,7	129,1	10,8	4,1
AVE 61	21.Aug2003	28.Aug2003	21,35	11,57	353,4	600,8	52,1	114,7	17,2	3,3
AVE 62	28.Aug2003	4.Sep2003	46,30	7,64	766,4	1302,9	34,4	75,7	23,5	1,4
AVE 63	4.Sep2003	11.Sep2003	71,43	14,32	1182,5	2010,2	64,5	141,9	36,3	2,6
AVE 64	11.Sep2003	18.Sep2003	72,49	19,79	1200,0	2039,9	89,1	196,1	17,1	1,6
AVE 65	18.Sep2003	25.Sep2003	70,82	16,32	1172,3	1992,9	73,5	161,8	31,5	2,6
AVE 66	25.Sep2003	2.Okt2003	71,83	10,94	1189,1	2021,5	49,3	108,4	32,9	1,8

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT AVEIRO *Jul. 02 - Jul. 04*

Sample Code	Starting date of sampling	End. date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP
AVE 67	2 Okt2003	9.Okt2003	70,36	20,97	1164,7	1980,1	94,4	207,8	33,4	3,5
AVE 68	9.Okt2003	16.Okt2003	96,27	12,62	1593,6	2709,1	56,8	125,1	20,3	0,9
AVE 69	16.Okt2003	23.Okt2003	68,77	26,29	1138,4	1935,4	118,4	260,5	20,7	2,8
AVE 70	23.Okt2003	30.Okt2003	102,23	17,09	1692,2	2876,8	77,0	169,3	52,0	3,1
AVE 71	30.Okt2003	6 Nov2003	110,59	45,04	1830,8	3112,3	202,9	446,3	38,7	5,5
AVE 72	6.Nov2003	13.Nov2003	86,41	22,33	1430,5	2431,8	100,6	221,3	26,8	2,4
AVE 73	13.Nov2003	20.Nov2003	128,86	27,19	2133,2	3626,4	122,5	269,5	30,1	2,2
AVE 74	20.Nov2003	27.Nov2003	133,10	14,55	2203,3	3745,6	65,6	144,2	23,3	0,9
AVE 75	27.Nov2003	4 Dez2003	139,22	8,72	2304,7	3918,0	39,3	86,4	17,2	0,4
AVE 76	4.Dez2003	11.Dez2003	156,49	34,66	2590,5	4403,8	156,1	343,5	36,5	2,8
AVE 77	11.Dez2003	18.Dez2003	140,93	32,66	2332,9	3965,9	147,1	323,6	38,5	3,1
AVE 78	18 Dez2003	25 Dez2003	485,80	52,09	8042,0	13671,4	234,6	516,2	73,3	2,8
AVE 79	25 Dez2003	31.Dez2003	190,75	33,82	3157,6	5367,9	152,3	335,1	66,5	4,2
AVE 80	31.Dez2003	8.Jän2004	384,33	37,65	6362,3	10815,9	169,6	373,1	55,0	1,9
AVE 81	8.Jän2004	15.Jän2004	186,83	7,24	3092,8	5257,8	32,6	71,7	113,4	1,5
AVE 82	15.Jän2004	22.Jän2004	328,95	36,28	5445,4	9257,2	163,4	359,6	43,6	1,7
AVE 83	22.Jän2004	29.Jän2004	284,62	46,52	4711,6	8009,7	209,5	461,0	42,1	2,4
AVE 84	29.Jän2004	5.Feb2004	228,22	38,46	3778,0	6422,6	173,3	381,2	31,8	1,9
AVE 85	5.Feb2004	12.Feb2004	224,72	47,48	3720,0	6324,1	213,9	470,5	28,4	2,1
AVE 86	12.Feb2004	19 Feb2004	219,25	51,72	3629,4	6170,0	233,0	512,5	24,4	2,0
AVE 87	19.Feb2004	26.Feb2004	169,25	38,11	2801,8	4763,0	171,7	377,7	40,1	3,2
AVE 88	26.Feb2004	4.Mär2004	190,92	39,11	3160,5	5372,9	176,2	387,6	38,7	2,8
AVE 89	4 Mär2004	11 Mär2004	211,66	42,21	3503,8	5956,5	190,1	418,3	54,9	3,9
AVE 90	11.Mär2004	18.Mär2004	218,23	39,50	3612,6	6141,5	177,9	391,5	45,5	2,9
AVE 91	18.Mär2004	25.Mär2004	137,09	37,38	2269,5	3858,1	168,4	370,5	44,2	4,2
AVE 92	25.Mär2004	1.Apr2004	53,70	15,68	889,0	1511,3	70,6	155,4	35,6	3,7
AVE 93	1.Apr2004	8.Apr2004	92,82	27,73	1536,6	2612,2	124,9	274,8	40,1	4,2
AVE 94	8.Apr2004	15.Apr2004	76,11	39,04	1260,0	2141,9	175,9	386,9	30,9	5,6
AVE 95	15 Apr2004	22.Apr2004	29,35	7,27	485,8	825,8	32,8	72,1	33,9	3,0
AVE 96	22.Apr2004	29 Apr2004	41,64	34,08	689,3	1171,9	153,5	337,7	16,7	4,8
AVE 97	29.Apr2004	6.Mai2004	20,13	6,56	333,2	566,5	29,6	65,0	24,8	2,8
AVE 98	6.Mai2004	13.Mai2004	41,54	3,40	687,7	1169,1	15,3	33,7	54,0	1,6
AVE 99	13.Mai2004	20 Mai2004	31,48	5,96	521,1	885,9	26,8	59,0	12,3	0,8
AVE 100	20.Mai2004	27.Mai2004	18,45		305,4	519,3			12,9	
AVE 101	27.Mai2004	3.Jun2004	14,28		236,4	401,9			13,9	
AVE 102	3.Jun2004	10.Jun2004	4,92	2,79	81,4	138,4	12,6	27,6	5,7	1,1
AVE 103	10.Jun2004	17.Jun2004	33,03	7,95	546,8	929,5	35,8	78,8	17,0	1,4

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT PUY DE DOME *Oct. 02 - Oct. 04*

