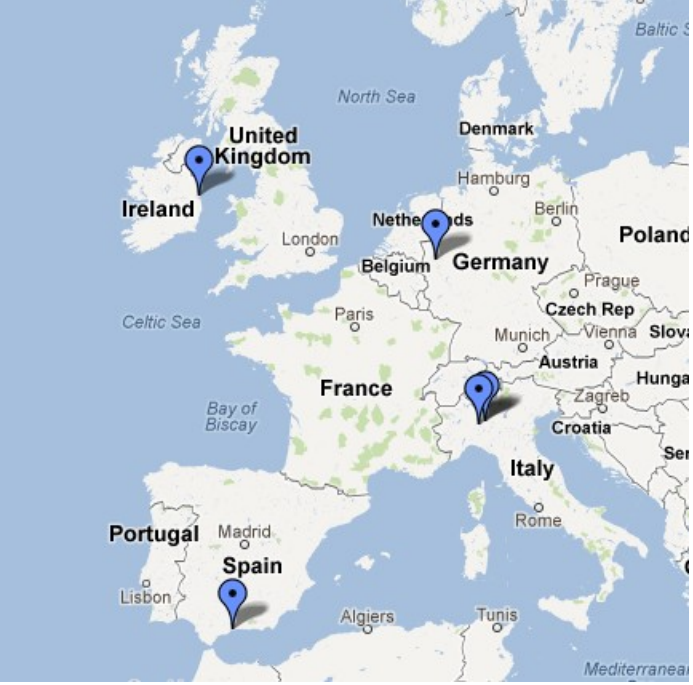
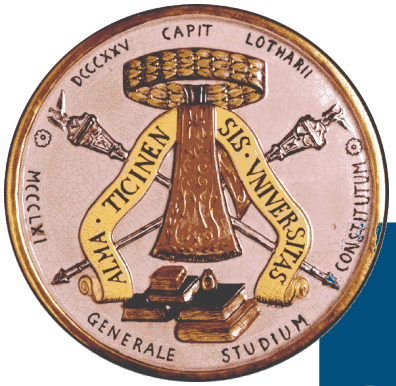


DANIELE ROSA

MS PHYSICS
CONSULTING
MS ENV.SYST. MATH MOD.
PhD Candidate EPS

Sports, Guitar, Hanging out, and mushroom hunting



accenture

HUMBOLDT STATE UNIVERSITY

THE UNIVERSITY OF CALIFORNIA BERKELEY
LET THERE BE LIGHT
1868

Aerosol forcing in a hybrid SPCAM

Daniele Rosa[1], William Collins[1,2]

1. University of California, Berkeley
2. Lawrence Berkeley National Laboratory

Motivation

- In regions of high aerosol emission, like southeast Asia, precipitation trends has been observed. Will there be negative consequences for the people?

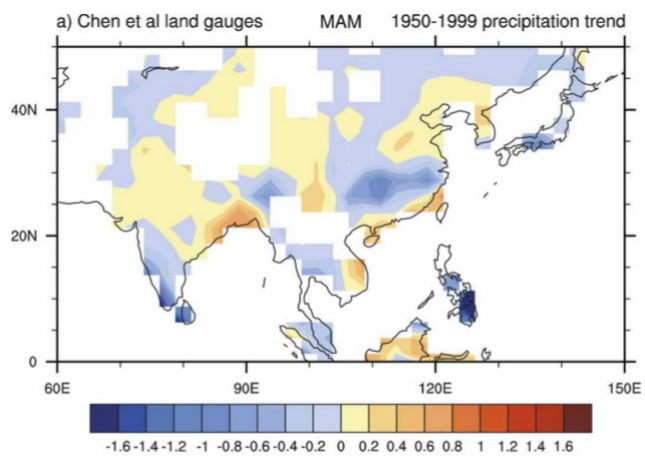
- Small and large scale aerosols effects on climate:
  - Absorbing aerosol add heat to atmospheric layers and ice surfaces
  - Scattering and absorbing aerosols dim surface radiation
  - Aerosols serve as cloud condensation nuclei

