MAY 7, 2020

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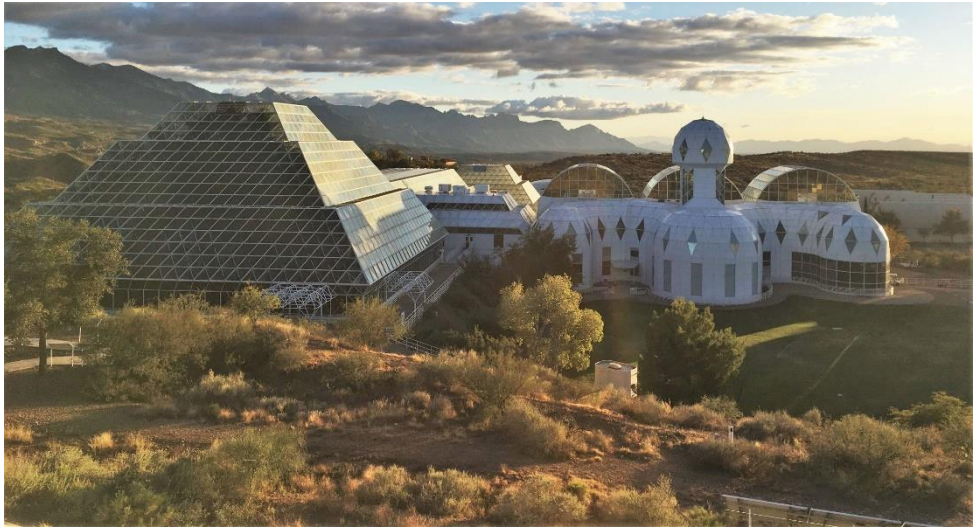
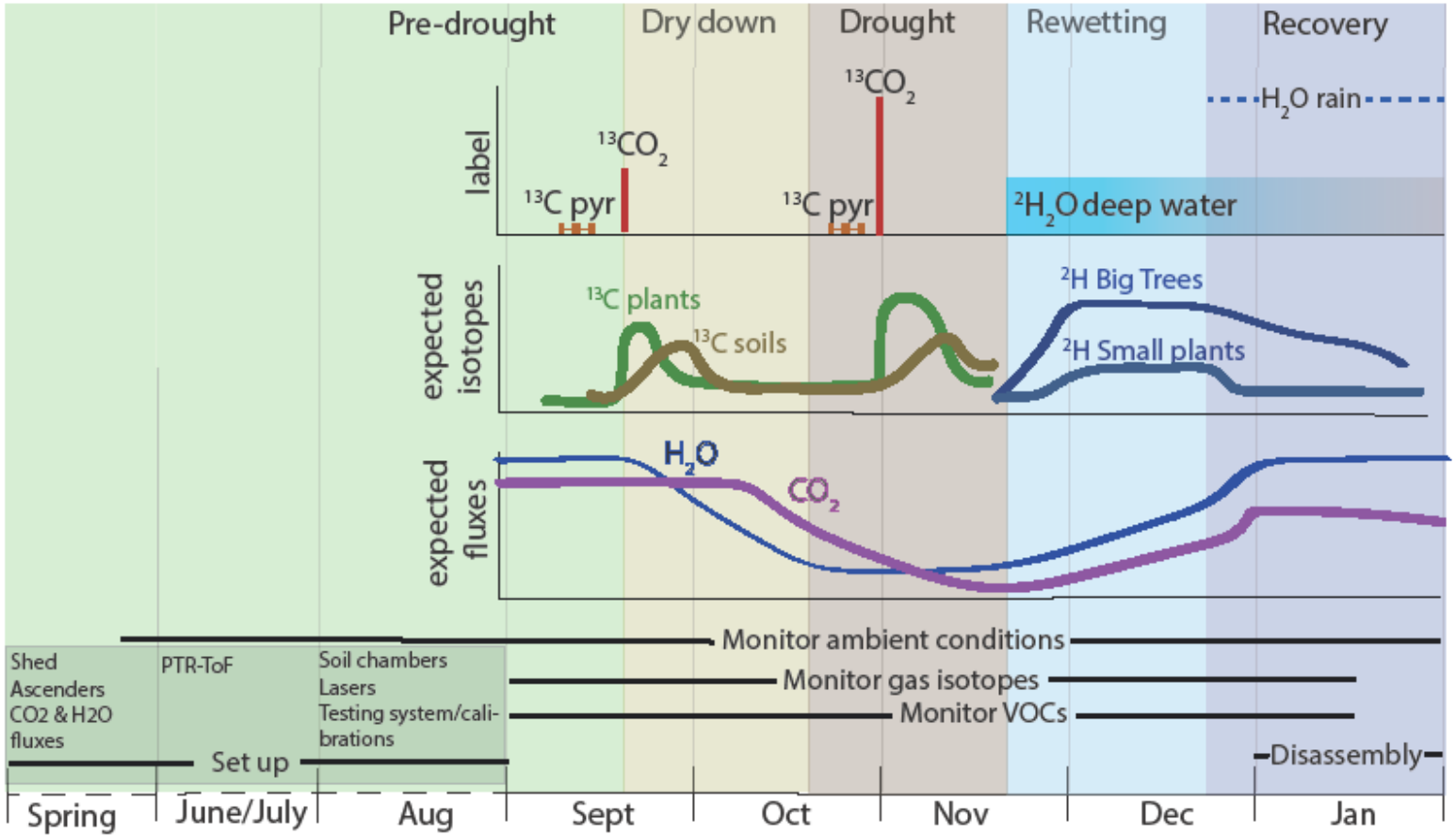
BIOSPHERE 2 WALD
WATER ATMOSPHERE AND LIFE DYNAMICS

