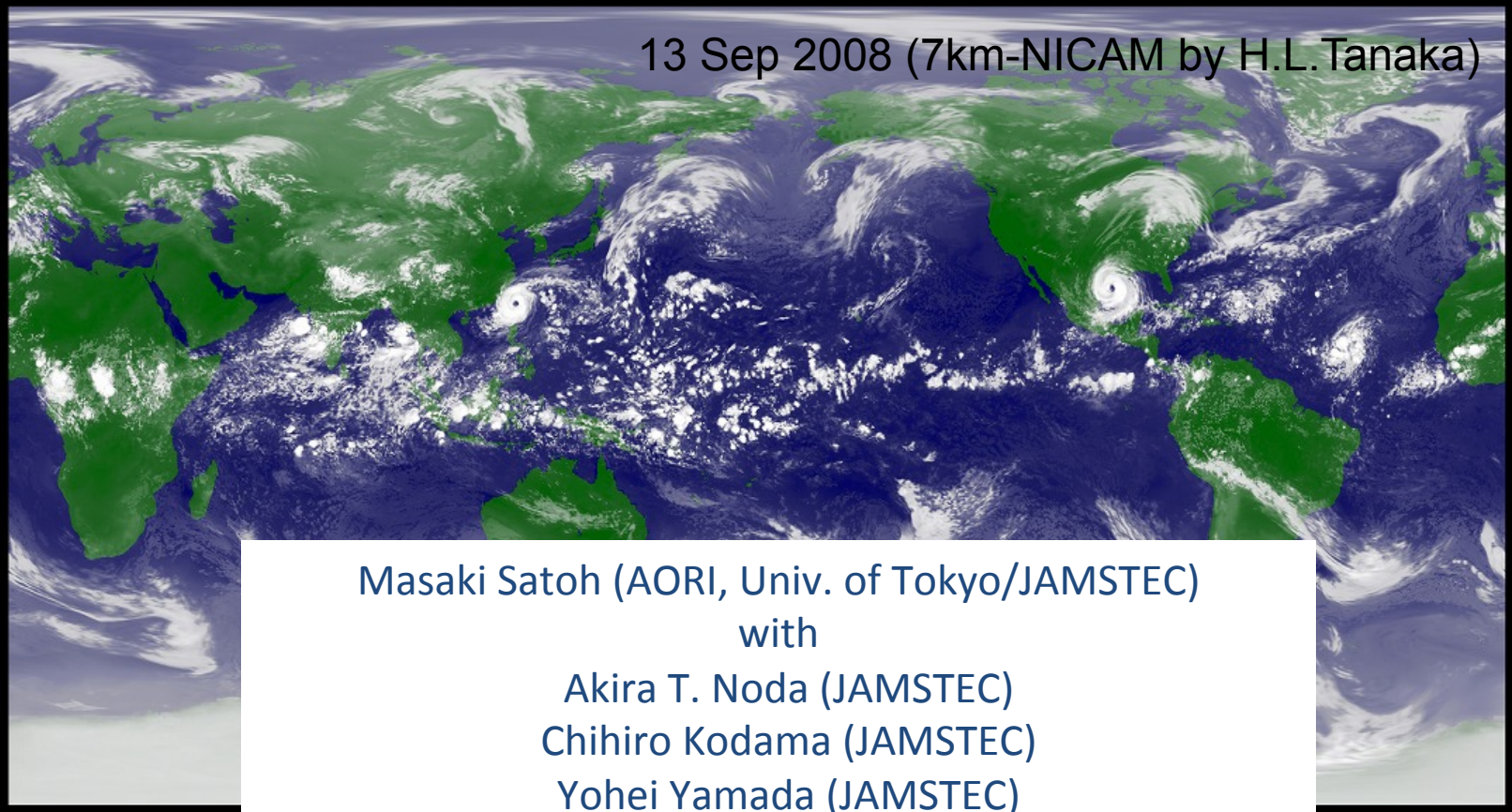
Clouds and Climate Breakout Summary

Peter Blossey

Six Talks

- Masaki Satoh, Cloud responses in NICAM
- Andrew Gettelman, Understanding evolution of cloud feedbacks in CAM from CMIP3 to CMIP5
- Marat Kharioutdinov, Climate sensitivity in a TC world
- Mike Pritchard, SP-CAM Forecasts of the MJO
- Kuan-Man Xu, Clouds along the GPCI in CAM5, SP-CAM and SP-CAM-IPHOC
- Peter Blossey, CGILS LES Intercomparison

