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Monitoring river morphological changes using high resolution multitemporal sar images: a case study on orco river, italy

Francesco Mitidieri (1), Maria Nicolina Papa (1), Giuseppe Ruello (2), Donato Amitrano (2), Simone Bizzi (3), and Luca Demarchi (3)

(1) Salerno University, Civil Engineering Department, Fisciano (SA), Italy (mnpapa@unisa.it), (2) Department of Electrical Engineering and Information Technology, University of Napoli Federico II, via Claudio 21, 80125 Napoli, Italy, (3) Institute for Environment and Sustainability (Water Resources Unit, Unit H.01), European Commission's Joint Research Centre, Via Enrico Fermi, 2749, 21027, Ispra (VA), Italy

Improving the knowledge about river processes by applying innovative monitoring techniques is extremely needed to face the challenge of a better river management. In this paper we test the capability of satellite synthetic aperture radar (SAR) images to enrich the monitoring of river geomorphological processes. Multitemporal SAR images provide observations and measurements at high spatial (3 m), and in particular temporal resolution (15 days). This information if properly processed and classified may significantly enrich our ability to monitor the evolution of river morphological phenomena (erosion/deposition, narrowing/widening, riparian vegetation's evolution and interferences with river flow). This is expected to lead to an enhancements in the river management capabilities, in particular as regards the assessment of hydro-morphological river quality, as strongly suggested by European Commission's Water Framework Directive (2000/60/EC).

A case study on the Italian River Orco is here presented. The case study has used a set of 100 COSMO-SkyMed stripmap images (from October 2008 to November 2014) from Italian Space Agency. All the data were acquired with medium look angle (almost 30°) and HH polarization, also for increasing the land-water contrast. Calibration, registration and despeckling procedures were applied on the acquired dataset. In particular, the optimal weighting multitemporal De Grandi filter was adopted in order to allow an effective extraction of the water surfaces contour. This method was applied to extract water contours over the entire historical series of SAR datasets available. Thanks to the generated information we were able to monitor the lateral dynamic of the water channels and infer on the evolutions of erosion/deposition phenomena. To this aim, an RGB representation of multitemporal SAR data was implemented. The series of detected river channel morphological changes was then analyzed in the light of the series of discharge measurements in order to better disclose the link between water (and associated sediment) fluxes and channel morphological evolution.