PTR-MS / PTR-TOF-MS
VOC fluxes during NOMAADS

NCAR, NOAA, NILU, UIBK

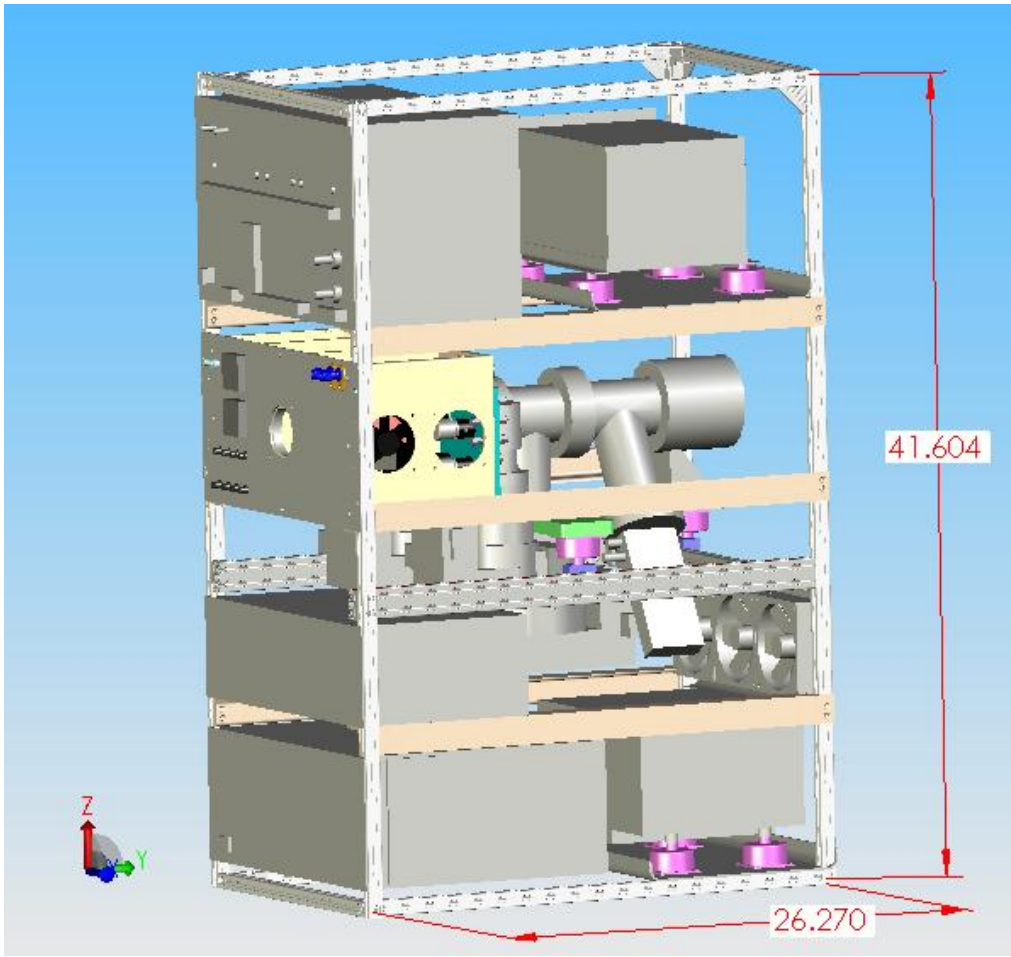
PTR-MS

Proton transfer reaction

$$H_3O^+ + VOC \xrightarrow{k} VOCH^+ + H_2O$$

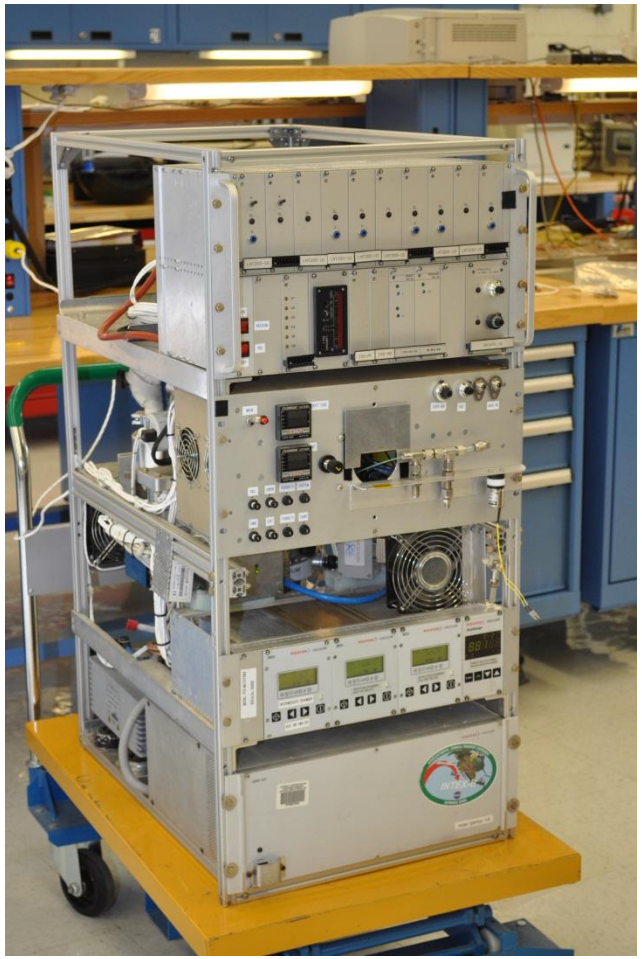
Calculation of the neutral concentration

