Proposed Focus Group

Thermodynamic and Microphysical Properties of Mixed Organic-Inorganic Aerosols

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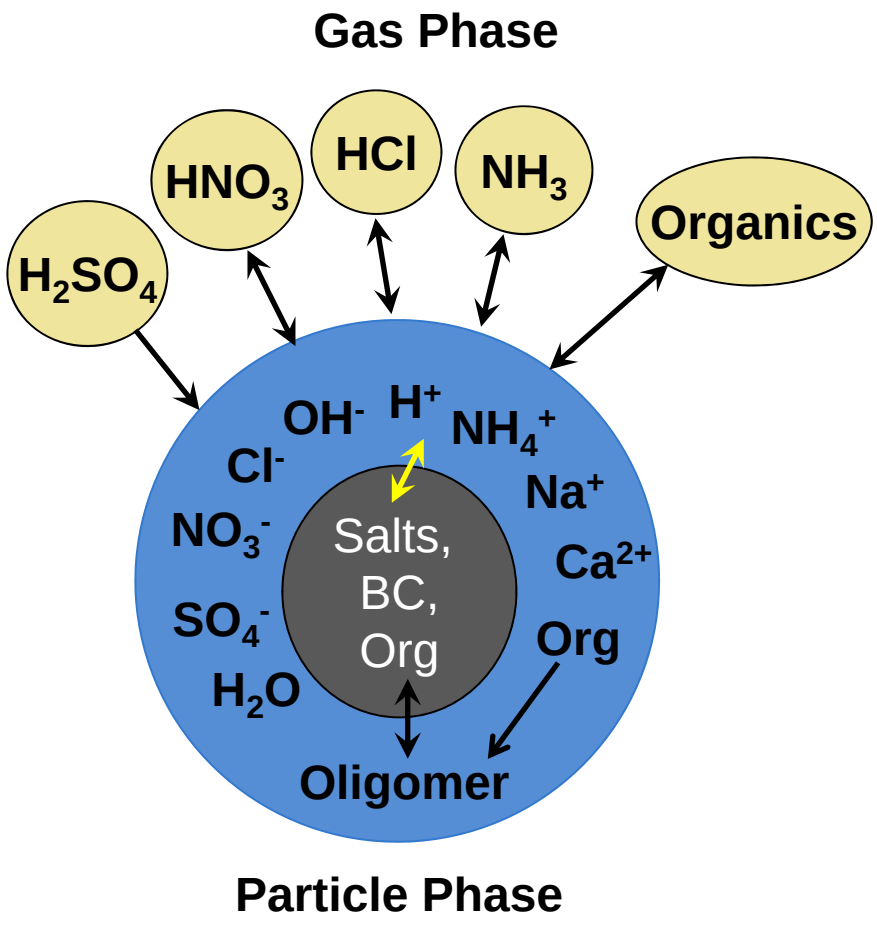
Motivation

- Organic aerosols and especially secondary organic aerosol (SOA) are found to comprise 20-90% of submicron aerosol mass in many regions around the world. However, SOA formation mechanisms are still poorly understood and represented in climate models.
- SOA is almost always found to be mixed with inorganic species such as ammonium sulfate and nitrate in varying proportions. SOA often includes species such as organosulfates, organic nitrates and oligomers, which are likely formed via reactive uptake of organic gases. The extent and effect of such reactions and products are still not well understood and represented in aerosol models.
- Organics are known to affect deliquescence and water uptake in mixed organic-inorganic particles, which can have a significant impact on the direct radiative forcing as well as on the further growth of such particles via aqueous-phase reactions. These thermodynamic effects on the phase state of mixed organic-inorganic aerosols are presently ignored in models.
- Condensation of organics is fast, but evaporation is found to be surprisingly slow. Also, volatility of organics in mixed organic-inorganic aerosols can be quite different than over organic-only aerosols. The volatility and mass transfer kinetics also depend on the phase state and morphology of the such aerosols. However, these processes are very poorly understood and therefore not taken into account in aerosol models.
- It is therefore necessary to focus attention on improving the thermodynamic and microphysical properties of mixed SOA-inorganic aerosols useful for developing reliable treatments for SOA formation and its climate-related properties in regional and global climate models.



Potential Activities of the Focus Group

- Characterize the phase state (solid, liquid, mixed) and deliquescence behavior of mixed SOA-inorganic aerosols as a function of RH and composition
- Investigate condensation and evaporation kinetics of organics and inorganics as a function of chemical composition, phase state, and morphology
- Investigate in-particle reactions and products
  - Rate of formation of organosulfates, oligomers, other products?
  - Are these reactions reversible?
  - Are the products non-volatile?
- Carefully parameterize these processes for inclusion in aerosol models
- Interface with and integrate findings from other focus groups into the improved models
- Evaluate and optimize the performance of the new treatments in a regional model using appropriate field observations
- Implement and evaluate the new SOA formation and properties treatments in a global model