

35. Findings from the Texas 2000 Air Quality Study: Characterization of Transport Processes Controlling the Distribution of Ozone in the Houston Area

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The Texas Air Quality Study (TexAQS 2000) was conducted in the summer of 2000 to identify the chemical and meteorological processes that are responsible for the large and frequent exceedances of the ozone air quality standards in the Houston, TX area. To meet these objectives, a large array of instruments, both ground-based and airborne, was deployed during TexAQS 2000. The focus of our research was to examine the effect of different atmospheric flow conditions, both on synoptic and local scales, on the three-dimensional distribution of ozone, ozone peak values, and transport pathways. To document the horizontal and vertical distribution of ozone we used data gathered with the NOAA/ETL airborne ozone and aerosol lidar. Back trajectory calculations using wind profiler network data provided information on the origin and transport pathways of the ozone plumes that were detected with the airborne ozone lidar. NOAA/ETL's ground-based Doppler lidar mapped out the local wind field associated with the land-sea breeze circulation. In addition, we incorporated airborne and surface-based in situ chemistry measurements into our analysis.

The main findings of our research can be summarized as follows:

- The occurrence of widespread ozone exceedances and extremely high ozone peak values was linked to a combination of two meteorological factors: a) light-wind conditions during midday allowed a buildup of ozone plumes over the source regions and b) aged pollution plumes emitted into the morning offshore flow were transported back over the source areas by the afternoon sea breeze, thus enhancing the already high pollutant levels (see figure 1 below).
- Subtle differences in the wind pattern, in particular the onset time, strength, and direction of the sea breeze flow caused significant differences in ozone distribution and ozone peak values.
- Under steady synoptic flow conditions, the Houston ozone plume was exported to the surrounding rural regions, resulting in ozone exceedances far downwind of the pollution sources.

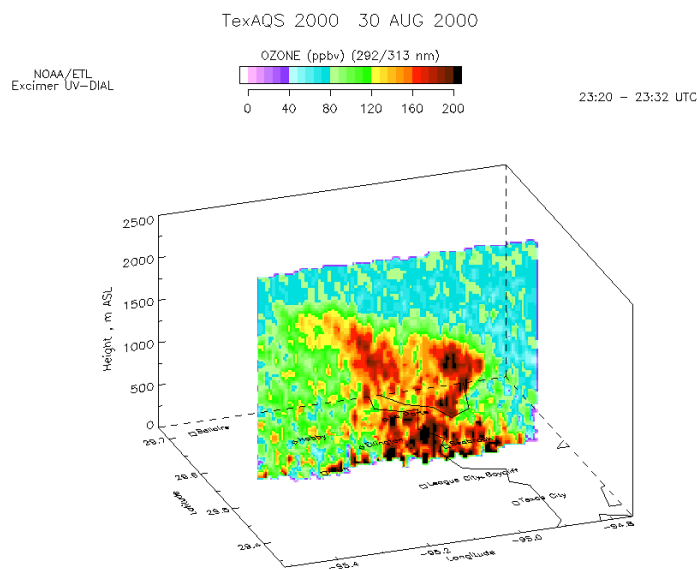


Figure1: East-west vertical cross section of ozone concentration across the coast of Galveston Bay obtained by NOAA/ETL's airborne ozone lidar on 30 August 2000. A plume of very high ozone concentrations reaching nearly 200 ppbv formed in the sea-breeze convergence zone in the late afternoon as aged pollutants recirculated by the sea breeze merged with the Houston pollution plume.