# May 2014 NOMADSS meeting

# Can wavelet analysis be used to get a higher spatial resolution on OH calculation from isoprene flux gradients?


Lisa Kaser

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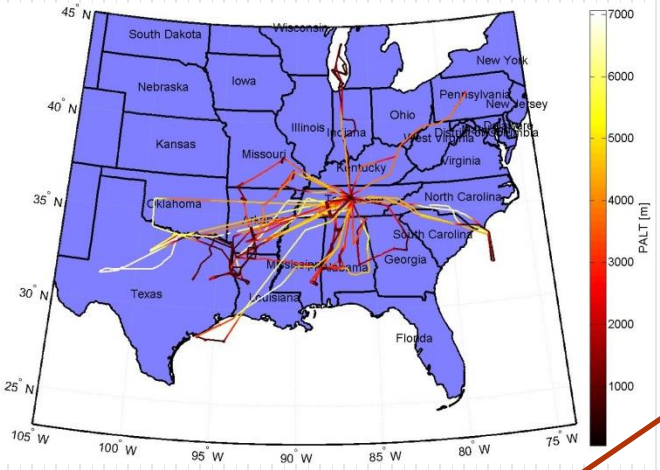
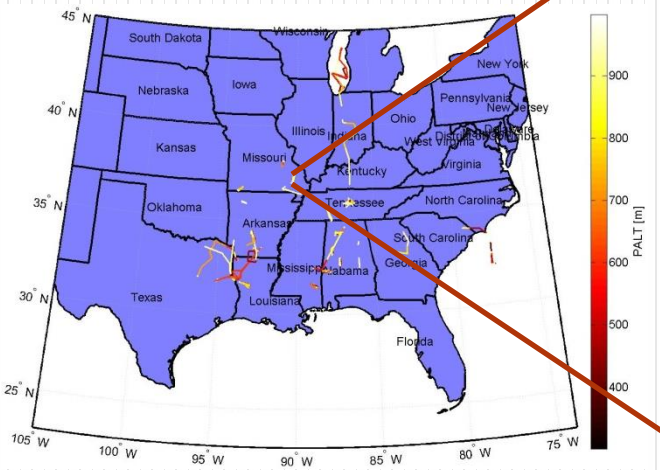
Co-authors: B. Yuan[2,3], T. Karl[4], E. Patton[5], L. Mauldin[6], C. Cantrell[6], N. Schardt[6], S. Shertz[1], M. Graus[2,3,4], E. Apel[1], R. Hornbrook[1], A. Hills[1], A. Weinheimer[1], C. Knote[1], L. Emmons[1], J. de Gouw[2,3], A. Guenther[7] & NOMADSS team

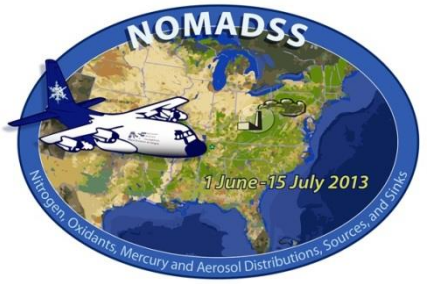
[1] *Atmospheric Chemistry Division, National Center for Atmospheric Research, Boulder, CO*
[2] *Chemical Sciences Division, NOAA Earth System Research Laboratory, Boulder, CO*
[3] *Cooperative Institute for Research in Environmental Sciences, University of Colorado, CO*
[4] *Institute for Meteorology and Geophysics, University of Innsbruck, Innsbruck, Austria*
[5] *Mesoscale and Microscale Meteorology, National Center for Atmospheric Research, Boulder, CO*
[6] *Department of Atmospheric and Oceanic Sciences, University of Colorado, Boulder, CO*
[7] *Pacific Northwest National Laboratory, Richland, WA*

