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Finecasting for renewable energy with large-eddy simulation

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We present results of a single, continuous Large-Eddy Simulation of actual weather conditions during the timespan of a full year, made possible through recent computational developments (Schalkwijk et al, MWR, 2015). The simulation is coupled to a regional weather model in order to provide an LES dataset that is representative of the daily weather of the year 2012 around Cabauw, the Netherlands. This location is chosen such that LES results can be compared with both the regional weather model and observations from the Cabauw observational supersite.

The run was made possible by porting our Large-Eddy Simulation program to run completely on the GPU (Schalkwijk et al, BAMS, 2012). GPU adaptation allows us to reach much improved time-to-solution ratios (i.e. simulation speedup versus real time). As a result, one can perform runs with a much longer timespan than previously feasible.

The dataset resulting from the LES run provides many avenues for further study. First, it can provide a more statistical approach to boundary-layer turbulence than the more common case-studies by simulating a diverse but representative set of situations, as well as the transition between situations. This has advantages in designing and evaluating parameterizations. In addition, we discuss the opportunities of high-resolution forecasts for the renewable energy sector, e.g. wind and solar energy production.