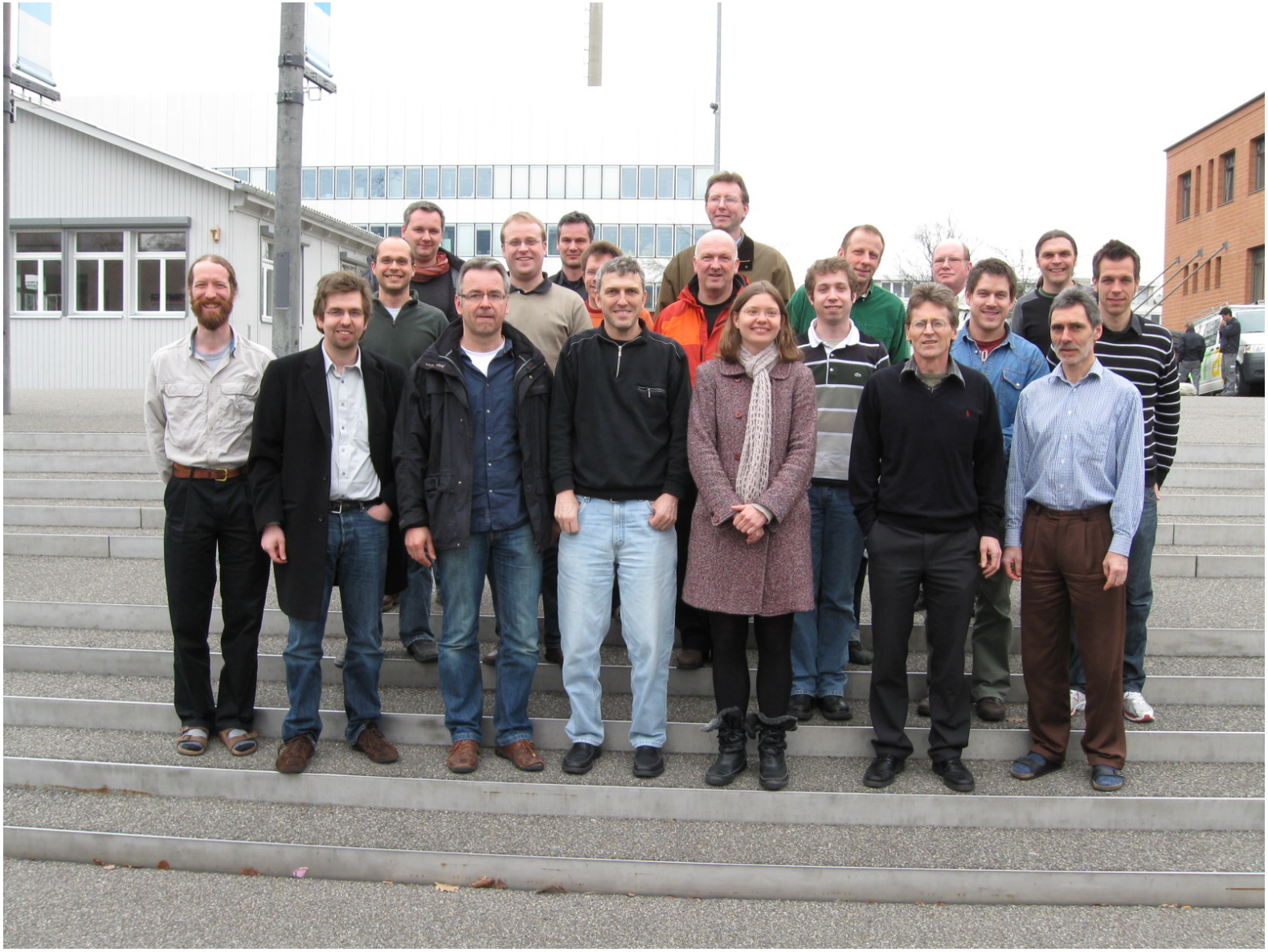
MUCHACHAS

Multiple Chamber Aerosol Chemistry and Ageing Studies

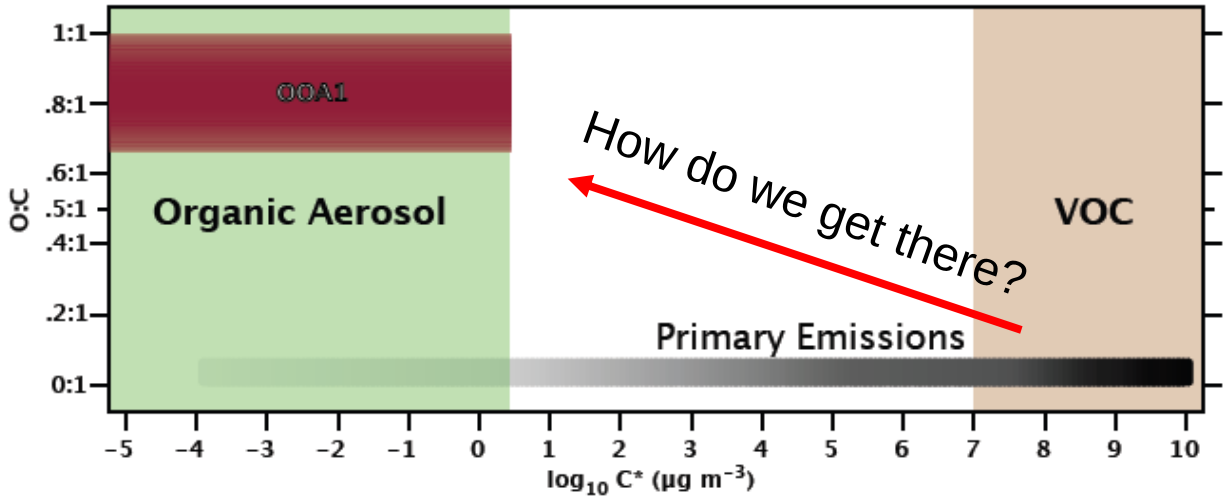


MUCHACHAS Goals

investigate later-generation oxidation of `traditional' SOA formed from ozone + terpene reactions

- **Reaction with OH radicals (in the dark, under light)**
- **Characteristic reaction products**
- **Changes in composition (e.g. C:O ratio)**
- **Changes of physical properties (e.g. volatility)**
- **Temperature dependence (253-313K)**

