IONS Sonde Data in Relation to Meteorological Features

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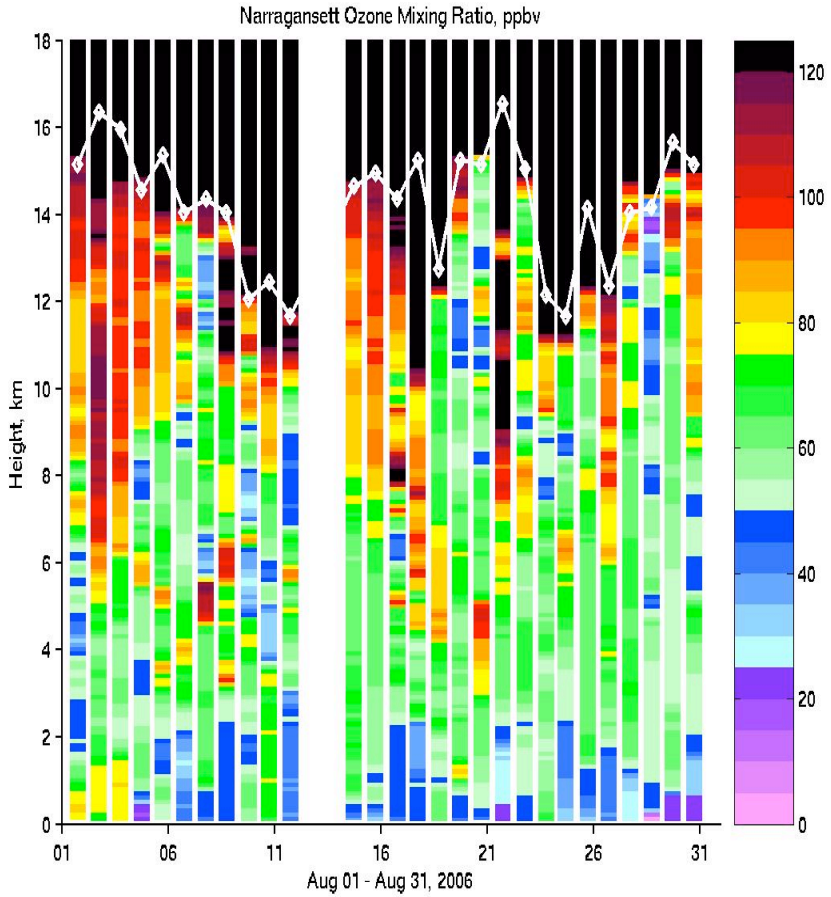
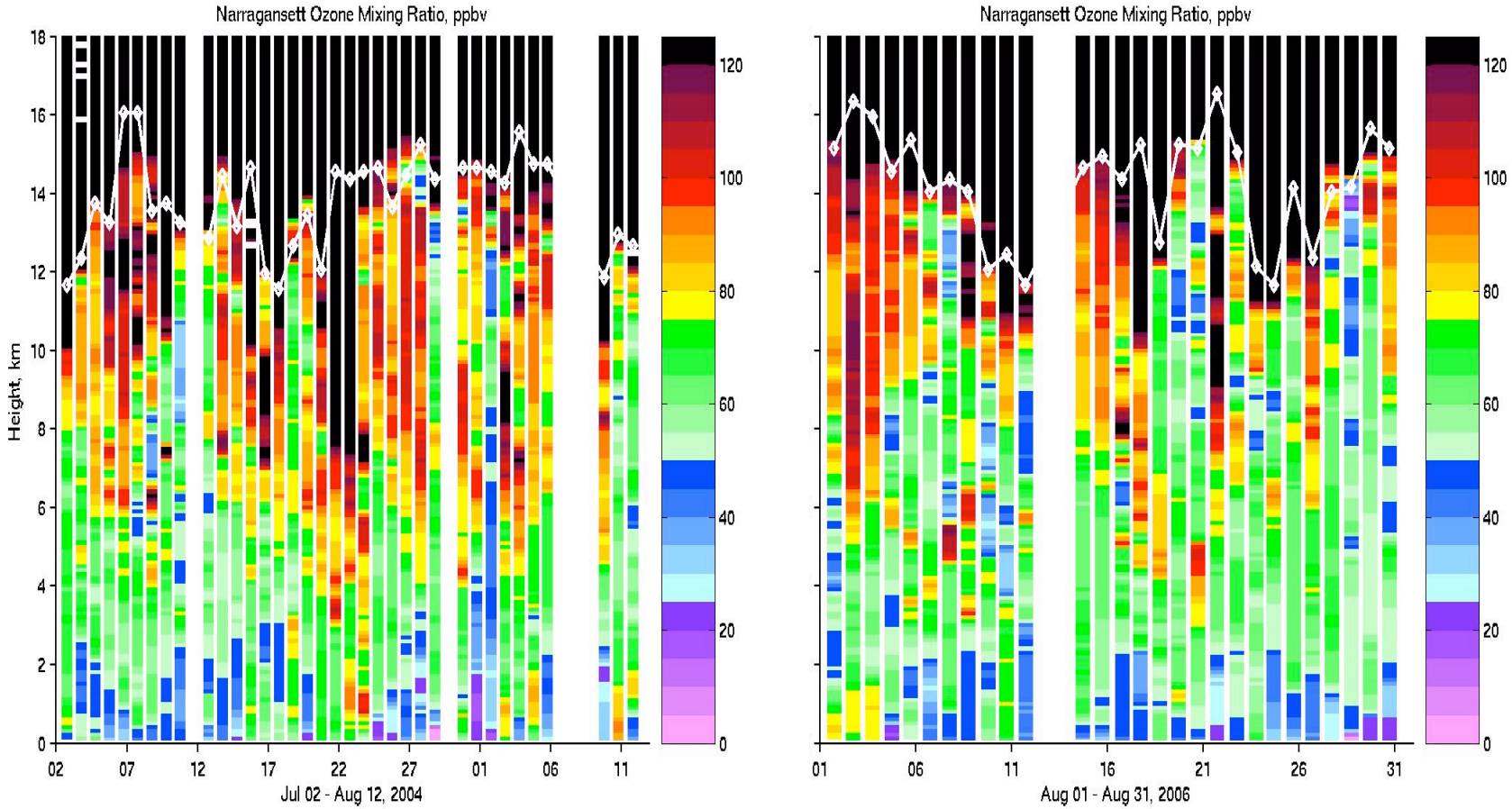
Height:Time section - slice; stripe; band

