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Heavy precipitation events over Liguria (Italy): high-resolution hydro-meteorological forecasting and rainfall data assimilation

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Liguria region in northern Italy, a coastal area characterized by complex orography that reaches high elevation within a few kilometres from the coastline, is particularly prone to heavy precipitation episodes that can severely affect urban areas, mostly located along the coast. The particular morphology of the area, characterized by catchments of small dimensions (mostly smaller than 200 km2) with very short response time, make rainfall predictions necessary to drive rainfall-runoff models in order to provide streamflow forecasts.
Autumn 2014 was characterized by a number of severe weather episodes associated with floods and relevant damages, including also a devastating flood on 9 October. These events are taken as a test-bed to evaluate the performance of a rainfall assimilation scheme based on nudging of humidity profiles and applied to a convection-permitting meteorological model (MOLOCH) at high-resolution. The meteorological model is then coupled with the operational hydrological forecasting chain and the whole system is implemented taking into account operational requirements.
The impact of radar data assimilation is evaluated in terms of quantitative precipitation forecast applying an object-oriented verification methodology (SAL), and also in terms of hydrological discharge prediction. It turns out to be dependent on the environment characteristics, being more effective when non-equilibrium convection dominates and thus an accurate prediction of the local triggering for the development of the precipitation system is required.