Measurement of Volatile Organic Compounds using Trigger Sampling in the Southeast Asia during Biomass Burning Season

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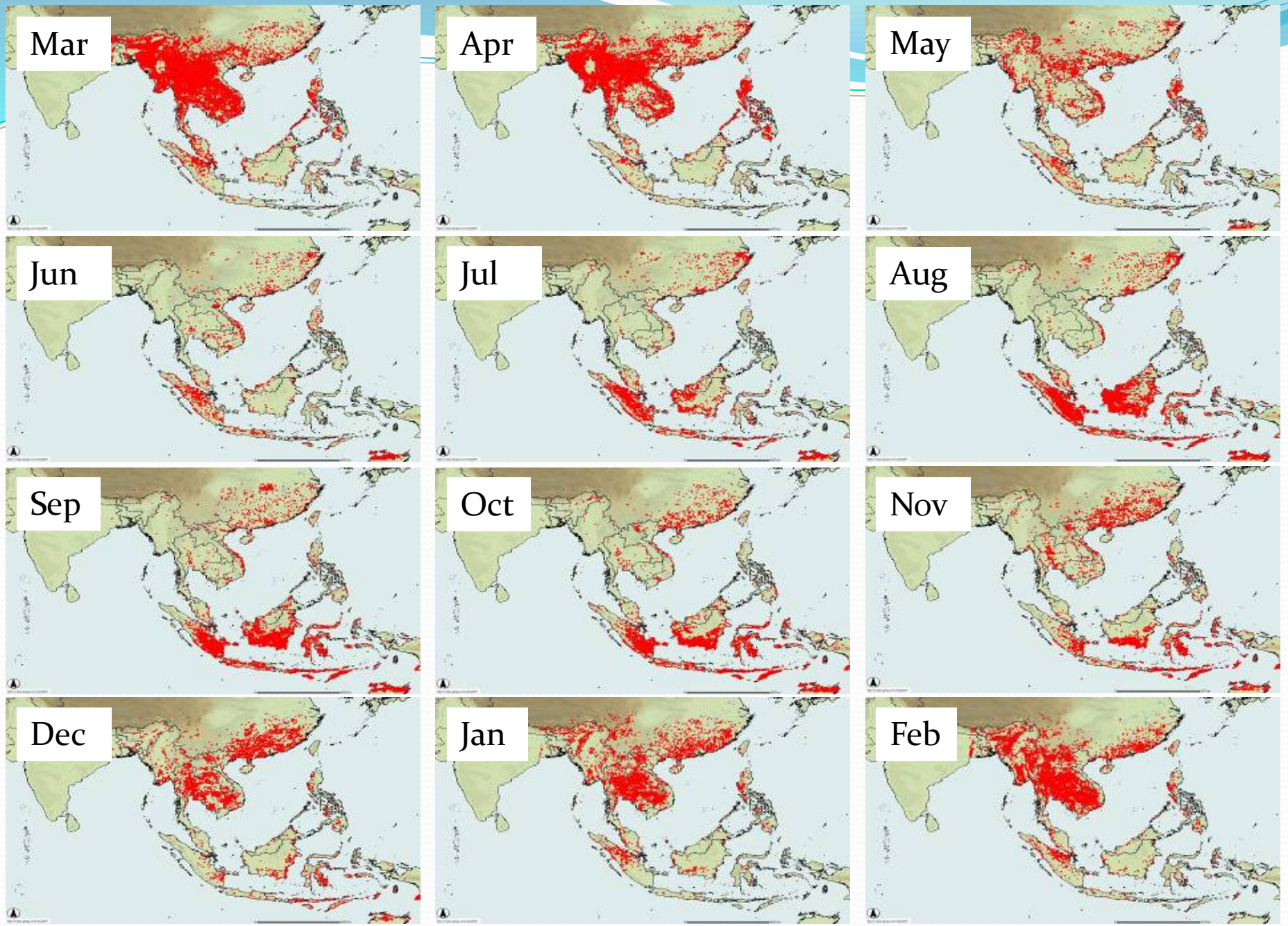
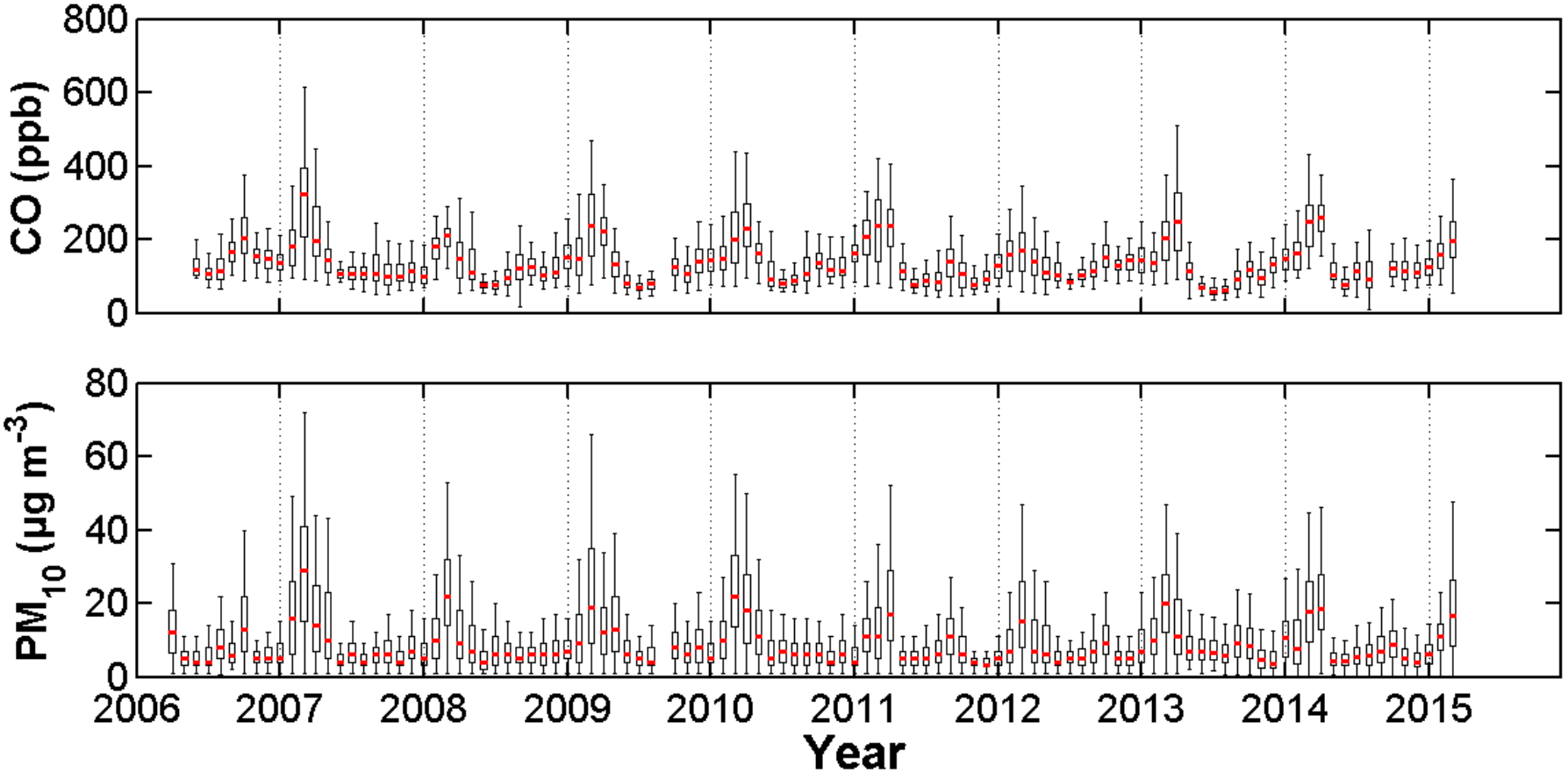