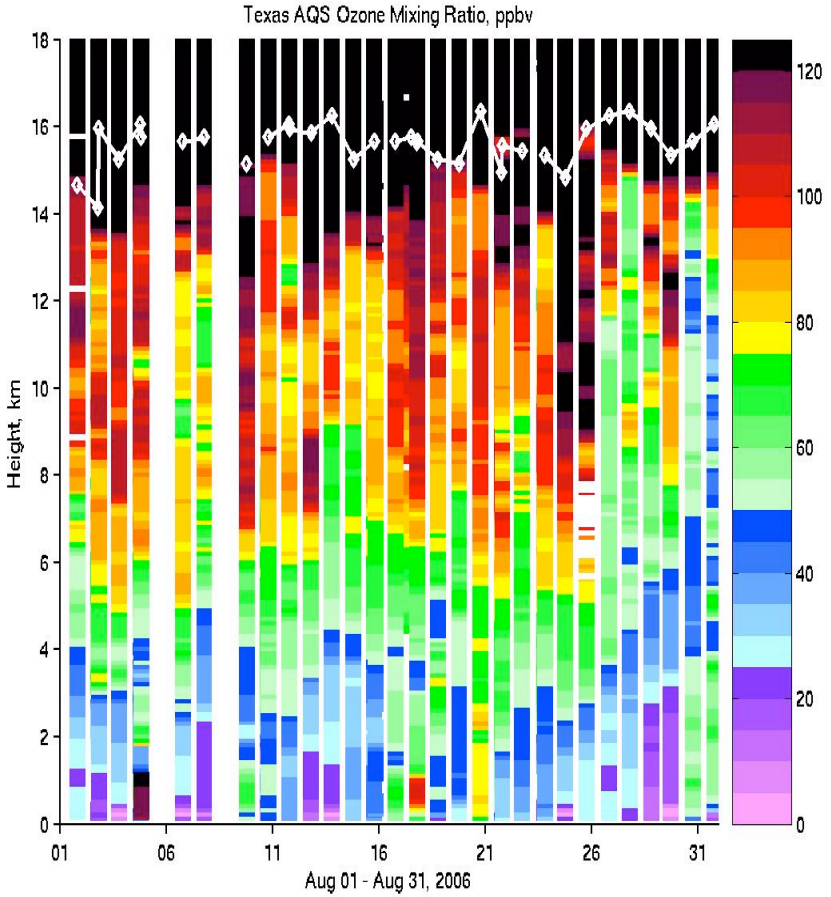


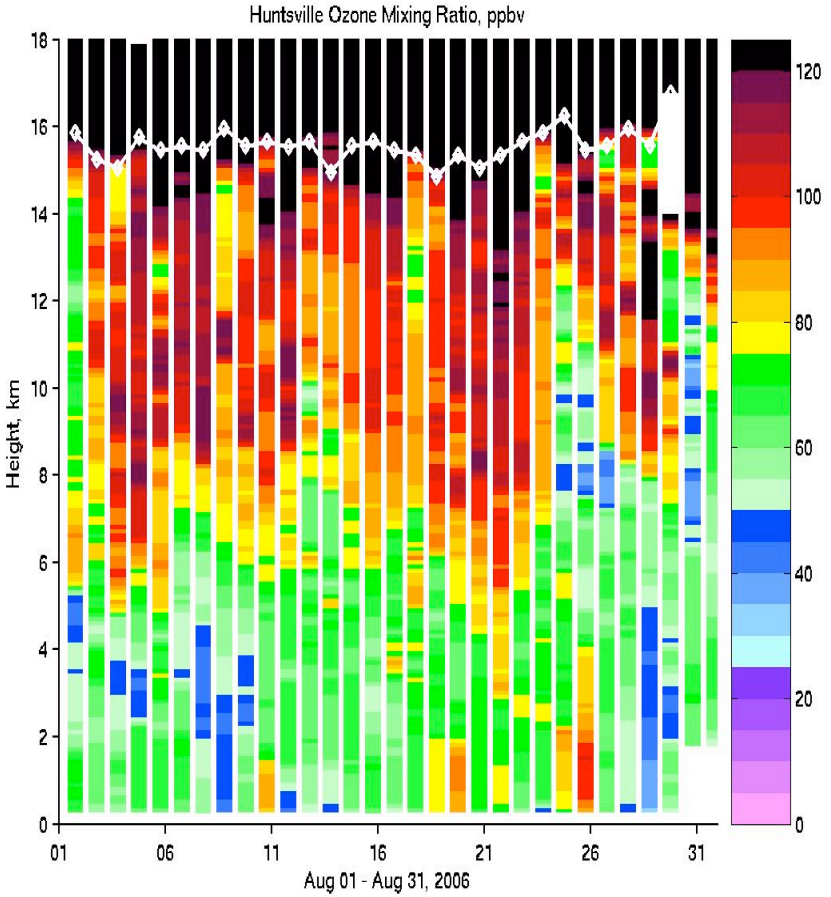
- Vertical averages (100 m) shown here.
- Smoothing only in fill color bands. No interpolation.
- Data shown at mid-profile time. Slice gaps denote separation.

