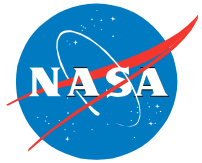


TES analysis - leveraging off of IONS

Annmarie Eldering & TES team

Jet Propulsion Laboratory
California Institute of Technology

IONS meeting

March 21-22, 2007, State College, PA

Contributors: Helen Worden, Line Jourdain, Owen Cooper

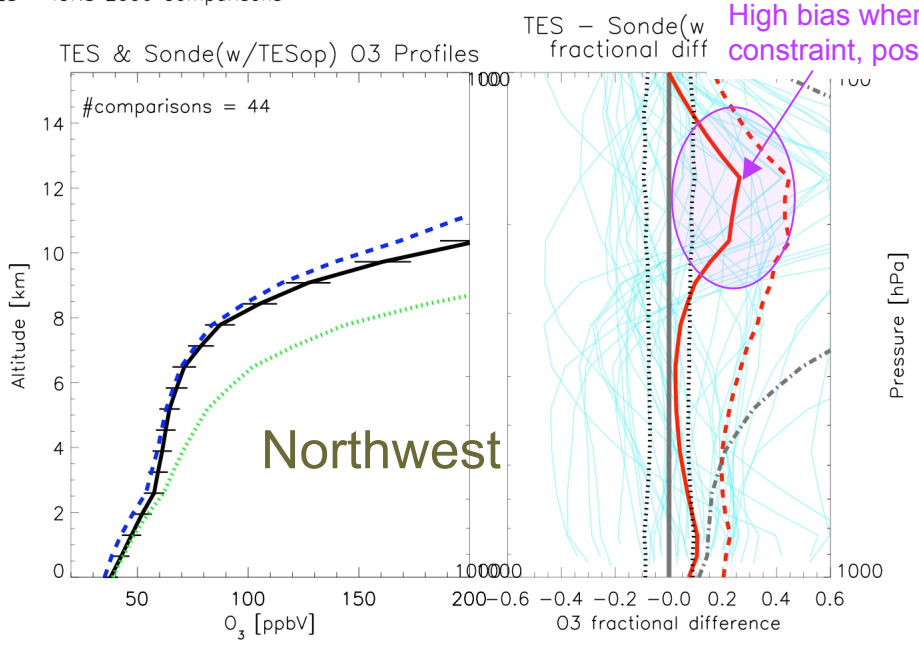
JPL Clearance: TBD

Last Modified: 3/20/2007

Outline

- TES comparisons to IONS sondes
- Identification of pathalogical cases
- Analysis of high ozone events and impact of lightening
- Analysis over southeast US using Flexpart

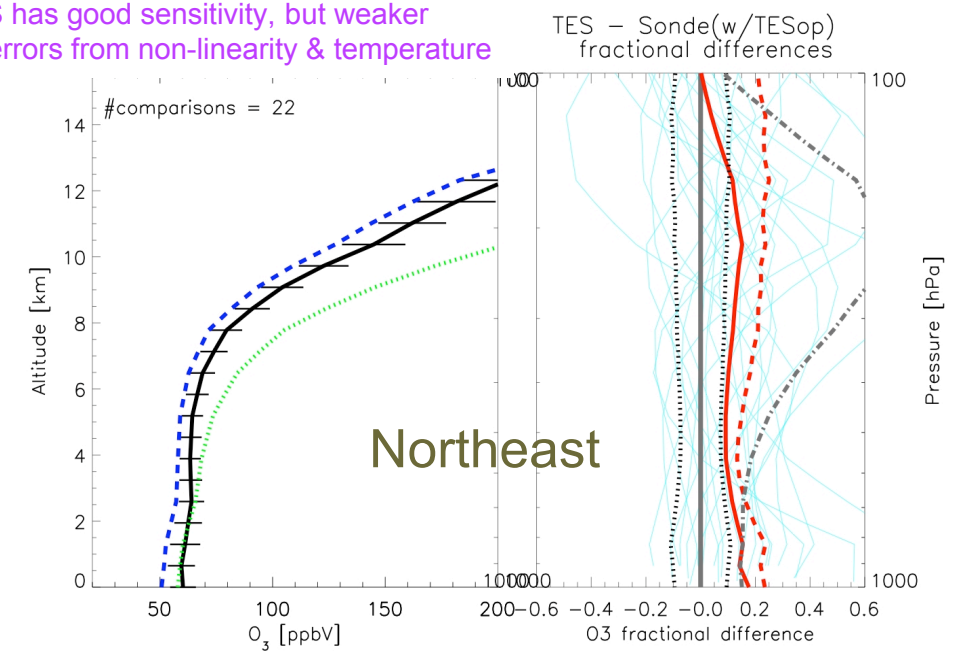
TES – IONS 2006 Comparisons



TES avg
Sonde (w/TES op) avg
I.G. avg

avg.[TES–sonde(TESop)]/sonde(TESop)
rms of relative differences
avg. TES observational error
avg. [TES I.G.–sonde(TESop)]/sonde(TESop)

SummerIONS06_NWest_3hr_200km
Fri Feb 16 16:00:39 2007

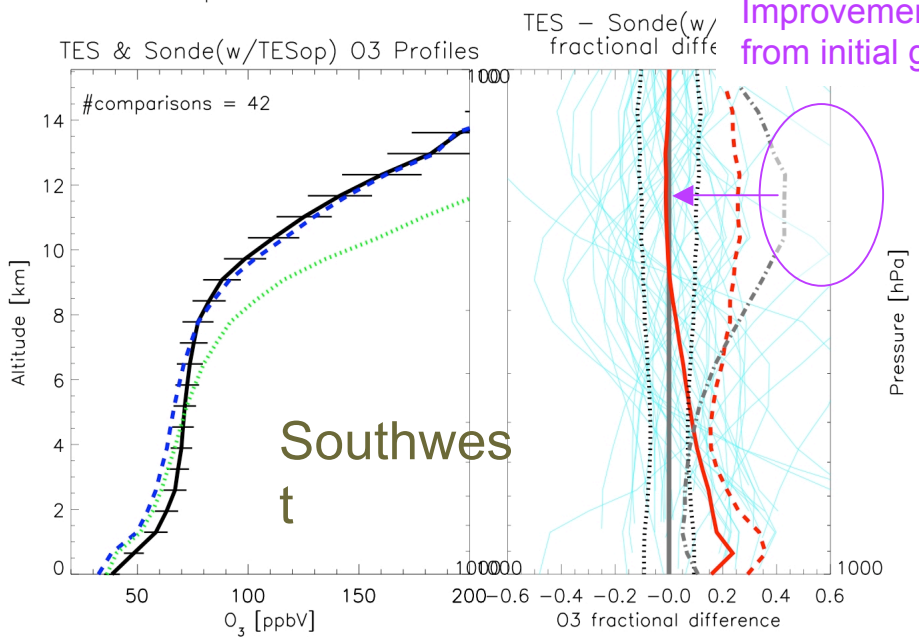


TES avg
Sonde (w/TES op) avg
I.G. avg

avg.[TES–sonde(TESop)]/sonde(TESop)
rms of relative differences
avg. TES observational error
avg. [TES I.G.–sonde(TESop)]/sonde(TES

