

**H102, Investigation of VOC radical
sources in the Houston Ship
Channel by the Solar Occultation
Flux (SOF) method and mobile
DOAS (SOF-II)**

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SOF activities

- **KORUS- yearly monitoring of Swedish light oil refineries -** ongoing
- **Petrochemical industries , yearly monitoring of olefines and ammonia at two industries** ongoing
- **Houston Texas, HRVOCs, alkanes** 2006
- **Bitumen refineries Göteborg & Nynäshamn (emissions and validation)** 2005/2006
- **Austria** 2008

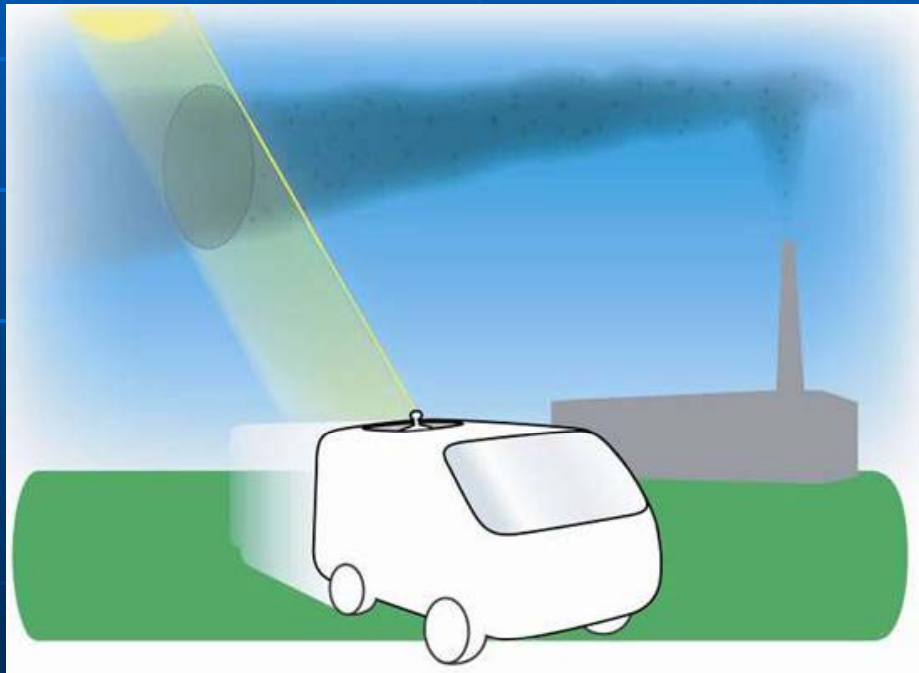
- **France, Le Havre- refineries and petrochemistry** 2008
- **Rotterdam, refineries** 2008

Technique

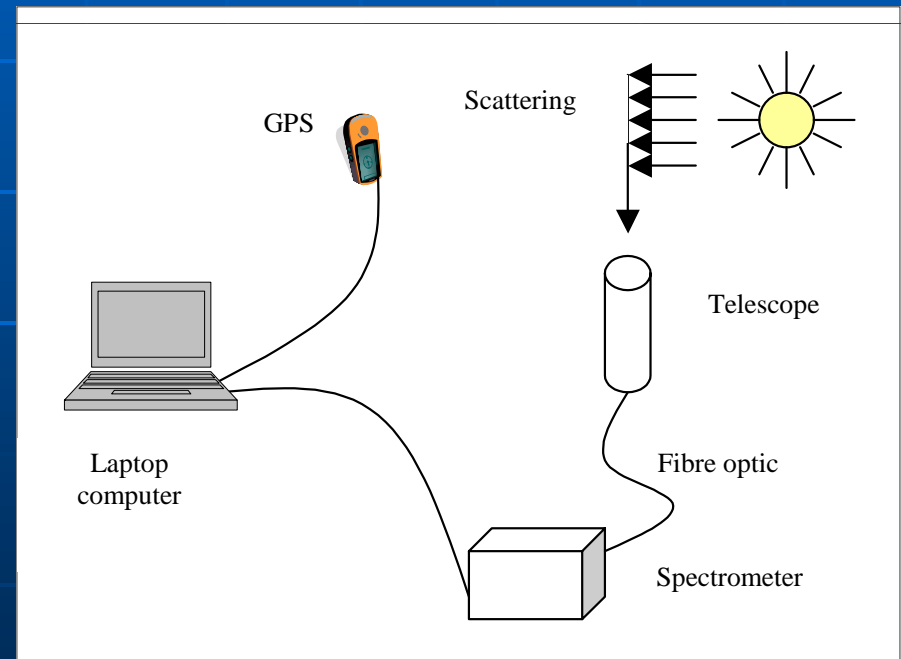
The Solar Occultation Flux method (SOF): mobile direct infrared solar measurements for retrieval of HRVOC

DOAS: mobile UV/visible measurements of scattered solar light for retrieval of formaldehyde, (NO₂ and SO₂)

SOF



Mobile DOAS



Slide 3

JM1

Here, techniques that we developed and applied in Texas to to directly measure gasfluxes.