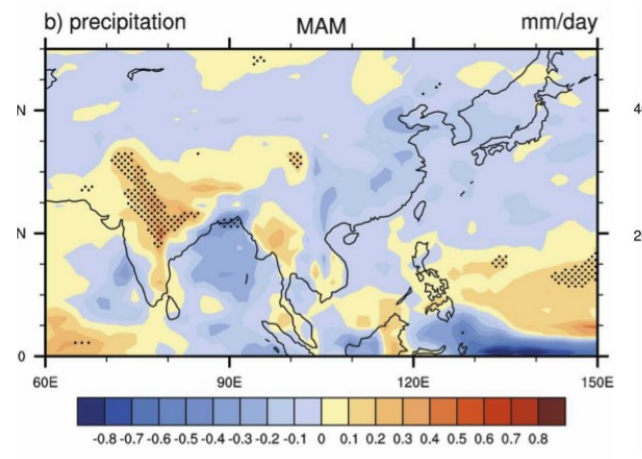
- Developing nations are the major emitters of aerosols and are likely to continue to do so

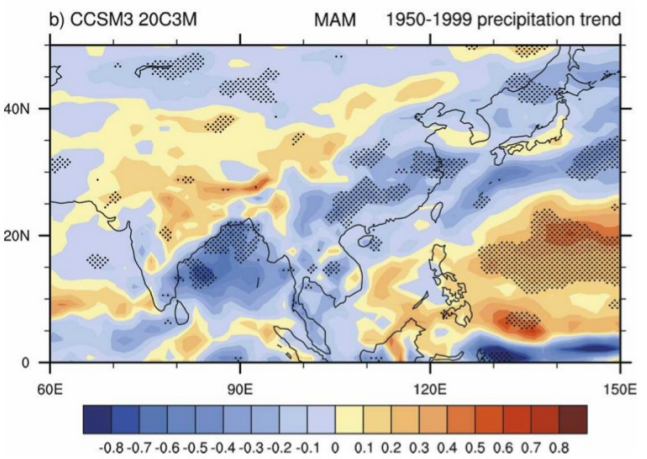
Intense research

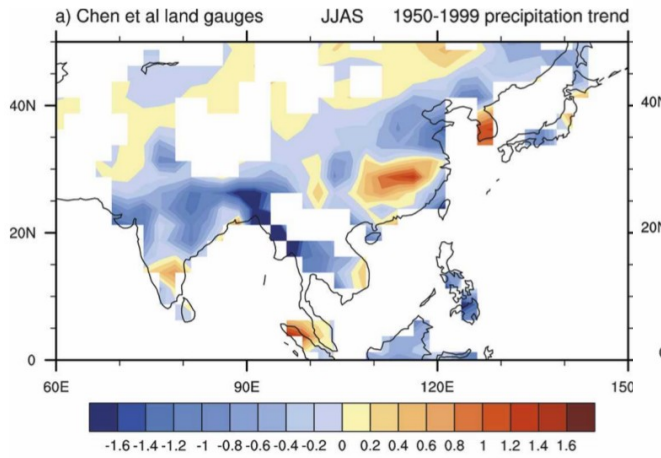
- Local effects: atmospheric instability & cloud variability
- Widespread and persistent aerosols burdens can alter remote climate
- Understand the mechanics of aerosols interaction with climate because emission patterns might change
- Indian monsoon rainfall altered by anthropogenic aerosols

