

# Physical-Process Working Group

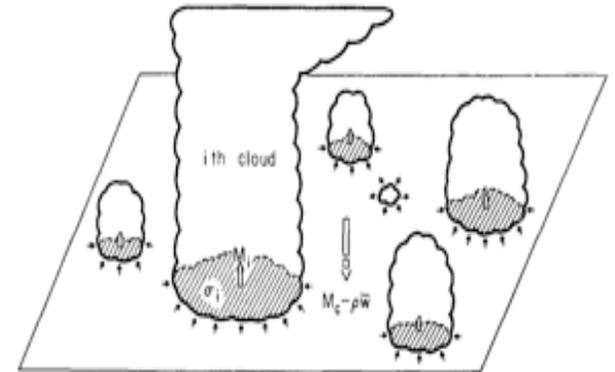
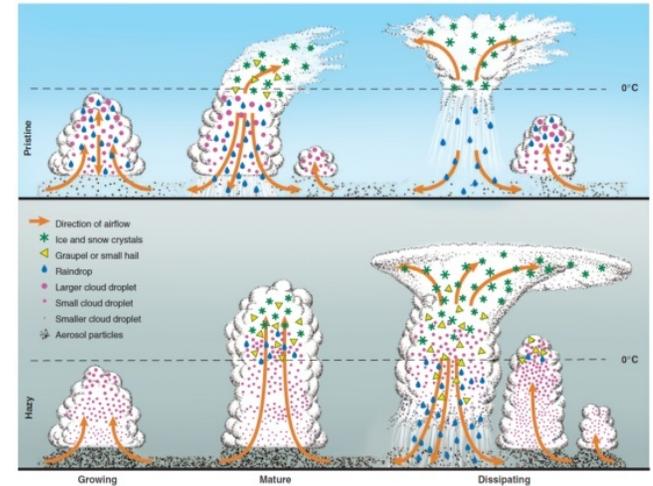
1. Hugh Morrison & Wojciech Grabowski: *Response of tropical deep convection to local heating perturbations: Implications for aerosol-induced convective invigoration*
2. Chin-Hoh Moeng & Akio Arakawa: *An updraft-downdraft scheme for SGS transport in cloud-resolving models*
3. Carl Schmitt & Andy Heymsfield: *On ice particle habits globally, seasonally, and latitudinally using data from satellite and wind tunnels.*
4. Kate Thayer-Calder: *Convective downdrafts in idealized CRM simulation*
5. Mike Pritchard: *A moist static energy analysis of the MJO in the SPCAM3.0 AMIP run*

