

Findings emerging from TexAQS II data analysis meeting: A personal selection of highlights



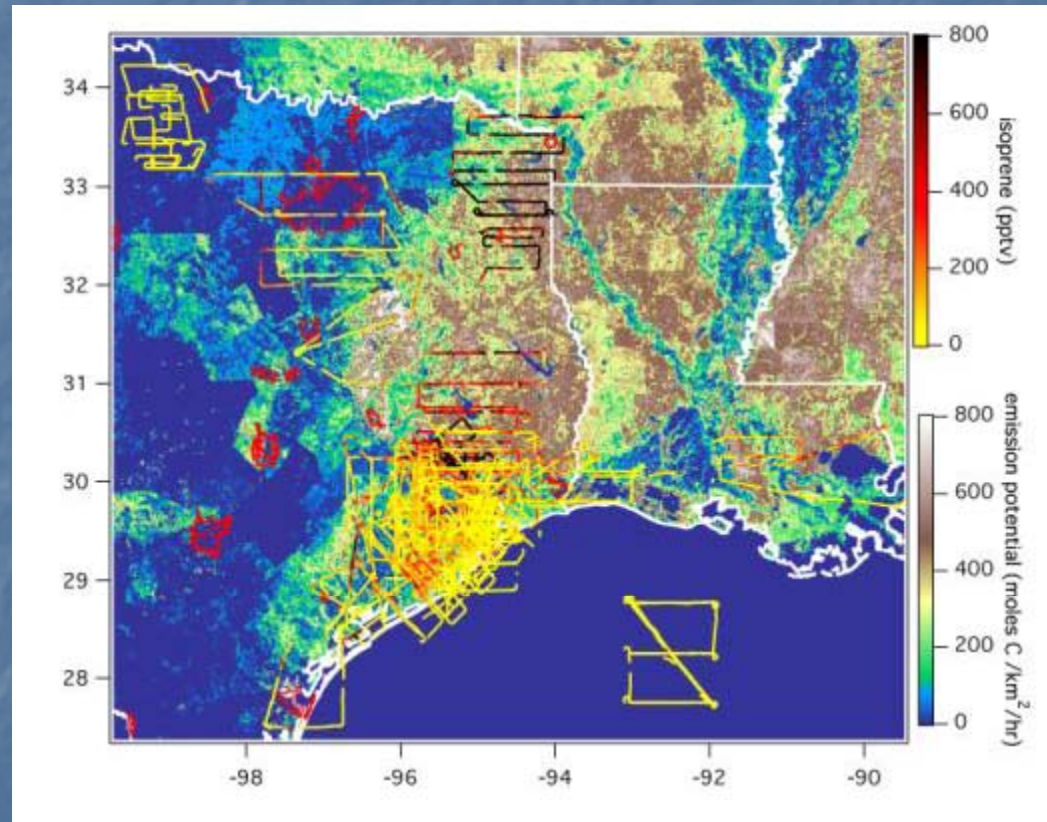
David Allen
University of Texas

Highlights of findings

- Emission inventories
 - Biogenics
 - Mobile and other urban sources
 - Port emissions
 - Industrial HRVOCs and other VOCs
- Chemical processing

