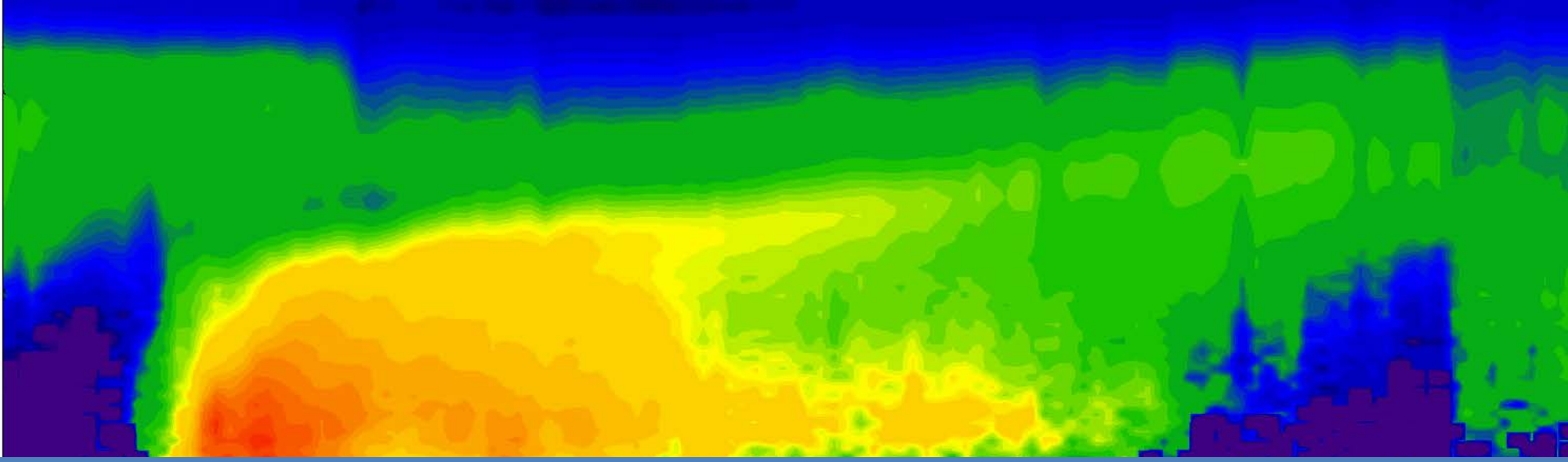
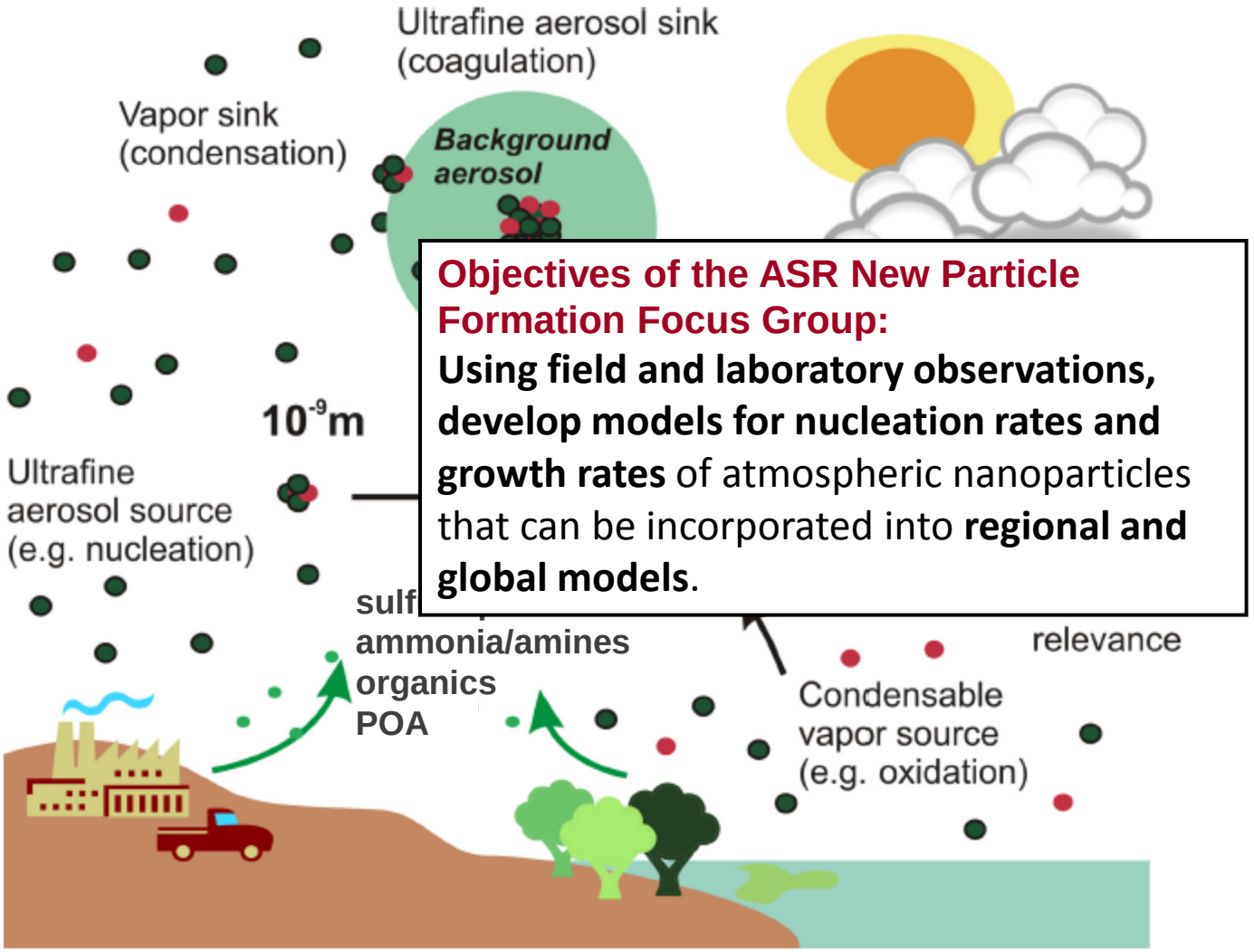