http://maps.geog.umd.edu/activefire_html

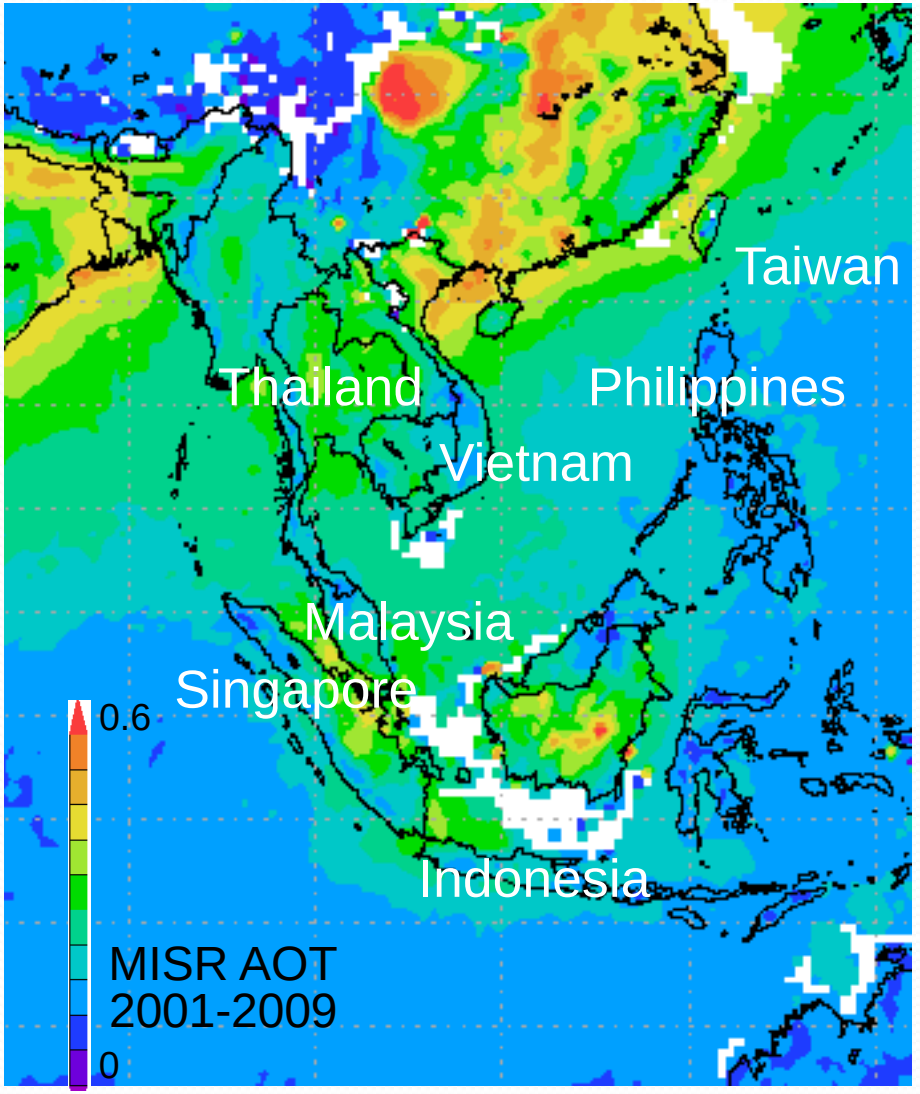
Springtime elevated CO & PM



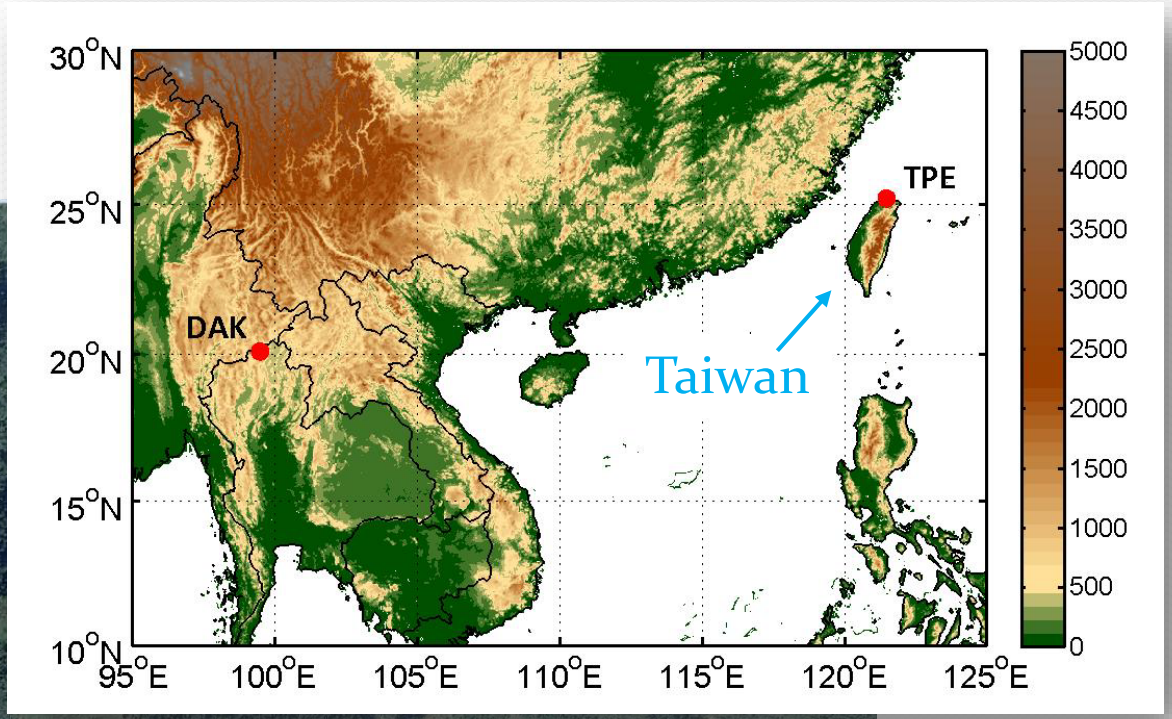
Seven South East Asian Studies (7-SEAS)

