



## **Comparison between 3D-Var and 4D-Var data assimilation methods for the simulation of a heavy rainfall case in central Italy**

Vincenzo Mazzearella (1), Ida Maiello (2), Vincenzo Capozzi (1), Giorgio Budillon (1), Rossella Ferretti (2,3)

(1) Department of Science and Technology, University of Naples "Parthenope", Italy, (2) Centre of Excellence CETEMPS, Department of Physics and Chemistry - University of L'Aquila, Italy, (3) Danish Meteorological Institute, DMI, Copenhagen, Denmark

This work aims to provide a comparison between three dimensional and four-dimensional variational data assimilation methods (3D-Var and 4D-Var) for a heavy rainfall case in central Italy. To evaluate quantitative precipitation forecasts (QPF), reflectivity and radial velocity acquired from Monte Midia Doppler radar are assimilated into the Weather Research Forecasting (WRF) model.

As a case study, the two methods were compared for a heavy rainfall case that occurred in central Italy during the intensive observation period IOP4 (14 September 2012) as part of the HYdrological cycle in Mediterranean EXperiment (HyMeX) program. This event, characterized by a cut-off low over the Tyrrhenian Sea, produced flash floods over Marche and Abruzzo region, rainfall maxima reaching more than 150mm/24h.

In order to identify the best QPF, three experiments are conducted to evaluate the impact of radar data assimilation: CTRL (run initialized using ECMWF analysis without data assimilation), 3D\_RD (run with assimilation of radar data using WRF-3DVar) and 4D\_RD (run with assimilation of radar data using WRF-4DVar). All simulations are compared in terms of rainfall forecast and precipitation measured by the gauges through three statistical indicators: forecast accuracy, equitable threat score and false alarm rate.