Cloud responses simulated by NICAM

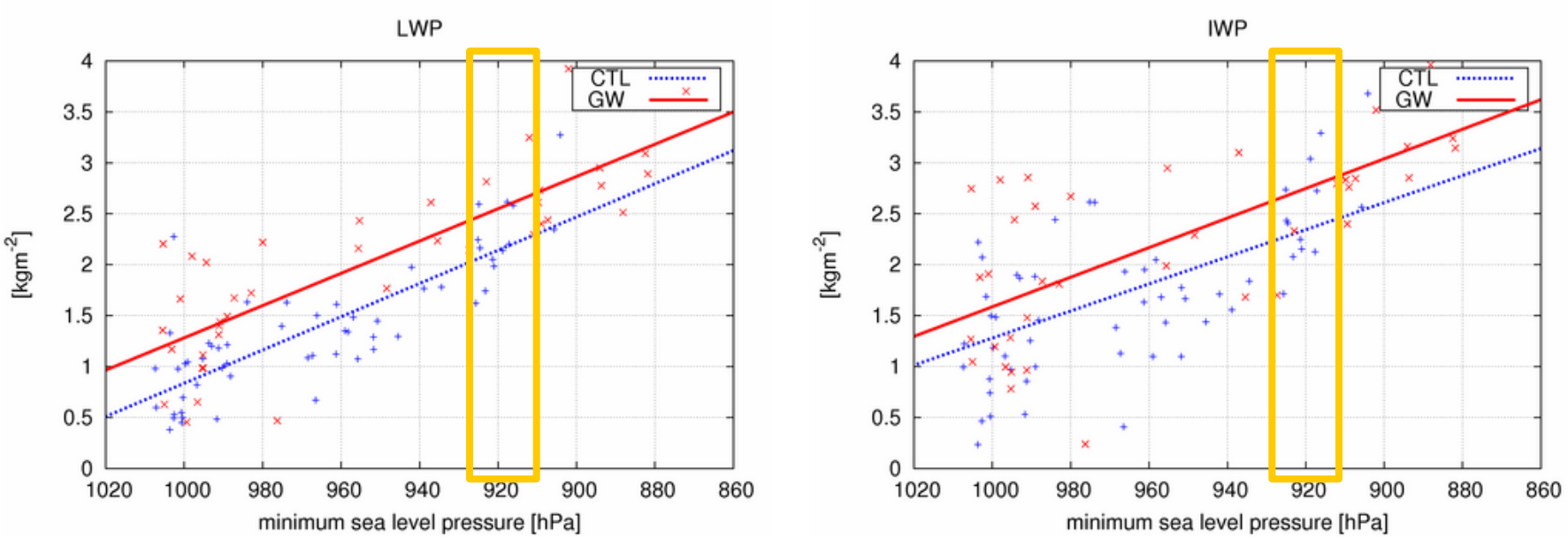


Masaki Satoh (AORI, Univ. of Tokyo/JAMSTEC)
with
Akira T. Noda (JAMSTEC)
Chihiro Kodama (JAMSTEC)
Yohei Yamada (JAMSTEC)
Shin'ichi Iga (RIKEN)

