

Dear Reviewer,

Many thanks for your constructive comments on our manuscript. We will give point-to-point responses after finishing the comparisons of the model results presented in Figures 2 & 3 with the satellite observations. We have collected the monthly-averaged CO MLS satellite data for 2010-2020. However, the satellite data for NH₃ and SO₂ profiles in the UTLS are very limited.

The MIPAS/Envisat measured the UTLS NH₃ and SO₂ profiles during 2002-2011 as reported by Höpfner et al. (acp-13-10405-2013, acp-15-7017-2015, acp-16-14357-2016). But I am not sure whether the detection limits of MIPAS are low enough to validate our model results, especially for SO₂. Moreover, there are only two years of overlapped data between our model simulation and MIPAS observations. I will contact Dr. Höpfner for the MIPAS data.

It would be very appreciated if you could give more detailed suggestions on what NH₃ and SO₂ satellite data should be used for comparisons.

Sincerely,
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