Sample Code	Starting date of sampling	End date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP
HV-Pdd-01	25 Sep 2002	3 Okt 2002	14,70	37,70	243,3	413,7	169,8	373,6	15,1	13,7
HV-Pdd-02	3 Okt 2002	10 Okt 2002	1,29	12,82	21,3	36,2	57,7	127,0	2,6	8,9
HV-Pdd-03	10 Okt 2002	16 Okt 2002	5,74	9,33	95,1	161,6	42,0	92,5	13,7	7,8
HV-Pdd-04	16 Okt 2002	24 Okt 2002	6,29	16,57	104,1	177,0	74,7	164,2	37,2	34,5
HV-Pdd-05	24 Okt 2002	31 Okt 2002	7,80	5,11	129,1	219,5	23,0	50,6	28,1	6,5
HV-Pdd-06	31 Okt 2002	7 Nov 2002	4,57		75,6	128,6			13,5	
HV-Pdd-07	7 Nov 2002	14 Nov 2002	2,57	3,95	42,6	72,4	17,8	39,1	10,3	5,6
HV-Pdd-08	14 Nov 2002	21 Nov 2002	14,15	4,43	234,2	398,1	20,0	43,9	89,6	9,9
HV-Pdd-09	21 Nov 2002	28 Nov 2002	3,66		60,6	103,1			22,2	
HV-Pdd-10	28 Nov 2002	10 Dez 2002	3,53		58,4	99,3			54,7	
HV-Pdd-11	10 Dez 2002	17 Dez 2002	5,84		96,7	164,3			29,4	
HV-Pdd-12	17 Dez 2002	27 Dez 2002	5,45		90,2	153,3			26,9	
HV-Pdd-13	27 Dez 2002	3 Jän 2003	1,25		20,7	35,2			25,7	
HV-Pdd-14	3 Jän 2003	9 Jän 2003	21,41		354,5	602,6			84,9	
HV-Pdd-15	9 Jän 2003	16 Jän 2003	27,68		458,2	779,0			42,1	
HV-Pdd-16	16 Jän 2003	23 Jän 2003	8,14		134,8	229,1			50,6	
HV-Pdd-17	23 Jän 2003	31 Jän 2003	6,30		104,3	177,3			38,9	
HV-Pdd-18	31 Jän 2003	6 Feb 2003	3,45	3,43	57,1	97,1	15,4	34,0	30,7	10,7
HV-Pdd-19	6 Feb 2003	13 Feb 2003	8,18		135,4	230,1			44,0	
HV-Pdd-20	13 Feb 2003	20 Feb 2003	26,43	4,53	437,6	743,9	20,4	44,9	25,1	1,5
HV-Pdd-21	20 Feb 2003	27 Feb 2003	14,06	10,67	232,7	395,6	48,1	105,7	11,6	3,1
HV-Pdd-22	27 Feb 2003	6 Mär 2003	10,74	10,00	177,7	302,1	45,0	99,1	38,7	12,7
HV-Pdd-23	6 Mär 2003	13/03/03 9h00	27,28	31,90	451,5	767,6	143,7	316,1	50,5	20,8
HV-Pdd-24	13/03/03 10h00	20/03/03 9h15	47,54	9,59	787,1	1338,0	43,2	95,0	27,5	2,0
HV-Pdd-25	20 Mär 2003	27 Mär 2003	25,87	19,86	428,3	728,0	89,5	196,9	12,6	3,4
HV-Pdd-26	27 Mär 2003	3 Apr 2003	11,88	17,24	196,6	334,3	77,7	170,9	8,3	4,2
HV-Pdd-28	3 Apr 2003	10 Apr 2003	7,35	29,96	121,7	206,9	135,0	296,9	9,5	13,6
HV-Pdd-29	10 Apr 2003	17 Apr 2003	5,40	40,54	89,4	151,9	182,6	401,8	3,9	10,3
HV-Pdd-31	23 Apr 2003	30 Apr 2003	5,22	24,14	86,5	147,0	108,7	239,2	4,2	6,8
HV-Pdd-32	30 Apr 2003	7 Mai 2003	7,61	48,82	126,0	214,2	219,9	483,8	6,7	15,1
HV-Pdd-33	7 Mai 2003	15 Mai 2003	13,53	50,70	224,0	380,9	228,4	502,4	8,5	11,3
HV-Pdd-34	15 Mai 2003	22 Mai 2003	4,40	29,51	72,8	123,8	132,9	292,4	7,0	16,5
HV-Pdd-35	22 Mai 2003	28 Mai 2003	7,31	11,47	121,1	205,9	51,7	113,7	7,7	4,3
HV-Pdd-36	28 Mai 2003	5 Jun 2003	26,28	66,70	435,1	739,7	300,5	661,0	11,2	10,0
HV-Pdd-37	5 Jun 2003	12 Jun 2003	32,11	81,12	531,6	903,6	365,4	803,9	14,8	13,2
HV-Pdd-39	17 Jun 2003	24 Jun 2003	54,73	100,30	906,1	1540,3	451,8	993,9	33,5	21,6
HV-Pdd-40	24 Jun 2003	1 Jul 2003	35,33	58,43	584,8	994,2	263,2	579,0	14,5	8,4
HV-Pdd-41	1 Jul 2003	8 Jul 2003	88,72	47,58	1468,6	2496,6	214,3	471,5	56,9	10,7
HV-Pdd-42	8 Jul 2003	15 Jul 2003	71,02	55,90	1175,6	1998,6	251,8	554,0	16,3	4,5
HV-Pdd-43	15 Jul 2003		28,85	26,86	477,6	811,8	121,0	266,2	14,4	4,7
HV-Pdd-44	22 Jul 2003	28 Jul 2003	12,61	38,23	208,7	354,8	172,2	378,8	7,4	7,9
HV-Pdd-45	2 Sep 2003	11 Sep 2003	30,64	25,90	507,3	862,4	116,7	256,7	39,7	11,8
HV-Pdd-46	11 Sep 2003	18 Sep 2003	21,67	22,81	358,6	609,7	102,7	226,0	15,5	5,7
HV-Pdd-47	18 Sep 2003	25 Sep 2003	19,39	15,25	320,9	545,6	68,7	151,2	10,7	3,0
HV-Pdd-48	25 Sep 2003	2 Okt 2003	12,89	16,68	213,4	362,8	75,1	165,3	10,8	4,9
HV-Pdd-49	2 Okt 2003	9 Okt 2003		13,97			62,9	138,5		8,5
HV-Pdd-50	9 Okt 2003	16 Okt 2003	17,39	24,72	287,8	489,3	111,4	245,0	24,5	12,3
HV-Pdd-51	16 Okt 2003	29 Okt 2003	18,02	19,43	298,3	507,1	87,5	192,5	23,7	9,0
HV-Pdd-52	29 Okt 2003	6 Nov 2003	25,92	11,45	429,1	729,5	51,6	113,5	34,2	5,3
HV-Pdd-53	6 Nov 2003	13 Nov 2003	6,37		105,4	179,1			9,3	
HV-Pdd-54	13 Nov 2003	15/11/2003 ??	5,74	35,41	95,0	161,4	159,5	350,9	45,0	97,7
HV-Pdd-55	20 Nov 2003	27 Nov 2003	22,51	18,02	372,6	633,4	81,2	178,6	55,3	15,6
HV-Pdd-56	27 Nov 2003	4 Dez 2003	6,58	4,85	108,9	185,1	21,9	48,1	44,4	11,5
HV-Pdd-57	4 Dez 2003	11 Dez 2003	13,75	11,03	227,7	387,1	49,7	109,3	28,5	8,1
HV-Pdd-58	18 Dez 2003	2 Jän 2004		4,52			20,4	44,8		5,5
HV-Pdd-59	6 Jän 2004	13 Jän 2004	7,11	7,62	117,6	200,0	34,3	75,5	85,3	32,2
HV-Pdd-60	13 Jän 2004	19 Jän 2004	1,65	9,95	27,3	46,4	44,8	98,6	24,5	52,2
HV-Pdd-61	21 Jän 2004	29 Jän 2004	1,59	24,98	26,3	44,7	112,5	247,6	3,5	19,2
HV-Pdd-62	29 Jän 2004	5 Feb 2004	10,85	25,50	179,6	305,4	114,9	252,7	42,2	34,9
HV-Pdd-63	5 Feb 2004	11 Feb 2004	23,02	34,59	381,2	648,0	155,8	342,8	56,0	29,6
HV-Pdd-64	11 Feb 2004	18 Feb 2004	12,97	11,15	214,7	364,9	50,2	110,5	36,9	11,2
HV-Pdd-65	18 Feb 2004	25 Feb 2004	13,94	2,88	230,8	392,3	13,0	28,5	90,5	6,6

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT PUY DE DOME *Oct. 02 - Oct. 04*

