Ozone events in the Pacific during INTEX-B

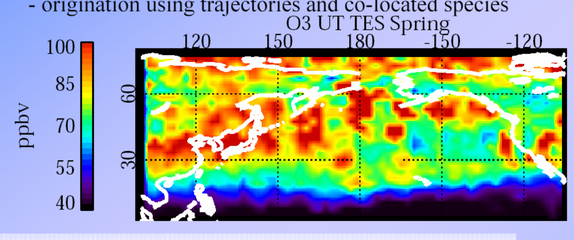
Susan Kulawik[1], John Worden[1], Line Jourdain[1], Robert Herman[1], and the TES team

[1]Jet Propulsion Laboratory, California Institute of Technology, 800 Oak Grove Drive, Pasadena, CA 91109
TES website: tes.jpl.nasa.gov

1)

Question

Where & why does high tropospheric ozone occur over the Pacific?
- seasonal variations
- maps compared to models
- origination using trajectories and co-located species



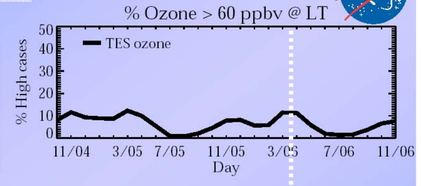
TES Spring, 2006
43,103 profiles

Tropospheric Emission Spectrometer (TES)

- First direct, global measurements of tropospheric ozone, with sensitivity in the upper, middle, and lower troposphere
- Co-located O3, CO, relative humidity – used to identify sources
- 2+ years of near continuous data covering all seasons

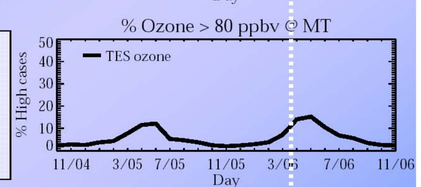
2)

Seasonality of TES high ozone events

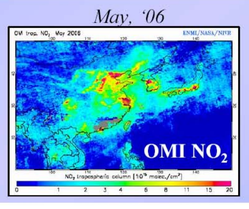


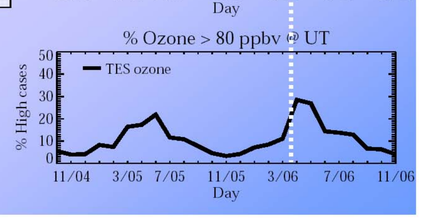
The lower tropospheric ozone maximum results from Southeast Asia Biomass Burning. Oltmans et al., 2004

Upper tropospheric ozone has a maximum in May and a minimum in November. Thouret et al., 2006



May, '06





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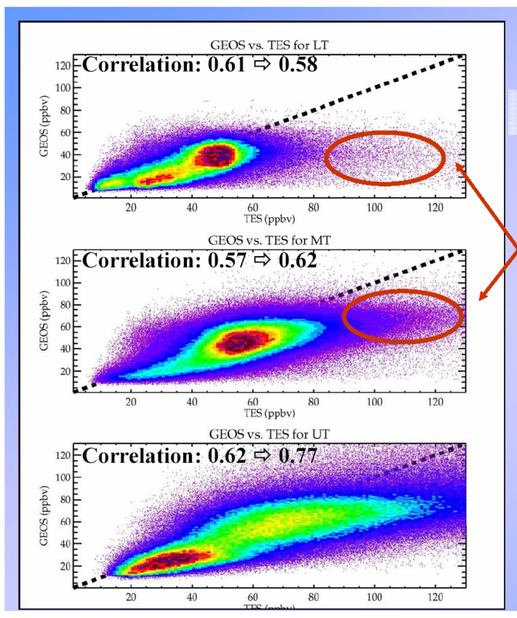

Correlations to GEOS-Chem

- **TES shows high values not matched by GEOS-Chem**
- **Improvement in mid and upper trop.**
- **No AK applied to GEOS**