- **Investigate the impacts of aerosol particles on weather and the total SE Asian environment**
- In order to do this, we need input from seven science areas:

- Aerosol lifecycle and air quality
- Tropical meteorology
- Radiation and heat balance
- Clouds and precipitation
- Land processes and fire
- Oceanography (phys. and bio.)
- Verification, analysis, and prediction



Location


30°N
25°N
20°N
15°N
10°N
95°E
100°E
105°E
110°E
115°E
120°E
125°E
DAK
TPE
Taiwan
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0

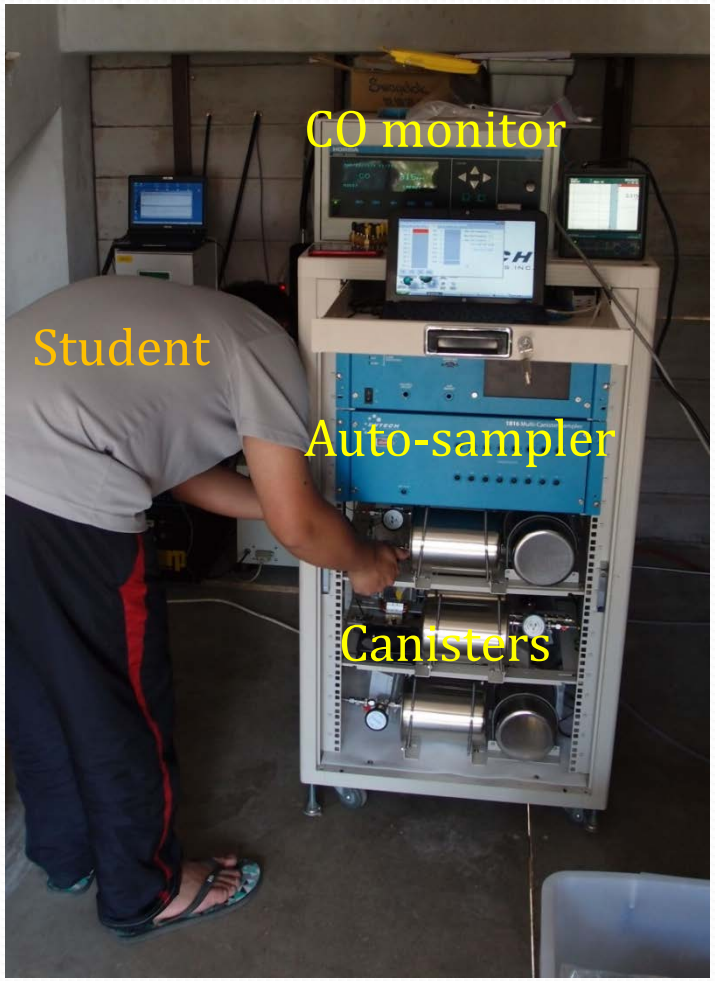
Burma
Thailand
Doi Ang Khang (DAK) weather station
(19.93˚N, 99.05˚E, 1536 m a.s.l.)
Google

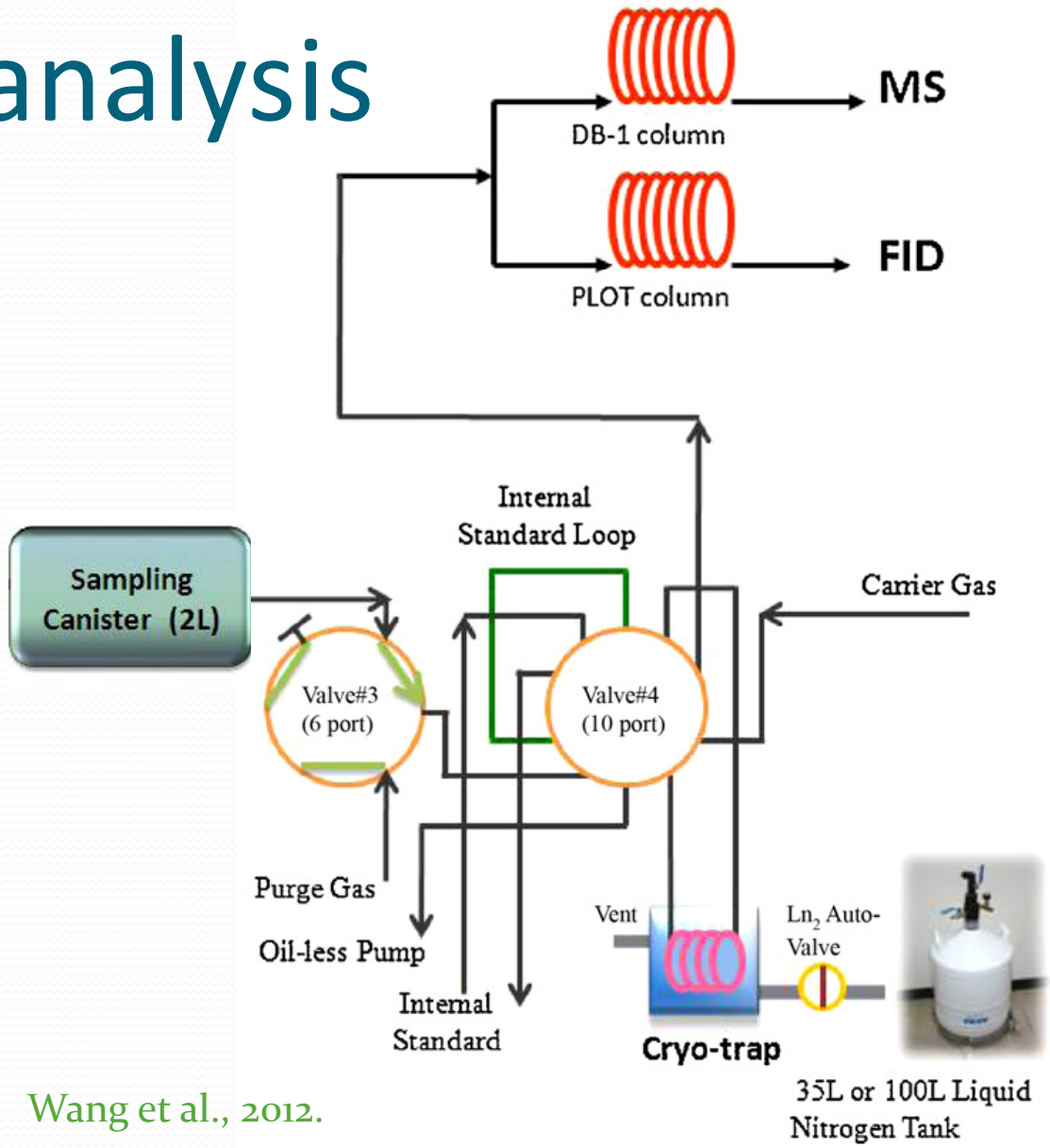
Strategy

- **Trigger sampling**
  - CO acted as a trigger for biomass burning indication
  - Sampling was triggered if the CO concentration > 1 ppm
  - Required time $= 5$ s to avoid false triggering due to any random surge of noise
  - Sampling period $= 1$ hour (controlled by MFC)

