and

What is ACAM? How is it relevant to AeroCom/ AeroSat? How can they help each other?

Mian Chin et al., NASA GSFC

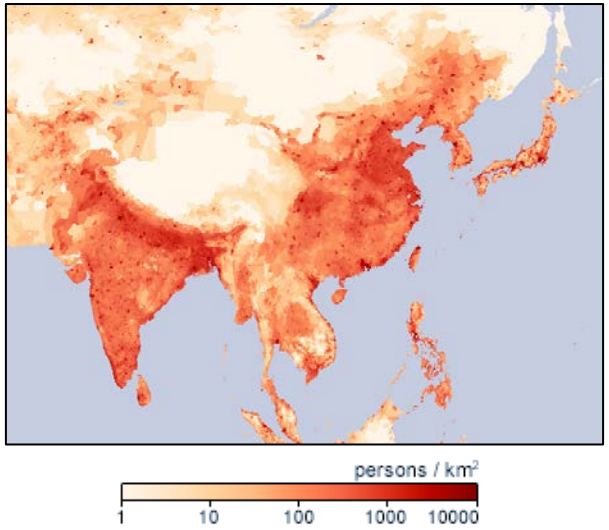
ACAM is a joint SPARC/IGAC activity established in 2013

- ACAM focuses on the following scientific themes:
  - Emissions and air quality in the Asian monsoon region
  - Aerosols, clouds, and their interactions with the Asian monsoon
  - Impact of monsoon convection on chemistry
  - UTLS Response to the Asian Monsoon
- ACAM working groups include
  - Observations and data sharing – data from ground measurements, aircraft, and satellite
  - Modeling – coordination with international modeling communities including AeroCom and CCMI
  - Training – for early career scientists using observations and research tools
- Outgoing co-chairs: Laura Pan (NCAR), James Crawford (NASA LaRC); incoming co-chairs: Hans Schlager (DLR), Mian Chin (NASA GSFC)

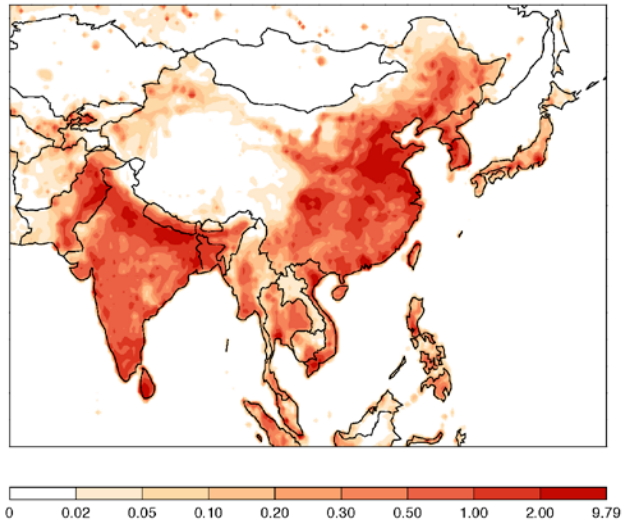
1. Aerosol “hot spots” co-located with major Monsoon regions

- Asian monsoon is a major climate component, comprised mainly of the South Asian and East Asian subsystems
- Asian monsoon region is an area with the highest population density overlapping with the aerosol hot spots