TEXAS
The University of Texas at Austin

BIOGENIC VOC EMISSIONS UNDER DROUGHT AND TEMPERATURE STRESS: CONCENTRATIONS OF TOWER GRADIENT



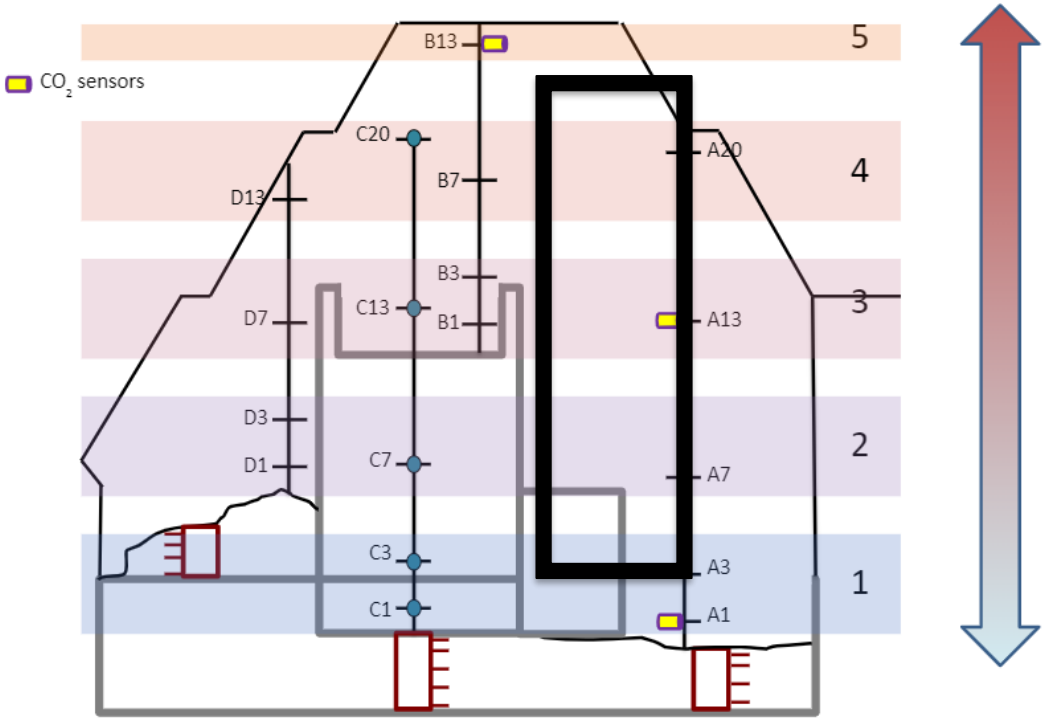

Pre-drought
Dry down
Drought
Rewetting
Recovery
label
$^{13}CO_2$
^{13}C pyr
$^{13}CO_2$
^{13}C pyr
H_2O rain
^2H_2O deep water
expected isotopes
^{13}C plants
^{13}C soils
^2H Big Trees
^2H Small plants
expected fluxes
H_2O
CO_2
Monitor ambient conditions
Monitor gas isotopes
Monitor VOCs
Shed
Ascenders
CO2 & H2O
fluxes
PTR-ToF
Soil chambers
Lasers
Testing system/cali-
brations
Set up
Disassembly
Spring
June/July
Aug
Sept
Oct
Nov
Dec
Jan

Atmospheric VOC tower gradient

- 5 heights (1 m, 3 m, 7 m, 13 m, 20 m)
- Connected to Ionicon PTR-QiTof via multi-port valves
- Measured counts per second of ~1400 unique mass/charge ratios

