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## ***Interactive comment on “The imprint of stratospheric transport on column-averaged methane” by A. Ostler et al.***

### **Anonymous Referee #2**

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This manuscript seeks to estimate how errors in stratospheric transport influence methane simulations and, subsequently, how these errors propagate into methane emission estimates produced by global inversions. It is an important topic and should be of great interest to ACP's readers. I have several serious concerns about the methodology and, as a result, cannot recommend publication at this time.

As addressed by the first reviewer, the entire analysis of the observed age of air is based on 7 profiles of SF<sub>6</sub> taken at 3 measurement location in the northern hemisphere. This is used to calculate age errors, globally. The authors need to justify why these extrapolations and assumptions should be considered reasonable since it is the basis of all that follows. In addition, reviewer #1 has cited numerous article that question SF<sub>6</sub>-based age estimates in high latitudes during winter. As the Arctic results

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are presented as a major finding, this would seem to be highly relevant and must be addressed.

In addition, the methodology used to estimate of the impact of these errors on inversions (section 6) is very unclear and hard to follow. For example, the error is estimated using a one-box model of the whole atmosphere. How is this disaggregated into the latitude bands shown in Figure 4? This is not discussed. Does the one box model assume that the stratospheric errors are spatially uniform? None of this is sufficiently described for other researchers to reproduce the results.

The authors attempt to contextualize the results using flux estimates from two inverse models: one that includes only surface data and one which includes both satellite and surface data. The influence of stratospheric transport errors should manifest in a very different way in model-surface data comparisons and in model-satellite data comparisons. Does the stratospheric 'correction' improve or affect comparisons with surface data? This is never shown or mentioned. If there is no improvement, why would we expect these types of transport error to be relevant in the context of a surface inversion? Unless this is justified, it seems inappropriate to present these results as an uncertainty using surface-based flux estimates.

These topics are very important and I hope encourage the authors to continue working to understand them. However, they deserve a more thorough analysis than is presented here.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 20395, 2015.

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