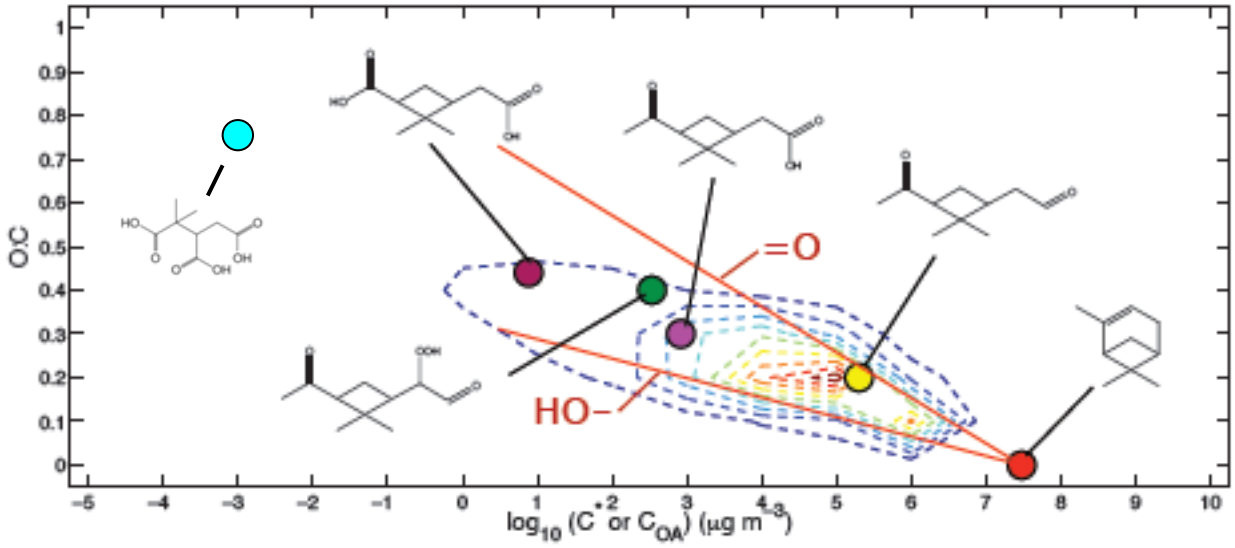
OC is not very volatile and very oxidized



OC is waaay to the left → < 10 μgm^{-3}

OOA has 0.7 < O : C < 1.0 [Aiken *et al,* 2007]

α-pinene SOA



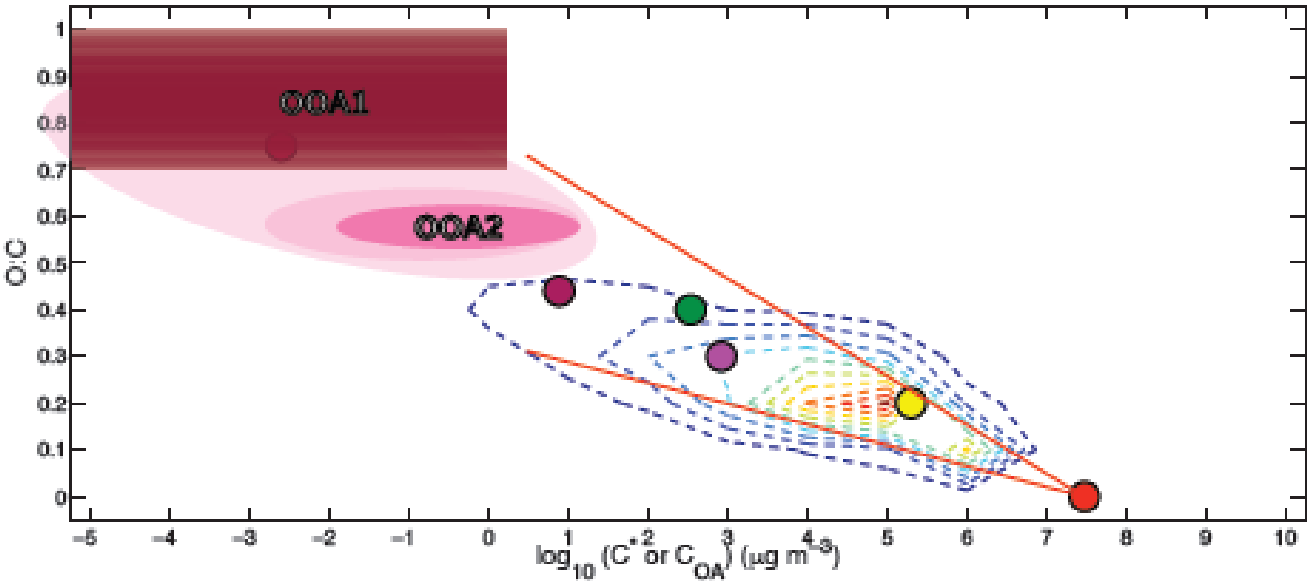
2 general oxygenated functionalities [Pankow].