@DrLauraMeredith, 2019

B2 rainforest height zones



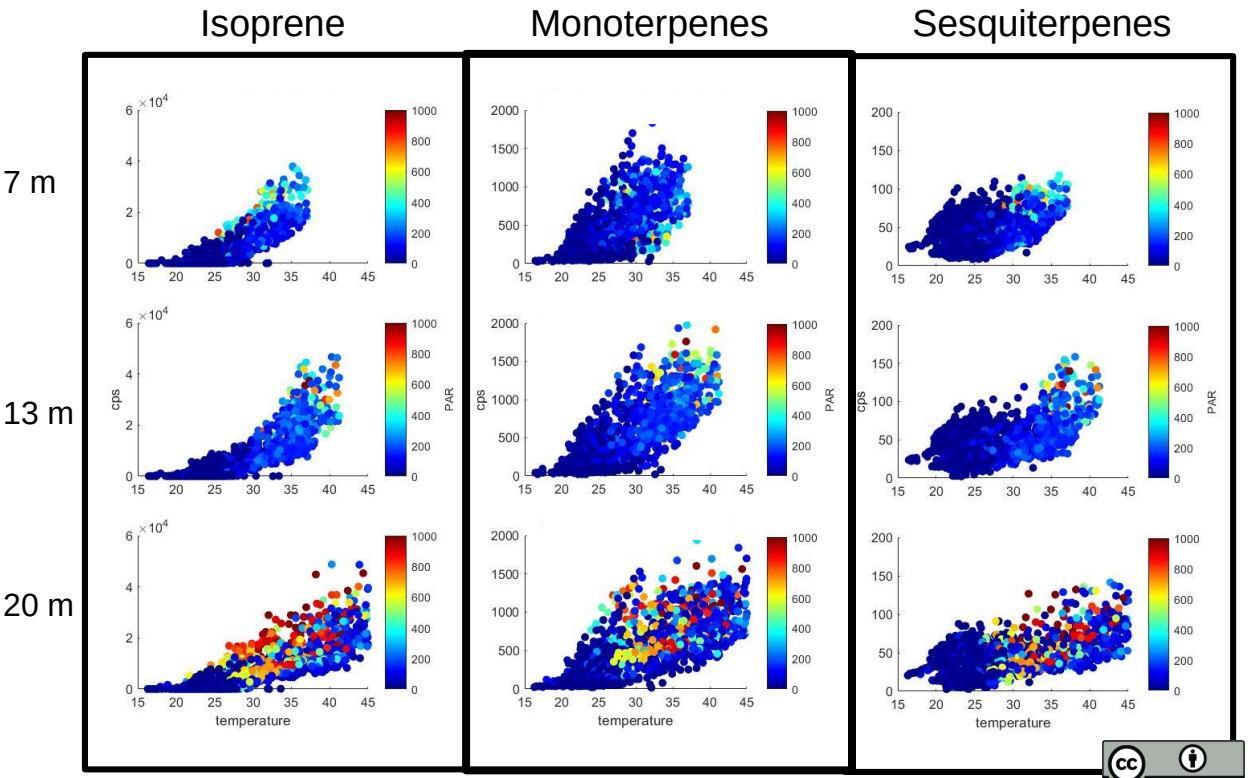
Joost van Haren, 2019

Important hydrocarbon VOCs for analysis

PAR = Photosynthetically active radiation [µmol s^{-1} m^{-2}]

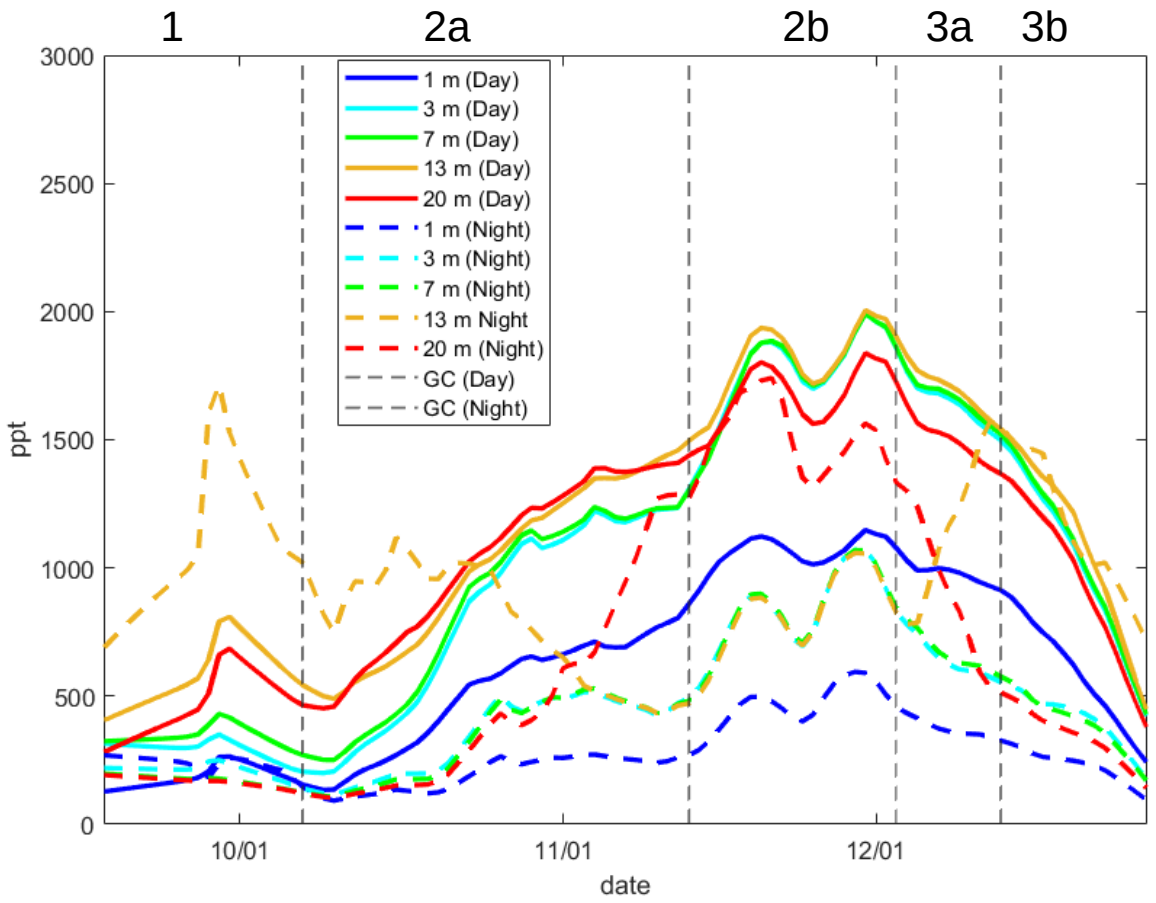
cps = counts per second

- **Isoprene (C_5H_8)**
  - temperature and PAR dependent
  - Most abundant BVOC at ~500 Tg/year (comparable to methane of 570 Tg/year)
- **Monoterpenes ($C_{10}H_{16}$)**
  - Some isomers dependent on temp and PAR, some are not
  - a-pinene, b-pinene most abundant
- **Sesquiterpenes ($C_{15}H_{24}$)**



