

# An Aerosol Branch

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# Aerosol Science Questions

- What are the direct and indirect effects of anthropogenic aerosol on the past, present and future planetary energy balance?
- What are the effects of anthropogenic aerosol on the global and regional water balance?
- What are the impacts of anthropogenic aerosol on past and future climate?
- What is the role of aerosol deposition in surface biology?
- How much does climate-wildfire feedback contribute to climate variability?
- What is the role of climate-dust feedback?
- How strong is the climate-DMS feedback?
- What are potential impacts of engineered aerosol?

# Aerosol Options in CAM

- Bulk Aerosol Model (BAM)
- Modal Aerosol Model (MAM)
- Community Aerosol-Radiation-Microphysics for Atmospheres (CARMA)
- LLNL Sectional Model

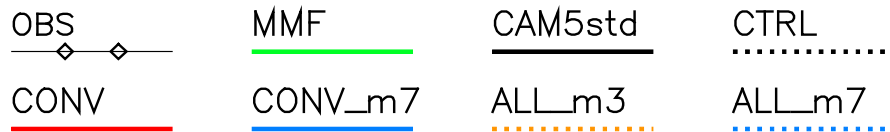
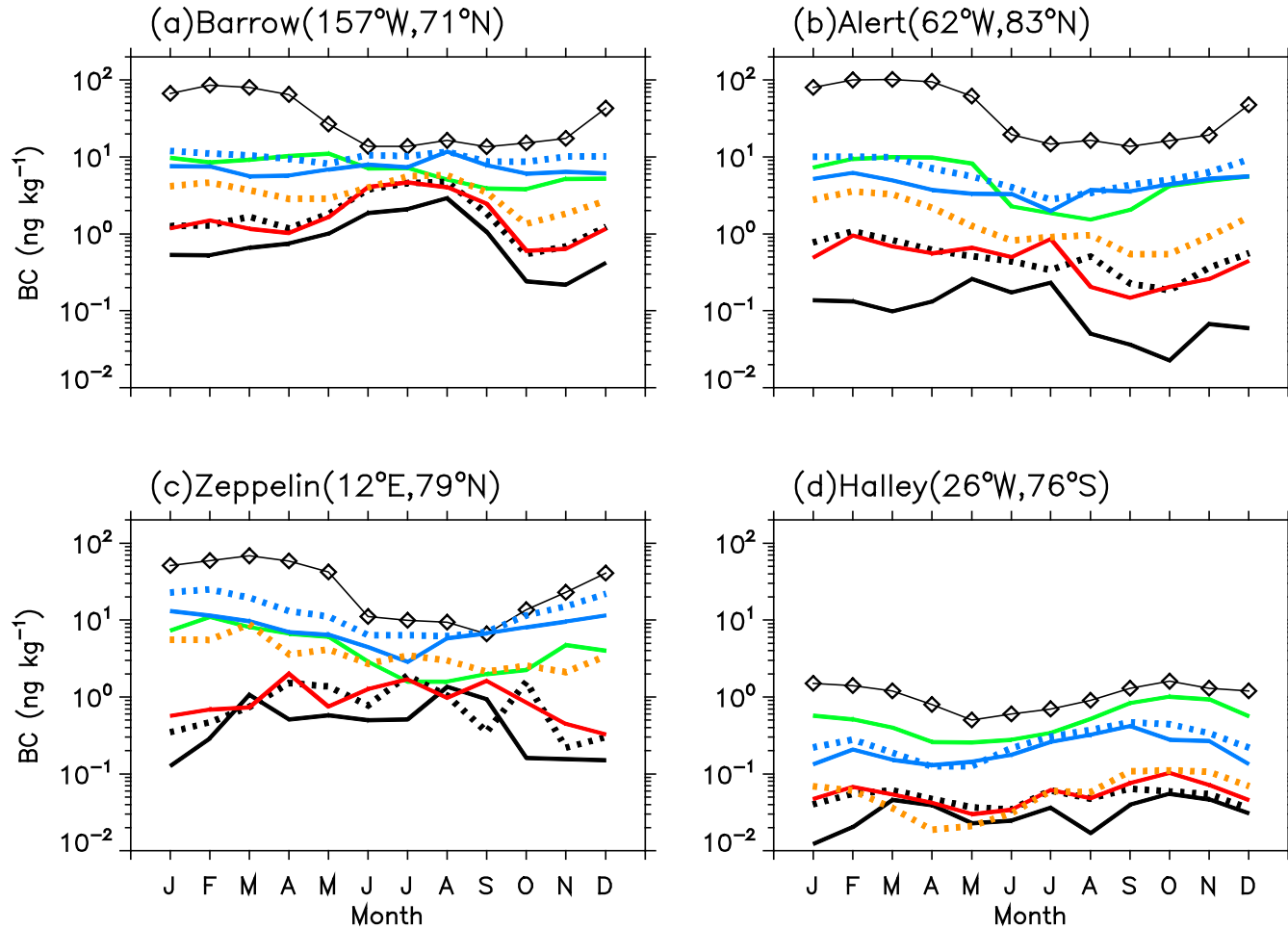
# A Modal Aerosol Model Branch

- Coordinate MAM development efforts
- Facilitate coupling of atmosphere and surface models
- Simplify merge onto trunk