$$[VOC] \cong \frac{1}{k \cdot t} \cdot \frac{cps(VOCH^+)}{cps(H_3O^+)}$$



Target compounds: Isoprene, isoprene oxidation products

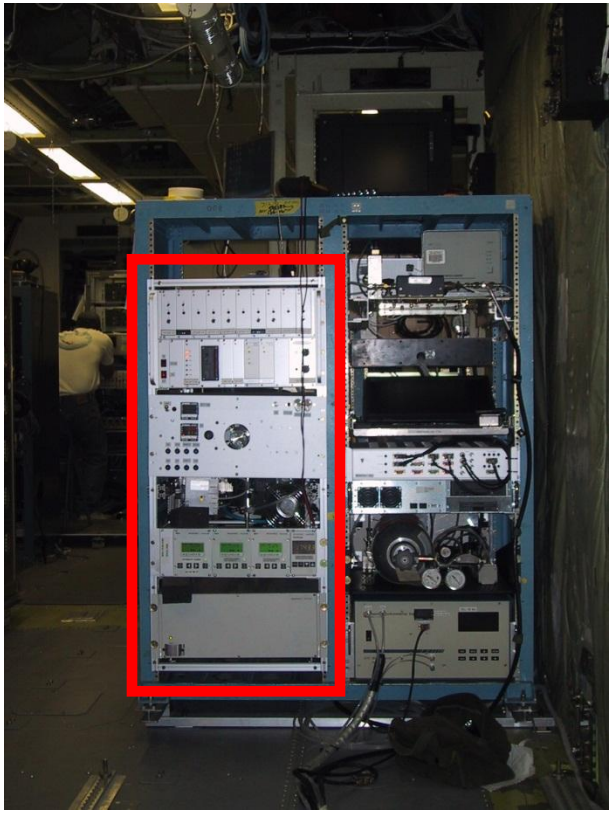
PTR-MS



- Slides into 1 bay of C-130 rack
- 2nd bay needed for additional options: i.e. inlet pump, calgas
- HIMIL inlet on C-130 requested
- For EC flux measurements we can only monitor 2-3 compounds (ie. isoprene, MVK+MAC and perhaps Meoh or MT)

Rack during Mirage

MIRAGE/INTEX-B



Note: For NOMAADS we will need to request space adjacent to PTRMS for inlet pump and calibration unit

Alternative or complimentary

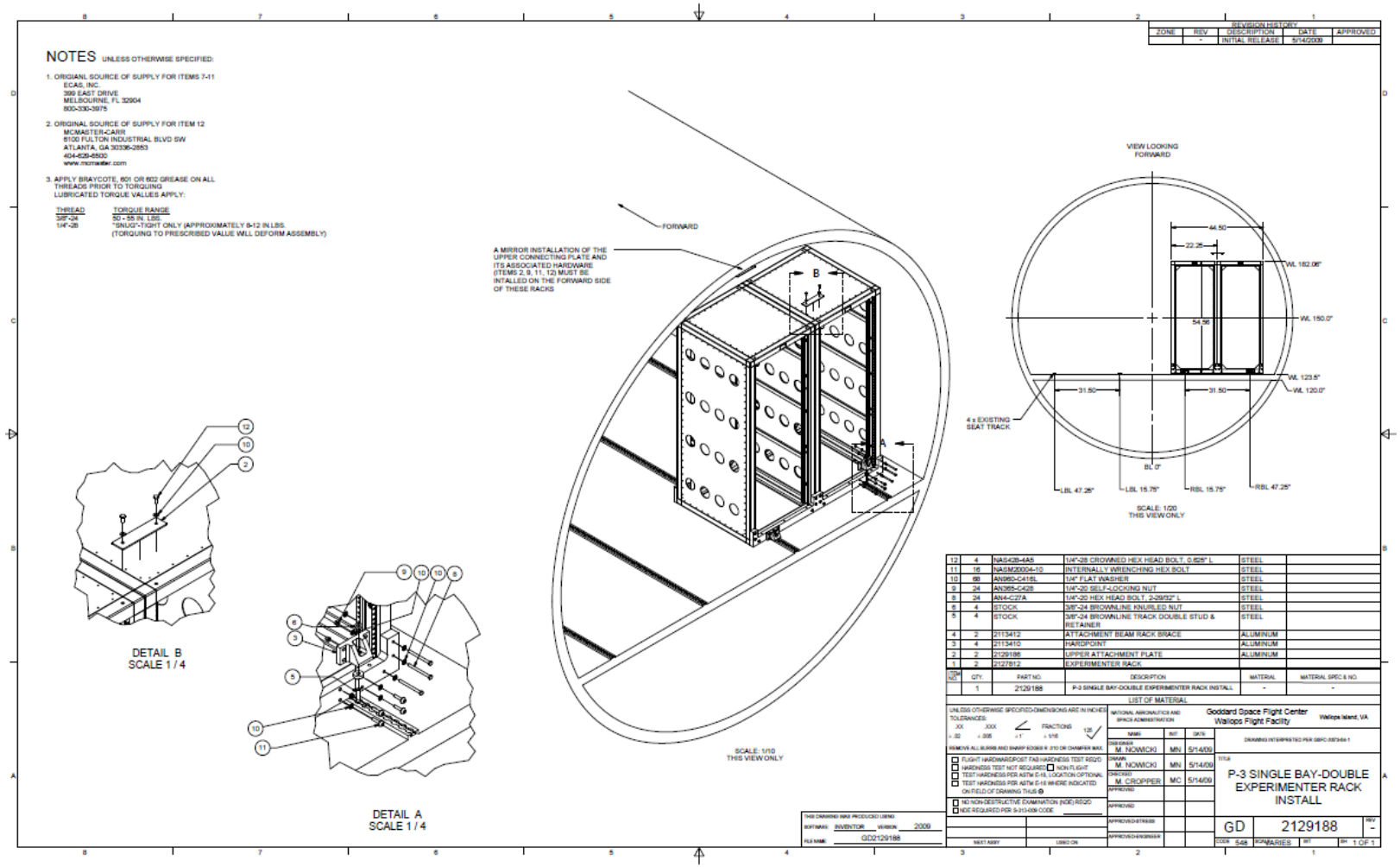
- Due to a broader chemistry focus of NOMAADS, a PTR-TOF-MS is proposed to be flown in collaboration between NILU, NOAA, UIBK and NCAR instead or along with PTR-MS

- Instrument comes already prepackaged in a NASA P-3 rack

- Inlet requirements will be the same as for PTR-MS

PTR-TOF-MS footprint

POWER: 120V/1000W
Weight: 600 lbs



PTR-MS (NCAR) vs PTR-TOF-MS (NILU/NOAA/UIBK/NCAR)

