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The Daily Plan-It

The TexAQS 2000
Field Study Newsletter
Issue 31
September 15, 2000

Ave atque vale! - Hail and Farewell Houston!

Weather Forecast

Today's weather in Houston features ever stronger northerly winds and a lessening chance of PM thundershowers (20%). A "cool" blast of continental air is headed our way which should result in a wonderful weekend with low temperatures in the lower 60s and highs in the 80s.

This morning's background ozone levels are low with Galveston Airport showing a 9 to 10 AM level of 18 ppbv.

Twin Otter N153BU

The Twin Otter is conducting a mid-day source characterization flight today over Galveston Bay and the Ship Channel. Leaving at 10 AM, the Otter should return to Ellington at 12:30 PM.

The Twin Otter will return to Baylor University in Waco, TX, this weekend.

Surface Measurements

By Ken Olszyna

A large array of exotic ground-based measurements for gas phase species and aerosols was established at the LaPorte site for TexAQS 2000. Similar measurements were also made at the Williams Tower site (see article by Carl Berkowitz in a previous Plan-It).

Enhanced gas phase air monitoring stations were also established at the Aldine site (located north of downtown Houston) and at the Bayland Park site (located southwest of downtown Houston). These sites, together with the LaPorte site (located southwest of downtown Houston), completed a strategic triangulation around downtown to allow the chemical characterization of the air parcels entering and leaving the central Houston area.

The photochemical production of ozone in the atmosphere involves an extensive array of chemical reactions. Although both VOCs and NO_X are the chemical precursors required to produce ozone, the rate of ozone production is dependent on the complex relationship between the two ozone precursors. This relationship includes the VOC to NO_X ratio, the concentrations of the precursors, and the specific VOC. Hydrocarbons come from both natural and anthropogenic sources. Anthropogenic sources include car exhaust and industrial emissions. The nitrogen oxides are produced in combustion processes which includes industrial boilers and car exhaust. The industrial boilers that use coal or oil as their fuel can be identified by their SO_2 emissions. Car exhausts are typically identified by their CO emissions.

The enhanced air monitoring stations provide 1-minute averages for ozone, SO_2, CO, NO, NO_2, and NO_Y (total nitrogen oxides). In addition, the TNRCC also collects air samples for VOC analysis. These enhanced air monitoring stations measure ozone and its precursors as well as the tracer gases for NO_X emission sources. The combination of the NO, NO_2, and NO_Y measurements also provide a measure of the extent of the completion of the chemical production of ozone from its precursors. This measure is labeled as the chemical age. A chemical age of zero (0) indicates that none of the NO_X has been photochemically reacted to produce ozone. A chemical age of unity (1) indicates that the ozone

production process has been completed. The chemical age can also be considered as a measure of the potential for further ozone production. Unfortunately, this measure is not a linear relationship due to the complex atmospheric chemistry processes. However, the chemical age does provide an indication of whether the ambient ozone is in the early stage of production, in the rapid production stage, or approaching the end. A chemical age of 0.4 or less suggests that ozone production is in its early stage, while a chemical age greater than 0.7 suggests that ozone production is nearing its completion. Chemical ages between 0.4 and 0.7 suggest that ozone production is rapid – the rate of ozone production being dependent on the VOC/NO_X relationships described above.

On page three, we present the data from the Bayland site for a 3-day period (August 23, 24, and 25). The **first figure** shows the ozone values for these 3 days with maximum observed ozone values of 180 ppbv on August 25. The **second figure** displays the tracer gases, SO_2 and CO. The **third figure** displays the ozone data together with the NO_Y data (a measure of initial NO_X emissions) as well as the chemical age.

The data suggest that the diurnal pattern observed for ozone at this site is linked to mobile emissions. The mobile emissions from the morning rush hour are trapped in the ground-based inversion layer that frequently develops during the night. This inversion layer breaks down and is quickly diluted into the residual mixed layer during the late morning hours. The data shows the morning bulge in CO and NO_Y and the corresponding disappearance of ozone due to the reaction of ozone with fresh NO emissions from car exhausts.