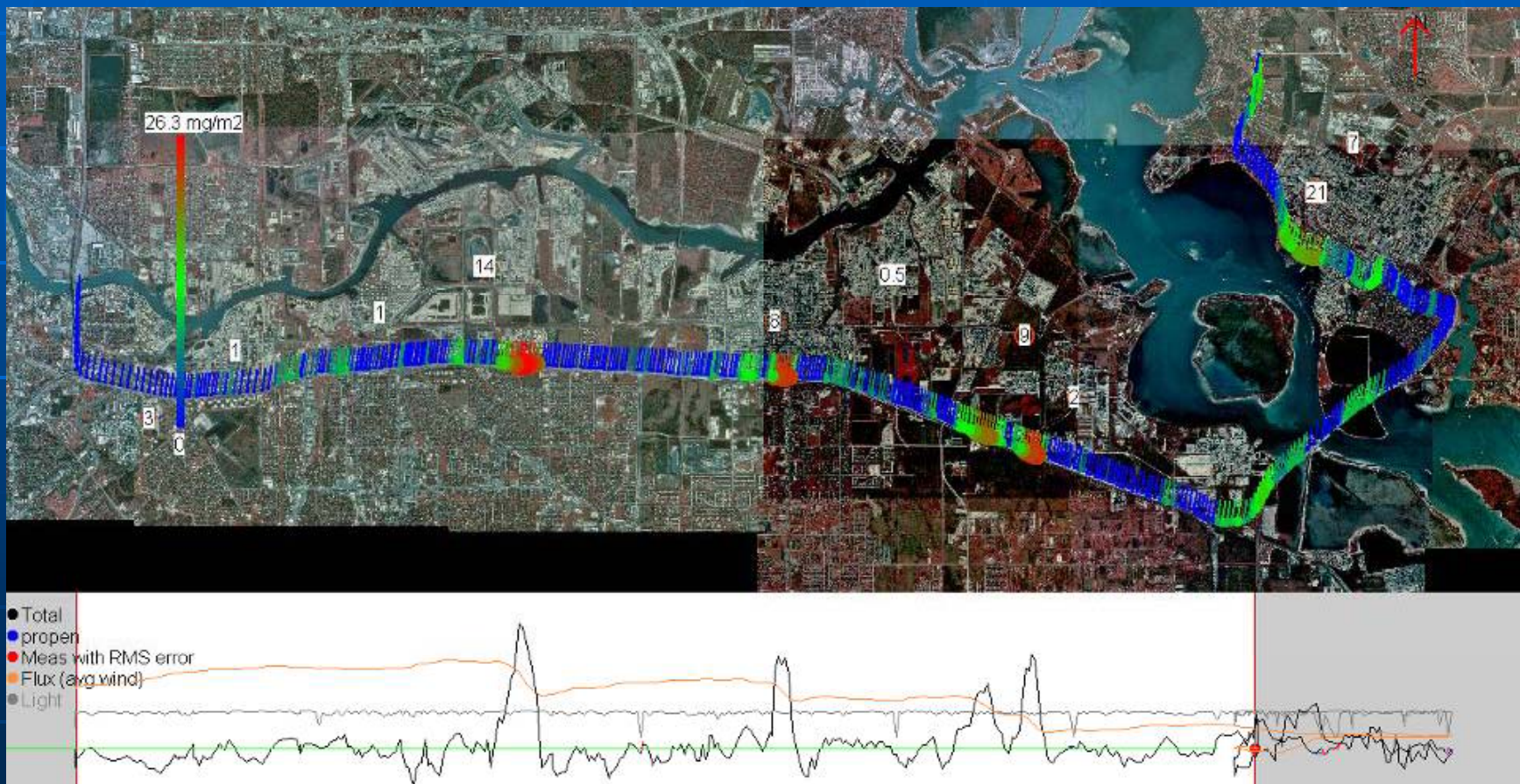
The massflux is obtained by moving perpendicular to the wind, measuring solar spectra.

the flux is obtained by multiplying the integrated mass across the plume with the windspeed, correcting for solarelevation and direction of movement

the windspeed of the plume is the biggest uncertainty, since there is usually a vertical gradient of the wind and we don't have information in the measurements about the height of the plume, more about this...

