Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Large-eddy simulation of boundary layer flow on a non-uniform grid using explicit filtering and reconstruction LAUREN GOODFRIEND, FOTINI KATOPODES CHOW, University of California, Berkeley, MARCOS VANELLA, ELIAS BALARAS, George Washington University — Many realistic flows, such as the urban boundary layer, are too expensive to simulate directly. Large-eddy simulation (LES) and adaptive mesh refinement (AMR) reduce the computational cost of turbulence modeling by restricting resolved length scales, but combining these techniques generates additional errors. The grid refinement interfaces in AMR grids can reflect resolved energy and create interpolation errors. This study investigates the use of explicit filtering and reconstruction to mitigate grid interface errors in LES of a pressure gradient forced boundary layer. The domain is split in the streamwise direction into two equally sized structured grids, one fine and one coarse, with periodic boundaries in the streamwise and spanwise directions. This simple test case allows observation of the effects of the grid interfaces. Explicit filtering is found to reduce accumulation of resolved energy at the fine-to-coarse interface and improve the shape of coherent structures, compared to basic LES. Reconstruction of the subfilter velocity is shown to further the improvements of explicit filtering. These results inform the use of LES on block-structured non-uniform grids, such as nested grids in local atmospheric models or on more complex Cartesian AMR grids.

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Date submitted: 01 Aug 2013 Electronic form version 1.4