- **Chemical analysis**
  - Canister air samples were analyzed using GC/MS/FID and CRDS in Taiwan
  - About 100 compounds were analyzed, e.g. non-methane hydrocarbons, halogenated compounds, and greenhouse gases

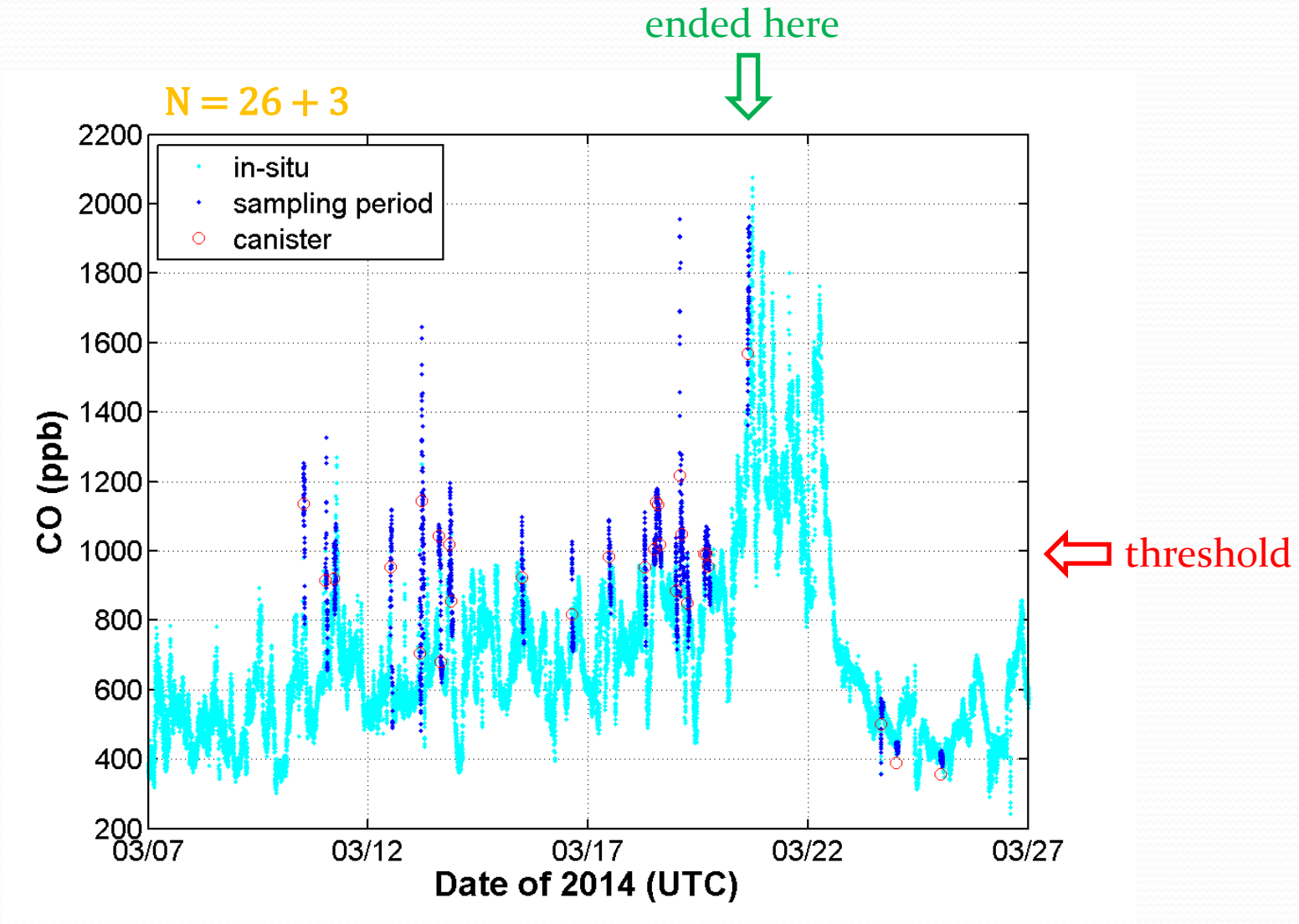
Sampling & analysis



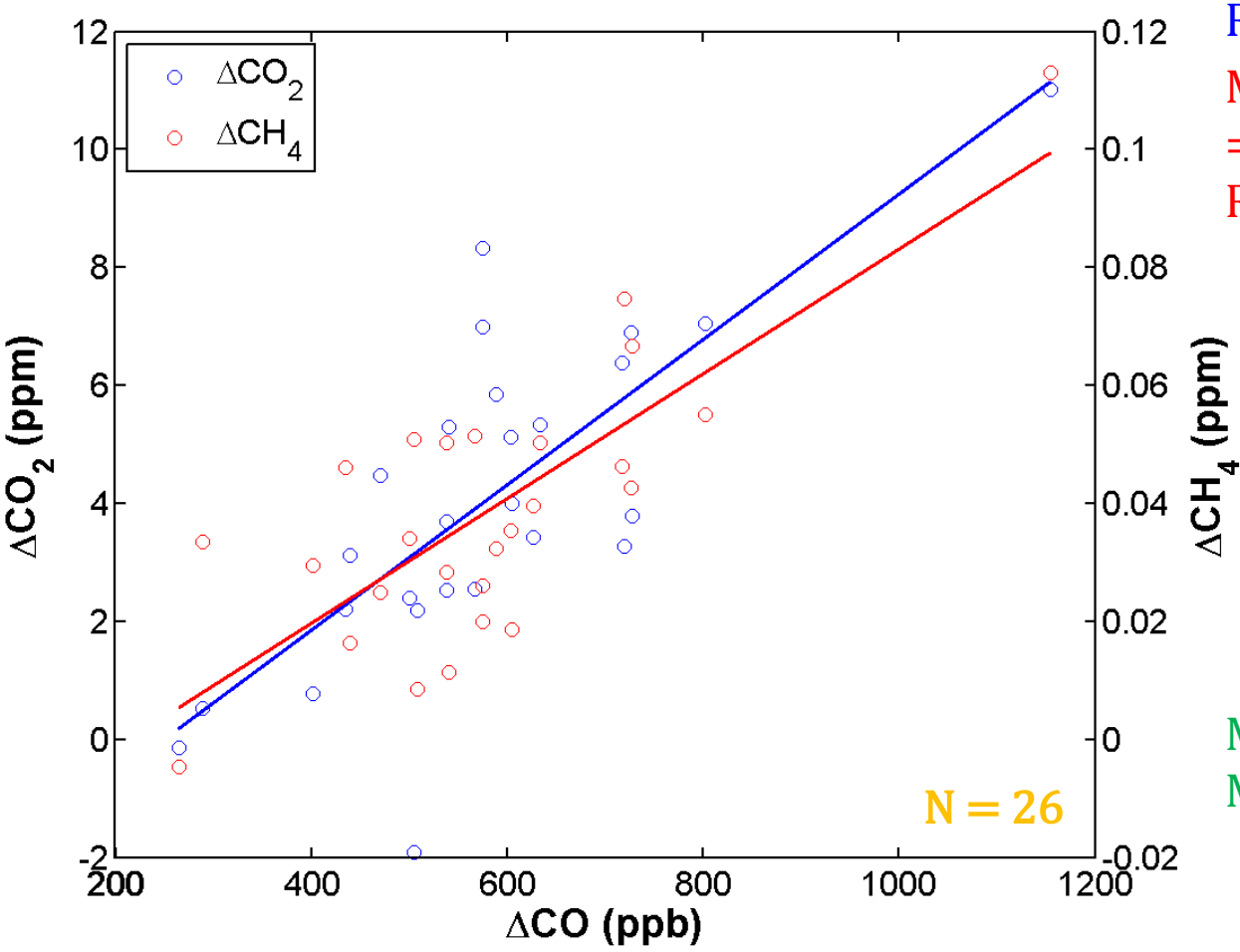


