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Is there a mismatch between observed and modelled age of air trends?

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Satellite instruments and in-situ measurements suggest that the mean age of air has not decreased over the past 25 years in the midlatitudes of the Northern Hemisphere (since the late 1980s), even as model estimates forced by observed greenhouse gas concentrations and ozone depleting substances consistently project a robust freshening of the stratosphere over this period. In order to attribute the features of the global circulation time series to the main forcing agents, we performed a set of simulations using the NASA Goddard Earth Observing System Chemistry-Climate Model (GEOSCCM). The model simulations show that while changes in concentrations of greenhouse gases (GHG) and increasing ozone depleting subtances (ODS) lead to the freshening of the stratosphere (as shown in previous work), sporadic volcanic events, internal atmospheric variability, and the solar cycle have a distinct signature in the time series of stratospheric age of air, and these forcing mechanisms likely played a significant role in the long-term trends over this period and may have caused a positive age trends from late 1980s to present day.