Report on New Particle Formation Focus Group Activities

Jim Smith, Chongai Kuang, Peter McMurry,
and the New Particle Formation Focus Group

17 March 2015
DOE ASR Spring Science Team Meeting

Background: New Particle Formation

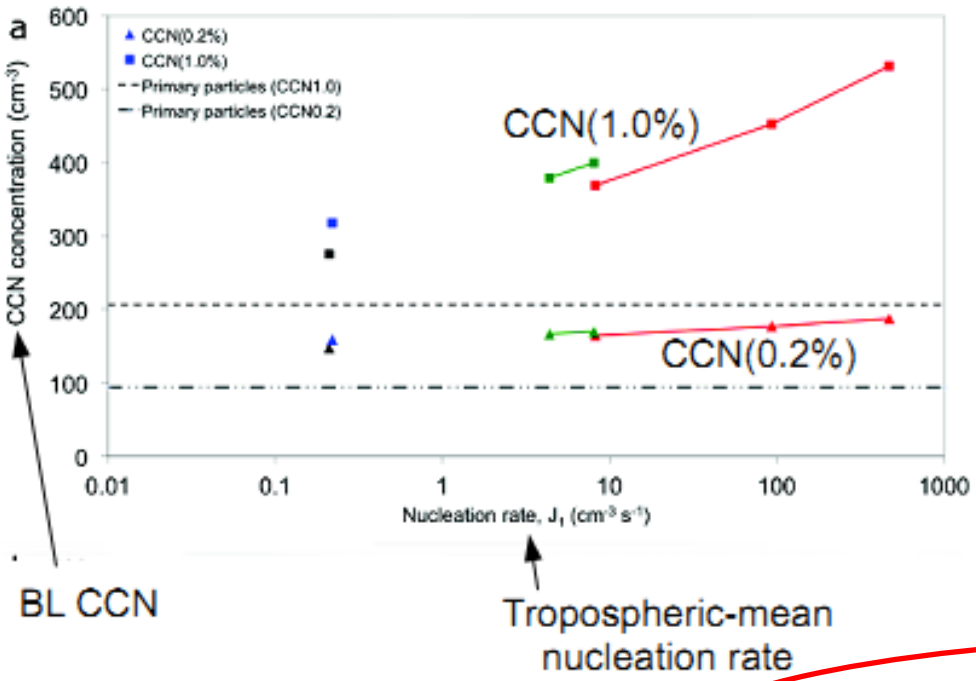


Objectives of the ASR New Particle Formation Focus Group:

