MLS Scientific Publication

Scientific Theme: Atmospheric Chemistry and Transport

Convective outflow of South Asian pollution: A global CTM simulation compared with EOS MLS observations, Qinbin Li, Jonathan H. Jiang, Dong L. Wu, William G. Read, Nathaniel J. Livesey, Joe W. Waters, Youngsheng Zhang, Bin Wang, Mark J. Filipiak, Cory P. Davis, Solene Turquety, Shiliang Wu, Roikjin J. Park, Robert M. Yantosca, Daniel J. Jacob, *Geophys Res. Lett.*, **32**, L14826, doi:10.1029/2005GL022762, 2005.

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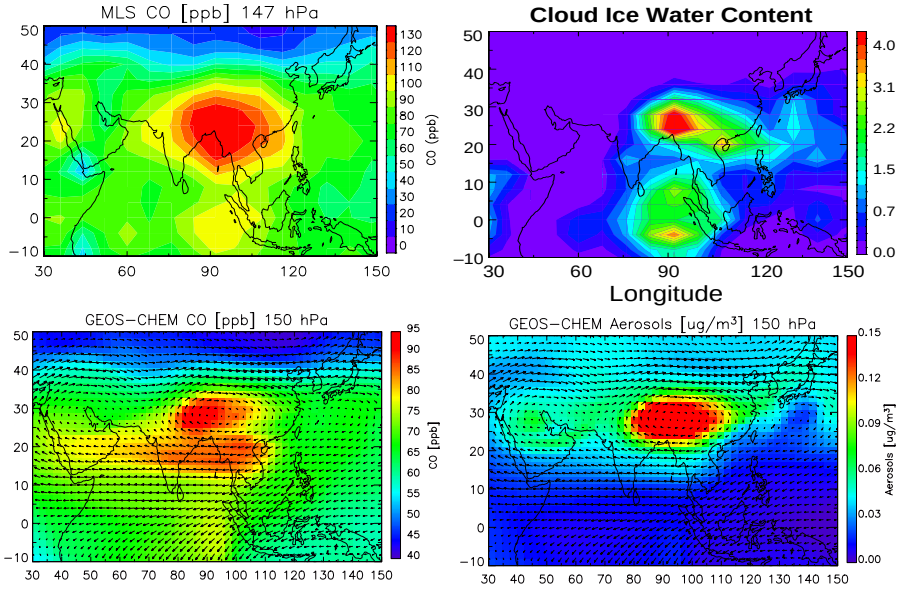
Summary

The EOS Microwave Limb Sounder (MLS) aboard the Aura satellite observed a broad maximum (~130 ppbv) of carbon monoxide (CO) at 147 hPa in the upper troposphere over the Tibetan plateau and southwest China during 25 August-6 September 2004. The maximum is collocated with the upper level Tibetan anticyclone associated with the South Asian High. Simultaneous observations of clouds by MLS also show elevated cloud ice water content collocated with the CO maximum during the same time period. These dense high clouds are accompanied with relatively little precipitation, as indicated by CMAP (CPC Merged Analysis of Precipitation) precipitation rate, compared with the heavy precipitation associated with the deep convective clouds over the northern Indian Ocean. Simulations of CO and aerosols are conducted for the MLS measurement time period with the GEOS-Chem global 3-D chemical transport mode driven by assimilated meteorological data. Model results indicate that anthropogenic emissions from northeast India and southwest China are transported by Asian summer monsoon convection and orographic lifting to the upper troposphere where simulated distributions of CO resemble MLS observations. Model results also show elevated aerosols in the anticyclone region. Analysis of model simulated CO and aerosols indicate that the Tibetan anticyclone could entrain and 'trap' the lifted pollution. A large fraction of the dense high clouds observed by EOS MLS have relatively small particle sizes (< 30 μm), and are thus distinguished from convective clouds which have larger particles. We speculate that the dense high clouds in the upper troposphere over the Tibetan plateau may be related to the convectively lifted South Asian anthropogenic aerosols 'trapped' by the upper level Tibetan anticyclone. Cloud formation and its microphysical properties are strongly influenced by the availability of aerosols. Changes in cloud properties could have profound impact on the global cloud system, hydrological cycle, and climate. The nature of the uplifted aerosols-high clouds interaction and the consequence on precipitation needs further investigation.



Comparison of MLS observations of upper tropospheric CO and cloud ice between 25 Aug and 2 Sep 2004 (top row) with GEOS-CHEM modeled concentrations of CO and aerosol (bottom row) for the same period and altitude as the MLS observations