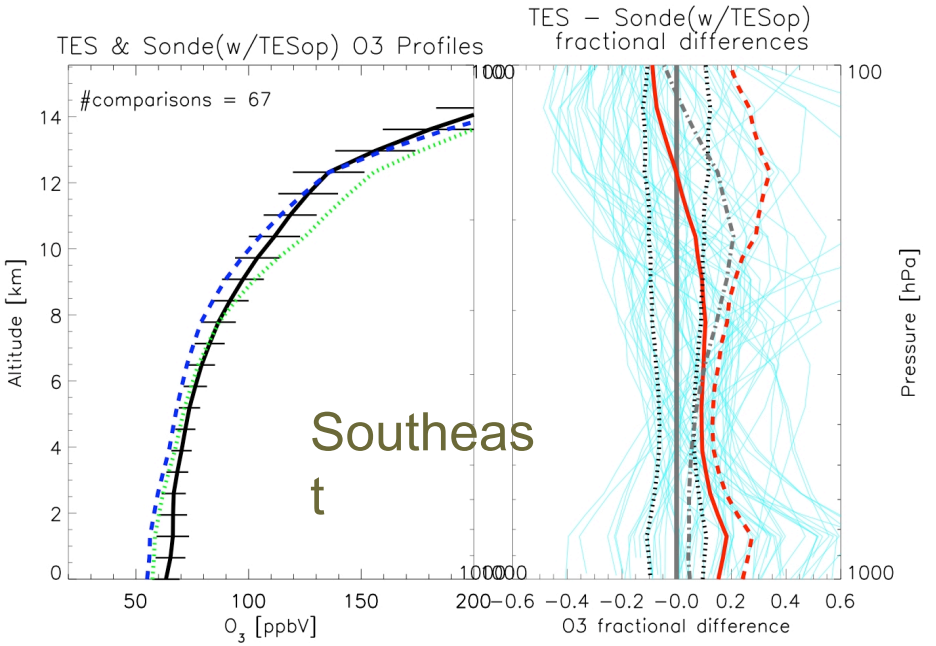
SummerIONS06_NEast_3hr_200km
Fri Feb 16 16:03:44 2007

TES – IONS 2006 Comparisons



TES avg
Sonde (w/TES op) avg
I.G. avg

avg.[TES–sonde(TESop)]/sonde(TESop)
rms of relative differences



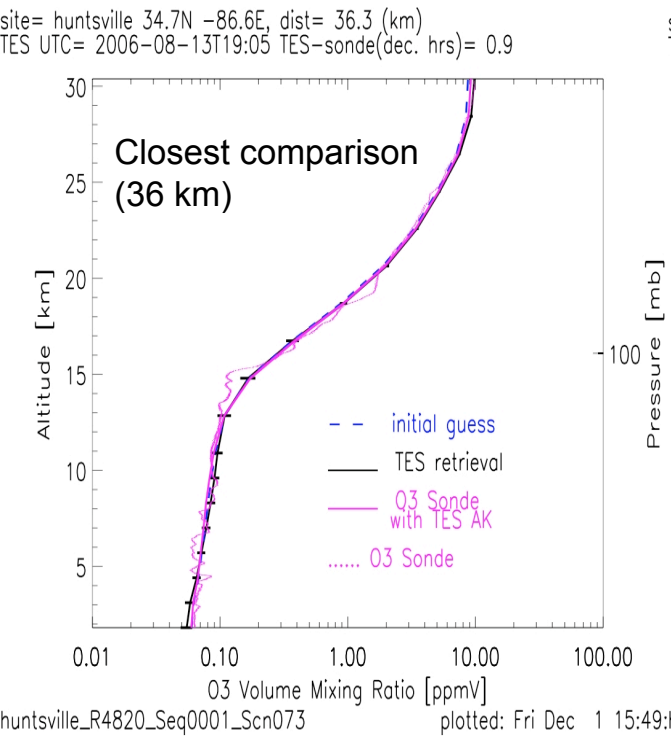
TES avg
Sonde (w/TES op) avg
I.G. avg

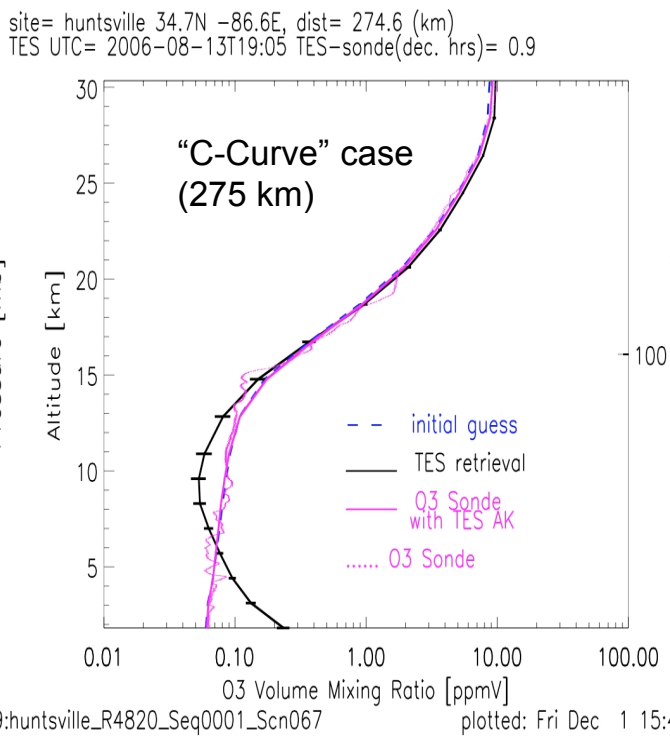
avg.[TES–sonde(TESop)]/sonde(TESop)
rms of relative differences

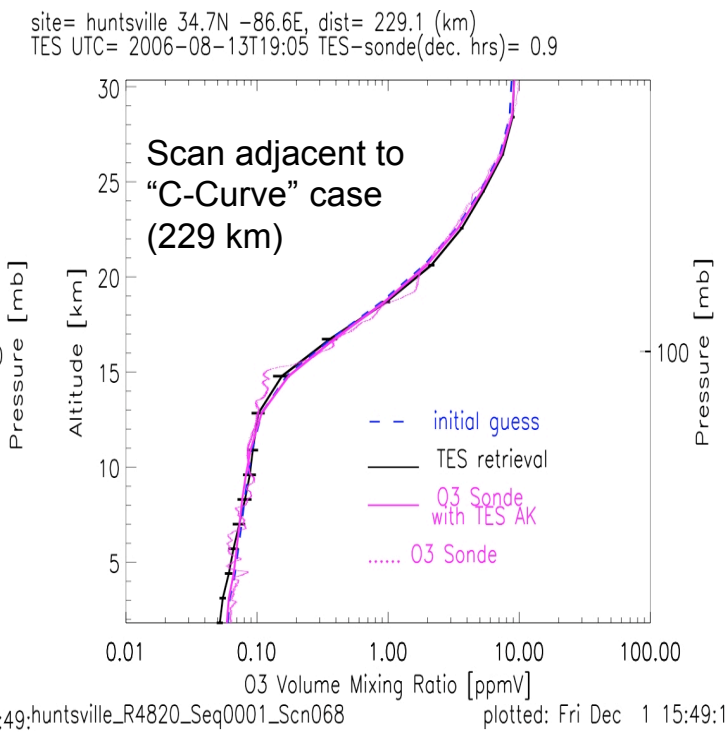
IONS data used for detection of “pathological” TES retrievals

