Representation of the Intraseasonal Variability over the Eastern Pacific ITCZ in Climate Models

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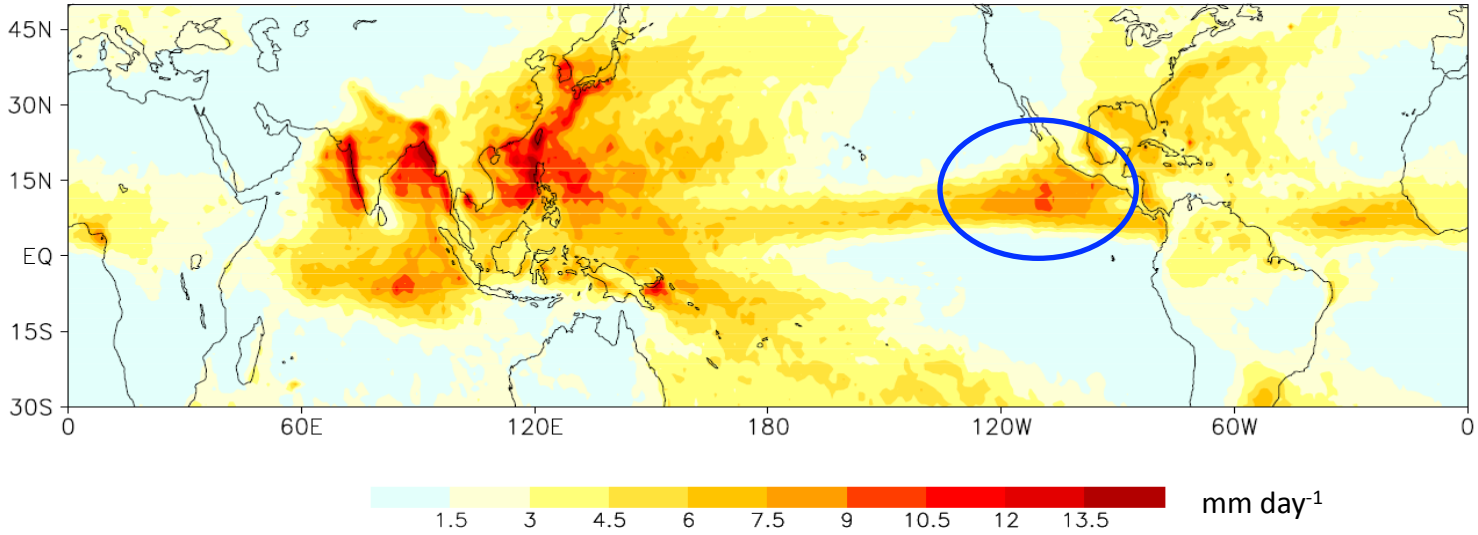
Funded by: NOAA Climate Program Office - CPPA Program

Introduction

Standard deviation of intraseasonal bandpass filtered rainfall (Northern Summer)



