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Tagged ozone mechanism for MOZART-4, CAM-chem and other chemical transport models

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Abstract. A procedure for tagging ozone produced from NO sources through updates to an existing chemical mechanism is described, and results from its implementation in the Model for Ozone and Related chemical Tracers (MOZART-4), a global chemical transport model, are presented. Artificial tracers are added to the mechanism, thus, not affecting the standard chemistry. The results are linear in the troposphere, i.e., the sum of ozone from individual tagged sources equals the ozone from all sources to within 3% in zonal mean monthly averages. In addition, the tagged ozone is shown to equal the standard ozone, when all tropospheric sources are tagged and stratospheric input is turned off. The stratospheric ozone contribution to the troposphere determined from the difference between total ozone and ozone from all tagged sources is significantly less than estimates using a traditional stratospheric ozone tracer (8 vs. 20 ppbv at the surface). The commonly used technique of perturbing NO emissions by 20% in a region to determine its ozone contribution is compared to the tagging technique, showing that the tagged ozone is 2–4 times the ozone contribution that was deduced from perturbing emissions. The ozone tagging described here is useful for identifying source contributions based on NO emissions in a given state of the atmosphere, such as for quantifying the ozone budget.

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