EGU24-9248, updated on 24 Apr 2024
https://doi.org/10.5194/egusphere-egu24-9248
EGU General Assembly 2024

Monitoring Metop ASCAT backscatter stability over tropical rainforests

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The Advanced Scatterometer (ASCAT) on-board the series of Metop satellites is a microwave radar instrument operating in C-band (5.255 GHz). ASCAT has been designed to measure wind speed and wind direction over open ocean, but the instrument has also shown its capabilities to observe changes of sea ice extent and surface soil moisture over land. While two Metop satellites (Metop-B launched in September 2012 and Metop-C launched in November 2018) are operational at the moment, the first Metop mission (Metop-A launched in October 2006) has been successfully completed in November 2021. Regular calibration campaigns based on active transponders located in Turkey ensure a continuous quality monitoring, but natural targets (e.g. tropical rainforests) have also been used in the past. Previous analyses have shown that ASCAT is an extremely stable instrument providing high quality Level 1b backscatter products. Any small changes are evaluated in detail and accounted for if necessary. However, the investigation of calibration anomalies detected by active transponders typically takes time. Monitoring natural targets has the advantage that data is continuously available rather than incremental (as is the case when using active transponders) allowing an earlier detection of anomalies. In any case, calibration problems can only be fully resolved retrospectively during a reprocessing of historic data and not entirely in Near Real-Time (NRT).

The upcoming EUMETSAT H SAF ASCAT Surface Soil Moisture (SSM) products sampled at 6.25 km and 12.5 km are divided into three product categories depending on their timeliness: (i) historic data are available as a Climate Data Record (CDR), (ii) a continuous and consistent extension of the CDR, also known as Intermediate CDR (ICDR) and (iii) Near Real- Time (NRT). It is important to note that NRT products could be subject to intentional (e.g. algorithmic updates) or unintentional (e.g. instrument drifts) changes at any given point in time, which would compromise the consistency compared to historic data. Therefore, ICDR products are introduced in order to fill this gap and maintain a consistency as best as possible. For this reason the ICDR products will be distributed with a one-week delay and ASCAT Level 1b backscatter will be continuously monitored using data over tropical rainforests.

In this study we present our strategy to monitor ASCAT Level 1b backscatter stability over tropical rainforests and show results based on historic ASCAT data for all three Metop satellites. We will also discuss the practical implementation of the monitoring methodology and its application as an early-warning system in case of the ASCAT SSM ICDR product. An anomaly detection should trigger

a warning for the users until a more in-depth analysis determines whether it is advisable to continue the product distribution or stop. Discovering problems that undermine the coherence between CDR and ICDR products is of critical importance, since applications like drought monitoring or climate studies rely on consistent time series data.