Wang et al., 2012.

CO measurements at DAK



Greenhouse gases at DAK

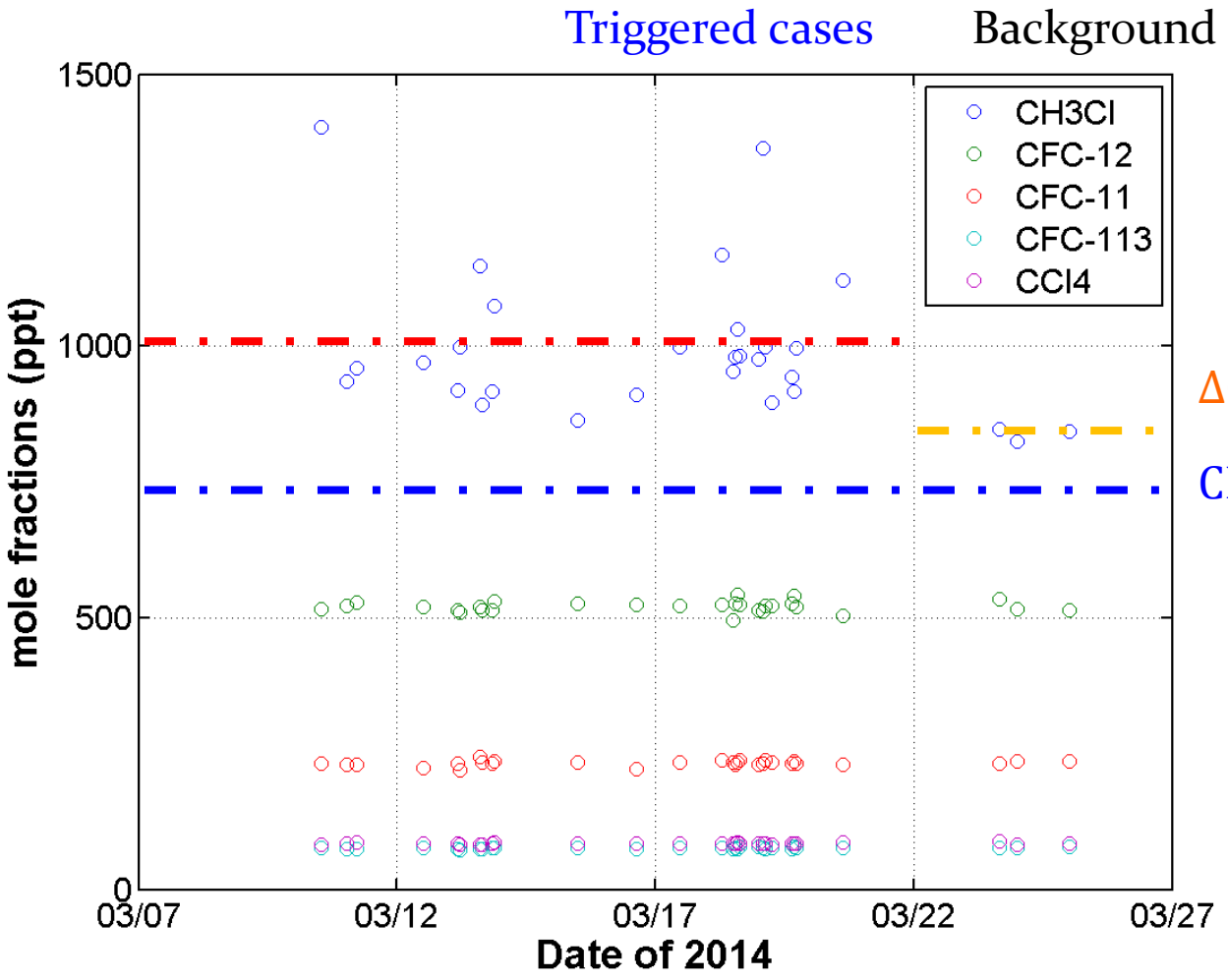


Mean $\Delta CO_2/\Delta CO$
$= 6.5 \pm 3.9 \times 10^{-3}$ (ppm/ppb)
$R^2 = 0.58$

Mean $\Delta CH_4/\Delta CO$
$= 6.4 \pm 3.2 \times 10^{-4}$ (ppm/ppb)
$R^2 = 0.61$

