



A fully automatic tool to perform accurate flood mapping by merging remote sensing imagery and ancillary data

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Flooding is one of the most frequent and expansive natural hazard. High-resolution flood mapping is an essential step in the monitoring and prevention of inundation hazard, both to gain insight into the processes involved in the generation of flooding events, and from the practical point of view of the precise assessment of inundated areas. Remote sensing data are recognized to be useful in this respect, thanks to the high resolution and regular revisit schedules of state-of-the-art satellites, moreover offering a synoptic overview of the extent of flooding. In particular, Synthetic Aperture Radar (SAR) data present several favorable characteristics for flood mapping, such as their relative insensitivity to the meteorological conditions during acquisitions, as well as the possibility of acquiring independently of solar illumination, thanks to the active nature of the radar sensors [1]. However, flood scenarios are typical examples of complex situations in which different factors have to be considered to provide accurate and robust interpretation of the situation on the ground: the presence of many land cover types, each one with a particular signature in presence of flood, requires modelling the behavior of different objects in the scene in order to associate them to flood or no flood conditions [2]. Generally, the fusion of multi-temporal, multi-sensor, multi-resolution and/or multi-platform Earth observation image data, together with other ancillary information, seems to have a key role in the pursuit of a consistent interpretation of complex scenes. In the case of flooding, distance from the river, terrain elevation, hydrologic information or some combination thereof can add useful information to remote sensing data.

Suitable methods, able to manage and merge different kind of data, are so particularly needed. In this work, a fully automatic tool, based on Bayesian Networks (BNs) [3] and able to perform data fusion, is presented. It supplies flood maps describing the dynamics of each analysed event, combining time series of images, acquired by different sensors, with ancillary information.

Some experiments have been performed by combining multi-temporal SAR intensity images, InSAR coherence and optical data, with geomorphic and other ground information. The tool has been tested on different flood events occurred in the Basilicata region (Italy) during the last years, showing good capabilities of identification of a large area interested by the flood phenomenon, partially overcoming the obstacle constituted by the presence of scattering/coherence classes corresponding to different land cover types, which respond differently to the presence of water and to inundation evolution

[1] A. Refice et al, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 7, no. 7, pp. 2711–2722, 2014.

[2] L. Pulvirenti et al., IEEE Trans. Geosci. Rem. Sens., Vol. PP, pp. 1- 13, 2015.

[3] A. D'Addabbo et al., "A Bayesian Network for Flood Detection combining SAR Imagery and Ancillary Data," IEEE Trans. Geosci. Rem. Sens., in press.