Sample Code	Starting date of sampling	End date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP
HV-Pdd-66	25 Feb 2004	3 Mär 2004	28,02	30,26	463,8	788,5	136,3	299,8	32,9	12,5
HV-Pdd-67	3 Mär 2004	10 Mär 2004	5,88	5,51	97,3	165,4	24,8	54,6	23,5	7,8
HV-Pdd-68	10 Mär 2004	14 Mär 2004	9,37	9,02	155,2	263,8	40,6	89,4	44,3	15,0
HV-Pdd-69	17 Mär 2004	24 Mär 2004	12,32	27,94	203,9	346,7	125,9	276,9	44,9	35,8
HV-Pdd-70	24 Mär 2004	30 Mär 2004	18,48	7,48	305,9	520,1	33,7	74,1	20,7	2,9
HV-Pdd-71	30 Mär 2004	6 Apr 2004	3,57	10,36	59,0	100,3	46,7	102,7	8,8	9,0
HV-Pdd-72	6 Apr 2004	13 Apr 2004	11,18	41,25	185,1	314,7	185,8	408,8	26,0	33,8
HV-Pdd-73	13 Apr 2004	22 Apr 2004	14,42	33,57	238,7	405,8	151,2	332,7	45,5	37,3
HV-Pdd-74	22 Apr 2004	28 Apr 2004	15,27	86,44	252,7	429,7	389,4	856,6	14,9	29,7
HV-Pdd-75	28 Apr 2004	5 Mai 2004	10,25	29,33	169,7	288,4	132,1	290,6	24,0	24,1
HV-pdd-77	12 Mai 2004	19 Mai 2004	13,59	33,50	225,0	382,6	150,9	332,0	6,9	6,0
HV-pdd-78	19 Mai 2004	26 Mai 2004	11,66	60,57	193,0	328,1	272,9	600,3	5,7	10,4
HV-pdd-79	26 Mai 2004	2 Jun 2004	14,65	34,02	242,5	412,3	153,2	337,1	31,8	26,0
HV-pdd-80	2 Jun 2004	9 Jun 2004	24,38	46,24	403,7	686,2	208,3	458,2	18,5	12,3
HV-pdd-81	9 Jun 2004	16 Jun 2004	21,19	43,97	350,8	596,4	198,1	435,7	9,9	7,2
HV-pdd-82	16 Jun 2004	23 Jun 2004	21,84	31,64	361,5	614,5	142,5	313,5	18,0	9,2
HV-pdd-83	23 Jun 2004	30 Jun 2004	44,86	27,15	742,7	1262,5	122,3	269,0	36,5	7,8
HV-pdd-84	30 Jun 2004	7 Jul 2004	31,54	15,30	522,2	887,7	68,9	151,6	23,6	4,0
HV-pdd-85	7 Jul 2004	13 Jul 2004	40,12	11,85	664,1	1129,0	53,4	117,4	40,2	4,2
HV-pdd-86	13 Jul 2004	21 Jul 2004	86,09	38,30	1425,2	2422,8	172,5	379,5	46,0	7,2
HV-pdd-87	21 Jul 2004	27 Jul 2004	142,56	50,16	2360,0	4011,9	225,9	497,1	55,0	6,8
HV-pdd-88	27 Jul 2004	4 Aug 2004	77,53	59,45	1283,4	2181,8	267,8	589,1	25,7	6,9
HV-pdd-89	4 Aug 2004	11 Aug 2004	118,41	24,97	1960,2	3332,4	112,5	247,4	111,6	8,3
HV-pdd-91	26 Aug 2004	6 Sep 2004	11,34	2,87	187,6	319,0	12,9	28,5	21,6	1,9
HV-pdd-92	6 Sep 2004	15 Sep 2004	29,10	4,58	481,8	819,0	20,6	45,4	34,4	1,9