Yee et al. Atmos. Chem. Phys., 2018

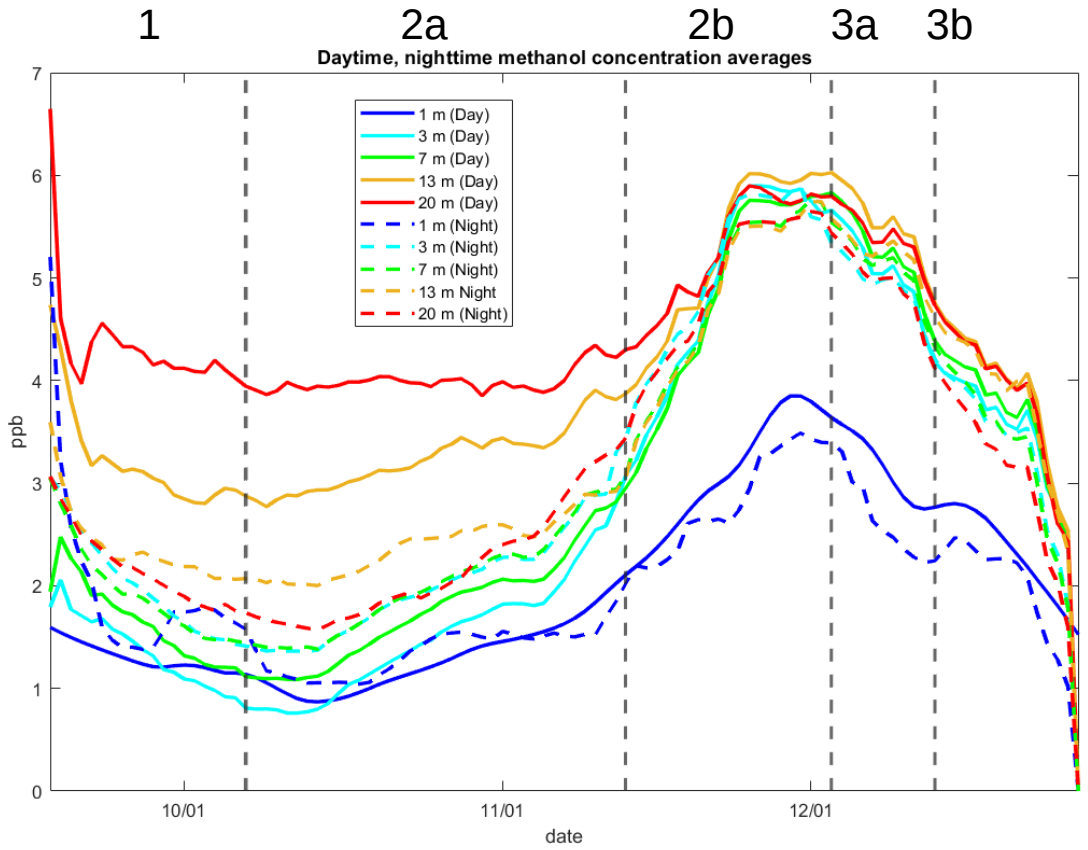
Monoterpene



Sections:

1. Pre-drought
2a. Drought stage 1
2b. Drought stage 2
3a. Deep rewet
3b. Rain rewet

Methanol



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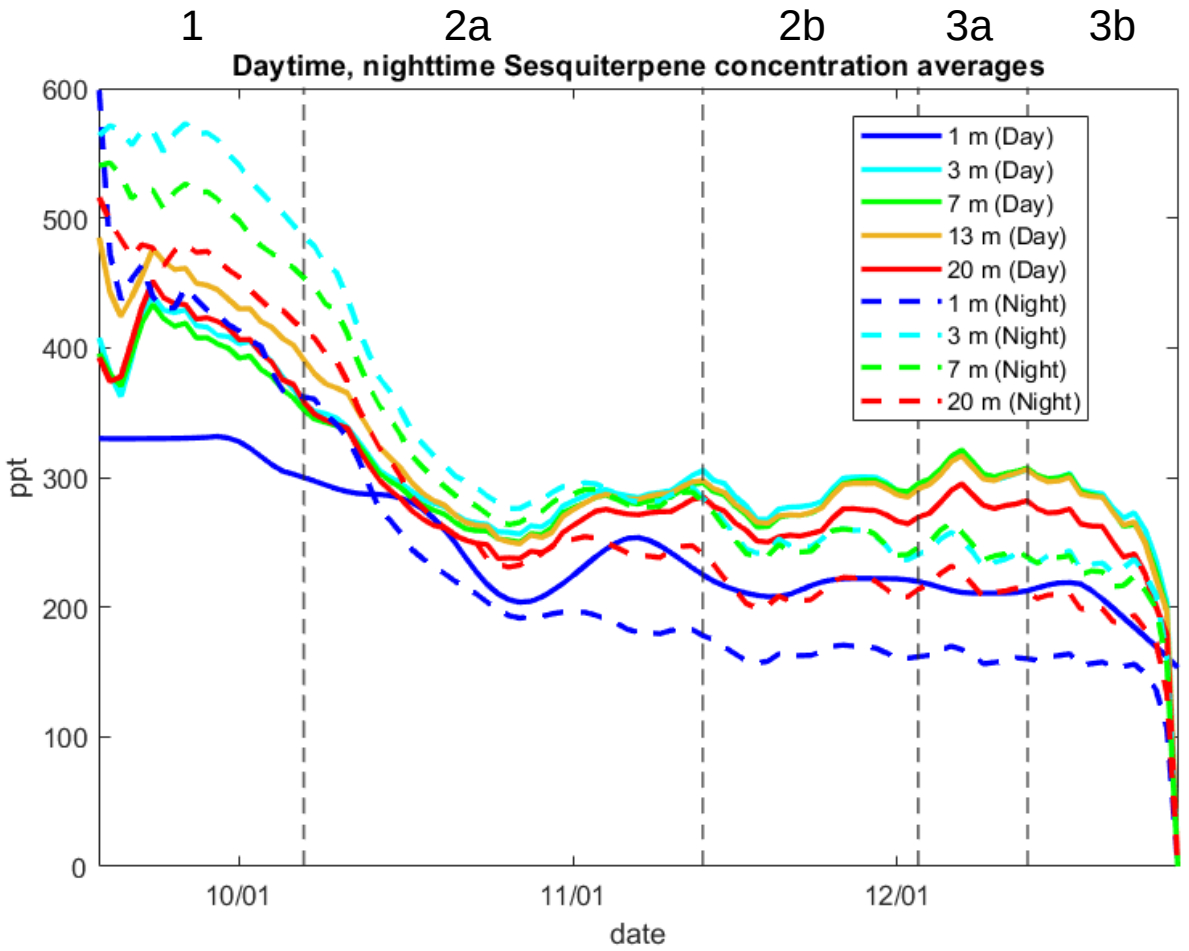
Sesquiterpene