- PTR-TOF-MS advantages: no pre-selection of compounds needed – we can measure the entire mass spectrum at 10 Hz
- LOD: similar btw. PTR-TOF-MS and PTR-MS for a nominal mass (i.e. compound), but much lower for PTR-TOF-MS, when considering that the instrument scans over the entire mass range
- PTR-TOF-MS disadvantage: somewhat lower sensitivity, but probably acceptable for isoprene flux measurements
- PTR-TOF-MS will also have the option of a SRI (selective reagion ionization) capability

EC flux leg flight patterns

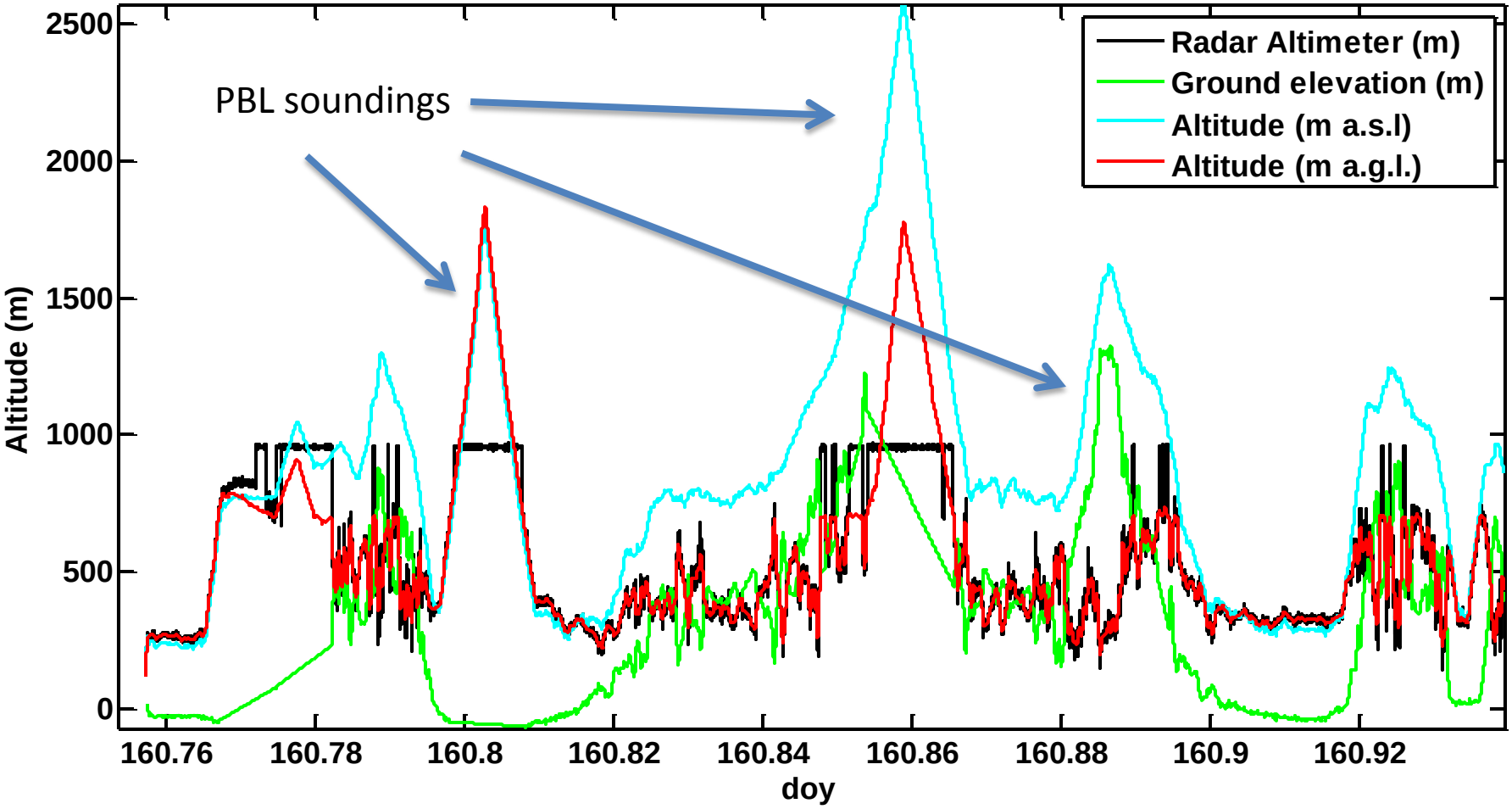
Will need 20 Hz data stream post-flight

- Horizontal gradients (land cover characterization)

