Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Large Eddy Simulation of a turbulent flow in two dimensional dunes using an immersed boundary method GETNET AGEGNEHU, HEATHER D. SMITH, Louisiana State University — The flow over dunes separates at the crest, generating a shear layer which has a big role for energy dissipation and formation of coherent structures. Large Eddy Simulations using bodyfitted and immersed boundary grids are performed to study the detailed flow dynamics that occurs in a fixed two dimensional dunes. We used a three-dimensional, non-hydrostatic solver; OpenFOAM for this study. The immersed boundary method was implemented using a discrete forcing approach with direct imposition of the boundary conditions. A periodic boundary condition is imposed in both the streamwise and spanwise directions. No-slip and free slip conditions are applied for the bottom and top walls respectively. The flow is forced with a pressure gradient which yields the mean velocity. The numerical results have been quantitatively compared with an experimental data for the mean flow and turbulence profiles. Resolved streamwise velocity profiles from both the immersed boundary and bodyfitted grids are in a good agreement with the experimental data. A good correlation of turbulent intensities and instantaneous flow fields are also observed between the two methods. It is also shown that the numerical model overestimates the vertical velocity profiles in the leeward side of the dune.

Getnet Agegnehu
Louisiana State University

Date submitted: 02 Aug 2013 Electronic form version 1.4