An intercomparison of mesoscale models at simple sites for wind energy applications

Understanding uncertainties in wind resource assessment associated with the use of the output from numerical weather prediction (NWP) models is important for wind energy applications. A better understanding of the sources of error reduces risk and lowers costs. Here, an intercomparison of the output from 25 NWP models is presented for three sites in northern Europe characterized by simple terrain. The models are evaluated using a number of statistical properties relevant to wind energy and verified with observations. On average the models have small wind speed biases offshore and aloft (< 4%) and larger biases closer to the surface over land (> 7%). A similar pattern is detected for the inter-model spread. Strongly stable and strongly unstable atmospheric stability conditions are associated with larger wind speed errors. Strong indications are found that using a grid spacing larger than 3 km decreases the accuracy of the models, but we found no evidence that using a grid spacing smaller than 3 km is necessary for these simple sites. Applying the models to a simple wind energy offshore wind farm highlights the importance of capturing the correct distributions of wind speed and direction.