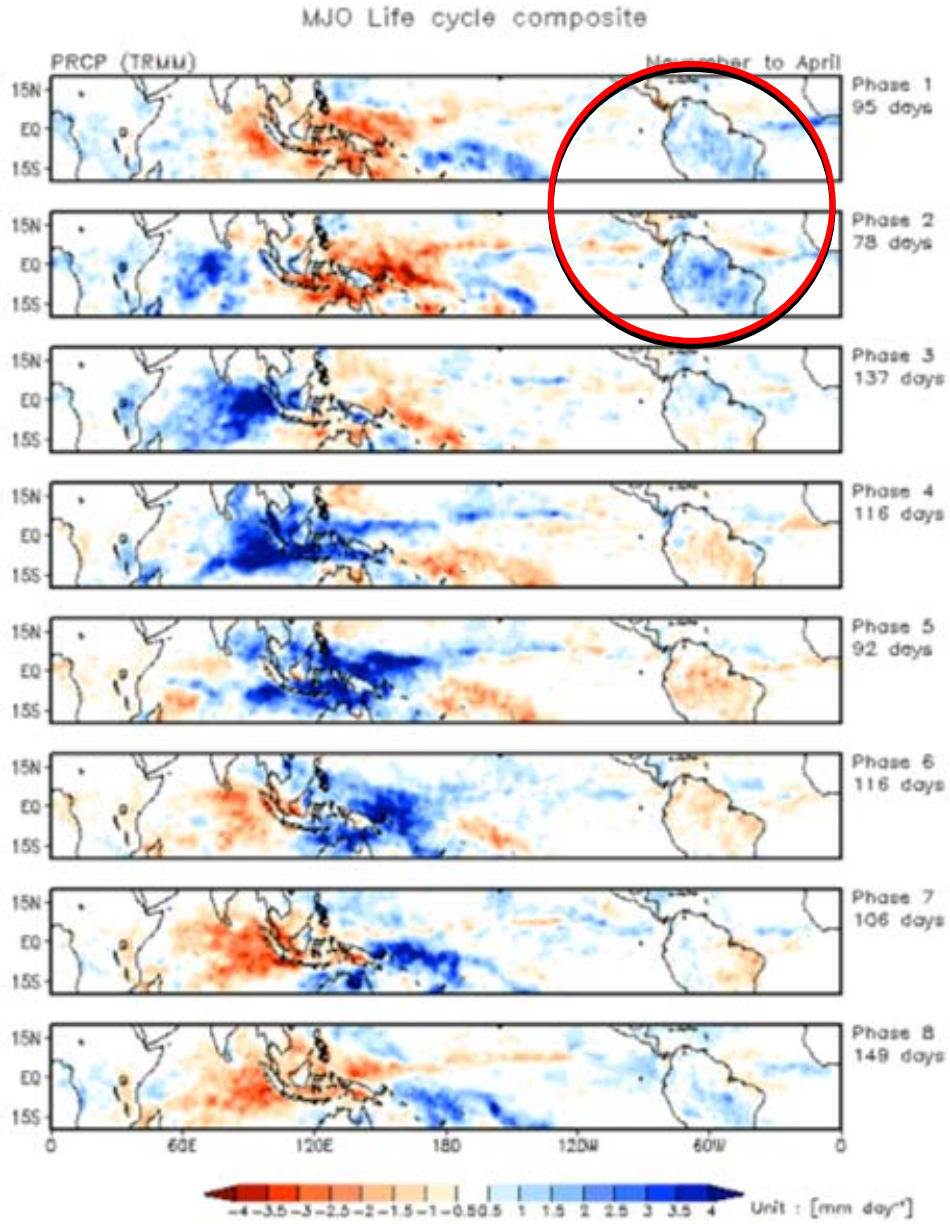
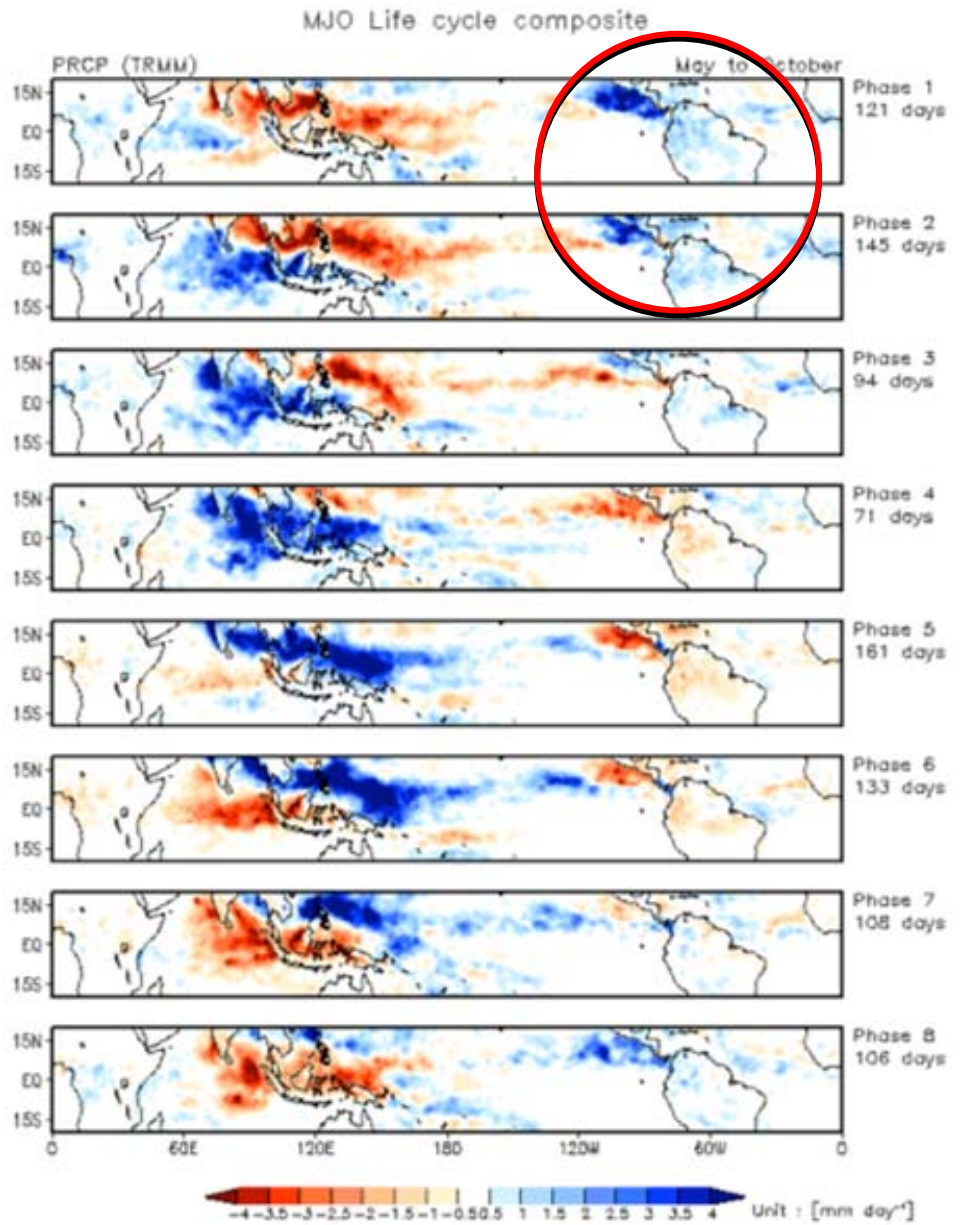
WCRP-WWRP/THORPEX YOTC MJO Task Force





