Radar and lightning data assimilation: the impact of different setting options discussed for a heavy precipitation event occurred in Italy.

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The forecast of severe events at the local scale still remains challenging because of the multitude of physical processes involved on a wide range of scales. Improving the initial conditions (IC) of numerical weather prediction (NWP) models is a key point for good forecasting. Since limited-area models are nowadays operational at the kilometric scale (< 5 km), the assimilation of data from high-resolution space-time observations is crucial to correctly represent the state of the atmosphere at local scale.

Radar and lightning data are both useful to improve the IC of NWP models for several reasons. Radar data is available with a high spatio-temporal resolution and provides information on hydrometeors and wind, while lightning data locates convection both spatially and temporally accurate.

Recently, Federico et al. (2019) studied the impact of radar reflectivity factor and lightning data assimilation on the Very Short-Term Forecast (VSF) of the RAMS@ISAC NWP model for two intense precipitation events over Italy. They found that, despite an improvement of the rainfall VSF due to the assimilation of lightning and radar reflectivity factor data, the usefulness of the procedure is partially limited by the increase in false alarms, especially in case of high precipitation rates (> 50 mm/3h).

In this work, we apply the methodology proposed by Federico et al. (2019) to an intense precipitation event occurred in Italy in November 2019. The RAMS@ISAC meteorological model is used here, with a horizontal resolution of 3km.

RAMS@ISAC is initialized by a 3D-Var data assimilation scheme that uses both lightning and radar reflectivity factor data. Different 3D-Var data assimilation scheme settings are used to produce different ICs for the RAMS@ISAC model for the specific case. The sensitivity of the precipitation field prediction to changes in these ICs will be discussed.
Keywords: lightning data assimilation, radar reflectivity factor data assimilation, very short-term forecast, numerical weather prediction

Reference