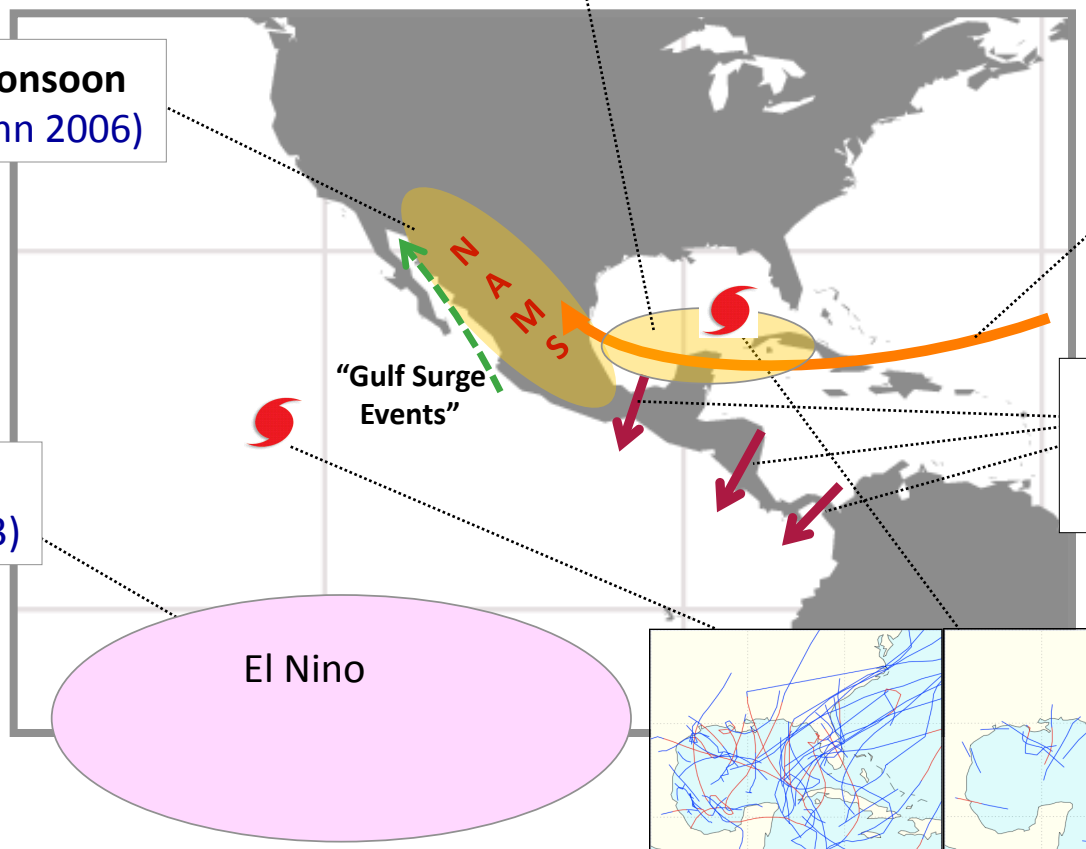
10-90 day filtered

Regional Impacts of ISV over the Eastern Pacific

Caribbean Precipitation
(Martin et al. 2010)

North American Monsoon
(Lorenz and Hartmann 2006)

Caribbean Sea LLJ
(Serra et al. 2010)



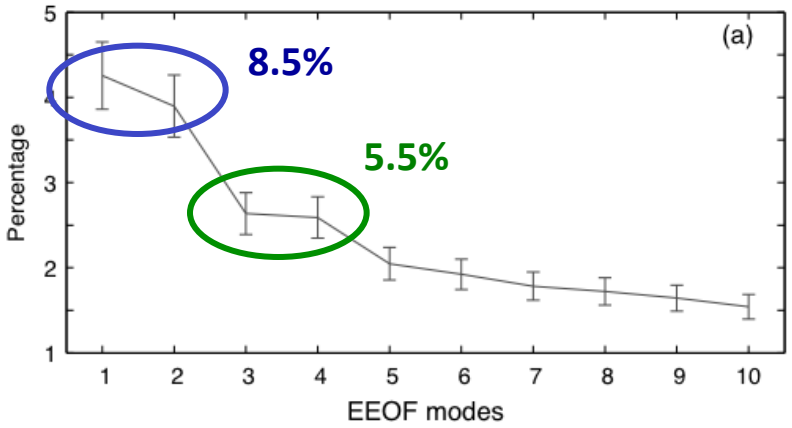
Gap Winds
(Maloney & Esbensen 2003)

El Nino Turn-about
(Vintzileos et al. 2003)