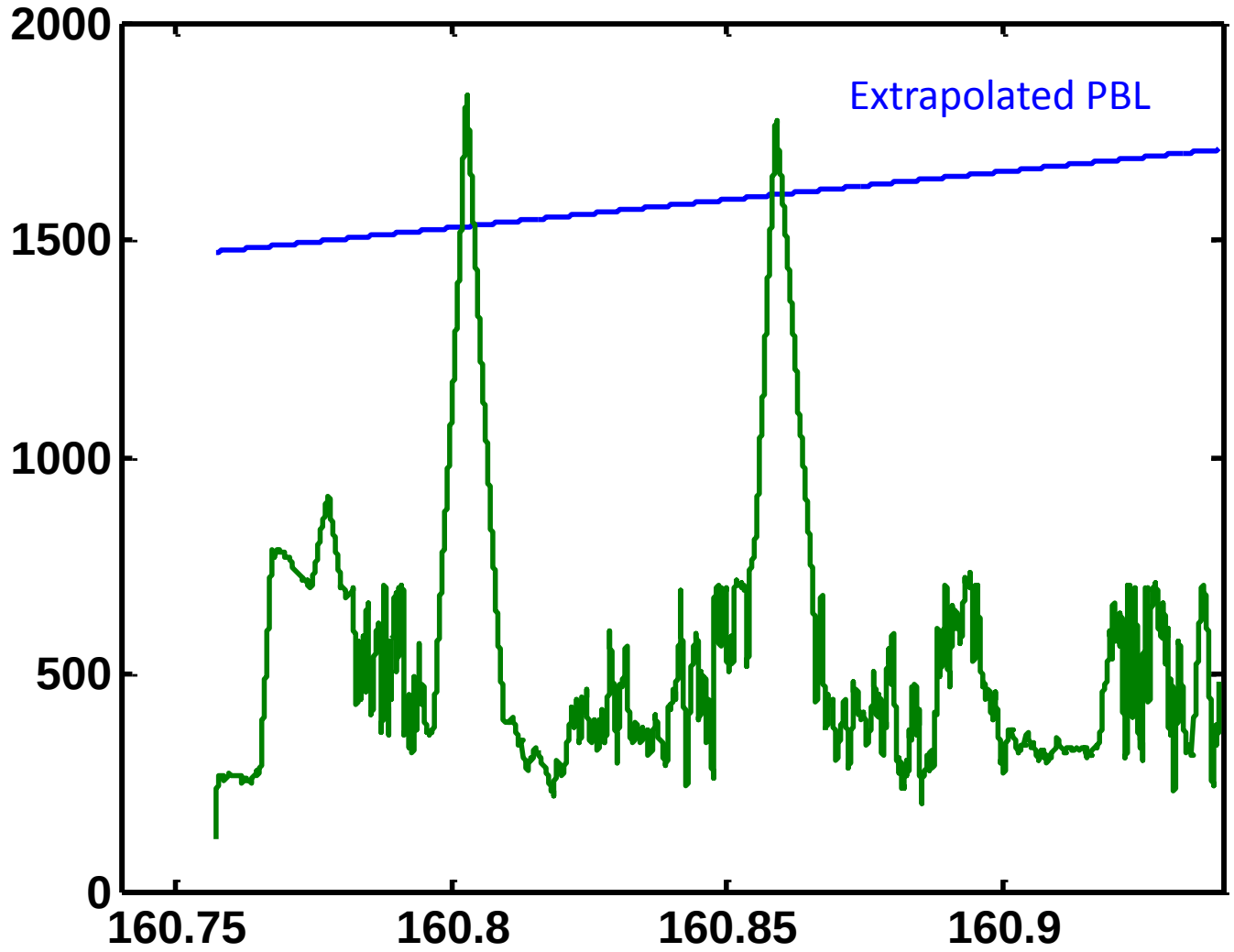
- Vertical gradients (flux divergence measurements)

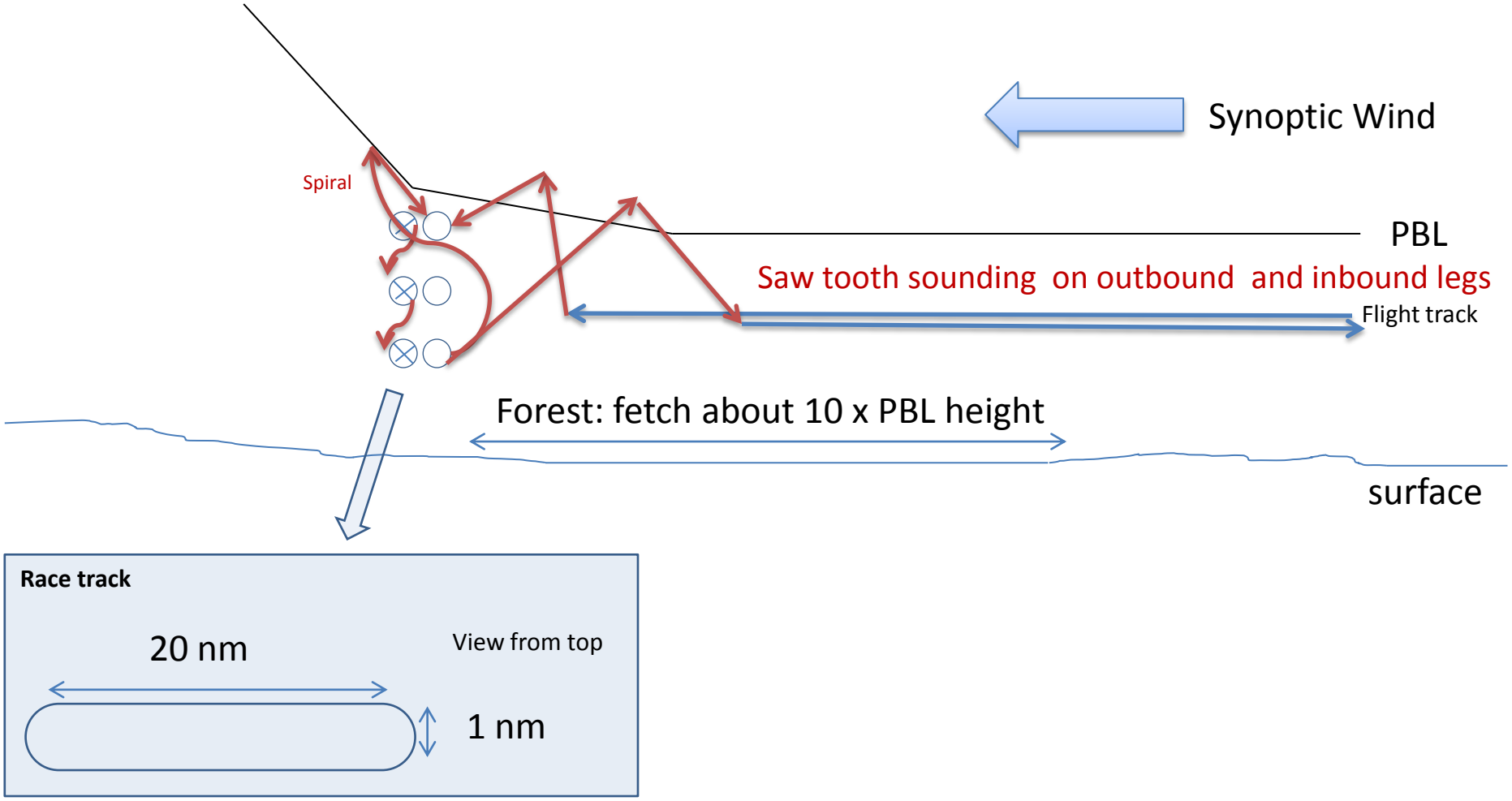
2011 CIRPAS Twin Otter
NCAR/UC Berkeley/CIRPAS