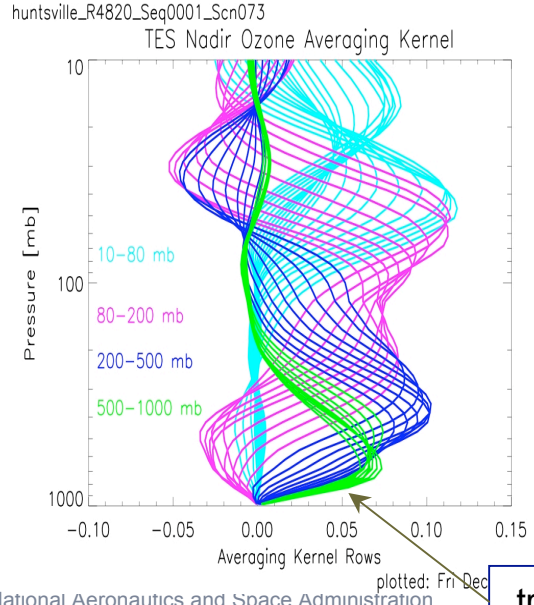
- the “C-Curve” result for TES ozone retrievals
  - IONS instrumental in defining new TES data quality flag.
  - TES ozone retrievals are obviously wrong compared to sonde and adjacent TES scans.
  - Likely related to retrieval non-linearity and cloud sensitivity.
  - O_3 too high near surface; too low around 350-200 hPa.
  - 13/1050 (1.2%) cases detected for IONS comparisons.

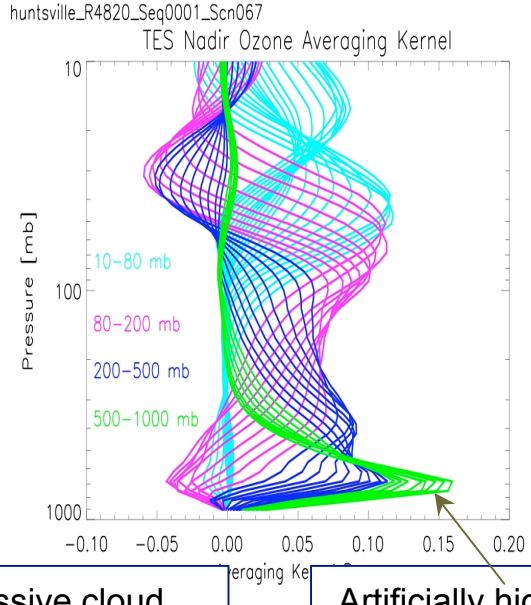
Huntsville 2006.08.13 comparison examples and corresponding AKs