Contrast of IONS 06/IONS 04 at one site

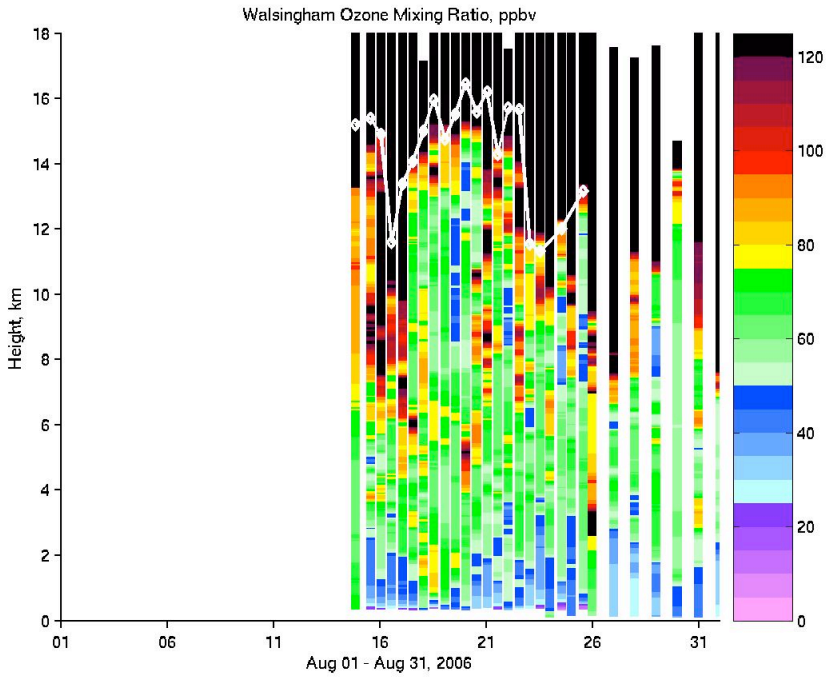


Compsite of Houston/RV Brown profiles echo Huntsville UT behavior



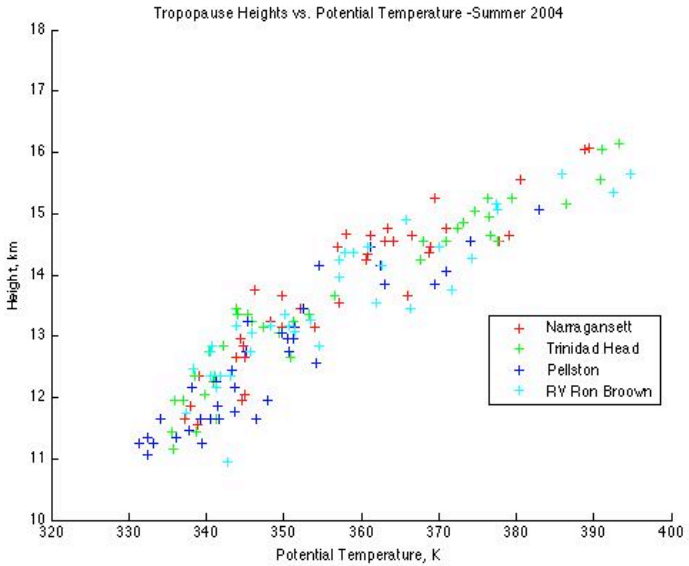


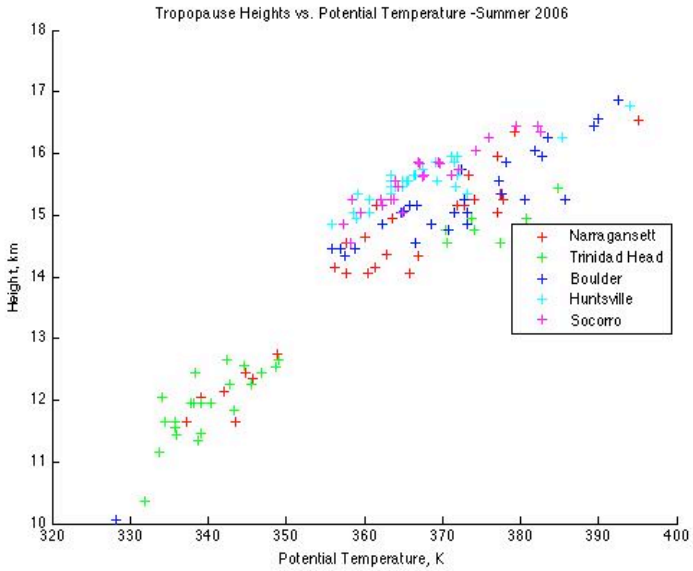
Sub-synoptic variability revealed by twice-daily profiles