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT SCHAUINSLAND

Oct. 02- Oct. 04

Sample Code	Starting date of sampling	End date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP
SIL-02/01	12 Sep 2002	18 Sep 2002	28,34	29,87	469,2	797,6	134,5	296,0	10,8	4,0
SIL-02/02	15 Okt 2002	22 Okt 2002	13,72	21,01	227,1	386,1	94,6	208,2	23,9	12,9
SIL-02/03	22 Okt 2002	28 Okt 2002	13,90	21,72	230,1	391,2	97,8	215,2	24,0	13,2
SIL-02/04	28 Okt 2002	5 Nov 2002	12,66	10,54	209,5	356,2	47,5	104,4	16,5	4,8
SIL-02/05	5 Nov 2002	12 Nov 2002	10,67	6,59	176,6	300,3	29,7	65,3	31,3	6,8
SIL-02/06	12 Nov 2002	21 Nov 2002	33,81	16,92	559,6	951,4	76,2	167,6	51,0	9,0
SIL-02/07	21 Nov 2002	28 Nov 2002	4,22	7,50	69,9	118,8	33,8	74,3	10,8	6,7
SIL-02/08	28 Nov 2002	5 Dez 2002	8,67	2,83	143,5	243,9	12,8	28,1	22,5	2,6
SIL-02/09	5 Dez 2002	9 Dez 2002		4,29			19,3	42,5		5,4
SIL-02/10	9 Dez 2002	12 Dez 2002	31,53	21,79	522,0	887,4	98,2	216,0	44,2	10,8
SIL-02/11	12 Dez 2002	19 Dez 2002	7,98	6,43	132,1	224,6	29,0	63,7	23,6	6,7
SIL-02/12	19 Dez 2002	26 Dez 2002	16,96	9,91	280,8	477,3	44,6	98,2	48,7	10,0
SIL-02/13	26 Dez 2002	2 Jän 2003	14,90	7,46	246,7	419,4	33,6	74,0	65,3	11,5
SIL-03/01	2 Jän 2003	9 Jän 2003	51,98	10,31	860,5	1462,9	46,5	102,2	69,2	4,8
SIL-03/02	9 Jän 2003	16 Jän 2003	15,66	5,81	259,3	440,8	26,2	57,6	10,8	1,4
SIL-03/03	16 Jän 2003	23 Jän 2003	17,13	3,79	283,6	482,1	17,1	37,5	44,5	3,5
SIL-03/04	23 Jän 2003	30 Jän 2003	8,24	3,74	136,4	231,9	16,8	37,0	36,4	5,8
SIL-03/05	30 Jän 2003	6 Feb 2003	25,37	3,23	419,9	713,9	14,6	32,1	84,0	3,8
SIL-03/06	6 Feb 2003	13 Feb 2003	45,72	3,56	756,9	1286,6	16,0	35,3	46,6	1,3
SIL-03/07	13 Feb 2003	20 Feb 2003	55,99	5,88	926,8	1575,6	26,5	58,3	20,8	0,8
SIL-03/08	20 Feb 2003	27 Feb 2003	33,97	5,13	562,3	955,9	23,1	50,8	23,2	1,2
SIL-03/09	27 Feb 2003	6 Mär 2003	26,05	16,81	431,3	733,2	75,7	166,6	23,6	5,4
SIL-03/10	6 Mär 2003	13 Mär 2003	30,24	23,06	500,6	851,0	103,9	228,5	35,2	9,5
SIL-03/11	13 Mär 2003	20 Mär 2003	40,53	14,49	670,9	1140,5	65,3	143,6	30,5	3,8
SIL-03/12	20 Mär 2003	27 Mär 2003	23,54	27,57	389,7	662,5	124,2	273,3	12,4	5,1
SIL-03/13	27 Mär 2003	3 Apr 2003	13,77	101,16	228,0	387,6	455,7	1002,5	6,8	17,7
SIL-03/14	3 Apr 2003	10 Apr 2003	15,27	23,22	252,7	429,6	104,6	230,1	20,9	11,2
SIL-03/15	10 Apr 2003	17 Apr 2003	24,14	27,56	399,6	679,3	124,1	273,1	15,9	6,4
SIL-03/16	17 Apr 2003	24 Apr 2003	17,40	38,43	288,1	489,8	173,1	380,9	13,9	10,8
SIL-03/17	24 Apr 2003	30 Apr 2003	10,33	110,96	171,0	290,7	499,8	1099,6	8,1	30,7
SIL-03/18	30 Apr 2003	8 Mai 2003	10,10	88,44	167,3	284,3	398,4	876,4	3,1	9,6
SIL-03/19	8 Mai 2003	15 Mai 2003	19,82	150,13	328,1	557,7	676,3	1487,8	11,6	31,1
SIL-03/20	15 Mai 2003	22 Mai 2003	10,19	115,23	168,7	286,7	519,1	1141,9	10,9	43,4
SIL-03/21	22 Mai 2003	28 Mai 2003	3,04	19,11	50,4	85,6	86,1	189,3	2,0	4,4
SIL-03/22	28 Mai 2003	5 Jun 2003	16,00	80,48	264,9	450,4	362,5	797,5	7,8	13,8
SIL-03/23	5 Jun 2003	12 Jun 2003	6,88	100,86	114,0	193,7	454,3	999,6	2,9	15,1
SIL-03/24	12 Jun 2003	18 Jun 2003	8,43	140,58	139,6	237,3	633,2	1393,1	3,8	22,0
SIL-03/25	18 Jun 2003	25 Jun 2003	6,43	85,43	106,4	180,8	384,8	846,6	3,1	14,6
SIL-03/26	25 Jun 2003	3 Jul 2003	7,16	46,21	118,6	201,6	208,1	457,9	3,5	8,0
SIL-03/27	3 Jul 2003	10 Jul 2003	14,53	34,19	240,5	408,9	154,0	338,8	8,4	6,9
SIL-03/28	10 Jul 2003	17 Jul 2003	10,31	42,33	170,7	290,1	190,7	419,5	4,6	6,6
SIL-03/29	17 Jul 2003	24 Jul 2003	26,90	27,37	445,3	756,9	123,3	271,2	16,0	5,7
SIL-03/30	24 Jul 2003	31 Jul 2003		31,46			141,7	311,7		6,6
SIL-03/31	31 Jul 2003	7 Aug 2003	62,90	63,42	1041,2	1770,0	285,7	628,5	21,4	7,6
SIL-03/32	7 Aug 2003	14 Aug 2003	50,78	46,43	840,6	1429,0	209,1	460,1	11,1	3,6
SIL-03/33A	14 Aug 2003	21 Aug 2003	18,34	16,17	303,6	516,1	72,9	160,3	13,9	4,3
SIL-03/34A	21 Aug 2003	28 Aug 2003	32,79	27,44	542,8	922,8	123,6	272,0	19,1	5,6
SIL-03/35	28 Aug 2003	4 Sep 2003	14,08	24,17	233,1	396,3	108,9	239,5	7,9	4,8
SIL-03/36	4 Sep 2003	11 Sep 2003	29,90	46,05	495,0	841,5	207,4	456,3	10,4	5,6
SIL-03/37	11 Sep 2003	18 Sep 2003	46,94	25,09	777,0	1321,0	113,0	248,7	28,6	5,4
SIL-03/38	18 Sep 2003	25 Sep 2003	55,48	32,86	918,4	1561,4	148,0	325,6	18,4	3,8
SIL-03/39	25 Sep 2003	2 Okt 2003	43,09	33,36	713,3	1212,6	150,3	330,6	30,4	8,3
SIL-03/40	2 Okt 2003	9 Okt 2003	29,37	62,60	486,2	826,6	282,0	620,3	44,0	33,0
SIL-03/41	9 Okt 2003	16 Okt 2003	50,04	55,52	828,4	1408,3	250,1	550,2	42,0	16,4
SIL-03/42	16 Okt 2003	23 Okt 2003	24,71	54,09	409,1	695,4	243,6	536,0	16,2	12,5
SIL-03/43	23 Okt 2003	30 Okt 2003	19,97	19,38	330,7	562,1	87,3	192,0	20,8	7,1
SIL-03/44	30 Okt 2003	5 Nov 2003	32,04	26,79	530,4	901,7	120,7	265,5	43,2	12,7
SIL-03/45	5 Nov 2003	13 Nov 2003	5,83	46,21	96,5	164,0	208,1	457,9	4,2	11,7
SIL-03/46	13 Nov 2003	20 Nov 2003	18,70	5,09	309,6	526,4	22,9	50,5	40,3	3,9
SIL-03/47	20 Nov 2003	27 Nov 2003	46,28	30,41	766,1	1302,3	137,0	301,3	55,1	12,8
SIL-03/48	27 Nov 2003	4 Dez 2003	24,13	17,98	399,4	679,1	81,0	178,2	31,9	8,4
SIL-03/49	4 Dez 2003	11 Dez 2003	37,28	15,30	617,2	1049,2	68,9	151,7	47,1	6,8
SIL-03/50	11 Dez 2003	18 Dez 2003	9,30	9,15	154,0	261,7	41,2	90,7	31,1	10,8
SIL-03/51	18 Dez 2003	26 Dez 2003	17,27	12,28	285,9	486,0	55,3	121,7	42,9	10,7
SIL-03/52	26 Dez 2003	30 Dez 2003	27,64	36,58	457,6	777,9	164,8	362,5	56,9	26,5
SIL-04/01	2 Jän 2004	8 Jän 2004	16,04	6,99	265,6	451,5	31,5	69,3	38,1	5,8
SIL-04/02	8 Jän 2004	15 Jän 2004	15,92	45,43	263,5	448,0	204,6	450,2	47,6	47,8