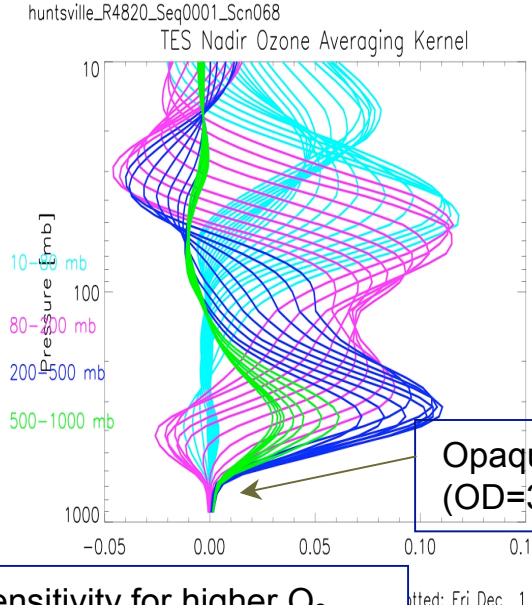










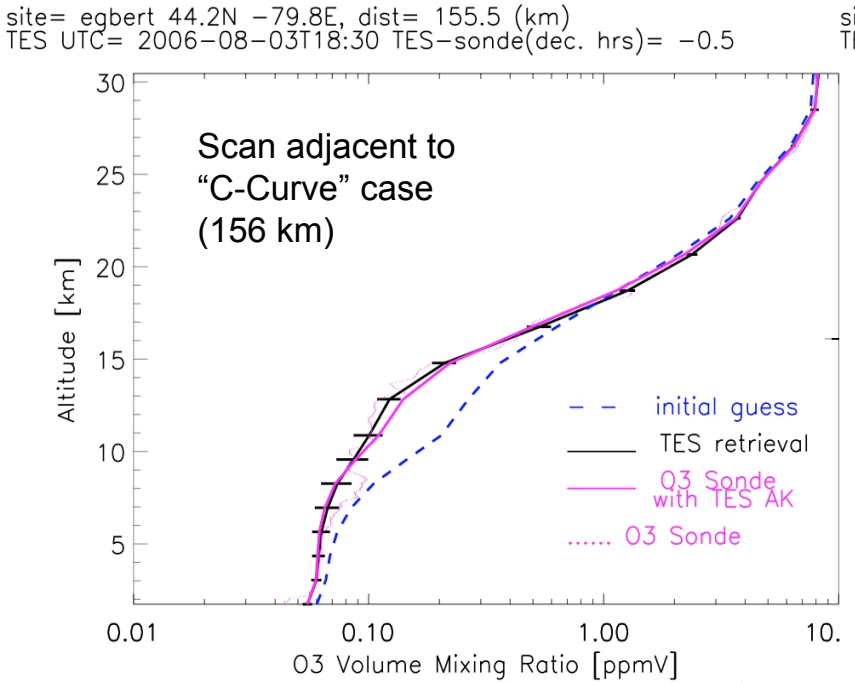


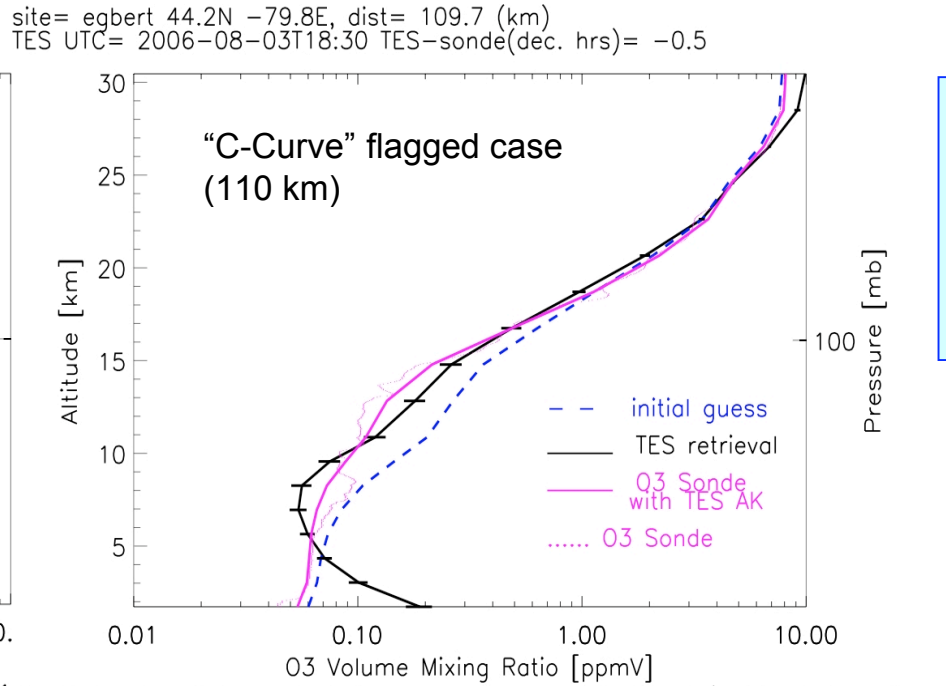
Opaque cloud (OD=3.4) at 675 h

transmissive cloud

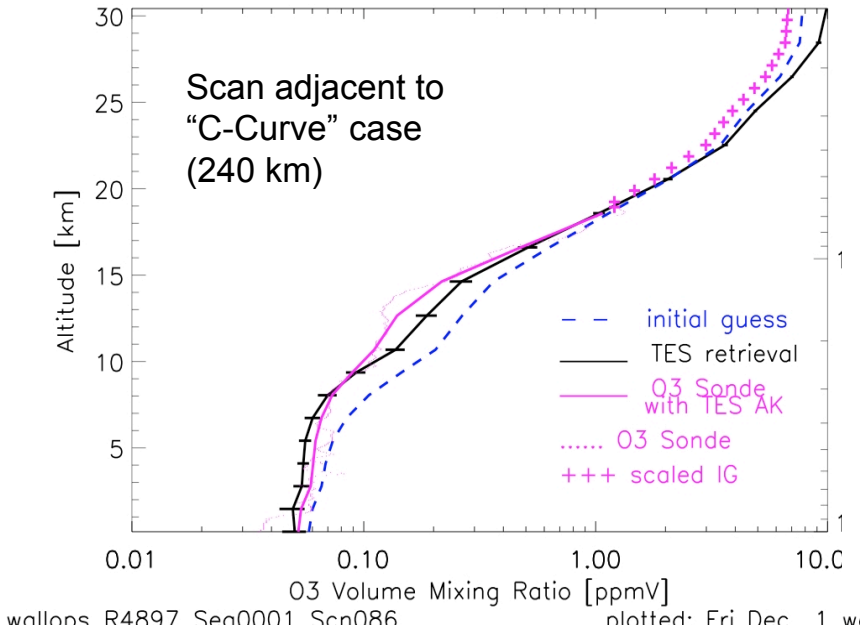
Artificially high sensitivity for higher O_3

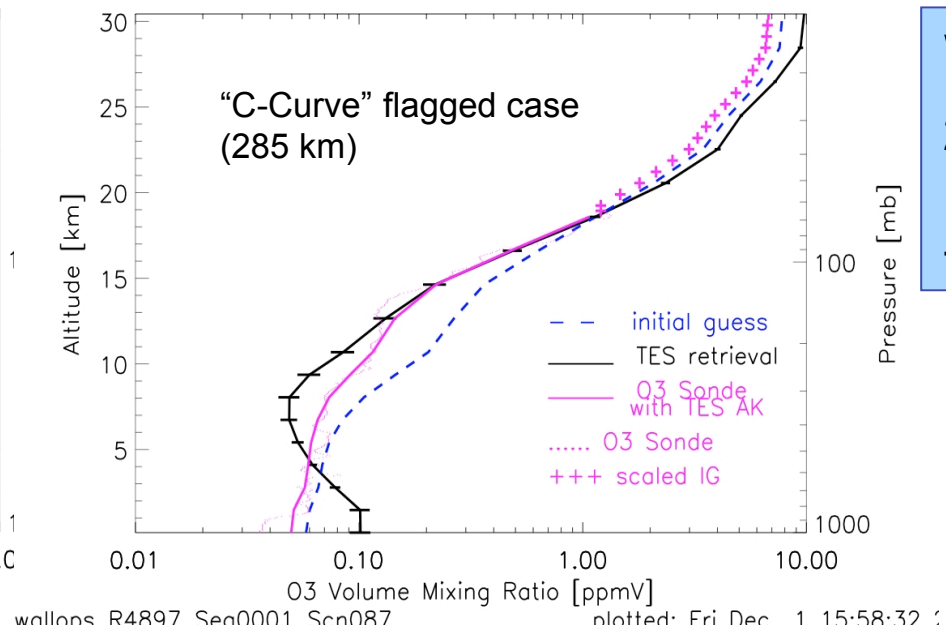
Sonde/TES comparisons for TES Step/Stare data with “C-Curve” cases





Egbert
2006.08.03
44.2° N
-79.8° E





Wallops
2006.08.21
37.8° N
-75.5° E

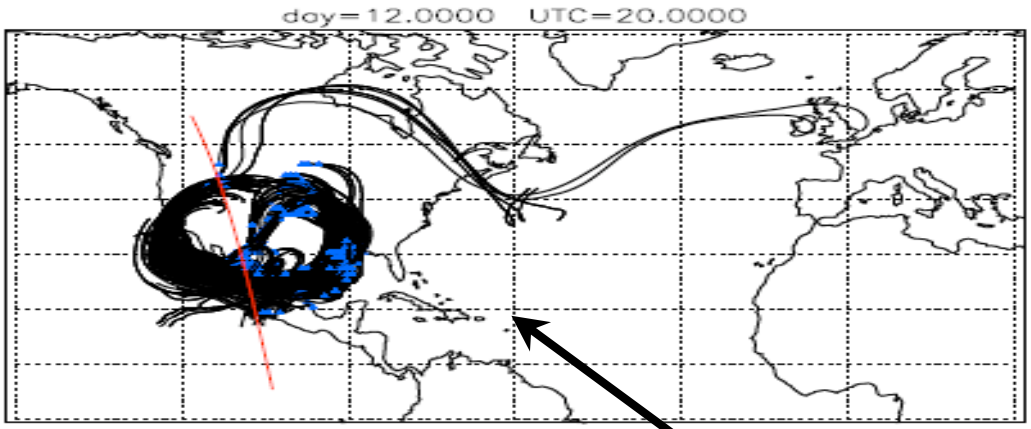
Constrain the lightning NOx source over North America in the global scale models using TES, NLDN, and the GEOS-Chem model

