



Potential and limitations of high resolution multitemporal sar images in river morphology

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In this study we test the capability of satellite synthetic aperture radar (SAR) images to enrich the monitoring of river geomorphological processes. A case study on the Italian River Orco is presented; a set of 100 COSMO-SkyMed stripmap images (from October 2008 to December 2016) from Italian Space Agency was employed. All the data, acquired with medium look angle (almost 30°) and HH polarization for increasing the land-water contrast, were processed in order to calibrate, register and reduce the speckle effect. Moreover, the optimal weighting multi-temporal De Grandi filter was adopted 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 relations between low or peak flow and river morphology.

Multi-temporal SAR images were compared to orthophotos and in situ measurements (performed at the same time of a SAR acquisition) in terms of river features extraction (e.g. active channel, vegetated islands) and measurements of morphometric parameters (e.g. reach length, channel width, curvature and sinuosity). Results of this comparison highlighted the potential offered by the use of SAR technology, with some limitations. In particular, good performances were reached by the extraction of the active channel and vegetated island compared to the ones obtained using the orthophotos. On the other hand, some issues were encountered in extracting water surfaces where riffles exhibit surface waves having heights greater than the wavelength of the electromagnetic signal of SAR, which causes a low land-water contrast. Hence, given the high spatial (3 m) and temporal resolution (15 days) of SAR images and the all-weather all-time acquisition conditions, a significant enhancement in the river management capabilities is possible, in particular regarding the assessment of hydro-morphological river quality, as strongly suggested by European Commission's Water Framework Directive (2000/60/EC).