WCRP-WWRP/THORPEX YOTC MJO Task Force

Predecessor: *US CLIVAR MJO Working Group* (2006-2009)

Main Accomplishment:

(1)Recommended standardized diagnostics for MJO simulations

CLIVAR Madden-Julian Oscillation Working Group, 2009: MJO Simulation Diagnostics. J. Climate, 22, 3006-3030.
Gottschalck, J., M. Wheeler, K. Weickmann, F. Vitart, N. Savage, H. Lin, H. Hendon, D. Waliser, K. Sperber, C. Prestrelo, M. Nakagawa, M. Flatau, and W. Higgins, 2010: A framework for assessing operational model MJO forecasts: A project of the CLIVAR Madden-Julian Oscillation Working Group. Bull. Amer. Meteor. Soc., in press.
Gottschalck, J., M. Wheeler, K. Weickmann, D. Waliser, K. Sperber, F. Vitart, N. Savage, H. Lin, H. Hendon, M. Flatau,2008: CLIVAR Exchanges No 47, page 18.
Kim D, Sperber K, Stern W, Waliser D, Kang I, Maloney E, Wang W, Weickmann K, Benedict J,Khairoutdinov M (2009) Application of MJO Simulation Diagnostics to Climate Models. Journal of Climate 22(23): 6413
Sperber, K R and D E Waliser, 2008: New approaches to understanding, simulating, and forecasting the Madden-Julian Oscillation. Bull. Amer. Meteorol. Soc. 89, 1917-1920.
Waliser, D E and K R Sperber, 2006: U.S. CLIVAR Madden-Julian Oscillation Working Group (MJOWG). CLIVAR Exchanges No 38, page 7.
Waliser, D E and K R Sperber, 2006: U.S. CLIVAR Madden-Julian Oscillation Working Group (MJOWG) Meeting Report. U.S. CLIVAR Variations, Vol. 4, No. 3, page 6-7.

(2) Initiated multi-model dynamical MJO forecast (in collaboration with WGNE)

WCRP-WWRP/THORPEX YOTC MJO Task Force

(established in December 2009)

Overall goal:

Facilitate improvements in the representation of the MJO in weather and climate models in order to increase the predictive skill of the MJO and related weather and climate phenomena

Objectives:

- Further development and promotion of process-oriented diagnostics/metrics that facilitate improvements in parameterizations relevant to the MJO
- Develop, coordinate, and promote analyses of the multi-scale interactions and vertical structure associated with the MJO using observations and high-res and multi-scale modeling frameworks.
- Promote the ongoing evaluation of real-time MJO forecasts and multi-model ensemble forecast development
- Expand a boreal summer focus
- Develop and analyze an MJO hindcast experiment to assess predictability as well as forecast skill of the MJO and related phenomena
- Organize workshops and meetings of opportunity to further the work of the Task Force