Using field and laboratory observations, develop models for nucleation rates and growth rates of atmospheric nanoparticles that can be incorporated into **regional and global models**.

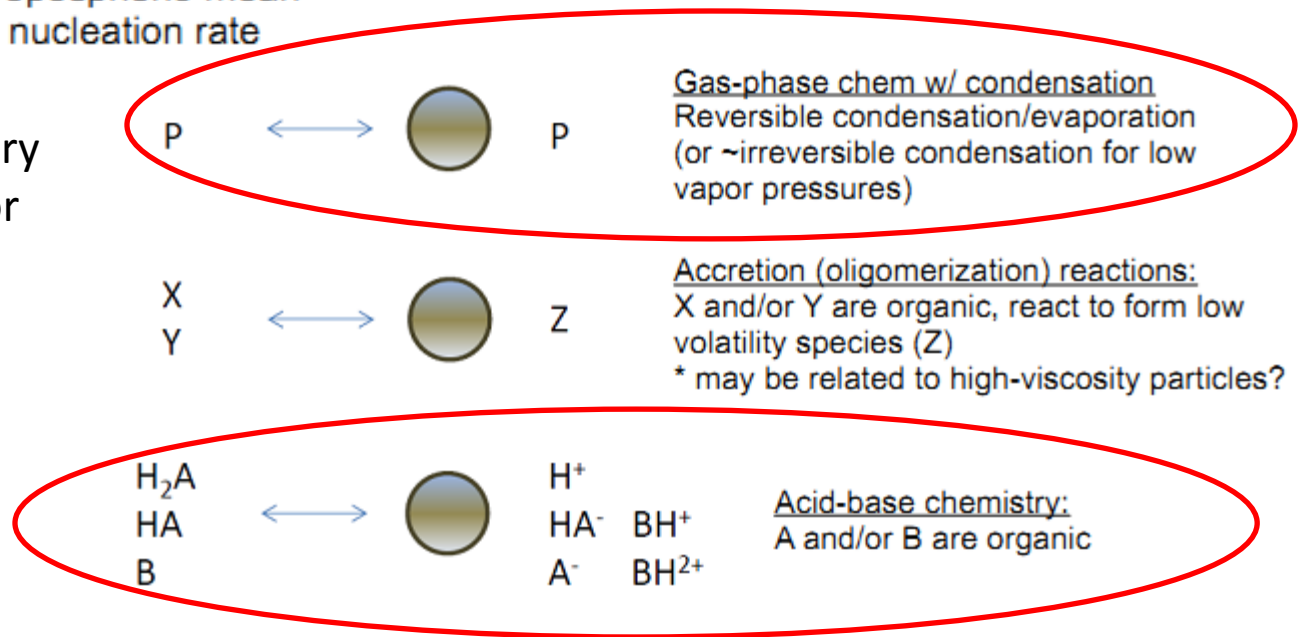
adapted from Riipinen et al., 2011

Modeling atmospheric new particle formation and growth



CCN concentrations are dampened to changes in nucleation rate. Nanoparticle growth has a greater impact on CCN concentrations

