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Low-cost flood mapping using free satellite data from Sentinels constellation

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The Sentinel satellites of the Copernicus program provide free-of-charge data with global coverage. The different typologies of Sentinel sensors allow mapping and monitoring a wide range of natural (e.g., floods, earthquakes, volcanic eruptions) and man-made (e.g., land-use changes, urban growth, air pollution) hazards and processes. In this work, we focus on the detection and mapping of flooding events with Sentinel satellites whose revisit time increases the probability to acquire free images in correspondence of the flood peak (co-flood), or few days after (post-flood).
Flood-related studies may benefit of three types of Sentinel satellites:
Sentinel-1 constellation provides SAR data every 6 days in Europe and 12 days in the rest of the world. This allows a near-real-time flood mapping also in cloudy and night conditions. In the case of co-flood acquisitions, Sentinel-1 data allow mapping the flooded areas with good precision.
Sentinel-2 mission provides multispectral images every 5 days in Europe and 12 days in the rest of the world, which can be profitably used for post-flood mapping and damage assessment with high spatial resolution (10 m).
The two Sentinel-3 with the Ocean and Land Colour Instrument (OCLI) provide low-resolution multispectral images over wide areas with an about 3-days revisit time, allowing to map the main flooding and to integrate the possible lack of Sentinel-2 data.
In our study, we developed a methodology for low-cost flood mapping (Notti et al., 2018), based on the exploitation of free data collected by Sentinel missions and other satellites (i.e. Landsat, Proba-V, MODIS). Such images, joined with ancillary data (e.g., water depth models, river discharge data) allowed creating reliable geomorphological-based flood maps for several case studies of flood events. The proposed methodology is user-friendly and based on open source software, e.g., QGIS and SNAP, thus addressed also to the flood hazard management community, with no expertise in remote sensing processing.
This methodology could be an implementation, more focused on damages assessment and hazard planning, of the near real-time flood mapping Copernicus-EMS. The flood map based on satellite data allows also detect most critical areas like dense urban settlement, that need more in-depth investigations (Giordan et al., 2018).