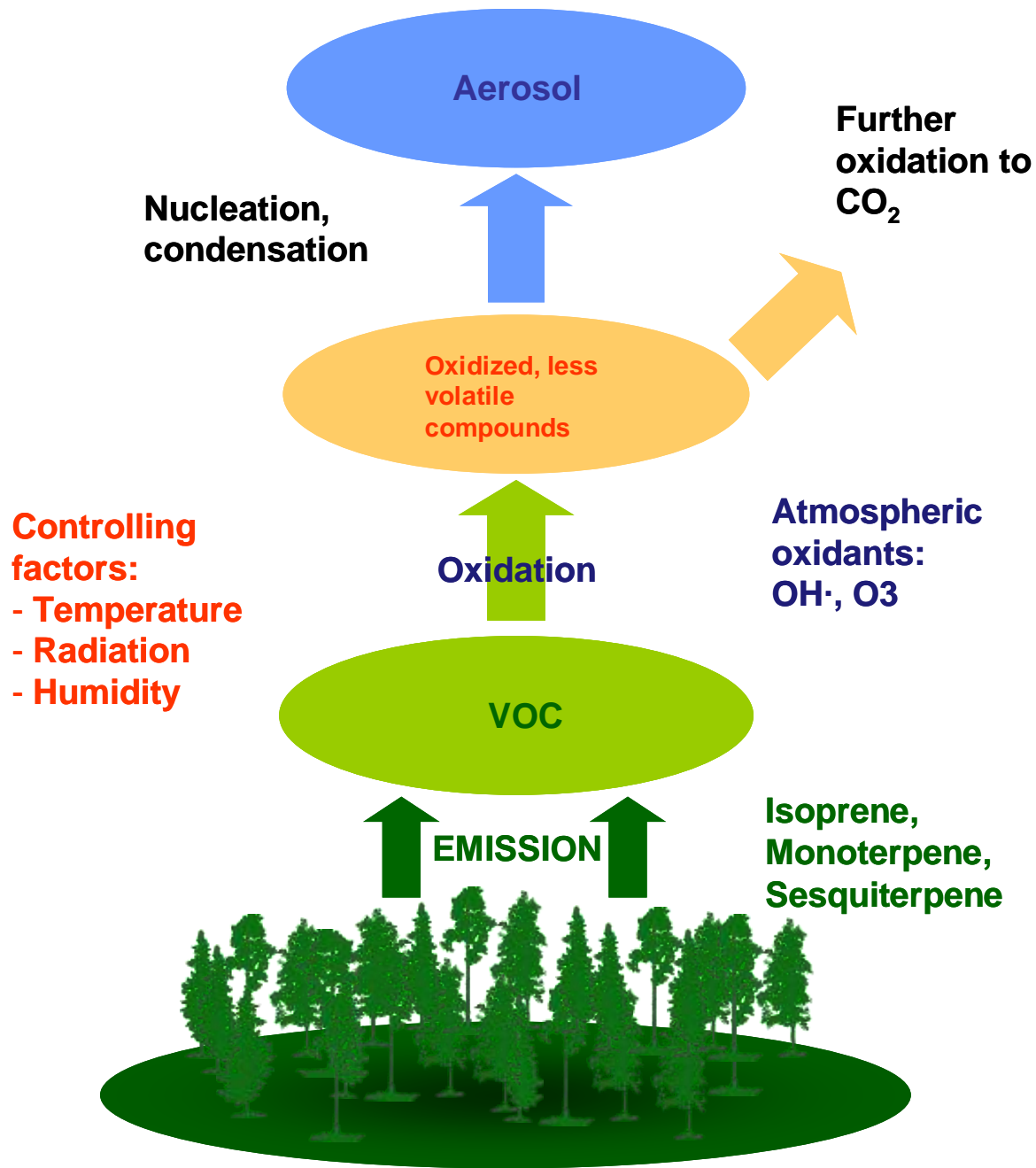


Aerosol formation potential of plant emissions - analysis of plant chamber experiments

