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Real time weather forecasting in southern Italy: a detailed verification

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ABSTRACT:

In the framework of the project Sinergreen-ResNovae - “Smart Energy Master for the energetic government of the territory”, a real-time weather forecasting system was set-up at high-horizontal resolution in southern Italy. The weather forecasting system is based on the Regional Atmospheric Modeling System (RAMS), using a version of the model maintained and developed at CNR-ISAC.
The RAMS configuration for this application has two two-ways nested grids with 12 km and 3 km horizontal resolution. The first grid covers the Central Mediterranean Basin (261x241 grid points in the horizontal plane), while the second extends over the whole southern Italy (254x222 grid points in the horizontal plane). The forecast is performed on a daily basis for the following three-days and has a time resolution of 1 h.
The aim of the work is to assess the performance of the real-time forecasting system for a whole year (1 December 2012 – 30 November 2013) for the following surface parameters: temperature, relative humidity, wind speed and direction. The forecast is compared with observations from the Global Telecommunication System (GTS), which counts several (between 20 and 60 stations, depending on the day for the period considered) observational points over southern-Italy.
Different statistical scores have been computed for the meteorological parameters and statistics have been computed for different seasons and for land and coastal stations, allowing for a detailed depiction of the forecasting errors.
Results show that error varies with the season and, due to the complexity of the area, with the position. The increase of the forecasting error with forecasting time is small for all parameters, confirming the results obtained previously for the temperature forecast over Calabria (Federico, 2011; Federico et al. 2011).
In this contribution we show first the statistical scores of the performance of the operational forecast in Southern Italy, then we address two practical issues: the impact of the horizontal resolution on the forecast performance, and the impact of a a-posteriori correction technique on the forecast error.
The impact of the horizontal resolution is assessed by running, the forecast for a two-month period (December 2012 and April 2013), with only the first-grid (12 km horizontal resolution) and comparing the errors with the operational forecast (3 km horizontal resolution). Results show that, the use of the second grid is important for improving the quantitative forecast: in particular the addition of the second-grid improves the performance of the forecast of 0-20% of the RMSE depending on the parameter, time of forecast and month of the year. In fact, the enhanced resolution provides a better representation of the local topographical features (e.g. the land-sea mask) improving the forecast performance.
The impact of the a-posteriori correction of the forecast is assessed by applying of the MOS (Model Output Statistics, Wilks, 2006) technique for the meteorological parameters temperature, relative humidity, wind speed and wind direction. The MOS regression curve has as predictor the model forecast at the surface station and as predictand the meteorological parameter observed at the station. Only one predictor is considered for each predictand. Results show that the MOS technique is a cheap and effective way to improve the model performance at specific locations. This point is particularly important for the application of quantitative forecast for renewable energy applications.

Finally, to further specialize the study for coastal regions, a detailed verification for the Lamezia Terme site, in the Central Tyrrhenian coast of Calabria, is performed. For this site measurements from a LIDAR wind profiler and from a surface weather station are available for the period July-November 2013 and simulations are verified in the lower part of the boundary layer (0-300 m).

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