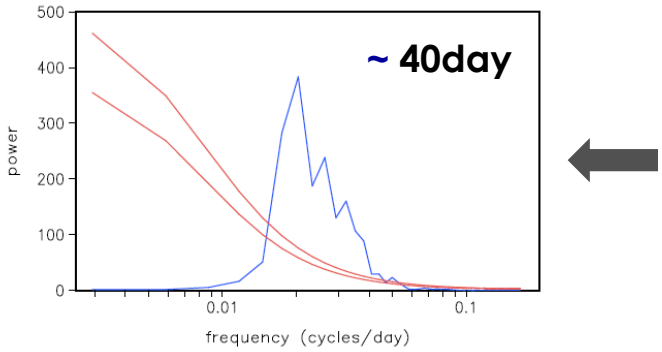
El Nino

Tropical Cyclone
Maloney and Hartmann (2000a,b),
Higgins and Shi (2001)

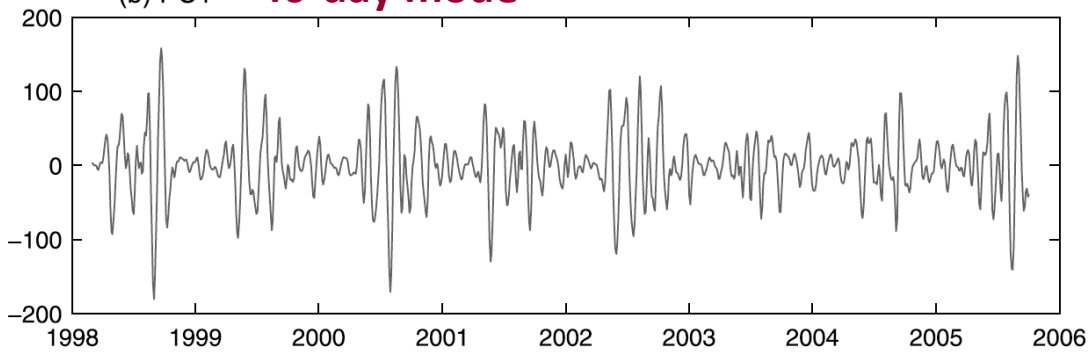
Variances of the EEOF modes of TRMM rainfall over the EPAC

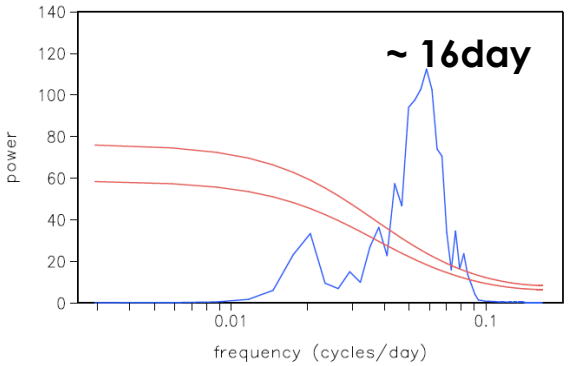


Jiang and Waliser (2008, 2009)