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT SCHAUINSLAND										
Sample Code	Starting date of sampling	En.a. date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP
SIL-04/03	15 Jän 2004	22 Jän 2004	24,90	31,08	412,1	700,6	140,0	308,0	78,3	34,4
SIL-04/04	22 Jän 2004	29 Jän 2004	19,88	14,05	329,0	559,4	63,3	139,2	48,4	12,1
SIL-04/05	29 Jän 2004	5 Feb 2004	19,57	20,77	324,0	550,8	93,6	205,9	40,2	15,0
SIL-04/06	5 Feb 2004	12 Feb 2004	29,34	35,00	485,7	825,7	157,7	346,8	65,3	27,4
SIL-04/07	12 Feb 2004	19 Feb 2004	19,26	17,84	318,8	542,0	80,3	176,8	21,2	6,9
SIL-04/08	19 Feb 2004	26 Feb 2004	24,69	21,13	408,7	694,7	95,2	209,4	23,3	7,0
SIL-04/09	26 Feb 2004	4 Mär 2004	16,48	13,79	272,7	463,7	62,1	136,7	12,7	3,7
SIL-04/10	4 Mär 2004	11 Mär 2004	18,82	7,73	311,6	529,7	34,8	76,6	14,2	2,1
SIL-04/11	11 Mär 2004	19 Mär 2004	9,81	42,54	162,4	276,2	191,6	421,5	8,2	12,6
SIL-04/12	19 Mär 2004	25 Mär 2004	14,67	18,08	242,8	412,8	81,4	179,2	45,7	19,9
SIL-04/13	25 Mär 2004	1 Apr 2004	25,47	37,00	421,6	716,7	166,7	366,7	12,6	6,5
SIL-04/14	1 Apr 2004	8 Apr 2004	21,14	163,95	350,0	595,0	738,5	1624,8	27,5	75,1
SIL-04/15	8 Apr 2004	15 Apr 2004	29,93	31,58	495,5	842,4	142,2	312,9	17,4	6,5
SIL-04/16	15 Apr 2004	22 Apr 2004	39,37	83,28	651,7	1107,9	375,1	825,3	31,0	23,1
SIL-04/17-I	22 Apr 2004	23 Apr 2004	22,33	144,82	369,6	628,3	652,3	1435,1	15,2	34,7
SIL-04/17-II	23 Apr 2004	29 Apr 2004	39,40	132,47	652,2	1108,7	596,7	1312,8	27,2	32,2
SIL-04/18	29 Apr 2004	6 Mai 2004	22,22	90,74	367,8	625,2	408,7	899,2	15,9	22,8
SIL-04/19	6 Mai 2004	13 Mai 2004	17,79	34,03	294,6	500,8	153,3	337,3	19,0	12,8
SIL-04/20	13 Mai 2004	19 Mai 2004	23,25	73,79	384,8	654,2	332,4	731,3	9,7	10,8
SIL-04/21	19 Mai 2004	27 Mai 2004	6,12	92,57	101,2	172,1	417,0	917,3	4,2	22,3
SIL-04/22	27 Mai 2004	3 Jun 2004	22,39	93,43	370,7	630,2	420,8	925,8	13,6	20,0
SIL-04/23	3 Jun 2004	9 Jun 2004	23,23	79,62	384,6	653,7	358,6	789,0	7,2	8,6
SIL-04/24	9 Jun 2004	17 Jun 2004	41,26	18,68	683,0	1161,1	84,2	185,2	11,0	1,8
SIL-04/25	17 Jun 2004	24 Jun 2004	32,51	50,73	538,2	915,0	228,5	502,7	17,6	9,7
SIL-04/26	24 Jun 2004	1 Jul 2004	6,96	138,67	115,2	195,8	624,6	1374,2	2,7	19,0
SIL-04/27	1 Jul 2004	8 Jul 2004	36,98	85,30	612,2	1040,7	384,2	845,3	16,3	13,2
SIL-04/28	8 Jul 2004	13 Jul 2004		4,23			19,1	42,0		2,0
SIL-04/28II	14 Jul 2004	15 Jul 2004	208,63	78,49	3453,6	5871,2	353,5	777,8	70,2	9,3
SIL-04/29	15 Jul 2004	22 Jul 2004	24,47	45,72	405,0	688,6	205,9	453,1	11,6	7,7
SIL-04/30	22 Jul 2004	29 Jul 2004	29,56	30,49	489,3	831,8	137,3	302,1	5,5	2,0
SIL-04/31	29 Jul 2004	5 Aug 2004	45,40	31,81	751,6	1277,7	143,3	315,2	10,0	2,5
SIL-04/32	5 Aug 2004	12 Aug 2004	21,46	28,15	355,2	603,8	126,8	278,9	6,9	3,2
SIL-04/33	12 Aug 2004	19 Aug 2004	34,30	37,72	567,8	965,3	169,9	373,8	28,8	11,1
SIL-04/34	19 Aug 2004	26 Aug 2004	13,99	26,07	231,5	393,6	117,4	258,3	9,6	6,3
SIL-04/35	26 Aug 2004	2 Sep 2004	25,75	17,61	426,3	724,6	79,3	174,5	29,0	7,0
SIL-04/36	2 Sep 2004	9 Sep 2004	14,25	27,27	236,0	401,1	122,8	270,2	5,1	3,4
SIL-04/37	9 Sep 2004	16 Sep 2004	10,44	47,82	172,8	293,7	215,4	473,8	8,9	14,3

