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Operational services of satellite soil moisture products for flood, landslide, drought and precipitation

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Soil moisture is an essential variable in the water and energy cycle as it governs the partitioning of the mass and energy fluxes between the land surface and the atmosphere. Therefore, the knowledge of soil moisture is fundamental in many applications such as flood forecasting, drought monitoring and water resources management. Large scale monitoring of soil moisture can be achieved only through remote sensing techniques. Indeed, the development of satellite soil moisture products has steadily increased in the last decade by reaching a high level of accuracy and maturity. Satellite soil moisture products are currently developed operationally through the Copernicus Land Monitoring and Climate Change Service, and though the EUMETSAT Satellite Application Facility on Support to Operational Hydrology and Water Management (H SAF). These services provide satellite soil moisture products, also in real time, characterized by spatial resolutions ranging from 1 to 25 km, temporal resolution between 1 and 6 days. The temporal coverage ranges between 5 and 35 years and the spatial coverage from the Europe to the global scale. Specifically, two products are considered here: 1) the Soil Water Index (SWI) obtained from the Advanced SCATterometer (ASCAT) and distributed through the Copernicus Land Monitoring service, and 2) the real time ASCAT surface soil moisture product distributed through H SAF.
Three operational applications of satellite soil moisture products will be illustrated. Firstly, the use of real time ASCAT soil moisture for the hydrological and hydrogeological risk alert in Italy from the Italian Department of Civil Protection (DPC). Specifically, satellite soil moisture data are used together with precipitation forecasts for determining the day-by-day risk levels for the occurrence of flood and landslide events. Secondly, the Copernicus ASCAT SWI has been recently introduced for the assessment of drought conditions in the context of seasonal forecasting from DPC. The consistency of satellite soil moisture data in space and time allows to obtain reliable measurements of current conditions of soil moisture anomalies, that can be easily compared with conditions occurred in the past or at different locations. Therefore, these measurements are being introduced for the planning of water resources management in Italy. Thirdly, the real time H SAF ASCAT soil moisture product is being used for obtaining a global satellite rainfall product through the application of SM2RAIN algorithm (Brocca et al. 2014, doi:10.1002/2014JD021489). An operational satellite rainfall product is going to be obtained that can be potentially useful in many applications. The first results of using the SM2RAIN-derived satellite rainfall product for quantitative flood forecasting throughout Europe and landslide prediction in Italy will be shown.