Membership

(represented by 5 countries)
(Initial term of 3 years 2009 - 2012)

Duane Waliser- co-chair	Cal Tech/JPL, USA
Matthew Wheeler - co-chair	Centre for Australian Weather and Climate Research, Australia
Xiouhua Fu	IPRC, University of Hawaii, USA
Jon Gottschalck	National Centers for Environmental Prediction, USA
Harry Hendon	Centre for Australian Weather and Climate Research, Australia
DaehyunKim	Lamont-Doherty Earth Observatory of Columbia University, USA
Hai Lin	Environment Canada, Canada
Eric Maloney	Colorado State University, USA
Richard Neale	National Center for Atmospheric Research, USA
Dave Raymond	New Mexico Institute of Mining & Technology, USA
Masaki Satoh	Frontier Research Center for Global Change, Japan
Ken Sperber	Lawrence Livermore National Laboratory, USA
AugustinVintzileos	National Centers for Environmental Prediction, USA
Frederick Vitart	European Centre for Medium-Range Weather Forecasts, UK
Chidong Zhang	RSMAS, University of Miami, USA

Approach

- Quasi-bimonthly teleconferences; emails
- Annual meetings (first in Busan, Korea, June 2010, joint with CLIVAR AAMP, 15+ graduate students/postdocs participated with support by NSF)

Themes

- Process-oriented diagnostics
- Northern Summer monsoon ISV diagnostics/metrics
- Dynamical model MJO/ISO hindcasts
- Real-time forecast of the MJOand its impacts (including TCs and higher latitude effects) and operational verification metrics

Website

http://www.ucar.edu/yotc/mjo.html

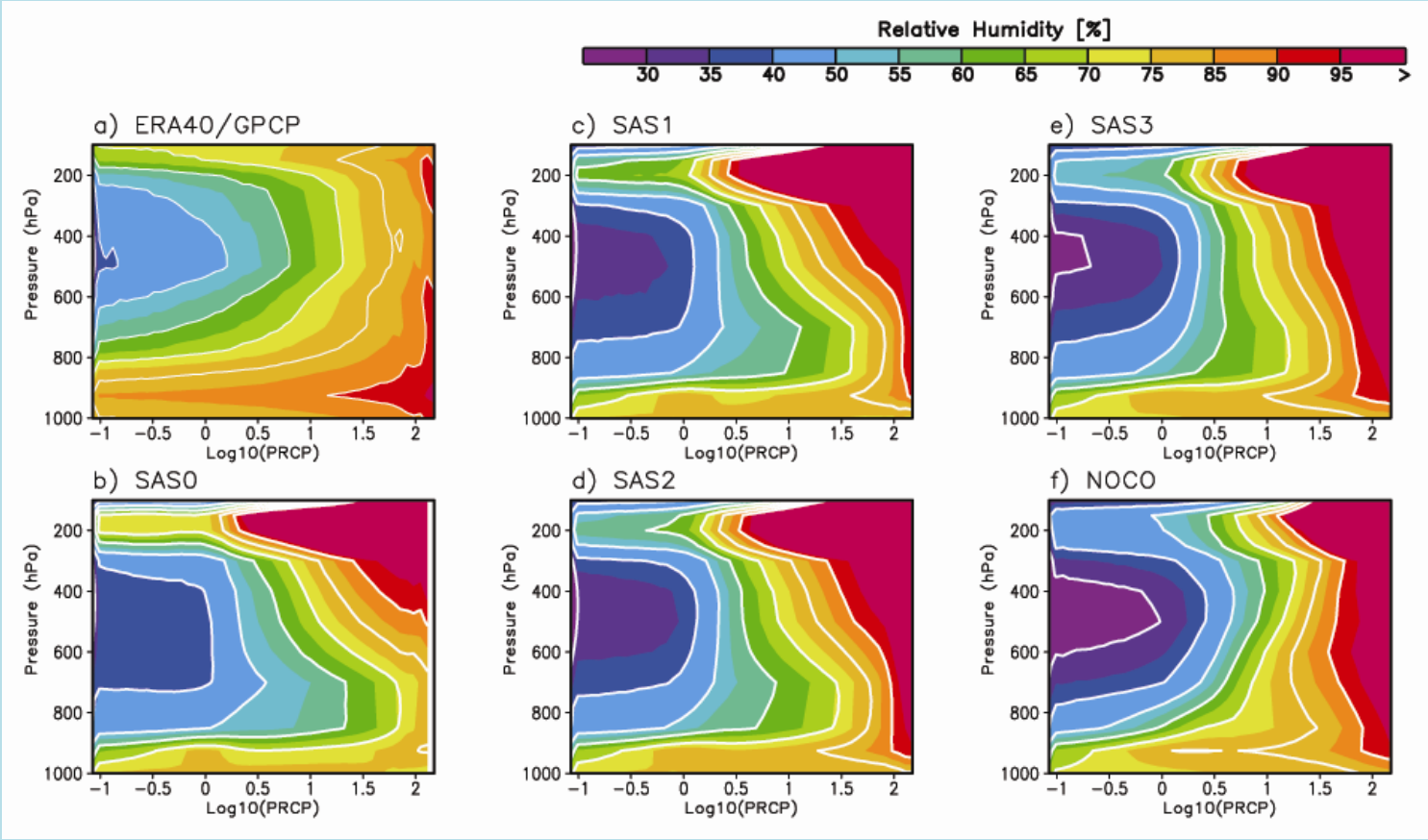
(supported by Pam Johnson via the US THORPEX Executive Committee)