In the remaining time: joint discussion with Land Surface Processes on Giga-LES

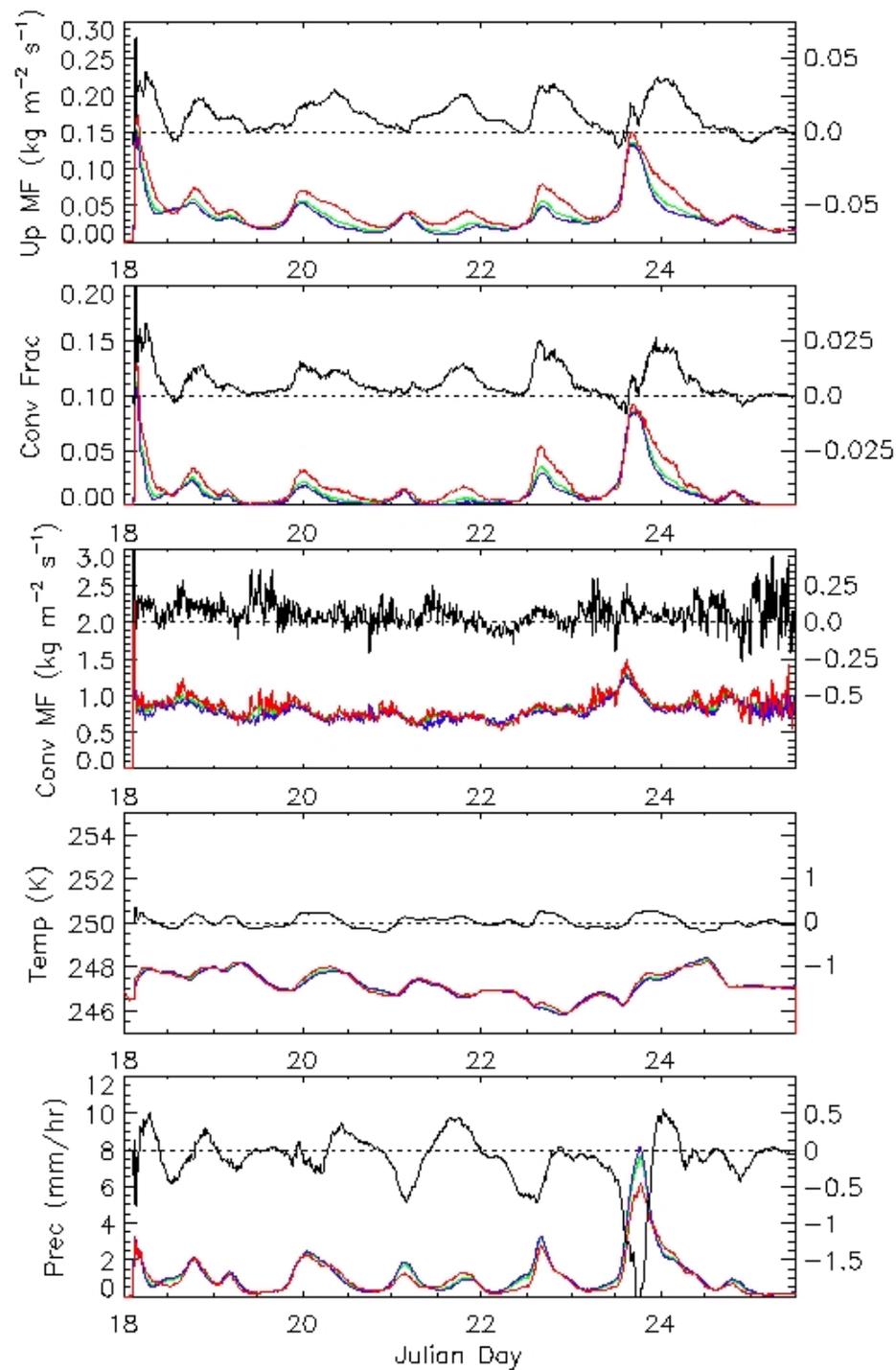
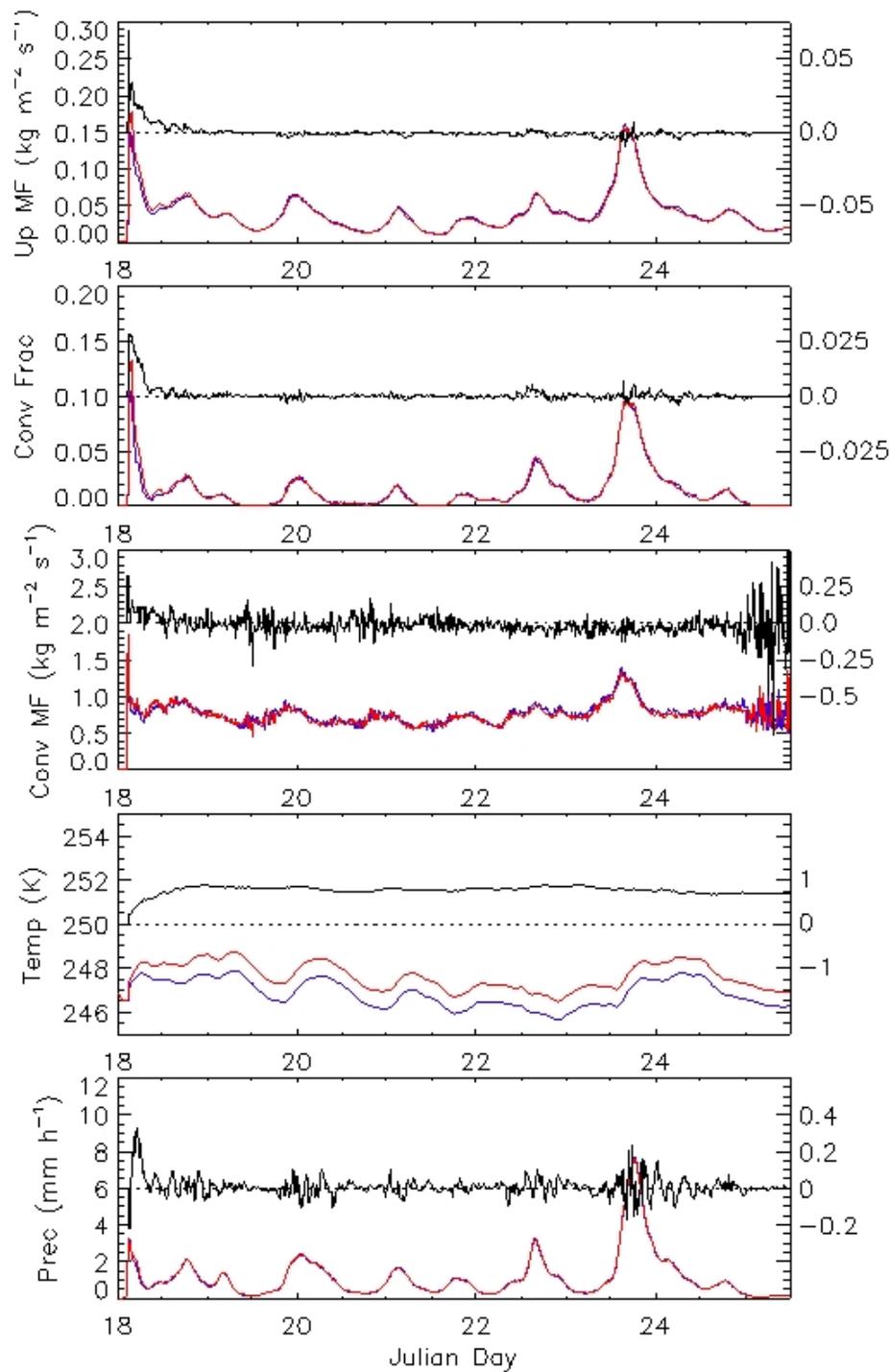
# Morrison single-cloud reasoning