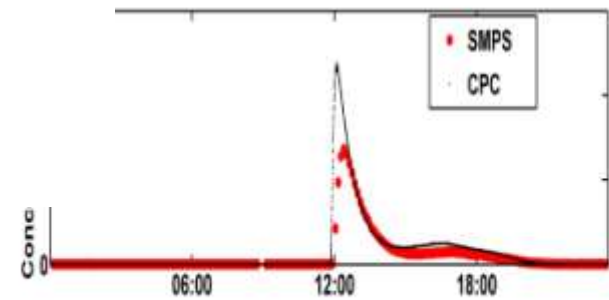
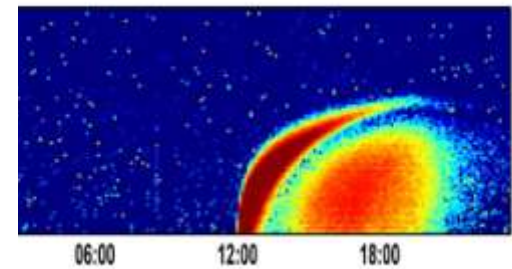
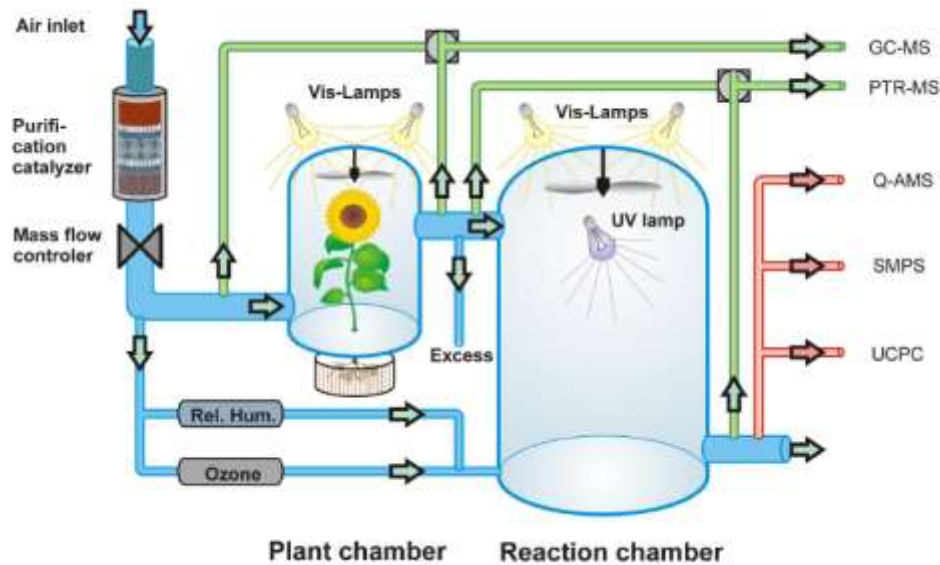
M. Dal Maso^{1,2}, A. Kiendler-Scharr¹, T. Hohaus¹, E. Kleist¹, R. Tillmann¹, R. Uerlings¹, T. Mentel¹, J. Wildt¹

*¹Institut für Chemie und Dynamic der Geosphäre,
Forschungszentrum Jülich, D-52425 Jülich, Germany*

*²University of Helsinki, Dept. of Physics, P.O. Box 64, FIN-00014
Univ. of Helsinki, Finland*



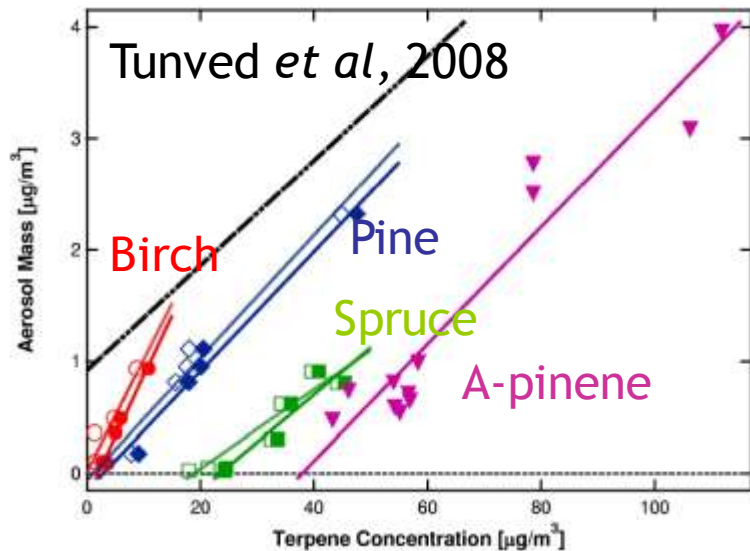
Background: the Jülich plant chamber – reaction chamber setup



