A PRE-PROCESSING UTILITY FOR COUPLING WRF AND OPENFOAM

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The prediction of wind resource is the initial step for the construction of wind farm, which plays a crucial role in making good use of wind energy. Numerical simulation is a useful tool for the prediction of wind resource. However, mesh in large resolution is required for complex terrain, which leads to large computational resource consumption. Thus, more efficient numerical model is necessary. Furthermore, precise boundary condition is also important, which depends on observation or weather report. As a matter of fact, some coupled numerical models [1] have been developed. In those coupled models, Weather Research and Forecasting (WRF) [2] is often used in a mesoscale computational domain for providing boundary conditions of Computational Fluid Dynamics (CFD) software. CFD software is used in a micoscale domain for prediction wind resource. In this paper, OpenFOAM is applied for simulating wind field with the boundary conditions supplied by WRF. Due to different mesh resolutions and computational domains, the WRF results should be transferred into boundaries and internal field of OpenFOAM domain. Hence, a utility is developed for data transfer. The process of data transfer contains three steps. Firstly, coordinates of face centres of boundaries and cell centres of internal field in OpenFOAM are transformed from Cartesian coordinate into Geographic coordinate. Then, both velocity and kinetic turbulence energy should be interpolated from WRF results. In the third place, the necessary files including U and k are output with prescribed values on the boundaries. Finally, the steady incompressible solver simpleFoam is used to simulate wind field coupled with WRF. Proper boundaries conditions prescribed by WRF are used. A probe location shown in Figure 1 is used for recording velocity, which shows the iterative process of the simulation in Figure 2.

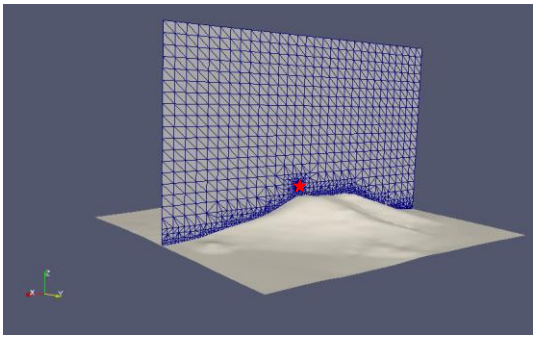

Figure 1: The probe location in OpenFOAM domain (red star)

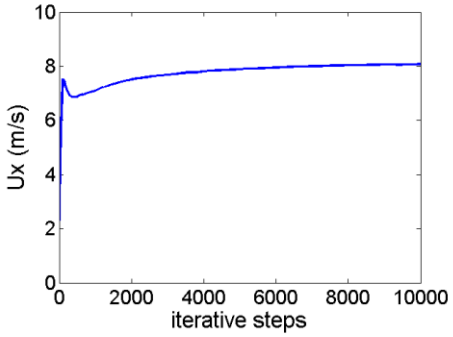

Figure 2: The x component of velocity in probe location

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