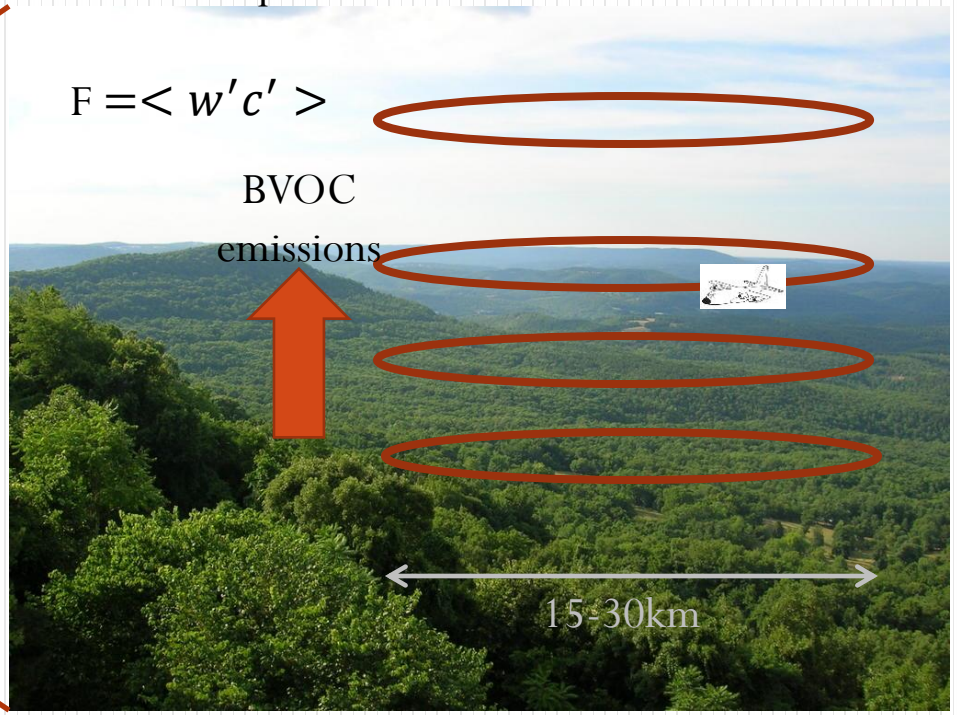
# Experiment (PTR-MS during NOMADSS)



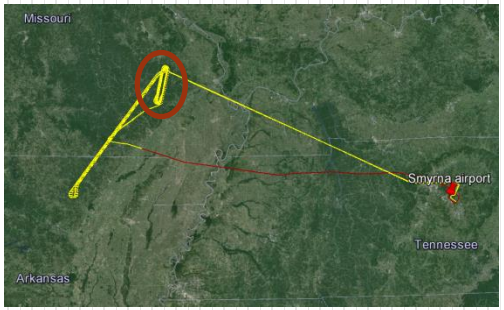

- Fast (25Hz) 3D wind measurements
- Fast (10Hz disjunct) PTR-MS VOC measurements (**Isoprene**, MVK+MACR, sum of Monoterpenes



