A twenty-month intercomparison study of three limited area models over the Italian Calabria region using the contiguous rain area analysis

S. Mariani (1,2), N. Tartaglione (3), C. Accadia (4), M. Casaioli (1) and S. Federico (5, 6)

(1) APAT, Rome, Italy, (2) Department of Mathematics, University of Ferrara, Ferrara, Italy, (3) Department of Physics, University of Camerino, Camerino, Italy, (4) EUMETSAT, Darmstadt, Germany, (5) CRATI s.c.r.l., Cosenza, Italy, (6) CNR–ISAC, Lamezia Terme, Italy (stefano.mariani@apat.it / Phone: +39-065007-4209)

Verification of quantitative precipitation forecast (QPF) is commonly applied in operational meteorological centres in order to assess the general quality of numerical weather prediction models. In particular, QPF verification over a long time series, including different type of meteorological events, gives insights about how the atmospheric physical processes are modeled. In this frame, a twenty-month intercomparison study over the Italian Calabria region was previously conducted comparing 24-h precipitation fields modeled by three limited area models (LAMs) with the Barnes rain-gauge based analyses. The models included in the intercomparison are: the Quadrics BOlam Limited Area Model (QBOLAM), the Fifth Generation Mesoscale Model (MM5), and the Regional Atmospheric Modeling System (RAMS). The first LAM is a hydrostatic, 10-km model operational at APAT; whereas the other two are non-hydrostatic, 6-km models operational at CRATI.

LAMs' precipitation forecasts have been evaluated, over a common 10-km grid (via remapping), using three non-parametric skill scores, namely the bias score (BIA), the equitable threat score (ETS) and the Hanssen–Kuipers skill score (HK), and a hypothesis test for skill score differences based on the bootstrap method. One of the drawbacks of such an approach (i.e., a verification study performed by using only skill scores) is the impossibility to directly extract from score measures information on the spatial distribution on forecast errors. Besides, skills scores might be strongly penalized by misplacing correct precipitation forecast patterns with respect to the actual rainfall fields (feature known as double penalty effect). Thus, the scope of this work is the extension of the previous verification study by implementing, at regional level, the contiguous rain area (CRA) analysis. This object-oriented method allows, indeed, quantifying (in latitude and longitude) the spatial forecast shift and identifying the error sources that affected the LAMs' forecasts. Furthermore, applying the CRA analysis on a long time series (twenty months), systematic forecast misplacements might be also diagnosed. Forecast misplacements are also analyzed as a function of the number of rain gauge observations available in the daily comparison.