Process-Oriented Diagnostics

– to help identify and correct model deficiencies

- precipitation-moisture relationship

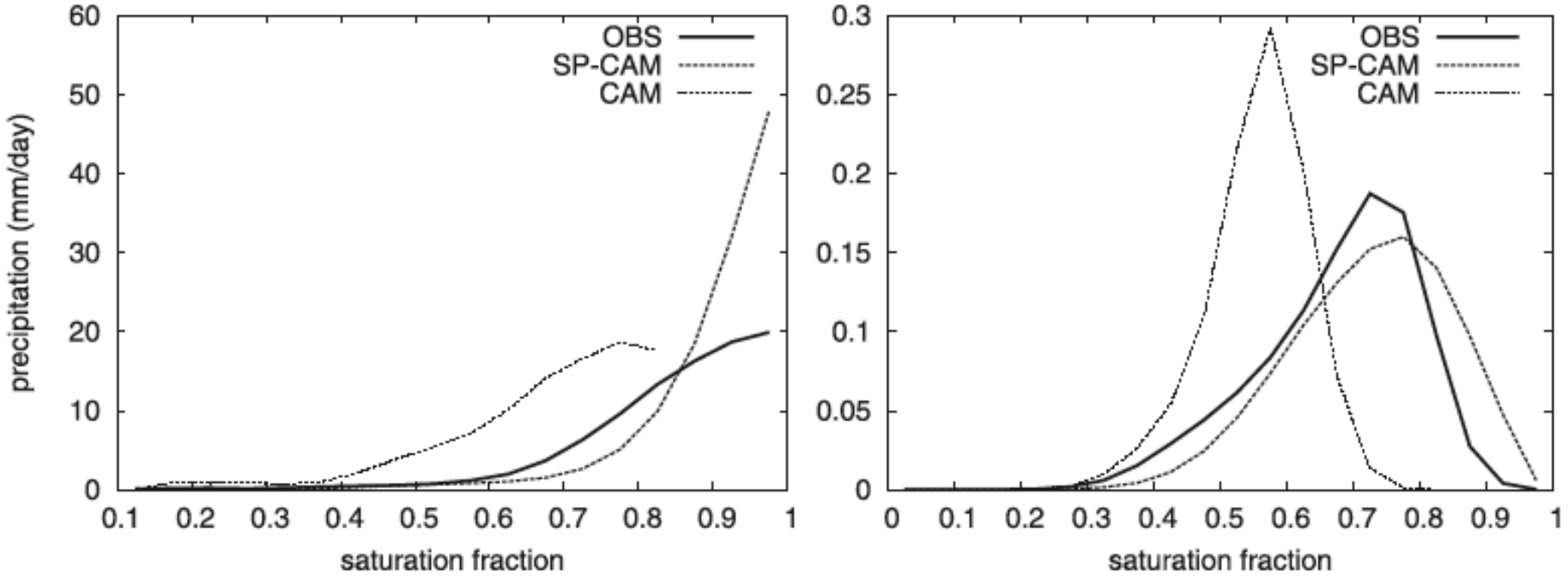
Composite of Relative Humidity



Process-Oriented Diagnostics