versus

# cloud-ensemble reasoning



Another way to think about the problem: **single-process reasoning** (e.g., microphysics) versus the **system-dynamics approach**. Only the latter includes all the feedbacks and forcings in the system.



Moeng

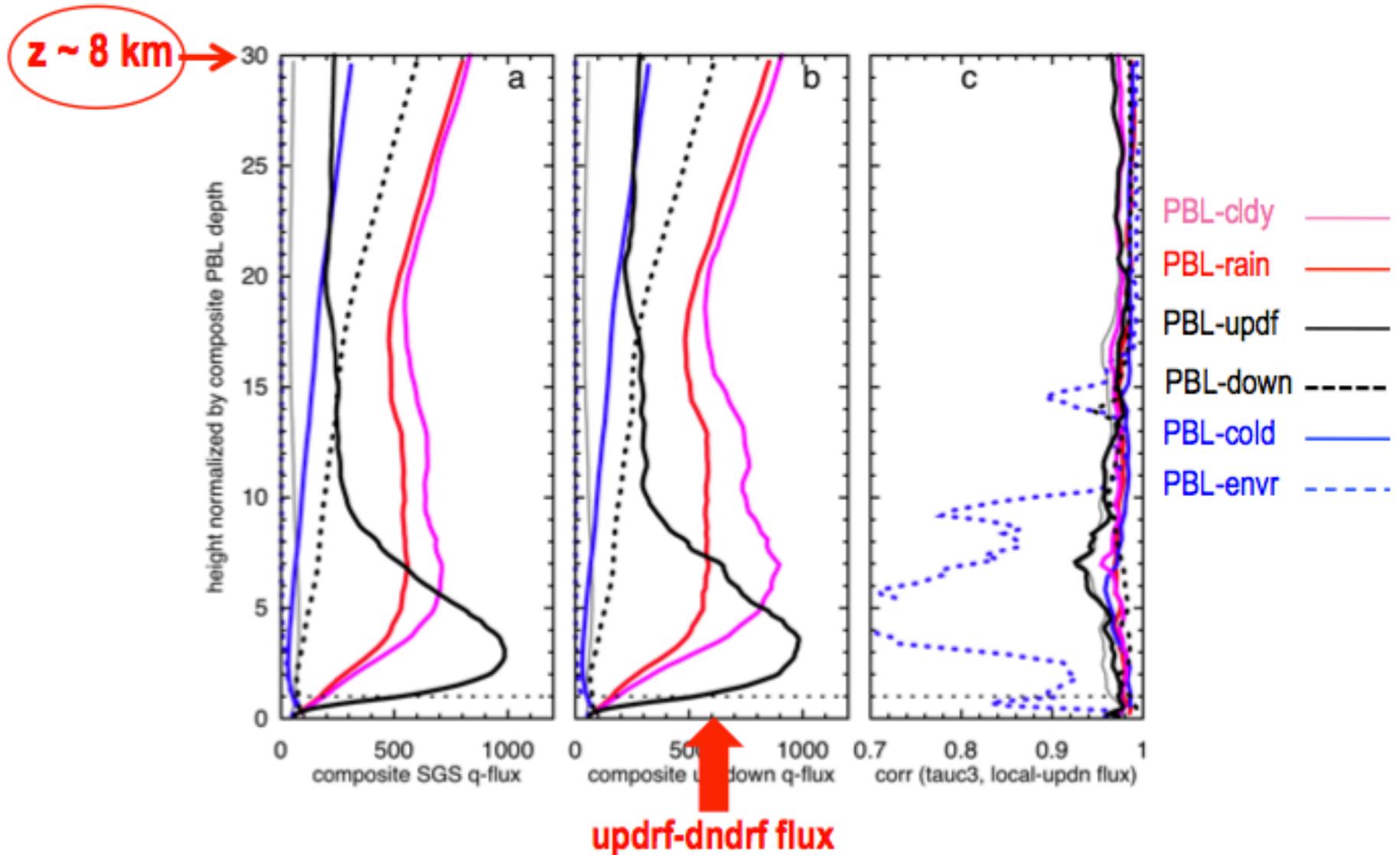
## A parameterization scheme for SGS q-flux in CRMs

