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Hydrological and hydrometeorological analysis of the September 26 2007 flash flood event in the metropolitan area of Venice

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In the early morning of 26 September 2007, a mesoscale convective system (MCS) formed in an area of convergence between a southeasterly low level jet flowing along the Adriatic Sea and a northeasterly barrier-type wind south of the Alps. The storm system was responsible for precipitation exceeding 320 mm in less than 12 hours, of which 240 mm in only 3 hours. The resulting flash flood event produced extensive damages throughout the densely populated Venice metropolitan area.
Questions which motivate this study include the following:
1. Examination of annual rainfall maxima in north-eastern Italy shows occurrence of extreme precipitation at 1 hour interval over the coastal area around Venice (Norbiato et al., 2007); mesoscale modelling of the 26 September 2007 flash flood event aims at developing understanding of the relevant meteorological processes leading to such extremes.
2. The river basins feeding the Venice lagoon are characterised by a very smooth and gentle topography, which is almost entirely artificially drained. Combination of heterogeneous land use, with highly urbanized and extensive agricultural areas, highly variable rainfall fields, and slow reacting drainage network leads to strongly heterogeneous flooding. This hydrological situation is examined here by means of a hydrological model and data from a nearby weather radar, conventional hydrometerological network, and pumping stations which provide information on runoff volume generated within relatively small areas.
3. The seasonal fluctuations of the ground water table affect the initial conditions and influence the rainfall fraction that contributes to the rapid stream response. Examination of local data is carried out to assess the impact of these initial conditions on the runoff response.
4. Post-event simulation of the rainfall fields by means of high resolution limited area models shows that, although predictability is limited due to the convective nature of the rainfall event, the forecast errors are relatively small mainly as a consequence of the fact that convection is embedded in a large scale flow with some degree of predictability. Examination of the coupled meteorological-hydrological modelling chain for this event may therefore reveal the impact of the forecast error on the simulated discharges across the impacted basins.

Norbiato, D., M. Borga, M. Sangati and F. Zanon, 2007: Regional Frequency Analysis of Extreme Precipitation in the eastern Italian Alps and the August 29, 2003 Flash Flood. J. Hydrology, 345, 3-4, 149-166, 2007.