Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Spatial Reduction Method for Global Atmospheric Modeling
YEVGENII RASTIGEJEV, MICHAEL BRENNER, DANIEL JACOB, Harvard University — Numerical modeling of global atmospheric chemical dynamics presents an enormous challenge. The main problem is associated with a broad range of time scales varying from milliseconds to several years. This introduces significant stiffness into the governing equations and causes formation of fine spatial structures. The described difficulties are exacerbated by the fact that a typical chemical mechanism includes hundreds of species and thousands of chemical reactions. We offer a dynamically adaptive spatial reduction method for numerical modeling of atmospheric chemical evolution equations. The algorithm diagnoses the chemical dynamics online rather than a priori, locally and separately for every species according to its characteristic reaction time and splits the region into different domains where, depending on chemical complexity, a properly reduced chemical model is used. Unlike conventional time-scale separation methods, the spatial reduction algorithm speeds up not only a "chemical solver" but also advection-diffusion integration. The algorithm reduces computational cost by at least an order of magnitude for typical atmospheric chemical kinetic mechanism.

Yevgenii Rastigejev
Harvard University

Date submitted: 31 Jul 2006 Electronic form version 1.4