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Flood inundation mapping with multi-satellite soil moisture observations

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In recent decades, remote sensing has widely been used in mapping floods inundations, and many studies have explored the association between antecedent soil moisture and precipitation to assess or predict floods with quantity and intensity. However, capturing the specific flooding events is not always guaranteed because of the satellite poor revisit frequency. Moreover, little attention has been paid to retrieve historic flood inundation based on soil moisture dynamics, especially in the areas with the data scarcity both in terms of soil moisture observations and fine temporal resolution satellite data.

In this study we attempt to explore this issue in two contrasting areas: one arid and one humid, which are the Nile Delta and the Mississippi River Delta, respectively. Several flooding events are selected to conduct specific flood inundation analysis. Multiple satellite microwave soil moisture products are analysed, including European Space Agency Climate Change Initiative (ESA-CCI) Soil Moisture, Soil Moisture Active Passive (SMAP), Advanced Microwave Scanning Radiometer (AMSR-2) and ESA Sentinel satellite imagery.

Considering that the soil moisture decreases more slowly than the surface flooded water, the present study aims to retrieve historic flood inundation based on soil moisture dynamics from satellites, and the main objectives are: (1) to make a comparison on spatial and temporal dynamic patterns of the above-mentioned products in two study areas; (2) to investigate a method for distinguishing the flooded areas and the areas which are always fully saturated; (3) to develop an approach for detecting historic flood inundation based on soil moisture dynamics; and (4) to calibrate the soil moisture output from WRF-Hydro model using satellite soil moisture observations. Results are expected to be applicable for decision-making in flood disaster relief and flood prediction.