

TERC Air Quality Research Beyond 2007

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Overview

- Status of TERC Air Quality Research funding
- Federal regulatory developments
- Future research needs for Ozone
 - Local ozone productivity issues
 - Long-range transport
 - New local and regional control strategies
- Future research needs for PM
- Future research needs for Air Toxics
- Updated TERC Strategic Research Plan

TERC Funding Outlook

- Texas SB 12 extended Texas Emission Reduction Program (TERP) to 2013.
- TERC Air Quality Research will get 20% of 9.5% of TERP revenues (~\$170 M/yr).
- This is \$3.2 M/yr for FY2008-2009.
- Likely availability of new CIAP funds by 1Q or 2Q of 2008.

Possible Lower Ozone Standard

- EPA's proposed new rule for ozone to be announced on June 20, 2007.
- EPA's CASAC recommended lowering O₃ NAAQS to 70 ppb or below.
- CASAC also recommended:
 - increasing number of significant digits in O₃ standard (e.g., from 0.08 ppm to 80 ppb);
 - adopting a longer-term (e.g., seasonal) average for secondary O₃ NAAQS.

Consequences of a Change in the Ozone NAAQS

- Changes in future O₃ design value (DV) at a monitor are typically ~1-2 ppb for local NO_x reductions of ~50 tpd (DFW SIP).
- It will take ~258 tpd NO_x to bring DRPK monitor into attainment under **current** O₃ NAAQS according to Houston SIP (more than all ground-level sources in HGB).
- A change in O₃ attainment DV of 5 ppb or more would put severe added pressure on local emission sources.

Strategies for O₃ Attainment Demonstration

- Need to enhance simulated effectiveness of local control strategies by boosting model ozone productivity, esp. in HGB.
- Need to better understand and simulate long-range transport based on wider incorporation of available data (e.g., satellite) and physical processes (e.g., lightning NO_x).
- Need to find novel control strategies both locally and regionally.

Local Ozone Productivity

Formaldehyde

- HCHO is a major source of new radicals.
- Friedfeld et al. (2002) concluded that primary HCHO may be 37% of total HCHO in Houston.
- Vizuite et al. (2006) in Project H60 showed that hypothetical flare and mobile source emissions of HCHO may boost peak O₃ by 20-30 ppb.
- SNL controlled burns of refinery fuel gas showed flue gas concentrations of 1 ppm HCHO.
- HCHO can also be secondary product of night-time ozone-olefin reactions in addition to being formed as part of daytime photochemistry.

Local Ozone Productivity

HONO

- HONO may be a significant radical source.
- HONO is associated with motor vehicle exhaust.
- HONO may also be formed in multiphase reactions on manmade surfaces and soot.
- Current AQ models do not simulate heterogeneous formation of HONO.
- Need more observational data to enable models to better simulate HONO.

Local Ozone Productivity

Night-to-Day Transition

- Emissions of olefins and/or formaldehyde into residual layer at night may fuel daytime O₃ production.
- A key process may be early morning vertical mixing between upper boundary layer and surface.
- Night-time horizontal flushing of ozone and precursors may be too strong in models.

Local Ozone Productivity

VOC Emissions

- SOF and NOAA aircraft data suggest VOC emissions underestimated by 10-40x.
- Elevated VOC emissions may be especially undercounted.
- Near-source chemistry and vertical mixing of elevated VOCs and their byproducts may not be well simulated in models.
- Coker emissions may be substantial and are currently not included in inventory.