Biogenic emissions

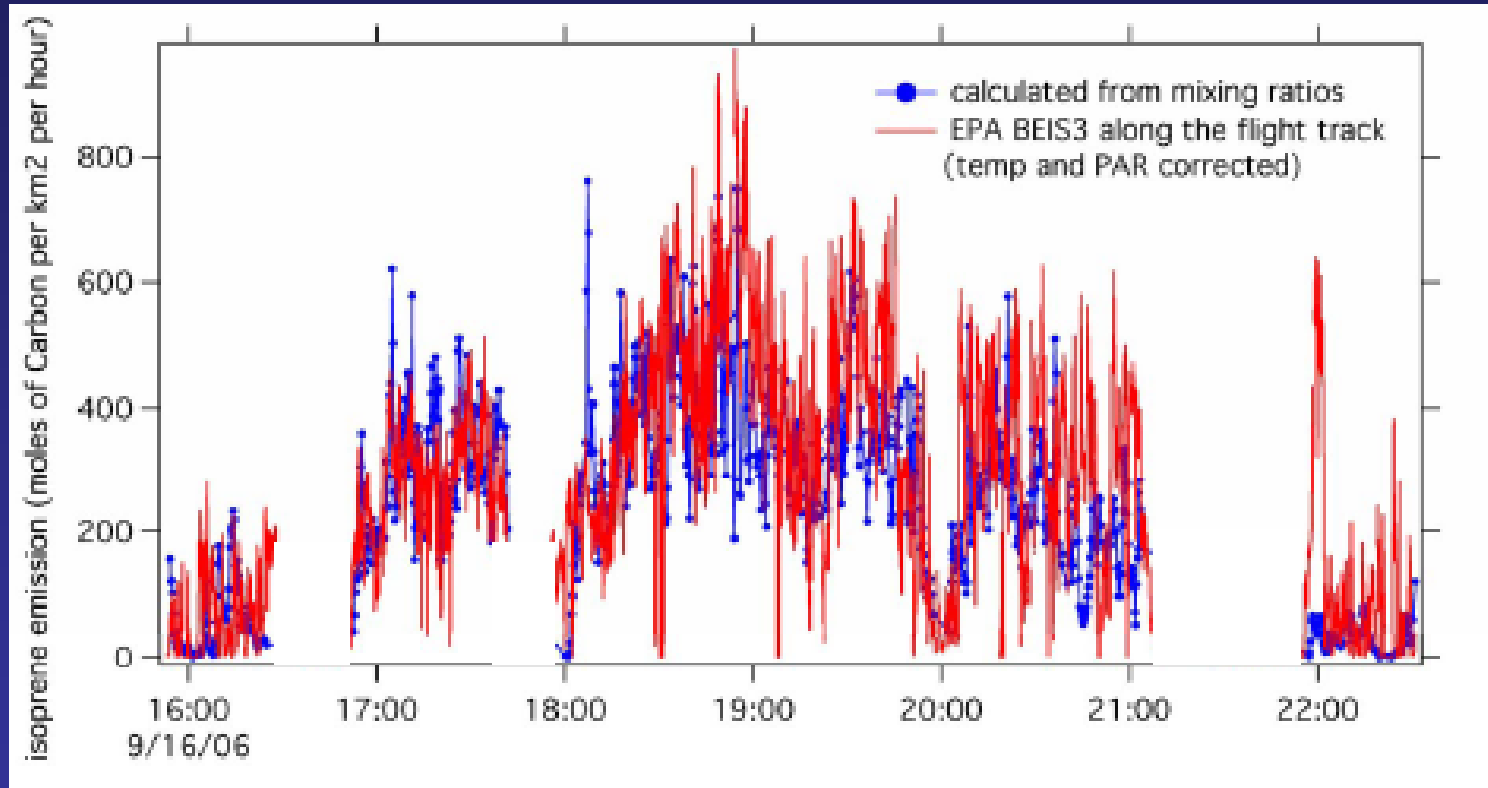
- Over broad areas, biogenic emissions agree with P-3 measurements with 50%
- Landcover updates underway using satellite data with ground truthing in Houston area



Mixed Boundary Layer Method

Method 1: $\text{emission} = \text{isoprene} * \text{OH} * k_{\text{OH}} * \text{BL}_{\text{height}}$