– to help identify and correct model deficiencies

- precipitation-moisture relationship

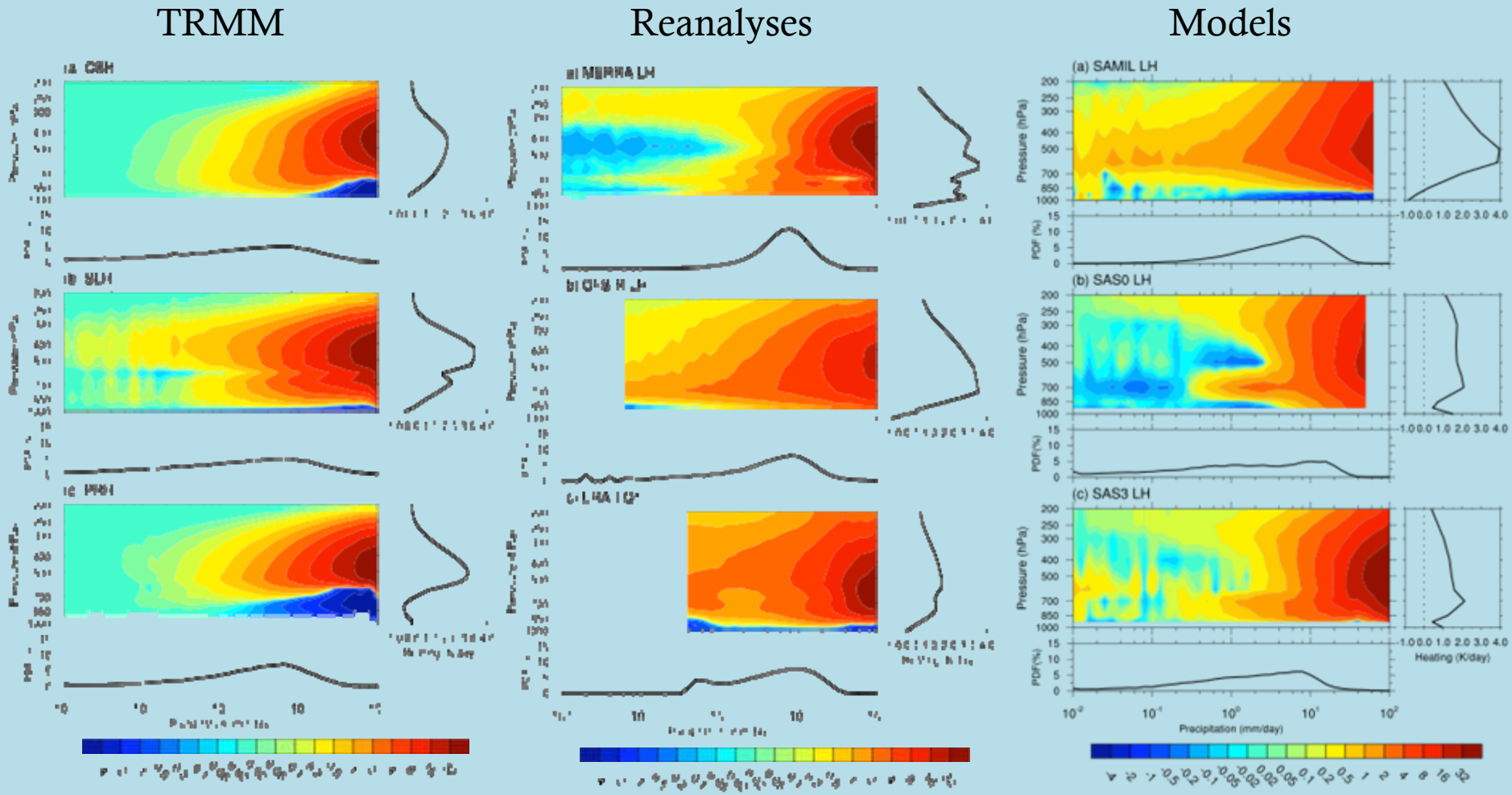


(Zhu et al 2009)

Process-Oriented Diagnostics

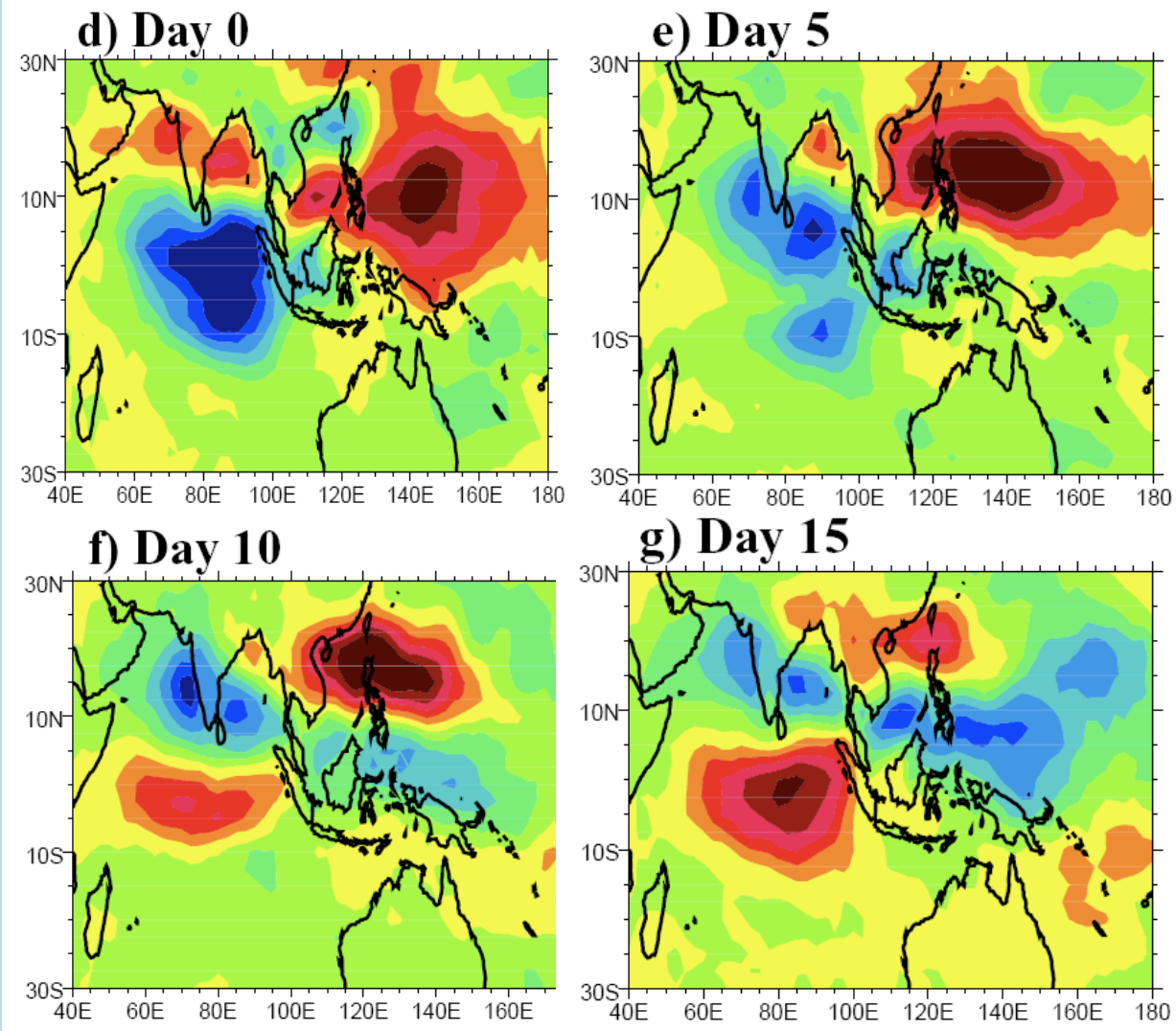
– to help identify and correct model deficiencies

