New Particle Formation (NPF) Focus Group

Chongai Kuang, BNL

Peter H. McMurry, U Minnesota

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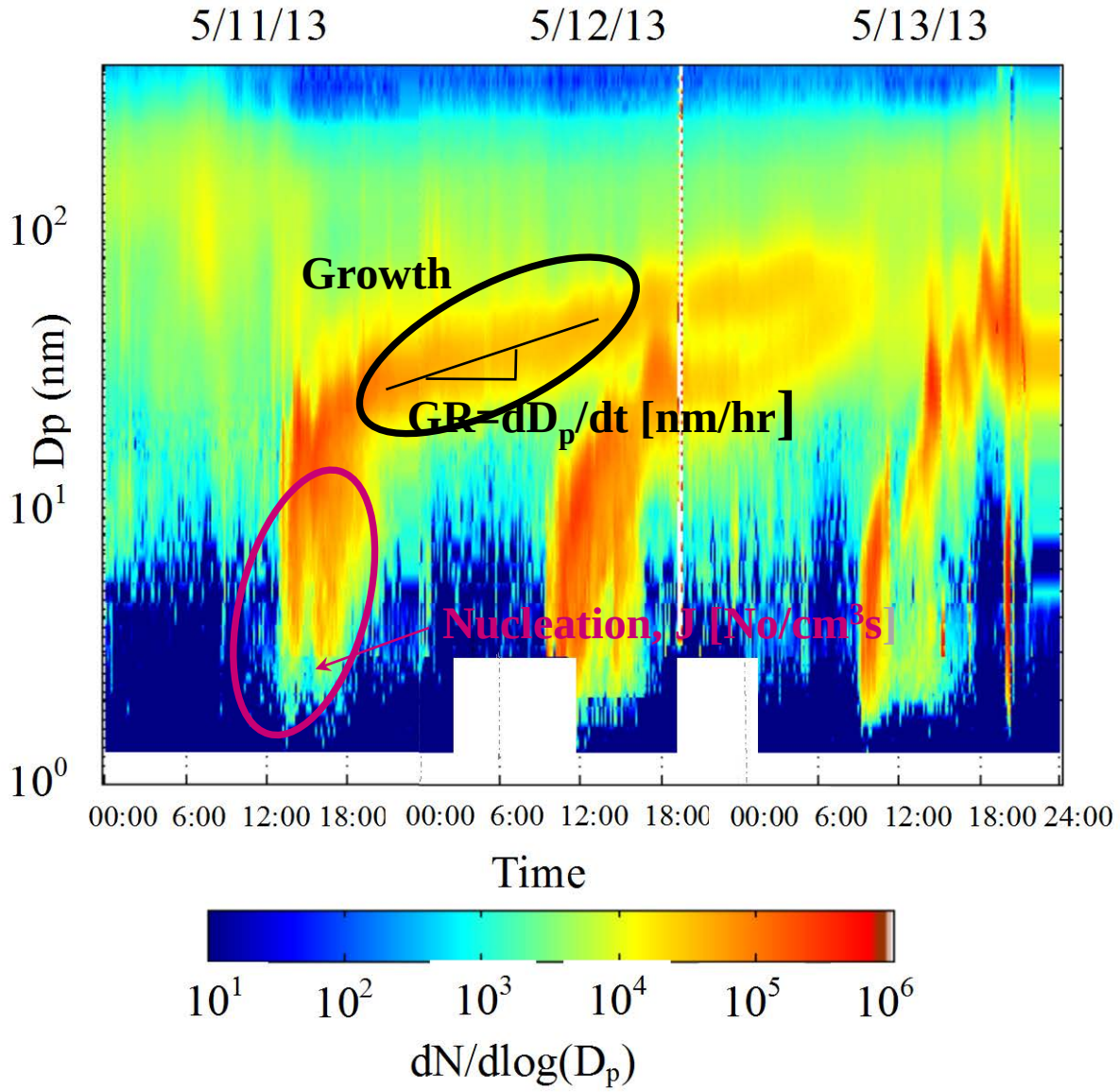
New Particle Formation (NPF) Events, May 11-13, 2013. Lamont, Oklahoma, US



Focus Group Objectives

- 1. Develop empirical and first-principles models for
  - *nucleation rates*
  - *growth rates*