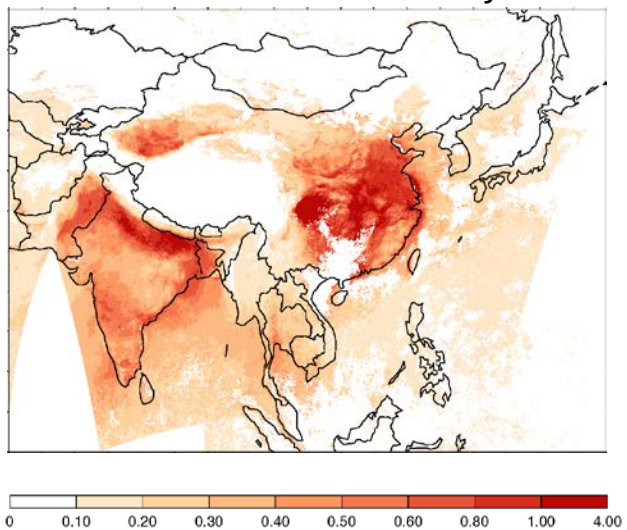
Population Density 2000



Anthro BC+OC emission (CEDS) 2010

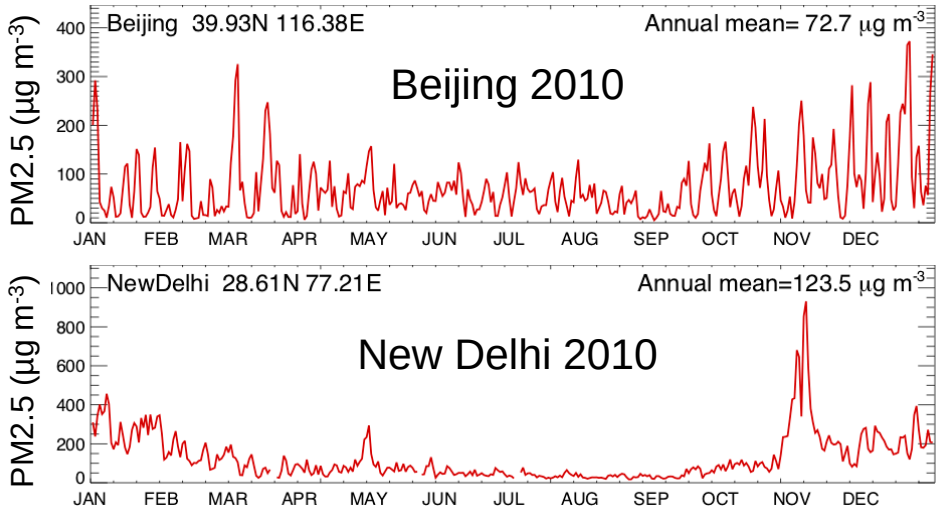


MODIS MAIAC AOD January 2010

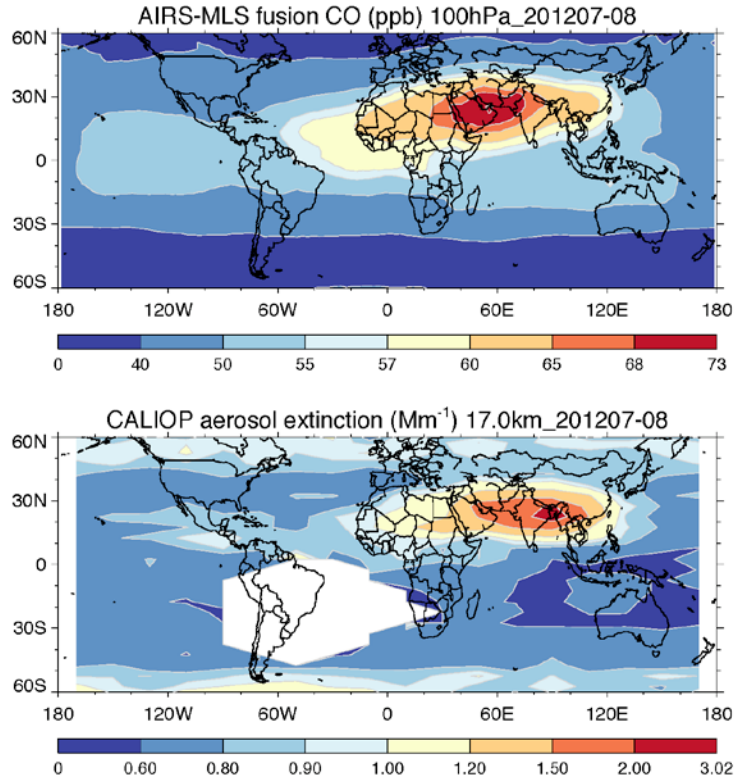


2. Connections between Asian air pollution and monsoon system