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Ensemble assimilation of stratospheric temperature and ozone observations with a Chemistry-Climate Model

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Outstanding studies by Daley (1995) or Riishojgaard (1996) looked at the possibility of constraining the forecasted/analyzed winds by assimilating atmospheric tracer observations. These studies were cast in simplified settings but paved the way for more realistic testing and possible practical implementations. The stratosphere is a region of the atmosphere where assimilation of (active) tracer observations could readily benefit our numerical representation of the flow, considering the scarcity of wind observations but the strong advection dynamics and the prominence of ozone. Here, we are investigating the potential for improving wind representation in the stratosphere in a more realistic setting with an interactive chemistry-climate model, the IGCM-FASTOC. Our study also explores ensemble assimilation of chemical and dynamical observations. This advanced data assimilation technique uses ensemble statistics to produce along-the-flow, including cross-variable, background error-covariances allowing for propagation of information from the observed variable to all other model variables. We will present results from ozone and temperature assimilation experiments in a perfect-model hypothesis context showing the stability of the Ensemble Kalman Filter (EnKF) even without artificial inflation of background error covariances, in such a sparse observation network context. The influence of assimilation of ozone observations on dynamical variables will be shown.