Horizontal PBL gradients



Altitude above ground – PBL height

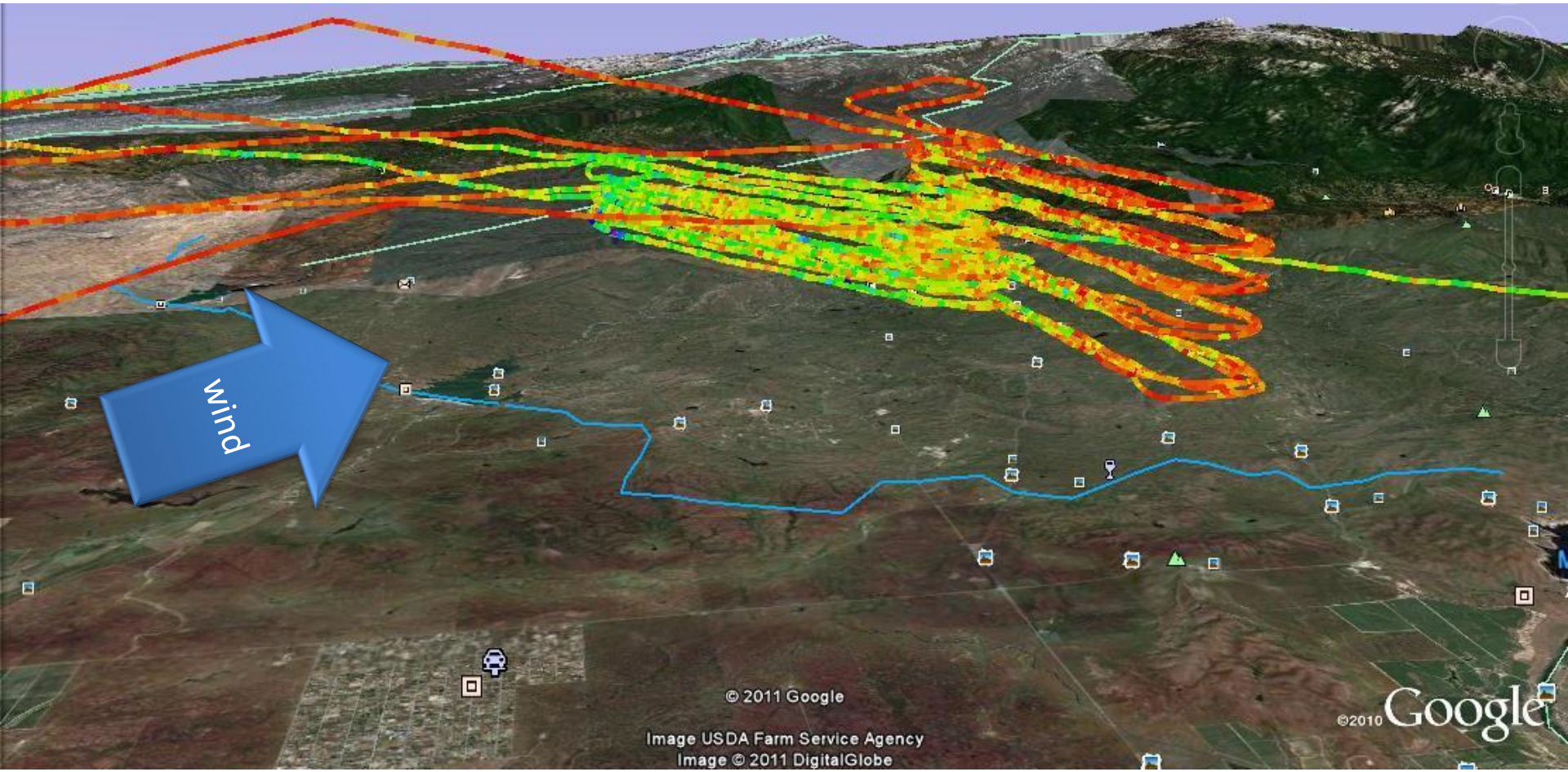




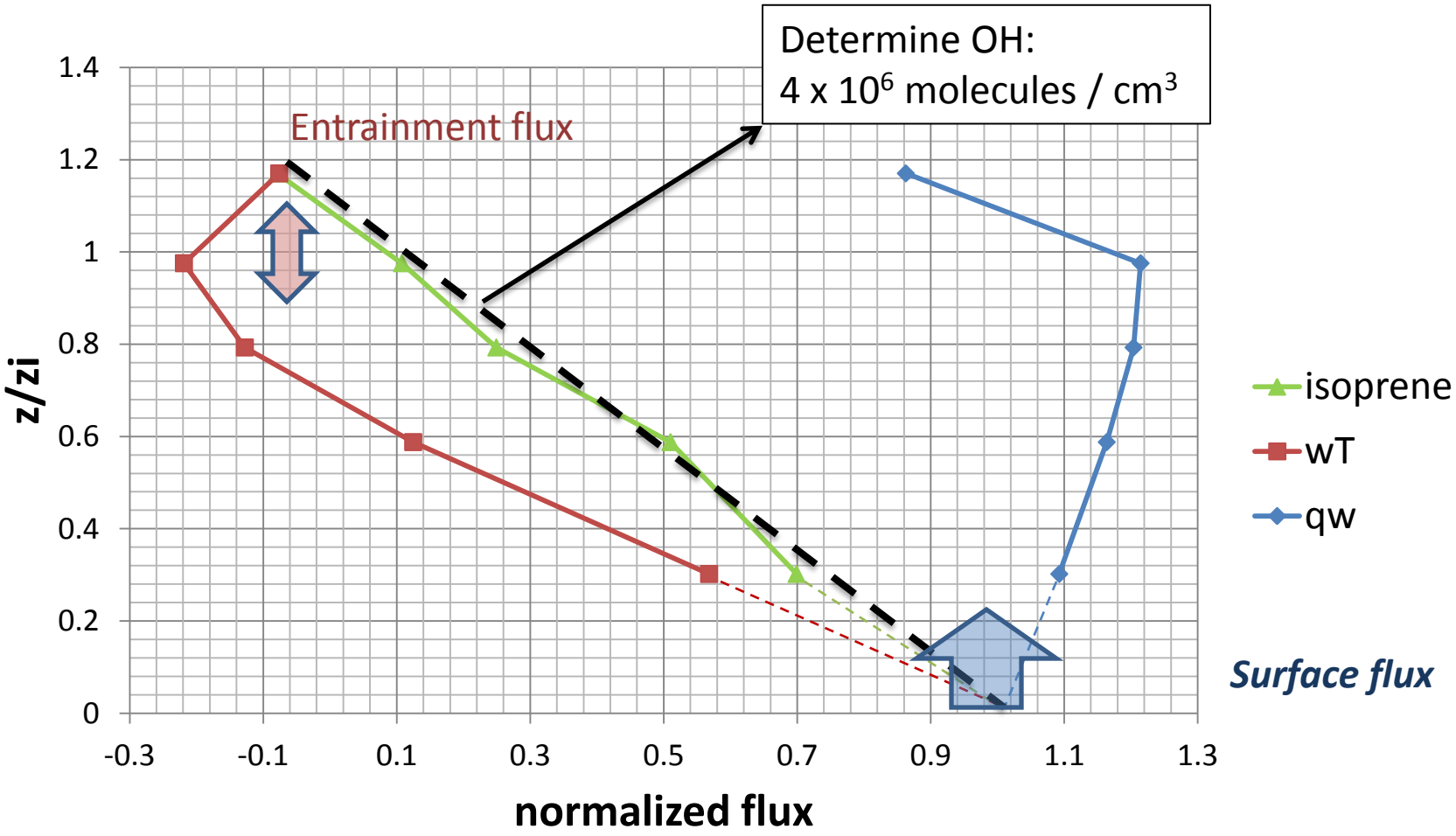
1 track is about 30 minutes
Entire profile is about 1.5 hours at 70 m/s

