(34-240329-A) **Detecting Multi-decadal Changes in the Brewer-Dobson Circulation from In-situ Trace Gas Measurements and Idealized Modeling**

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We utilize in situ stratospheric measurements of trace gases from two recent high altitude aircraft campaigns, DCOTTS and SABRE, as well as from StratoCore to compare mean ages and long-lived trace gas relationships in the NH stratosphere to those from ER-2 and balloon campaigns in the 1990s. The ER-2 and balloon data from nearly three decades ago have been a primary reference for in situ-based estimates of mean age in the lower stratosphere, but very few measurements have been made in this region since then. We use an updated technique to consistently calculate mean ages from simultaneous in situ measurements of SF_6, CO_2, N_2O and CH_4, allowing us to compare mean ages and their relationship with N_2O between the 1990s and 2020s. The mesospheric loss of SF_6 and subsequent old age biases are largely accounted for based on newly developed theory and modeling work. We then use an idealized model of the stratosphere to explore Brewer-Dobson circulation changes that are consistent with the observations.

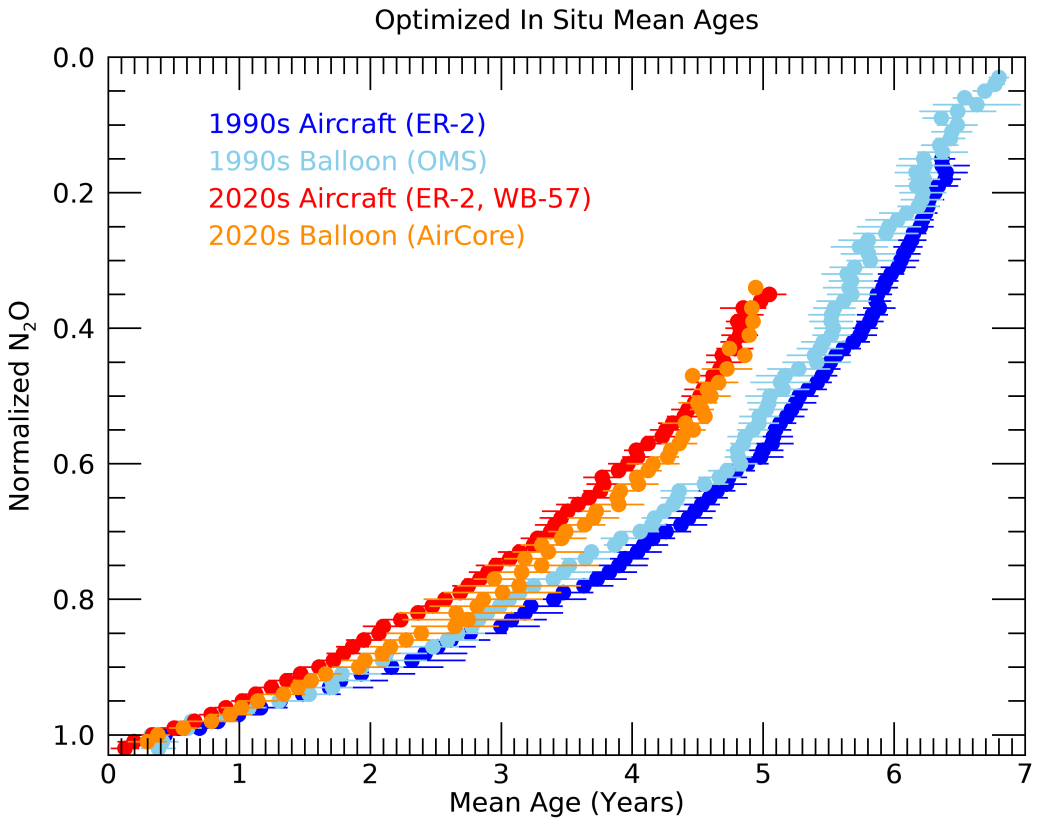

Figure 1. Mean age vs. normalized N_2O based on in situ measurements from aircraft and balloon platforms in the 1990s and the 2020s. The mean ages are based on a new optimization technique using simultaneous measurements of SF_6, CO_2 and CH_4.