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Monitoring flood extent and area through multi-sensor, multi-temporal remote sensing: the Strymonas (Greece) river flood

Alberto Refice (1), Khalid Tijani (2), Francesco P. Lovergine (1), Annarita D'Addabbo (1), Raffaele Nutricato (2), and Alberto Morea (2)

(1) CNR-ISSIA, Bari, Italy (refice@ba.issia.cnr.it), (2) GAP srl, c/o Dip. di Fisica "M. Merlin", Bari, Italy

Satellite monitoring of flood events at high spatial and temporal resolution is considered a difficult problem, mainly due to the lack of data with sufficient acquisition frequency and timeliness. The problem is worsened by the typically cloudy weather conditions associated to floods, which obstacle the propagation of e.m. waves in the optical spectral range, forbidding acquisitions by optical sensors. This problem is not present for longer wavelengths, so that radar imaging sensors are recognized as viable solutions for long-term flood monitoring. In selected cases, however, weather conditions may remain clear for sufficient amounts of time, enabling monitoring of the evolution of flood events through long time series of satellite images, both optical and radar.

In this contribution, we present a case study of long-term integrated monitoring of a flood event which affected part of the Strymonas river basin, a transboundary river with source in Bulgaria, which flows then through Greece up to the Aegean Sea.

The event, which affected the floodplain close to the river mouth, started at the beginning of April 2015, due to heavy rain, and lasted for several months, with some water pools still present at the beginning of September. Due to the arid climate characterizing the area, weather conditions were cloud-free for most of the period covering the event. We collected one high-resolution, X-band, COSMO-SkyMed, 5 C-band, Sentinel-1 SAR images, and 11 optical Landsat-8 images of the area. SAR images were calibrated, speckle-filtered and precisely geocoded; optical images were radiometrically corrected to obtain ground reflectance values from which NDVI maps were derived. The images were then thresholded to obtain binary flood maps for each day. Threshold values for microwave and optical data were calibrated by comparing one SAR and one optical image acquired on the same date.

Results allow to draw a multi-temporal map of the flood evolution with high temporal resolution. The extension of flooded area can also be tracked in time, allowing to envisage testing of evapotranspiration/absorption models.