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- Title and Author Search

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Review

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[Volumes and Issues](#) [Contents of Issue 6](#)

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Evaluation of model-simulated source contributions to tropospheric ozone with aircraft observations in the factor-projected space

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Abstract. Trace gas measurements of TOPSE and TRACE-P experiments and corresponding global GEOS-Chem model simulations are analyzed with the Positive Matrix Factorization (PMF) method for model evaluation purposes. Specially, we evaluate the model simulated contributions to O₃ variability from stratospheric transport, intercontinental transport, and production from urban/industry and biomass burning/biogenic sources. We select a suite of relatively long-lived tracers, including 7 chemicals (O₃, NO_y, PAN, CO, C₃H₈, CH₃Cl, and ⁷Be) and 1 dynamic tracer (potential temperature). The largest discrepancy is found in the stratospheric contribution to ⁷Be. The model underestimates this contribution by a factor of 2–3, corresponding well to a reduction of ⁷Be source by the same magnitude in the default setup of the standard GEOS-Chem model. In contrast, we find that the simulated O₃ contributions from stratospheric transport are in reasonable agreement with those derived from the measurements. However, the springtime increasing trend over North America derived from the measurements are largely underestimated in the model, indicating that the magnitude of simulated stratospheric O₃ source is reasonable but the temporal distribution needs improvement. The simulated O₃ contributions from long-range transport and production from urban/industry and biomass burning/biogenic emissions are also in reasonable agreement with those derived from the measurements, although significant discrepancies are found for some regions.

[Final Revised Paper](#) (PDF, 1257 KB) [Discussion Paper](#) (ACPD)

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