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Representation of near-surface winds in the COSMO reanalysis systems

Benno Thoma (1), Sabrina Wahl (1,2), Jan D. Keller (2,3), and Andreas Hense (1)

(1) University of Bonn, Meteorological Institute, Bonn, Germany, (2) Hans Ertel Center for Weather Research, Climate Monitoring Branch, (3) Deutscher Wetterdienst, Offenbach, Germany

The observational network of near-surface wind is very sparse compared to other variables, e.g. precipitation. Spatially extended observations, equivalent to radar derived precipitation, are not available. For the retrospective assessment of wind speed and wind direction, the gap in observation coverage can be closed by high-resolution regional reanalysis systems. 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. Two high-resolution reanalysis datasets have been generated by the Climate Monitoring and Diagnostics Branch of the Hans-Ertel-Centre for Weather Research. The reanalyses are based on the COSMO model with its operational NWP setup as used by the German Meteorological Service (DWD). COSMO-REA6 with a horizontal grid spacing of 6 km covers Europe over a 20-year period (1995 to 2014). Further, a convection permitting reanalysis for Central Europe on a 2 km horizontal grid (COSMO-REA2) is available for a time period of seven years (2007 to 2013).

This study investigates the representation of 10m wind vectors (wind speed and direction) over Germany within the COSMO reanalysis systems. Observational data from about 181 sites over a time period of 10 years are used for verification. We compare the bivariate distribution of wind speed and direction using wind roses which are calculated from the observations and the reanalyses, separately. Moreover, the joint occurrence of the 2-dimensional wind vector in both observations and reanalysis is investigated using vector correlation techniques. A comparison to global reanalyses gives insights about the added value of high resolution regional reanalysis systems with respect to the representation of near-surface winds.