EGU23-14712, updated on 26 Apr 2024
https://doi.org/10.5194/egusphere-egu23-14712
EGU General Assembly 2023

NWP model updates and post-processing: a strategy for an EMOS model on ECMWF wind gusts forecasts

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In the framework of KNMI's Early Warning Center (EWC), ECMWF ensemble (ENS) predictions are used to issue medium-range forecasts of severe weather. Timely forecasts of wind gusts extremes are important to prevent potential damage. However, ensemble forecasts are affected by biases and under- or over-dispersion. These errors lead to a reduction in the skill of the forecasts, especially for long lead-times and for extreme cases, such as windstorms and deep convective episodes. Hence, statistical post-processing is a fundamental step in the establishment of a skillful weather alert system for extreme wind gust events.

However, weather models like ECMWF-IFS are subject to frequent updates, which include changes in the calculation of certain diagnostic variables and by consequence in statistical features of their ensemble distribution. This is the case for ECMWF wind gusts forecasts, whose bias has been reduced with the last update in October 2021. Therefore, the use of pre-update wind gusts forecasts in the training of the post-processing model must be considered with care.

In the context of the development of an Ensemble Model Output Statistics (EMOS) model, this limitation has been tackled by reconstructing wind-gusts forecasts with a preliminary EMOS model. This step has been performed by including in the regression those variables that are used by ECMWF for the calculation of wind gusts, which were less affected by the update.

The reconstructed wind gusts forecasts have been added to a set of summary statistics of the ensemble distribution of variables physically related to wind gusts. A process of forward selection has been applied to identify the most relevant contributions to the general EMOS model, highlighting reconstructed wind gusts as the most important predictor for all lead-times.

The post-processed forecasts obtained with this experimental EMOS model have been verified and compared to those calculated with a conventional EMOS model (performed ignoring the above caveats) and with the results of a non-parametric Quantile Regression Forest. These models have been trained on the same period (2018-2021) and tested on the period that has followed the update (2021-2022), including only grid-points and stations that cover the territory of the Netherlands and distinguishing between summer and winter half-years. The method showing the best performance will be employed operationally for the post-processing of ECMWF-ENS wind gust forecasts over the Netherlands and will be used in the EWC weather alert system.