•diabatic heating profile



Northern Summer Monsoon ISV Diagnostics/Metrics

– characteristic northward propagation



(Annamalai and Sperber2005)

Dynamical Model MJO/ISO Hindcasts

(January1 1989-Oct 31 2009)

led by Bin Wang (UW)

Objectives:

– understand the physics of the MJO/ISO and their prediction;
– assess intraseasonal predictability;
– help model improvement;
– develop multi-model ensemble (MME) prediction

Experimental Design:

Exp 1: Climate simulations (CGCM or AGCM)

Exp 2: Hindcasts

• start on the 1st, 11th, and 21st of each calendar month
• integrate for ≥ 45 days
• include ≥ 5 ensemble members

Participation: 19 models from 10 countries

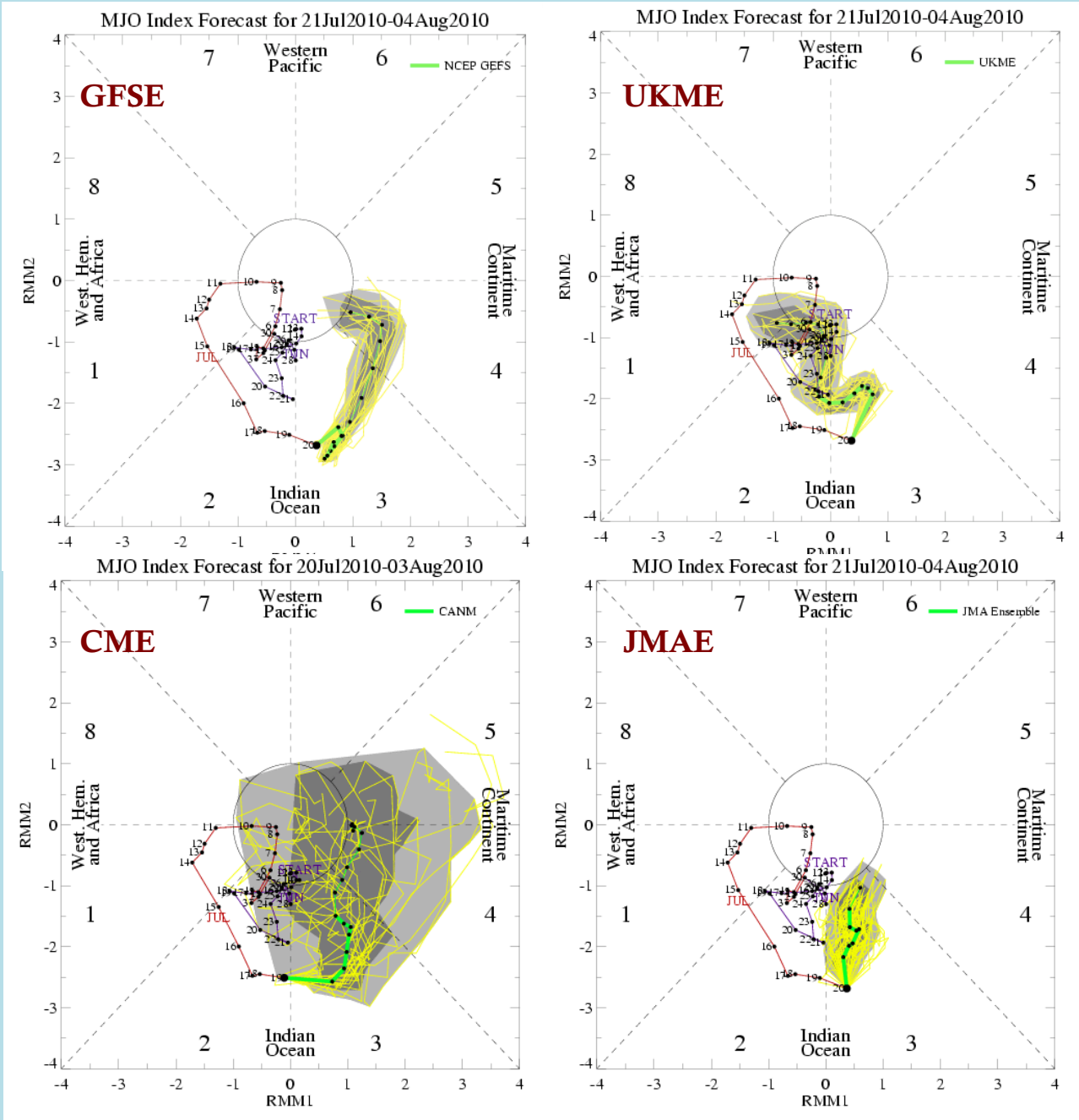
Dynamical Model MJO Forecasts U.S. CLIVAR International CLIVAR
WCRP - WWRP/THORPEX YOTC MJO Task Force

