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The LQ-WARN Project – Development of a Model Output Statistics Product for Air Quality Warnings

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In order to reach legal air quality limits, several municipalities in Germany have decided to take actions if concentrations of NO₂ and Particulate Matter (PM) exceed certain thresholds. The decision for concrete measures is usually based on observations or use the Direct Model Output (DMO) of air quality models. However, due to large biases of state-of-the-art numerical air quality models, the skill of DMO forecasts to predict periods of polluted air up to four days ahead is very limited.

The project LQ-WARN aims to develop a system for warning of poor air quality based on Model Output Statistics (MOS). Therefore, air quality related observations, model results provided by the Copernicus Atmosphere Monitoring Service (CAMS) and meteorological parameters from the ECMWF numerical weather prediction model are used as predictors to forecast the air quality by applying Multiple Linear Regression (MLR). In this way MOS equations are calculated for four seasons. The final forecast product will comprise post-processed probabilistic as well as deterministic (e.g. mass concentration) parameters for the species NO₂, O₃, PM₁₀ and PM_{2.5}. Forecasts will be available for several hundred German locations and cover lead times up to 96 hours.

Here, we show first results of our phase 1 MOS prototype, for which observational, meteorological and empirical predictors are applied. Despite of the preliminary exclusion of CAMS predictors, the verifications of the MOS equations imply a considerable reduction of variance and a significant reduction of RMSE (Root Mean Square Error) compared to the climatological values for all four species. Hence, the MOS system can already provide a reasonably good air quality forecast. Furthermore, our analysis of used meteorological predictors, enables a detailed analysis of the importance of specific meteorological parameters for improved statistical air quality forecasts. As an outlook we will provide detailed information about the final phase 2 LQ-WARN product, which will also include the MOS predictors of CAMS and is expected to be launched in pre-operational mode by 2022.