Influence of Transport by the Nocturnal Jet on Ozone Levels in Central Texas

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KWKT tower in Moody, Texas has been the home to NOAA ESRL's CO, CO_2, and meteorological continuous-monitoring equipment since 2006. Additional instrumentation was installed in April 2009 and the tower now hosts a number of continuous-sampling instruments at multiple levels (6m, 30m, 122m and 457m above ground level) that measure ozone, carbon dioxide, carbon monoxide, and meteorological components (temperature, relative humidity, wind direction and wind speed) every 30 seconds. The primary purpose for this ongoing study is to determine whether ozone levels in central Texas are influenced by the nocturnal transport of air that carries ozone and precursors from upwind sources. In addition to continuous tower measurements, an ozonesonde campaign was conducted at the tower site during late August and September, 2009, which is a time of year with many high ozone (O_3 > 80 ppb) days. Newly installed and already existing instrumentation at the site is discussed. General seasonal trends and findings are presented, including quantification of diurnal and seasonal nighttime median wind, ozone, CO and CO_2 values. Evidence suggests that a low-level nighttime continental jet exists and generally influences the region by transport of low ozone "clean" air from the Gulf of Mexico. Occasionally, the low-level nocturnal jet carries high ozone to the vicinity, but does not appear to have a strong affect on surface ozone levels. However, high ozone levels were often found to be a result of non-jet North/Northeast winds that have travelled from the vicinity of Dallas before reaching the tower. Study conclusions, recommendations for further study are also discussed.

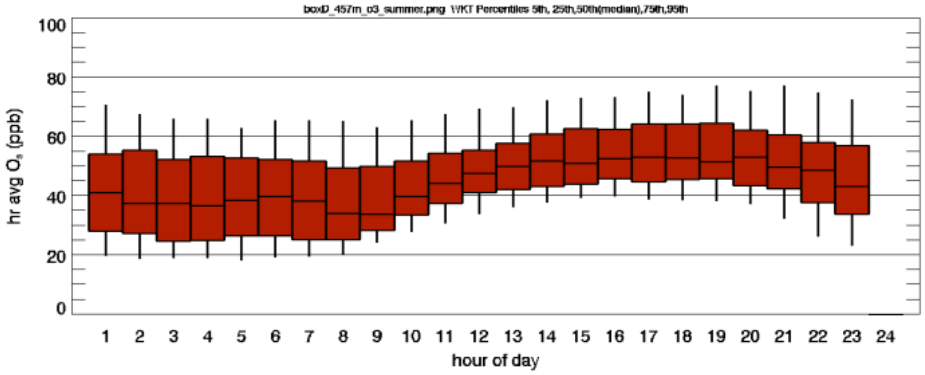

Figure 1. KWKT nighttime O_3 percentiles (5th, 25th, 50th (median), 75th, 95th) at the 457m tower level in summer (Jul, Aug, and Sep).

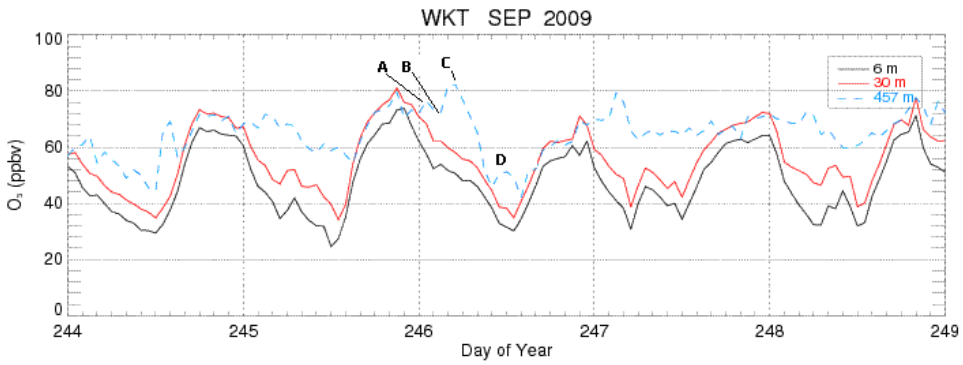

Figure 2. September 2009 hourly-ozone averages at times marked A, B, C, D were found to originate in various locations through the use of HYbrid Single-Particle Lagrangian Integrated Trajectory back trajectories.