**The updraft-downdraft scheme:**

$$\tau_{wq}^{UD} = A_1 (w^{up} - w^{dn})(q^{up} - q^{dn})$$

$w^{up}, w^{dn}, q^{up}, q^{dn}$  are SGS updraft-downdraft mean properties.

# Updraft-downdraft scheme with $A1=0.4$ for the **entire convection layer**



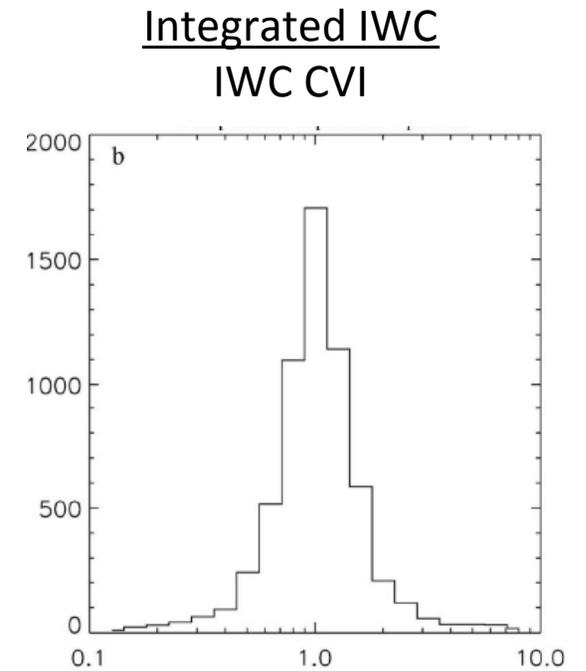
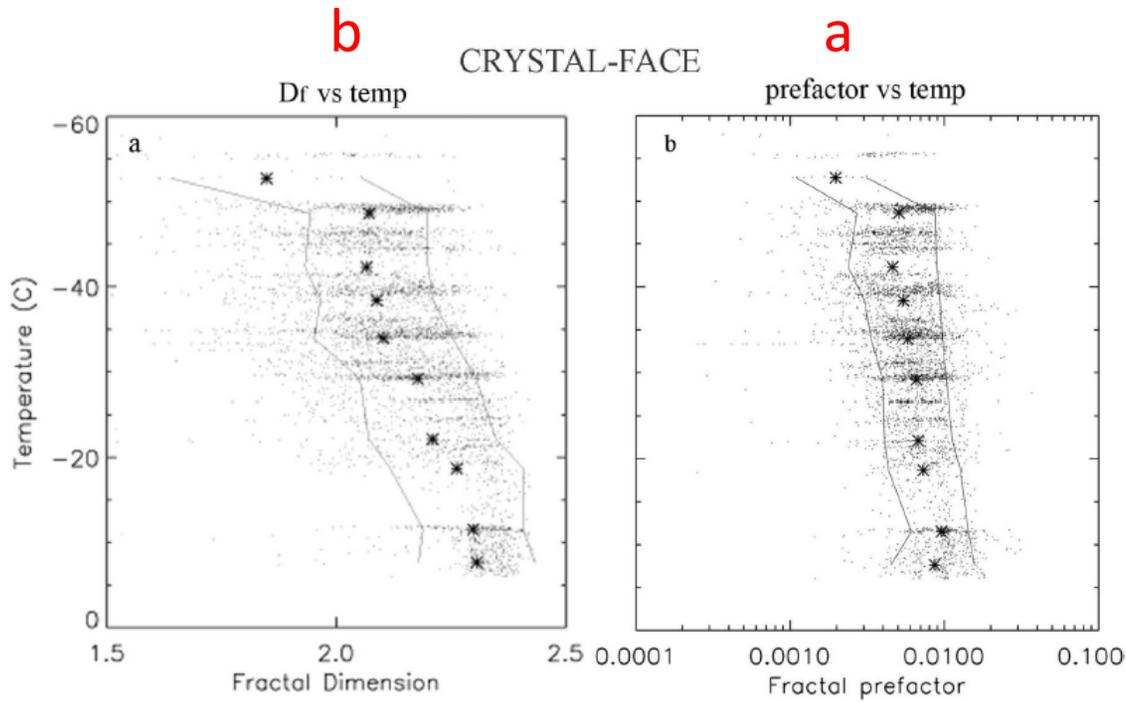
Schmitt

