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Remote sensing of rainfall at high spatial-temporal resolution through soil moisture

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In order to enhance our understanding of the hydrologic cycle, frequent, reliable and detailed information on precipitation are fundamental. In-situ measurements are the traditional source of this information, but they have limited spatial representativeness and the number of stations worldwide is declining and their access is often troublesome. Satellite products are able to overcome these issues and actually are the main, if not the only, source of information over many areas of the world. Notwithstanding this, the spatial resolution is still limited to tens or hundreds of kilometers, limiting their usefulness for hydrological applications. In the recent decade, a new approach for estimating rainfall from satellite-derived soil moisture observations has been proposed, named SM2RAIN (Brocca et al., 2014) and based on the inversion of the soil water balance equation. The application of SM2RAIN to Sentinel-1 satellites carrying a C-band Synthetic Aperture Radar (CSAR) sensor can provide rainfall data at unprecedented spatial and temporal resolution.

In this study, we combined the soil moisture data retrieved from backscatter observations of Sentinel-1 (1.5/4 days temporal frequency over Europe, 500 m sampling) with the soil moisture data obtained from ASCAT sensor, onboard of METOP satellites (8-24 h temporal frequency, 12.5 km sampling) through a data fusion algorithm. The result is an innovative soil moisture dataset with a temporal resolution of 1 day and a spatial resolution of 1 km (Bauer-Marschallinger et al., 2018). These data are used as input for SM2RAIN, obtaining as output a rainfall product with temporal and spatial sampling of 1 day and 1 km, respectively.

The approach was applied over test regions in Italy and Austria obtaining promising results. Specifically, the comparison with high density observations from raingauges and meteorological radars has allowed the assessment of the method at high spatial resolution and varying temporal resolution. Results show that good quality rainfall estimates at 1 km of spatial resolution can be obtained in reproducing 3- to 5-day rainfall accumulations. Further testing will be carried out in the next months and presented at the conference.

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Reference

Bauer-Marschallinger, B., Paulik, C., Mistelbauer, T., Hochstöger, S., Modanesi, S., Ciabatta, L., Massari, C., Brocca, L. & Wagner, W. (2018). Soil Moisture from Fusion of Scatterometer and SAR: Closing the Scale Gap with Temporal Filtering. Remote Sensing, 10(7), 1030. doi:10.3390/rs10071030

Brocca L., Ciabatta L., Massari C., Moramarco T., Hahn S., Hasenauer S., Kidd R., Dorigo W., Wagner W., Levizzani V. – "Soil as a natural rain gauge: Estimating global rainfall from satellite soil moisture data". J. Geophys. Res. Atmos. vol. 119, pp. 5128–5141, 2014. doi: 10.1002/2014JD021489