CMMAP 13th Team Meeting, August 7 - 9, 2012
Hilton, Fort Collins, USA

Group web page http://nicam.jp

TC intensities and LWP, IWP

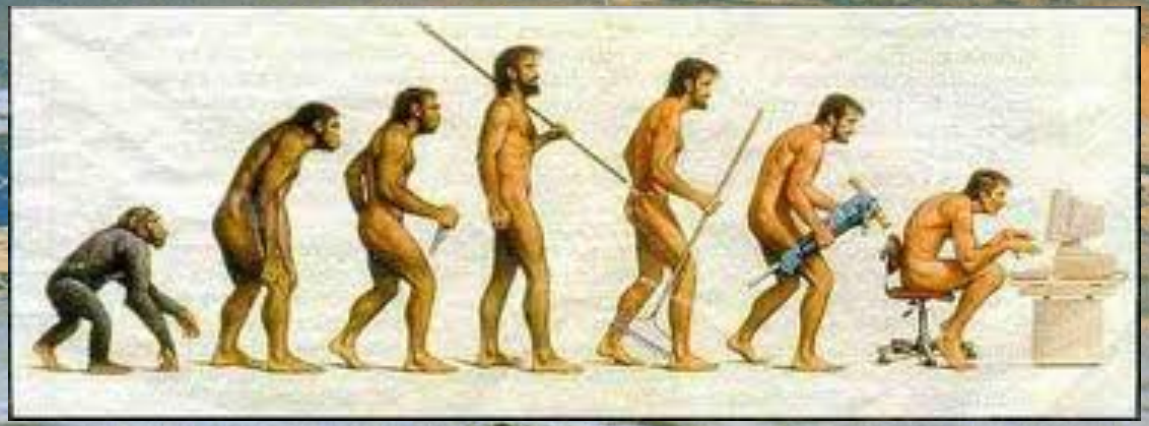


IWP & LWP: GW > CTL, especially for SLP>920hPa

Number of TCs CTL=57, GW=40

Average in the circle with R=500km from the TC Center at the strongest stage

Climate Sensitivity and Cloud Feedbacks in the Evolution of a GCM



A. Gettelman (NCAR, ETH-Zürich),
J. E. Kay, J. T. Fasullo (NCAR), K. M. Shell (OSU)

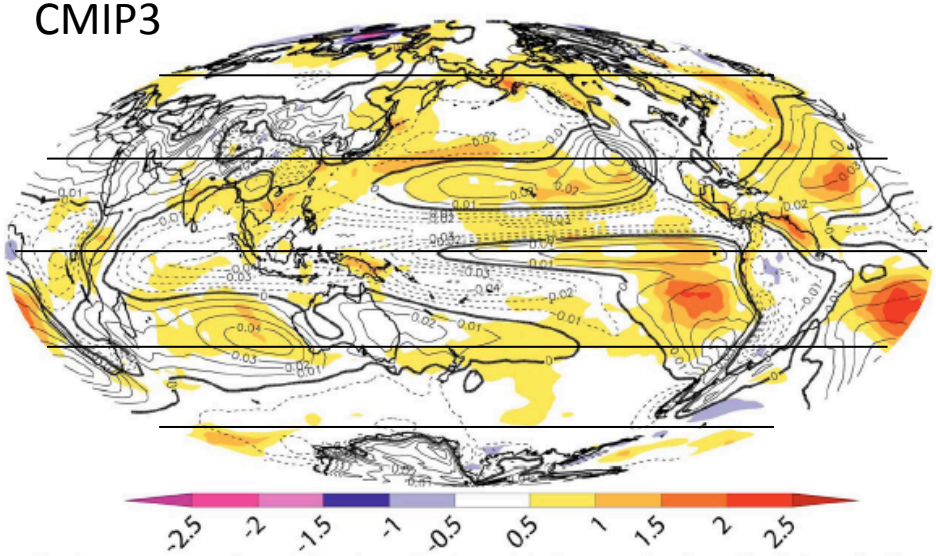
IAC ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

NCAR
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

Regressions: Compared to CMIP3

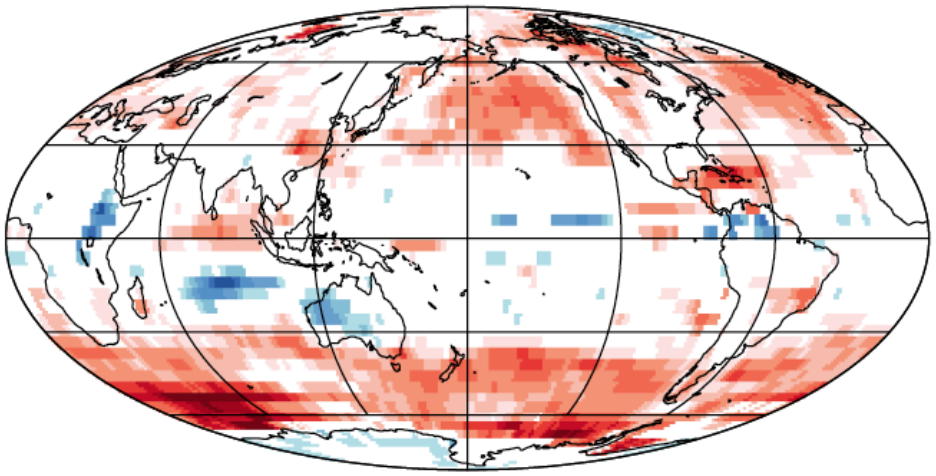
SODEN AND VECCHI: VERTICAL DISTRIBUTION OF CLOUD FEEDBACK

CMIP3



Shade: Regression of Local Cloud Feedback to Global-mean Cloud Feedback ($W \cdot m^{-2} \cdot K^{-1}$)
Contour: Background 500hPa Pressure Velocity ($Pa \cdot s^{-1}$)

