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A model output statistics system to forecast the 2 metre temperature at the "Wettermast Hamburg" site

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The model output statistics (MOS) method is frequently used to downscale and improve numerical weather models for specific measurement sites. One of these is the "Wettermast Hamburg" (http://wettermast-hamburg.zmaw.de/) in the south-east of Hamburg. It is operated by the Meteorological Institute of the University of Hamburg. The MOS approach was used to develop a not yet existing 2 metre temperature forecasting system for this site. The forecast system is based on the 0 UTC control run of the legacy "global ensemble forecast system". The multiple linear equations were calculated using a training period of 2 years (01.03.2012-28.02.2014), while the developed models were evaluated using the following year (01.03.2014-28.02.2015).
During the development process it was found that a combination of forward and backward selection together with the "Bayesian information criterion", a warm-cold splitting and a five-fold cross-validation was the best automated method to minimize the risk of overfitting. To further reduce the risk, the number of predictors were limited to 6. Also the first 3 possible predictors were selected by hand. In comparison to the fully automated method, the error was not changed significantly through this restrictions for the evaluation period.
The analysis of the importance of selected predictors shows that the global weather model has problems characterizing specific weather phenomena. Large model errors by misrepresenting the boundary layer were highlighted through the 10 metre wind speed, the surface temperature and the 1000 hPa temperature as frequently selected predictors.
The final forecast system has a root-mean-square error minimum of 1.15 K for the initialization and a maximum 2.2 K at the 84 hour lead time. Compared to the direct model output this is a mean improvement of $\sim 22\%$. The main error reduction is achieved in the first 24 hours of the forecast, especially at the initialization (up to 45% error reduction).