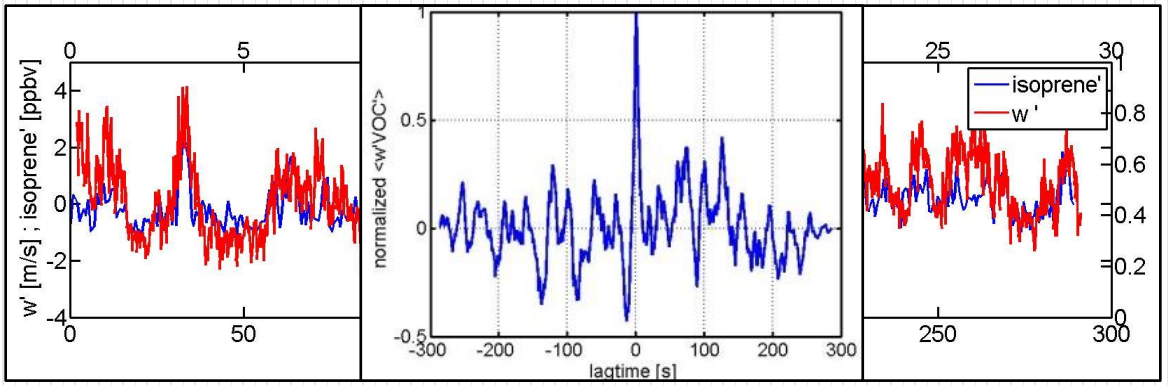



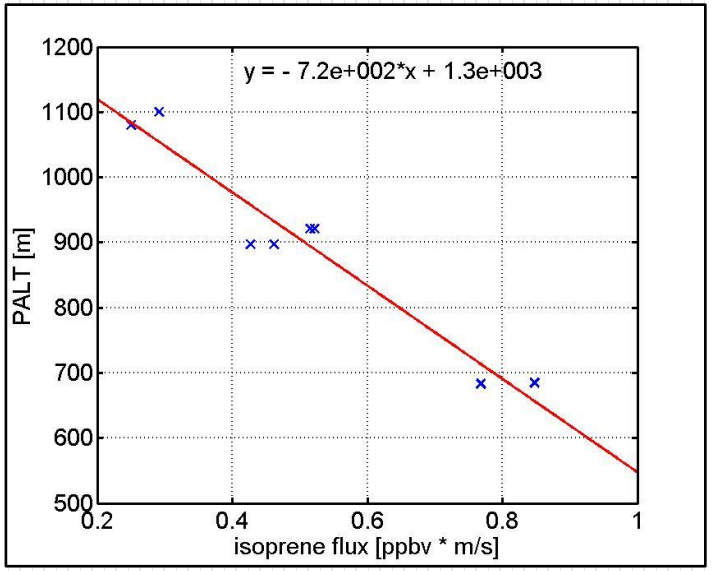
# ‘Traditional’ - OH from eddy covariance

- Each of the legs needs to be analyzed separately!
- RF 17: 5 heights, 20 legs




- One OH density value can be calculated for the whole area. Time and space averaged.
- RF17: $7.4 * 10^6 \pm 2.2 * 10^6$ molecules/$cm^{-3}$ (isoprene lifetime 23min)



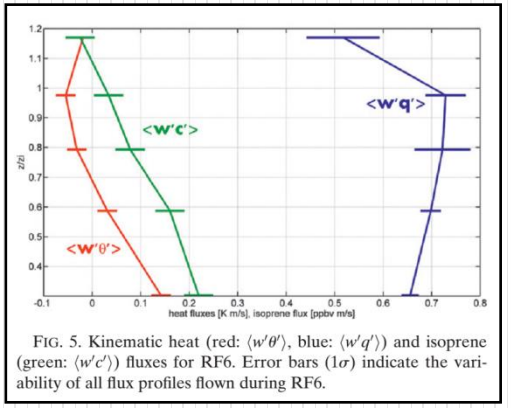




FIG. 5. Kinematic heat (red: $\langle w'\theta' \rangle$, blue: $\langle w'q' \rangle$) and isoprene (green: $\langle w'c' \rangle$) fluxes for RF6. Error bars ($1\sigma$) indicate the variability of all flux profiles flown during RF6.

Karl et al. 2013

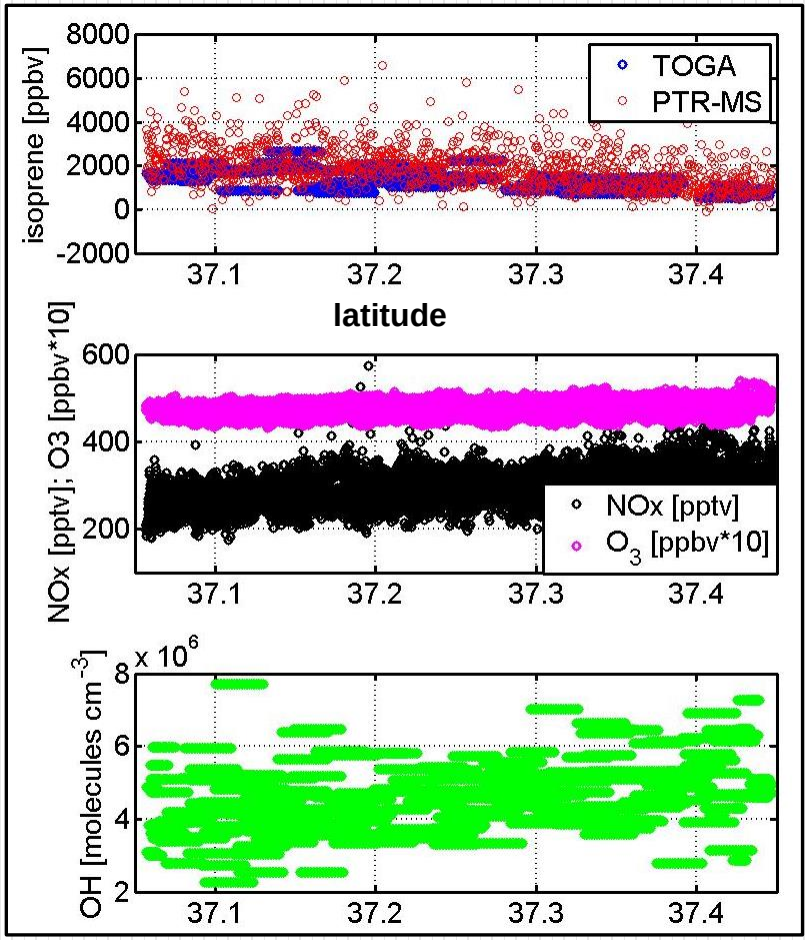
$$\frac{dC}{dt} + \frac{dF}{dz} = \frac{C}{\tau} \Rightarrow isoprene\ lifetime$$