Johan Mellqvist, 12/9/2007

The Solar Occultation Flux method (SOF)



Work Schedule

- Sept 1, 2008- Feb 31, 2009 Logistic planning and instrument preparation.
- March 1, 2009 – April 31, 2009, Field deployment during the FLAIR campaign,
- May 1, 2009 – July 31, 2009 Analysis of data
- Aug. 1, 2009 – Aug. 31, 2009 Final report submitted to TCEQ

Preparatory phase

- A new UV-DOAS instrument will be modified with suitable optics and hardware for measurements of formaldehyde. A spectral retrieval schemes will be developed that will be implemented in an automatic retrieval code.
- Acquire meteorological equipment, balloon sounding system and a mobile mast.
- Prepare SOF instrumentation for HRVOC measurements, optics and software.
- Prepare shipment of equipment from Sweden, Gothenburg to Houston
- Prepare campaign logistics
- Send equipment to Houston (Feb 2009)

Measurements

- 4-6 week intensive field campaign during March and April in Houston including
 - (a) SOF measurements of HRVOCs
 - (b) Mobile DOAS measurements of formaldehyde, SO₂ and NO₂
 - (c) Meteorological measurements with GPS sondes and wind meters.
- After successful completion of the measurements in the HSC, we hope to conduct similar studies in Freeport, Chocolate Bayou and Sweeny. Most measurements will be conducted along the fence line of the industries, but any possibility of entering the industrial sites to get closer to the emission sources will be taken advantage of.

