Physical and Computational Modelling of Topographically Generated Wake Turbulence

Keith Ayotte[1]

[1]*Windlab, keith.ayotte@windlab.com*

1 ABSTRACT

Atmospheric boundary layer flow calculations in the broader wind engineering arena share a number of aspects with those done in the wind energy industry. In both areas, the strength of the mean wind and how it is affected by topography is important. Additionally, the need to know the turbulent characteristics of the flow is important for structural and other considerations. As wake generated turbulence often impinges on structures, understanding the mechanisms for the production, downwind transport and dissipation of turbulence generated in the lee of topographic features is important in both cases. This talk will present a mostly successful effort to combine very high resolution Large Eddy Simulations of flow over hills and detailed laser Doppler measurements of matching wind tunnel flows in order to understand these mechanisms. Though the wind tunnel flows are aerodynamically rough, they present particular challenges in terms of resolving turbulent motions within the inner layer flow, where length and time scales are small. In turn it will be shown that accurately representing the inner layer flow is key to representing the mechanisms responsible for production of turbulence in the lee of topographic features in the study. Finally the talk will present a view of the physical processes involved in wake turbulence production in the context of a scaling based on simple linear theory of flow over hills.