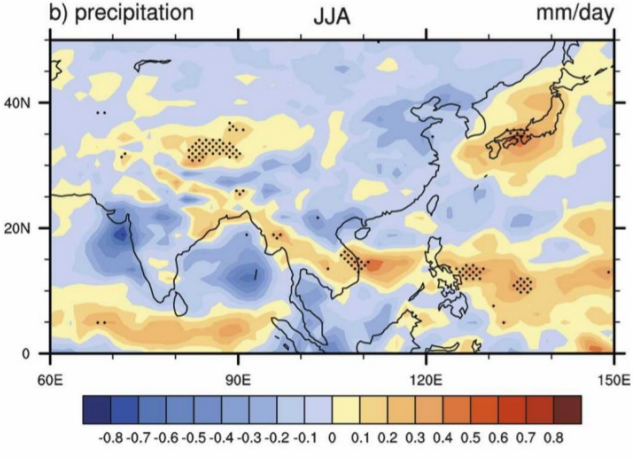
Precipitation trends

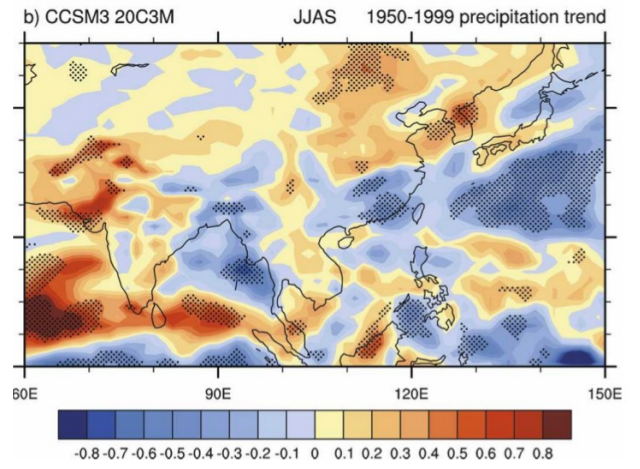












OBS

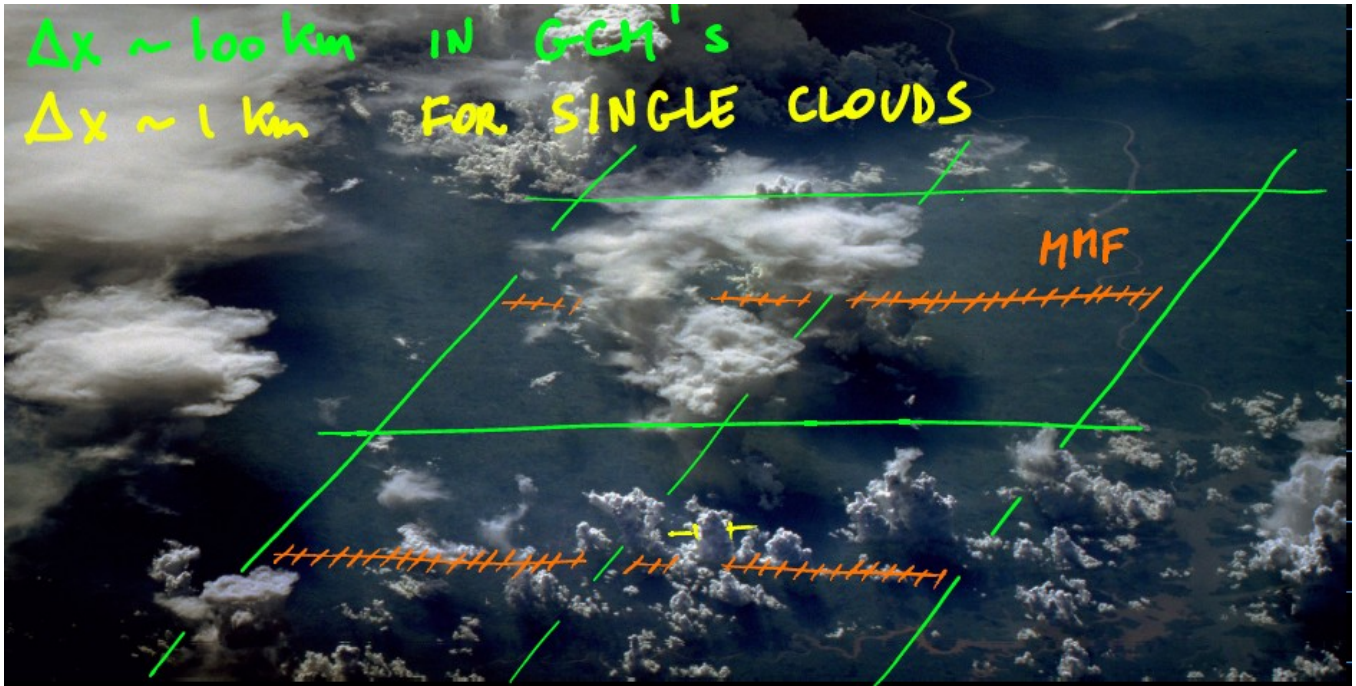
BC – PI

ALL - PI

Pre-monsoon rainfall increases and monsoon rainfall decreases.
Black carbon aerosols seem to play a major role

Super-Parameterization

- Cloud-resolving model (CRM) embedded into each grid column of a realistic GCM, to replace traditional cloud parameterization
- Use the first-principle approach to modeling the dynamics of clouds with the exception of cloud microphysics.
- Resolve most of the cloud dynamics and physical process interactions down to some scale defined by the CRM’s grid resolution and, thus, may be expected to react to the applied forcing in a more physically realistic manner.