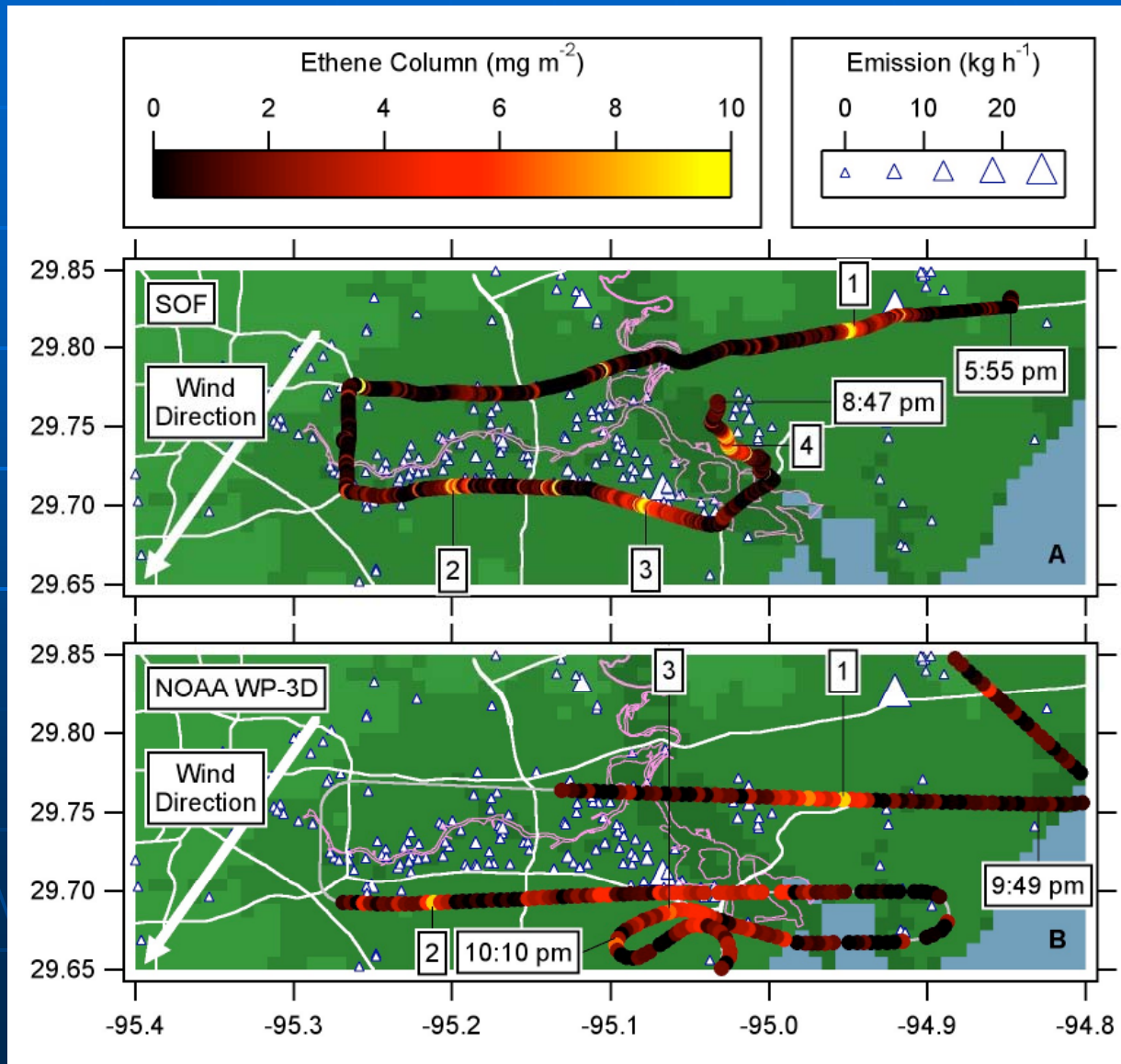
Analysis and reporting

- Post analysis of spectral data for SOF.
- Post analysis of spectral data for DOAS.
- Calculation of emissions of HRVOCs and formaldehyde including met data
- Data interpretation and comparison to inventory. The emission data will be compared with the latest TCEQ inventory.
- Comparisons to other measurements. Data from other measurements, Baylor aircraft, "Eye-DOAS" by UCLA/UH and La Porte profiler will be used in the data interpretation. Reporting at appropriate meeting(s) in Texas.

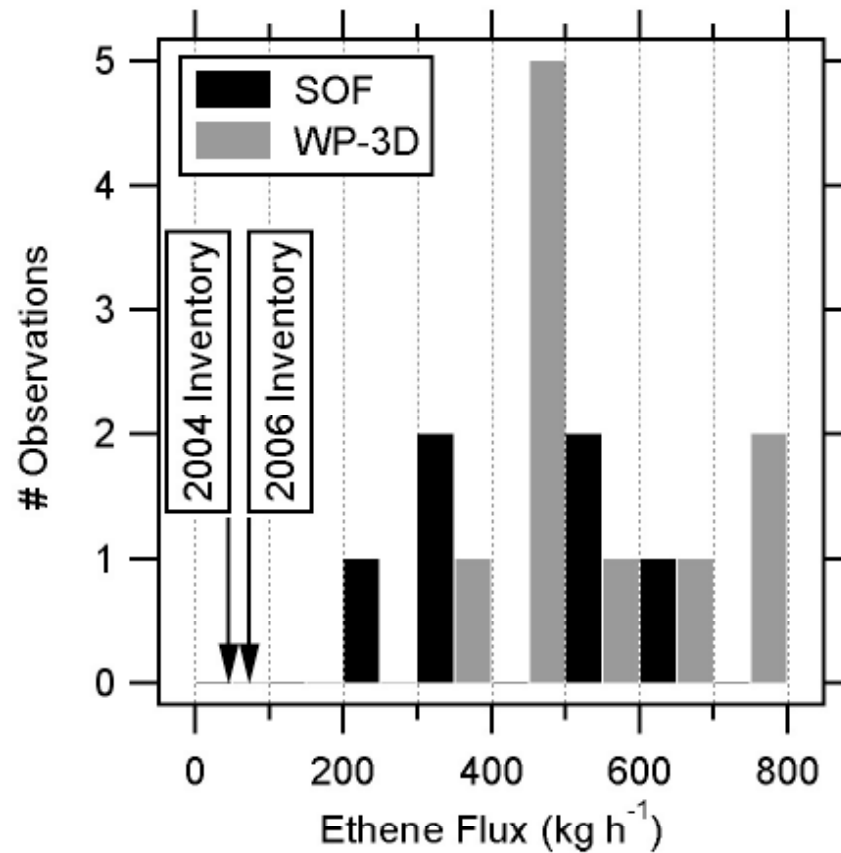
Reanalysis of 2006 data

- Comparison between SOF and NOAA WP3 Joost (ES&T)
- Comparison of 2006 SOF data to new emission inventories (TCEQ). JGR spec issue
- Analysis of HCHO from mobile DOAS spectra. High values on 3 transects on Aug 31, one hour after the Baylor team found high values south west of Deer park (Rivera, JGR spec issue)

SOF and NOAA-WP3 Sep 19 Joost et al., submitted to ES&T



Ethene emissions from Mt Belvieu, Joost et al., submitted to ES&T



Comparisons of SOF and TCEQ 2006 inventory for ethene at Mt Belvieu

Date	Time	SOF	Daily inventory 2006	Annual inventory 2004
2006-08-30	113203-114235	354	79	45
2006-08-30	121556-122843	275	79	45
2006-09-19	131054-133246	331	83	45
2006-09-25	145616-152408	559	83	45
2006-09-25	155455-160559	536	82	45
2006-09-25	164328-170104	605	83	45
		443	81	45