Led by Jon Gottschalck (NCEP/CPC)

http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/clivar_wh.shtml

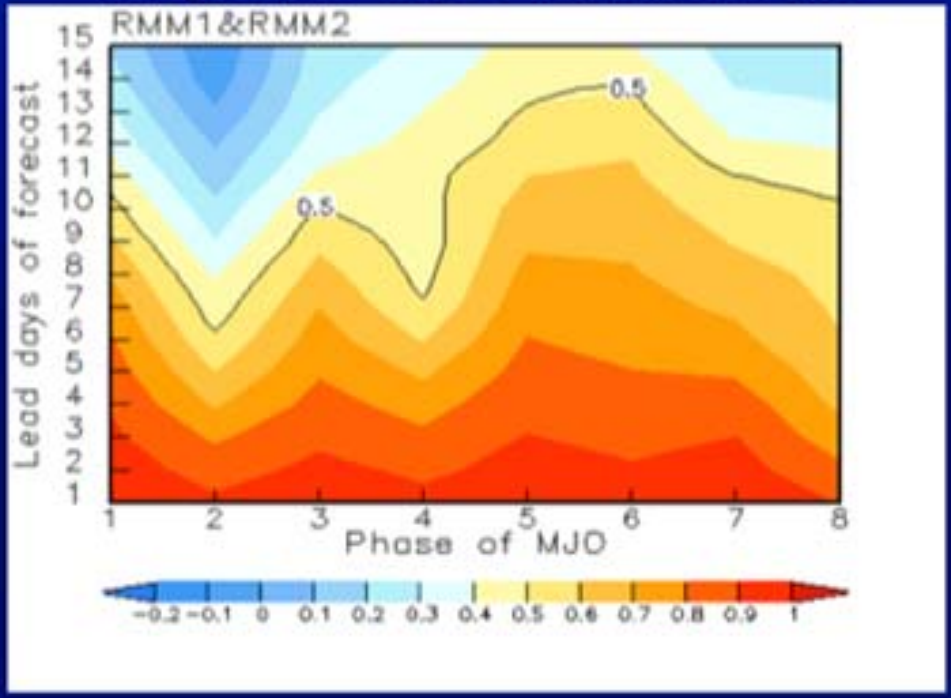
10 operation centers, 20 data streams, 13 ensemble forecasts (with 4 – 51 members)

