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Understanding the Impact of Spatio-Temporal Resolution in Soil Moisture-Data Assimilation Systems for Flash Flood Early Warning

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In small catchments, such as those characterizing the Mediterranean region, flash flood risk can be very high. In these basins, antecedent soil moisture (SM) conditions largely determine whether a given amount of rainfall produces a flood risk alert or not. Therefore, accurate and reliable SM estimates are of fundamental importance for reducing uncertainties of flash flood early warning systems. Several studies have shown that more accurate SM estimates can be obtained by combining satellite observations and hydrological modelling through data assimilation (DA) techniques. However, satellite-based soil moisture data assimilation (SM-DA) is a (relatively) new field of research with still many open questions: e.g. what is the impact of the spatial and temporal resolution in a SM-DA system?

In this study, we investigated the impact of the assimilation of different satellite SM products (retrieved from Sentinel 1 and ASCAT acquisitions) within a continuous, distributed, physically based, hydrological model (i.e. Continuum) for improving discharge predictions. A simple assimilation algorithm, computationally efficient and thus particularly suitable for operational hydrology, was used (i.e. Nudging). The experiment was carried out on the Orba River catchment (Italy), which has been selected as representative of small Mediterranean basins prone to flash floods. Results were evaluated by comparing the observed river discharge with the modelled one, obtained with and without SM-DA. The objective is to compare the performances of SM estimates retrieved from a C-Band, SAR sensor with higher spatial resolution and lower temporal resolution (i.e. Sentinel 1) and from a C-Band, scatterometer with lower spatial resolution and higher temporal resolution (i.e. ASCAT).