Sounding (up to 4000-7000 ft depending on PBL) at beginning and end of each profile
Sounding can be a “sawtooth” on the outbound leg, should be a spiral between consecutive profiles and a “saw tooth” on the inboundleg: climb rate 500 ft/min

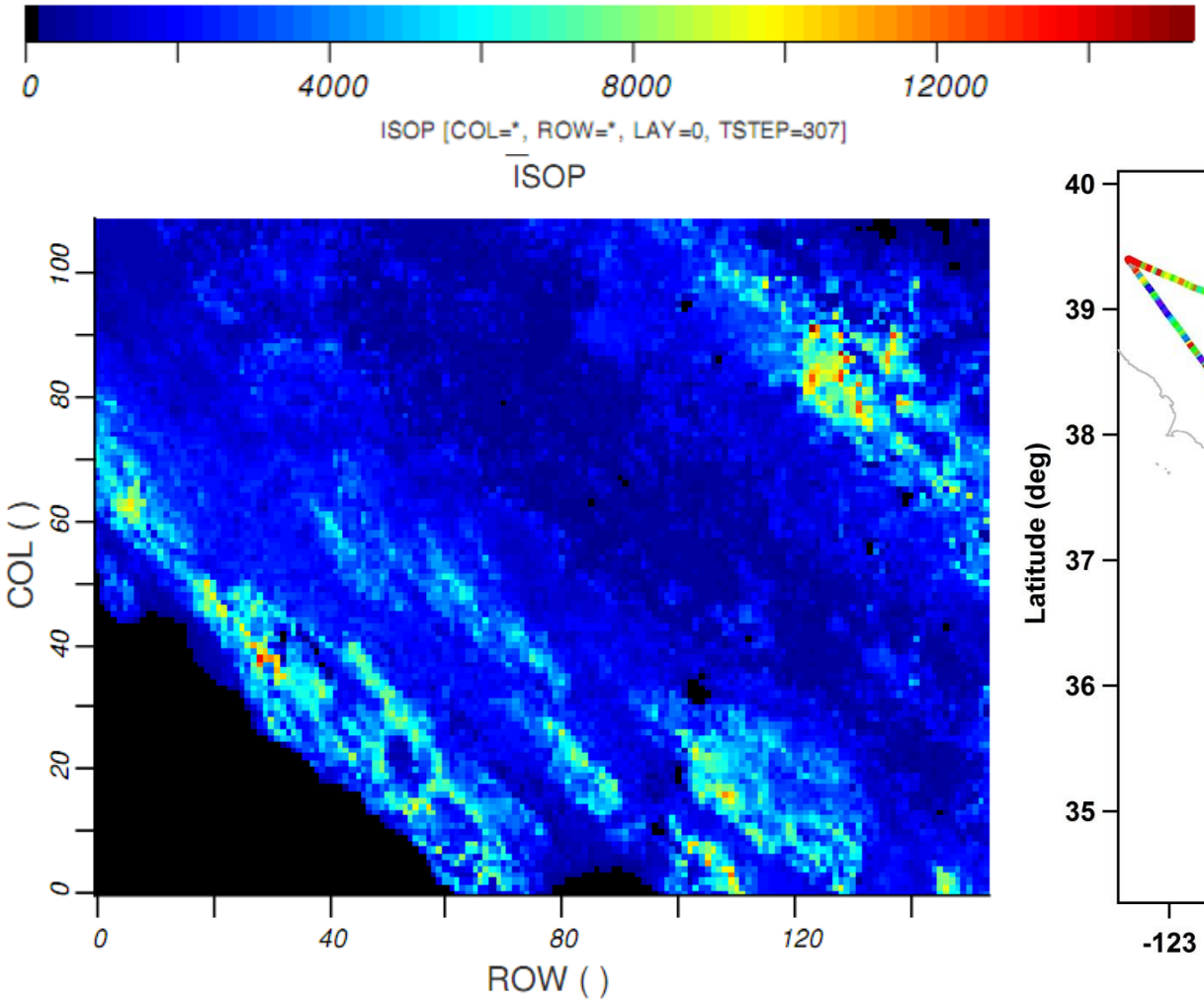
Profiles flown during CABERNET

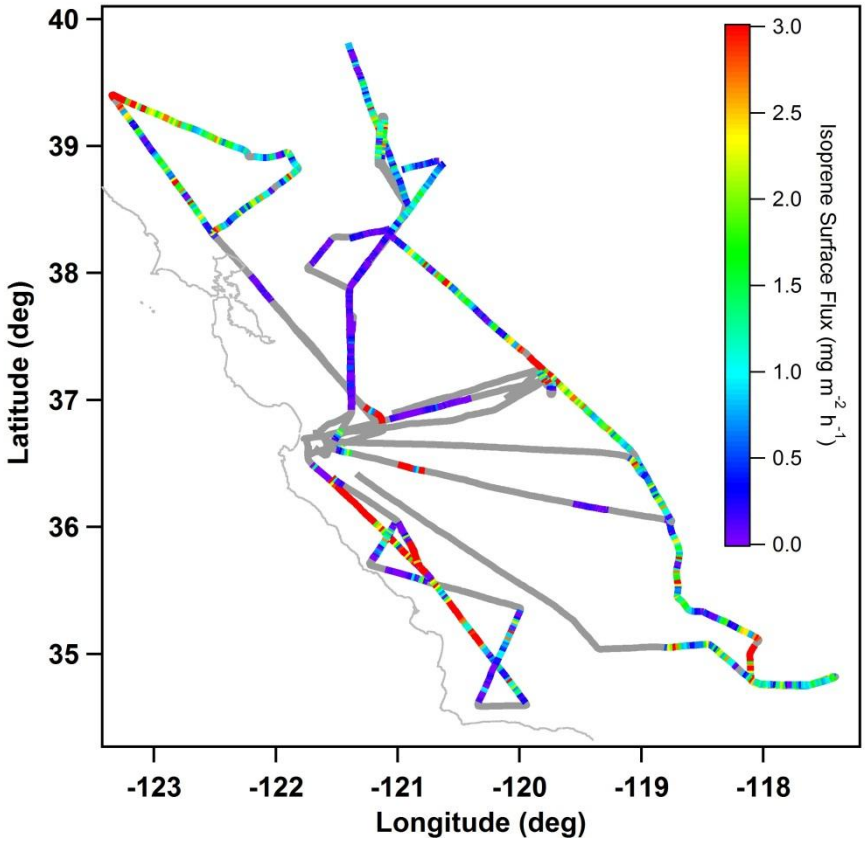


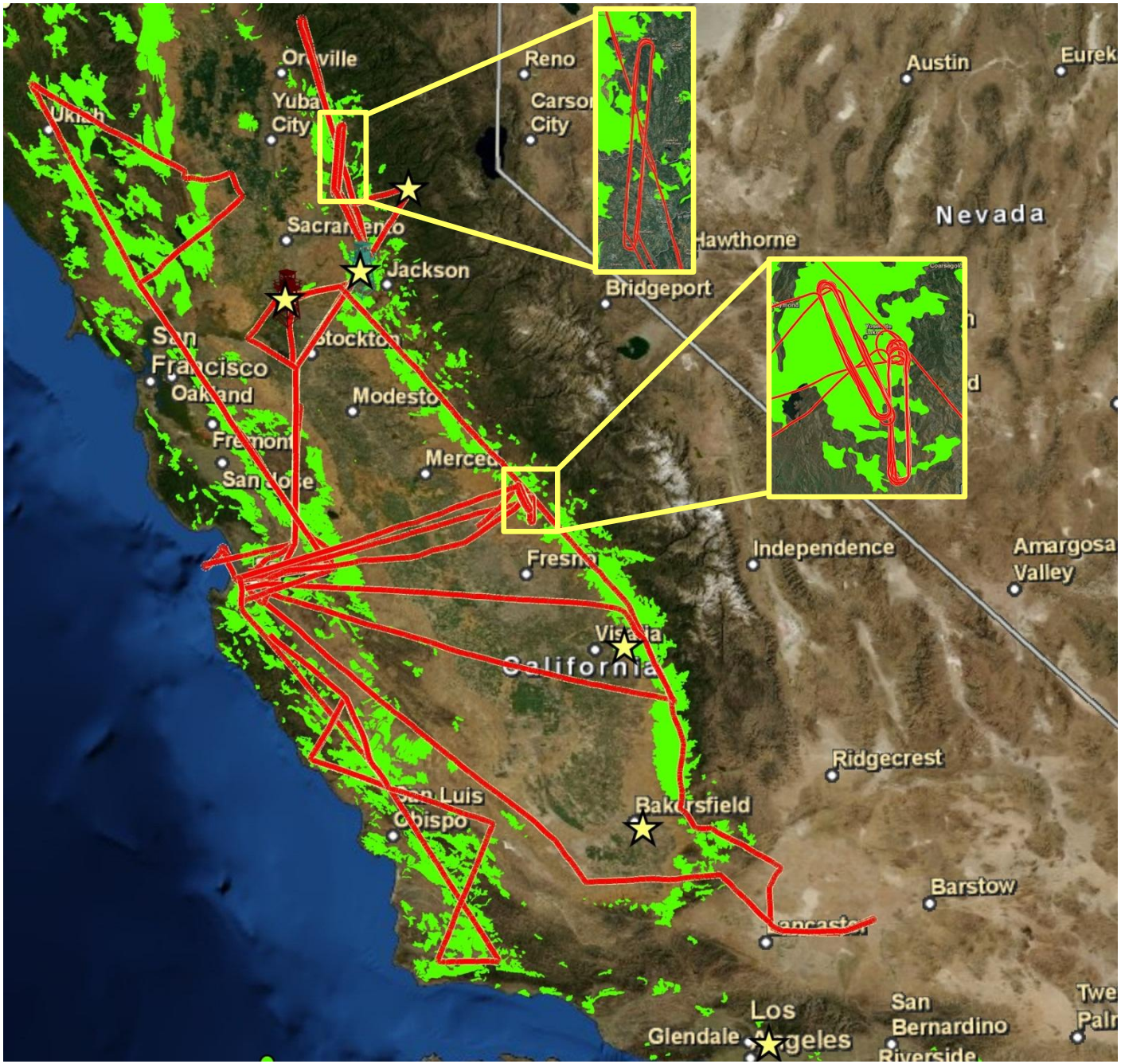
Flux divergence



MEGAN - Model of Emissions of Gases and Aerosols from Nature

