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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

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This is an interesting paper on the influence of model resolution on intercontinental transport of chemical plumes. The paper is overall well written. However, I believe there is an inadequate recognition of previous work that are based on models other than GEOS-Chem. This is probably an oversight, but almost all studies cited in the Introduction of the current manuscript are based on one single model - GEOS-Chem. On Page 2, about Line 5: the authors stated that "Eulerian models used for simulating global atmospheric transport fail to reproduce this persistent layered structure". However, there are a few studies showing that high-resolution models with interactive stratospheric and tropospheric chemistry have skills simulating the layered structure of

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ozone plumes in the free troposphere.

For example, Lin et al. (2012A, JGR) showed that the GFDL-AM3 model at ∼50km horizontal resolution successfully reproduces observed sharp ozone gradients above California, including the interleaving and mixing of Asian pollution and stratospheric air associated with complex interactions of midlatitude cyclone air streams (see their Figures 2 and 5 for comparison with ozonesondes).

A follow up paper by Lin et al. (2012B, JGR) showed that GFDL-AM3 captures the observed layered features and sharp ozone gradients of deep stratospheric intrusions over the western United States (see their Figures 3, 5, and 7).

Lin et al. (2015, Nature Communications) further examined the influence of horizontal resolution in GFDL-AM3 on the simulation of deep stratospheric intrusions (see their Methods and Supplementary Figures 1 to 2).

These models are obviously not perfect. For example, Lin et al. (2012B) found that the layers with the peak O3 enhancements in the model appear to be wider in thickness and lower in altitude than observed by the sondes. This discrepancy will actually support your idea to increase the model vertical resolution as well.

References:

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