

Modeling Global Thunderstorm Electrical Activity with Radial Basis Function-generated Finite Differences

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The Earth's electric system is the link between solar, upper and lower atmosphere processes, and cloud system dynamics. However, its presence is currently lacking in global community climate models such as WACCM. As a result, efforts have begun at NCAR, in collaboration with the university community, to model these electrical linkages. Computational challenges include dipole current sources from thunderclouds that are sub-grid scale, conductivity of the atmosphere that varies by extreme orders of magnitude, and integration of topography on microscales. The model, an elliptic 3D PDE in spherical geometry, is solved with a novel mesh-less numerical method known as radial basis function-generated finite differences (RBF-FD). We will show how it easily handles rapid changes in topography and is computationally efficient for elliptic solvers due to the sparsity of the differentiation matrices