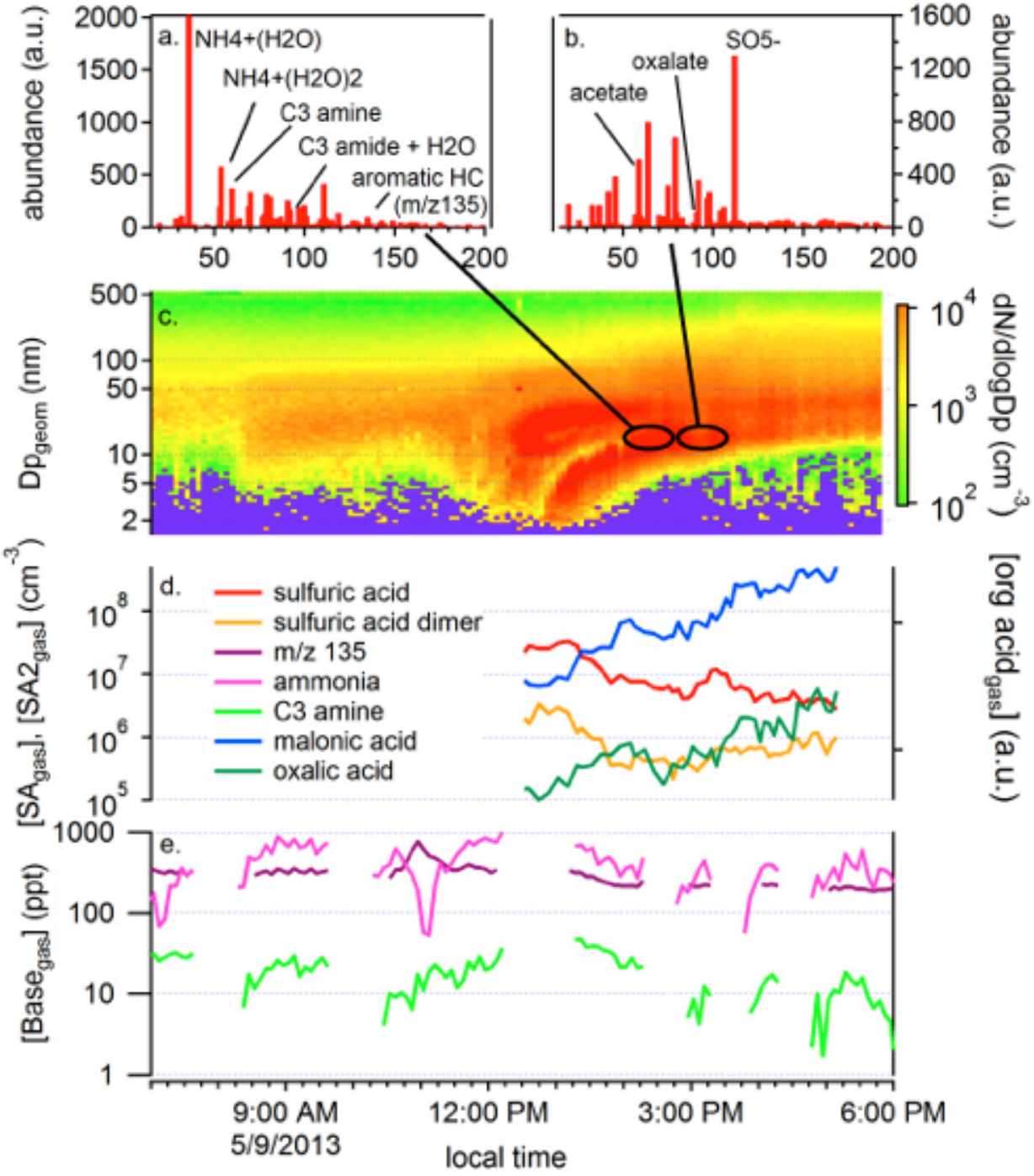
- 2. Use observations to determine climatically important physico-chemical properties of the aerosol formed by nucleation such as hygroscopicity, phase, and surface tension.

- 3. Incorporate NPF models into regional models.

- 4. Incorporate NPF models into global climate models.

Approach towards Achieving Objectives

- 1. IMPROVED INSTRUMENTATION:
  - Gas phase precursors
  - Particle composition
- 2. Atmospheric Observations
- 3. Theoretical Model Development Coupled to Laboratory Research
- 4. Validation and Application of Atmospheric Models



Parallel Measurements of Precursor Vapor and Particle Composition During a Nucleation Event at DOE's Southern Great Plains Site on May 9, 2013

Smith et al., 2014

Key Scientific Challenge: Understanding Mechanisms by which Organic Compounds Contribute to Growth