CESM: Net



Regression Slope (Wm-2K-1)

-6 0 6

- CESM different than CMIP3 even with feedback sign change in Strato-cu regions…
- CMIP3: tied to sub-tropical descent regions (no correlation where forcing is large)

- CESM: looked at ω_{500}: not strong correlations or regression
- CESM: more storm track focused (where forcing is large)

Forecasting the Madden Julian Oscillation with SPCAM

Preliminary results from a new CMMAP contribution to the international MJO Diabatic Heating Intercomparison Project.

Mike Pritchard
University of Washington

Chris Bretherton & Tom Ackerman
(postdoc hosts)

Nicholas Klingaman, U. Reading
Gabe Kooperman, Scripps
(collaborators)

NOAA Climate & Global Change Fellowship
(funding)

Conclusions

How realistic is the MJO in the latest versions of the SPCAM?

The original model, SPCAM3.0 has a much better MJO and mean climate than its new sister models.

Can SPCAM skillfully forecast real-world MJO events?

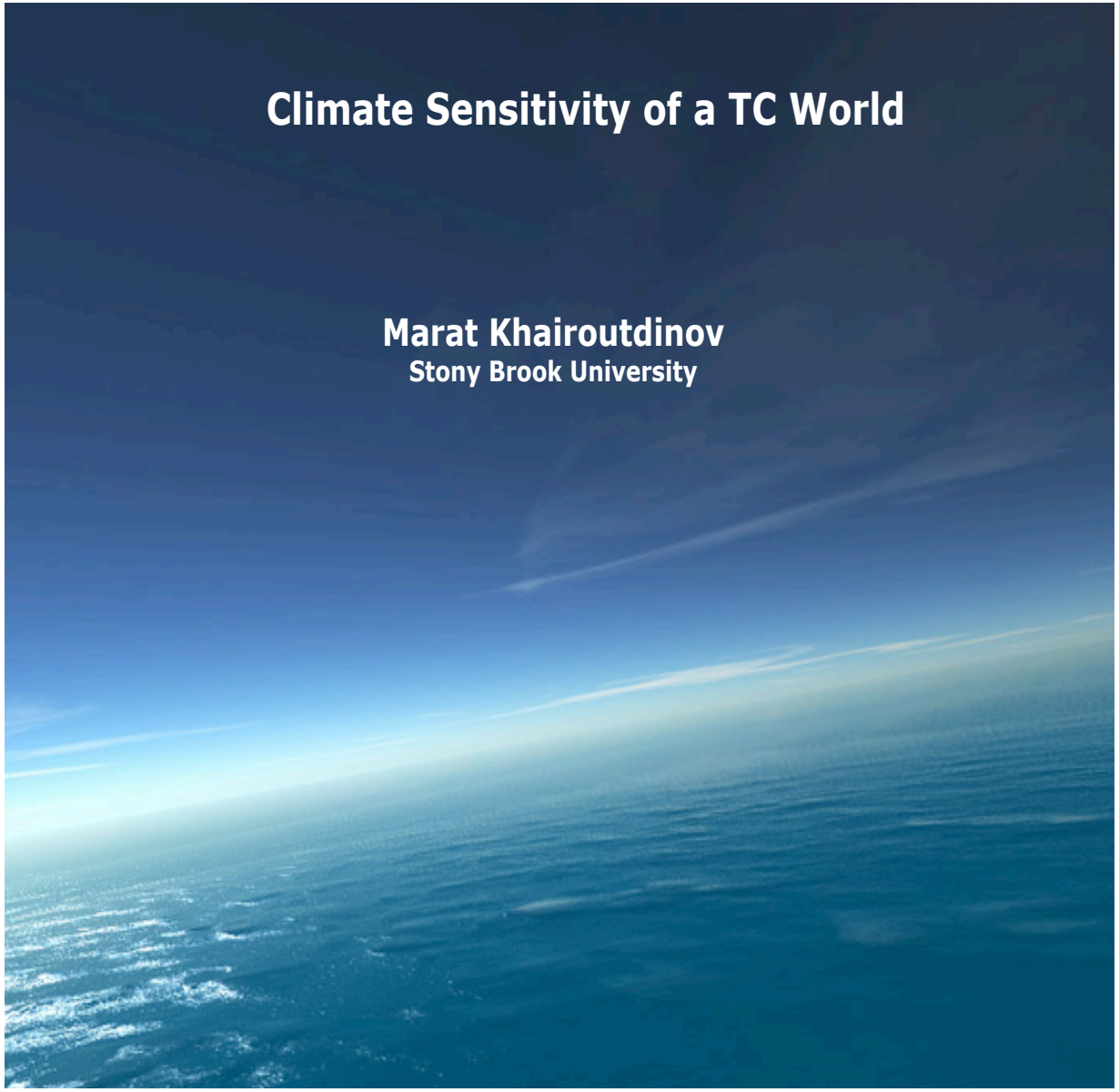
Sort of. First tests using nudged initialization of SPCAM3.0 across O(50)-member suggest a RMM skill limit ~ 12 days for YOTC events.