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT SONNBLICK

Sample Code	Starting date of sampling	En.a. date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP	[ng/m^3] STP
SBO 05	3 Okt 2002	10 Okt 2002	2,68	24,56	44,3	75,4	110,6	243,4	1417,1	4575,6
SBO 04	10 Okt 2002	17 Okt 2002	3,94	13,62	65,1	110,7	61,3	134,9	4459,1	5433,6
SBO 03	17 Okt 2002	24 Okt 2002	2,52	3,27	41,7	70,9	14,7	32,4	1290,9	590,8
SBO 02	24 Okt 2002	31 Okt 2002	4,36	6,34	72,1	122,6	28,6	62,8	906,2	464,3
SBO 01	31 Okt 2002	19 Nov 2002	2,15	3,99	35,6	60,6	18,0	39,5	2900,7	1892,9
SBO 06	21 Nov 2002	30 Nov 2002								
SBO 07	30 Nov 2002	5 Dez 2002		3,36			15,1	33,3		
SBO 08	5 Dez 2002	12 Dez 2002	1,46		24,2	41,1				
SBO 09	12 Dez 2002	19 Dez 2002	31,64		523,8	890,5			62103,6	
SBO 10	19 Dez 2002	26 Dez 2002	73,62	4,17	1218,8	2071,9	18,8	41,3	70432,0	1403,7
SBO 11	26 Dez 2002	2 Jän 2003	9,83	3,28	162,8	276,7	14,8	32,5	11056,7	1300,1
SBO 12	2 Jän 2003	9 Jän 2003								
SBO 13	9 Jän 2003	16 Jän 2003	2,71	4,85	44,9	76,4	21,8	48,1		
SBO 14	16 Jän 2003	24 Jän 2003	0,76	5,16	12,6	21,4	23,3	51,2	989,8	2369,6
SBO 15	24 Jän 2003	30 Jän 2003		6,54			29,5	64,9		2111,7
SBO 16	30 Jän 2003	14 Feb 2003	3,32		55,0	93,4			2281,7	
SBO 17	14 Feb 2003	20 Feb 2003	2,37	6,76	39,3	66,8	30,5	67,0	753,5	756,3
SBO 18	20 Feb 2003	27 Feb 2003	1,26	6,71	20,9	35,5	30,2	66,5	883,7	1657,0
SBO 19	27 Feb 2003	6 Mär 2003		9,37			42,2	92,9		701,5
SBO 20	6 Mär 2003	13 Mär 2003	3,36	11,05	55,7	94,6	49,8	109,5	943,7	1092,2
SBO 21	13 Mär 2003	20 Mär 2003	3,30	2,27	54,7	93,0	10,2	22,5	884,9	214,1
SBO 22	20 Mär 2003	27 Mär 2003	19,42	14,70	321,4	546,4	66,2	145,7	2474,0	659,6
SBO 23	27 Mär 2003	4 Apr 2003	24,46	13,78	404,9	688,3	62,1	136,6	2046,6	406,1
SBO 24	4 Apr 2003	11 Apr 2003	7,70	3,39	127,4	216,6	15,3	33,6	2133,6	330,7
SBO 25	11 Apr 2003	17 Apr 2003	4,88	11,68	80,7	137,2	52,6	115,8	1825,5	1540,2
SBO 26	17 Apr 2003	24 Apr 2003	3,10	13,23	51,4	87,3	59,6	131,1	541,3	812,6
SBO 27	24 Apr 2003	2 Mai 2003	5,97	13,11	98,9	168,1	59,0	129,9	605,8	467,9
SBO 28	2 Mai 2003	8 Mai 2003	12,33	40,16	204,2	347,1	180,9	397,9	549,9	630,4
SBO 29	8 Mai 2003	15 Mai 2003	29,10	27,08	481,7	818,9	122,0	268,3	972,6	318,7
SBO 30	15 Mai 2003	22 Mai 2003	38,06	39,85	630,0	1071,1	179,5	394,9	3864,5	1424,9
SBO 31	22 Mai 2003	29 Mai 2003	2,71	6,56	44,9	76,3	29,6	65,0	404,0	344,5
SBO 32	29 Mai 2003	5 Jun 2003	3,14	18,03	51,9	88,3	81,2	178,6	635,1	1285,6
SBO 33	5 Jun 2003	12 Jun 2003	2,88	10,61	47,6	80,9	47,8	105,1	658,5	855,2
SBO 34	12 Jun 2003	26 Jun 2003	8,30	15,02	137,4	233,6	67,6	148,8	983,5	626,5
SBO 35	26 Jun 2003	3 Jul 2003	4,59	20,72	76,0	129,2	93,3	205,3	463,7	736,9
SBO 36	3 Jul 2003	10 Jul 2003	5,39	8,40	89,3	151,8	37,8	83,2	1437,0	788,1
SBO 37	10 Jul 2003	17 Jul 2003	10,51	16,33	174,0	295,8	73,6	161,9	384,9	210,6
SBO 38	17 Jul 2003	24 Jul 2003	3,74	55,05	62,0	105,3	248,0	545,5	81,6	422,6
SBO 39	24 Jul 2003	31 Jul 2003	7,61	36,21	126,0	214,1	163,1	358,9	357,7	599,5
SBO 40	31 Jul 2003	2 Aug 2003	7,80	2,86	129,2	219,6	12,9	28,3	388,6	50,2
SBO 41	2 Aug 2003	7 Aug 2003	45,29	33,61	749,8	1274,7	151,4	333,0	723,9	189,1
SBO 42	7 Aug 2003	14 Aug 2003	24,13	42,02	399,5	679,1	189,3	416,4	829,7	508,7
SBO 43	14 Aug 2003	21 Aug 2003	6,73	15,65	111,4	189,3	70,5	155,1	347,0	284,2
SBO 45	28 Aug 2003	4 Sep 2003	7,29	39,53	120,7	205,1	178,1	391,7	380,4	726,4
SBO 46	4 Sep 2003	11 Sep 2003	2,07	28,01	34,2	58,1	126,2	277,6	120,4	574,9
SBO 47	25 Sep 2003	2 Okt 2003	7,13	30,12	118,0	200,6	135,7	298,5	548,9	816,7
SBO 48	2 Okt 2003	9 Okt 2003	3,55	9,36	58,8	100,0	42,2	92,8	1400,0	1299,2
SBO 49	9 Okt 2003	15 Okt 2003	5,14	52,02	85,1	144,6	234,3	515,5	140,8	501,7
SBO 50	15 Okt 2003	16 Okt 2003	6,20		102,6	174,4			360,2	
SBO 51	16 Okt 2003	23 Okt 2003	1,82	9,27	30,1	51,2	41,8	91,9	371,4	665,8
SBO 52	23 Okt 2003	31 Okt 2003	2,01	16,13	33,3	56,6	72,7	159,8	951,3	2688,0
SBO 53	31 Okt 2003	6 Nov 2003	4,63	11,88	76,6	130,2	53,5	117,7	1041,6	941,6
SBO 54	6 Nov 2003	13 Nov 2003	2,57	14,23	42,5	72,2	64,1	141,0	690,2	1347,1
SBO 55	13 Nov 2003	22 Nov 2003	1,05	9,21	17,3	29,5	41,5	91,3	424,8	1315,4
SBO 56	22 Nov 2003	27 Nov 2003	0,84	2,76	13,9	23,6	12,5	27,4	74,4	86,4
SBO 57	27 Nov 2003	4 Dez 2003		6,49			29,2	64,3		945,1
SBO 58	4 Dez 2003	11 Dez 2003	2,67	15,34	44,2	75,2	69,1	152,1	581,1	1175,5
SBO 59	11 Dez 2003	18 Dez 2003		4,33			19,5	42,9		994,5
SBO 60	18 Dez 2003	25 Dez 2003	2,27	8,25	37,6	64,0	37,2	81,8	641,4	820,3
SBO 61	25 Dez 2003	2 Jän 2004	2,45		40,5	68,9			1090,5	
SBO 62	2 Jän 2004	8 Jän 2004	0,99	23,05	16,5	28,0	103,8	228,4	186,3	1521,3
SBO 63	8 Jän 2004	15 Jän 2004	1,83	12,52	30,3	51,6	56,4	124,1	1857,5	4467,8
SBO 64	15 Jän 2004	22 Jän 2004	4,22	14,02	69,8	118,7	63,1	138,9		
SBO 65	22 Jän 2004	29 Jän 2004	3,52	4,56	58,3	99,1	20,5	45,2	966,5	440,6
SBO 66	29 Jän 2004	5 Feb 2004	4,44	21,16	73,4	124,8	95,3	209,7	925,5	1554,3

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT SONNBLICK

Sample Code	Starting date of sampling	En.a. date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP
SBO 67	5 Jän 2004	12 Feb 2004	6,08	14,56	100,7	171,1	65,6	144,3	1472,8	1242,1
SBO 69	19 Feb 2004	26 Feb 2004	2,21	6,89	36,7	62,3	31,0	68,3	1563,0	1712,5
SBO 70	26 Feb 2004	4 Mär 2004	9,16	8,74	151,6	257,8	39,4	86,6	4299,8	1445,1
SBO 71	4 Mär 2004	11 Mär 2004	5,21	9,44	86,3	146,6	42,5	93,5	1064,0	678,6
SBO 72	11 Mär 2004	18 Mär 2004	1,25	6,05	20,7	35,1	27,2	59,9	181,8	310,3
SBO 73	18 Mär 2004	25 Mär 2004	7,31	17,69	121,0	205,7	79,7	175,3	1031,4	878,9
SBO 74	25 Mär 2004	26 Mär 2004	20,97	68,99	347,1	590,1	310,8	683,7	790,5	915,9
SBO 75	26 Mär 2004	2 Apr 2004	1,82	12,09	30,2	51,3	54,5	119,9	432,4	1010,5
SBO 76	2 Apr 2004	8 Apr 2004	4,32	7,12	71,6	121,6	32,1	70,6	946,4	549,2
SBO 77	8 Apr 2004	15 Apr 2004	1,84	6,45	30,4	51,7	29,1	64,0		
SBO 78	15 Apr 2004	22 Apr 2004	2,06	4,78	34,1	58,0	21,5	47,4	566,2	462,6
SBO 79	22 Apr 2004	29 Apr 2004	7,83	10,11	129,6	220,4	45,5	100,2	1420,0	645,6
SBO 80	29 Apr 2004	6 Mai 2004	2,18	5,64	36,1	61,4	25,4	55,9		
SBO 81	13 Mai 2004	20 Mai 2004	21,17	18,41	350,4	595,6	82,9	182,4	7473,3	2289,1
SBO 82	20 Mai 2004	27 Mai 2004	38,25	9,00	633,2	1076,4	40,6	89,2	4622,6	383,2
SBO 83	27 Mai 2004	3 Jun 2004	53,49	17,31	885,5	1505,3	78,0	171,6	52033,4	5930,8
SBO 84	3 Jun 2004	10 Jun 2004	12,59	14,11	208,5	354,4	63,6	139,9		
SBO 85	10 Jun 2004	17 Jun 2004	22,41	24,82	371,0	630,7	111,8	246,0	8910,3	3475,3
SBO 86	22 Jun 2004	1 Jul 2004	3,33	5,61	55,1	93,7	25,3	55,6	758,1	449,4
SBO 87	1 Jul 2004	8 Jul 2004	6,90		114,2	194,2			2569,9	
SBO 88	8 Jul 2004	15 Jul 2004	0,79	11,70	13,0	22,2	52,7	116,0	194,4	1016,3
SBO 89	15 Jul 2004	22 Jul 2004	0,74		12,2	20,7			84,4	
SBO 90	22 Jul 2004	29 Jul 2004	11,17	9,96	185,0	314,5	44,8	98,7	1212,7	380,5
SBO 91	29 Jul 2004	5 Aug 2004	4,11	13,19	68,1	115,8	59,4	130,7	409,9	462,7
SBO 94	19 Aug 2004	26 Aug 2004	3,32	6,29	54,9	93,3	28,3	62,3	453,1	302,4
SBO 95	26 Aug 2004	2 Sep 2004	3,92	8,03	64,9	110,4	36,2	79,5	3072,2	2214,2
SBO 96	2 Sep 2004	9 Sep 2004	5,16	4,81	85,5	145,3	21,7	47,7	832,1	273,1
SBO 97	9 Sep 2004	16 Sep 2004	2,24	4,81	37,0	63,0	21,7	47,7	229,5	173,8
SBO 98	16 Sep 2004	24 Sep 2004	1,75	4,81	29,0	49,3	21,7	47,7	218,2	211,0
SBO 99	24 Sep 2004	30 Sep 2004	2,56	18,39	42,3	71,9	82,8	182,2	592,2	1500,5
SBO 100	30 Sep 2004	7 Okt 2004	1,43	11,04	23,7	40,3	49,7	109,4	1096,7	2980,6