~ ÷10 per =O

~ ÷100 per –OH

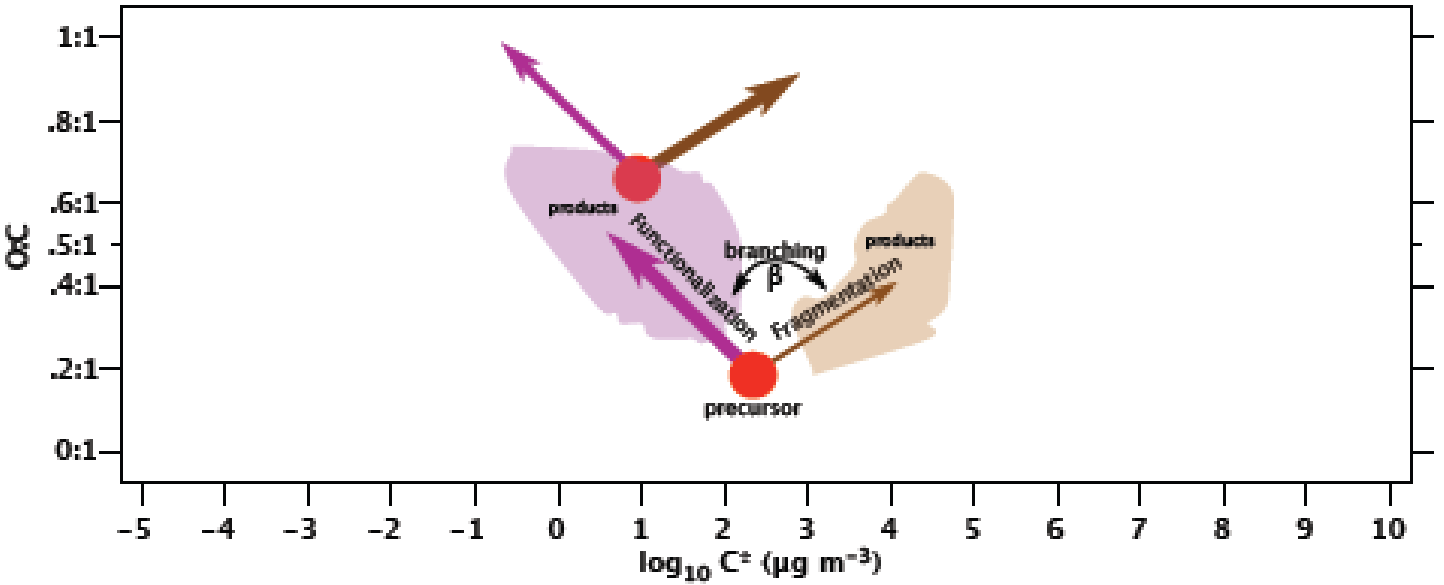
Donahue *et al., Atm. Env.,* 2008; **Grieshop** *et al., GRL*, 2007; **Shilling** *et al., ACP,* 2008

Does α-pinene SOA = OOA?



- Too volatile and O:C too low. So, NO.
- However, some aging products like the Claes C8 triacid do look promising.

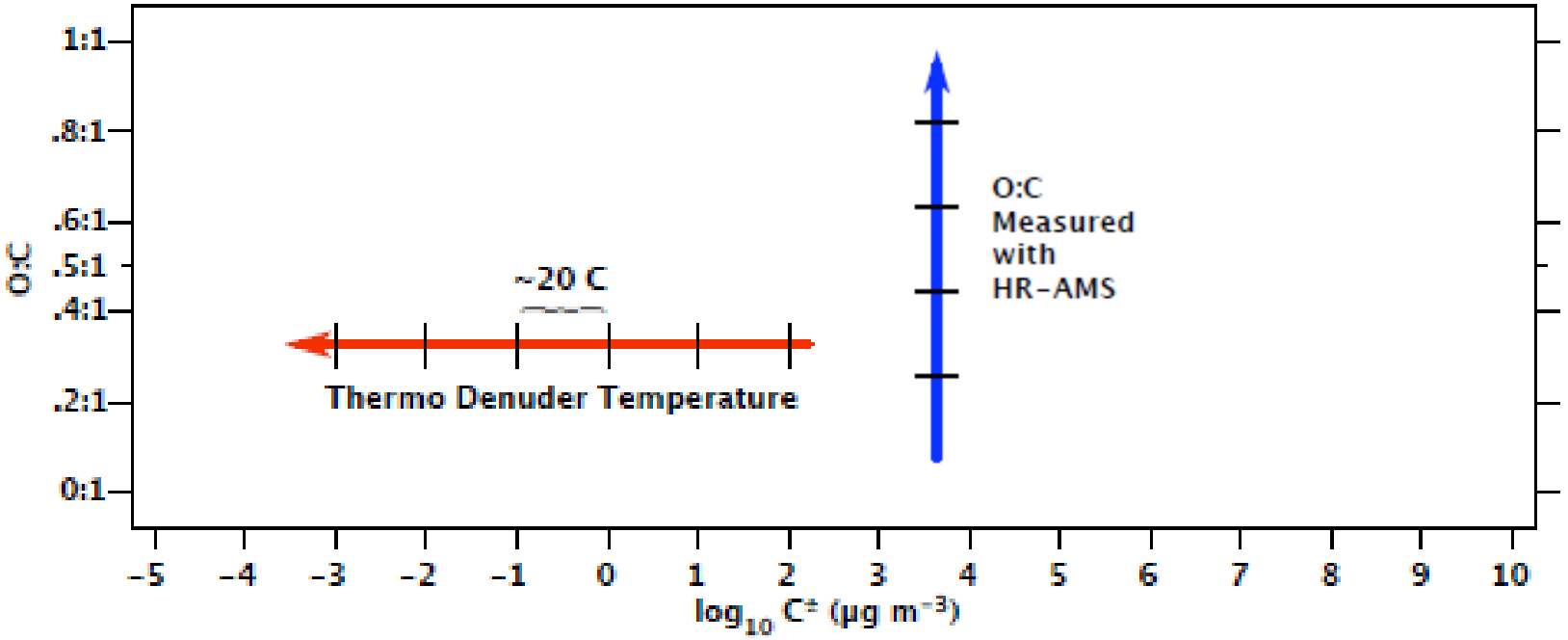
What does Chemistry do?



- Oxidation tends to move upward in O:C.
- End product if reactions go to completion is CO2.
- Making lower C*!* stuff – SOA – is swimming upstream.