Example: Flight 09/16/2006 NE Texas



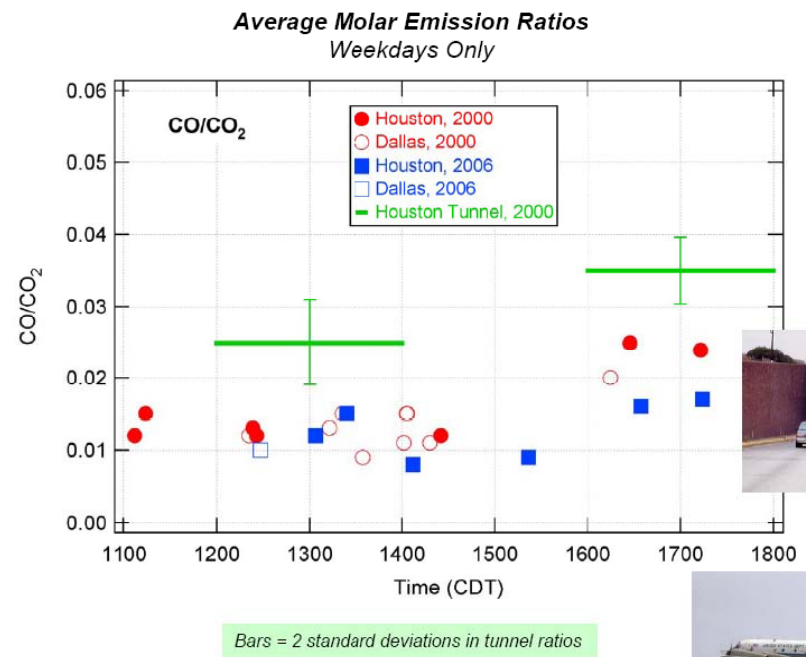
Summary Method 1:

- Each flight agrees within $\pm 50\%$
- Overall fairly good agreement (within 50%)

Mobile and other urban sources

- NOAA reports little difference between fuel based emission factors in 2000 and 2006 – attributed to mobile sources

Mobile Emission Estimates from P-3 and Tunnel Observations



Port/Ship emissions

Summary of Emission Factor Data

<u>EF Source</u>	<u>NO₂</u>	<u>CO</u>	<u>SO₂</u>
this work; SSD	74	12	28
this work; MSD	60	16	9
Lloyd's (1995) ¹ ; SSD	87	7.4	20 X %S
Lloyd's (1995) ¹ ; MSD	57	7.4	20 X %S
ERG (2007) ² ; SSD ³	74	4	8
ERG (2007) ² ; H/MSD ³	54	NA	5

¹Marine Exhaust Emissions Research Programme, Lloyd's Register, London, 1995.

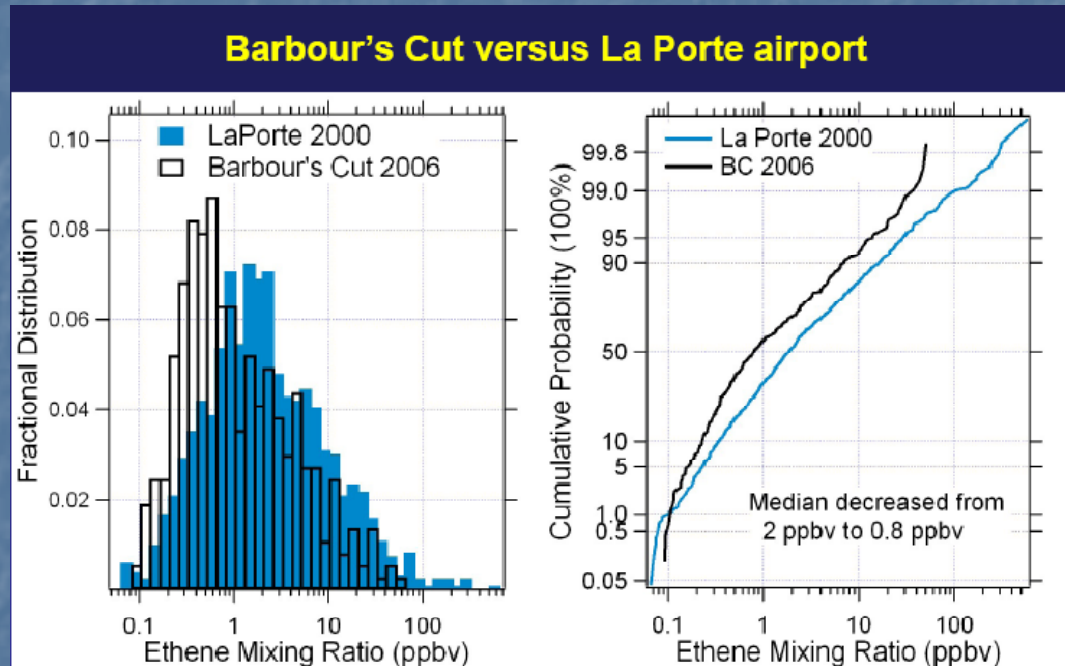
²Houston/Galveston Routine Vessel Identification and Traffic Study, Eastern Research Group, Inc., TCEQ
Contract No. 582-04-65564-23, 26 January, 2007.