Dynamical Model MJO Forecasts

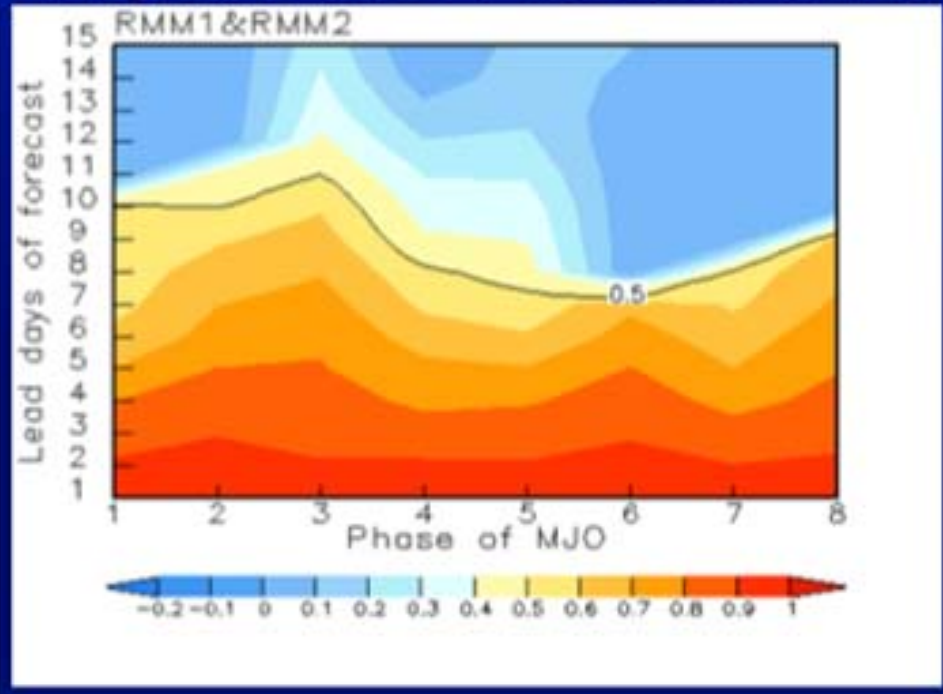


GEFS MJO Index Forecast Skill

Keyed to MJO Initial Phase

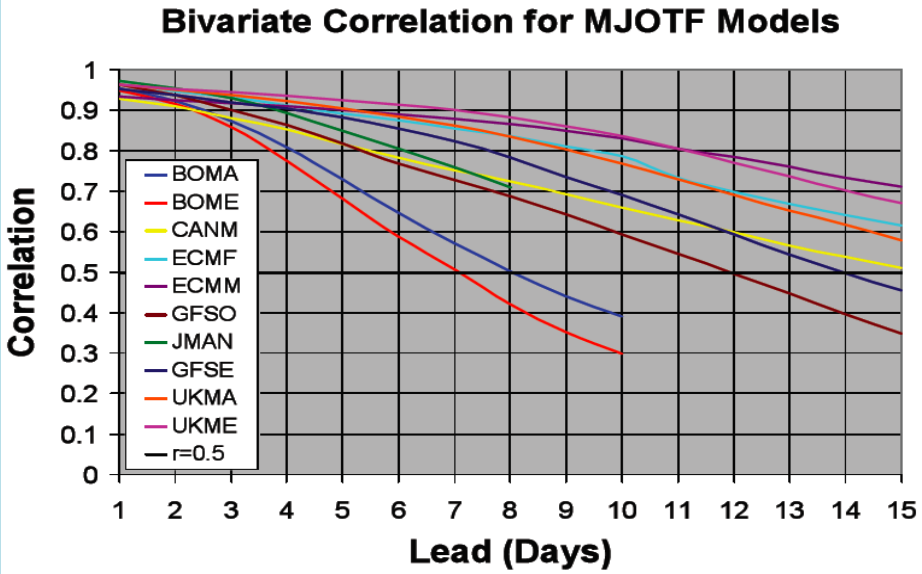


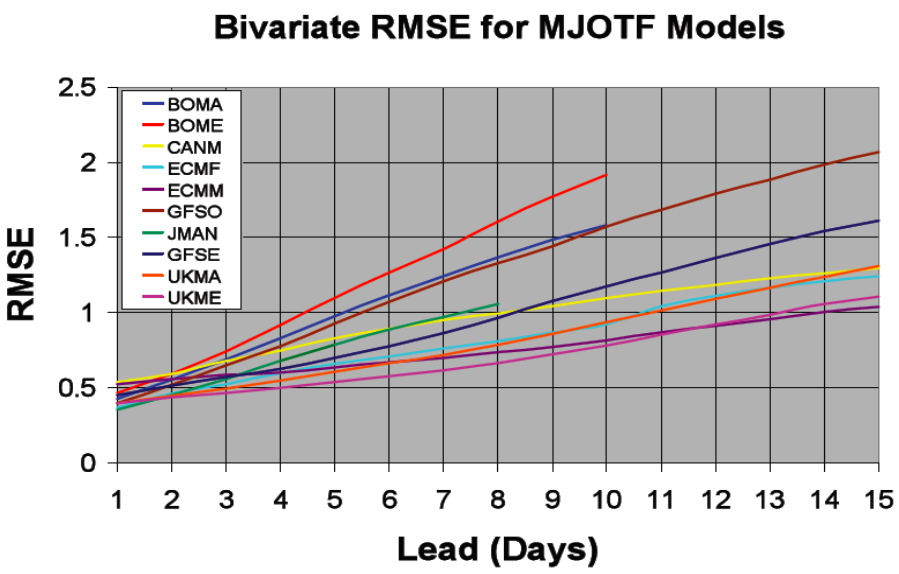
Keyed to MJO Forecast Phase



Dynamical Model MJO Forecasts

Verification





$$COR(\tau) = \frac{\sum_{t=1}^{N}\left[a_1(t)b_1(t,\tau) + a_2(t)b_2(t,\tau)\right]}{\sqrt{\sum_{i=1}^{N}\left[a_1^2(t) + a_2^2(t)\right]}\sqrt{\sum_{i=1}^{N}\left[b_1^2(t,\tau) + b_2^2(t,\tau)\right]}}$$

$$RMSE(\tau) = \sqrt{\frac{1}{N}\sum_{t=1}^{N}\left[a_1(t) - b_1(t,\tau)\right]^2 + \left[a_2(t) - b_2(t,\tau)\right]^2}$$

Dynamical Model MJO Forecasts

On-going activities:

(1)Evaluate real-time MJO prediction skill

(2)Design MJO forecast metrics

(3)Assess MJO forecast impact

– Tropical cyclone activity

– Extreme rainfall events

– Cold air outbreaks

– Wet/dry monsoon periods

– ENSO

(4) Develop multi-model ensemble forecast

MJOTF-CLIVAR Linkage

- *Asian-Australian Monsoon Panel (AAMP)*
- Variability of the American Monsoon Systems (VAMOS)
- Variability of the African Climate System Panel (VACS)
- Working Group on Seasonal and Interannual Prediction (WGSIP)
- CLIVAR/LOC-GOOS Indian Ocean Panel (IOP)
- Pacific Implementation Panel (PIP)
- Atlantic Implementation Panel (AIP)

MJOTF-VAMOS Synergy

- Applications of MJO TF forecast products
- Targeted assessment of forecast skill of MJO impact
- IASCLIP Forecast Forum + MJO TF forecast