have shown two characteristically distinctive phenomena

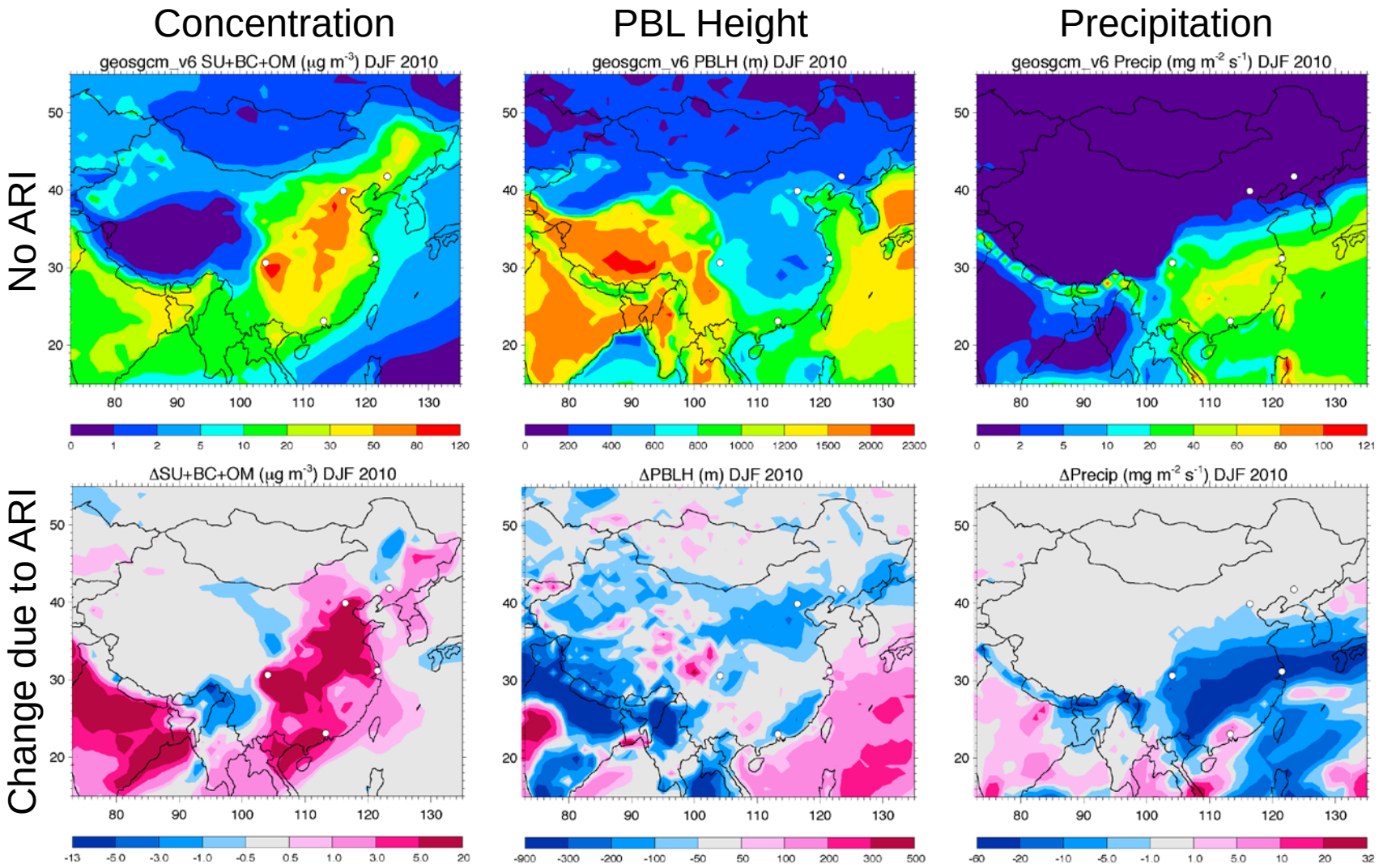
- Winter monsoon season featured by severe air pollution problem, stagnant circulation, shallow boundary layer, and dry weather that make pollutants accumulated near the surface