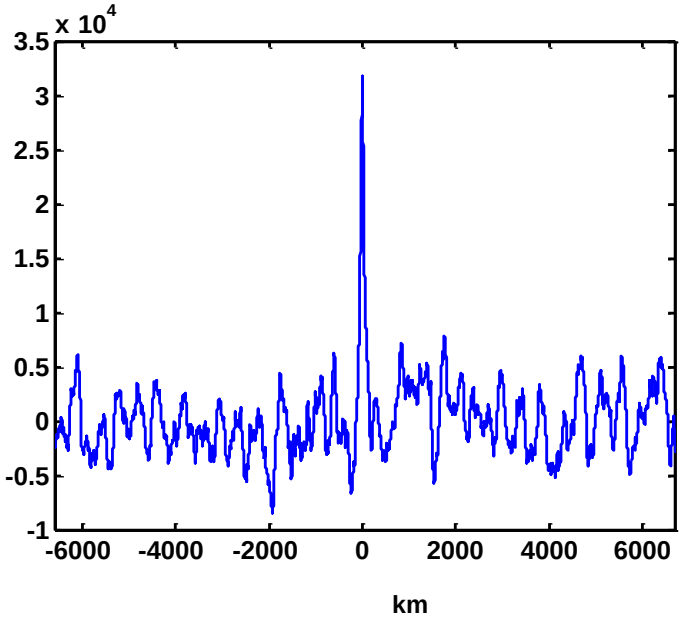


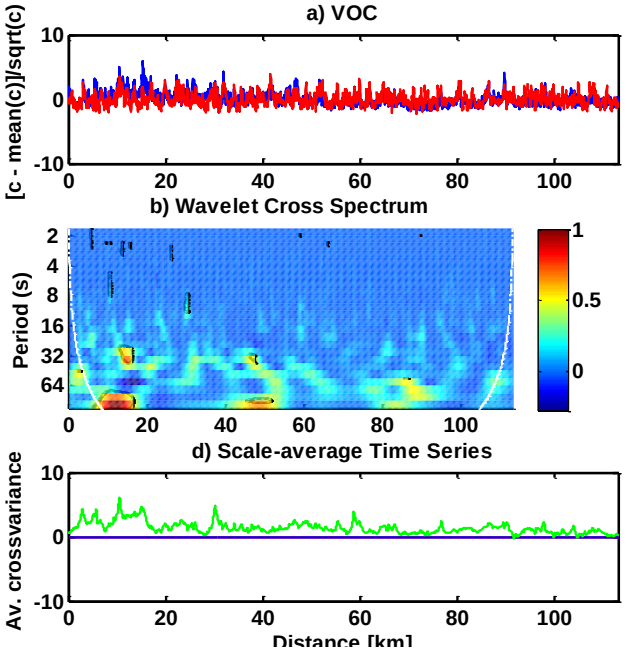


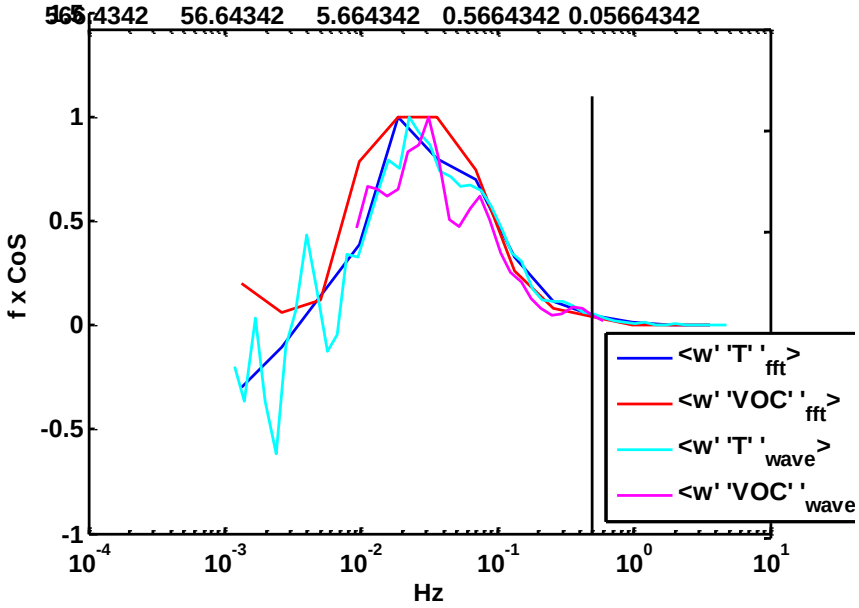


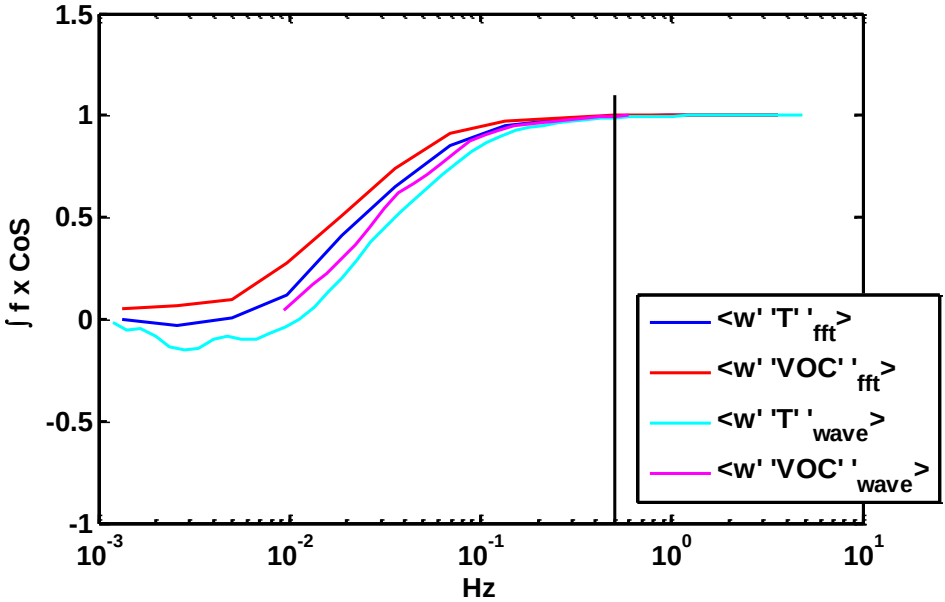
OAK WOODLANDS

Flux processing (FFT and wavelet decomposition)









Flux divergence