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Representation of wind gusts in regional reanalyses

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Retrospective wind gust analysis is of particular interest for weather services in order to evaluate their warning systems, but also for other applications such as model development or risk analysis for insurance companies. Although the spatial variability of wind gusts is comparable to that of precipitation, the observational network is very sparse, e.g., there is no equivalent observation for wind speed with a spatial coverage of radar derived precipitation. For the retrospective assessment of wind speed and wind direction, the gap in spatial observations is partly closed by regional reanalysis systems. Such a reanalysis combines a numerical weather prediction (NWP) model with a fixed data assimilation scheme to provide a retrospective time series of the three-dimensional atmospheric state constrained to the assimilated observations. For Europe two such systems have been set up by the Climate Monitoring and Diagnostics Branch of the Hans-Ertel-Centre for Weather Research based on the COSMO model with its operational NWP setup as used by the German Meteorological Service (DWD). Two data sets have been created: A European reanalysis with a horizontal grid spacing of 6 km over a 20-year period (1995 to 2014) and a convection permitting reanalysis for Central Europe on a 2 km horizontal grid for a shorter time period of seven years (2007 to 2013). For both reanalysis systems, about 150 variables with hourly temporal resolution are stored. Previous studies have shown the good representation of 10m wind speed in the COSMO regional reanalyses systems. However, wind gusts are not simulated explicitly and rely on diagnostic/parametric descriptions. In this study, the potential of reanalysis systems to provide guidance for retrospective wind gust analysis is investigated, and possible short-comings of the wind gusts diagnostics in NWP models are discussed.