- Summer monsoon season features a strong convective transport lifting the surface pollutants to near the tropopause, where they further spread out to alter the atmospheric composition far beyond Asia



3. Aerosol-cloud-radiation interactions and convective transport are particularly important processes within the Asian monsoon system

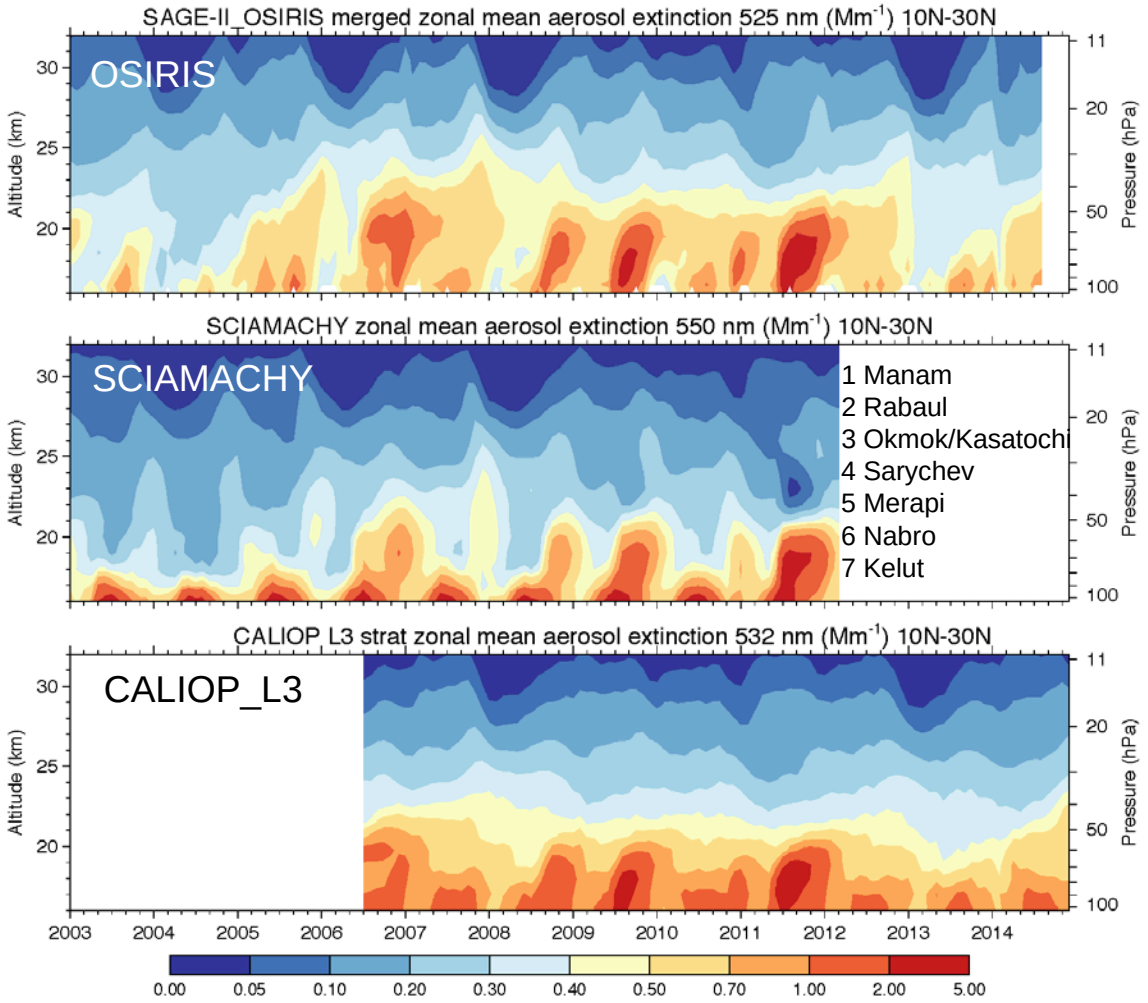


GEOS model simulations showed that absorbing aerosols interacting with radiation in winter time can suppress the PBL height and reduce the precipitation, thus trapping more pollutants near the surface

