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Statistical adaptation of mesoscale numerical weather forecasts for designing predictive control of indoor building climates

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With the continuous improvement of numerical weather prediction (NWP) models and the ongoing increase of computational power, the range of applications making use of NWPs is expanding and includes both, industrial and decision making sectors. In particular, the availability of NWPs at a certain location for several days ahead enables anticipatory planning and/or the deployment of intelligent technologies in order to save limited resources. This in turn reinforces the need for accurate weather predictions at point locations.

However, NWP models area averaged predictions diverge systematically and stochastically from the observed conditions at the location in question. So called statistical downscaling methods have been developed to tackle this problem. These aim to derive systematic relationships between time series of NWP model outputs and local observations. The identified relationships can be parametric, (e.g. based on uni- or multivariate (non-)linear regressions or filters) or nonparametric (e.g. based on cluster analyses or analogues) and are estimated from (re-) analysis data or (re-) forecasts of NWP models along with associated surface observations. Obviously, because of the empirical nature of these methods, their performance heavily depends on the information content of the underlying database and, possibly even more so, on the methods ability to exploit that information.

Here, several statistical adaptation approaches for the local correction of 2m temperature and global radiation forecasts produced by the COSMO mesoscale NWP model (as in operational use at MeteoSwiss) will be explored. First, we demonstrate the forecast performance of these methods when compared to the direct model output with common verification methods. We then investigate the impact of these methods on potential energy savings when being used for the control of indoor building climate by means of a simulation study.