# Analysis of Vertical Ozone Distribution above the University of Houston

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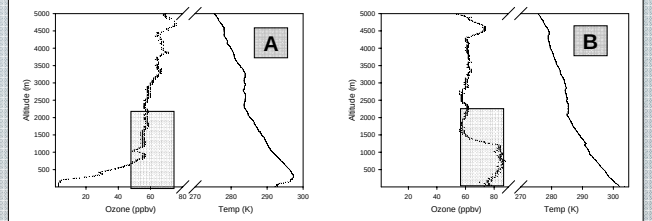
## *Introduction*

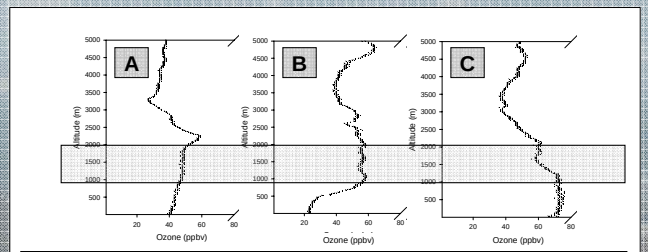
During TEXAQS-II ozonesondes were launched on 20 days during August 2006 and 11 days during September 2006 from the University of Houston (UH) campus to retrieve information about the vertical distribution of ozone.
The UH campus site (29.7421 N and 95.3395 W, 11 m a.s.l.) was chosen due to its central location approximately 5 km to the southeast of downtown Houston and thus it is the most representative site to characterize the structure and dynamics of the urban boundary layer in the Houston area. Launches occurred at approximately 1300 CDT. On intensive operation periods, two launches were performed; at 700 and approximately 1300 CDT. Ozonesonde data coverage was 87.5%, representing 35 successes out of 40 launches. For the balloon-borne ozone measurements, aqueous solution Model 2Z electrochemical concentration cell (ECC) ozonesondes manufactured by EN-SCI Corporation of Boulder, Colorado, were used.

First results from these soundings address (1) the relation of the vertical ozone structure to surface ozone observations, (2) the identification of the relative role of regional transport and local concentration in determining the vertical ozone distribution and (3) the description of ozone distribution within the free troposphere, and how it varies with regional transport patterns.




Ozonesonde and radiosonde profiles at 700 CDT [A] and 1300 CDT [B] on 09/20/06.

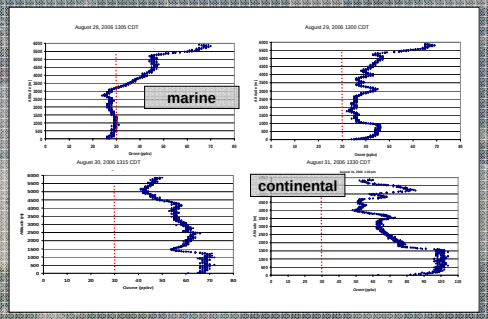
The difference between the maximum $O_3$ values of about 90 ppbv in the afternoon boundary layer and the 60 ppbv originating from the input of the residual layer is most likely due to in-situ $O_3$ formation.

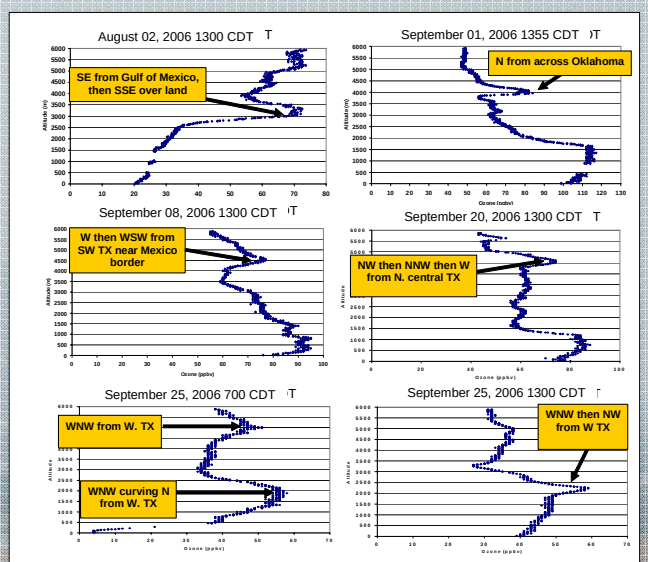



Ozonesonde profiles at 1300 CDT [A] on 09/25 and at 1040 CDT [B] and 1415 CDT [C] on 09/26/06.

Temporal variation of ozone soundings suggest that $O_3$ in the residual layer are partly mixed downward and that about 10 ppbv ozone may be considered as left-over ozone from the previous day and remain in the residual layer.

Ozonesonde data shows that regional-scale transport may have an impact on local ozone levels. Depending on the air mass origin background ozone levels may range from 30 ppbv (marine) to close to 60-70 ppbv (continental).




Selected ozonesonde profiles and back trajectory information for specific layers based on NOAA ARL-UH 24-hr back trajectories calculations.

Significantly enhanced $O_3$ values could be identified in layers above 3.000 m a.g.l.. Their vertical extension is not larger than 500 m. Often, the $O_3$ enhancement is about 10-20 ppbv, but can also reach up to 40 ppbv as it was observed on August 02, 2006. This strong enhancement was associated with transport of air masses over the Gulf of Mexico and an origin in Mexico. In most other cases enhanced $O_3$ values are associated with W to NW wind directions. Since these layers are mostly found in altitudes above 3.000 m a.g.l. it is likely that biomass burning, i.e. forest fires in the Canadian or US Rocky Mountains may have contributed to these higher $O_3$ values

## *Summary*

Preliminary analysis suggests that about 10 ppbv ozone may be considered as left-over $O_3$ from the previous day and remain in the residual layer. In addition, preliminary analysis of ozonesonde data also shows that regional-scale transport may have an impact on local $O_3$ levels. Depending on the air mass origin background ozone levels may range from 30 ppbv (marine) to close to 60-70 ppbv (continental).

Vertical $O_3$ profiles frequently showed specific layers with enhanced values. In most cases these layers occur above 3.000 m a.g.l. and do not have a vertical extension larger than 500 m. Often, $O_3$ enhancement is about 10-20 ppbv, but can also reach up to 40 ppbv. Possible source areas are Mexico and the Rocky Mountains and may be associated with biomass burning or eventually urban sources. So far, the preliminary analyses do not show impacts coming from the industrial areas in the northeast of the US.

The results so far indicate that PBL effects on ozone levels cannot be considered as an isolated process. Various effects likely superimpose and require further analysis. In particular, the contribution from ozone in the residual layer, free troposphere and from the continental/marine background may be important.