³Averages of vessel types and converted from power to mass with specific fuel consumption = 0.20 kg/kWh

Emission inventories: Industrial HRVOCs and OVOCs

- Overall changes in inventories
- Hourly emission inventory
- SOF and aircraft results
- Modeling impacts of emission variability

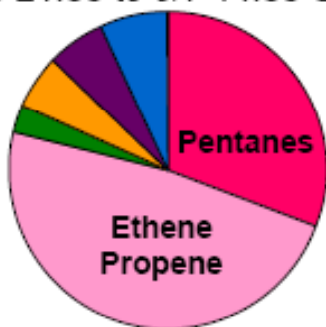
Overall trends in HRVOC and NOx



- Industrial NOx emissions down significantly, consistent with inventories
- Industrial HRVOC down by roughly a factor of 2, not consistent with the inventory

Sources of reactivity by location: Data from Ron Brown

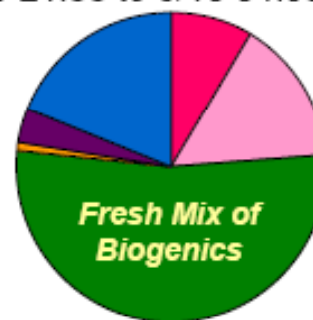
Jacinto P.: 49.6 s⁻¹
9/6 21:00 to 9/7 14:00 UTC



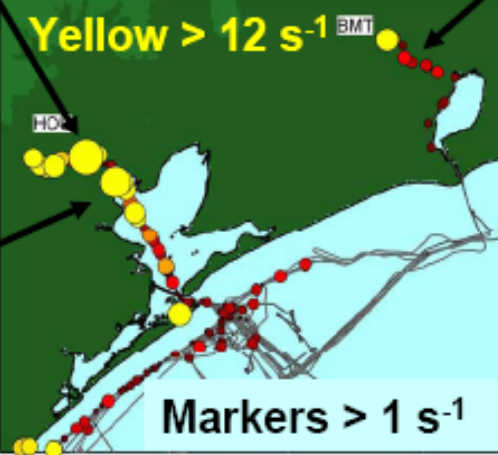
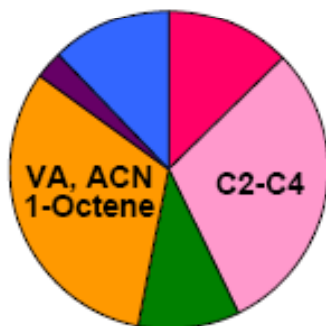
**Mean •OH loss
by VOC Groups:**

- Alkanes
- Alkenes
- Terpenes & Prod.
- Other Alkenes/Monomers
- Aromatics
- Oxygenates
- Other (N, S, Cl, F)

