P1.9

OZONESONDES DURING TEXAQS 2000

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The time-series of figure 1 show strong variability of ozone (in a) and water vapor (b) at all levels of the troposphere on both daily and synoptic time scales. The elevated middle and upper-tropospheric ozone mixing ratios observed between days 234-7 (08/21-08/24) are associated with convective activity one to two days prior over the central United States, Figure 2. Elevated ozone profiles associated with convective activity 1-4 days prior were also observed over Nashville, TN during SOS99.

We hypothesize that ozone precursors lifted by the convective activity into the middle and upper troposphere mixed with NOx from lighting, resulted in the measured ozone profiles. Chatfield and Delany, 1990, refer to this mechanism as "lift then cook."

The elevated middle-tropospheric ozone and low upper-tropospheric ozone observed in days 241-245 (08/28-09/01) is a result of different air mass origins evident in the strong vertical shear in back trajectories for day 242 (08/29,) Figure 3. The elevated ozone between 5-8 km descended across the continental United States and is possibly of stratospheric origin, while the low upper-tropospheric ozone levels originate from the tropical upper troposphere.

The low middle and upper-tropospheric ozone profiles observed between days 246-252 (09/02-09/08) are associated with transport of clean air from the Pacific Ocean, as shown in the back trajectories of Figure 4.

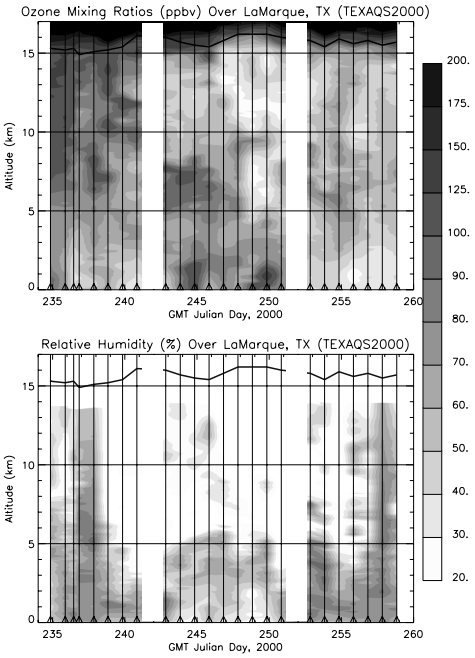

Figure 1. Time-series of (a) ozone mixing ratios and (b) relative humidity at TexAQS

A pronounced layer of very high ozone mixing ratios extending from the surface to about 2 km was observed on day 249 (09/05,) see Figure 1. The layer has a peak ozone mixing ratio of 148 ppbv at 900 m. Back trajectory analysis of this layer, Figure 4, shows the parcel five days earlier over Lake Michigan at 500 hPa.

CONCLUSIONS AND FUTURE DIRECTIONS

Tropospheric ozone concentrations are highly variable from the surface to the tropopause on daily and synoptic time scales. Transport and photochemistry are likely major contributors to this variability.

3-D dynamical and photochemical modeling (MODELS-3/MM5) will help diagnose the combination of dynamics and chemistry along the paths of these air parcels that conspired to produce the measured profiles.

This will provide for the ability to quantify the important processes (convection, upper tropospheric photochemical production, stratosphere/troposphere exchange, and convective boundary layer/free troposphere exchange,) that operate in this domain.

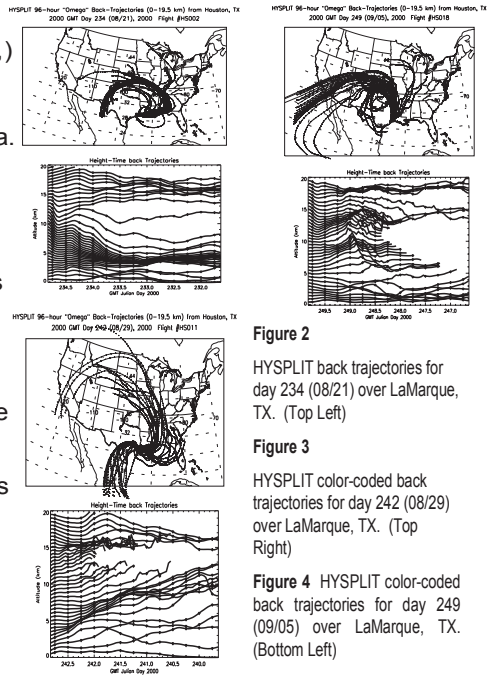

Figure 2

HYSPLIT back trajectories for day 234 (08/21) over LaMarque, TX. (Top Left)

Figure 3

HYSPLIT color-coded back trajectories for day 242 (08/29) over LaMarque, TX. (Top Right)

Figure 4 HYSPLIT color-coded back trajectories for day 249 (09/05) over LaMarque, TX. (Bottom Left)

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