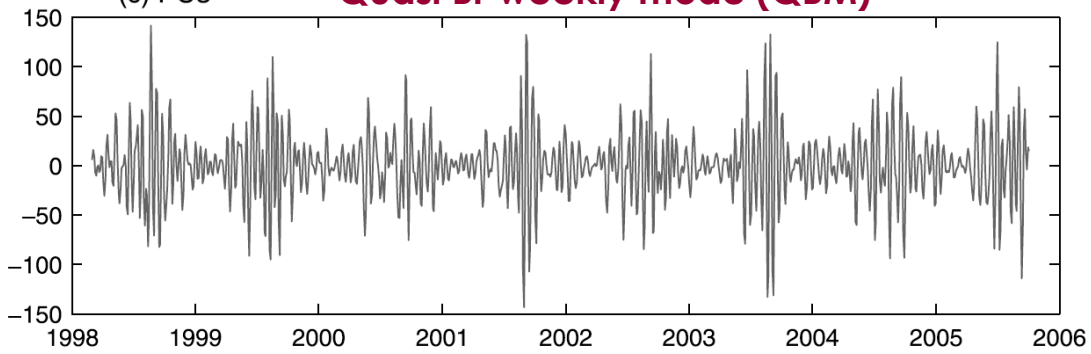


(b) PC1 **40-day mode**





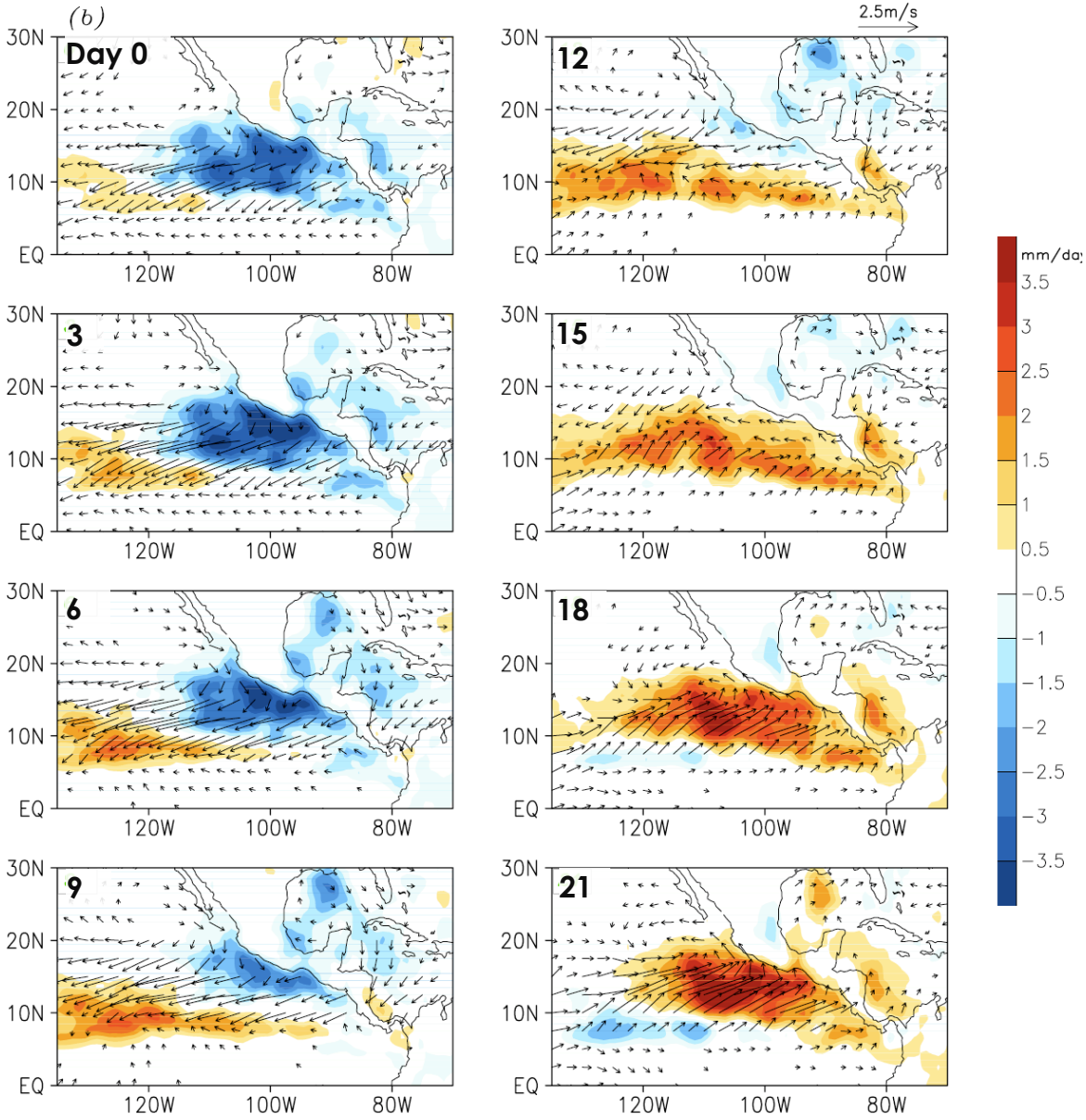
(c) PC3 **Quasi Bi-weekly mode (QBM)**