## Two pronged approach

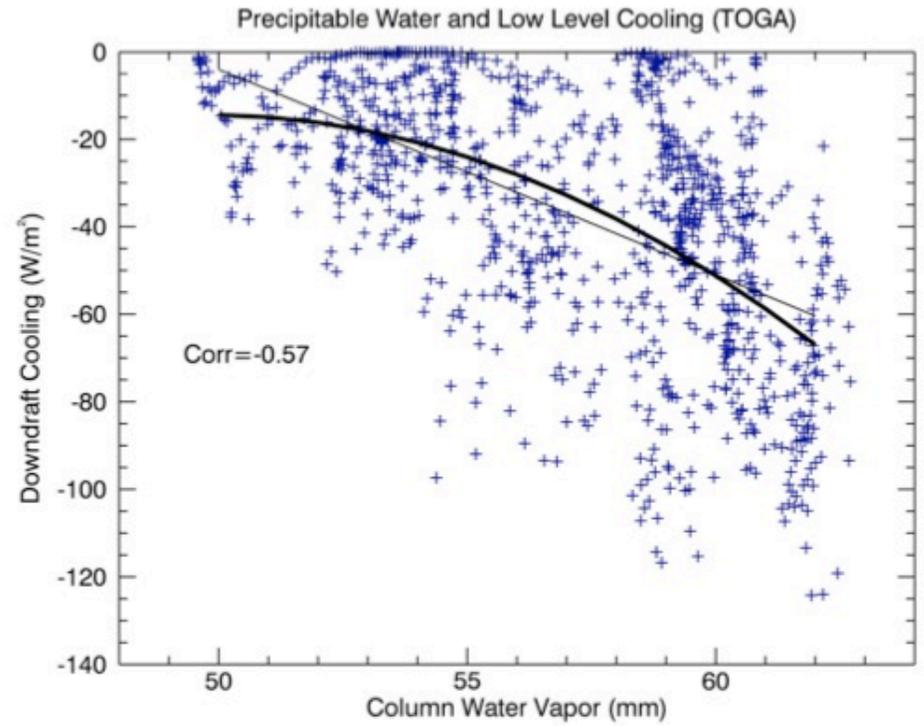
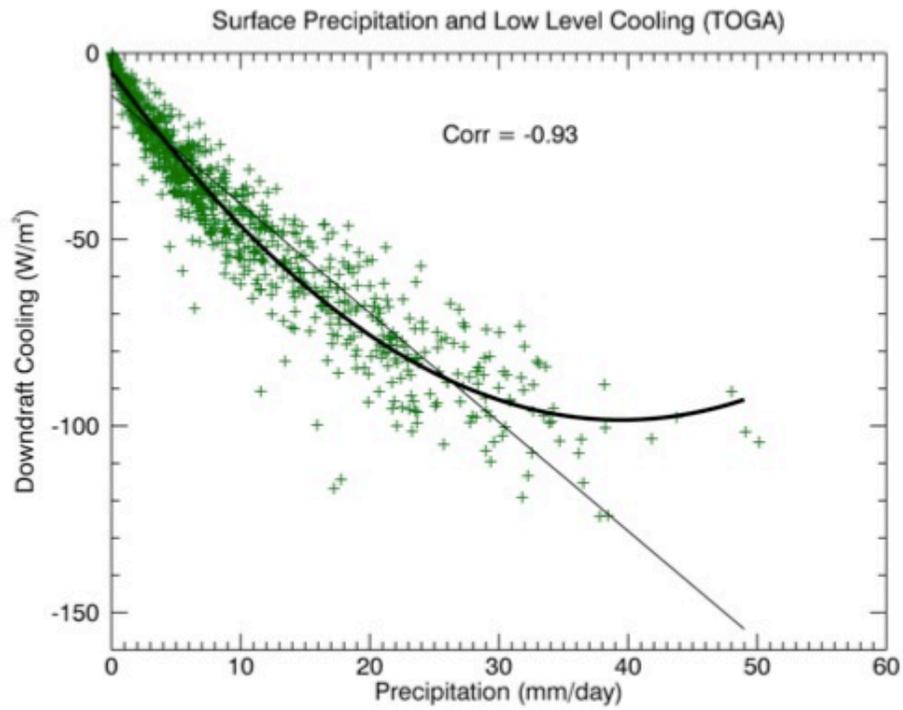
- Pristine particle habits in upper cloud regions (where radiative properties are affected by shapes)
- Fractal particle properties in more dense clouds where aggregation is the dominant particle growth mechanism.

