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CAMS pollen forecasts in Europe: prediction quality for season 2022

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Modern technologies in representation of the future atmospheric conditions are relying on the use of three-dimensional numerical models. The advancements in the weather prediction and air quality models had provided a physically grounded prerequisites (served a solid basis) for the development of numerical pollen forecasts. In many numerical models, the pollen grains are considered as the passive tracers with fixed aerodynamical characteristics which are species dependent. The fundamental difference of pollen prediction models from others is the integration of phenological processes responsible for the pollen development, maturation and release. Not a single numerical model among the existent ones is capable of perfect reproduce the spatiotemporal evolution of the atmosphere. All of them do contain numerous uncertainties originated not only from their design but also from the imperfect knowledge of the state of the atmosphere at every moment of time. The numerical discretization in space and time of continuous atmospheric processes by model equations will inevitably generate some errors. One of the efficient ways to minimize the uncertainties of numerical models is to construct the ensemble out of their forecasts. This approach is applied in CAMS (Copernicus Atmosphere Monitoring Service, https://atmosphere.copernicus.eu/) to provide the optimal air quality prediction over the European domain. Together with other atmospheric pollutants the 4-days forecast for pollen is computed by 11 state-of-the-art chemical transport models and their ensemble. The surface concentrations fields are available on the regular grid with horizontal resolution of about 10 by 10 km. The aim of this work is to analyze the diversity of skill scores of the pollen predictions for different ensemble members for the pollen season 2022.

The quality of pollen forecast for every individual model is estimated with standard statistical characteristics: model mean bias, temporal correlation coefficient, root mean square error and also shift of the pollen season start/end for aerobiological and medical season. Hourly model timeseries were averaged and compared with corresponding daily observations from 100 European Aeroallergen Network (EAN) stations in Europe (provided within a contract agreement between CAMS and EAN). The model list consists of CHIMERE, DEHM, EMEP, EURAD, GEMAQ, LOTOS-EUROS, MATCH, MOCAGE, MINNI, MONARCH, SILAM, and ENSEMBLE.

The reliability of pollen predictions in 2022 varied depending on the model, statistical parameter and pollen taxon. The analysis had revealed the underestimation of the birch daily levels (less than 30% of mean concentrations 60 pollen/m3) for the majority of the models, while for ragweed the absolute bias was about 25% (of the mean 21 pollen/m3). The mean temporal correlation was about 0.5 - 0.6 for birch and above 0.6 for grass. The timing and duration of the birch season were predicted quite good by most of the models with errors in the season start/end about ± 2-3 days on average. The mean olive concentrations have negative bias (within about 50% of the mean value 20 pollen/m3) for most of the models while for the grass predictions only 6 models have lower than 50% (mean 21 pollen/m3). Olive season propagation was represented with lower accuracy than for birch that worsened the correlation scores.

In this study we analyzed the performance of the pollen forecasts by comparing them with the data from aerobiological observations. Results show that on average the ensemble of models routinely have better scores than any individual model.

Keywords
Pollen forecast, numerical model, CAMS ensemble, forecast evaluation

Please, submit you abstract

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