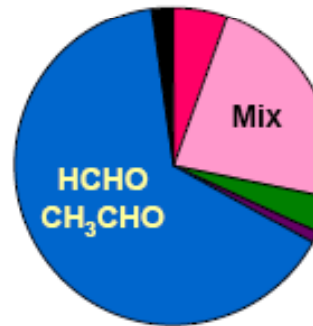
Beaumont: 3.65 s⁻¹
8/9 21:00 to 8/10 04:30 UTC



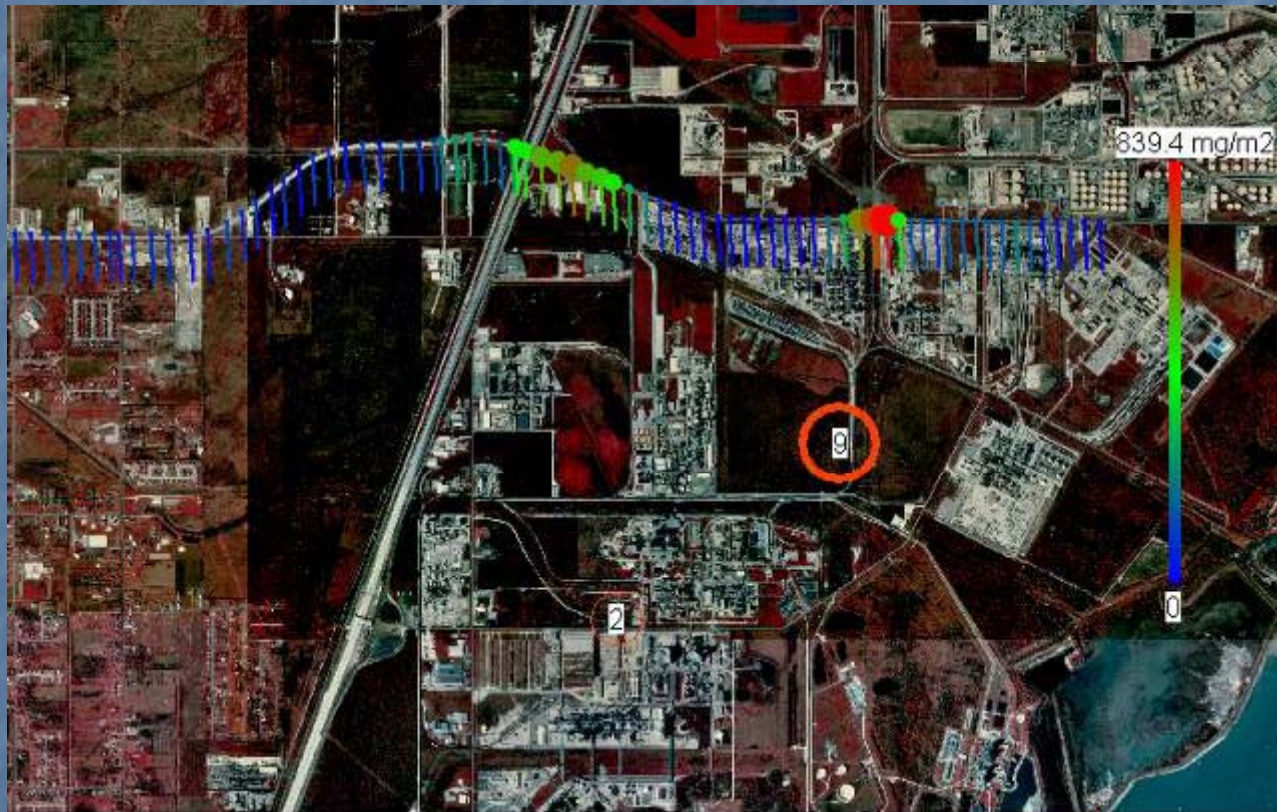
Barbour's: 7.0 s⁻¹
8/13 01:00 to 8/15 06:00 UTC



