Aerosol Microphysics

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Points for discussion

- What are the major challenges with the current aerosol microphysics models? How these biases impact aerosol direct and indirect effects?
- Are bulk aerosol models (i.e., without aerosol size and number prediction, and assuming external mixing) accurate enough to calculate the aerosol effects (direct and indirect)? Can aerosol microphysical models provide some useful information (e.g., carbonaceous aerosol aging time) used to constrain these bulk models?

Points for discussion

- How sensitive are the model results (size, number) to aerosol nucleation? How these new particles contribute to the abundance of climate-relevant particles?
- Do we have better information on the size distribution of primary aerosols (e.g., carbonaceous and sulfate)?
- Is a model comparison project within AEROCOM on aerosol microphysics and dynamics now possible at current stage, e.g., with different approaches: sectional, modal and moment treatment?

Dataset to validate models on aerosol number, size distribution and mixing

- Surface
  - NOAA-CMEL; WMO-GAW
- Aircraft
  - Selected campaign measurements from literature:
    Rae et al. (2000): ACE-2;
    Clarke and Kapustin (2002):
    ACE-1; GLOBE2; PEM-Tropical A and B.
    Schroder et al. (2002): LACE98
    TRACE-P; ACE-Asia; INDOEX; INTEX-A
  - Balloon CN measurements (Univ. Wyoming)

- Satellite on sizes
  - OMI aerosol index (size and shape)

Aerosol mixing from single particle measurements

- Measurements by PALMS: Dan Murphy in ACCENT; Crystal-FACE; Pre-AVE; CR-AVE;
- Measurements by ATOFMS: Kim Prather
- DOE PNNL-G1 (SPLAT..): MILAGRO in Mexico city;
- ….

Recent Progress

Modeling

- **Spracklen DV**, Pringle KJ, Carslaw KS, et al., Evaluation of a global **aerosol** microphysics model against size-resolved **particle** statistics in the marine atmosphere , ATMOSPHERIC CHEMISTRY AND PHYSICS 7 (8): 2073-2090 2007.
- **Stier P**, Feichter J, Kloster S, et al., Emission-induced nonlinearities in the global **aerosol** system: Results from the ECHAM5-HAM **aerosol**-climate model
  JOURNAL OF CLIMATE 19 (16): 3845-3862 AUG 2006.
- **Lauer A**, Hendricks J, Simulating **aerosol** microphysics with the ECHAM4/MADEGCM - Part II: Results from a first multiannual simulation of the submicrometer **aerosol** , ATMOSPHERIC CHEMISTRY AND PHYSICS 6: 5495-5513 DEC 6 2006

Aerosol nucleation

- Merikanto J, Napari I, Vehkamaki H, et al., New parameterization of sulfuric acid-ammonia-water ternary **nucleation** rates at tropospheric conditions, JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES 112 (D15): Art. No. D15207 AUG 7 2007
- Yu F, From molecular clusters to nanoparticles: second-generation ion-mediated **nucleation** model, ATMOSPHERIC CHEMISTRY AND PHYSICS 6: 5193-5211 NOV 15 2006;
- Yu, F. (2006a), Binary H2SO4-H2O homogeneous nucleation rates based on a kinetic quasi-unary model: Look-up tables, *J. Geophys. Res*., *111,* D04201, doi:10.1029/2005JD006358.
- Vaattovaara P, Huttunen PE, Yoon YJ, et al., The composition of **nucleation** and Aitken modes particles during coastal **nucleation** events: evidence for marine secondary organic contribution, ATMOSPHERIC CHEMISTRY AND PHYSICS 6: 4601-4616 OCT 12 2006.