Aerosols and Climate: Overview of ESRL's Research Program

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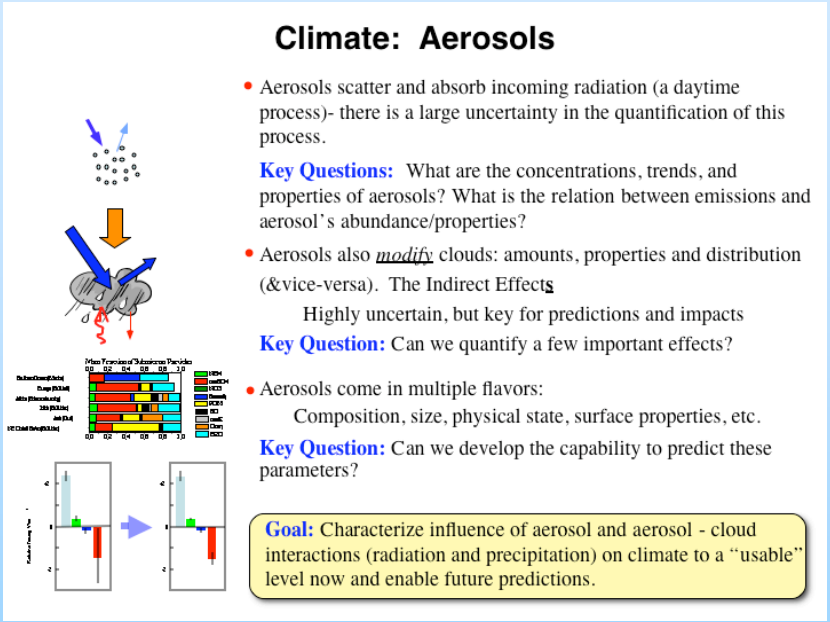
Why study aerosols and climate?

- **Forcings are large, especially on regional scale**
  - patchy distribution
- **Uncertainties are largest of all terms in IPCC assessment**
- **Additional effects, e.g. on precipitation, are also important**
- **Forcings and effects are controlled by aerosol amount and type (size, composition)**
  - In contrast to greenhouse gases where only amount is needed to calculate forcing
- **Characterization of aerosols and their contribution in today's atmosphere lags behind those of other constituents.**
  - The large error bars are a reflection of this issue



What we do

- **Mission: To observe and understand aerosol effects on climate in support of decision makers through:**
  - Long-term monitoring
  - Field studies
  - Laboratory studies
  - Modeling
- **Payoffs:**
  - Improved understanding of aerosol processes and properties, leading to...
  - Predictive capability of aerosol climate forcing ...
  - With known uncertainties.

Aerosol/Climate Research Matrix

Topic \ Tool	Process Studies	Long-term Studies	Modelling Studies
Aerosol Chemistry	Formation of secondary organics	Arctic aerosol trends	Organics in cloud water
Direct Radiative Forcing	Hygroscopic growth	Climatology of radiative properties	Using field data to assess model uncert.
Indirect Effects on Clouds	Combine remote-sensing and in-situ msmts	CCN climatology	Cloud-scale modeling

Reviewers' Charge: Relevance

- **Does the research address existing (or future) societally relevant needs (national and international)? Are customers engaged to ensure relevance of the research?**
  - IPCC bar chart shows that aerosols are the source of the biggest uncertainties in radiative forcing
  - Active involvement in all phases of IPCC process (research, authors, reviewers) keep us in close touch with our highest-visibility customer
- **How well does it address issues identified in the NOAA research plans or other policy or guiding documents?**
  - **CCSP:** *Develop reliable representations of the climatic forcing resulting from atmospheric aerosols*
  - **NOAA:** *Improve the quantification and understanding of the forces bringing about climate change by examining relevant human-induced increases in atmospheric constituents*
  - **OAR:** *Reduce the uncertainty in model simulations of the influence of aerosols on climate*

Reviewers' Charge: Transition

- **How well has the laboratory delivered products?**
  - Publications, CCSP and IPCC contributions
  - Long-term data in WMO/GAW data archive
  - Export of long-term monitoring stations
- **Are there appropriate interactions with stakeholders and customers?**
  - Evaluate chemical transport models with field data
    - key partners at GFDL and PMEL
    - good example of results in Bates et al. (2006)
  - Provide essential information to assessments (IPCC, CCSP Synthesis and Assessment Products)
  - Key partner in CCSP
  - Contribute to formulation and execution of international research programs (IGAC, AEROCOM, AC&C, WMO/GAW, GCOS)

Today's Talks

- **Overview**
  - Ogren: ***Aerosol Direct Radiative Forcing***
  - Murphy: ***Aerosol Composition***
  - Feingold: ***Aerosol-Cloud Interactions***
- **Focused Science**
  - Andrews: ***Influence of clouds on aerosol properties***
  - Lack: ***Soot emissions from ships***
- **Discussion**