Marine: 0.29 s⁻¹
7/27 17:00 to 8/1 20:00 UTC



N-S Transect on Battleground road Aug 31.
On Aug 31 & Sep 14 the measurements vary
between 200-2000 kg/h) (upsets, flares?)



propene 2000 kg/h



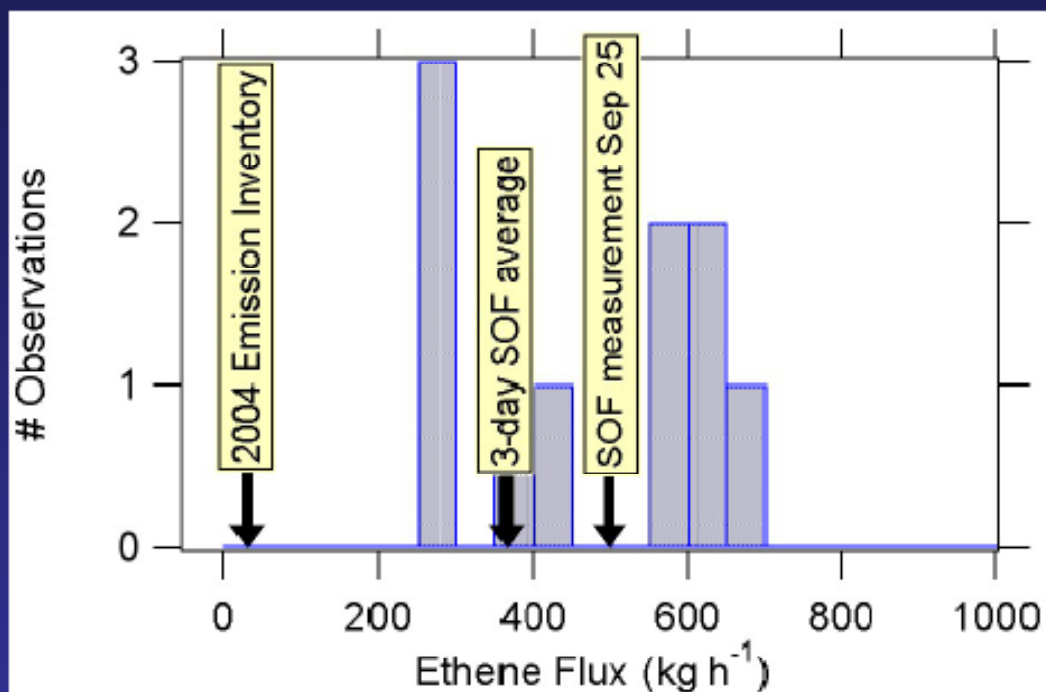
HSC Sep 06, Average emissions in kg/h

Species	Meas	Inventory
ethene	860±180	47
propene	1500±500*	60
alkanes	12400	372
NH3	190 ±20	
NO2	4500±1900	3089
SO2	5200 ±2400	2752