UV on

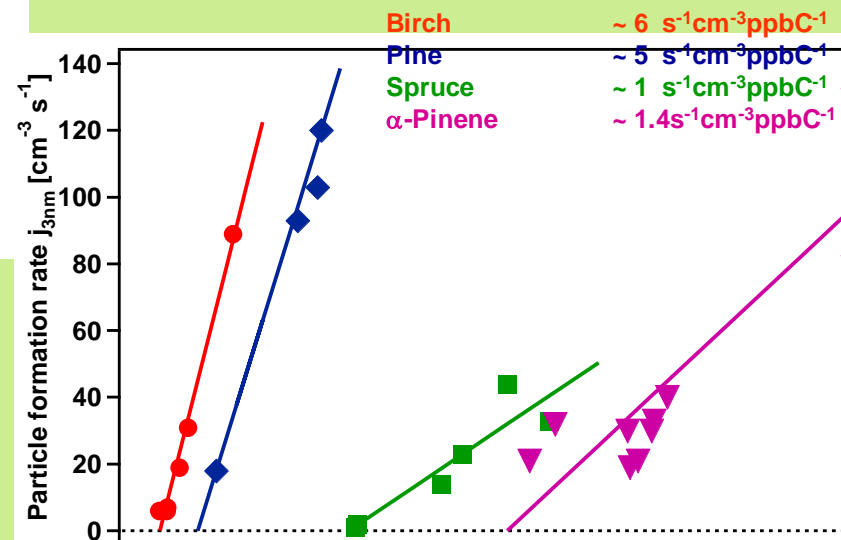
Light on

Plant chamber general result: VOC mixture matters!



- Positive correlation with:
 - RH
 - UV irradiation
 - Plant chamber T

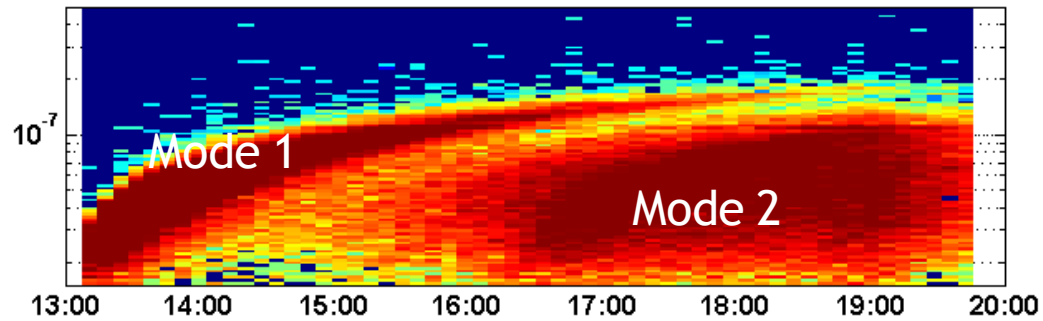
- Generally: more VOCs \rightarrow more aerosol
- pure alpha-pinene the weakest aerosol producer