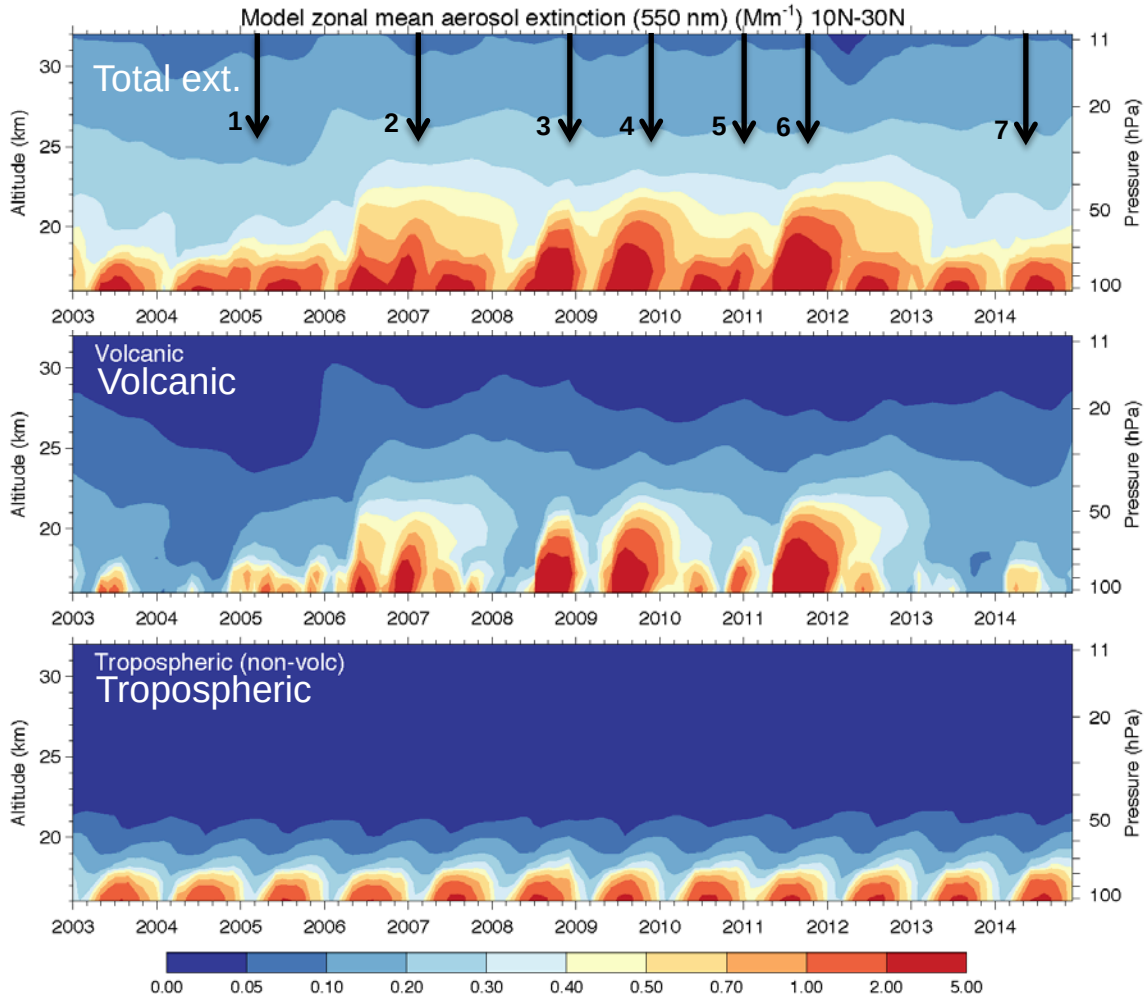
Chin et al., 2017

5. Asian monsoon convective transport affects UTLS composition and possibly cirrus cloud formation near the tropopause – example of UTLS aerosol extinction