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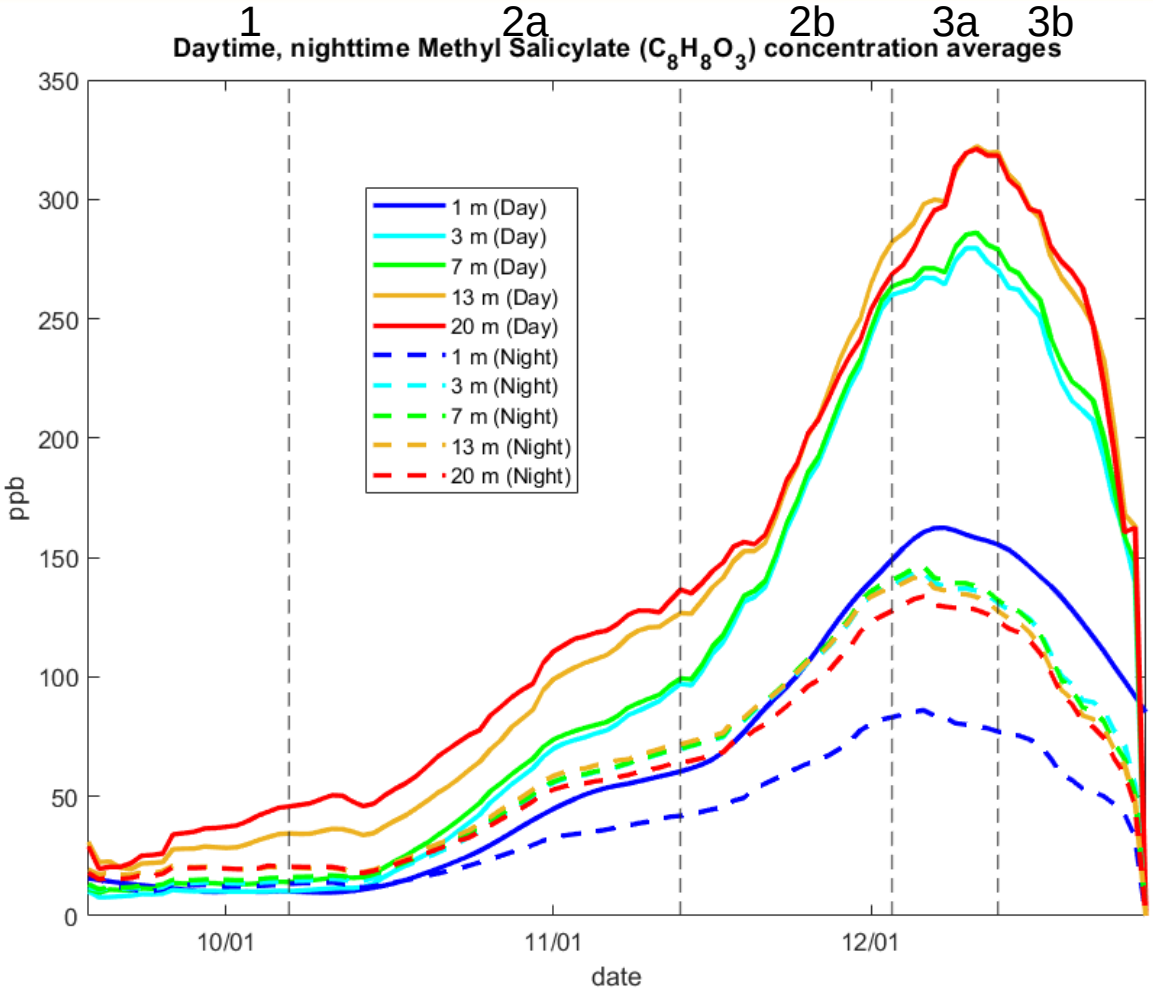
Methyl Salicylate



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Conclusions

- Further work:

1. Take advantage of PTR-MS resolution to look at trace VOCs such as diterpenes ($C_{20}H_{32}$) or known stress markers
2. Examine total VOC (TVOC) concentrations throughout different periods
3. Compare results with Model of Emission and Aerosols from Nature (MEGAN) (Guenther et al. 2012)

Erik Daber, 2019

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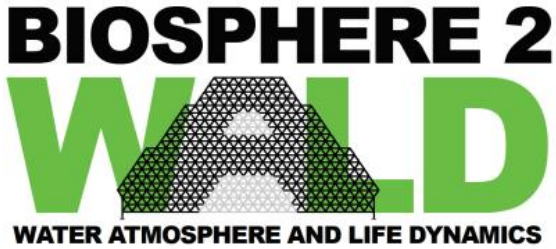

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