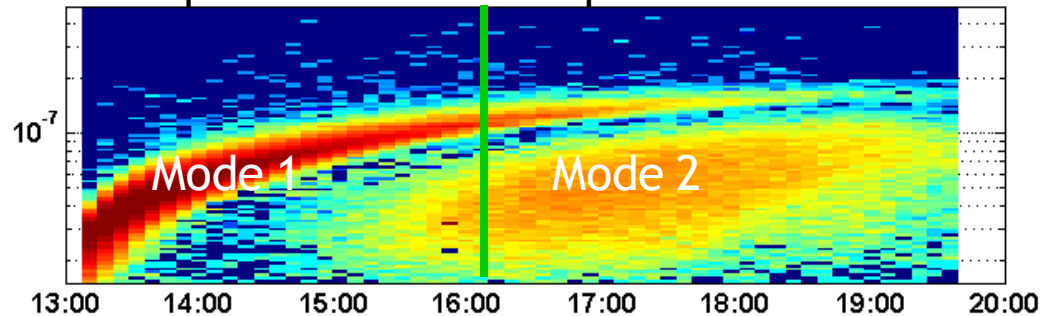
Mentel *et al.*, ACP 2009

The isoprene effect

Plant chamber event: no added isoprene

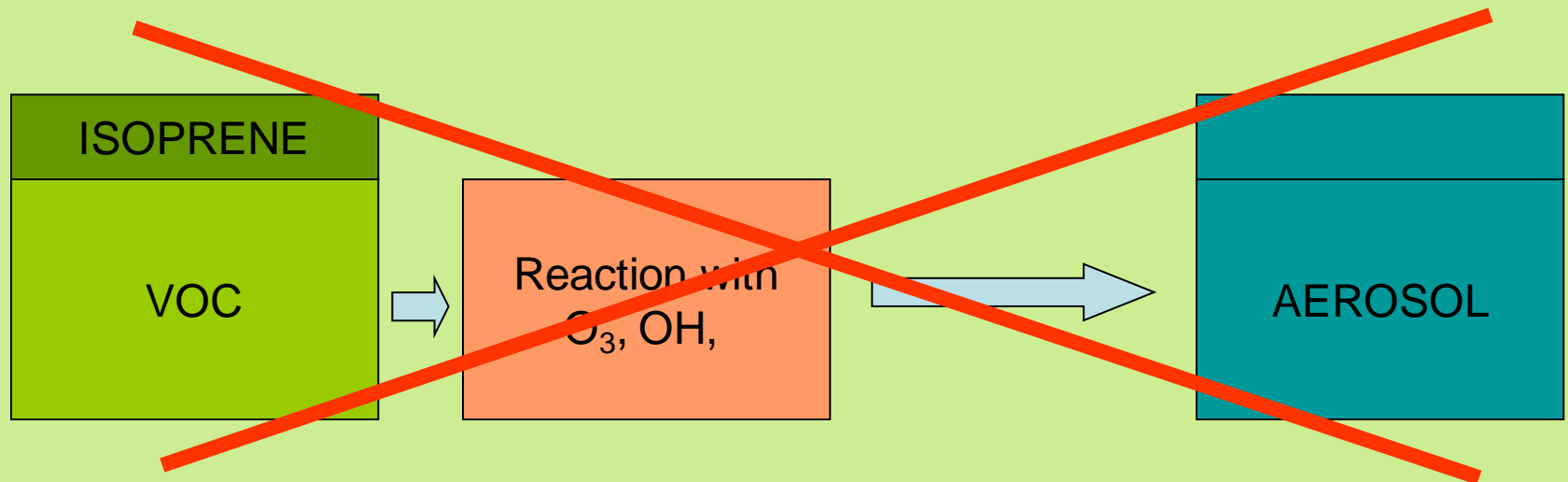


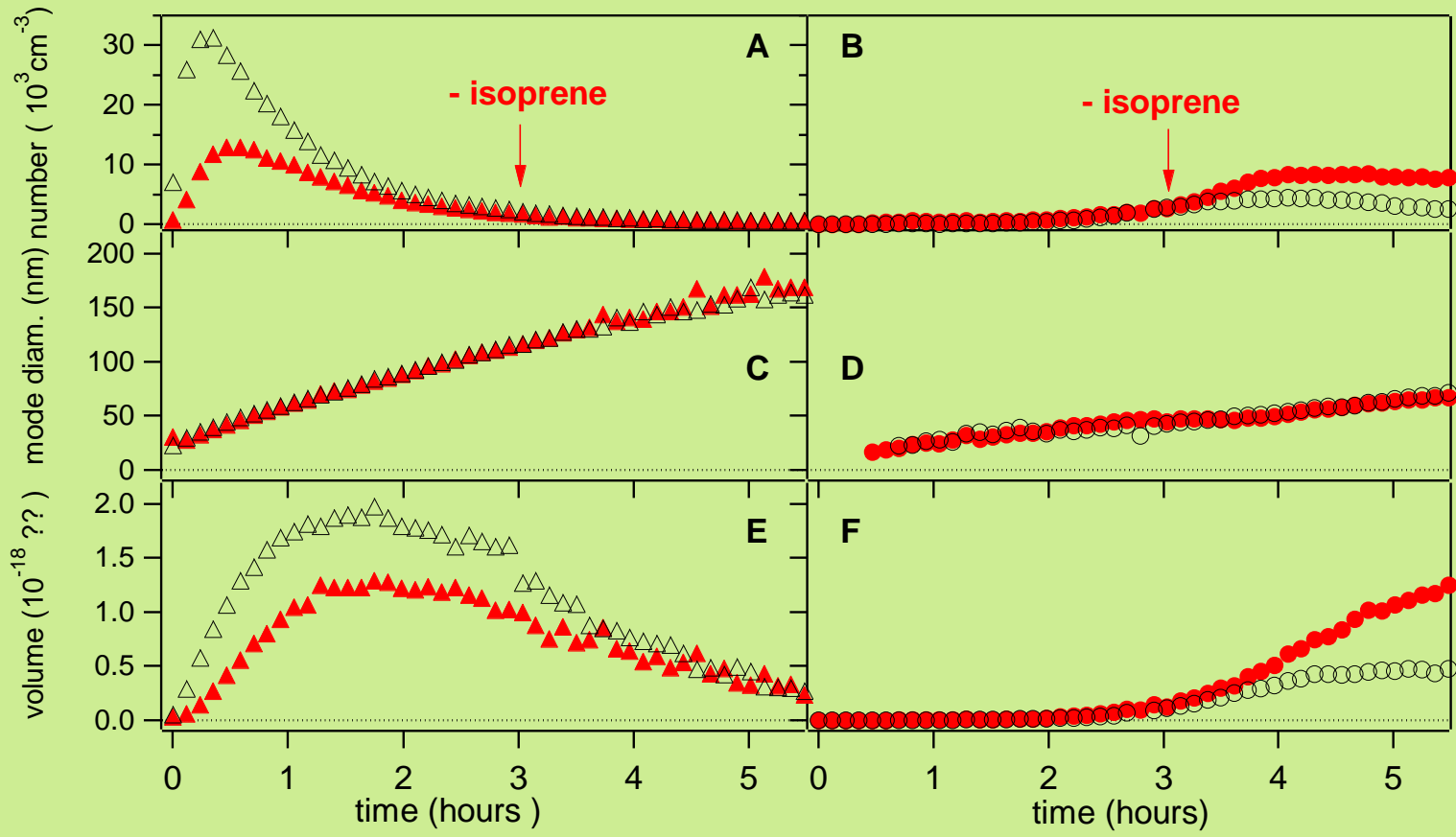
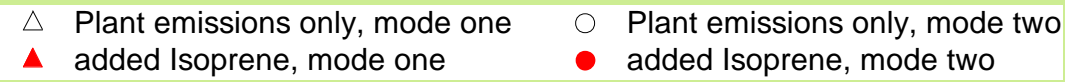
Isoprene added Isoprene off



