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Spectral nudging with COSMO-CLM: Improvement or deterioration?

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Spectral nudging imposes time-variable large-scale atmospheric states on a regional atmospheric or climate model, in order to condition the regional-scale climate statistics by the large-scale [U+FB02]ow conditions of the driving conditions. Although this technique is often described to improve the large-scale features, an improvement of sub-synoptic or small-scale features is less straightforward. Moreover, these results could be biased due to the fact that spectral nudging studies often compare the mean properties of meteorological variables (e.g. temperature, precipitation, GPH500...) between runs with and without spectral nudging.

In the present research, we opt to test the performance of spectral nudging in an extended hindcast simulation using the COSMO-CLM model driven by ERA40 reanalysis data. Here, we use the COSMO-CLM simulations described in Jäger et al. (2008) and Jäger & Anders (2009) of which some were performed in the framework of the ENSEMBLES project. Special attention is paid to these variables that are important for air quality modelling (e.g. wind speed, incoming solar radiation, maximum temperature, boundary layer height...), as this research is part of the CLIMAQS (CLimate IMpact and Air Quality modelling for policy Support) project. In contrast to Jäger et al. (2008), the analysis is also done in terms of the higher percentile statistics (e.g. extremes) instead of the mean properties of above-mentioned meteorological variables. This research will provide further insight in the advantages or disadvantages of spectral nudging, and could be used as a platform for the regional climate modelling community for further use of this indirect data assimilation technique.