

Interactive comment on “Simulating age of air and distribution of SF₆ in the stratosphere with SILAM model” by Rostislav Kouznetsov et al.

Anonymous Referee #4

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This paper simulates the impact of the mesospheric destruction and gravitational separation on stratospheric SF₆ distribution using a chemical transport model driven by ERA-Interim meteorology. In the model, mesospheric depletion and gravitational separation of SF₆ are parameterized as upper boundary conditions. Sensitivity simulation were conducted and the roles of mesospheric destruction, gravitational separation, and vertical turbulent diffusion in the distribution of stratospheric SF₆ are determined. The effects of these processes on the derived mean age of air and its trend are also discussed.

This paper clearly demonstrate that the apparent mean age of air derived from SF₆ measurements is not suited for studying the trend of stratospheric mean age of air. The results have important implications in understanding the differences in the observed

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and modeled Brewer-Dobson circulation trends. I recommend publication of the paper after my comments are addressed.

Comments:

My major concern is that the SILAM model doesn't capture the SF₆ distribution in the upper stratosphere. The authors attribute this deficiency to the low top of ERA-interim that can't accurately represent the circulation in the upper stratosphere and mesosphere. However, the mesosphere circulation, particularly the downwelling branch of the summer-to-winter pole circulation, is essential to understand how the mesospheric sink affects SF₆ distribution in the stratosphere. This issue needs to be discussed in more detail. I wonder if it is possible to drive SILAM with a model of higher top, e.g., WACCM, to see if SF₆ in the upper stratosphere can be improved.

Section 5: Describe how the mean age of air is derived using SF₆.

Lines 484-486: Figure 7 shows that the simulated SF₆ distribution doesn't agree with MIPAS measurement about 40 km (above 30 km in the winter pole). How can the derived AoA agrees with each other?

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