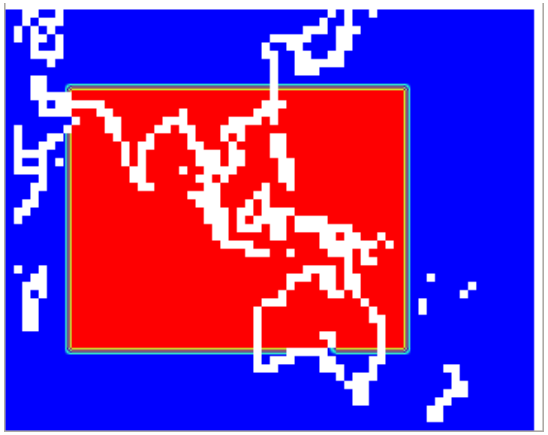
Super-Parameterization in the Indian and Western Pacific oceans

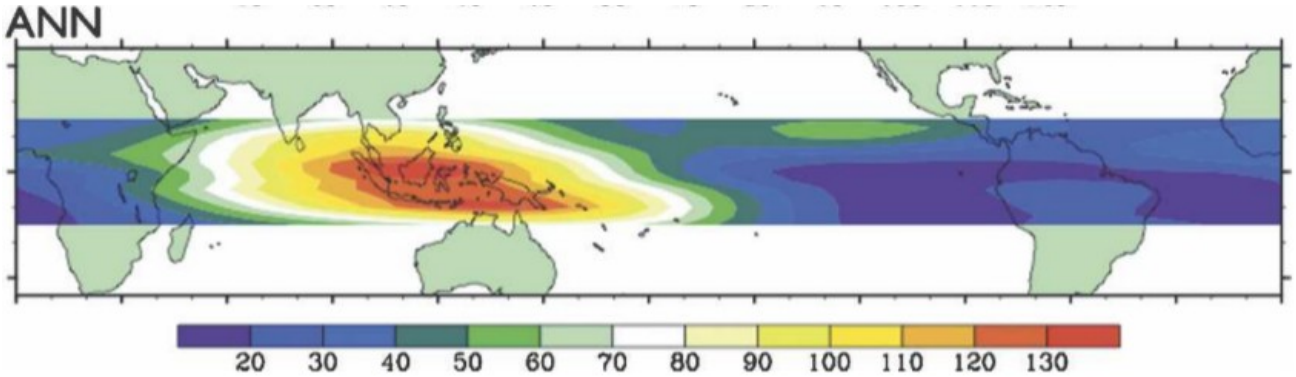
- “SP-CCSM is the only model to reasonably simulate the E-, W-, and N-propagating components of the Asian monsoon” DeMott et al 2011 JC
- Monsoon variability linked to MJO and SP-CAM can reproduce the MJO while other GCMs cannot

  => SPCAM is the natural choice for studying aerosol effects on Indian monsoons

Model Setup

- SLAB and Hybrid SPCAM because SP-CCSM is too expensive for running several aerosol scenarios
- GCM: SOM, FV, 1.9x2.5, 30 levels, 30 minutes.
- Hybrid: 2D CRM patch, 32x4Km on 60E-160E and 30S-30N.



