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GMI estimates of lifetimes and ozone depletion potentials for dominant ozone-depleting substances

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The ozone depletion potential (ODP) is the amount of ozone loss per kg of an ozone-depleting substance (ODS) divided by the amount of ozone loss per kg of CFCl3 (CFC-11). The ODP clearly depends on the atmospheric lifetimes of the ODS and CFC-11. ODPs for dominant ODSs such as CFC-11, CFC-12, and CFC-113, were evaluated by two-dimensional models in the 1990's. Atmospheric models have changed dramatically since that time, e.g., improvements in tropical isolation and age of air, but lifetime estimates have not been updated. Simulations that have realistic mean age of air also have longer lifetimes than those used by the WMO (2011) to project future evolution of dominant ODSs. We have performed a series of perturbation experiments on CFC-11, CFC-12, CH3Cl3, HCFC-22, CCl4, CFC-113, CH4, and N2O with the Global Modeling Initiative (GMI) chemistry transport model (CTM). These simulations use a full tropospheric and stratospheric chemical mechanism. The meteorological fields used are from the GEOS-5 GCM with source gas boundary conditions for the year 2000. Transport characteristics of the GEOS-5 GCM were evaluated in the SPARC CCMVal Report and were shown to have realistic representation of mean age of air, tropical isolation, and stratospheric circulation. In each experiment, a small change in ODS flux was run to steady state, resulting in a ~0.5-1% ozone change. Lifetimes and ODPs calculated from the GMI experiments will be presented. In addition, comparisons of simulated long-lived trace species with observations will be presented to demonstrate model credibility.