# Mass dimensional parameters by temperature for CRYSTAL-FACE

$$\text{Mass} = a * D^b$$

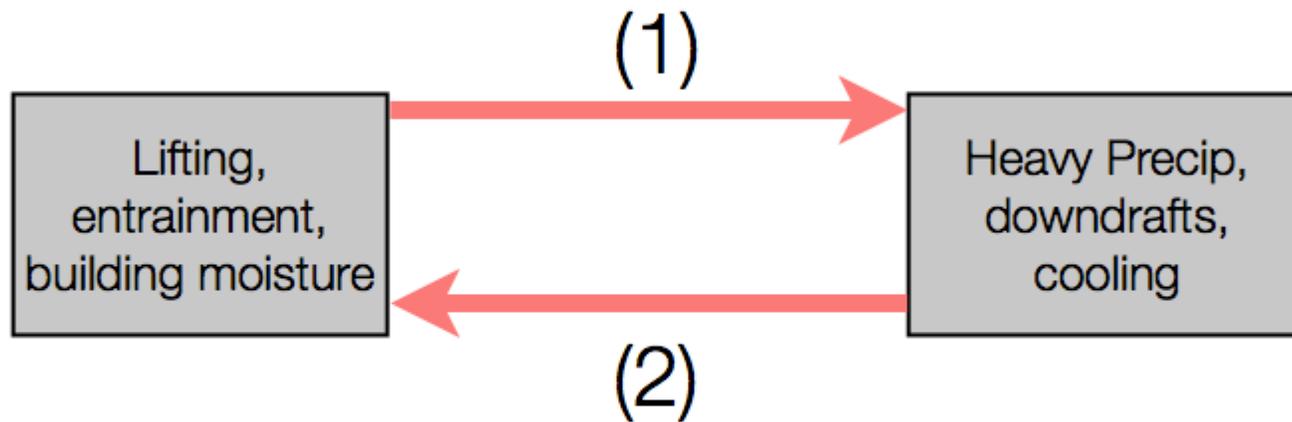


# Thayer-Calder



# Downdrafts, Low Level Cooling, and Relative Humidity

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- Downdrafts could be more re-active than interactive.
- A two step process would result in a lagging relationship between downdrafts and mid-tropospheric relative humidity

# How does real-world SPCAM's mature phase oceanic intraseasonal moisture mode compare to other models?

Pritchard

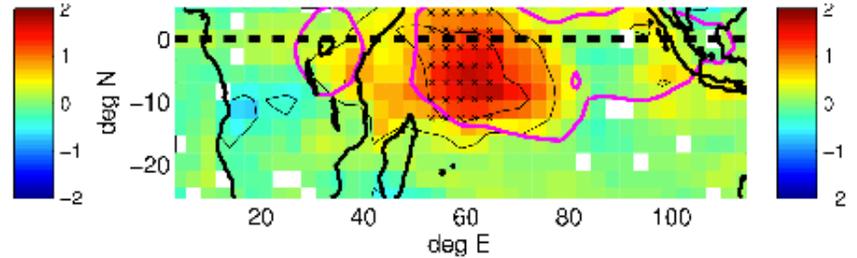
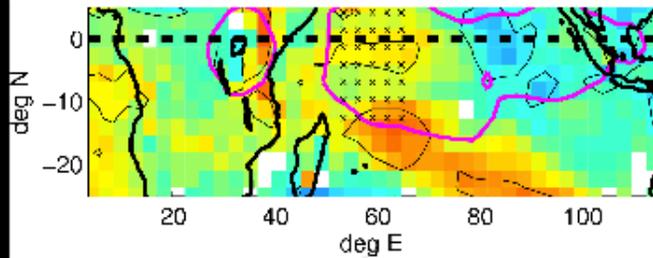
|   | <b>Modified CAM3</b><br>Maloney et al. 2010     | <b>SPCAM3.5</b><br>Andersen & Kuang 2011 | <b>SPCAM3.0</b>          |
|---|---|--|--------------------------|
| Basic state configuration   | Aquaplanet w. warm pool + $1/4 \text{ dSST/dy}$ | Aquaplanet w. zonally symmetric SSTs     | Real-world               |
| Horizontal column MSE advection appears to mediate eastward travel? | ✓   | ✓  | ✓                        |
| Role of longwave heating anomalies?                                 | Hard to say                                     | Strongly destabilizing                   | Moderately destabilizing |
| Role of surface flux anomalies?                                     | Strongly destabilizing                          | Stabilizing                              | Moderately destabilizing |

# Radiative destabilization seems to play a larger role in the column MSE budget over the Indian Ocean and Maritime Continent sectors.

