

# Mid-and far-field chemistry

## **Tasks**

Progress on major themes

Identification of work that needs to be done

Progress on Tasks identified at last meeting

Summary statement of preliminary findings

- What is the apportionment of sources of pollutants observed over the Gulf of Mexico. MCMA? SE USA? Central American fires? Coastal Mexico?

No significant progress at this time, but tracer fingerprints to distinguish MCMA, N. America, BB, etc. are needed.

This question will ultimately be addressed by a combination of data analysis and models

Observations over the Gulf were polluted, but appeared to represent inputs from many regions

Pollution over the Gulf traceable to MCMA by trajectory was typically confined to the lower trop, but above the MBL.

- Model verification of plume propagation

Under strong forcing conditions, forecast models successfully directed the aircraft to the MC plume. There were some issues with accuracy in altitude of the plume.

In one instance, the plume location was accurately predicted 1000 km downwind and was sampled by the C-130.

A more rigorous assessment of forecast success in predicting the plume location is needed.

- Does MCMA contribute pollution to the coastal plain to the northeast?

This question will be the subject of DC-8 analysis for flights between MCMA and the coast.

- Examine organic precursors and oxidation products to determine dominant oxidation pathways.

This has been pursued in the near-field observations but needs to be extended to the far-field observations.

Need to determine the extent to which “missing” radical sources persist beyond MCMA. Do observed and modeled radicals agree better far downwind?

Relatively large concentrations of acetaldehyde persist downwind of MCMA. Can they be reconciled with local chemistry?

- Integration of satellite observations in far-field interpretation.

Observations are being used from MOPITT (CO), OMI (NO<sub>2</sub>), MODIS and MISR (aerosol optical properties).

Access to satellite data in a useful form continues to be an issue.

## Specific Tasks

- Danny McKenna will provide a geographical and trajectory-based flag system to associate aircraft merge data with specific source locations
- Identify 1-day/2-day old encounters on consecutive flights (C-130-FFL, DC-8-Fuelberg)
- Need to tabulate “pseudo-lagrangian” encounters between all aircraft (Frank will distribute his list).
- Bill Skamarock will provide a flight path overlay for WRF-Chem for each aircraft
- Examine strong partitioning of reactive nitrogen into aerosol phase (important role for dust). Calcium was dominant positive ion for PILS observations at T1. (Weber, Jimenez, Weinheimer, Dibb Perring)
- Determine how to link near and far-field observations. Identify the key linking observations. (Blake, Huey, Brune)

## Summary statements:

Regional impacts of MCMA are easily discernible to the SE, south and west where other sources are smaller and MCMA provides the dominant influence.

Contribution of MC pollutants to the NE is not so easily apportioned because of the influence from US, regional BB, and N Mexico.

The MC plume was detected at distances up to 1000 km downwind.

At these downwind distances, NO<sub>x</sub> and other O<sub>3</sub> precursors are still present at sufficient levels to sustain O<sub>3</sub> production

## Preliminary Findings

- Pollution over the Gulf of Mexico is persistent and is apparently derived from diverse sources over the SE US, Mexico, and Central America
- Propane and toluene are good tracers for MCMA. Tracers of biomass burning (e.g., HCN and CH<sub>3</sub>Cl) are enhanced both within MCMA and the surrounding region. **Propane and toluene NOT optimal. MtBE, C<sub>2</sub>H<sub>2</sub>/C<sub>6</sub>H<sub>6</sub>, PAN/PPN better.**
- H-1211, previously thought to indicate Asian origin, was detected in MCMA. **Could be associated with release from banks**
- Several MCMA plume encounters over the Gulf exhibited enhanced ozone and continued to produce ozone well downstream.
- Sulfate aerosol increased relative to HNO<sub>3</sub> in older polluted air.
- AMS data for C-130 demonstrate the dominance of organics