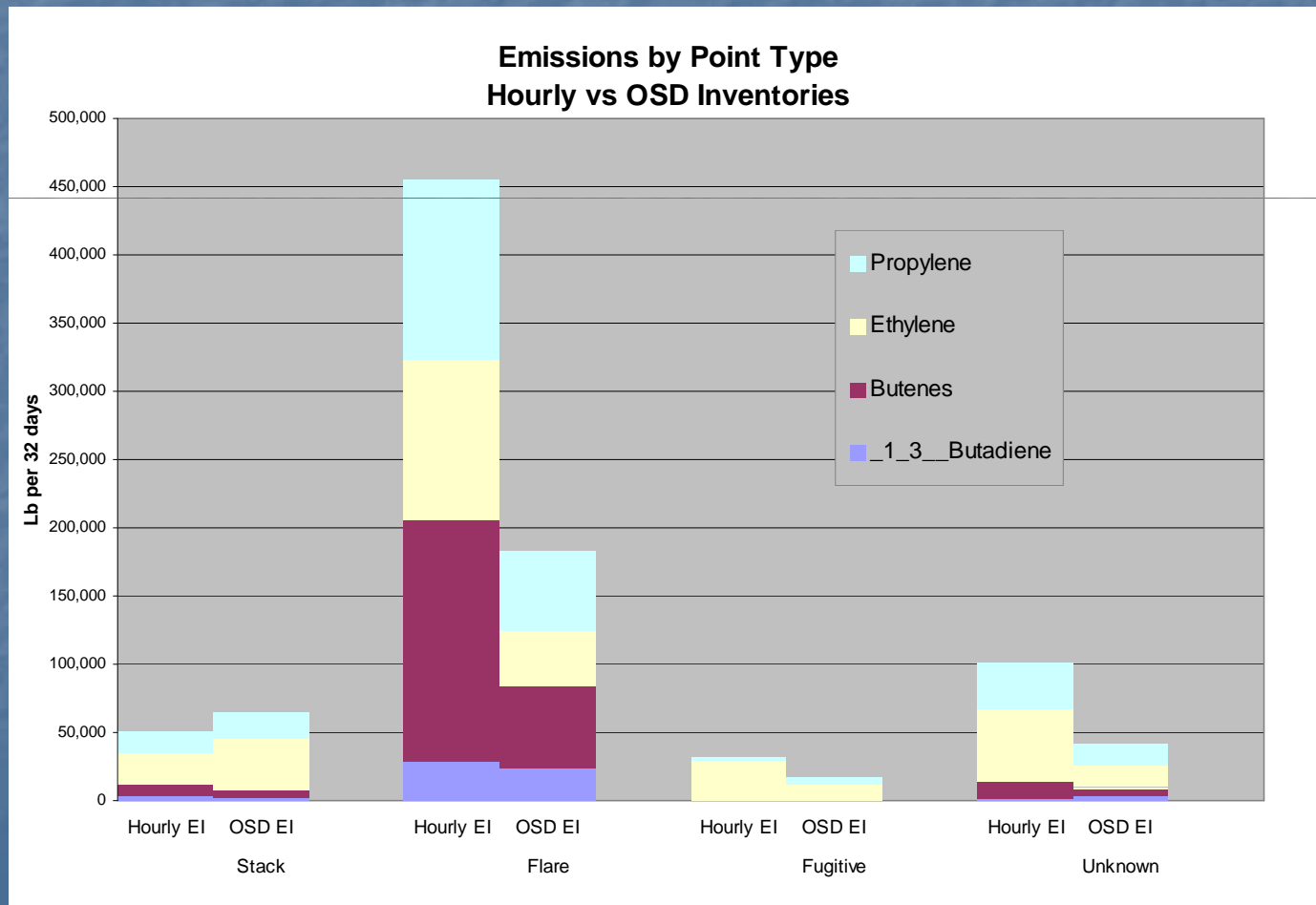
* Uncertain due to large variability in the emissions

Aircraft data also indicate underestimate of emissions, although concentrations lower than in 2000