− Fragmentation probability related to substitution, i.e. *&* O:C

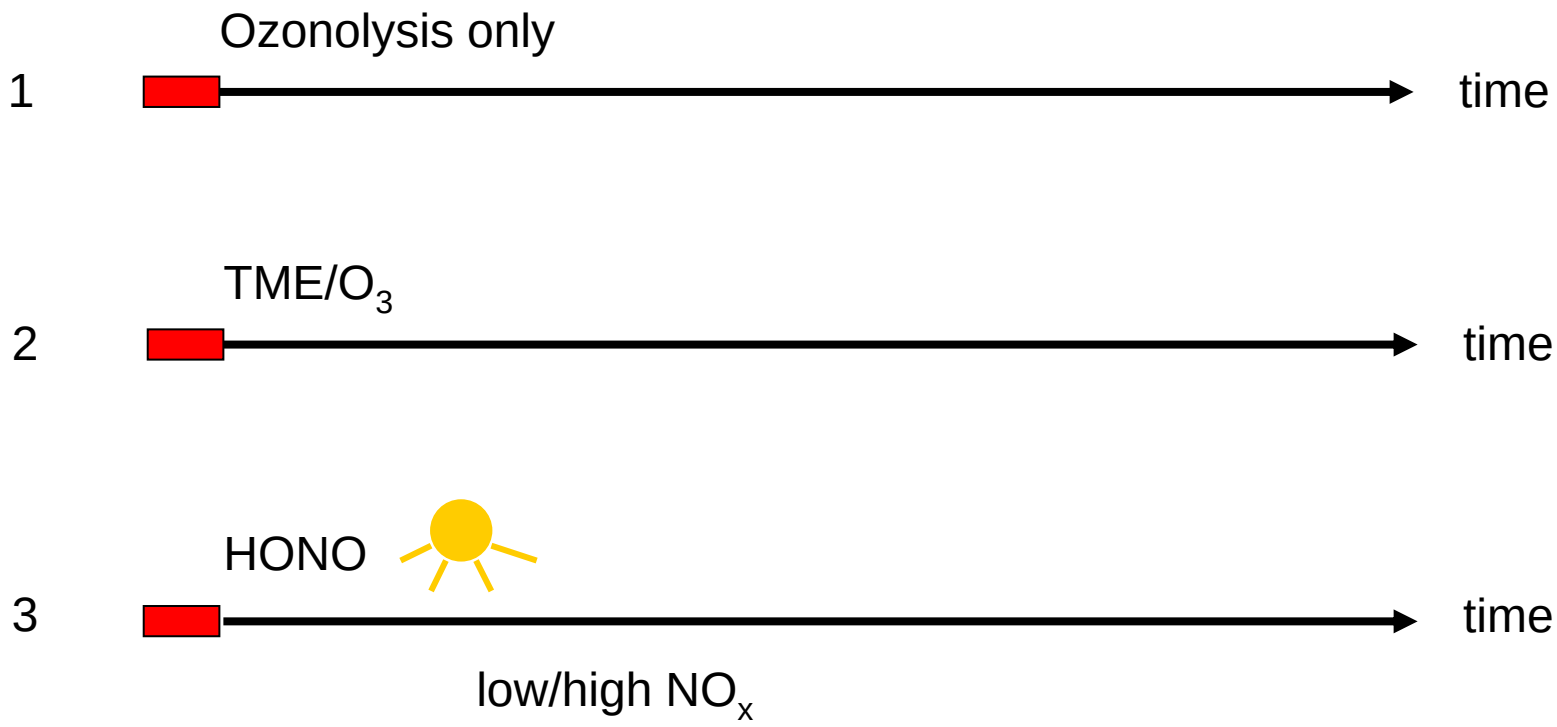
How do we place stuff in 2D?



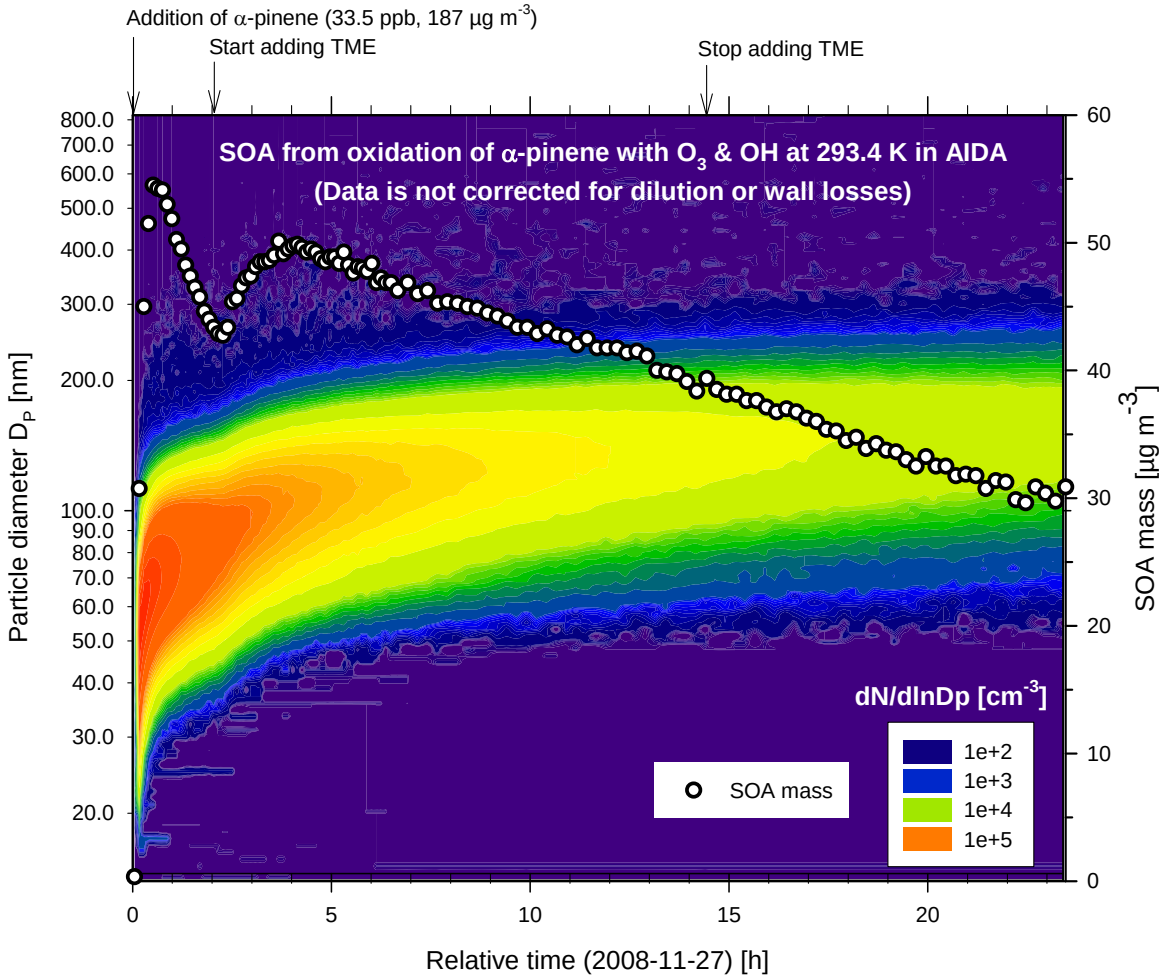
High-resolution MS constrains O:C
Thermodenuders constrain C*