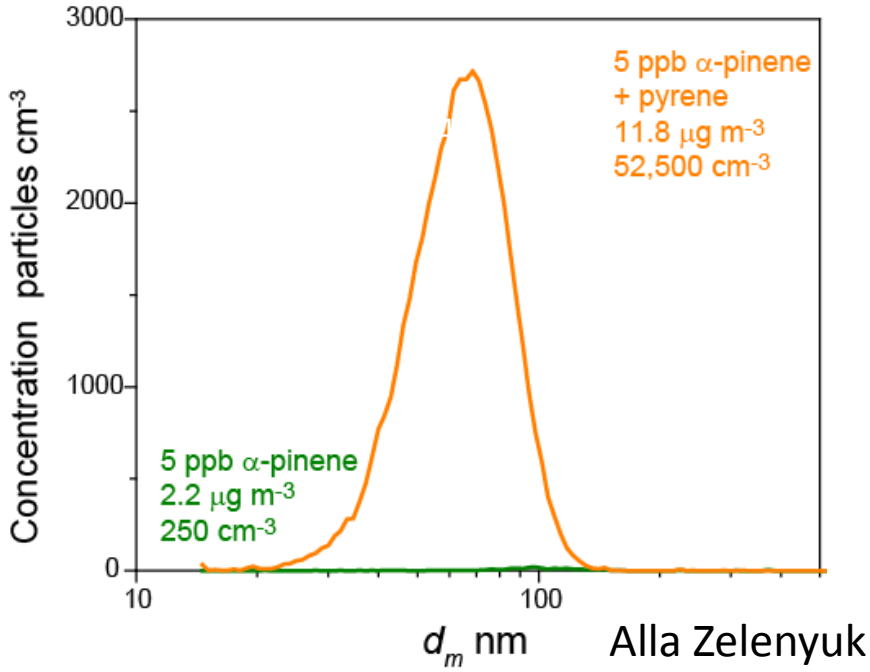
Currently models have very simple representations for growth rates. Progress is being made in some mechanistic areas.



Jeff Pierce

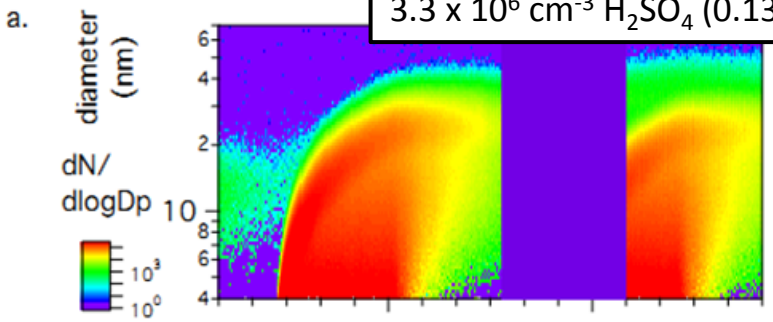
Laboratory studies

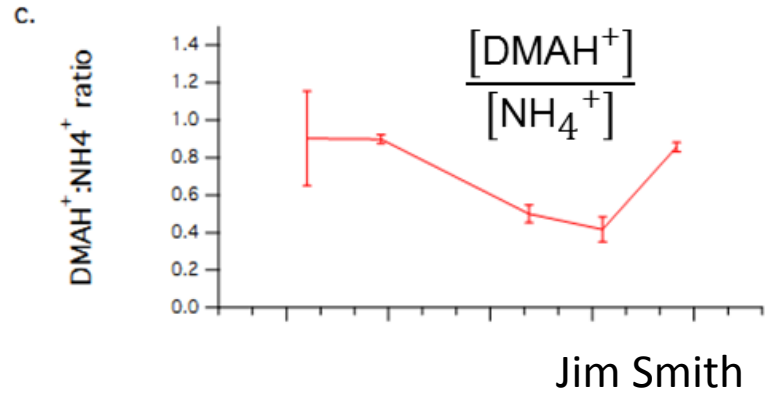
In chamber studies at PNNL, new particle formation from a-pinene is dramatically enhanced by adding ppb levels of pyrene



Alla Zelenyuk

40 ppt dimethylamine (DMA)
10-20 ppt NH_3 (contaminant)
3.3 x 10^6 cm^{-3} H_2SO_4 (0.13 ppt)





