



Predicting wind gusts by realistic large area LES weather forecast simulations

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Current operational weather forecast models with kilometre scale resolution can't resolve small scale turbulent processes. Wind gust forecasts are thus mostly based on theoretical concepts or empirical data. Furthermore, a profound knowledge of the physical processes relevant for wind gusts is still lacking. Large Eddy Simulations (LES), resolving large parts of the turbulence spectra directly, can help to improve our understanding by providing detailed insights into the atmosphere. However most LES studies are restricted to idealised setups or to small areas. The increased computational resources allow nowadays for realistic LES covering large regions.

The novel ICOSahedral Non-hydrostatic (ICON) LES model is used to perform two months of weather forecast like LES simulations for April and May 2013 with a horizontal resolution of up to 76 m. The domain covers parts of Western Germany with a diameter of almost 220 km. In addition, the extensive HOPE field campaign of the HD(CP)² project took place during these two months, providing various high resolution observations like e.g. WindLiDAR and in-situ measurements. Further wind gust observations are available from the DWD weather station network. The operational COSMO-DE wind gust forecasts are used as reference.

The different resolutions of the ICON LES nests are analysed to find out at which scale turbulent wind gusts can be directly resolved or if still a wind gust parameterization for a resolution of 76 m is necessary. Is there a benefit of a shorter model time step and can we learn about wind gusts at higher levels by the LES? Furthermore, the general forecast quality of wind gusts is evaluated and compared to the COSMO-DE. First results indicate an added value of the finest LES resolution compared to the coarser ones. The potential of high resolution LES for a better understanding of wind gusts is discussed.