The chemical age and NO_Y data, together with the tracer gas measurements, provide preliminary, but real time, interpretations of the ozone behavior. On August 23, the ozone levels were around 80 ppbv but a spike of ozone is observed from 5 to 6 PM CDT. Since there is no corresponding increase in NO_Y or tracer gases and since the chemical age indicates this spike is due to more photochemically processed (i.e., aged) air, we suspect that this ozone may be from a point source emission of one or more highly reactive volatile organic compounds. It is interesting to note that the chemical age is only 0.4 for the observed 80 ppbv ozone level suggesting that this air parcel has the potential for further ozone production.

On August 24, we observe the converse situation of a drop of ozone from 2 to 4 PM CDT. The bulge in CO and NO_Y together with the decline in chemical age, suggest that fresh emissions have titrated ozone away.

August 25 shows high ozone levels in the 160 to 180 ppbv range. The CO and NO_Y levels decrease although the ozone is being very rapidly produced from 1 to 3 PM CDT. Thus, the rate of ozone production is much faster than the dilution and dispersion of the ozone precursors. The chemical age values of 0.8 suggest that the ozone production in this parcel of air has neared full potential.

Study T-Shirts

We have handed out about 200 TexAQS 2000 t-shirts as of this writing. All remaining t-shirts will be left with Jim Price for TNRCC to distribute to TNRCC folks and those from UT-Austin. If demand is sufficient, Jim will be able to purchase more from the vendor at cost.

In any case, after today, any remaining t-shirt issues should be directed to Jim Price.

Upcoming Events

Computer Network Termination - Monday, September 18th. The offices at LaPorte and Ellington Field will have internet and printing access until the 18th. Cathy B's packing it up and going home on September 20th!

Taking Things Down - Vince Torres, in particular, needs to know when he can shut off the lights at some of our temporary sites. So take the time to give Vince a call and let him know your plans.

Closing Words from Editor Bill

It has been a pure and unmitigated pleasure to work with each and every one of you during TexAQS 2000. I believe that we have all gained immeasurably both in terms of the scientific knowledge - for which we have labored so long and hard - and also in the larger contexts of our national, societal and individual lives.

On a personal note, I want to particularly thank Jim Price and Jim Thomas who made it possible for me to participate in this great effort, to Pete Daum who unhesitatingly guided all our steps, and, as always, to Jim Meagher and Fred Fehsenfeld for their continuing wisdom and friendship. As I am fond of quotations - inspirational and otherwise - I leave you with this one.

"When we walk to the end of all the light we have, and take a step into the darkness of the unknown, we must believe one of two things will happen: that we will land on something solid, or we will learn to fly."
–Anonymous

Famous Last Words

"Don't worry, I read somewhere that bears mostly eat roots and berries."

"Hey y'all, watch this!"