Variability in Ethene Fluxes from Mt. Belvieu



OSD EI lower than hourly inventory for sources reported, especially flares



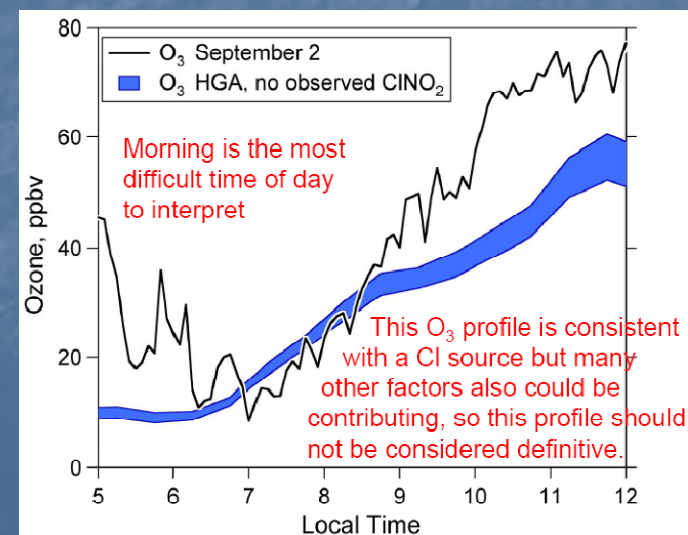
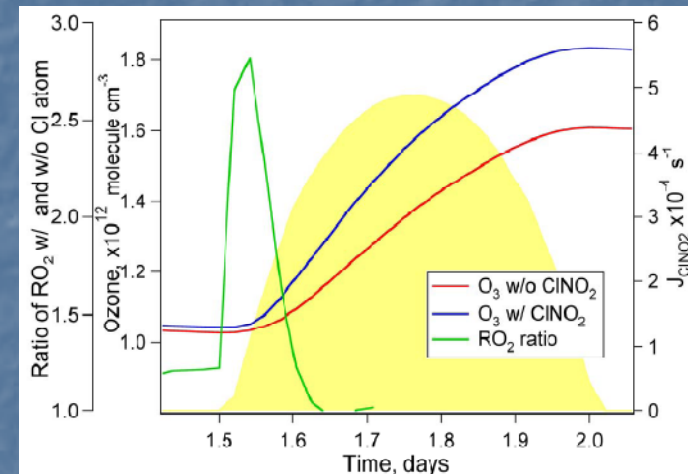
There has been measurable improvement since 2000, but the magnitude and reactivity of industrial VOC emissions remains an issue in Houston; emission inventories continue to need improvement

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Chemical processing: Ron Brown team detects ClNO₂

- Observed concentrations of up to 1 ppb of ClNO₂
- Formed by reaction of N₂O₅ and a chlorine source (sea salt?)
- Source of free radicals at sunrise
- Not enough Cl to account for molecular markers observed in 2000

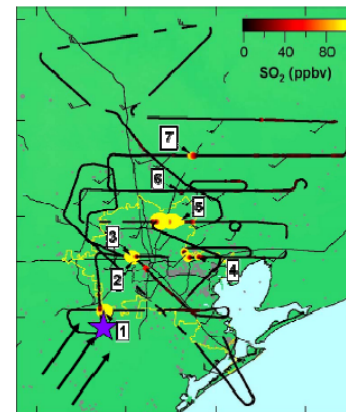


Chemical processing: P-3 team suggests little N_2O_5 conversion to nitric acid at night

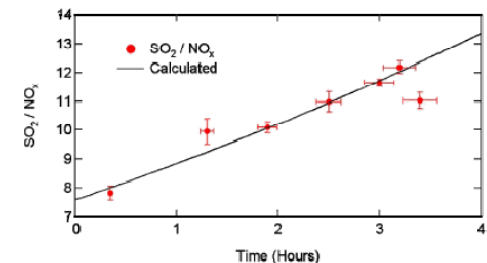
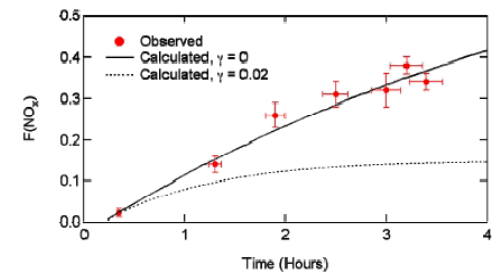
- In current modeling most NO_x is processed overnight, through N_2O_5 to nitric acid, becoming inactive
- If this pathway is less effective than previously thought, more NO_x and radicals may be available at sunrise

NO_x Transport - Parish Plume

$$F(NO_x) = \frac{NO_3 + 2N_2O_5}{NO_2 + NO_3 + 2N_2O_5}$$



NO_x conserved within this plume
note: Low VOC case



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