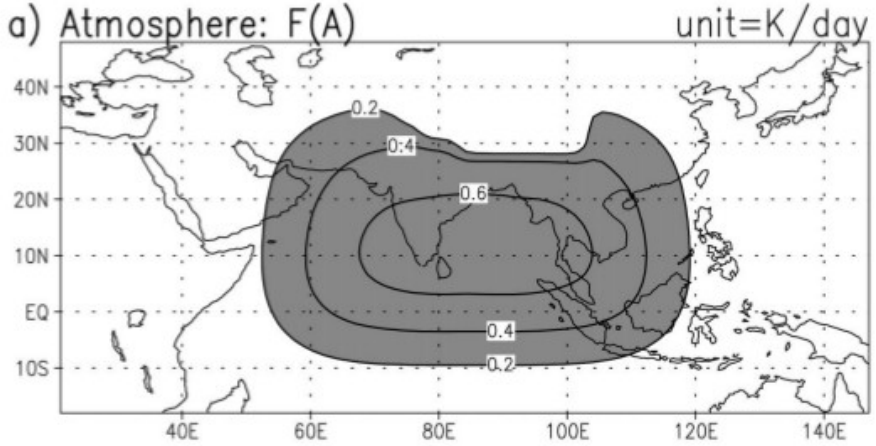


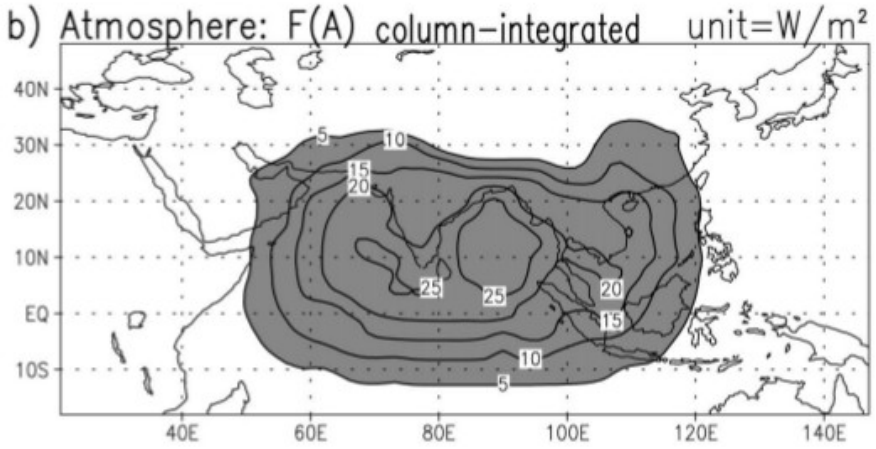
First quality check:

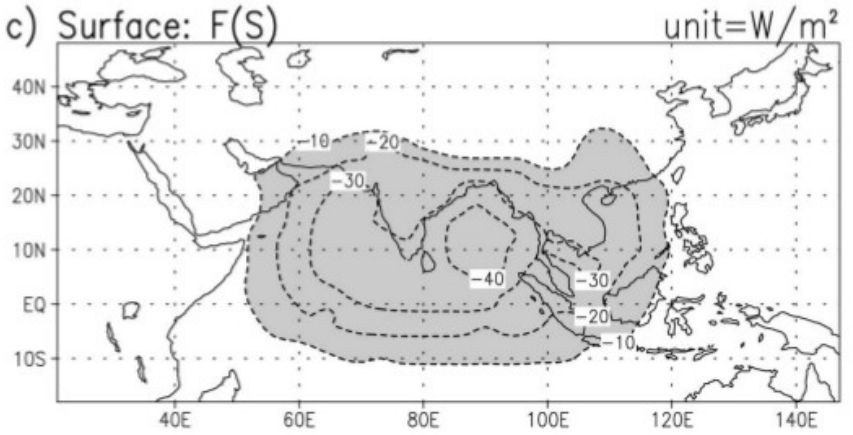
Will the hybrid MMF get a realistic variability in the Indian and Pacific oceans?

