EUROPEAN-AMERICAN
COLLABORATION IN WIND ENERGY

MONTHLY WEBINAR SERIES

Assessing Risk to Offshore Wind Turbines using Large-Eddy Simulations

Prof. Julie K. Lundquist
UNIVERSITY OF COLORADO BOULDER

Wednesday, September 13, 2023
1600 CET (0800 MDT)
WEBINAR Meeting ID: 893 0709 8960 | Passcode: 683618
https://us06web.zoom.us/j/89307098960?pwd=ajBFTFhDN3lvK3Z5Y1BGNyt1ZjBNdz09

ABSTRACT Offshore wind energy deployment is expected to increase in future years to come, with proposed wind farm sites located in regions with high risk for tropical cyclones. However, the wind turbine design criteria outlined by the International Electrotechnical Commission for extreme events may not account for wind field characteristics unique to tropical cyclones. With few observations available within tropical cyclones at wind turbine altitudes, numerical simulations can provide some insight into the atmospheric boundary layer within these storms. To evaluate if current design standards capture the extreme conditions of these storms, we perform idealized large-eddy simulations of five tropical cyclones (two Category 1, two Category 2 (Cat-2), and one Category 3 (Cat-3) storms) using the Weather Research and Forecasting model (WRF-LES). This presentation will summarize how wind conditions near the eyewall of Cat-1, Cat-2, and Cat-3 storms can exceed current design standards for offshore wind turbines, specifically addressing wind speeds and wind speed shear. Further, wind direction veer is not currently addressed in the standards, although these simulations show large values of veer, which can amplify loads in wind turbines. The existence of hurricane wind field characteristics that are not represented in design standards does not imply that damage or failure will certainly occur. Engineering safety factors incorporated in the design of the turbine's blades and structural components may prevent damage from occurring.

BIO Prof. Lundquist leads an interdisciplinary research group in the Dept. of Atmospheric and Oceanic Sciences, University of Colorado Boulder, with a joint appointment at the National Renewable Energy Laboratory. Her research group uses observational and computational approaches to understand the atmospheric boundary layer, with emphasis on atmospheric influences on turbine productivity, turbine wake dynamics, and downwind impacts of wind energy. Her Ph.D. is in Astrophysical, Planetary, and Atmospheric Science from University of Colorado Boulder, as is her M.S. degree. She has authored or co-authored over 130 refereed publications and over 200 conference presentations. Her current research focuses on onshore wind farm wakes (through the DOE AWAKEN project), offshore wind farm wakes and marine boundary layer dynamics (DOE WFIP3), and interactions between offshore wind energy and hurricanes (OWIND). Additional research projects include assessment of dissipation rate in the atmospheric boundary layer (NSF-CAREER), flow in complex terrain (NSF: Perdigão), and improving simulation capabilities for wildfire (DOI) and urban fires (OPP). She is a Fellow of the American Meteorological Society.