Results of Houston DISCOVER-AQ Project Revealed

By Ben Kaldunski
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Preliminary results of a comprehensive study of air quality in the Houston metro area known as DISCOVER-AQ were revealed last week during the sixth biannual meeting of NASA's Air Quality Applied Sciences Team (AQAST).

The Houston DISCOVER-AQ project combined in situ ground-level monitoring activities, ground-based and airborne remote sensing, and in-situ aircraft measurements taken during nine flight days throughout the metro area. The major objective of the project is to improve our understanding of how satellite observations can be better used for air quality applications. This NASA Earth Venture mission was augmented by additional ground-based observations funded by the Texas Air Quality Research Program.

During the entire month of September 2013, AQAST researchers collaborated with government agencies, universities and other organizations to produce a wealth of air quality and meteorological data. Another objective of the project was to use observed data to evaluate and fine tune air quality models so they can more accurately predict meteorological and chemical processes.

In general, the CMAQ model (provided by AQAST member, Pius Lee) accurately predicted high ozone concentrations over Houston and Galveston, Texas during the month long observation period. But the model failed to capture the early onset of a bay breeze blowing in from Galveston Bay that recirculated ozone over the area on September 25, according to a presentation given January 15 by NASA senior physical scientist Ken Pickering.

Eight ground-level monitors in the Houston-Galveston area exceeded the 75 ppb federal standard that day, while maximum ozone concentrations peaked at 150 ppb.

In addition to the major ozone event that occurred on September 25, three ground-level monitors recorded 8-hour average ozone concentrations above the 75 ppb threshold on September 26. Those were the only two days that experienced high ozone levels, while the rest of September saw low to moderate ozone concentrations.

Pickering said the measurements taken by the DISCOVER-AQ aircraft and ground-level monitors proved that the CMAQ model performed well during the September 26 ozone event, but it requires a finer resolution to accurately capture the bay breeze present during the September 25 event.

Rob Griffin, a professor of civil and environmental engineering at Rice University, and Barry Lefer, a professor of atmospheric science at the University of Houston, provided another unique perspective to the DISCOVER-AQ project. Their teams used a mobile air quality laboratory to measure pollution beneath the aircraft's flight path to determine the sources of emissions contributing to elevated pollution concentrations in the Houston area.

The mobile lab (pictured in the top right corner of this page) was outfitted with video cameras in addition to air quality measurement equipment to capture the elusive sources of urban pollution. Griffin found that modified passenger diesel trucks, oil tanker plumes, petrochemical facilities, meat cooking and biomass burning were some of the sources that produced spikes in localized concentrations of fine particulate matter (PM2.5).

Last week's presentations only scratched the surface of the results of last September's DISCOVER-AQ project. Moving forward, the DISCOVER-AQ team, AQAST members and their partners will work on more comprehensive evaluations of the CMAQ forecasts and in-depth statistical analysis of surface versus column observations.

Pickering, Griffin and Leifer gave presentations on January 16th at AQAST's 6th biannual meeting at Rice University in Houston, Texas. The meeting agenda can be found at this website. To learn more about the DISCOVER-AQ project, please visit this website.

Sources and media coverage

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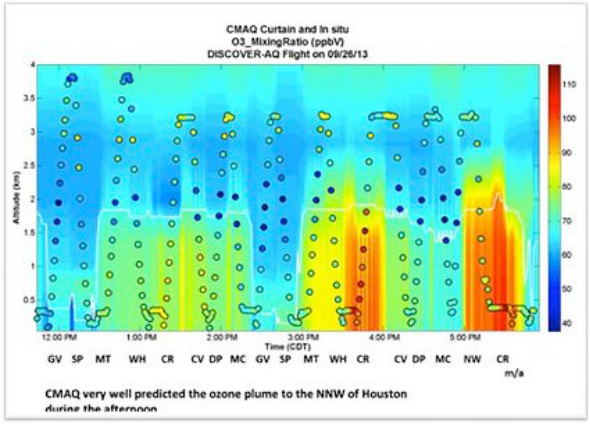
These figures illustrate the flight path taken by the DISCOVER-AQ P-3B aircraft (left) and the University of Houston mobile air quality laboratory instrumented by Barry Lefer (UH) and Rob Griffin (Rice University).



This figure compares the ozone concentrations predicted by the CMAQ model (background colors) versus measurements taken by the DISCOVER-AQ P-3B aircraft, represented by the multi-colored dots.