What is the phase-dependence of SPCAM's MJO forecast skill?

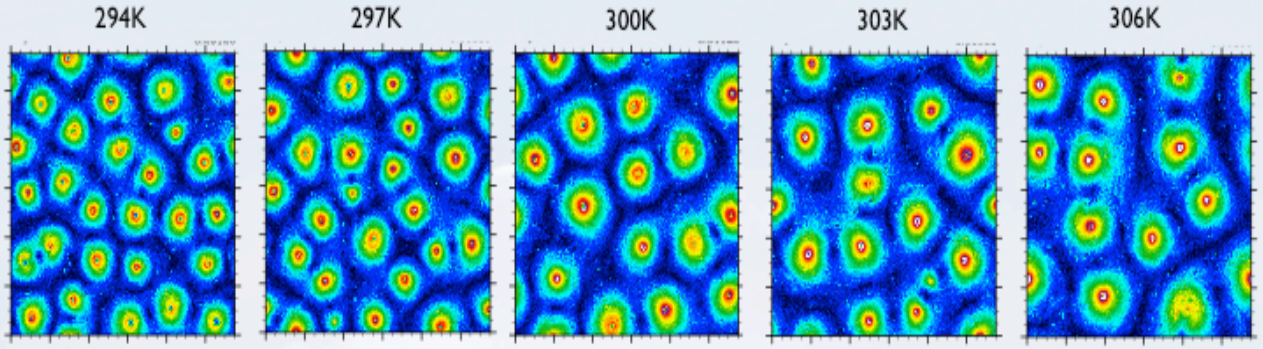
Hints of higher skill during initiation.

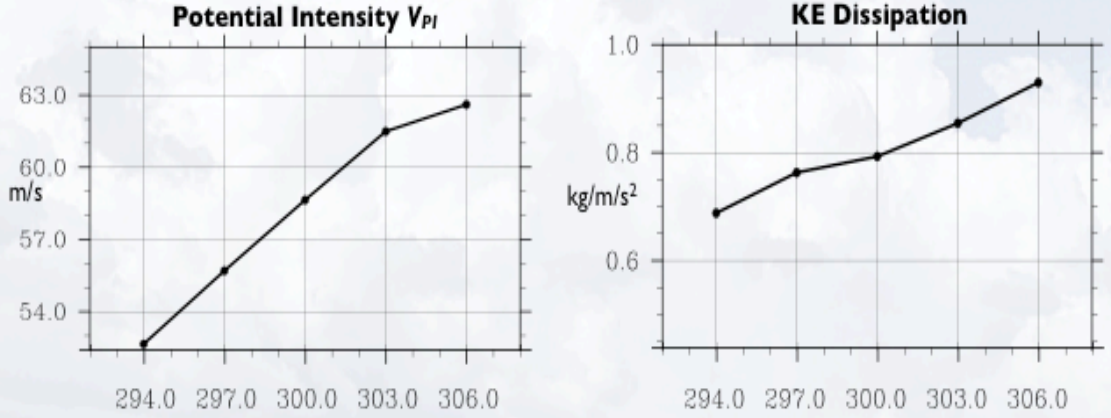
Does convective momentum transport matter to the SP-MJO?