$$\tau = \frac{1}{k_{OH}[OH] + k_{O_3}[O_3] + k_{NO_3}[NO_3]}$$

$$\Rightarrow [OH]\text{density}$$

$$k_{OH} = 2.5 * 10^{-11} * e^{410/T} \frac{cm^3 s}{molec.}$$

# Motivation for OH from wavelet analysis




Concentration gradients observed over the racetrack

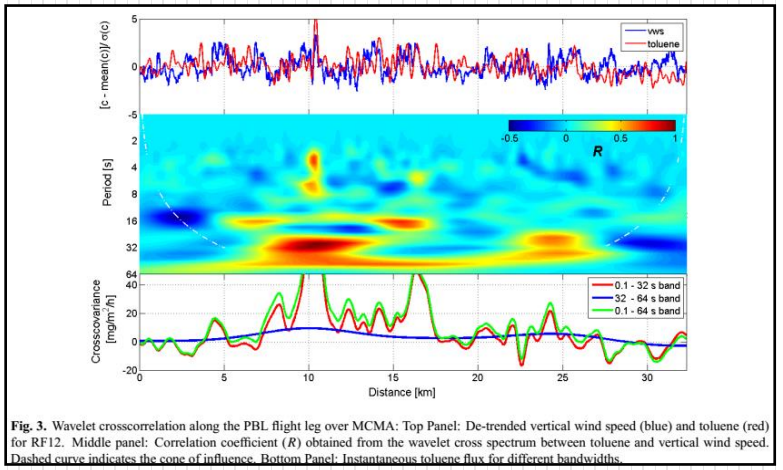



**Fig. 3.** Wavelet crosscorrelation along the PBL flight leg over MCMA: Top Panel: De-trended vertical wind speed (blue) and toluene (red) for RF12. Middle panel: Correlation coefficient (*R*) obtained from the wavelet cross spectrum between toluene and vertical wind speed. Dashed curve indicates the cone of influence. Bottom Panel: Instantaneous toluene flux for different bandwidths.