Mean $CO_2 = 407.9 \pm 2.8$ ppm
Mean $CH_4 = 1.95 \pm 0.02$ ppm

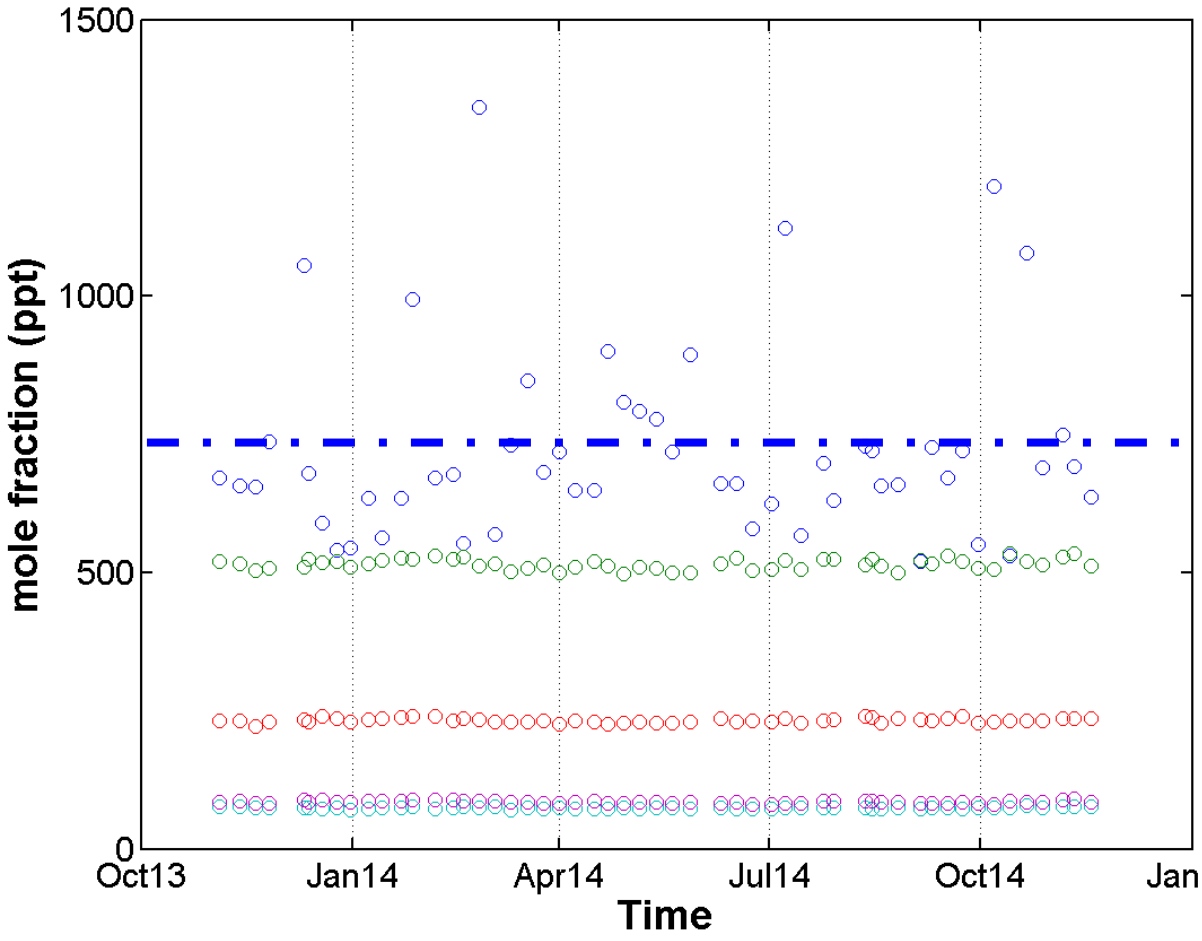
Halocarbons at DAK



$\Delta CH_3Cl = 173.8$ ppt

$CH_3Cl = 722.3$ ppt (LLN)

