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The HSAF H64 soil moisture-precipitation integrated product: development and preliminary results

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State-of-the-art satellite rainfall products are often the only way for measuring precipitation in remote areas of the world. These products are mainly based on the exploitation of microwave (MW) radiometers on board LEO satellites (top-down approach). However, it is well known that they may fail in properly reproducing the amount of precipitation reaching the ground, which is of paramount importance for hydrological applications (natural hazards forecast and mitigation, water management). Currently, one of the major issues impacting the quality of the information retrieved from space is related to the estimation of light precipitation that causes a general underestimation of the total amount of rainfall. This issue is particularly important over land due to the uncertainty and spatial variability of surface emissivity. With the purpose of improving the accuracy of satellite rainfall products, some approaches using satellite soil moisture (SM) data were recently developed (bottom-up approach). In 2013 a new method for estimating rainfall using satellite SM observations, called SM2RAIN, has been proposed. The method is based on the inversion of the soil water balance equation, i.e. it estimates rainfall by using the variation in time of the amount of water stored into to the soil, thus considering it "as a natural rain gauge". SM2RAIN has been applied both at local and global scale with ground- and satellite-based SM data as input with satisfactory results in terms of rainfall estimation. Moreover, previous studies found that the correction of rainfall estimates through SM2RAIN provides improvement in flood modeling.
However SM-only based rainfall estimates suffer a number of issues such as the inability to estimate precipitation when the soil is fully saturated, when it is vegetated or snow-covered, besides not providing any precipitation data over the sea. Thus a fully global satellite rainfall product, able to integrate rainfall estimates derived from top-down and bottom-up approaches, has been demonstrated to be highly beneficial for increasing the accuracy of satellite precipitation estimates.
Through the EUMETSAT Satellite Application Facility on Support to Operational Hydrology and Water Management (HSAF), the SM2RAIN approach together with the MW-based rainfall product H23 are the scientific background for the development of the "H64 precipitation-soil moisture integrated product". H23 provides daily precipitation estimates by combining MW precipitation rate estimates derived from conical (H01) and cross-track (H02) scanning radiometers. SM estimates obtained through H16 and H101 H SAF products are used to estimate rainfall through SM2RAIN, and then merged with H23 precipitation estimates through a simple nudging scheme. H64 has been designed to combine optimally the two different approaches in order to provide a more reliable rainfall product, that can be used in an operational framework. Preliminary results show that H64 can efficiently reproduce the observed rainfall during a 4-year period, providing a useful and reliable source of information over scarcely instrumented areas. This first assessment provides very useful insights about the development of a near-real time rainfall product based on SM2RAIN and MW-based top-down precipitation products.