Karl et al. 2009 – BTEX-fluxes over Mexico City

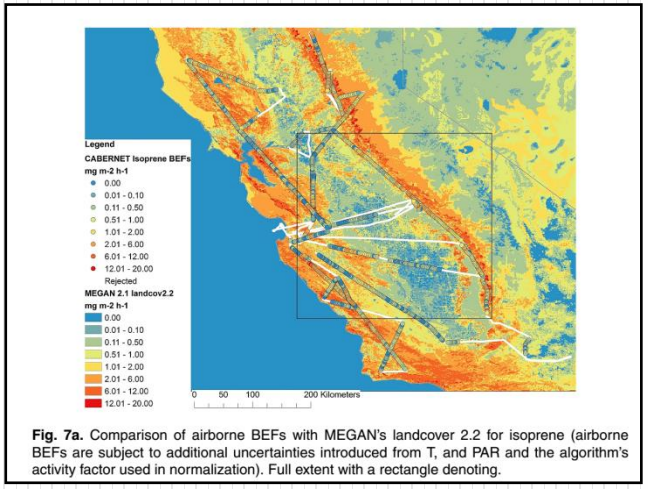
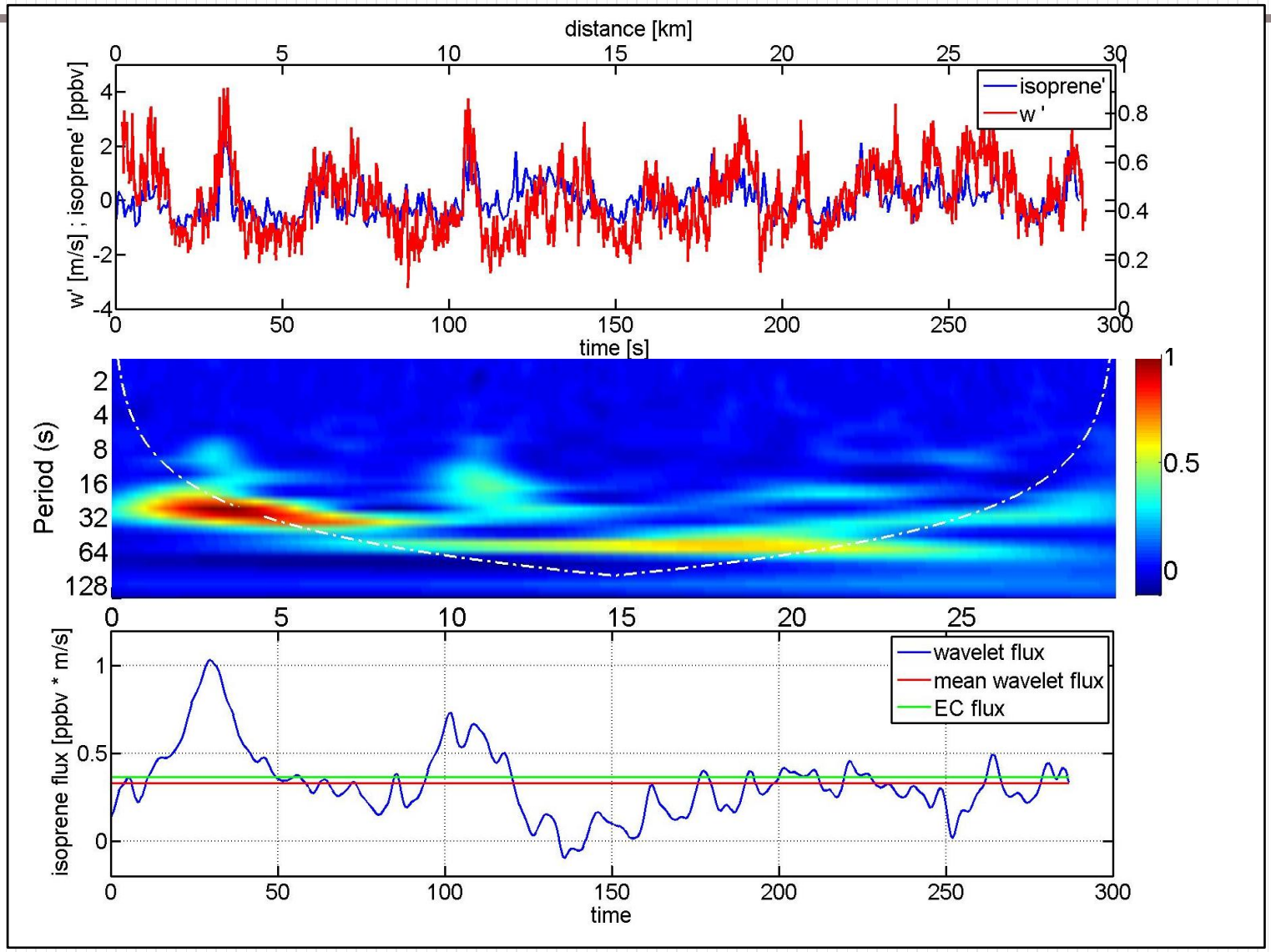