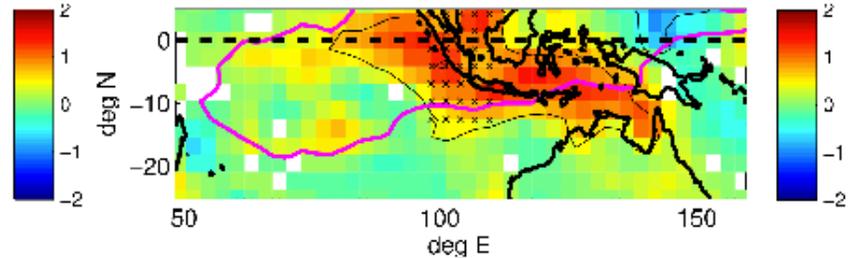
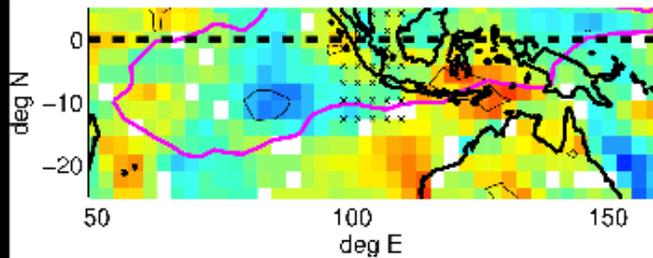
Evaporation  
( $W/m^2$  per  $W/m^2$ )

vs. Column longwave heating  
( $W/m^2$  per  $W/m^2$ )

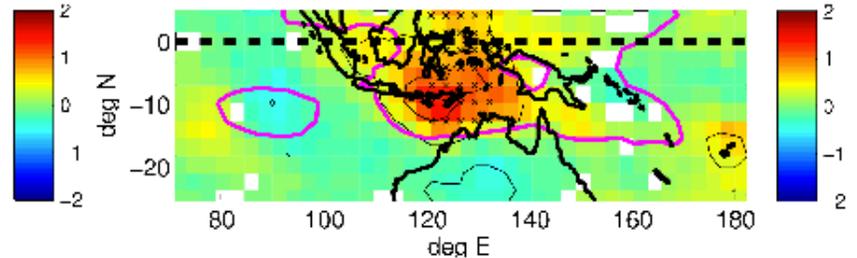
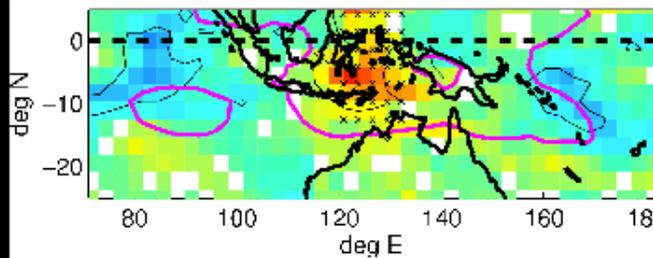
Phase 2  
(initiation)



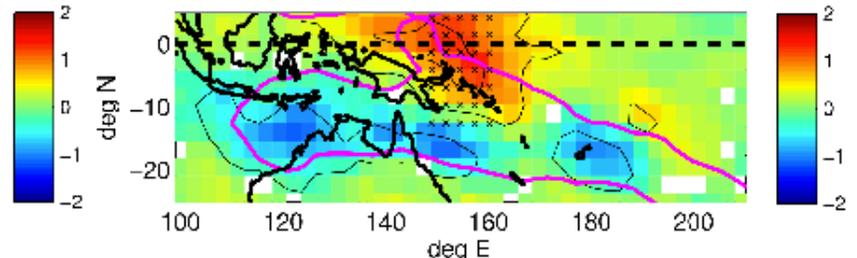
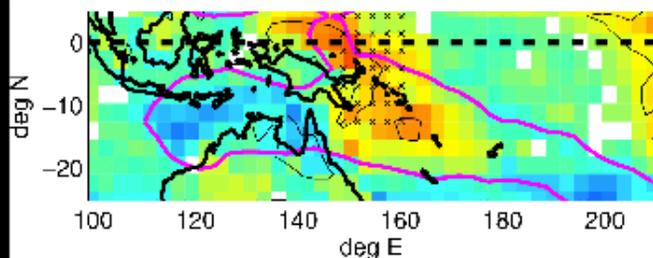
Phase 3