Transport

Large-Scale Data Assimilation

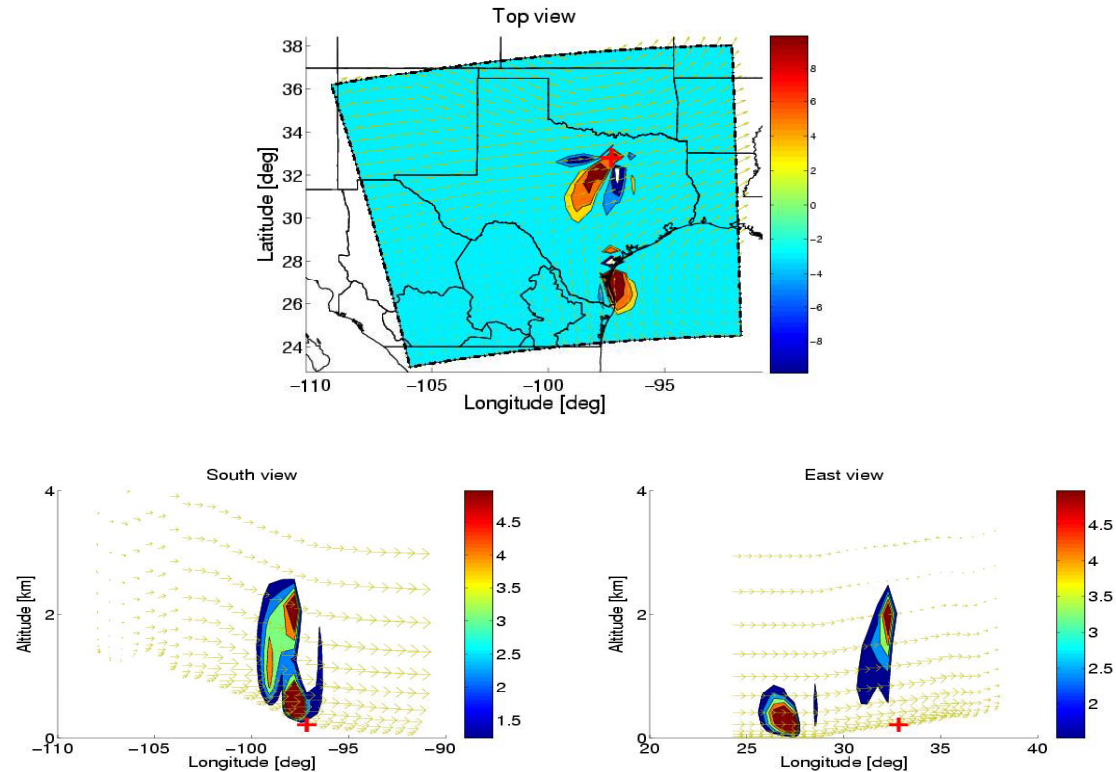
- Background ozone formation and transport may be more critical to success of AQ models.
- Need to do both meteorological (EnKF) and chemical (4DVar) data assimilation using input from profilers and satellites.
- Meteorological data includes SSTs, cloud data, wind profiler data, land use/land cover, etc.
- Chemical data includes ozone, CO, NO₂, HCHO, HNO₃, etc. (e.g., TES vertical profiles).

Transport

Physical Process Studies

- Lightning NO_x impacts on regional O₃
- PBL-Free Troposphere vertical exchange
- Stationary front dynamics and chemistry
- Nocturnal jet influence on pollution export
- Remote biogenic influences through isoprene and formaldehyde transport
- Remote anthropogenic VOC influences through PAN and formaldehyde transport

Transport Results of Project H59



9 am July 1, 2004 – 9 pm July 2, 2004 . Time-integrated areas of HCHO influence on DFW O₃ concentration. Given a 1% change in the local HCHO concentration each hour of the 36 hour simulation interval, the contours represent the total percent change in DFW ozone at the final time.

New Control Strategies

- May need to look at region-wide controls beyond non-attainment areas.
- May need to look at new area source controls (e.g., regionally reactive VOCs in AIM coatings and consumer products).
- May need to evaluate strategies involving alternative fuels (e.g., biodiesel).
- May need advanced monitoring strategies (e.g., OP-FTIR/DOAS+CAT) for enforcement.

New Research Directions

PM Formation

- Possible non-attainment of annual PM_{2.5} NAAQS.
- May need to help TCEQ develop modeling infrastructure for PM_{2.5} SIP (e.g., emissions).
- Basic issues in multiphase chemistry need to be addressed:
 - Chemical mechanism development
 - Smog chamber and lab bench studies
 - New observational data in the field.

New Research Directions

Air Toxics

- To be accomplished with federal funds.
- Neighborhood scale air quality modeling.
- Human exposure modeling a necessary complement to air quality modeling.
- Interpretation of HEATS field study data.
- Collaboration with Texas Medical Center in applying real-time AQ forecast model to Epidemiological Surveillance Systems.

TERC Strategic Research Plan

- Last TERC SRP was for 2004 – 2007.
- Identified research needed to address transition from 1-hr to 8-hr O₃ standard.
- Potential new situation with the EPA's response to CASAC recommendations.
- PM and Air Toxics should be more prominent in new SRP.
- New SRP targeted for September 1, 2007.