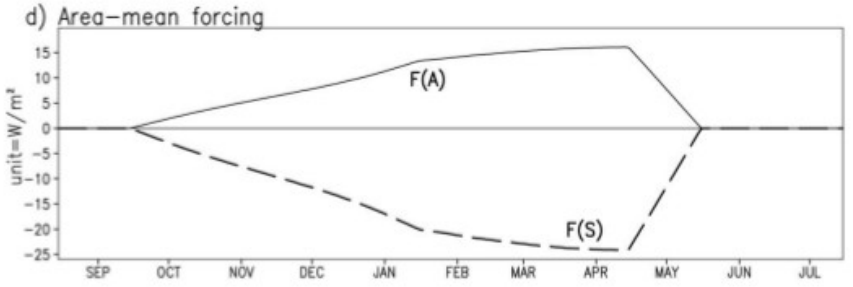
Model Setup

- Aerosol radiative forcing perturbation from Chung et al 2002





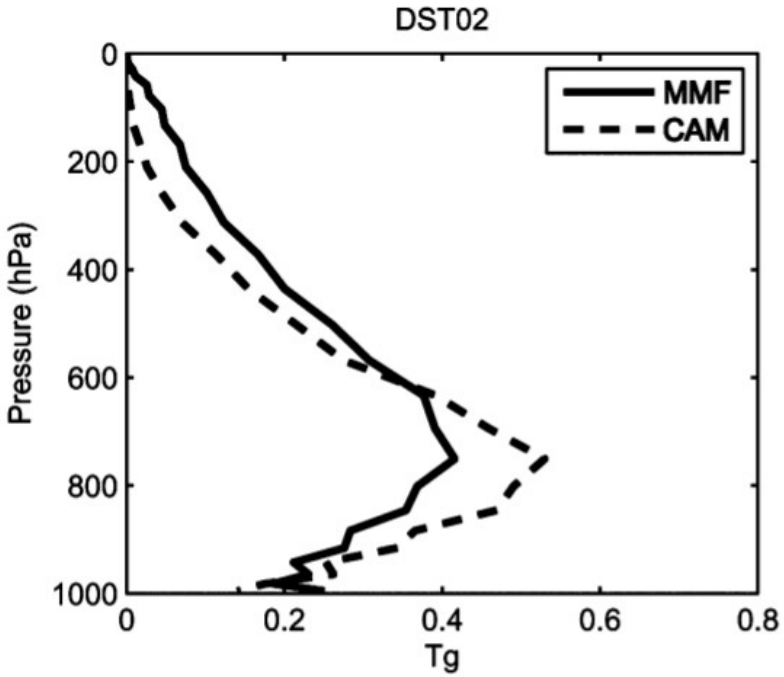




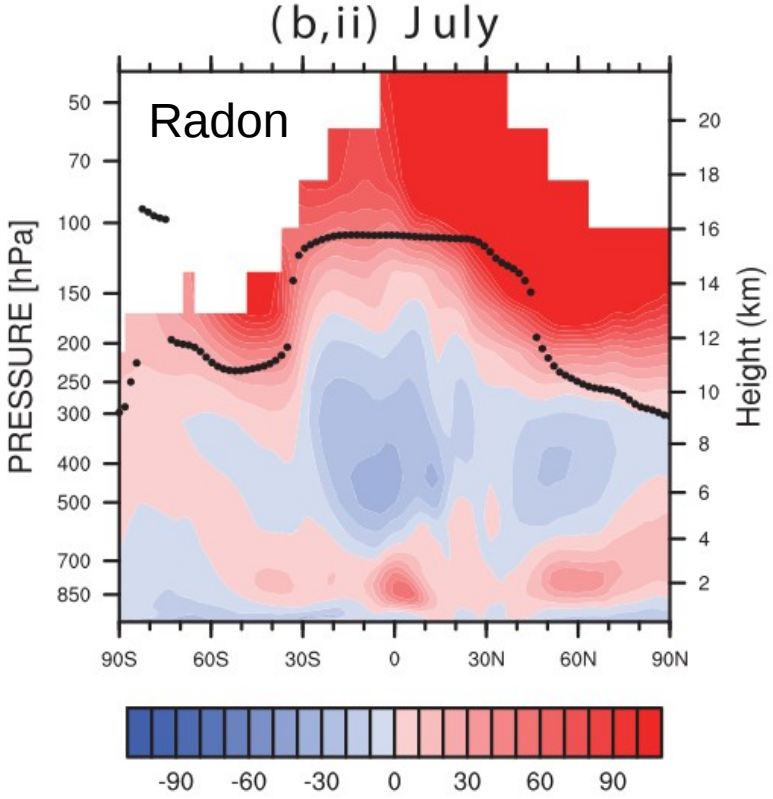
["R=-1.5" Exp.]

Transport and Chemistry

- SP-CAM vertical transport for dust and short-lived tracers:

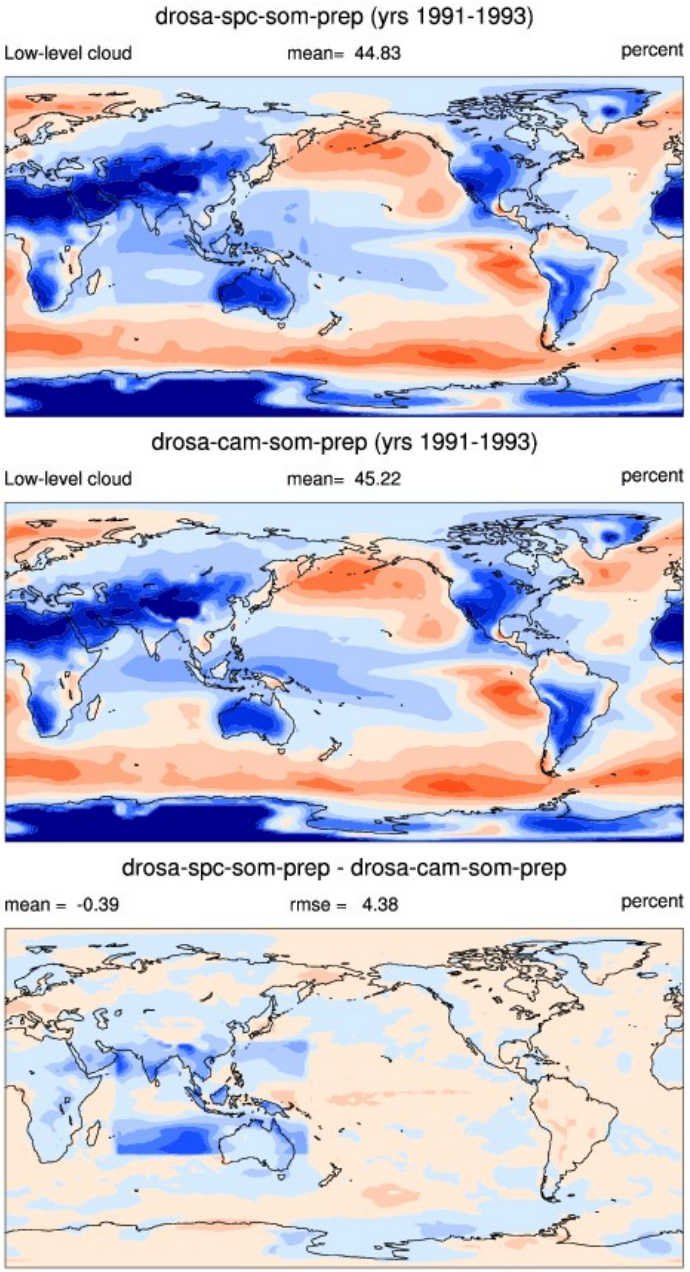


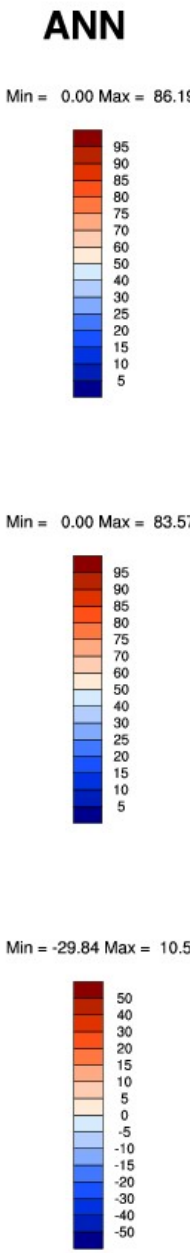
Hsieh et al 2013 JAMES

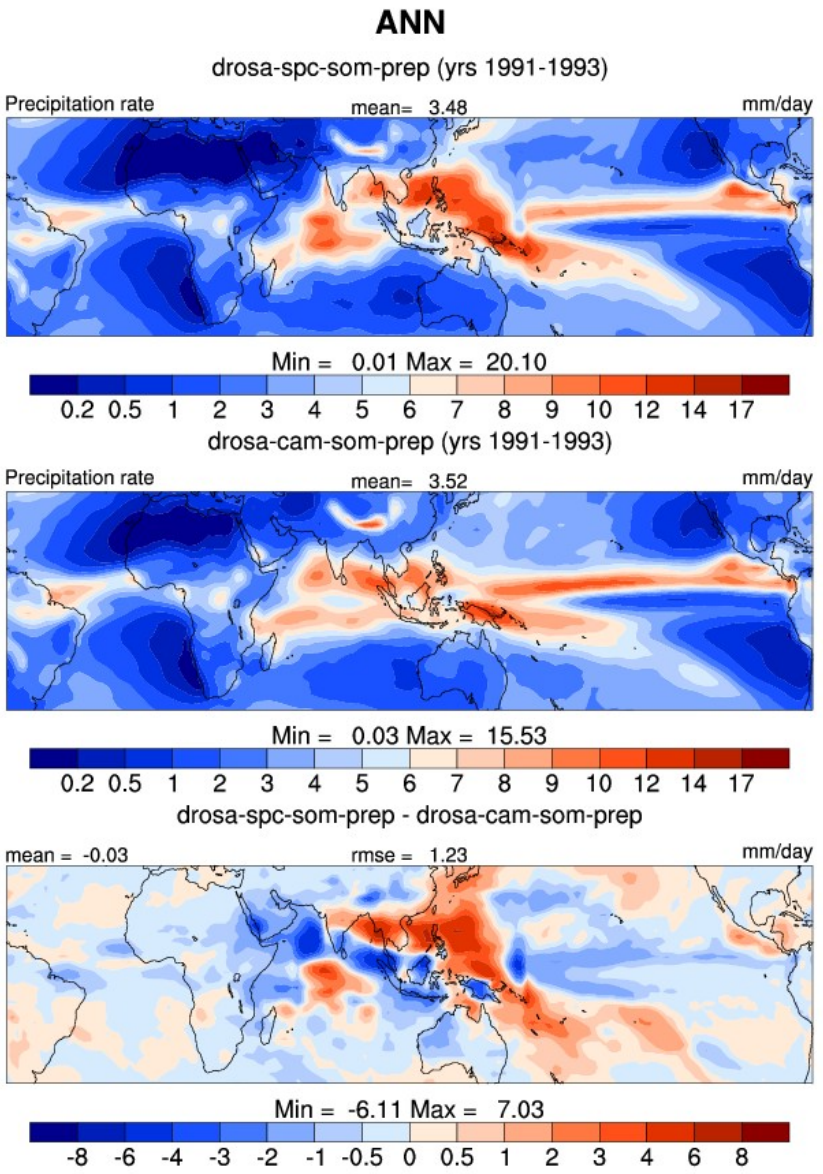


Rosa et al 2012 JAMES

First look at the hybrid SPCAM

