RADAR-DRIVEN HIGH-RESOLUTION HYDRO-METEORO-LOGICAL FORECASTS OF THE 26 SEPTEMBER 2007 VENICE FLASH FLOOD

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Abstract

This study aims to assess the feasibility of using carefully checked radar-derived quantitative precipitation estimates (QPE) by assimilation into numerical weather prediction (NWP) and hydrological models for flash flood forecasting. The hydrometeorological modeling chain includes the convection-permitting NWP model COSMO-2 and a hydrologic-hydraulic models built upon the concept of geomorphological transport. Radar rainfall observations are assimilated into the NWP model via the latent heat nudging method. The study is focused on 26 September 2007 extreme flash flood event which impacted the coastal area of north-eastern Italy around Venice. The hydro-meteorological modeling system is implemented over the Dese river, a 90 km^2 catchment flowing to the Venice Lagoon.

The radar rainfall observations are carefully checked for artifacts,

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including beam attenuation, by means of physics-based correction procedures and comparison with a dense network of rain gauges.

The impact of the radar QPE in the assimilation cycle of the NWP model is very significant, in that the main individual organized convective systems were successfully introduced into the model state, both in terms of timing and localization. Also, incorrectly localized precipitation in the model reference run without rainfall assimilation was correctly reduced to about the observed levels. On the other hand, the highest rainfall intensities were underestimated by 20% at a scale of a few tens of kilometers, the local peaks at a scale of a few kilometers by 50%. The positive impact of the assimilated radar rainfall was carried over into the free forecast for about 2-5 hours, depending on when this forecast was started, and was larger, when the main mesoscale convective system was present in the initial conditions. The improvements of the meteorological model simulations were directly propagated to the river flow simulations, with an extension of the warning lead time up to three hours.