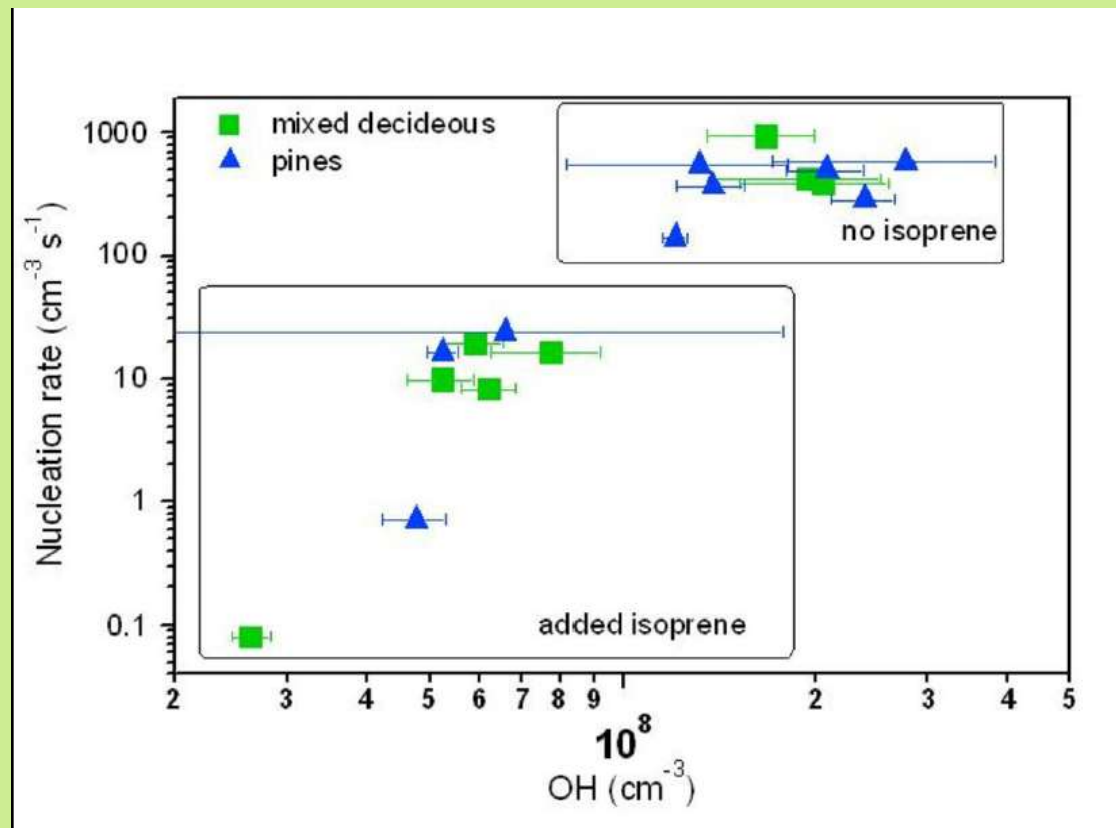
Forest: birch, beech, spruce

The isoprene effect



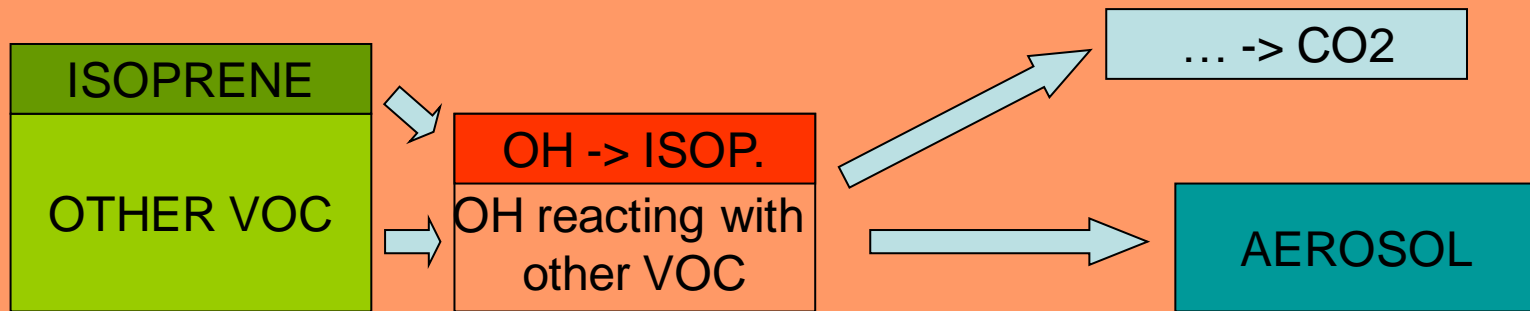


It seems to be an OH effect...



Kiendler-Scharr *et al.*: New particle formation in forests inhibited by isoprene emissions, *Nature*, *in press*

Isoprene competes with other VOCs for OH



How much is the formation inhibited?

- Guess: Particle formation depends on OH-oxidation products, but isoprene-OH products **do not** nucleate
- Simple system tests: α -pinene and isoprene: can be modelled by MCM



- Ideal (No other losses and reactions, steady state...)

