Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Atmospheric turbulence and its relevance for wind energy related research MICHAEL HÖLLING, ForWind, Institute of Physics - University of Oldenburg, ALLAN MORALES, MATTHIAS WÄCHTER, JOACHIM PEINKE — Positioned in the highly turbulent atmospheric boundary layer, wind turbines experience extreme wind conditions. By using the mean wind speed and the turbulence intensity on a ten minute basis to describe these turbulent wind fields, information about the chronology of the wind time series gets averaged out. Detailed knowledge about the wind field's behavior in time and their statistics can e.g. help to better estimate wind induced loads on wind turbines. We present a method to estimate the statistics of the fluctuations and more importantly the extreme fluctuations based on the ten minute averaged values of the turbulent intensity. In addition we present the effect of turbulent wind velocities on the lift coefficient of a FX 79-W-151A airfoil. Square grids and a fractal grid have been used to create turbulent flows with different turbulence intensities and increment statistics. Even though the turbulent intensity of the wind field generated by the fractal grid is smaller than of the wind field generated by the square grid, the results show a higher standard deviation in the measured lift coefficients. These increased fluctuations are a direct result from the generated atmospheric-like wind field with intermittent increment statistics on a wider range of scales created by the fractal grid.

Michael Hölling
ForWind, Institute of Physics - University of Oldenburg

Date submitted: 08 Aug 2011 Electronic form version 1.4