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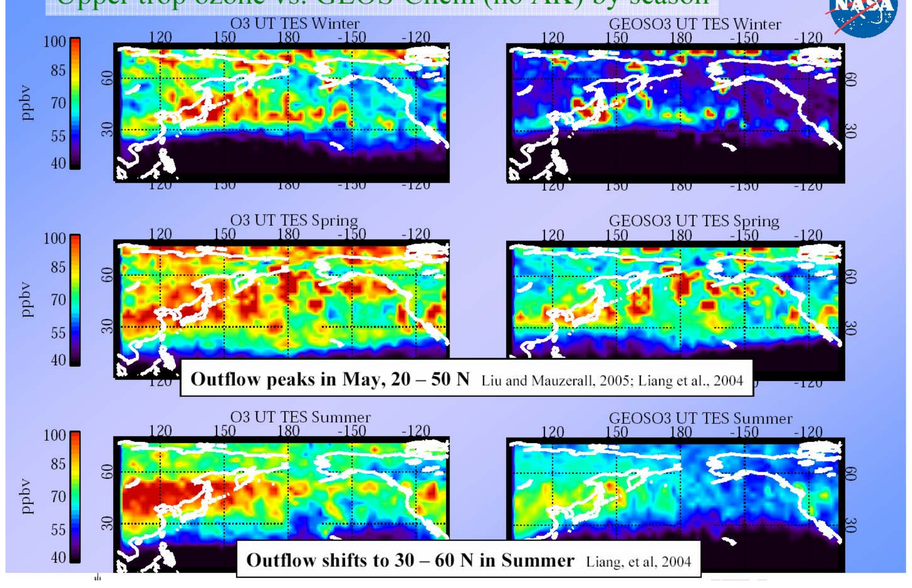
Upper trop ozone vs. GEOS-Chem (no AK) by season



Outflow peaks in May, 20 – 50 N Liu and Mauzerall, 2005; Liang et al., 2004

Outflow shifts to 30 – 60 N in Summer Liang, et al, 2004

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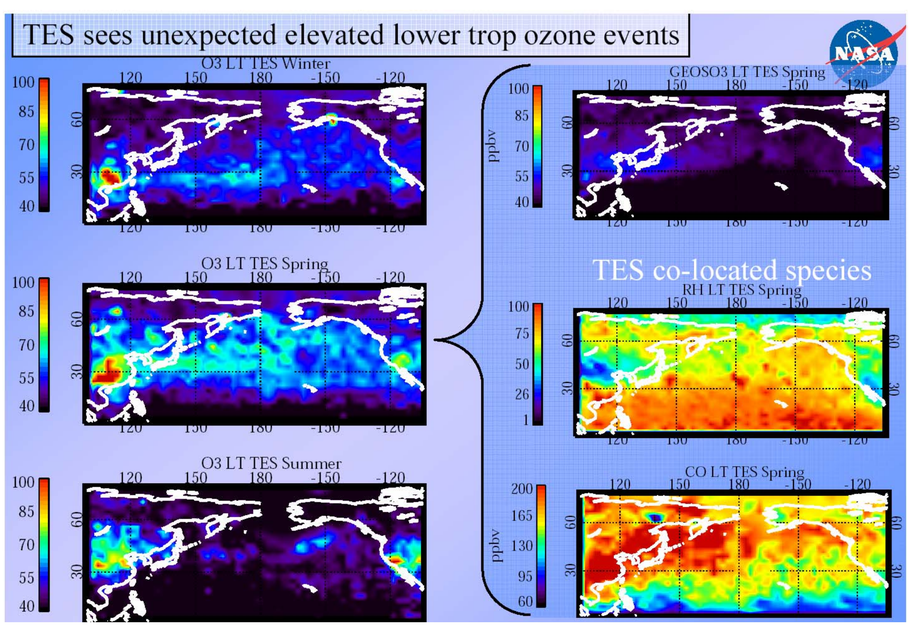
TES sees unexpected elevated lower trop ozone events



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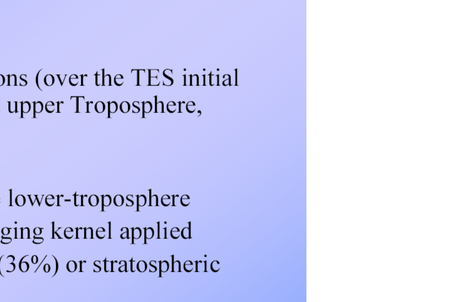
Origin of elevated TES lower trop ozone events

- About 1000 lower trop ozone events (60 - 80 ppb) in Spring, 2006
- Back-trajectories show 25% from mid to lower troposphere Asia. Of these, 80% from E. Asia, 20% from S.E. Asia

0.5% show very low humidity → strat



36% show elevated CO → pollute. or B.B.

7)

Conclusions

- TES shows similar patterns and improved correlations (over the TES initial guess) compared to GEOS-Chem in the middle and upper Troposphere, with TES ~15 ppb higher than GEOS-Chem.
- TES shows a seasonal elevated ozone pattern in the lower-troposphere
  - Not seen in GEOS-Chem with or without averaging kernel applied
  - Co-located species identify events as pollution (36%) or stratospheric (0.5%) in origin.
  - Seasonally consistent with biomass burning, however back-trajectories indicate only 20% are from S.E. Asian source, whereas 80% from E. Asia.
- Exploration of differences seen between TES & models should improve our understanding of global ozone and pollution