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Short-term variability in the atmosphere seen by regional hindcasts

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The variability of electricity load within complex power grids are simulated with so-called energy system models. Performing them over a couple of years allows to investigate where to install storages for renewable energies. However, the energy system models require to have input data of the energy production for conventional power plants as well as the renewable power plants. Regarding the latter, we rely on data from regional hindcasts, because they provide consistent long-term and three-dimensional data about the atmospheric processes.
Our focus is on feed-in power from wind turbines, solar plants and hydroelectric power. Therefore, the performance of the regional hindcasts is established with respect to long-term and short-term variability. The short-term variability is of particular interest for the estimation of generated wind power. Considering data from different measurement towers located over Mid-Europe we investigate how well the low-frequency variability of the atmospheric PBL is captured over land and ocean. Moreover, we examine if measures for short-term variability can be extracted from the hindcasts, which 'only' parameterize the turbulent processes and thus did not resolve the turbulence statistics. That is, in particular, to examine causes for short-term variability like thermal stratification and wind shear.
Our study involves, on the one side, regional hindcasts utilizing state-of-the-art data assimilation to force the model to observations: thanks to the UERRA project and other projects, reanalyses data are available from various European meteorological services (for instance the COSMO-REA6 product by the DWD). On the other side, our study involves regional hindcasts based on pure dynamical downscaling as well as nudging of only large-scale information (as done for example at the Helmholz-Zentrum Geesthacht).
In the presentation we only consider data being independent in the sense of a data assimilation process. It is shown to which extent the reanalyses products differ from each other and to which extend they are superior over the 'simple' downscaling products. Moreover, we analyze where both hindcast types share error characteristics and how well they time specific lower-tropospheric weather events.