Perhaps. Revisiting YOTC Case D using a 3D CRM with CMT suggests potential for improved skill at lead times > 12 days.


Climate Sensitivity of a TC World
Marat Khairoutdinov
Stony Brook University

In warmer TC World, TCs become larger, less frequent, but more intense.





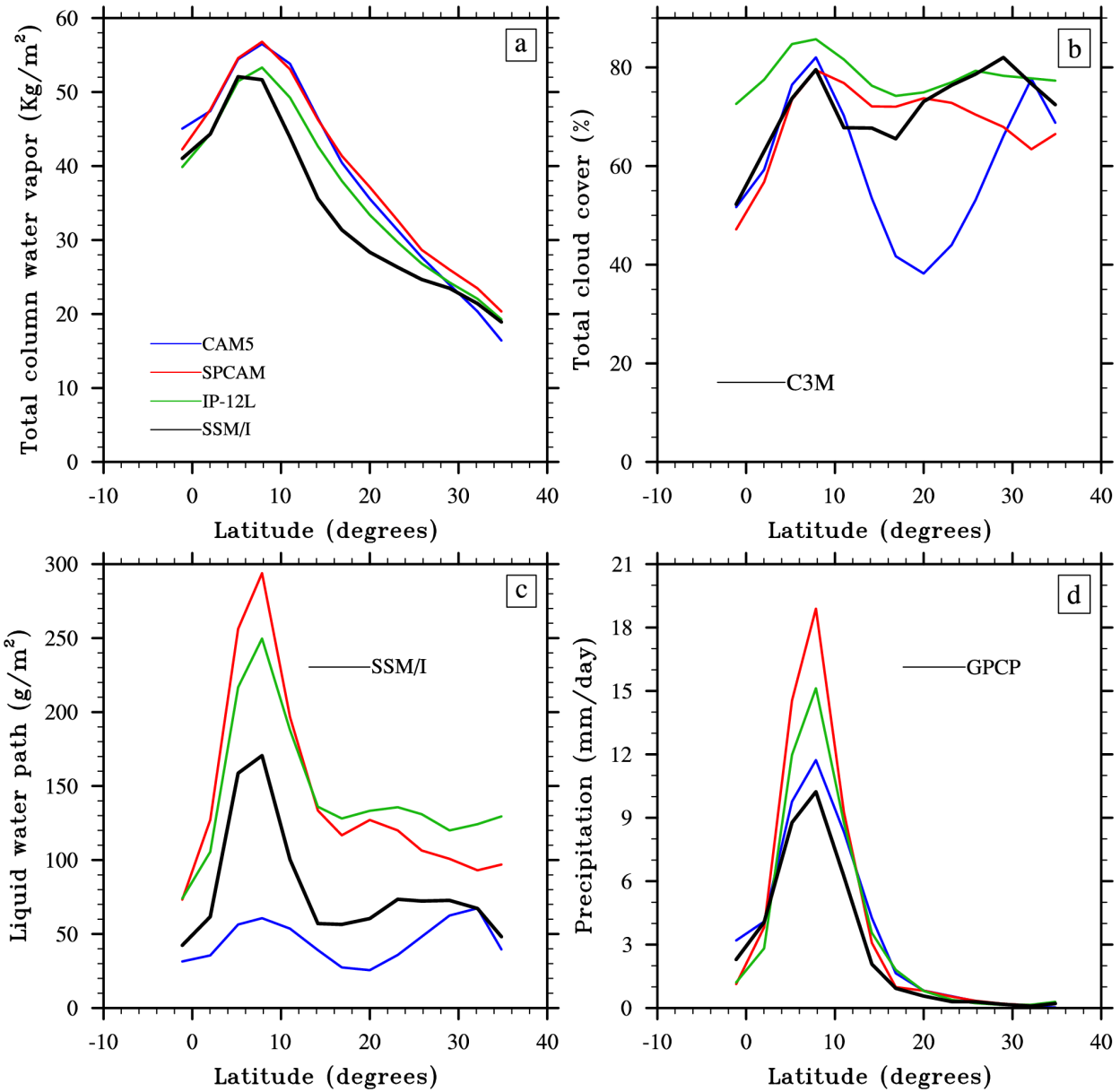
TC size: $D \approx \frac{V_{PI}}{f}$ #TC per unit area: $f^2 V_{PI}^{-2}$ Power dissipation per TC: V_{PI}^3

