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Imposing scalar fluxes with the immersed boundary method in WRF JINGYI BAO, University of California, Berkeley, KATHERINE LUNDQUIST, Lawrence Livermore National Laboratory, FOTINI CHOW, University of California, Berkeley — The Weather Research and Forecasting model (WRF) is being used over increasingly complex terrain at higher grid resolutions. However, when it comes to the situation of complex terrain, resolved terrain slopes can become large, causing numerical errors from grid stretching of the terrain-following coordinates. An immersed boundary method (IBM), a non-conforming grid technique was recently implemented into WRF (Lundquist et al. 2010, 2012), to alleviate numerical errors associated with the extreme distortion of the grid cells. The IBM uses a Cartesian grid with the terrain boundary "immersed" within the grid. The force of the boundaries on the fluid is represented with the addition of a body force term in the momentum equation. In this work, we extend the existing WRF-IBM model to represent the Neumann boundary condition at the surface for potential temperature and moisture in order to simulate realistic atmospheric flows. The Neumann boundary condition for potential temperature and moisture is designed to accommodate different closures, such as the most common Smagorinsky closure. Validation test cases include thermally induced slope flows in an idealized valley with both coupled and uncoupled heat fluxes. In the uncoupled cases, the surface heating is specified as a function of time, and there are no surface or land attributes such as vegetation or soil type. In the coupled cases, the surface fluxes are prescribed by atmospheric parameterizations, which have been modified to recognize the immersed boundary as the terrain surface. These test cases will provide a proof of concept and verify the implementation of the new temperature and moisture boundary conditions.

Jingyi Bao
University of California, Berkeley

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