L. Jourdain, H. Worden, K. Pickering and the TES team

Enhanced Ozone layers in TES influenced by lightnin

TES (red) and Hysplit Trajectories(black) from NDLN Flashes (blue)

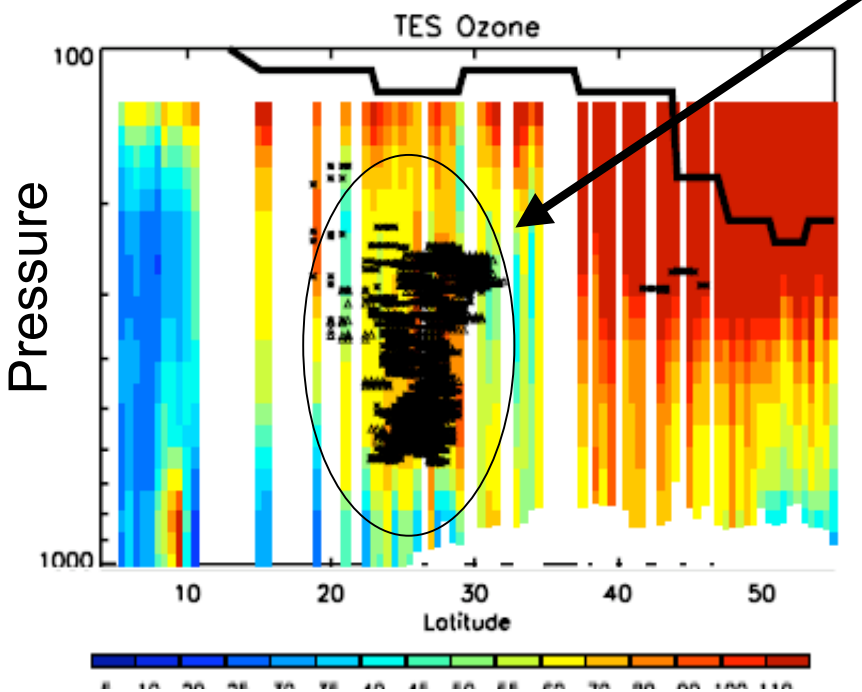
Run 4497

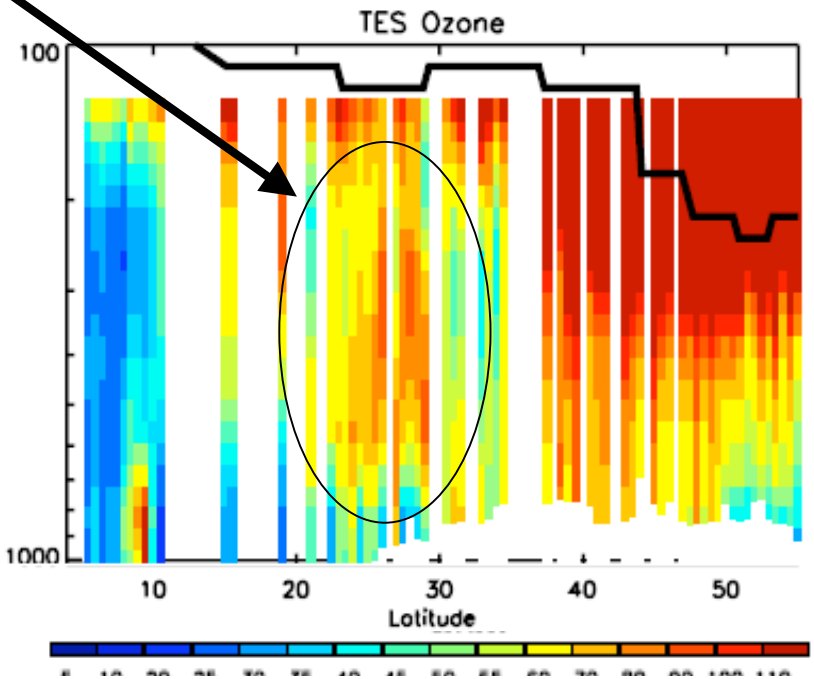


Black= Trajectories from lightning flashes that intersect TES

Blue=Lightning associated to these trajectories

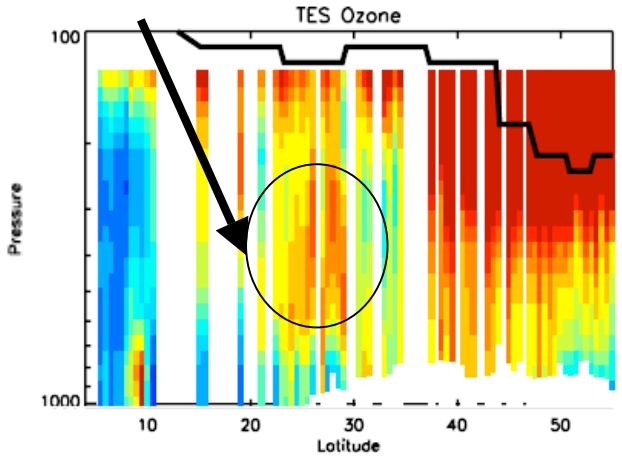
TES Run 4497, 07/12/2006

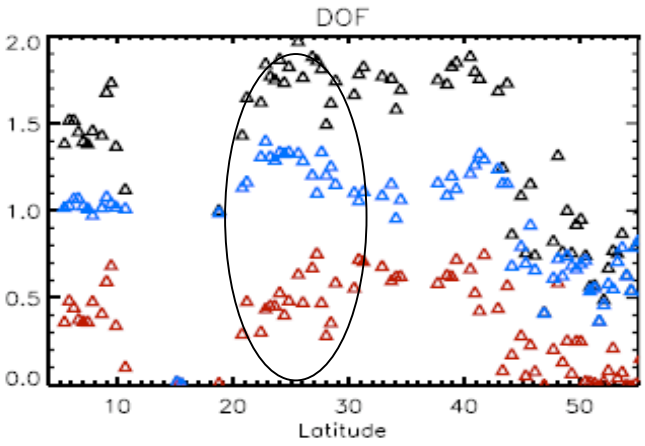




TES/GEOS-Chem Comparison (Run 4497)