Evolution of 40-day ISV Mode

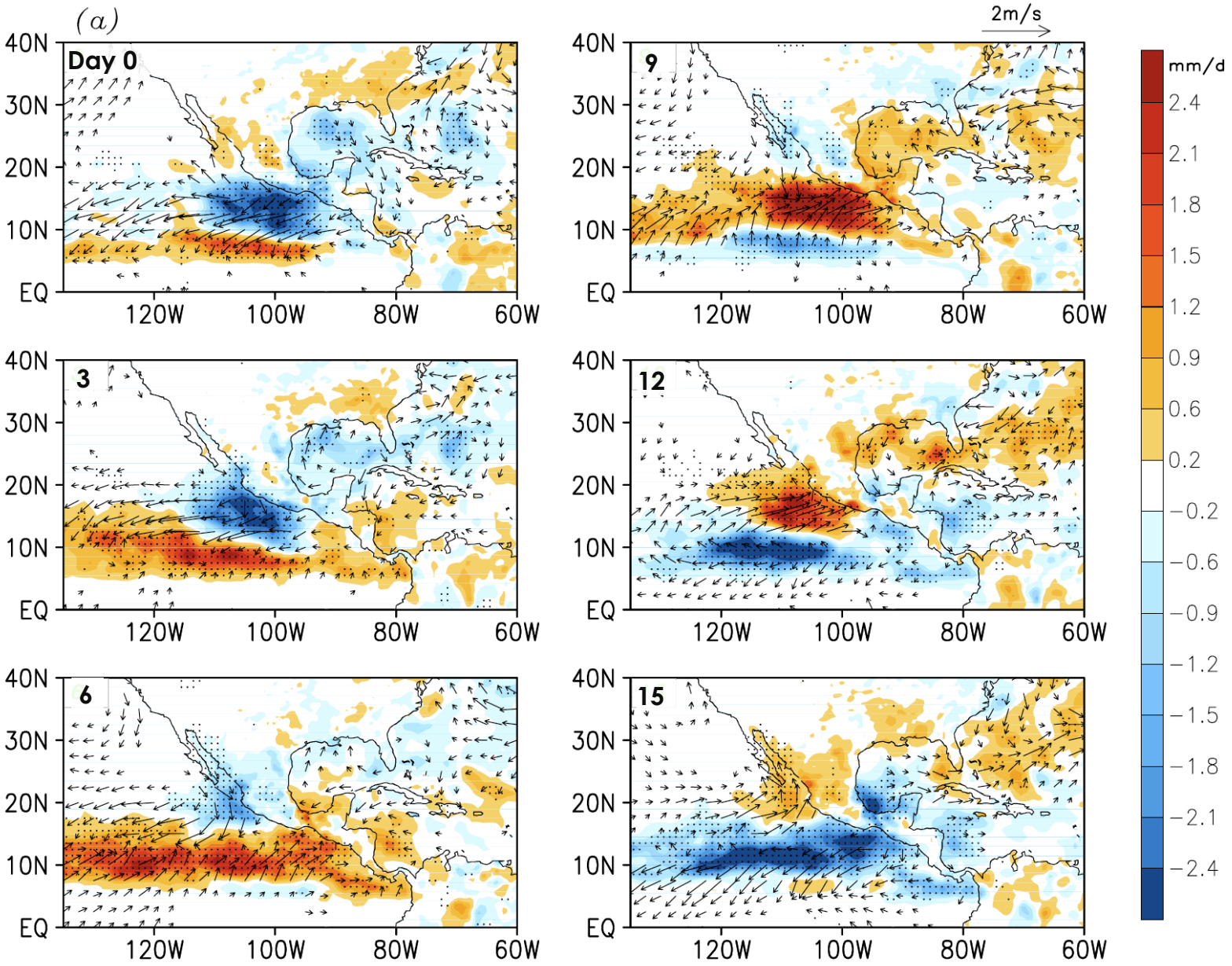
Shading: Rainfall
Vectors: QuikSCAT sfc wind

