The MISTRAL Project provides a new tool for Flash Flood Forecasting in Italy

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Localized heavy rainfall, which can be associated with flash floods, is difficult to predict accurately: both the predicted location and the intensity can exhibit large errors. Moreover, weather forecasts should be provided for points and not for the large regions represented by global model grid boxes. This mismatch can in principle be addressed using high-resolution limited-area models, or by applying some post-processing to global forecast models, as used in “ecPoint-rainfall”, a new ECMWF probabilistic post-processing technique to improve precipitation forecasts. One novel premise of ecPoint, which has a major positive impact on the calibration, is that the forecast-versus-point-observation relationship depends on “gridbox weather types” that could potentially occur in many parts of the world.

The MISTRAL (Meteo Italian SupercompuTing PoRtAL) project, funded under the Connecting Europe Facility (CEF) – Telecommunication Sector Programme of the European Union came to its end in January 2021. The main project goal was to facilitate and foster the re-use of datasets by weather-dependent communities, to provide added value services using HPC resources. ECMWF participated in the project with the goal of improving probabilistic 6-h rainfall forecast products, to improve the prediction of flash floods in Italy and nearby Mediterranean regions. One of the objectives was to exploit the CINECA supercomputer facilities in Bologna to extract maximum benefit from ecPoint-Rainfall and from a 2.2km resolution COSMO limited area ensemble. To address that, we applied a new and innovative scale-selective neighbourhood post-processing technique to the COSMOS output, which, on the one hand, identifies and preserves the most reliable heavy rainfall signals and, on the other, spreads out those signals which are less consistently handled. Then, it is blended with a new 6h ecPoint-Rainfall product in order to leverage the most skilful aspects of the two systems. The 6-h ecPoint Rainfall forecasts were also developed during the project, building on the pre-existing ecPoint-Rainfall 12h product (already delivered to ECMWF customers in real-time). The final blended product includes, for lead times of 1-10 days, 6-h accumulated rainfall for each COSMO gridbox in percentiles (1, 2,..99) and probabilities of exceeding certain thresholds.

The main objective of this work was to improve forecasts and support weather-alert decisions for flash flood prediction. As a legacy of the project, we are now providing forecast data for Italy and nearby regions with a higher level of quality and resolution than has hitherto been possible, and we are also delivering a robust gateway to products for the European community within the MISTRAL portal (https://meteohub.hpc.cineca.it/app/maps/flashflood). The principles could also be usefully applied in other parts of Europe, or indeed the world, where limited area ensembles are running operationally.

In this presentation, we will introduce the methodologies, the verification results and will illustrate
with forecast examples.