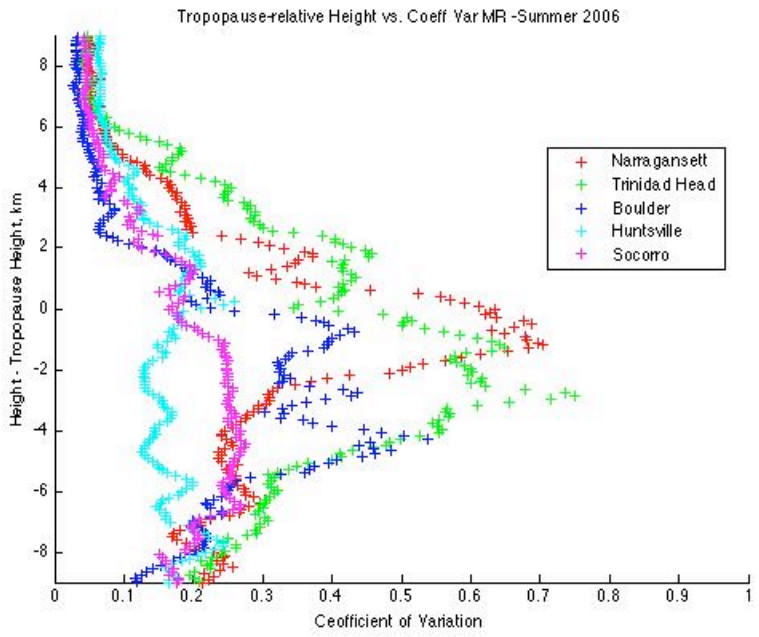
- Mesoscale variability throughout troposphere
- Numerous abrupt shifts
- Frequent deep, clean surface layer