Experiments

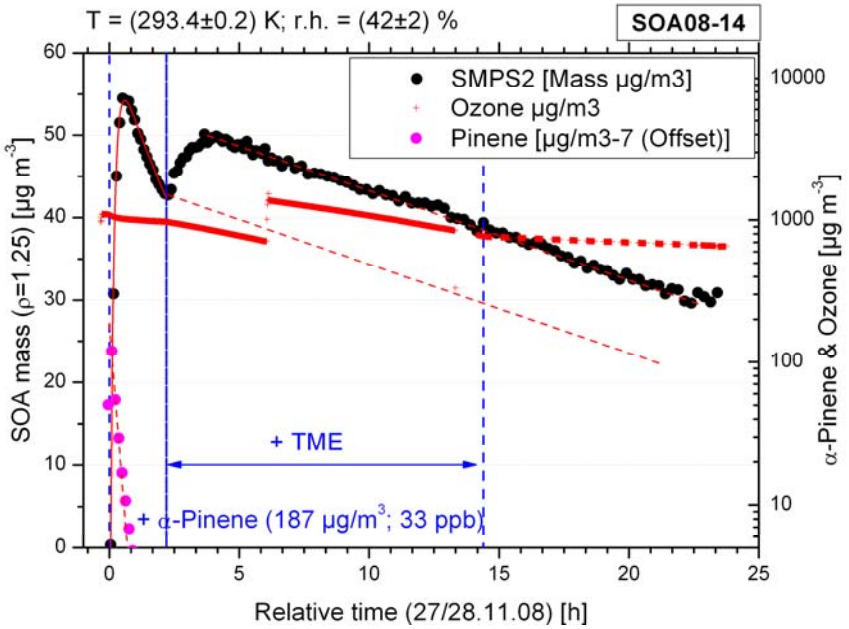
SOA from α-pinene ozonolysis is the starting point



AIDA: dark OH, T= 293.4 K



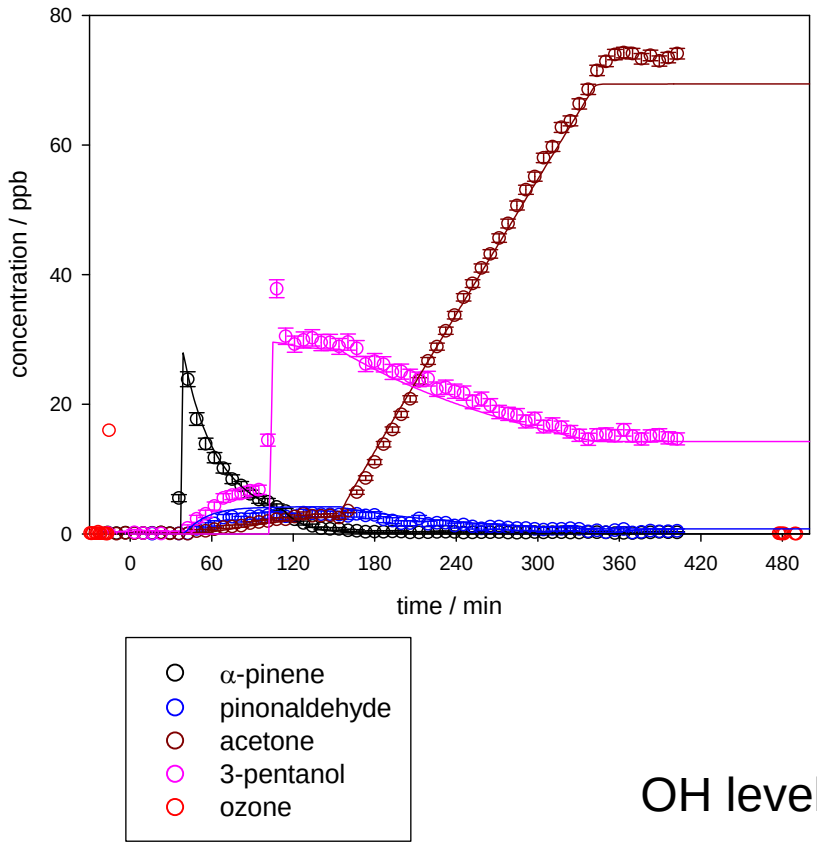
AIDA: dark OH, T= 293.4 K



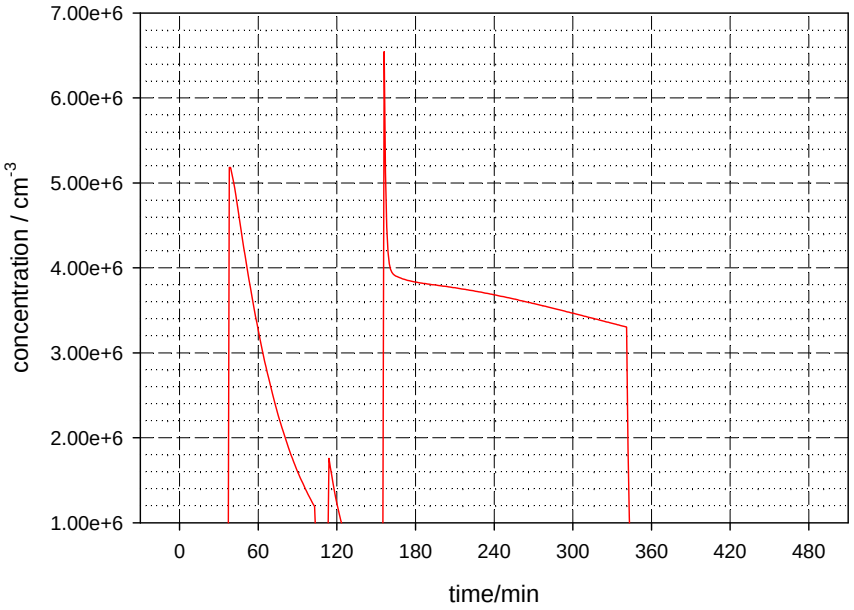
- **Addition OH radicals to SOA from ozonolysis of α-pinene resulted in**
- **additional formation of SOA mass in the order of 10-20%**
  - **the additional mass is formed typically within one hour**
  - **there seems to be no strong dependence on temperature (253-313K)**

