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Statistical Correction of Air Temperature Forecasts for City and Road Weather Applications

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The method for statistical correction of air /road surface temperatures forecasts was developed based on analysis of long-term time-series of meteorological observations and forecasts (from HIgh Resolution Limited Area Model & Road Conditions Model; 3 km horizontal resolution). It has been tested for May-Aug 2012 & Oct 2012 - Mar 2013, respectively. The developed method is based mostly on forecasted meteorological parameters with a minimal inclusion of observations (covering only a pre-history period). Although the st iteration correction is based taking into account relevant temperature observations, but the further adjustment of air and road temperature forecasts is based purely on forecasted meteorological parameters. The method is model independent, e.g. it can be applied for temperature correction with other types of models having different horizontal resolutions. It is relatively fast due to application of the singular value decomposition method for matrix solution to find coefficients. Moreover, there is always a possibility for additional improvement due to extra tuning of the temperature forecasts for some locations (stations), and in particular, where for example, the MAEs are generally higher compared with others (see Gilet et al., 2014).

For the city weather applications, new operationalized procedure for statistical correction of the air temperature forecasts has been elaborated and implemented for the HIRLAM-SKA model runs at 00, 06, 12, and 18 UTCs covering forecast lengths up to 48 hours. The procedure includes segments for extraction of observations and forecast data, assigning these to forecast lengths, statistical correction of temperature, one-&multi-days statistical evaluation of model performance, decision-making on using corrections by stations, interpolation, visualisation and storage/backup. Pre-operational air temperature correction runs were performed for the mainland Denmark since mid-April 2013 and shown good results. Tests also showed that the CPU time required for the operational procedure is relatively short (less than 15 minutes including a large time spent for interpolation). These also showed that in order to start correction of forecasts there is no need to have a long-term pre-historical data (containing forecasts and observations) and, at least, a couple of weeks will be sufficient when a new observational station is included and added to the forecast point. Note for the road weather application, the operationalization of the statistical correction of the road surface temperature forecasts (for the RWM system daily hourly runs covering forecast length up to 5 hours ahead) for the Danish road network (for about 400 road stations) was also implemented, and it is running in a test mode since Sep 2013.

The method can also be applied for correction of the dew point temperature and wind speed (as a part of observations/ forecasts at synoptical stations), where these both meteorological parameters are parts of the proposed system of equations. The evaluation of the method performance for improvement of the wind speed forecasts is planned as well, with considering possibilities for the wind direction improvements (which is more complex due to multi-modal types of such data distribution). The method worked for the entire domain of mainland Denmark (tested for 60 synoptical and 395 road stations), and hence, it can be also applied for any geographical point within this domain, as through interpolation to about 100 cities' locations (for Danish national byvejr forecasts). Moreover, we can assume that the same method can be used in other geographical areas. The evaluation for other domains (with a focus on Greenland and Nordic countries) is planned. In addition, a similar approach might be also tested for statistical correction of concentrations of chemical species, but such approach will require additional elaboration and evaluation.