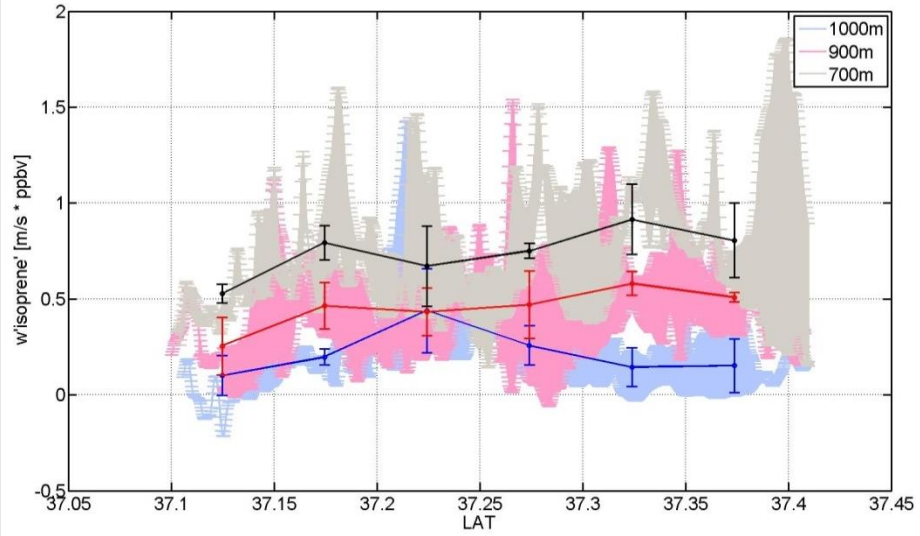

**Fig. 7a.** Comparison of airborne BEFs with MEGAN's landcover 2.2 for isoprene (airborne BEFs are subject to additional uncertainties introduced from T, and PAR and the algorithm's activity factor used in normalization). Full extent with a rectangle denoting.

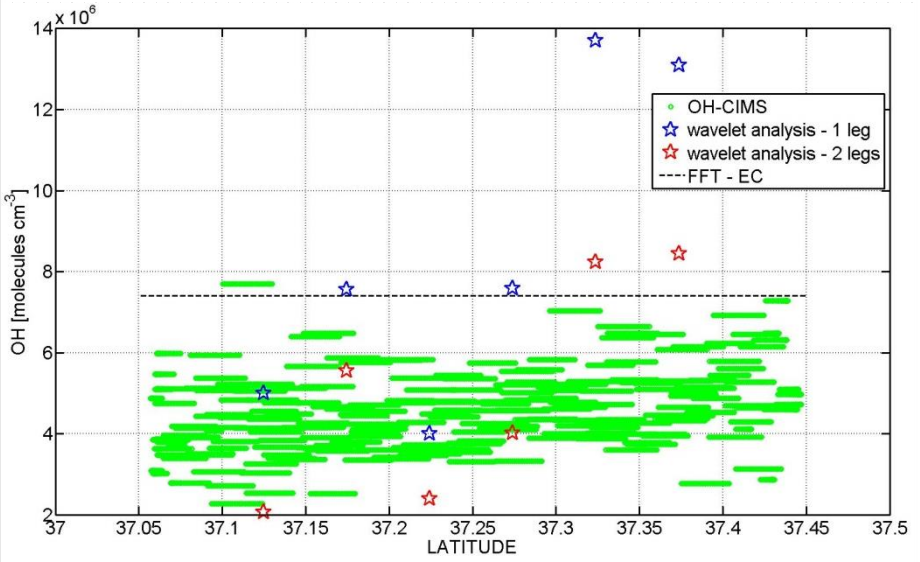
Misztal et al. 2014 – Regional mapping of BVOC fluxes

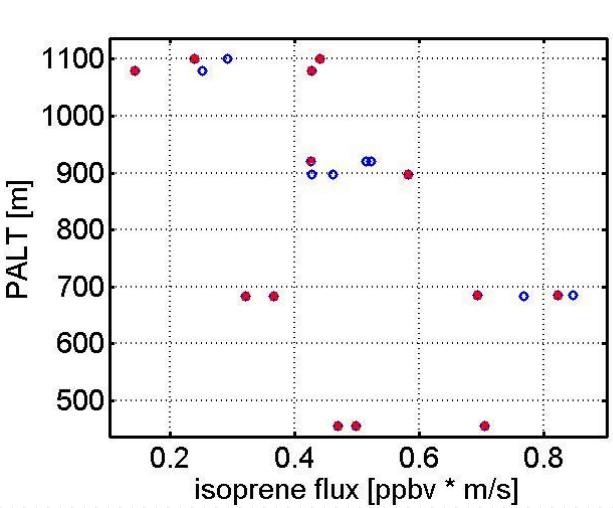
# Higher spatial resolution of fluxes with wavelet analysis



# Results


1000m
900m
700m
w'isoprene' [m/s * ppbv]
LAT


x 10^6
OH-CIMS
wavelet analysis - 1 leg
wavelet analysis - 2 legs
FFT - EC
OH [molecules cm^-3]
LATITUDE


PALT [m]
isoprene flux [ppbv * m/s]