Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Effects of Turbine Spacing in Very Large Wind Farms[1] SØREN JUHL ANDERSEN, JENS NØRKÆR SØRENSEN, ROBERT FLEMMING MIKKELSEN, Technical University of Denmark — The Dynamic Wake Meandering model(DWM) by Larsen et al.(2007) is considered state of the art for modelling the wake behind a wind turbine. DWM assumes a quasi-steady wake deficit transported as a passive tracer by large atmospheric scales. The approach is also applied to wake interaction within wind farms, although certain aspects of the complex wake interaction are not captured, see Churchfield et al.(2014). Recent studies have shown how turbines introduce low frequencies in the wake, which could describe some of the shortcomings. Chamorro et al.(2015) identified three regions of different lengths scales. Iungo et al.(2013) related low frequencies to the hub vortex instability. Okulov et al.(2014) found Strouhal numbers in the far wake stemming from the rotating helical vortex core. Simulations by Andersen et al.(2013) found low frequencies to be inherent in the flow inside an infinite wind farm. LES simulations of large wind farms are performed with full aero-elastic Actuator Lines. The simulations investigate the inherent dynamics inside wind farms in the absence of atmospheric turbulence compared to cases with atmospheric turbulence. Resulting low frequency structures are inherent in wind farms for certain turbine spacings and affect both power production and loads.

[1]Funded by Danish Council for Strategic Research (grant 2104-09-067216/DSF), the Nordic Consortium on Optimization and Control of Wind Farms, and EuroTech wind project. The proprietary data for Vestas' NM80 turbine has been used.

Søren Juhl Andersen
Technical University of Denmark

Date submitted: 29 Jul 2015 Electronic form version 1.4