Organics typically account for 90% of growth

- $GR = (5\text{-}10)*GR_{H2SO4} = GR_{H2SO4} + GR_{other}$

Diverse reaction pathways likely contribute to organic uptake

- $GR_{other} = GR_{acid\text{-}base} + GR_{accret} + GR_{rev\ cond}$

Focus Group Participants

- NCAR, CSU, UMN, Augsburg, Portland State team
  - Jim Smith, Jeff Pierce, Pete McMurry, Dave Hanson, Kelley Barsanti
- BNL
  - Chongai Kuang, Jian Wang
- Others
  - SOA uptake; Computational chemistry, etc.
- International: U Helsinki (Kulmala, Worsnop)
- Other modeling groups

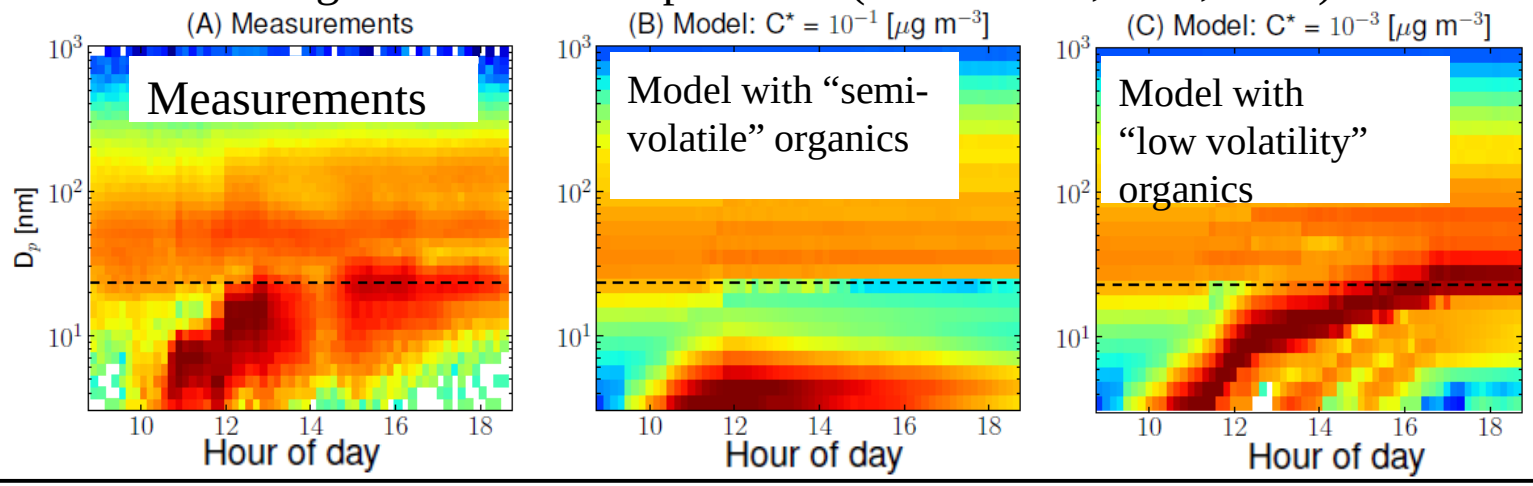
A Vision for Optimizing Effectiveness of NPF Focus Group

- Tightly knit, collaborative team
- Complementary objectives
- Flexibility
- Periodic (annual?) meetings that focus exclusively on NPF

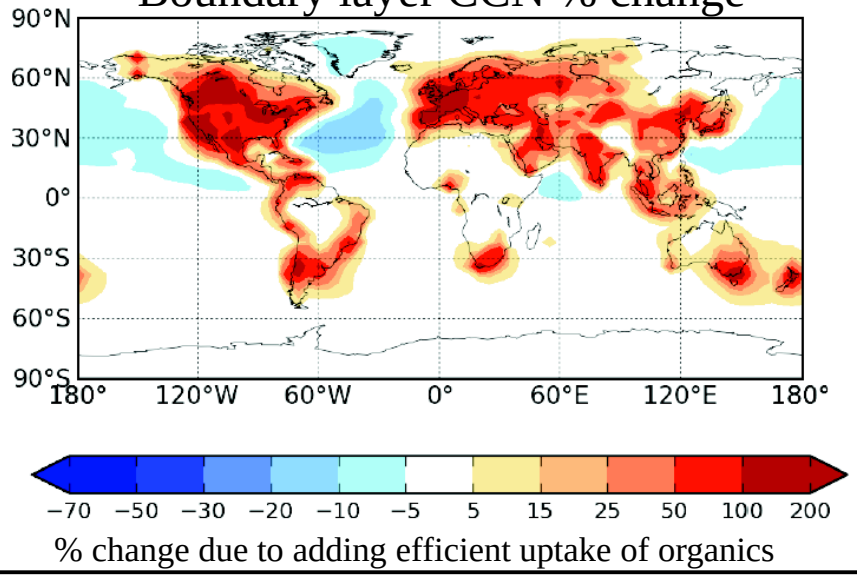
Some Recent Activities

NPF and Growth in Models (Jeff Pierce)