Determination of OH levels with MCM

SOA 08-2 293.2 K

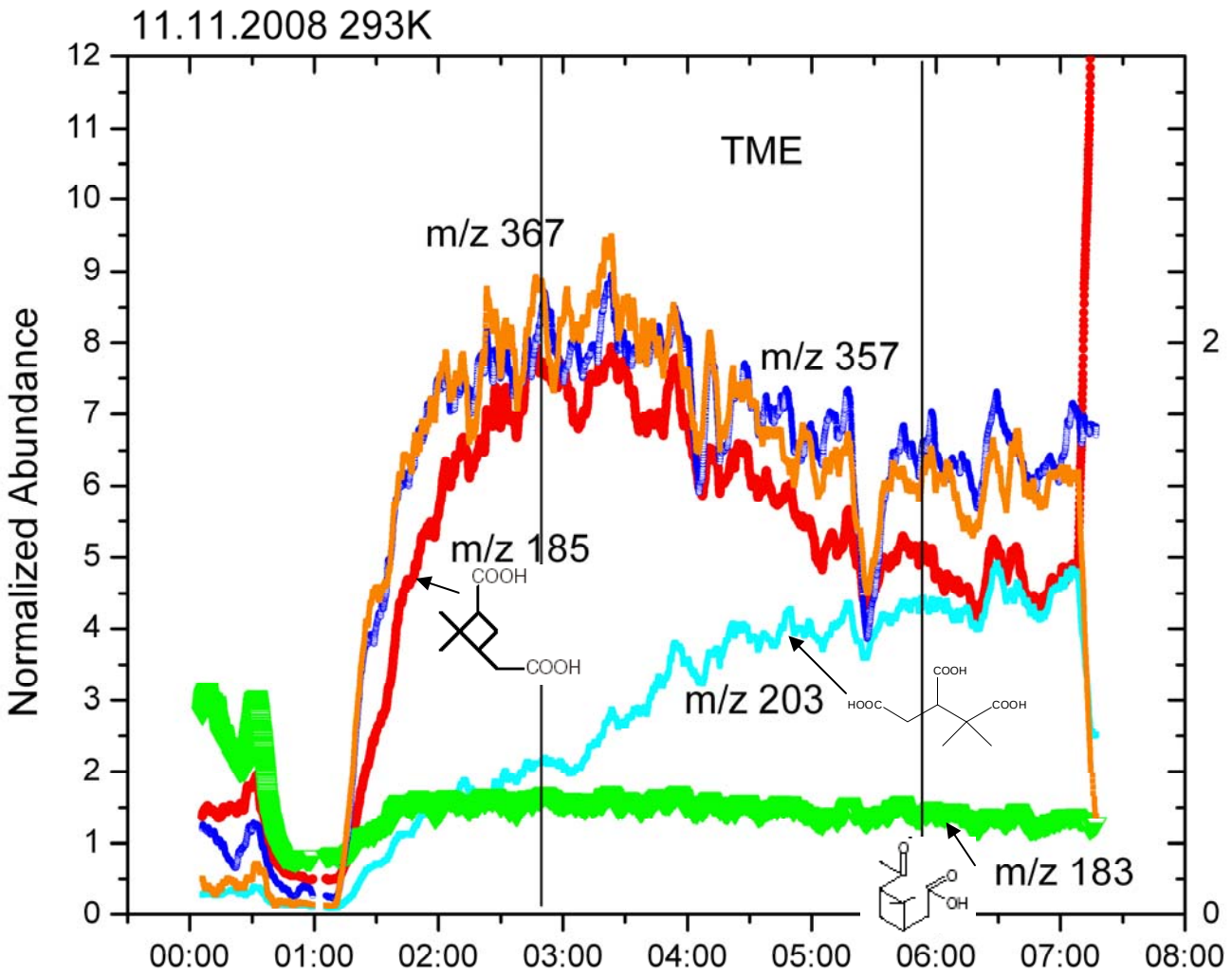


SOA 08-2: OH concentration



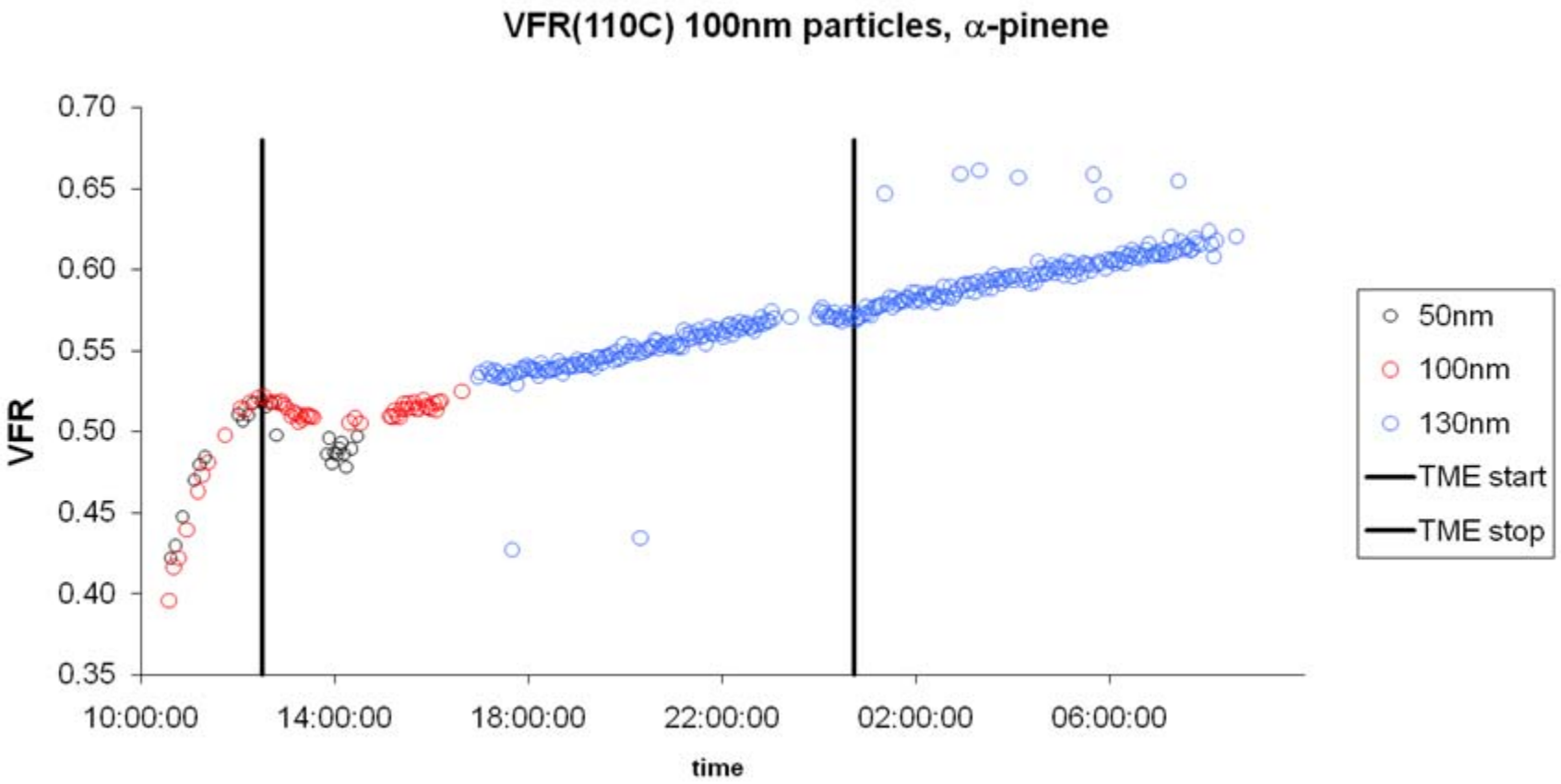
OH levels between $2*10^6$ cm^{-3} and $12*10^6$ cm^{-3}