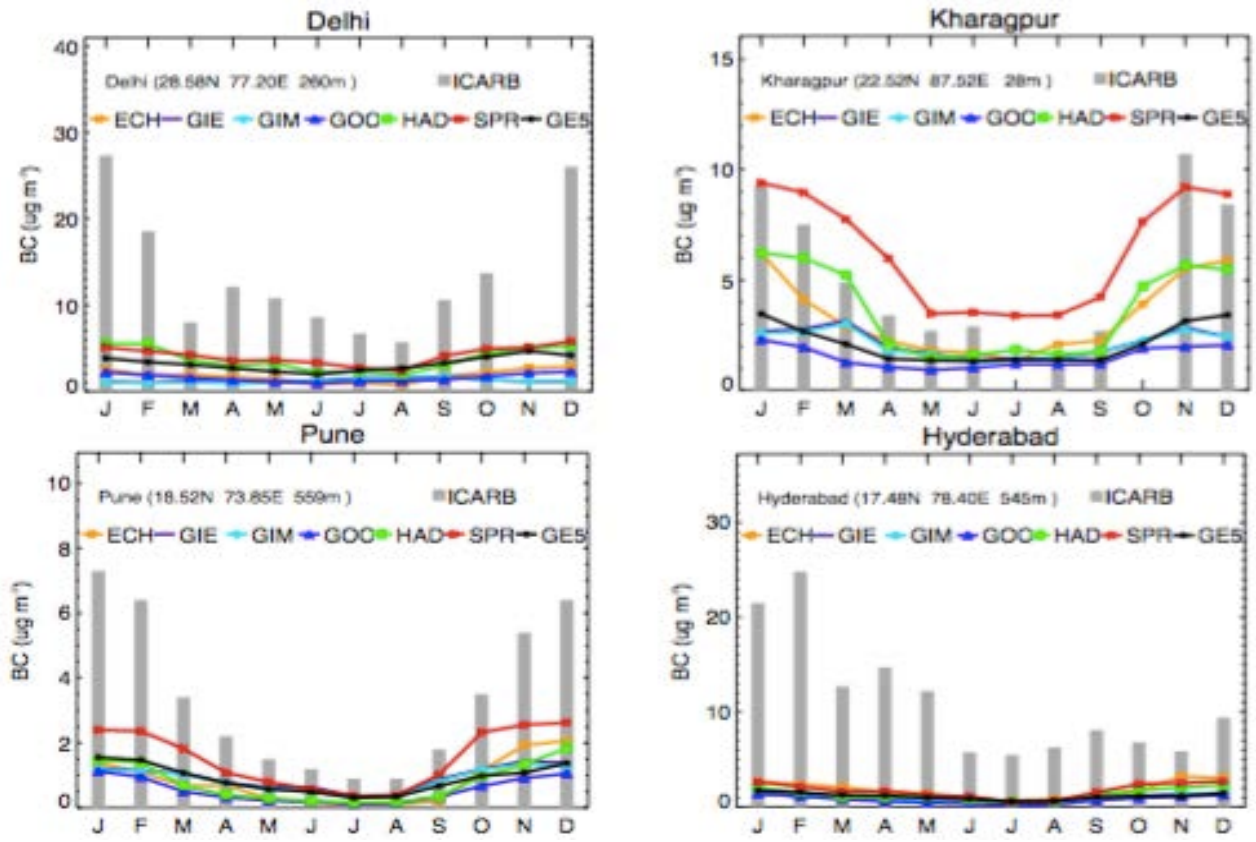
Satellite data. 10N-30N zonal mean



GEOS model simulation, 10N-30N zonal mean



6. AeroCom (and other) models have difficulty in their representations of Asian pollution aerosols and Asian monsoon transport – Example 1: BC surface concentration

