EGU24-8721, updated on 26 Apr 2024
https://doi.org/10.5194/egusphere-egu24-8721
EGU General Assembly 2024

Strenghts and limitations of common soil moisture products for operational drought monitoring

Jaime Gaona[1], Davide Bavera[5], Guido Fioravanti[2], Luca Ciabatta[1], Paolo Filippucci[1], Stefania Camici[1], Hamidreza Mosaffa[1], Silvia Puca[3], Nicoletta Roberto[3], Pietro Stradiotti[4], and Luca Brocca[1]

[1]Istituto di Ricerca per la Protezione Idrogeologica (IRPI-CNR), Hydrology group, Perugia, Italy (jaime.gaona@irpi.cnr.it)
[2]Joint Research Center, ISPRA, Italy
[3]Dipartimento della Protezione Civile, Rome, Italy
[4]Technische Universität Wien, Department of Geodesy and Geoinformation, Vienna, Austria
[5]Arcadia SIT, service provider for European Commission, Joint Research Centre (JRC), Milano, Italy

Soil moisture is a crucial state variable for understanding the water cycle. The increasingly available soil moisture data from remote sensing and models is rapidly facilitating improved hydrological analysis and evaluation of climate change impacts. To discern the degree of alteration of soil moisture, the patterns of spatiotemporal anomalies must be considered, but often product-specific uncertainties are overlooked. Such limitations are of particular concern for the operational monitoring and long-term evaluation of soil moisture.

Among the sources of uncertainty jeopardizing remotely sensed and modeled soil moisture, this study evaluates over Europe (1) the heterogeneous spatial patches of validity, (2) the residual trends in the series, and (3) the sensitivity of anomaly detection to the baseline period of popular soil moisture products such as the Satellite Application Facility on Support to Operational Hydrology and Water Management (H SAF), the passive subset of the Climate Change initiative on SM (CCIp) and the European Drought Observatory (EDO) datasets.

The inter-comparison of these remotely sensed and modeled soil moisture products by triple collocation analysis and against data of the international soil moisture network (ISMN) provides insightful results regarding (1) the contrasting patches of accurate soil moisture estimates, (2) the existence of residual temporal trends in the series, and (3) the differing sensitivity of the products to the baseline period for anomaly analysis. The factors impacting products are subject to debate, particularly concerning spatial and temporal consistency.

Merged products combining H SAF, EDO and CCIp are also assessed to elucidate their potential and limitations for operational monitoring in comparison to individual products. Overall, the combined products equal or exceed the performance of individual products while incorporating specific benefits and drawbacks. Outcomes also inform about the best-performing product by area and period.

All in all, the study illustrates the notable degree of consistency of commonly available soil

moisture databases for multiple applications, despite some constraints, while highlighting the potential of merged soil moisture products for the operational monitoring of droughts within the European Drought Observatory (EDO) system.