Jim Smith

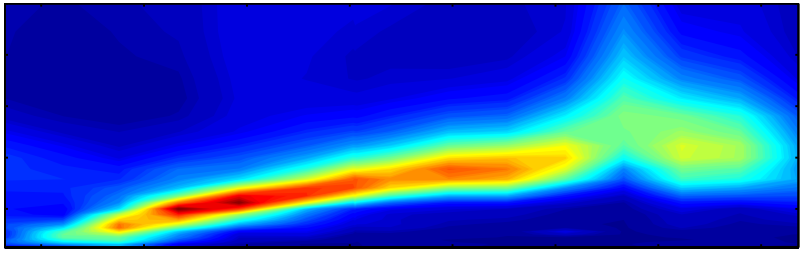
At the CLOUD experiment at CERN, the smallest nucleated sulfate particles are enriched with NH_4^+ compared to $DMAH^+$ … more than expected from solution thermodynamics

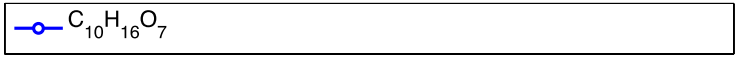
Field Observations

Recent field studies with observations of new particle formation:

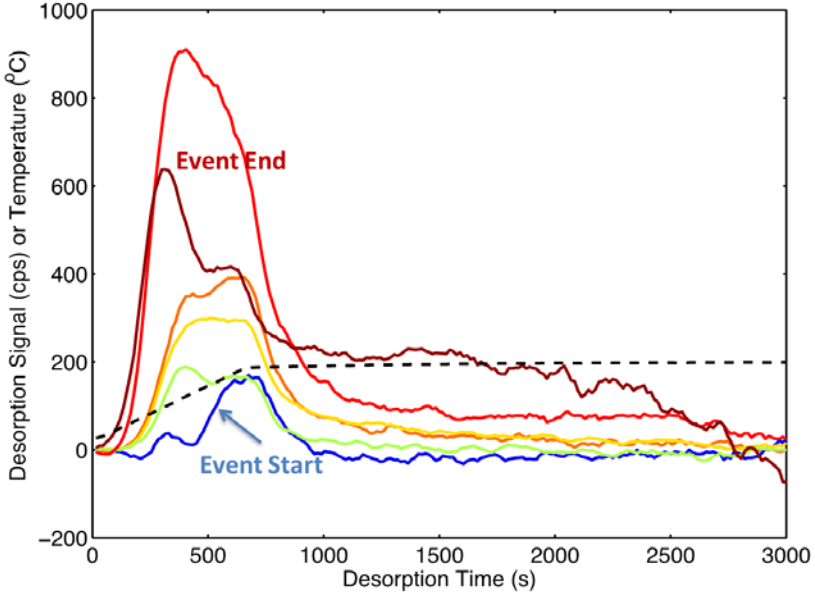
- **CARES** (Central Valley, CA, 2010)
- **NPFS** (Southern Great Plains, 2013)
  Final dataset submitted to archive
- **GoAmazon 2014/5** (Manaus, Brazil, 2014)
- **BAECC** (Hyytiälä, Finland Feb – Oct 2014)

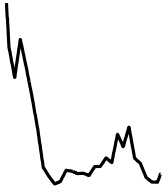
Particle-phase compounds detected during a new particle formation event in Finland





Evolution of the volatility of C18-20 particle-phase compounds during new particle formation in Finland