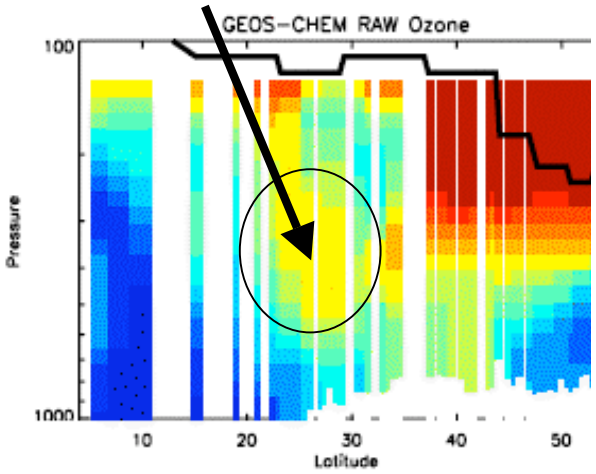
Influence from lightning

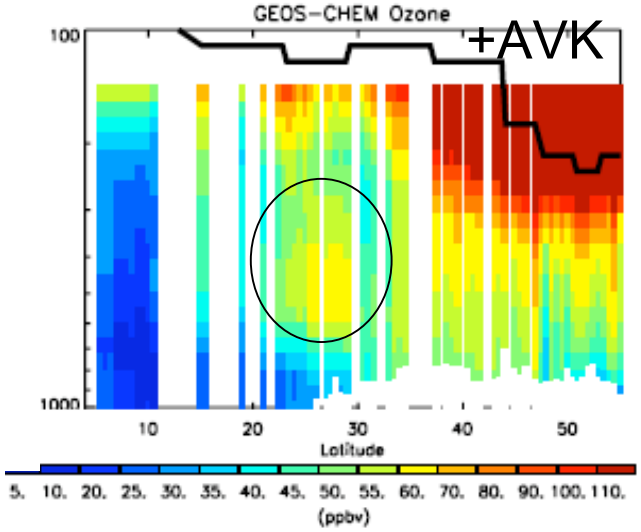




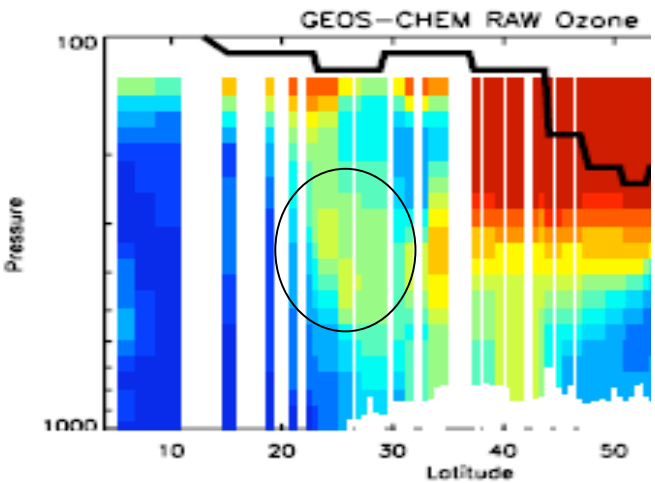
Troposphere
500 hPa-Tropopause
Surface-500 hPA

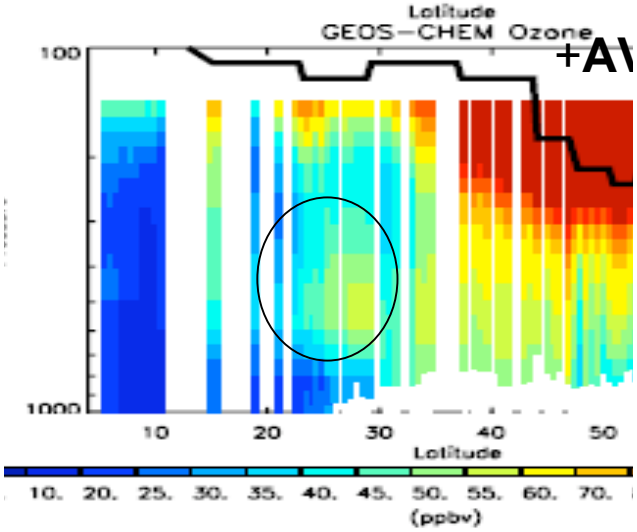
Enhancement also seen In GEOS-Chem





Results without lightning in GEOS-Chem

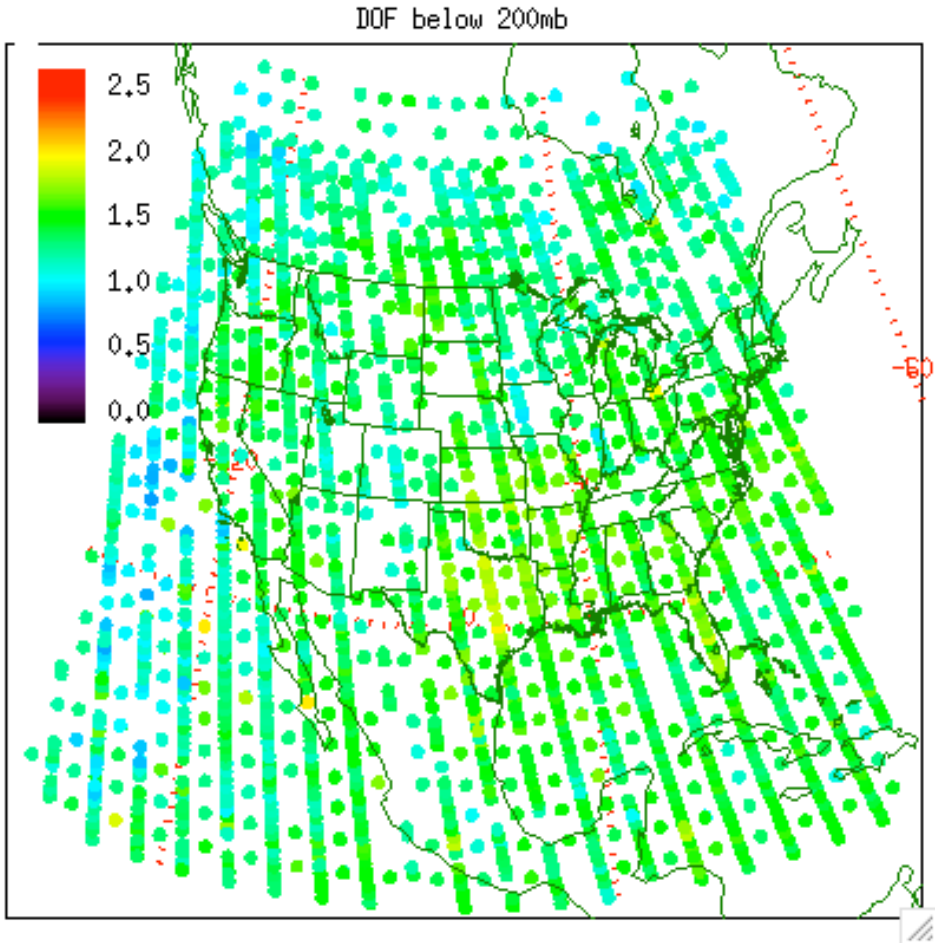




•Significant decrease (~10 ppbv) of the ozone enhancement in the GEOS-Chem simulation without

