P71 Coupling the mesoscale to the microscale using momentum tendencies.

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Wind turbine design, plant construction, and operations all rely on a suite of simulation design tools of varying levels of complexity and fidelity. Unfortunately, the current generation of tools is insufficient to adequately simulate winds and turbulence on all of the atmospheric scales that drive wind plant performance. Microscale flow structures are influenced by meteorological, topographical, and other environmental drivers, and affect turbine and plant performance. Failure to adequately understand, represent and account for these microscale flow structures has resulted in suboptimal turbine design, siting, and operation strategies.
Meso-microscale coupling (MMC) allows for the use of time-varying mesoscale forcing and/or boundary conditions (derived from either model output or data) to drive microscale model simulations. These simulations will allow for microscale simulations that represent a wide range of important meteorological phenomena, such as frontal passages, over the wind plant. A difficulty with MMC is that it bridges a wide span in spatial and temporal scales. Mesoscale models were designed for horizontal resolutions on the order of kilometers with time scales ranging from days to minutes. Microscale models have resolutions on the order of multi-meters (i.e., ten down to a couple meters is common), depending on the stability and desired resolution, and they resolve time scales ranging from hours to seconds.
Here we present challenges associated with coupling the mesoscale model WRF with a microscale model (OpenFOAM). One way of MMC is to input momentum tendencies from the mesoscale into the microscale model. Here we explain in particular how to optimally post-process momentum tendencies extracted from the WRF model, why this is necessary, and how this influences the solution in the microscale.