GPCI Tropical Cloud and Subtropical Cloud Transitions Simulated from CAM5, SPCAM and SPCAM-IPHOC

Kuan-Man Xu[1] and Anning Cheng[2]

1. NASA Langley Research Center, Hampton, VA
2. Science Systems and Applications, Inc., Hampton, VA

Water vapor, total cloud cover, LWP and precipitation



- The decrease of column water vapor from the tropics to the subtropics is well simulated, with the smallest overestimate in IP-12L (i.e., SPCAM-IPHOC)
- Large differences in total cloud cover of different regions along the transect among the models;
  - underestimates for CAM5 (except for tropics) and stratocumulus regions of SPCAM;
  - overestimates in the tropics and trade cumulus regions of IP-12L and trade cumulus regions of SPCAM
- Large differences in liquid water path from observations by a factor of two or more; with underestimates in CAM5, but overestimates in both MMFs
- Precipitation is generally overestimated in all models

Clouds to Idealized Climate Perturbations: The CGILS LES Intercomparison

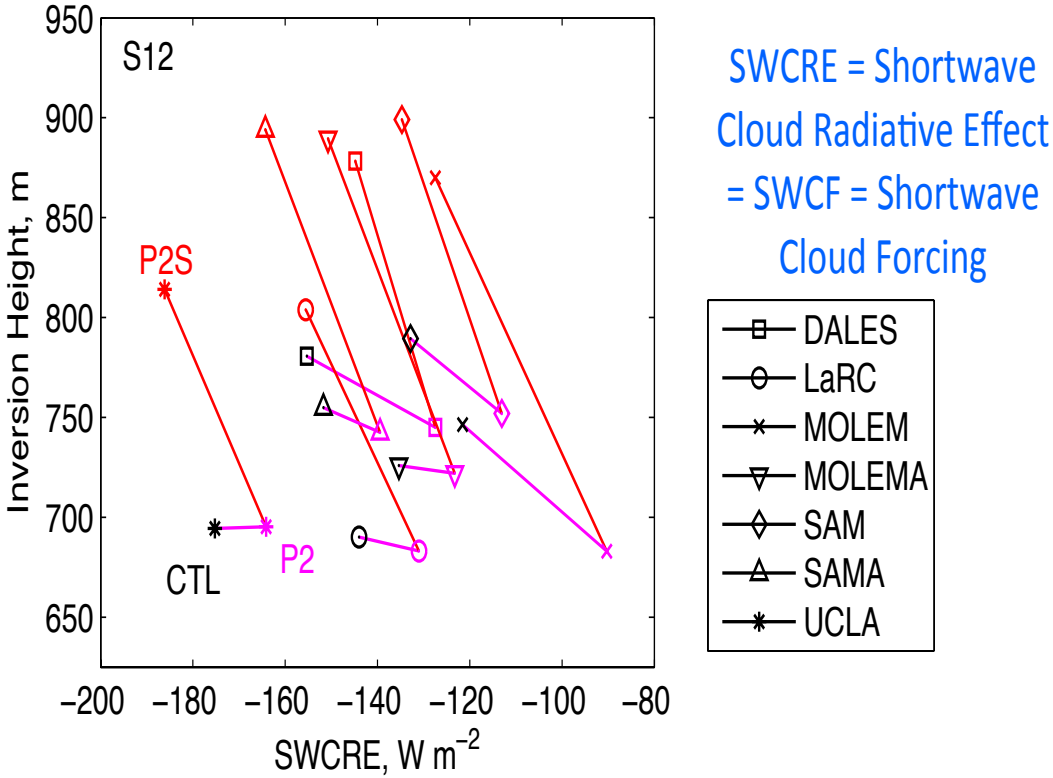
Peter Blossey and Chris Bretherton (UW)

Minghua Zhang (Stony Brook)

and CGILS LES Models and Modelers:

- MOLEM: Adrian Lock (UKMO),
- DALES: Stephan de Roode (Delft, the Netherlands),
- UCLA: Thijs Heus (MPIM),
- LaRC: Anning Cheng, Kuan-Man Xu (NASA LaRC, USA),
- WRF: Satoshi Endo, Yangang Liu (Brookhaven Natl Lab, USA)

Summary of S12 cloud response



- Reasonable agreement on control cloud SWCRE
- LES all thin the cloud layer (positive feedback) in P2 case
- Cloud thickens w/deeper inversion in P2S case.