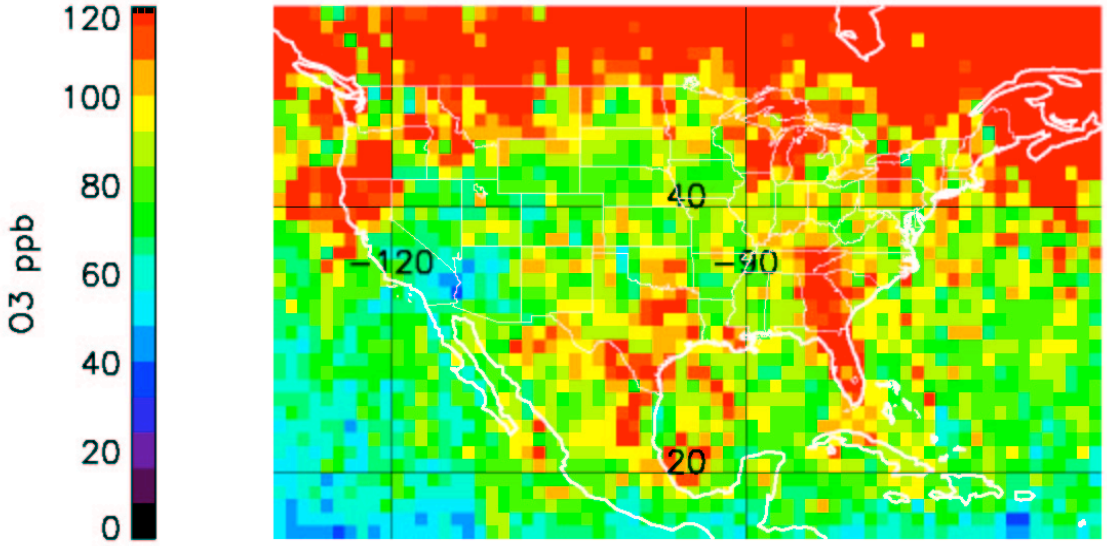
Analysis with FLEXPART

- Extend analysis reported by Cooper et al (2004, 2006) to study ozone budget over southeast US using TES ozone profile data.
- Focus on August 2006
- Work in progress!