Tropopause phenomena
Height of thermal tropopause vs. θ



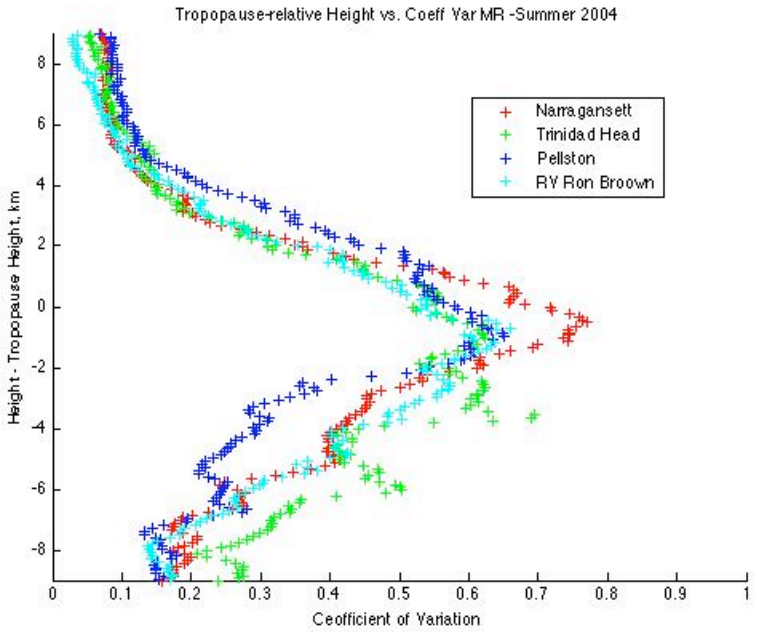


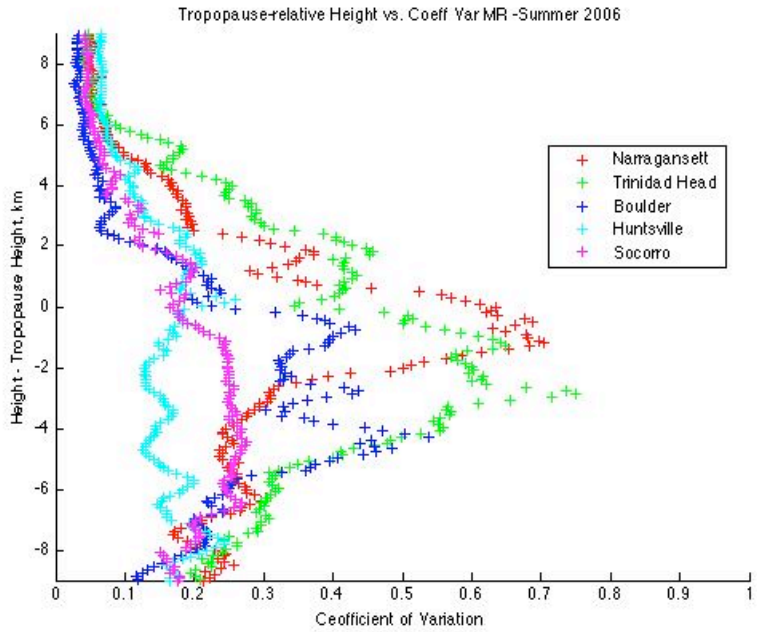
O_3 mixing ratio variability near tropopause



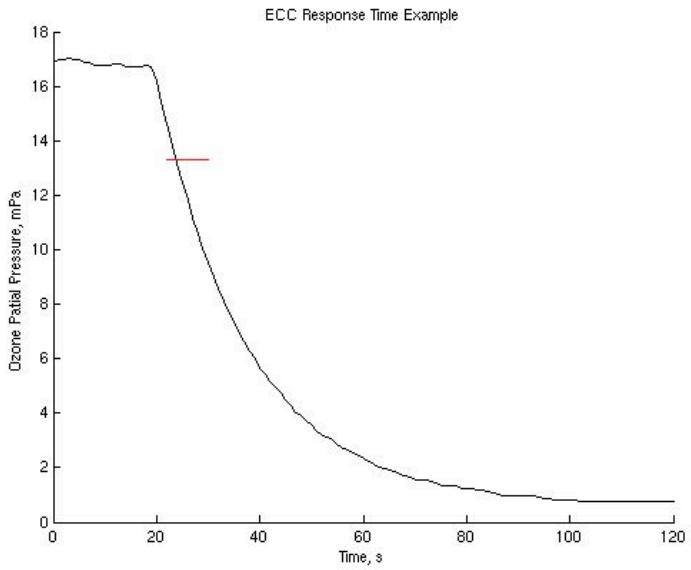
- Height relative to tropopause *vs*. coefficient of variation, here about monthly mean.
- Notable intra-site differences
- Mid-tropospheric and mid-stratospheric variability minima