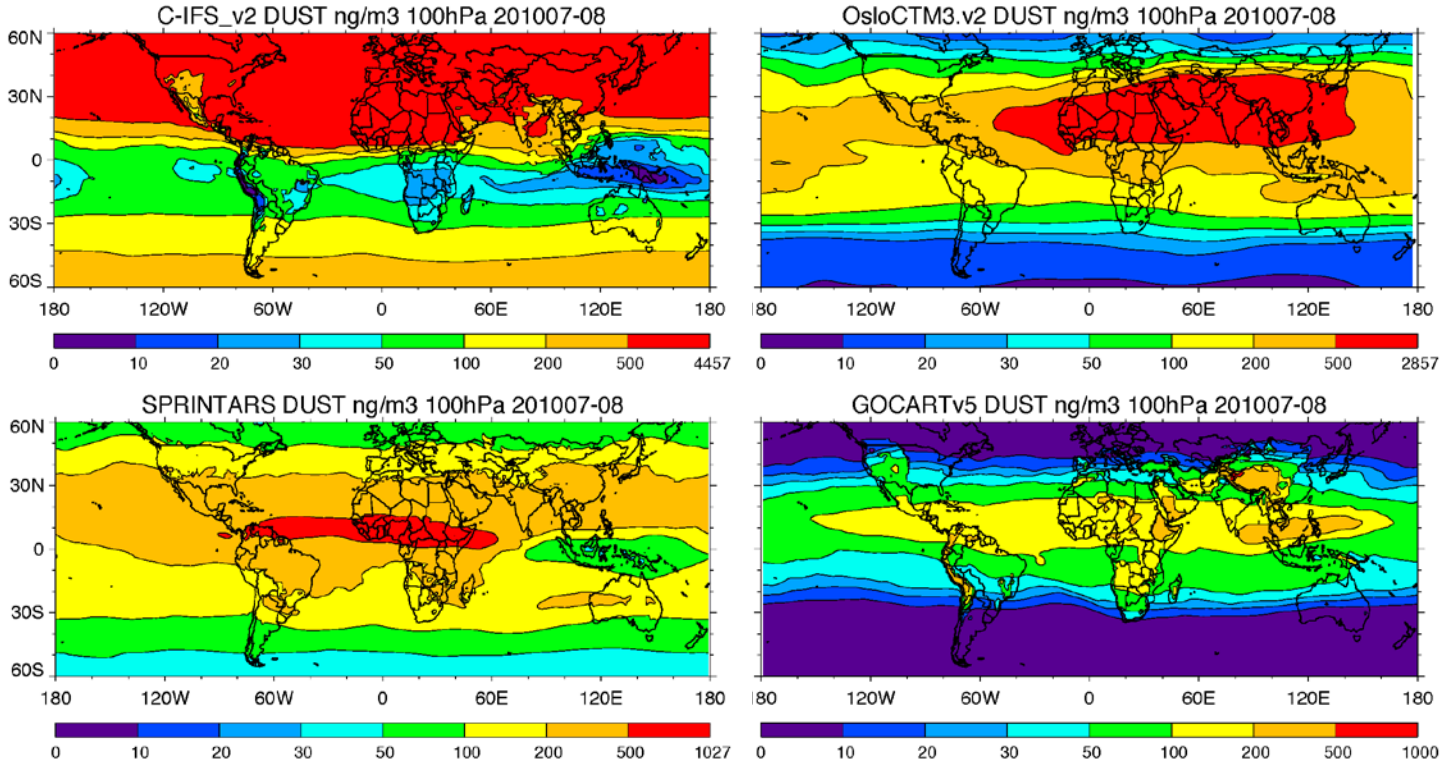


Pan et al., 2015

- Comparisons of AeroCom II model simulated BC concentrations with the ICARS observations have clearly shown that the models are unable to reproduce the high BC concentrations at most sites, especially in winter
- Possible explanations include the models missing agriculture burning emissions, underestimating anthropogenic emissions and not considering their seasonal cycles, problems with wintertime meteorological fields or missing aerosol-radiation interactions