- **Local expression of MJO (cf. Maloney et al; 2007);**
- **Signal from west;**
- **Enhanced convection corresponding to westerly wind anomalies;**



Jiang and Waliser (2008)

Evolution of the QBM



Jiang and Waliser (2009)

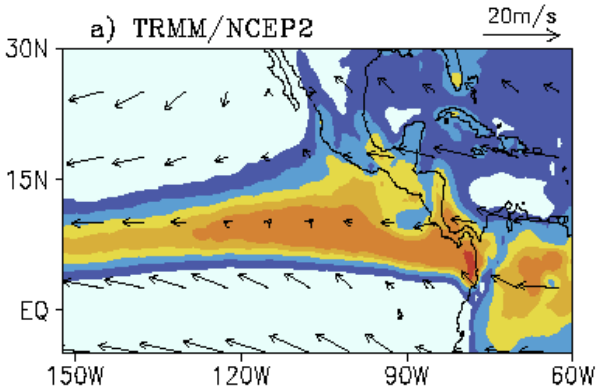
Participating models

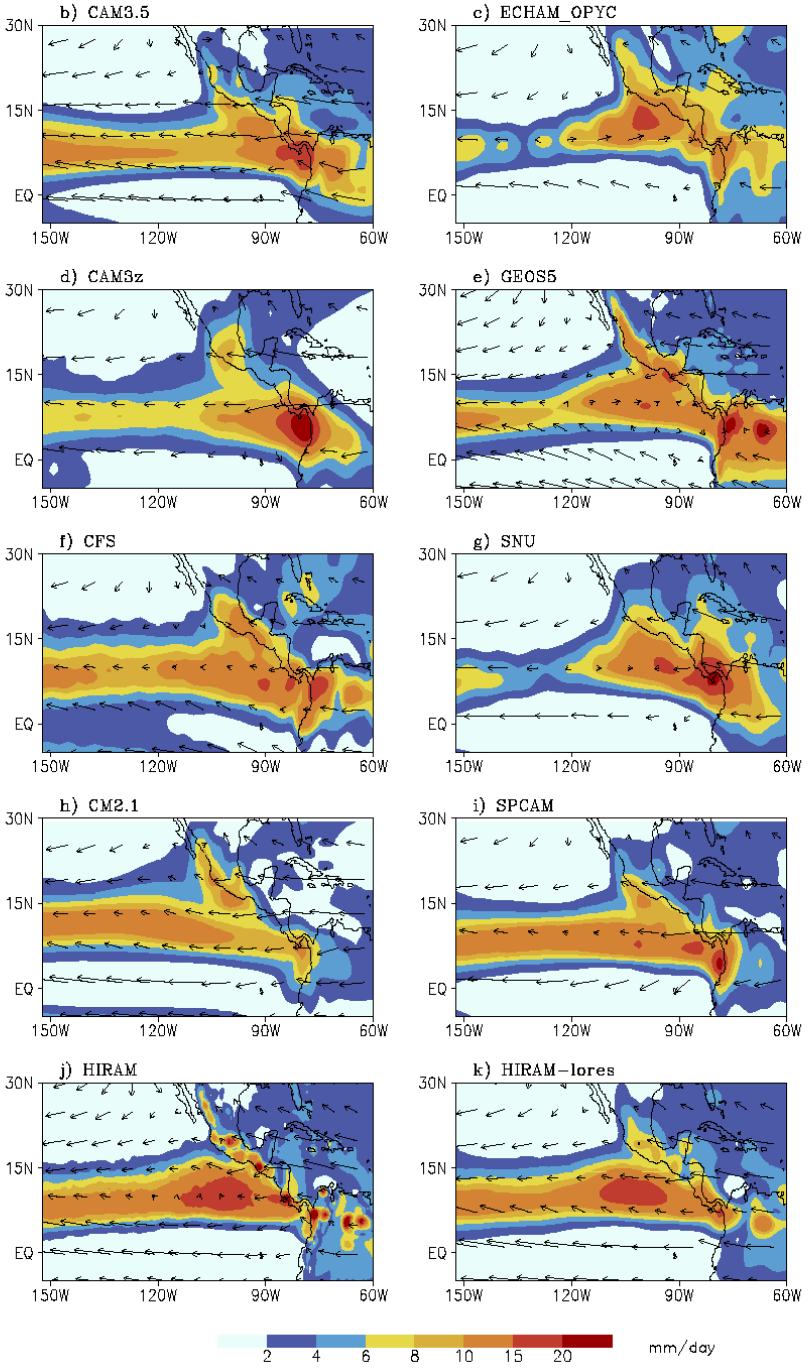
Model (group)	Horizontal Resolution -AGCM	Vertical Resolution (top level)-AGCM	Cumulus parameterization	Integration	Reference
CAM3.5 (NCAR)	1.9° lat x 2.5° lon	26 (2.2hPa)	**Mass flux** (Zhang & McFarlane 1995)	20 years 01JAN1986-31DEC2005	Neale et al. (2007)
CAM3z (SIO)	T42(2.8°)	26 (2.2hPa)	**Mass flux** (Zhang & McFarlane 1995)	15 years 29JAN1980-23JUL1995	Zhang and Mu (2005)
CFS (NCEP)	T62(1.8°)	64 (0.2hPa)	**Mass flux** (Hong & Pan 1998)	20 years	Wang et al. (2005)