Near-tropopause variability - 2004/2006 comparison



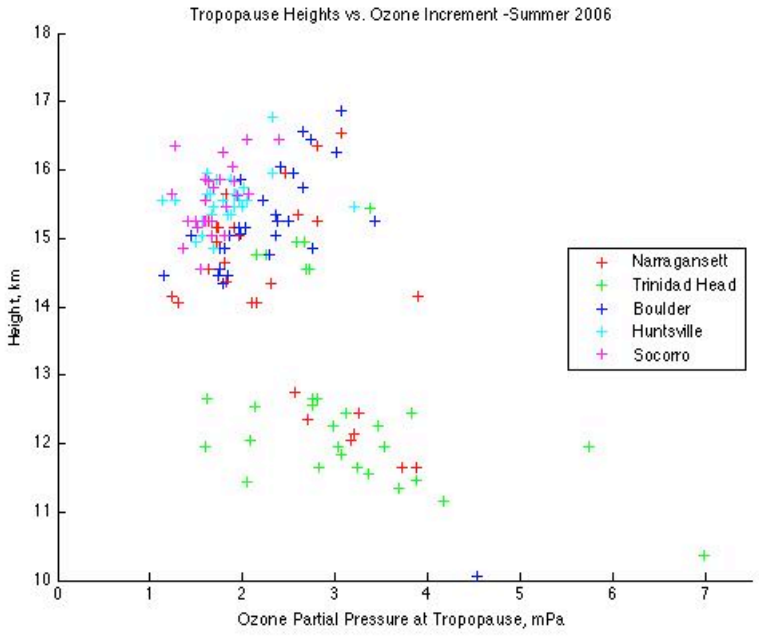


Response time of ECC sonde



- Time to e^{-1} response typically 22-28s.
- 3 RT x Ascent rate ~350 m
- Effects not accounted for in typical analysis.
- Asymetric response - a long tail for $\delta O_3 < 0$.

Underestimate of tropospheric column - crude, lag-displacement analysis



- O_3 partial pressure averaged over 300 m above thermal tropopause.
- Shown for summer, 2006 profiles at several sites.
- Summer, 2004 data cover wider range, higher values.
- Absence of height dependance is notable.

Effects of RT on column and variability estimates

- Column amounts minimally impacted for layers that are symmetrically distributed.
- Variability systematically underestimated because maxima and minima unreachable except for broad features (such as the stratospheric maximum).
- The underestimate is likely greatest near the tropopause.
- Relative impact of asymmetrical response effect is unknown.

Use of synoptic classification to group profiles for statistical analysis

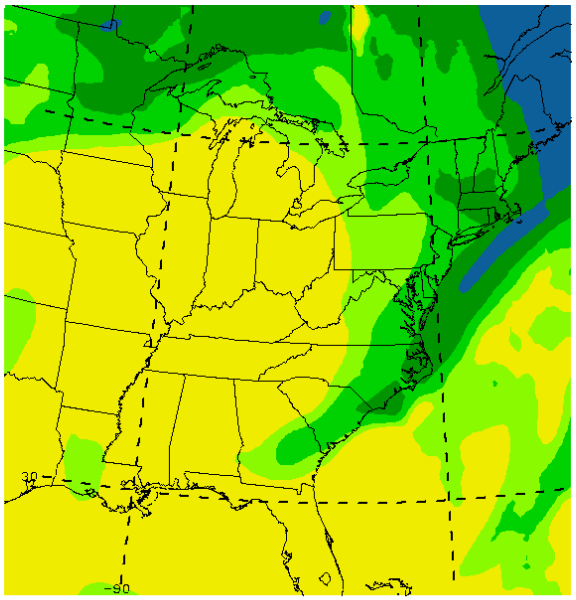
…	BL	NA …
(18)		
Sc	st-co	ac
Z_{Tr}	16.55	12.75
DU_{Tr}	44.12	45.16
(19)		
Sc	ac	wf-pre
Z_{Tr}	16.45	15.25
DU_{Tr}	45.89	43.95
…		

- Some profile characteristics related to circulation.
- Grouping in relation to frontal conformation emphasizes features.
- Expected correspondence with air stream approach.

Lamina-labeling approach to source attribution

- Lamina-labeling technique apportions tropospheric ozone to sources including stratosphere based on analysis of layers.
- Layers in profiles with adequate static stability associated with stratospheric wave breaking and other sorces using θ, O_3 correlations.
- Wave breaking events leading to laminae are large-scale occurrences.

Going beyond lamina labeling



- Laminae discernable in high-resolution synoptic rawinsonde data as well, in θ, U correlations.
- O_3 rich air in laminae accompanied by PV, shown here at θ 347.5 K.
- Accidental Lagrangian analysis of distribution and evolution of laminae seems justified.

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