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Age of Air in the Stratosphere from Observations

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Age of air is an idealized tracer often used as a measure of the stratospheric circulation. We will show how to quantitatively relate age to the diabatic circulation and the adiabatic mixing. As it is an idealized tracer, age cannot be measured itself and must be inferred from other tracers. Typically, the two primary trace gases used are sulfur hexafluoride and carbon dioxide. Other tracers have a compact relationship with age, however, and can also be used to calculate age. We will discuss a range of tracer measurements from both satellites and in situ, including sulfur hexafluoride, carbon dioxide, nitrous oxide, methane, and the ratio of argon to nitrogen. We will compare the age derived from these different species, including different calculation methods and caveats, and compare with modeled ideal age and trace gas concentrations. We conclude by showing the strength of the diabatic circulation and the adiabatic mixing calculated from these trace gas calculations.