AIDA: APCI-MS



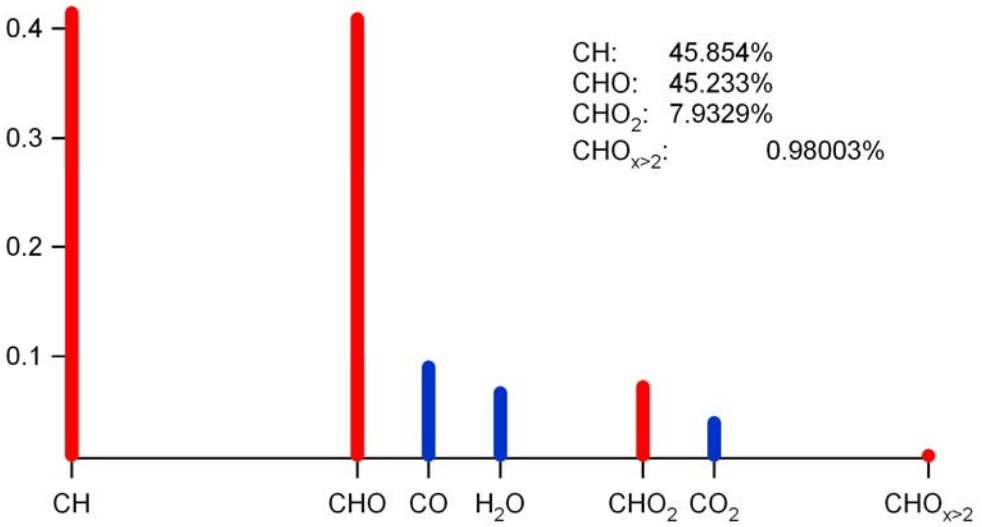
- Pinic acid seems to have a significantly lower vapour pressure than cis-pinonic acid
- 3-methyl-1,2,3-butanetricarboxylic acid identified produced from pinonic acid

