Assimilation of radar derived surface rain rate into the regional COSMO model through a 1D-Var+nudging scheme: analysis of results

V. Poli (1,2,3), F. Di Giuseppe (3), T. Paccagnella (3), P. P. Alberoni (3)

(1) DIST, University of Genova, Italy, (2) CIMA Foundation, Savona, Italy, (3) ARPA-SIM, Bologna, Italy (vpoli@arpa.emr.it)

Numerical Weather Prediction based on high resolution models, with grid resolution in the range of 1-4 km, is in the focus for intensive research and development. The aim is to improve the short range forecasting of severe and quickly evolving weather events. To hit the mark very frequent and dense observations are applied in a 1D-Var+nudging assimilation scheme.

Observational data are surface rain rate retrieved from Emilia-Romagna radar composit. The use of very high spatial and temporal resolution should guarantee improvements in the initial conditions knowledge. Nevertheless, highly correlated observations could introduce unwanted correlation error into the analysis. For this reason data thinning is performed and discussed.

The 1D-Var algorithm allows the vertical re-distribution of the heat released by the rain formation process in a physical consistent way. The scheme used performs the retrieval of temperature and humidity profiles from radar derived surface rain rate, employing two linearized parameterizations of large-scale condensation and convection firstly developed at ECMWF. Former studies prove that 1D-Var package is able to bring the model closer to observed quantities.
COSMO nudging scheme is then used to assimilate those new analyses into the very high resolution COSMO-Model run operationally at ARPA-SIM.

A convective event occurred in northern Italy on 2-4 May 2007 is examined. By employing the 1DVAR analysed products, error statistics are calculated and the quality of the retrieval performances is quantified in terms of the error reduction between the background and the analysis. Moreover results are compared with a simulated operational forecast run without radar data assimilation. Independent observations are then employed to check the absolute accuracy of the 1DVAR analysed profiles.