Halocarbons at LLN



$CH_3Cl = 722.3$ ppt

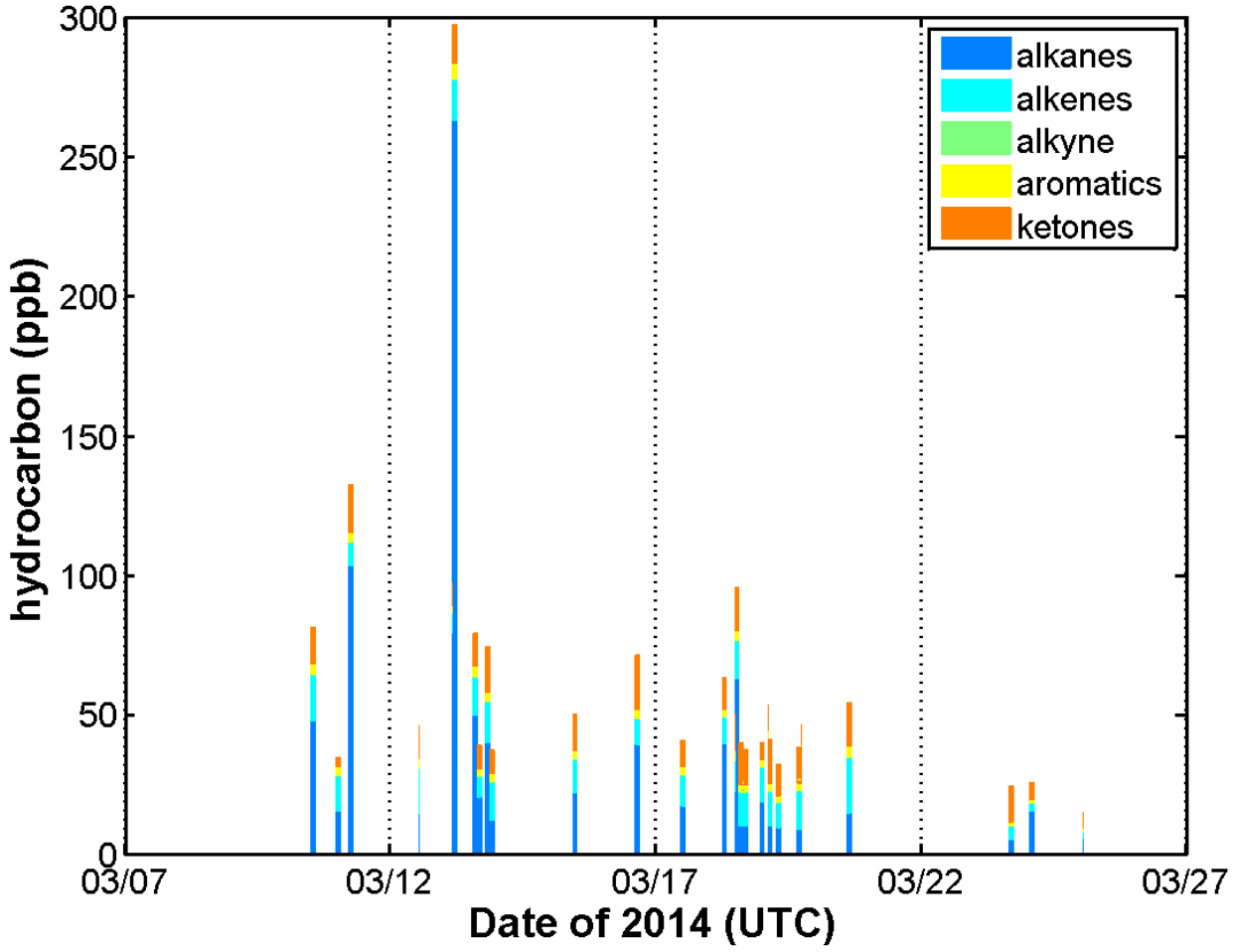
CFC-12 = 515.3 ppt

CFC-11 = 232.6 ppt

$CCl_4 = 85.1$ ppt

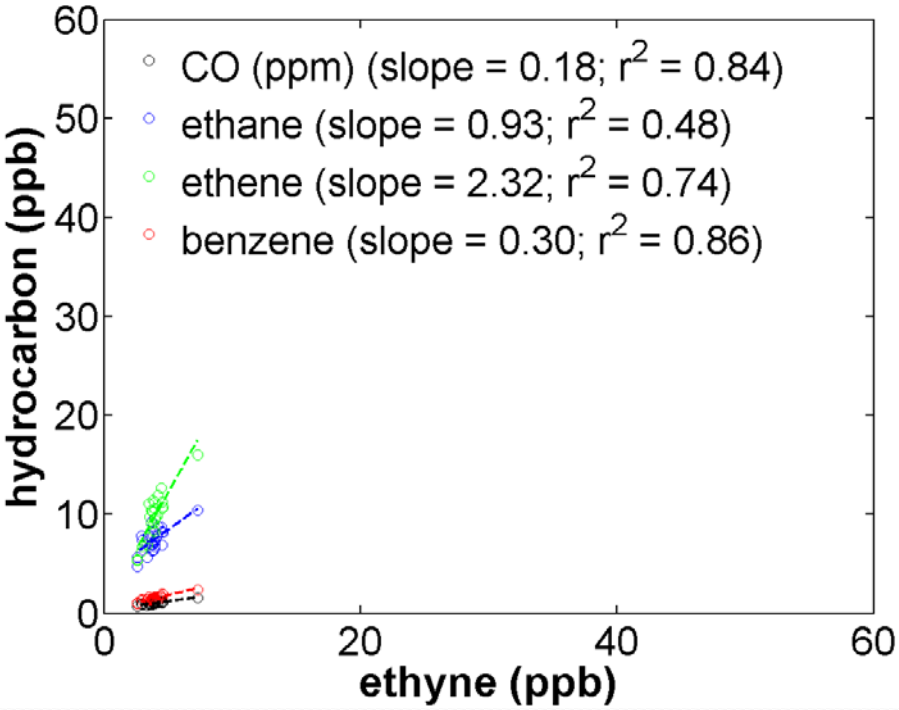
CFC-113 = 74.2 ppt

NMHCs in the air samples

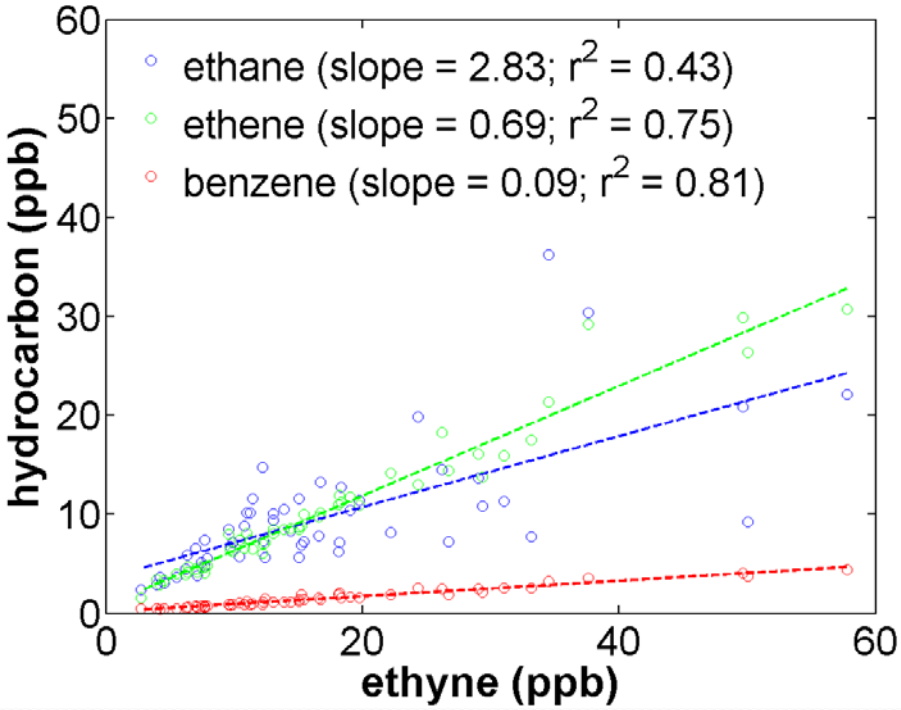


NMHC / ethyne ratios

@DAK (BB characteristics)