Phase 4



Phase 5

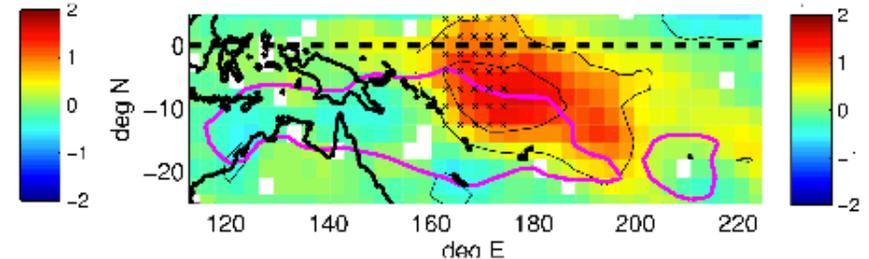
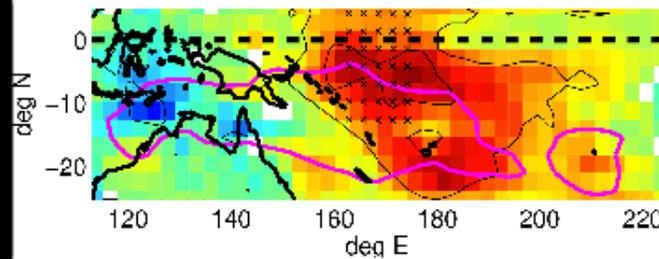


# Evaporative destabilization is dominant over all Warm Pool phases.

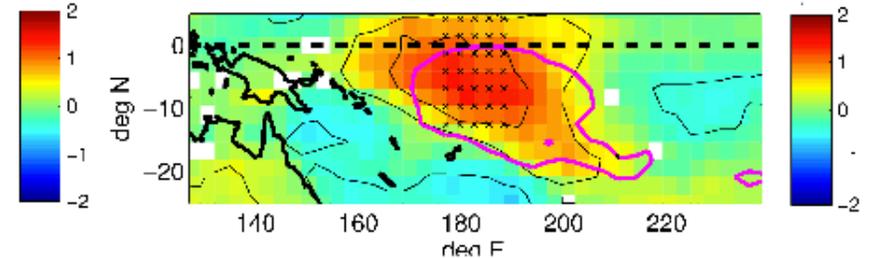
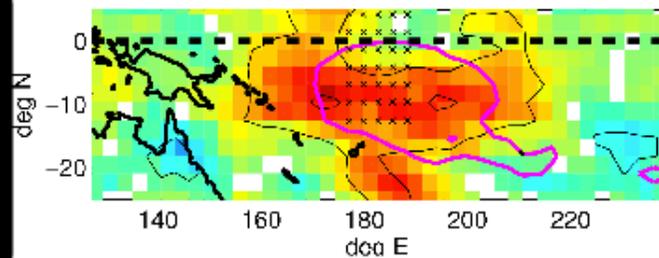
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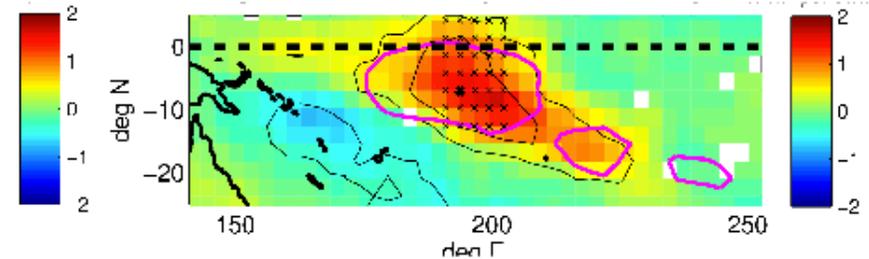
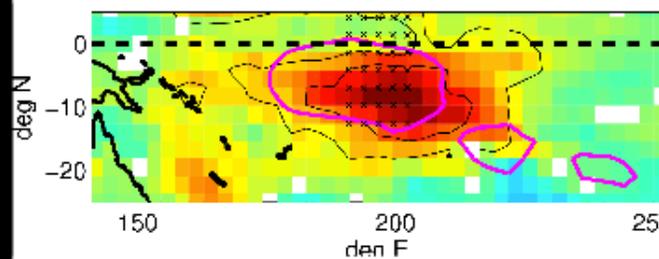
Phase 6



Phase 7



Phase 8



Regression slope of unfiltered latent heat flux and column radiative heating against 20-100 day MJO convection index across the reference region.

# Proposal for new Giga-LES runs

Two new cases:

- over ocean using the new microphysics scheme
- over land to study land-surface processes

Model Configuration

- SAM (6.9.5, ORTM, 2-moment physics)
- SIB3

Observations

- ARM July 1997 observation comparison and initialization

Resources

- XSEDE allocation request for time on Kraken (4 hour chunks)
- Submit Sep-Oct, allocation starts 1 Jan 2013