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT K-PUSZTA *Jul. 02- May. 04*

Sample Code	Starting date of sampling	End date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP
HU 2002.07.04E - 07.11	4 Jul 2002	11 Jul 2002	26,81	86,30	443,9	754,6	388,7	855,2	9,5	10,8
HU 2002.07.11 - 07.20	11 Jul 2002	20 Jul 2002	23,60	66,00	390,7	664,1	297,3	654,1	9,8	9,7
HU 2002.07.20 - 07.24	20 Jul 2002	24 Jul 2002	36,83	119,34	609,6	1036,4	537,6	1182,7	15,7	17,9
HU 2002.08.05 - 08.12	5 Aug 2002	12 Aug 2002	12,31	53,99	203,7	346,3	243,2	535,0	4,6	7,1
HU 2002.08.12 - 08.19	12 Aug 2002	19 Aug 2002	20,93	124,29	346,4	588,9	559,9	1231,7	7,9	16,5
HU 2002.08.27 - 09.03	27 Aug 2002	3 Sep 2002	53,52	133,84	885,9	1506,1	602,9	1326,3	8,5	7,5
HU 2002.09.03 - 09.10	3 Sep 2002	10 Sep 2002	47,50	121,10	786,3	1336,7	545,5	1200,1	9,4	8,4
HU 2002.09.10 - 09.17	10 Sep 2002	17 Sep 2002	0,88	121,04	14,5	24,7	545,2	1199,5	0,2	8,1
HU 2002.10.28-11.05.	28 Okt 2002	5 Nov 2002	98,08	19,03	1623,7	2760,3	85,7	188,6	37,3	2,6
HU 2002.11.05-11.12.	5 Nov 2002	12 Nov 2002	138,21	31,76	2288,0	3889,5	143,1	314,7	59,4	4,8
HU 2002.11.20-11.27.	20 Nov 2002	27 Nov 2002	158,40	44,09	2622,1	4457,6	198,6	436,9	47,7	4,7
HU 2002.11.27-12.04	27 Nov 2002	4 Dez 2002	235,37	47,42	3896,4	6623,9	213,6	469,9	64,5	4,6
HU 2002.12.04 - 12.11	4 Dez 2002	11 Dez 2002	214,94	49,99	3558,1	6048,7	225,2	495,4	52,9	4,3
HU 2002.12.11 - 12.18	11 Dez 2002	18 Dez 2002	231,54	85,67	3832,9	6515,9	385,9	849,0	27,0	3,5
HU 2003.02.14 - 02.21	14 Feb 2003	21 Feb 2003	173,23	32,02	2867,7	4875,0	144,2	317,3	17,4	1,1
HU 2003.02.21 - 02.28	21 Feb 2003	28 Feb 2003	193,92	14,71	3210,1	5457,2	66,3	145,8	21,9	0,6
HU 2003.02.28-03.07	28 Feb 2003	7 Mär 2003	303,49	38,53	5023,9	8540,7	173,6	381,9	24,1	1,1
HU 2003.03.07 - 03.14	7 Mär 2003	14 Mär 2003	121,64	38,36	2013,6	3423,2	172,8	380,1	28,0	3,1
HU 2003.03.14 - 03.21	14 Mär 2003	21 Mär 2003	88,36	31,83	1462,7	2486,5	143,4	315,5	31,3	4,0
HU 2003.03.21 - 03.27	21 Mär 2003	27 Mär 2003	149,08	53,07	2467,9	4195,5	239,1	525,9	22,9	2,9
HU 2003.03.27 - 04.03	27 Mär 2003	3 Apr 2003	58,71	67,42	971,8	1652,1	303,7	668,2	8,4	3,4
HU 2003.04.03 - 04.11	3 Apr 2003	11 Apr 2003	49,46	57,59	818,8	1391,9	259,4	570,7	14,7	6,0
HU 2003.04.11 - 04.18	11 Apr 2003	18 Apr 2003	103,52	55,08	1713,7	2913,2	248,1	545,8	31,4	5,9
HU 2003.04.18 - 04.25	18 Apr 2003	25 Apr 2003	23,83	70,33	394,4	670,5	316,8	696,9	7,5	7,8
HU 2003.04.25 - 05.02	25 Apr 2003	2 Mai 2003	29,06	109,78	481,0	817,7	494,5	1087,9	10,9	14,6
HU 2003.05.02 - 05.11	2 Mai 2003	11 Mai 2003	22,32	89,14	369,5	628,1	401,5	883,4	4,6	6,5
HU 2003.05.12 - 05.19	12 Mai 2003	19 Mai 2003	22,90	64,80	379,2	644,6	291,9	642,1	7,9	7,9
HU 2003.05.19 - 05.26	19 Mai 2003	26 Mai 2003	76,79	74,52	1271,2	2161,1	335,7	738,5	33,9	11,6
HU 2003.05.26 - 06.02	26 Mai 2003	2 Jun 2003	63,05	94,24	1043,8	1774,5	424,5	933,9	29,0	15,3
HU 2003.06.02 - 06.09	2 Jun 2003	9 Jun 2003	58,70	52,68	971,7	1651,9	237,3	522,1	24,0	7,6
HU 2003.06.09 - 06.16	9 Jun 2003	16 Jun 2003	64,42	36,47	1066,4	1813,0	164,3	361,4	21,6	4,3
HU 2003.06.16 - 06.23	16 Jun 2003	23 Jun 2003	96,05	48,69	1589,9	2702,9	219,3	482,5	39,3	7,0
HU 2003.06.23 - 06.30	23 Jun 2003	30 Jun 2003	73,93	54,95	1223,9	2080,6	247,5	544,5	34,7	9,1
HU 2003.06.30 - 07.07	30 Jun 2003	7 Jul 2003	101,99	73,03	1688,4	2870,3	329,0	723,7	33,5	8,4
HU 2003.07.14 - 07.21	14 Jul 2003	21 Jul 2003	121,13	33,02	2005,1	3408,7	148,7	327,2	62,1	6,0
HU 2003.08.04 - 08.11	4 Aug 2003	11 Aug 2003	151,95	91,38	2515,3	4276,1	411,6	905,6	48,2	10,2
HU 2003.08.11 - 08.18	11 Aug 2003	18 Aug 2003	98,28	47,85	1626,9	2765,7	215,6	474,2	33,7	5,8
HU 2003.08.18 - 08.25	18 Aug 2003	25 Aug 2003	51,71	71,57	856,0	1455,1	322,4	709,2	26,1	12,7
HU 2003.08.25 - 08.31	25 Aug 2003	31 Aug 2003	51,55	81,74	853,4	1450,8	368,2	810,0	12,9	7,2
HU 2003.09.01 - 09.08	1 Sep 2003	8 Sep 2003	78,66	56,55	1302,1	2213,6	254,7	560,4	43,4	11,0
HU 2003.09.08- 09.15	8 Sep 2003	15 Sep 2003	93,93	50,84	1554,9	2643,3	229,0	503,8	33,9	6,5
HU 2003.09.15 - 09.22	15 Sep 2003	22 Sep 2003	104,65	66,26	1732,5	2945,2	298,5	656,6	30,7	6,8
HU 2003.09.22 - 09.29	22 Sep 2003	29 Sep 2003	161,56	42,44	2674,4	4546,5	191,2	420,6	59,7	5,5
HU 2003.09.29 - 10.06	29 Sep 2003	6 Okt 2003	133,65	45,93	2212,5	3761,2	206,9	455,1	75,6	9,1
HU 2003.10.06 -10.13	6 Okt 2003	13 Okt 2003	60,93	16,58	1008,7	1714,8	74,7	164,3	45,9	4,4
HU 2003.10.13 - 10.20	13 Okt 2003	20 Okt 2003	122,11	33,61	2021,5	3436,5	151,4	333,1	45,3	4,4
HU 2003.10.20 - 10.27	20 Okt 2003	27 Okt 2003	105,96	16,21	1754,1	2981,9	73,0	160,7	32,1	1,7
HU 2003.10.27 - 11.03	27 Okt 2003	3 Nov 2003	74,56	14,72	1234,3	2098,3	66,3	145,9	36,6	2,5
HU 2003.11.03 - 11.10	3 Nov 2003	10 Nov 2003	195,04	57,66	3228,7	5488,8	259,7	571,4	76,5	8,0
HU 2003.11.10 - 11.17	10 Nov 2003	17 Nov 2003	262,58	107,62	4346,7	7389,4	484,8	1066,5	32,3	4,7
HU 2003.11.17 - 11.24	17 Nov 2003	24 Nov 2003	100,43	24,65	1662,5	2826,3	111,0	244,2	18,3	1,6
HU 2003.11.24- 12.01	24 Nov 2003	1 Dez 2003	125,18	16,47	2072,2	3522,8	74,2	163,2	31,2	1,4
HU 2003.12.01 -12.08	1 Dez 2003	8 Dez 2003	130,23	24,71	2155,8	3664,8	111,3	244,9	37,5	2,5
HU 2003.12.08 -12.15	8 Dez 2003	15 Dez 2003	163,03	72,11	2698,9	4588,1	324,8	714,6	43,4	6,8
HU 2003.12.15 -12.22	15 Dez 2003	22 Dez 2003	222,55	77,72	3684,1	6263,0	350,1	770,2	39,9	4,9
HU 2003.12.22 -12.29	22 Dez 2003	29 Dez 2003	194,31	74,66	3216,6	5468,2	336,3	739,8	36,7	5,0
HU 2003.12.29 -01.05	29 Dez 2003	5 Jän 2004	156,51	19,59	2590,9	4404,5	88,3	194,2	31,4	1,4
HU 2004.01.05 -01.12	5 Jän 2004	12 Jän 2004	155,42	40,42	2572,8	4373,8	182,1	400,6	18,5	1,7
HU 2004.01.12 -01.19	12 Jän 2004	19 Jän 2004	111,21	9,90	1840,9	3129,6	44,6	98,2	38,5	1,2
HU 2004.01.19 -01.26	19 Jän 2004	26 Jän 2004	110,49	11,81	1829,1	3109,5	53,2	117,0	25,0	0,9
HU 2004.01.26 -02.02	26 Jän 2004	2 Feb 2004	135,80	12,06	2248,0	3821,6	54,3	119,5	22,6	0,7
HU 2004.02.02 -02.09	2 Feb 2004	9 Feb 2004	145,45	37,90	2407,7	4093,1	170,7	375,6	44,2	4,1
HU 2004.02.09 -02.16	9 Feb 2004	16 Feb 2004	81,14	20,55	1343,2	2283,4	92,6	203,6	36,6	3,3
HU 2004.02.16 -02.23	16 Feb 2004	23 Feb 2004	122,57	20,55	2029,0	3449,2	92,6	203,7	42,4	2,5
HU 2004.02.23 -03.01	23 Feb 2004	1 Mär 2004	133,83	21,91	2215,5	3766,3	98,7	217,1	37,4	2,2