AIDA: volatility

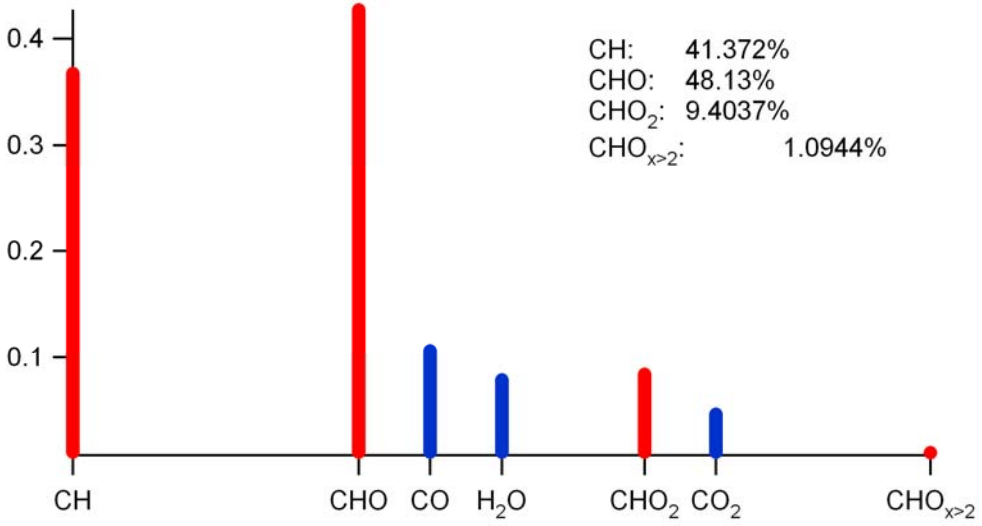


HR-AMS-TOF-MS: Limonene

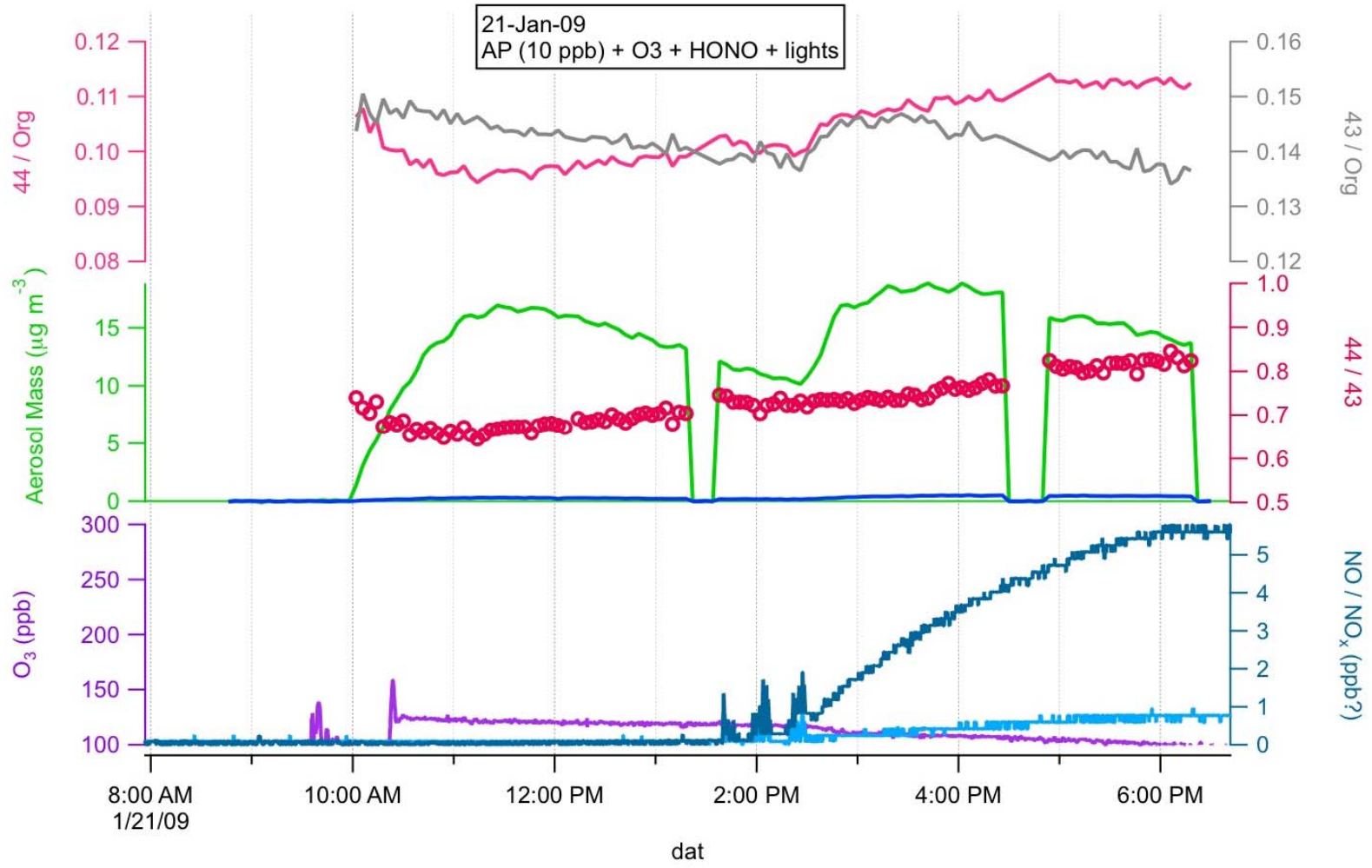
before TME-addition



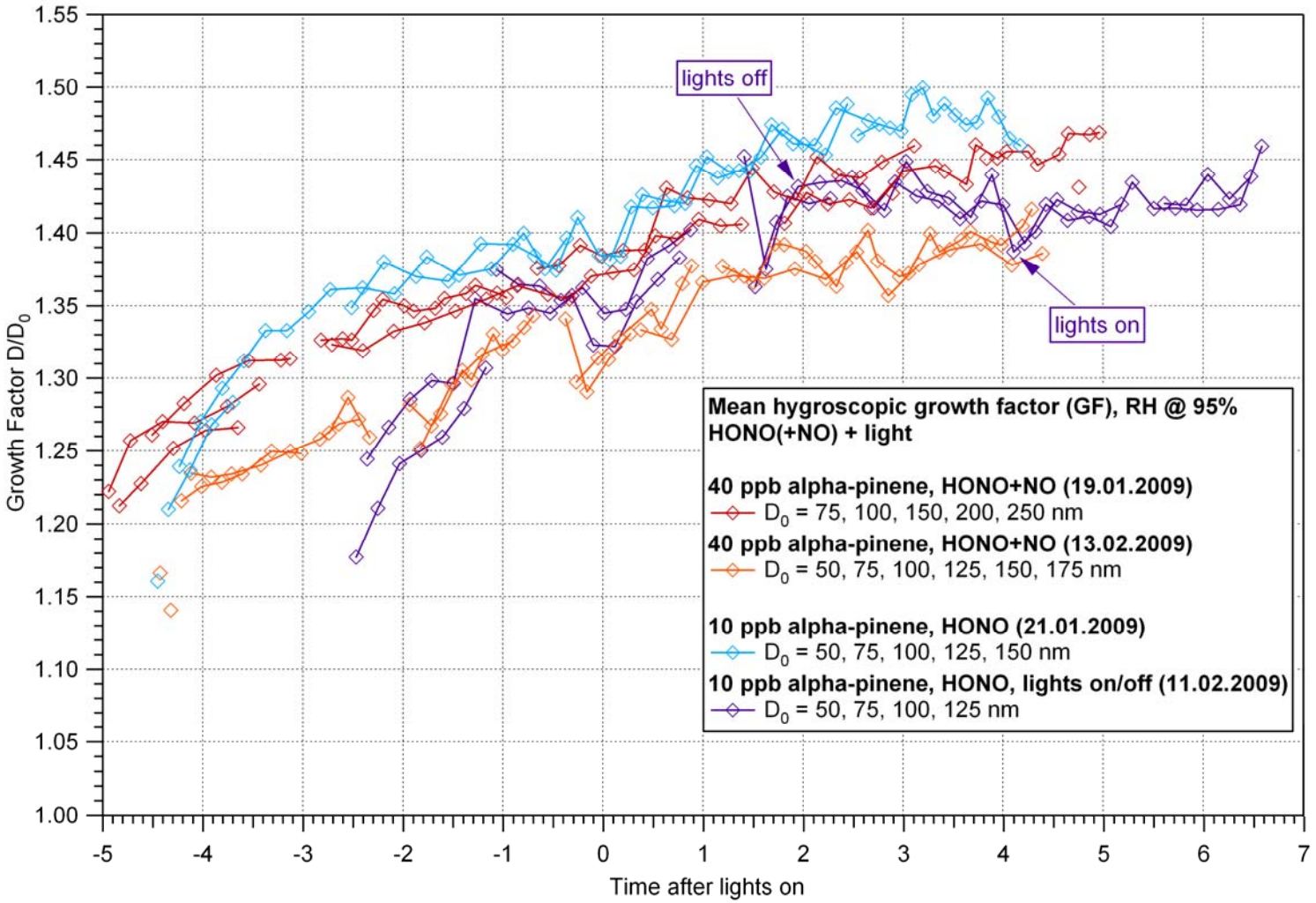
after TME-addition



PSI: AMS-ToF-MS



Hygroscopicity; CCN-activity ⇒ Poster



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