Future trends in stratosphere-to-troposphere transport in CCMI models

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Climate change due to increasing greenhouse gas emissions is expected to accelerate the stratospheric Brewer-Dobson circulation in the future. This acceleration can potentially lead to an increase of stratosphere-to-troposphere constituent transport (STT), with important implications for future ozone concentrations in the troposphere. In this work, future changes in tracer STT are evaluated using model output from the Chemistry-Climate Model Initiative (CCMI) covering the period 1960-2099. Three different tracers implemented in these runs are used to extract complementary information: ozone, stratospheric ozone, and the artificial tracer st80_25. The stratospheric ozone tracer is produced only in the stratosphere, and therefore it allows evaluating the fraction of ozone trends due to increased cross-tropopause ozone transport. The artificial tracer st80_25 has a constant stratospheric source, such that changes in its tropospheric concentration are attributed exclusively to changes in STT. The results show a wide spread across models, suggesting significant uncertainty in the representation of STT processes and their future changes in current-generation chemistry climate models.

Key words: future trends, stratosphere-to-troposphere transport, ozone, CCMI