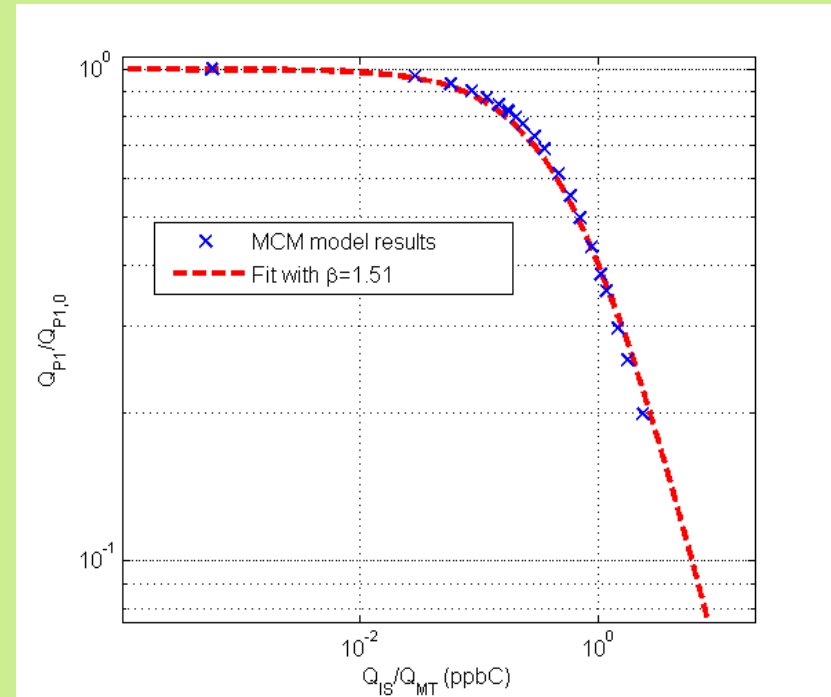
$$\frac{Q_{P1}}{Q_{P1,0}} = \frac{1}{\frac{Q_{Is}}{Q_{\alpha P}} + 1}$$

No Isoprene \nearrow

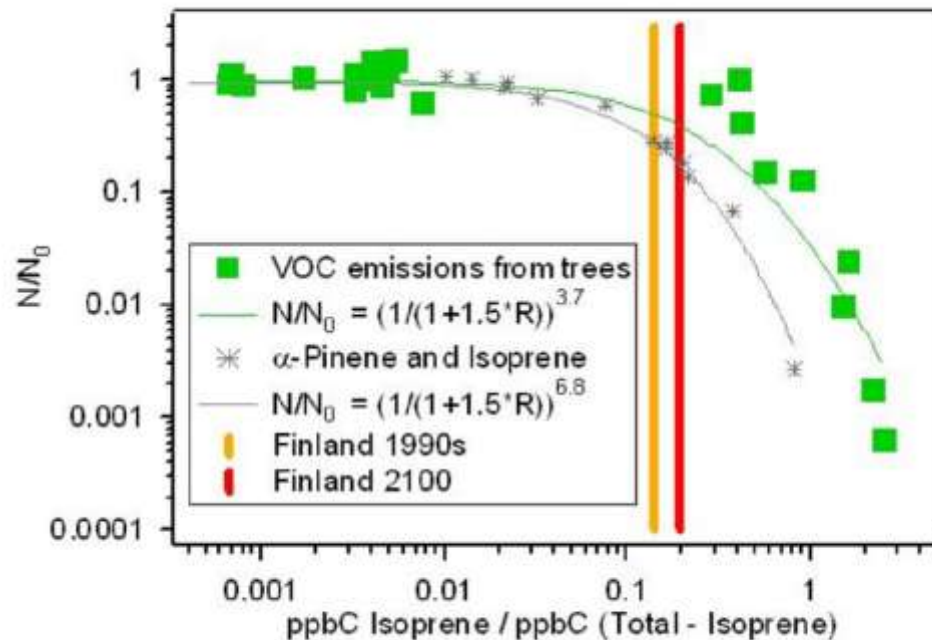
Parameterizing the inhibition by isoprene

$$\frac{Q_{P1}}{Q_{P1,0}} = \frac{1}{\beta \frac{Q_{Is}}{Q_{\alpha P}} + 1}$$

$$\frac{J}{J_0} = \left(\frac{1}{\beta \frac{Q_{Is}}{Q_{\alpha P}} + 1} \right)^n$$



The suppression of nucleation by isoprene



Kiendler-Scharr *et al.*: New particle formation in forests inhibited by isoprene emissions, *Nature*, in press (2009)

Conclusions

- More VOC -> more aerosol is NOT always true
 - The gas-phase chemistry should be considered carefully when studying organic aerosol formation: simple mass yields from precursor(s) don't work!
- The isoprene effect supports the hypothesis that OH oxidation is needed for nucleation
 - The OH effect could explain the RH and UV dependencies found in the chamber
- **Timescales** of oxidation, nucleation, and condensation need to be understood!