

Interactive comment on “Contributions of the troposphere and stratosphere to CH₄ model biases” by Zhiting Wang et al.

Zhiting Wang et al.

zhiting@iup.physik.uni-bremen.de

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The comments by referee #2 mainly include two parts: 1) The tropopause applied to integrate the model CH₄ to obtain tropospheric and stratospheric column-averaged CH₄ should be checked and the results could depend on the definition of the tropopause. 2) The comparison of the model with TES measurements does not support our conclusions.

1) For the first comment some sensitive tests have been conducted, a different definitions for the tropopause are applied to integrate the model outputs. That include, thermal tropopause according to WMO definition, the dynamical tropopause defined as 1.5, 2.5, 3.5 and 4.0 PUV surface in the extratropics and 380 K potential temperature surface in the tropics. The ECMWF-interim reanalysis data is used to calculate

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the tropopause.

The sensitive test is applied to TM3 and LMDz-PYVAR (TM5 has a similar configuration with TM3 and then not been tested). These sensitive tests show (see following plots) that, the tropospheric model bias almost is not affected by the selection of the tropopause, even for the unrealistically low tropopause of 1.5 PVU. The amplitude of the stratospheric model bias changes between the thermal tropopause and the dynamical tropopause of 2.5~4.0 PVU. However, there is still not a consistent latitudinal gradient existing during whole year for the stratospheric model biases. So the conclusion that the latitudinal gradient in the model bias of total column-averaged CH₄ come from the troposphere is valid. The dynamical tropopause of 1.5 PVU give some latitudinal pattern in the stratospheric model biases, but, that tropopause is unrealistically low and frequently reach 170 hPa (below 380 K potential temperature surface) in the tropics.

2) For the second comment, the results from TES actually support the conclusion that the inconsistency between the HIPPO and TCCON comparisons with the models come from the longitudinal dependence of latitudinal gradient in the tropospheric model bias. But there are writing errors in the figure caption of the Figure 6 in the manuscript. In the third panel of Figure 6, the black points correspond to HIPPO sampling area (110°W~150°E) and the red points to the region beyond it.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/acp-2016-1041/acp-2016-1041-AC2-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1041, 2016.

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