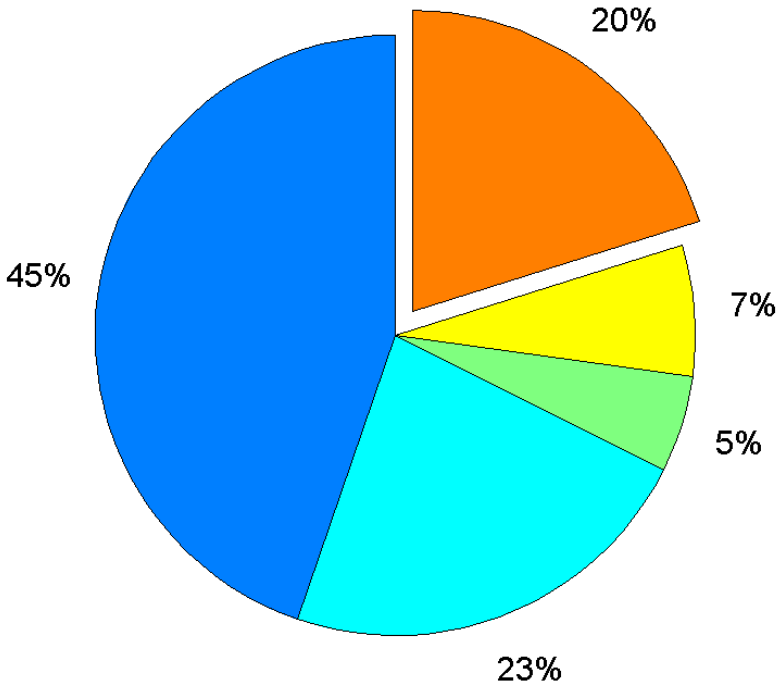


@Taipei in Rush Hours

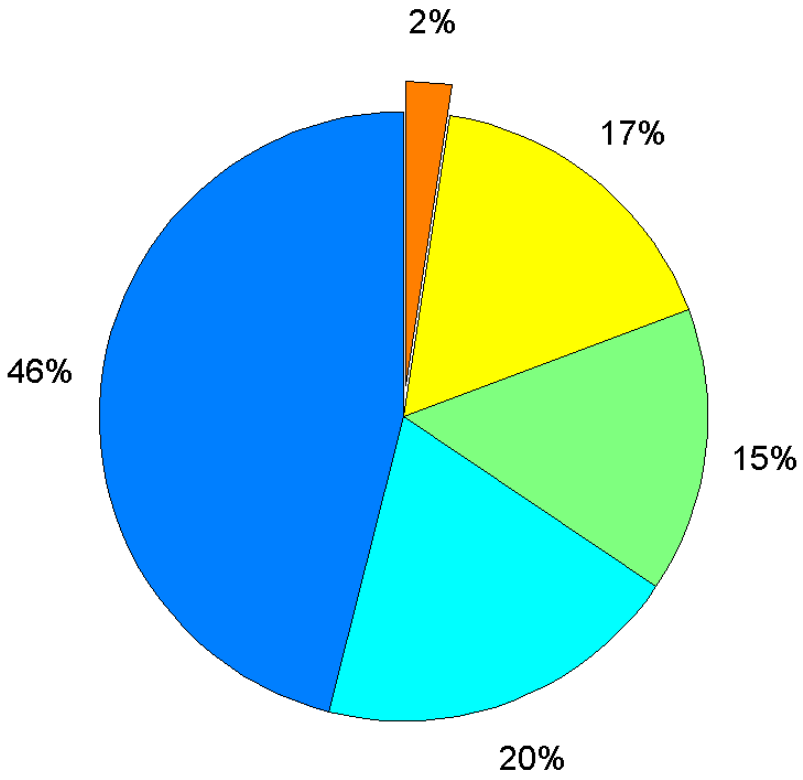


Distribution of NMHCs

Triggered Cases @DAK

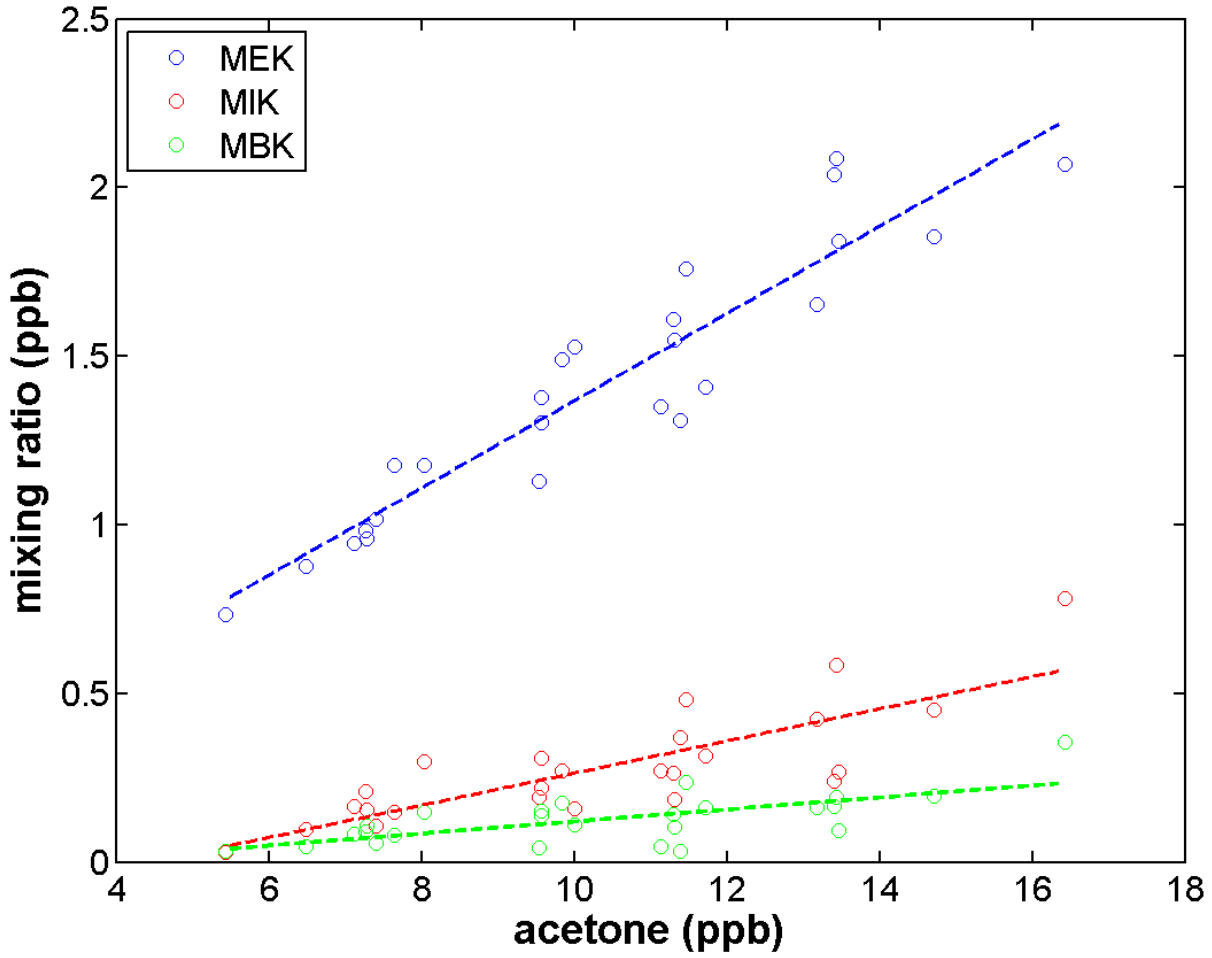


Rush hours @TPE



alkanes alkenes alkyne aromatics ketones

Ketones at DAK



Slope = 0.1293
$R^2 = 0.88$

Slope = 0.0477
$R^2 = 0.66$

Slope = 0.0178
$R^2 = 0.46$

Summary

- 26 triggered samples for measuring BB VOCs by high CO at DAK.
- Enhanced level of 173.8 ppt CH_3Cl was measured during the observation period.
- Correlations and factors between trace gases are found, e.g. greenhouse gases, light non-methane hydrocarbons, and ketones.