CONCENTRATION VALUES OF LEVOGLUCOSAN,CELLULOSE AT K-PUSZTA

Sample Code	Starting date of sampling	En.a. date of sampling	Levo-C	Cell-C	Wood smoke(OC)	Wood smoke (OM)	Plant Debris (OC)	Plant Debris (OM)	Wood smoke(OM)/OM (%)	Plant Debris(OM)/OM (%)
	(dd/mm/yyyy)	(dd/mm/yyyy)	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP	[ng/m³] STP
HU 2004.03.01 -03.08	1 Mär 2004	8 Mär 2004	125,50	11,21	2077,5	3531,8	50,5	111,1	272,2	8,6
HU 2004.03.08 -03.16	8 Mär 2004	16 Mär 2004	155,41	22,18	2572,6	4373,4	99,9	219,8	84,4	4,2
HU 2004.03.16 -03.22	16 Mär 2004	22 Mär 2004	154,00	178,27	2549,3	4333,8	803,0	1766,7	30,8	12,5
HU 2004.03.22 -03.29	22 Mär 2004	29 Mär 2004	62,18	15,74	1029,3	1749,8	70,9	156,0	44,7	4,0
HU 2004.03.29 -04.05	29 Mär 2004	5 Apr 2004	126,38	28,62	2092,1	3556,5	128,9	283,6	27,1	2,2
HU 2004.04.05 -04.12	5 Apr 2004	12 Apr 2004	70,41	29,69	1165,6	1981,5	133,7	294,2	46,9	7,0
HU 2004.04.12 -04.19	12 Apr 2004	19 Apr 2004	74,18	36,51	1228,0	2087,6	164,4	361,8	37,4	6,5
HU 2004.04.19 -04.26	19 Apr 2004	26 Apr 2004	55,08	56,84	911,7	1550,0	256,0	563,3	27,9	10,1
HU 2004.04.26-05.03	26 Apr 2004	3 Mai 2004	45,78	120,15	757,8	1288,3	541,2	1190,7	14,8	13,7
HU 2004.05.03 -05.10	3 Mai 2004	10 Mai 2004	62,71	118,93	1038,1	1764,7	535,7	1178,6	39,5	26,4
HU 2004.05.10 -05.17	10 Mai 2004	17 Mai 2004	55,58	154,97	920,0	1564,0	698,0	1535,7	17,1	16,8
HU 2004.05.17 -05.23	17 Mai 2004	23 Mai 2004	49,38	193,61	817,5	1389,7	872,1	1918,7	14,8	20,4