Comparisons of SOF and TCEQ 2006 inventory for Propene at Battleground road

Date	Time	SOF	Daily inventory 2006	Annual inventory 2004
2006-08-30	111647-111947	145	26	18
2006-09-13	150112-150614	1010	74	30
2006-09-19	145735-150249	213	75	16
2006-09-25	115424-115654	185	75	16
		388	63	20

Formaldehyde retrieved from mobile DOAS on Aug 31 (Rivera)

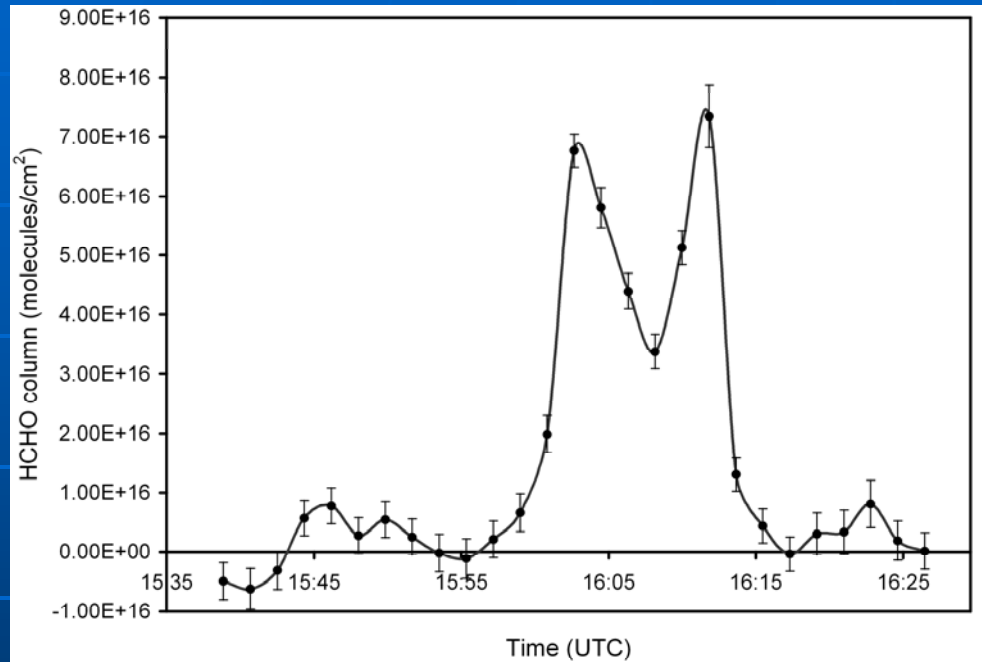


Figure 6. Example of a HCHO measurement at HSC on 31st August 2006.

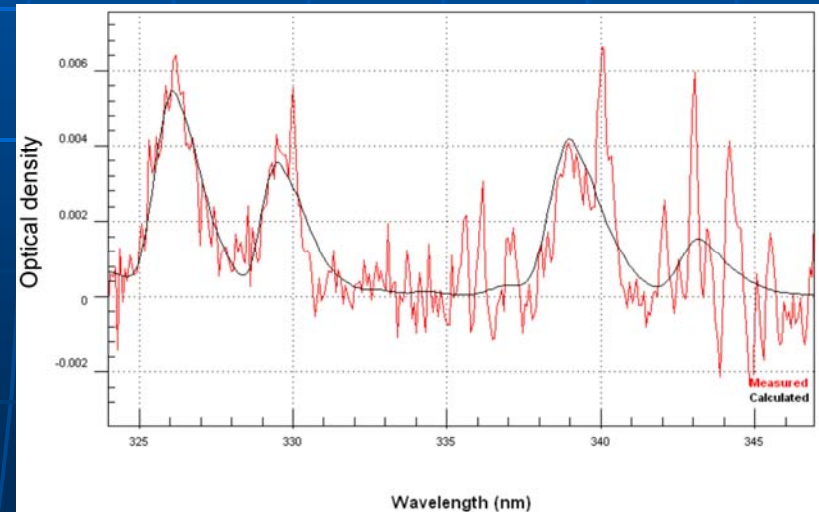


Figure 3. Typical example of a DOAS fitting, in this case HCHO was evaluated in the 324-347 nm wavelength range.