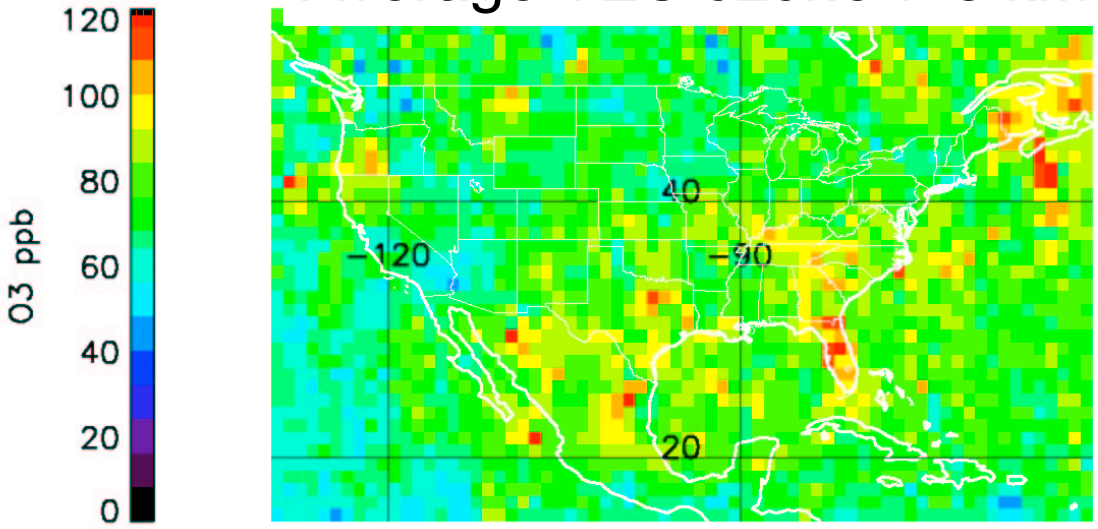


Ozone and CO as seen by TES

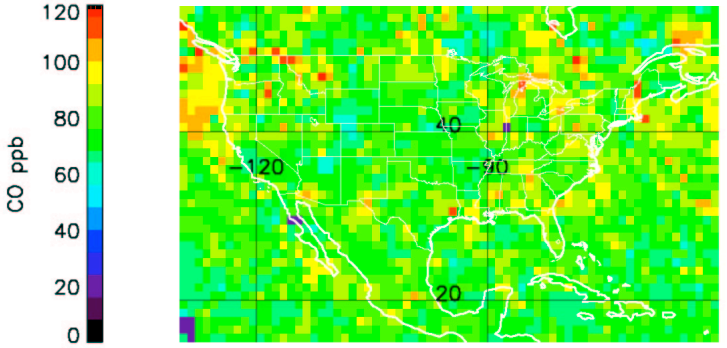
Average TES ozone 10-11 km



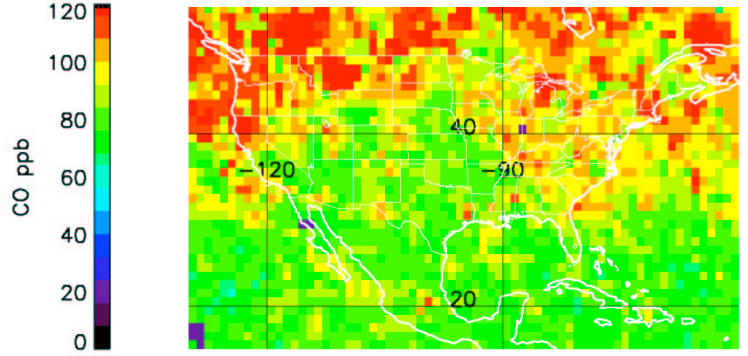
Average TES ozone 7-8 km



Average TES CO 10-11km

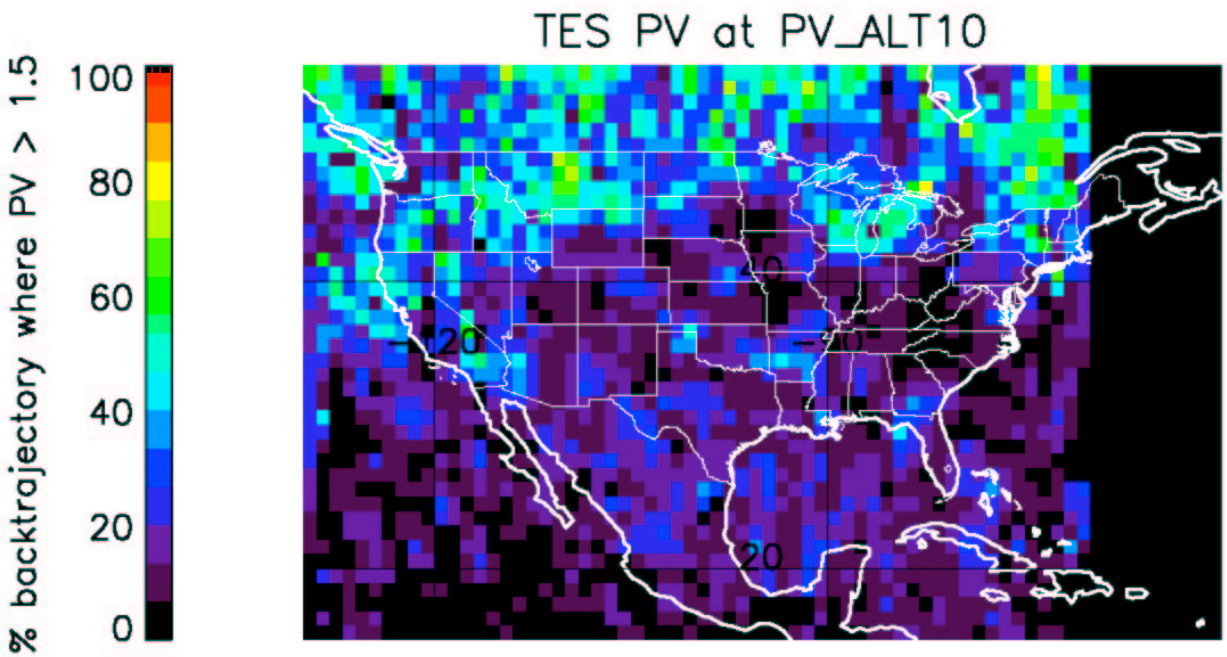


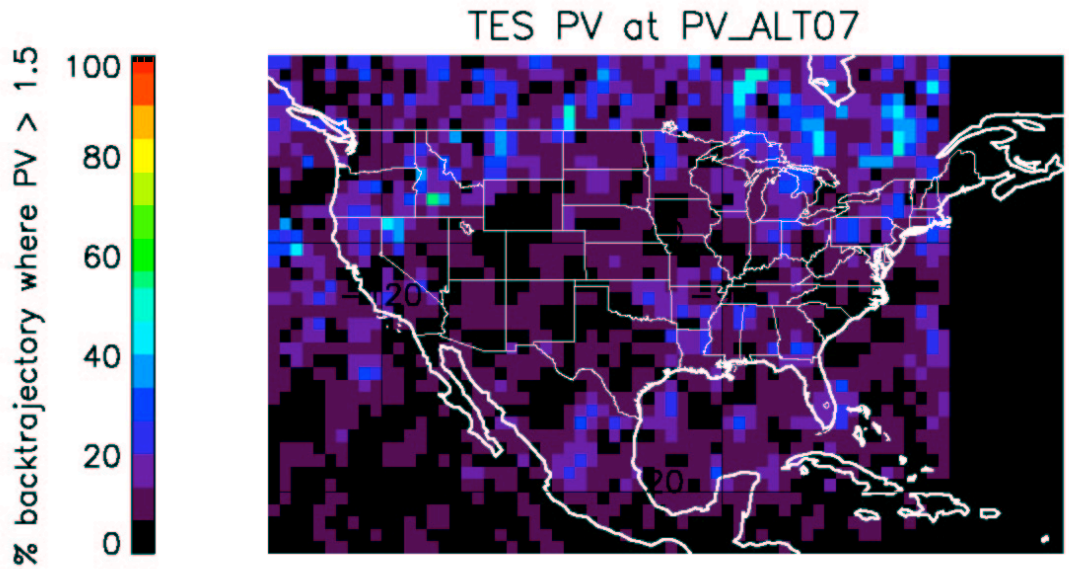
Average TES CO 7-8km



- Aggregate of ~16000 profiles over the month of August 2006

Flexpart trajectories and PV





- Flexpart was run to calculate 20 day back trajectories for each of the TES profiles
- Performed for ~3300 profiles that met strict quality requirements
- These are used to calculate the stratospheric influence

Next steps

- Apply TAES averaging kernals to flexpart back trajectories to account for stratospheric influence with the vertical smearing that is inherent in remote sensing measurements
- Calculate the ozone profile less the stratospheric influence
- Can also apply to TES CO measurements to help understand contribution of surface air to upper tropospheric concentrations.
- Complementary to IONS results.

BACKUP

Parameterization in the global scale models

LNO in a grid box = LNO (IC) x Flash IC + LNO (CG)x Flash CG

•LNO(IC)= NO/meter of lightning channel x length of the lightning channel
= 2.073 e22 x 1/3. x (Z negative charge center-Z top)

Test new numbers ↗ x 4 , EIC/ECG=1 (Pickering, 2006)

•Flash IC= Flash TOTAL x fraction IC

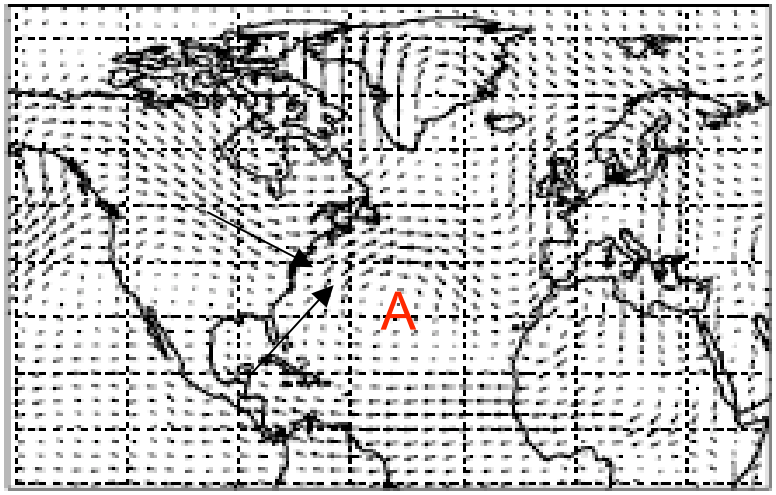
Price and Rind (1993)
IC/CG : function of the cloud cold thickness
Z(T=0 degrees C)-Z sol

Price and Rind (1992)
Power law of the Cloud top height

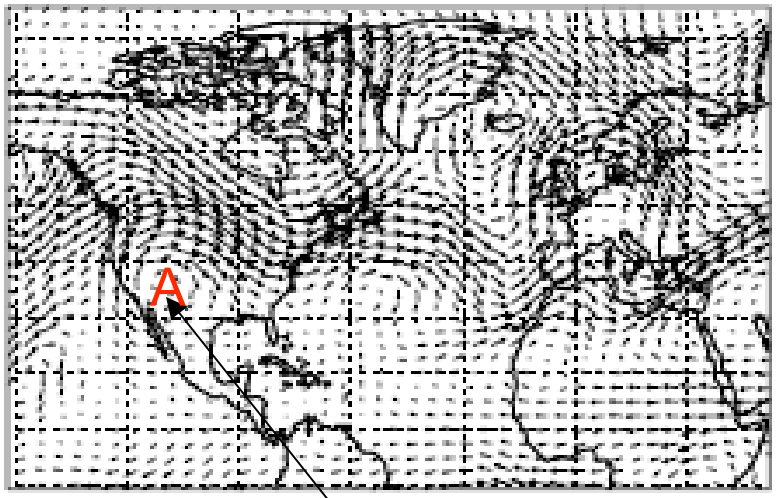
•Vertical profiles of emission are specified 55 %-75 % above 8 km
(Pickering et al., 1998)

Meteorological situation

700 hPa



300 hPa



Monthly Mean
Total Flashes fromOTD/LIS