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Performance of different ensemble systems for cases of high-impact weather over Italy

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The deterministic approach to weather prediction does not allow to establish a-priori the degree of skill of an individual forecast; instead, probabilistic forecasts provide a more complete, reliable and accurate view of what might happen in the future, ideally providing information on the relative frequency of an event occurring. Therefore, they bring definite benefits for decision-makers. Forecast users can exploit such information, for example, when they want to weight the losses associated with adverse weather events against the costs of taking precautionary actions. The aim of this work is to assess the added value of enhanced horizontal resolution in the probabilistic prediction of upper-level and surface fields.
In particular, the performances of three different ensemble systems were compared: ECMWF-ENS (51 members, 18 km horizontal resolution), COSMO-LEPS (16 members, 7 km horizontal resolution) and COSMO-2I-EPS (10 members, 2.2 km horizontal resolution).
While the first 2 ensemble systems are operational, COSMO-2I-EPS is still in a development phase. Therefore, the inter-comparison window covers a limited period, which ranges from 20 to 27 June 2016.
In this work, both upper-level and surface variables are analysed.
As for upper-level, both temperature and the geopotential height at three different pressure levels were considered; the ensemble spread and the root mean square error were computed using the available Italian radio-sounding data every 12/24 hours for verification.
As for the surface, 2-metre temperature and precipitation cumulated over six hours were verified against the non-conventional station network provided by the National Civil Protection Department. The ensemble spread and the root mean square error of 2-metre temperature were computed, while a number of probabilistic scores (Brier Skill Score, Ranked Probability Score, ROC-Area, Outliers Percentage and others) were considered for precipitation.
For both upper-level and surface verification, the best scores were mainly obtained by the COSMO-based ensemble systems which have higher horizontal resolution and lower ensemble size; in particular, the newly implemented COSMO-2I-EPS often achieved the best performances.
The results of this pilot study are based over a relative short period due to limited data availability and further investigations is needed.
Nevertheless, the added value of high resolution in mesoscale ensembles seems to play a crucial role in the probabilistic prediction of atmospheric fields at all levels.