Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-943-RC2, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Limits on the ability of global Eulerian models to resolve intercontinental transport of chemical plumes" *by* Sebastian D. Eastham and Daniel J. Jacob

Anonymous Referee #2

Received and published: 19 December 2016

General comments: This paper discusses the ability of the GEOS-Chem Eulerian model to resolve long range transport of chemical plumes in the free troposphere by simulating atmospheric transport in idealized 2D and 3D cases in which only advection is considered. Different metrics such as maximum volume mixing ratio, plume size are used to estimate a plume decay constant. Free tropospheric plumes decay much faster in the mid-latitudes than in the tropics because of stronger divergent flow. Sensitivity to the horizontal model resolution is discussed. The 3D simulations shows that the limiting factor in Eulerian chemical transport models capability to resolve free tropospheric plumes is more the vertical resolution than the horizontal resolution. The authors suggest a vertical resolution of 100m to preserve free tropospheric plumes in

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Discussion paper

Eulerian models.

The paper is well written and the results are of interest for the community. I recommend this paper for publication after addressing the following minor comments.

Main comments: Introduction: page 2, line 13-14: Lagrangian models have been used in numerous publications to describe long range transport of plumes originating from the boundary layer, free troposphere and stratosphere, with or without convection. This sentence should be rephrased or removed.

3D plume decay: page 15: The authors suggest that increasing the horizontal resolution in the model increases the development of fine scale vertical eddies and hence increases diffusion. Is there a meteorological product in GEOS that supports this claim?

Vertical resolution: page 16: Line 15 to 18: The conclusion on the vertical resolution is an important result, but the explanations given here are not convincing. I would like to see more details.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-943, 2016.