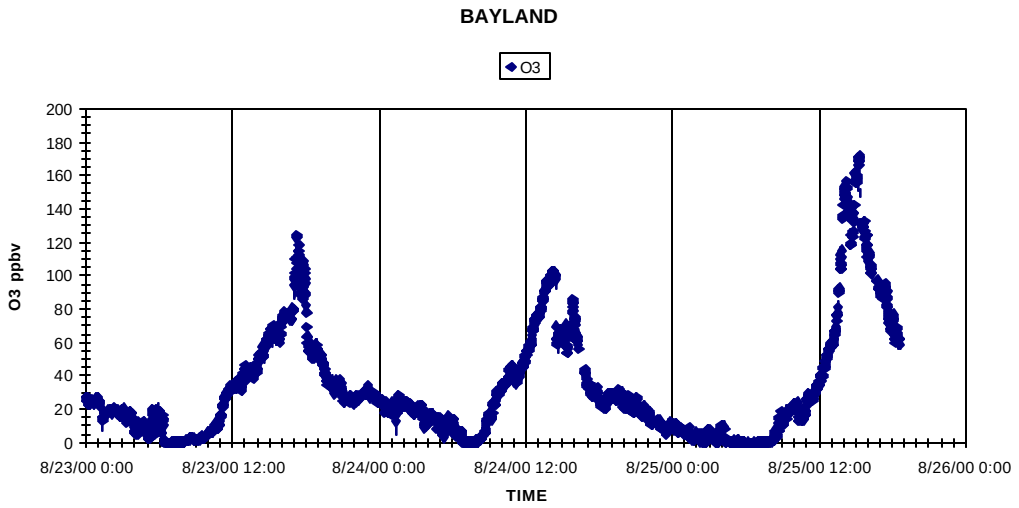

Figure 1. Bayland Park Ozone Concentrations August 23-26, 2000

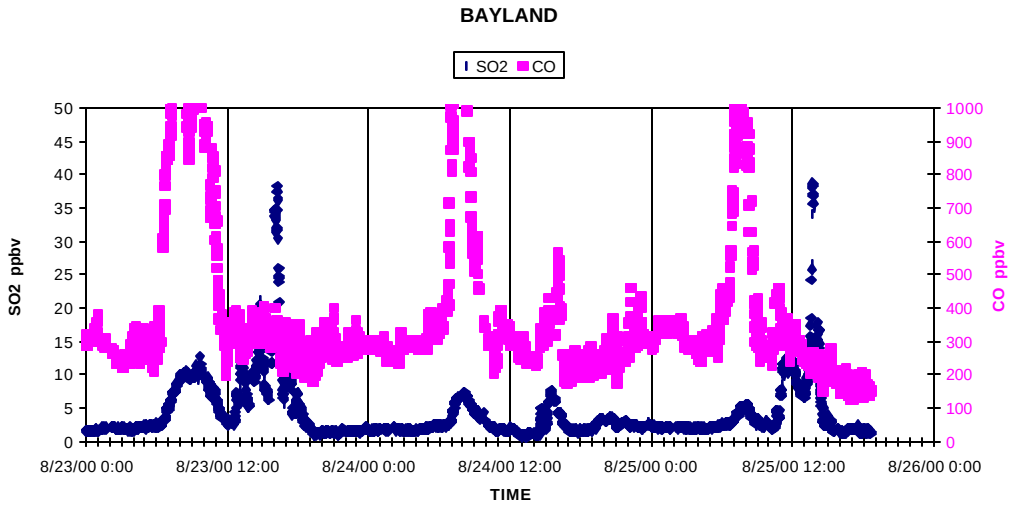

Figure 2. Bayland Park Sulfur Dioxide and Carbon Monoxide Concentrations August 23-26, 2000

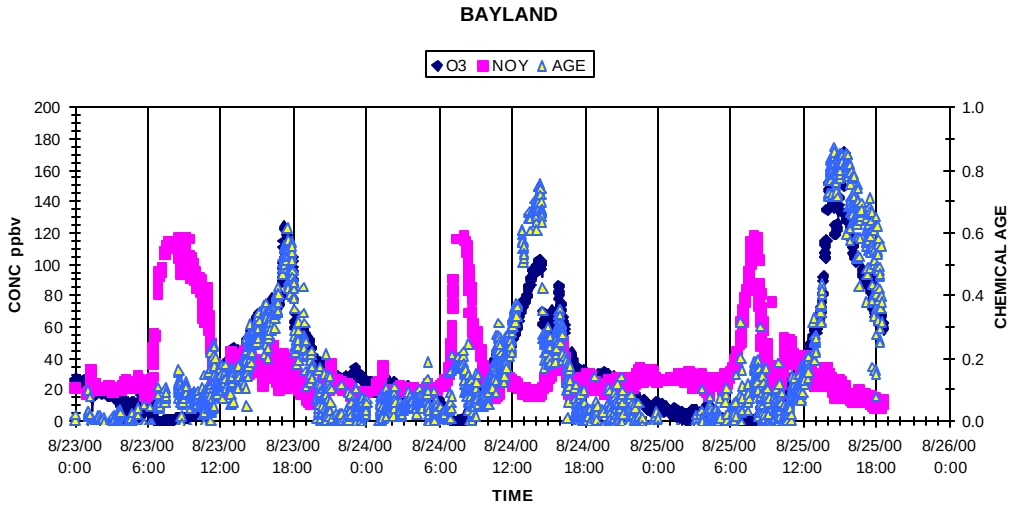

Figure 3. Bayland Park Ozone & Nitrogen Oxides Concentrations (& Chemical Age) August 23-26, 2000