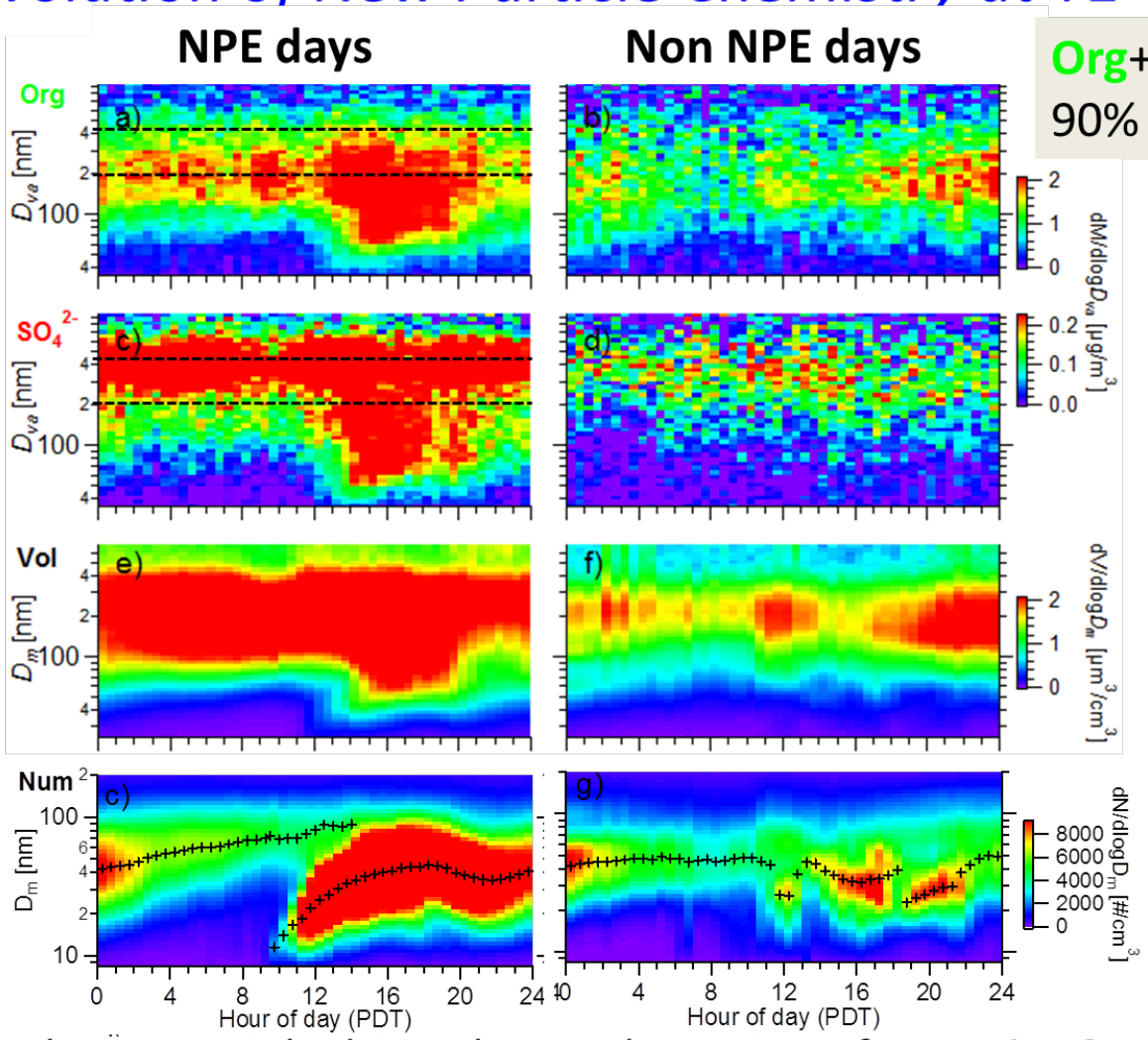




Joel Thornton

Field Observations

Evolution of New Particle Chemistry at T1



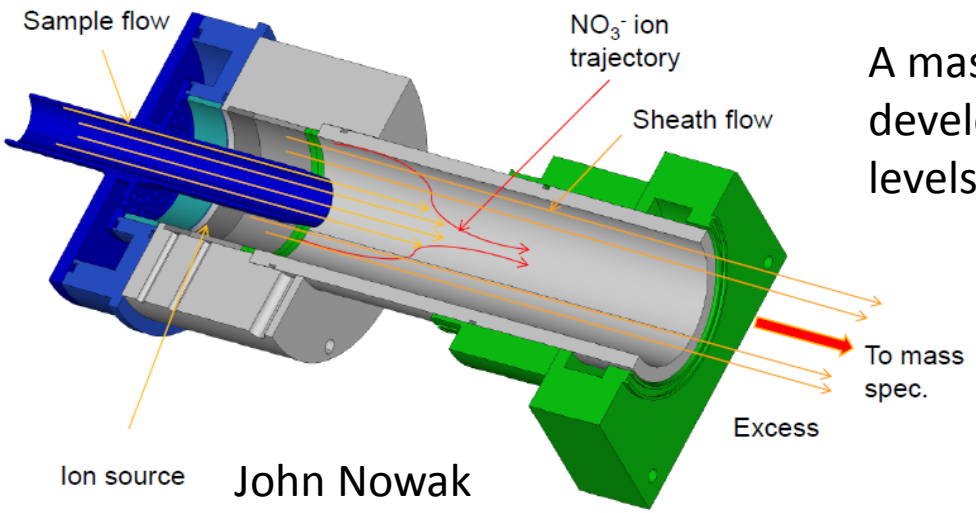
Org+SO4 > 90% of PM_1

Regional new particle events occurred almost daily during CARES

- *NP growth was mainly driven by condensation of **organics** & **sulfate***

Qi Zhang

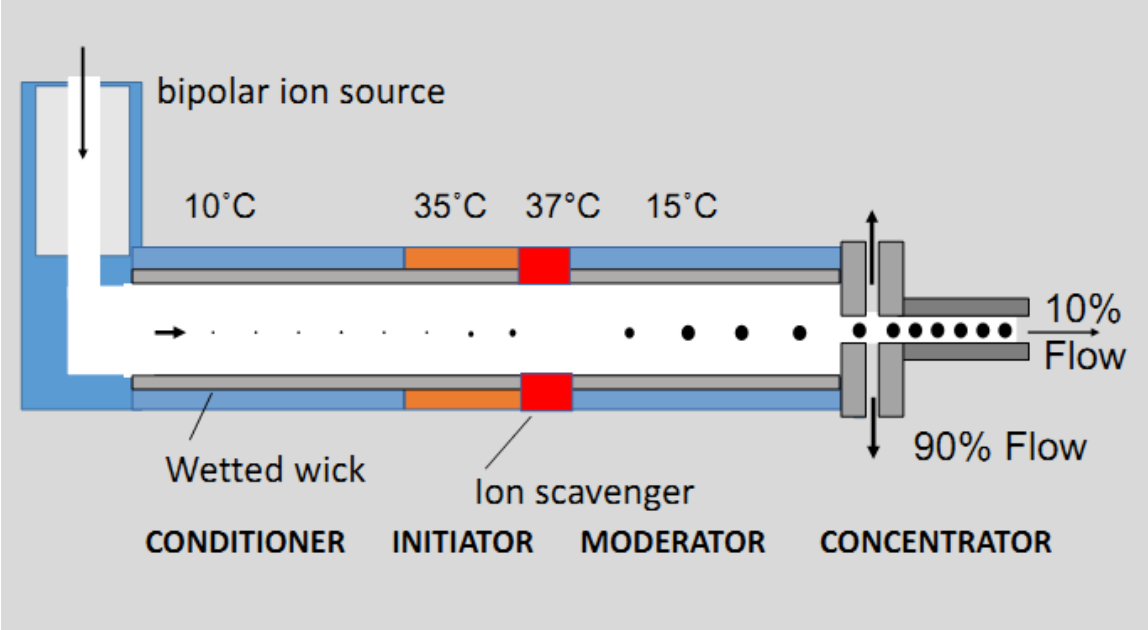
Instrument Development (SBIR/STTR program)



John Nowak

A mass spectrometer-based instrument is being developed to detect gas phase amines at ppt levels in the atmosphere

An aerosol charger is being developed to efficiently charge and concentrate nanoparticles, improving sensitivity of chemical and physical analysis instruments



Susanne Hering

Closing thoughts …

- ASR modeling progress is being made in representing salt formation and the condensation of low-volatility organics
- ASR laboratory process studies have focused on the role of anthropogenic compounds in enhancing new particle formation from biogenic precursors and on salt formation mechanisms.
- Several recent field projects and long-term observations are creating a valuable dataset. Details will be presented during the BAECC and GoAmazon breakouts and the poster sessions.
- Instruments are being developed via the DOE SBIR/STTR program to address crucial measurement needs.
- New ARM instruments will serve the needs of new particle formation research, including an SO2 analyzer for SGP and an SMPS for AMF1.