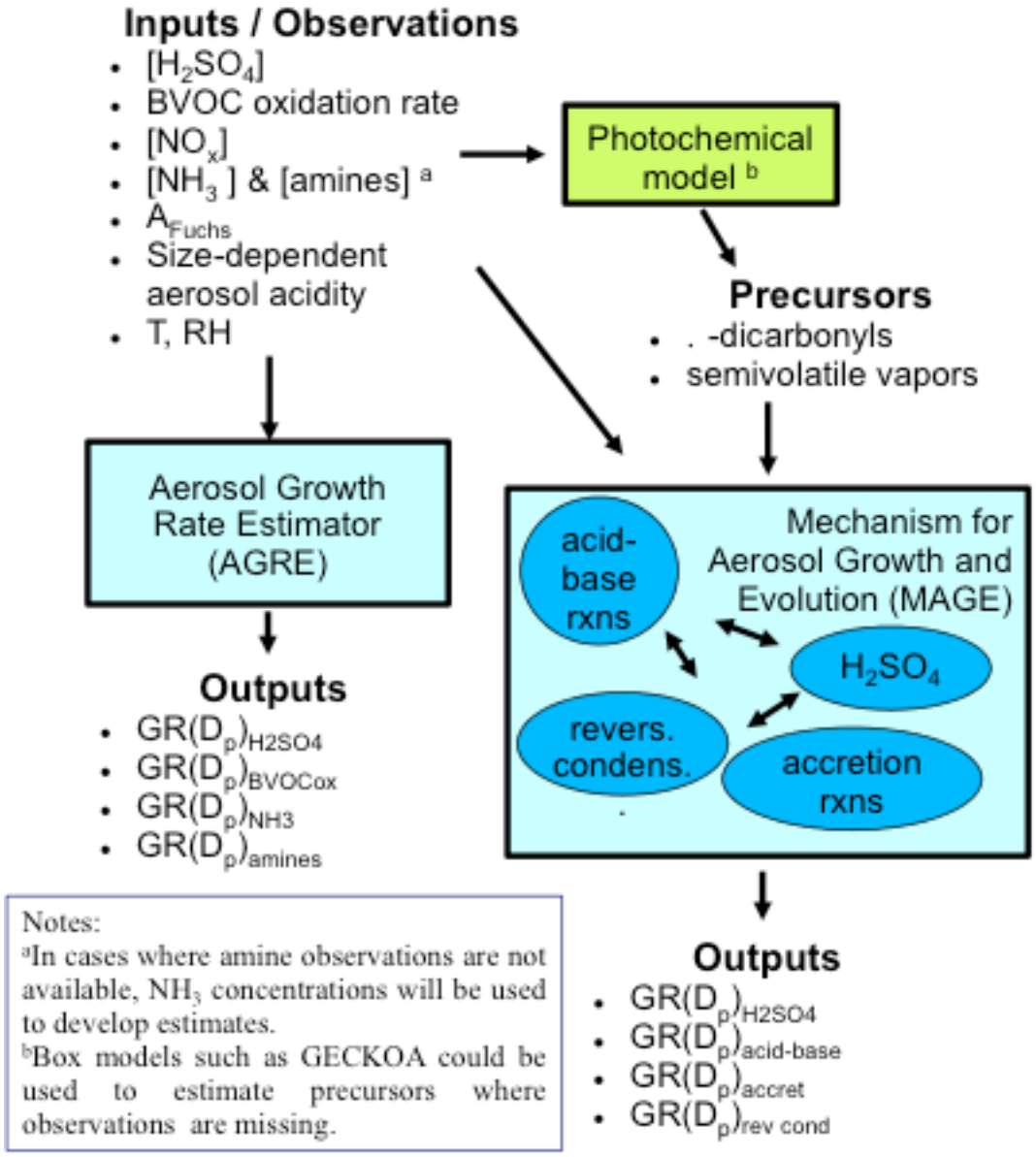
Models cannot capture the growth of new particles without efficient uptake of organics to the new particles. (Pierce et al., ACP, 2011)



Boundary layer CCN % change



CCN concentrations in the continental boundary layer are very sensitive to this efficient uptake of organics to new particles. (D'Andrea et al., ACP, 2013).



Approaches to Modeling Growth:

Mechanistic (MAGE)

and

Empirical (AGRE)

Kelley Barsanti and Jeff Pierce, 2014

Discussion…