Title: Constraining Middle Atmospheric Moisture in GEOS-5 Using EOS-MLS Observations

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Abstract

Middle atmospheric water vapor plays an important role in climate and atmospheric chemistry. In the middle atmosphere, water vapor, after ozone and carbon dioxide, is an important radiatively active gas that impacts climate forcing and the energy balance. It is also the source of the hydroxyl radical (OH) whose abundances affect ozone and other constituents. The abundance of water vapor in the middle atmosphere is determined by upward transport of dehydrated air through the tropical tropopause layer, by the middle atmospheric circulation, production by the photolysis of methane (CH_4), and other physical and chemical processes in the stratosphere and mesosphere. The Modern-Era Retrospective analysis for Research and Applications (MERRA) reanalysis with GEOS-5 did not assimilate any moisture observations in the middle atmosphere. The plan is to use such observations, available sporadically from research satellites, in future GEOS-5 reanalyses. An overview will be provided of the progress to date with assimilating the EOS-Aura Microwave Limb Sounder (MLS) moisture retrievals, alongside ozone and temperature, into GEOS-5. Initial results demonstrate that the MLS observations can significantly improve the middle atmospheric moisture field in GEOS-5, although this result depends on introducing a physically meaningful representation of background error covariances for middle atmospheric moisture into the system. High-resolution features in the new moisture field will be examined, and their relationships with ozone, in a two-year assimilation experiment with GEOS-5. Discussion will focus on how Aura MLS moisture observations benefit the analyses.