New Particle Formation Focus Group

2013 ASR Fall Meeting

Nucleation and New Particle Formation Focus Group: *Objectives*

- Develop models for *nucleation rates* and *growth rates* of atmospheric nanoparticles.
  - Ultimately, we will develop first-principles models for the dependence of these rates on concentrations of participating gas phase species.
  - Use observations of the chemical species and mechanisms responsible for growth to determine climatically important physico-chemical properties of the aerosol formed by nucleation such as hygroscopicity, phase, and surface tension.

- Incorporate mechanistic models for nucleation and growth rates into regional models to assess model performance during intensive atmospheric observations in well-defined environments.

- Incorporate these models into global climate models to quantify the effects of new particle formation on climate.

Nucleation and New Particle Formation Focus Group: *Approaches*

- *Model Development*: The development of experimentally verified models for nucleation and growth rates in the atmosphere will require a multidimensional approach.
  - Instrumentation. Measurements of (i) gas phase species that participate in nucleation and growth and of (ii) the composition of clusters and nucleated particles formed are required.
  - Atmospheric Observations. Atmospheric observations are needed to empirically identify those species, and where possible, to define the functional dependencies of nucleation and growth rates on their concentrations.
  - Laboratory Studies. Laboratory studies under well-controlled conditions are needed to develop accurate mechanistic models for nucleation and growth rates, and to determine climatically important aerosol properties.
  - **Model Development itself is currently missing in white paper**
- *Model Validation*: The micro-physical/chemical models for nucleation and growth will be incorporated into regional models and compared with intensive atmospheric measurements.
- *Global Modeling*: Models for boundary layer nucleation and growth rates that have been verified in atmospheric studies will be incorporated in global climate models

Metrics for Evaluating Progress

- Publication of papers that describe advances in measurement methods for the concentrations of gas phase precursors and the composition and size distributions of freshly nucleated particles.
- Publication of experimentally-verified model(s) for nucleation rates.
- Publication of experimentally-verified model(s) for growth rates.
- Publication of comparisons between predictions of regional models and atmospheric measurements.
- Incorporation of nucleation and growth parameterizations into climate models, and evaluation of model validity.
- Publication of papers that describe the effect of new particle formation on climate.

Today's Agenda

10:15 – noon: MORNING SESSION

10:15 – 10:20: Introductory comments (Smith)

10:20 – 11:15: Modeling New Particle Formation and Growth

Peter Adams (Modeling new particle formation; 15 min)
Rahul Zaveri (Modeling kinetic partitioning; 15 min)
Xiaohong Liu (New particle formation in CAM5; 15 min)
Jian Wang (MD simulations; 10 min)

11:15 – 11:45: Process studies

Barbara Finlayson-Pitts (lab, technique development and modeling; 15 min)
David Asner (A proposal to build a CLOUD-type chamber in the USA; 15 min)

11:45 – 12:00: Discussion about process studies and regional/global scale model development

13:30 – 15:00: AFTERNOON SESSION

13:30 – 14:30: Field Observations

Jim Smith (Southern Great Plains New Particle Formation Study; 20 min)
Chongai Kuang (Long-term observations; 20 min)
Future campaigns: BAECC (Finland) and GoAmazon2014 (Brazil) (20 min)

14:30 – 15:00: Discussion about how observations and modeling efforts can be better integrated