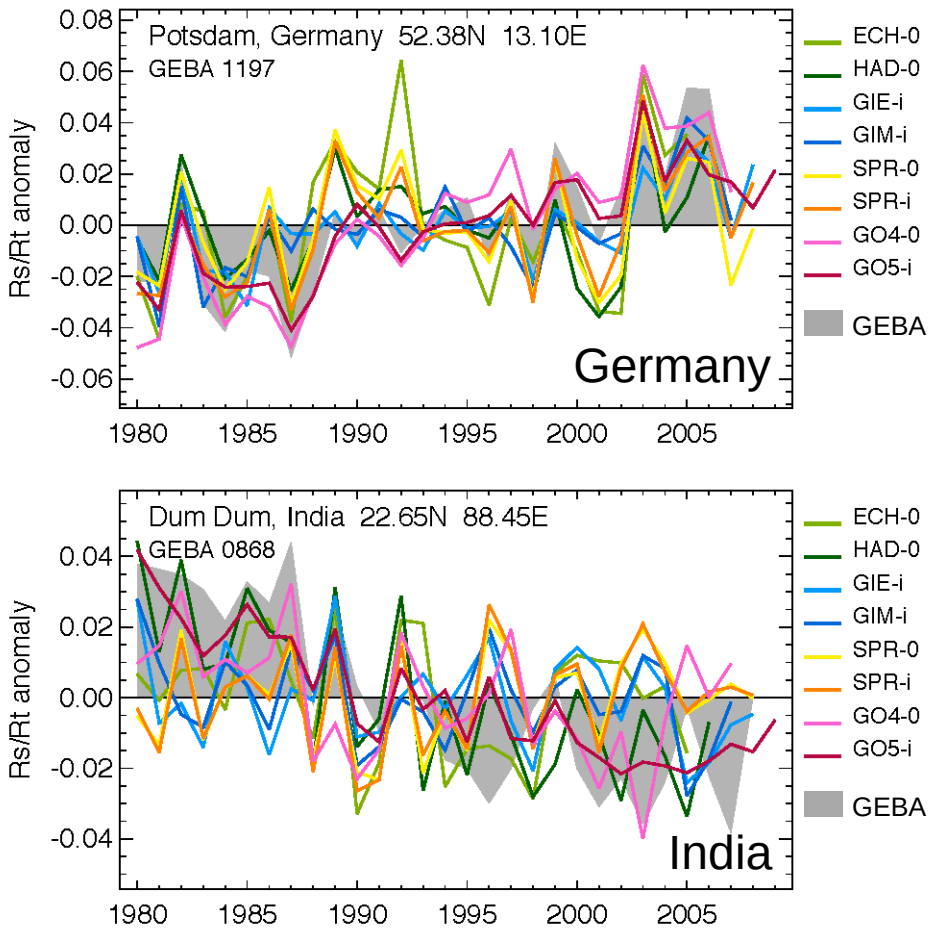
6. AeroCom (and other) models have difficulty in their representations of Asian pollution aerosols and Asian monsoon transport – Example 2: transport of dust to UT

July-August 2010 Dust mixing ratio at 100 hPa from models



- Example 2: There is a very large diversity among models on dust near the tropopause transported by the convective processes
- It has large implications on cirrus cloud formation and
- The lack of observations makes it difficult to know how wrong the models are

6. AeroCom (and other) models have difficulty in their representations of Asian pollution aerosols and Asian monsoon transport – Example 3: surface radiation trends



- Example 3: While the AeroCom II models agree on the trend of SW downward radiation at the surface (rsds) which is consistent with the GEBA data (brightening), they do not agree over Asia
- It is not clear if the problem is mostly associated with aerosol or clouds simulated in the model

7. Why should AeroCom and ACAM interact closely

- Atmospheric composition and Asian monsoon is a fascinating research area covering a range of aerosol-related processes and topics (ACRI, UTLS, air quality, emission, ERF, etc.)
- Models have low skills in simulating aerosols and meteorological conditions in Asian regions and urgently need to be improved
- ACAM is eager to establish connections with global and regional modeling communities and satellite communities to help achieve the ACAM objectives
- AeroCom can have easier access to the aircraft, balloon, and in-situ data made by ACAM scientists, especially in Asia, to improve the models

8. How to get involved

- Perform the proposed AeroCom model experiments relevant to ACAM (e.g., ACRI and UTLS I proposed last year)
- Take a lead of organizing comparisons and analysis on a topic that interests you and is relevant to ACAM
- Participate the ACAM workshops (once every two years; next one is planned in late June, 2019 in Kuala Lumpur