EMS Annual Meeting Abstracts
Vol. 16, EMS2019-146, 2019

Performance of ECMWF- and COSMO-based ensemble forecast systems for precipitation events over Italy

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The deterministic approach to weather prediction does not allow one to establish a-priori the degree of skill of an individual forecast; on the other hand, probabilistic forecasts should provide a more complete, reliable and accurate view of what could happen in the future. Therefore, probabilistic forecasts bring definite benefits for decision-makers. Furthermore, forecast users can exploit such information, when, for example, they want to weigh the losses associated with adverse weather events against the costs of taking precautionary actions.

The aim of this work, carried out in the framework of the EU-funded MISTRAL Project, is to assess strengths and weaknesses of different flavors of global and limited-area ensemble forecasts in the probabilistic prediction of heavy precipitation events. In particular, the performances of four different ensemble systems were compared: ECMWF-ENS-raw (51 members, 18 km horizontal resolution), ecPoint-rainfall (a newly-developed calibrated version of ECMWF-ENS), COSMO-LEPS (20 members, 7 km horizontal resolution) and COSMO-2I-EPS (20 members, 2.2 km horizontal resolution).

The intercomparison window covered separate periods, characterized by different weather types which include convective-precipitation events with weak synoptic forcing as well as stratiform-precipitation cases dominated by large-scale forcing.

In all cases, high-impact weather events affected different areas of Italy. As for the surface fields, precipitation fields accumulated over 6 or 12 hours were verified against the non-conventional station network provided by the National Civil Protection Department and a number of traditional probabilistic scores (Brier Skill Score, Ranked Probability Score, ROC-Area, Outliers Percentage and others) were considered to assess the probabilistic skill of the different ensemble systems.

The added value of calibration, of enhanced horizontal resolution and of higher/lower ensemble size was analyzed. The best scores were mainly obtained by ecPoint-rainfall and by the COSMO-based ensemble systems; in particular, the recently-implemented COSMO-2I-EPS often achieved the best performances, despite the smaller number of ensemble members.

Although these results are based on assessments over relatively short periods, they shed some light on the possibility of improving the probabilistic forecast skill of heavy precipitation events by calibrating global ensembles and by enhancing the horizontal and vertical resolution of limited-area ensemble systems.