# Current MAM Branch

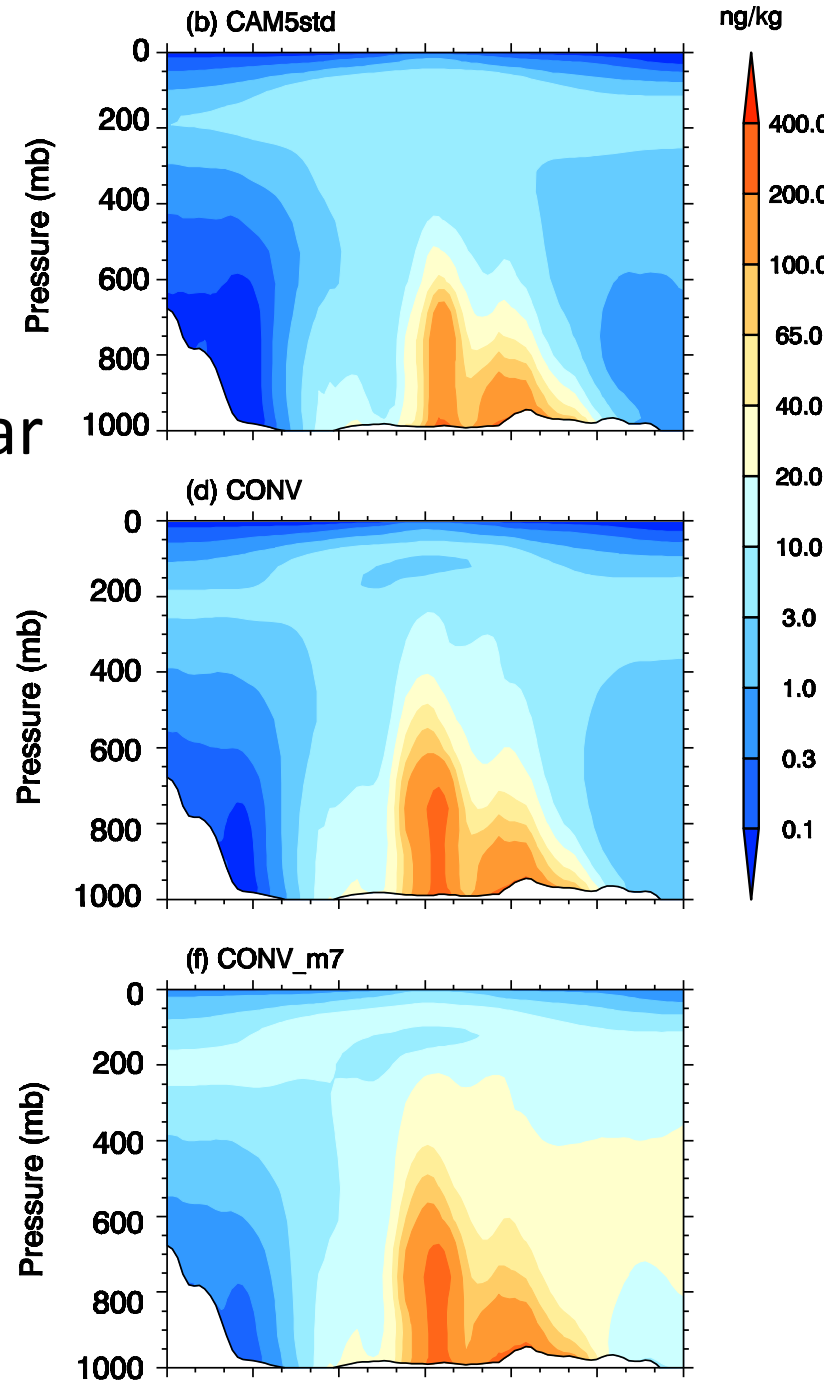
- Prescribed aerosol option (Rasch presentation)
- A primary carbon mode added to MAM3 (Liu presentation)
- Less absorbing dust physprops file (Ghan presentation)
- Improved aerosol scavenging (H. Wang GMDD)

# Improved Aerosol Scavenging



# BC vertical distribution

- Convective scavenging and transport mods increase polar concentrations in lower troposphere
- Externally-mixed mode puts much more BC in the Arctic middle troposphere



# Current MAM Branch

- Prescribed aerosol option (Rasch presentation)
- A primary carbon mode added to MAM3 (Liu presentation)
- Less absorbing dust physprops file (Ghan presentation)
- Improved aerosol scavenging (H. Wang GMDD)
- AeroCom diagnostics `history_aerocom`



# Future MAM Branch

- Prescribed aerosol option (Rasch presentation)
- A primary carbon mode added to MAM3 (Liu presentation)
- Less absorbing dust physprops file (Ghan presentation)
- Improved aerosol scavenging (H. Wang GMDD)
- AeroCom diagnostics history\_aerocom
- Speciation of dust: optics (Cornell) & ice nucleation (PNNL)
- Speciation of POM hygroscopicity (PNNL)
- Ion-induced nucleation (SUNY-Albany, PNNL)
- Marine organic sources (NC State, Harvard, LANL, Scripps, PNNL)
- Secondary organic aerosol (MIT, NCAR, PNNL, LLNL, UM)
- More general aerosol thermodynamics (PNNL)
- Ammonium & nitrate (NCAR)
- Improved dust emission size distribution (PNNL)
- Coupled DMS emissions (LANL, ORNL, LLNL, PNNL)
- Coupled fire smoke emissions (Cornell & PNNL)
- Coupling MAM to SNICAR (Flanner & PNNL)
- Frost flower sources (Scripps, LANL)
- MAM volcanic aerosol (NCAR, PNNL)
- Geoengineering stratosphere, CCN (NCAR, PNNL)

# Beyond MAM

- Generalize as many aerosol processes as possible to accommodate other aerosol representations
  - Primary emissions
  - Condensation of sulfuric acid
  - Water uptake
  - Aerosol optical properties
  - Aerosol activation
  - Nucleation scavenging
  - Impaction scavenging
  - Sedimentation
  - Dry deposition
  - Impacts on snow albedo

# Discussion

- Other science questions
- Other aerosol development needs
- Other chemistry development needs