Global Ozone-CO Correlations from OMI and AIRS as Constraints on Ozone Sources and Transport

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• Current global models capture observed ozone spatial and seasonal patterns, but there is large uncertainty in the driving factors

• Correlation with CO long used as a constraint on ozone sources and transport
Satellite Derived Ozone-CO Correlations

- O$_3$-CO correlations are preserved in satellite observations despite smoothing from averaging kernels.

- The ability to infer O$_3$-CO correlations from TES is limited by data sparsity.

- O$_3$-CO correlations from OMI/AIRS retrievals avoid the sampling limitations of the TES instrument.
**O₃ - CO Correlations (DJF, MAM)**

OMI/AIRS

GEOS-Chem

700 – 400 hPa

Insufficient Data for either OMI or AIRS
**O₃ - CO Correlations (JJA, SON)**

- GEOS-Chem captures large-scale structure of observed O₃ – CO correlation coefficients, but several regional discrepancies are apparent.
Testing Sensitivity to Transport

- Drive GEOS-Chem with two different assimilated meteorological fields (GEOS-4 & GEOS-5) for JJA 2006
- Large sensitivity of simulated O\textsubscript{3}-CO correlation to transport in the tropics
- We attribute these differences to the convective parameterizations used
Interpreting the Chemical Signature

No Combustion Emissions, JJA 2008

Ozone-CO Relationship for 60 W, 40 N

- Difference in reduced major axis (RMA) regression slopes allow quantitative calculation of slope sensitivity to model processes

Δ = Chemical signature of process on the O₃-CO slope

Correlation = .26
d[O₃]/d[CO] = .51 (-0.10, +0.12)

Correlation = -.04
d[O₃]/d[CO] = -0.40 (-0.09, +0.46)

- Slope controlled in the outflow by precursor emissions and stratospheric intrusions
Lightning NO\textsubscript{x} emissions dominate simulated ozone-CO relationship in the region.

Excellent agreement with OMI/AIRS over land.

Large negative overestimate over the East Pacific associated with the Pacific High.
Near-daily global coverage of OMI/AIRS allows us to calculate robust statistical relationships between ozone and CO with much less error and finer spatiotemporal resolution than previous satellite studies.

GEOS-Chem captures large scale spatial structure of the observed $O_3$ – CO correlation coefficients, but several regional discrepancies are apparent.

$O_3$-CO correlations simulated by GEOS-Chem using GEOS-4 and GEOS-5 winds show strong sensitivity to convection in the tropics.

GEOS-Chem successfully simulates North American outflow, with contributions from precursor emissions and stratospheric intrusions. The two are coupled due to the structure of mid-latitude cyclones.

The representation of lightning in the model controls the good agreement with OMI/AIRS over land but also the significant model negative overestimate in the East Pacific during JJA 2008.

Future work will include examining the interannual variability of ozone-CO correlations over SE Asia.