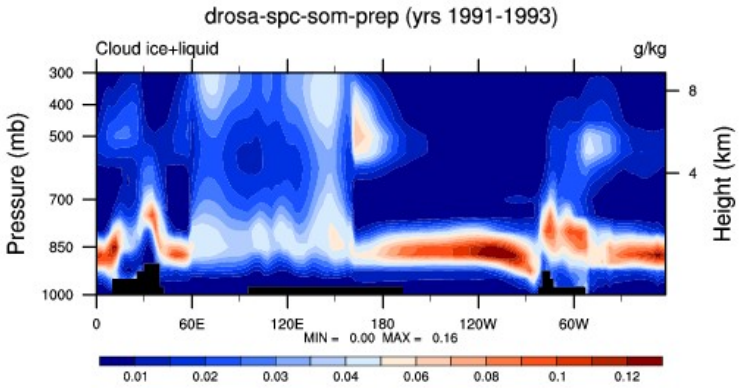


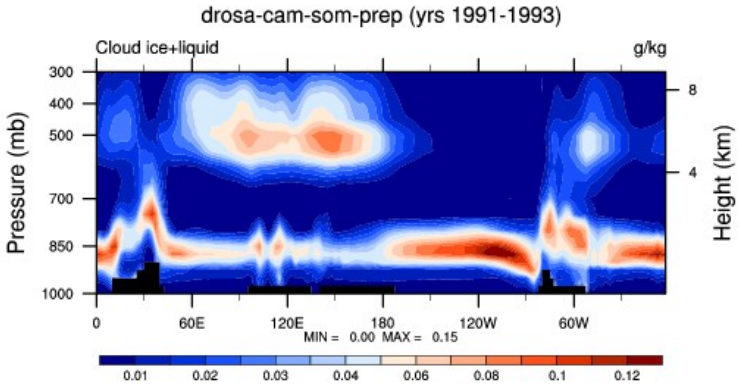


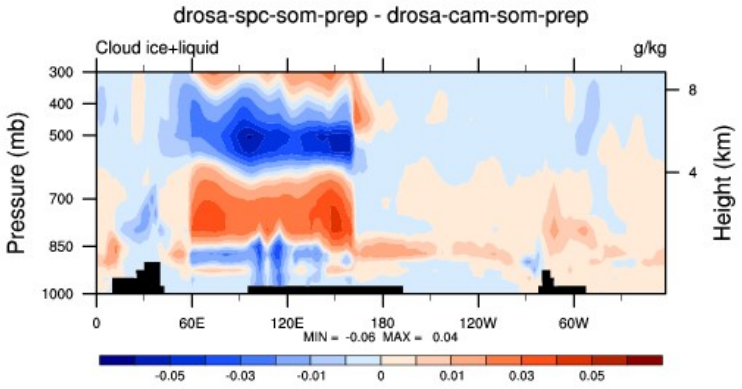


First look at the hybrid SPCAM

ANN







ANN