5.093 Investigating the effects of 'nudging' on the dynamical-chemical consistency of the UTLS.

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Abstract:

Chemistry-climate models (CCMs) are increasingly being used in a 'specified dynamics' configuration, whereby the dynamical evolution of the atmosphere is constrained to follow a predefined path. The typical approach being to add an additional tendency to the dynamical fields that 'nudges' them towards an external field, typically the historical, time-evolving state of the atmosphere as represented by a reanalysis dataset. Constraining the dynamical evolution of the atmosphere to follow observations as represented in reanalysis is advantageous for assessing CCMs as it constrains much of the internal variability of the atmosphere and allows for a more direct comparison of chemical fields with observations. While nudged CCMs have shown considerable skill in reproducing certain aspects of the observed evolution of the chemical state of the atmosphere, such as total column ozone, finer details of the representation have not been significantly explored. Further, a number of different methods for constraining the evolution of the dynamical fields exists and there is little information on the relative advantages and disadvantages of different approaches. As part of the Chemistry-Climate Model Initiative (CCMI) a specified dynamics simulation was specified for the participating CCMs, in addition to freely running historical simulations. Here we compare the relationships between dynamical and chemical fields in the vicinity of the tropopause for the specified dynamics (REF-C1SD) and freely-running (REF-C1) CCMI simulations from a number of CCMI models that performed both of these simulations to develop a greater understanding of how 'nudging' may affect the representation of model fields.