CM2.1 (GFDL)	2° lat x 2.5° lon	24 (4.5hPa)	**Mass flux** (RAS; Moorthi & Suarez 1992)	20 years	Delworth et al. (2006)
ECHAM4/OPYC* (MPI via PCMDI)	T42(2.8°)	19 (10hPa)	**Mass flux** (Tiedtke 1989; Nordeng 1994)	20 years	Roeckner et al. (1996), Sperber et al. (2005)
GEOS5 (NASA)	1° lat x 1.25° lon	72 (0.01hPa)♪	**Mass flux** (RAS; Moorthi & Suarez 1992)	12 years 01DEC1993-30NOV2005	To be documented
SNU-AGCM (SNU)	T42(2.8°)	20 (10hPa)	**Mass flux** (Numaguti et al. 1995)	20 years 01JAN1986-31DEC2005	Lee et al. (2003)
SPCAM (CSU)	T42(2.8°)	26 (3.5hPa)	**Superparameterization** (Khairoutdinov & Randall 2003)	19 years 01OCT1985-25SEP2005	Khairoutdinov et al. (2005)
HIRAM HIRAM_lores (GFDL)	0.5° lat x 0.6° lon 2.0° lat x 2.5° lon	32 (4.5hPa)	**Mass flux** (Bretherton et al. 2004)	19 years 01JAN1990-31DEC2008	Zhao et al. (2009)

Courtesy of MJO Working Group

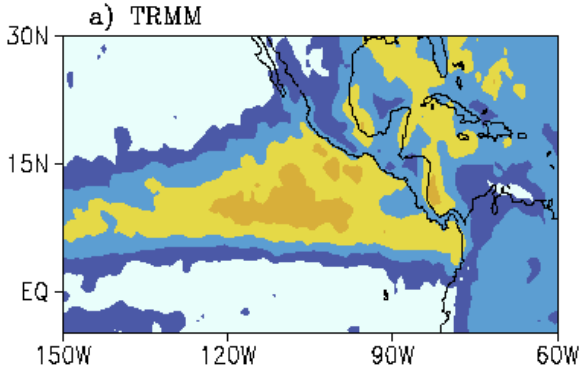
Kim et al. 2009

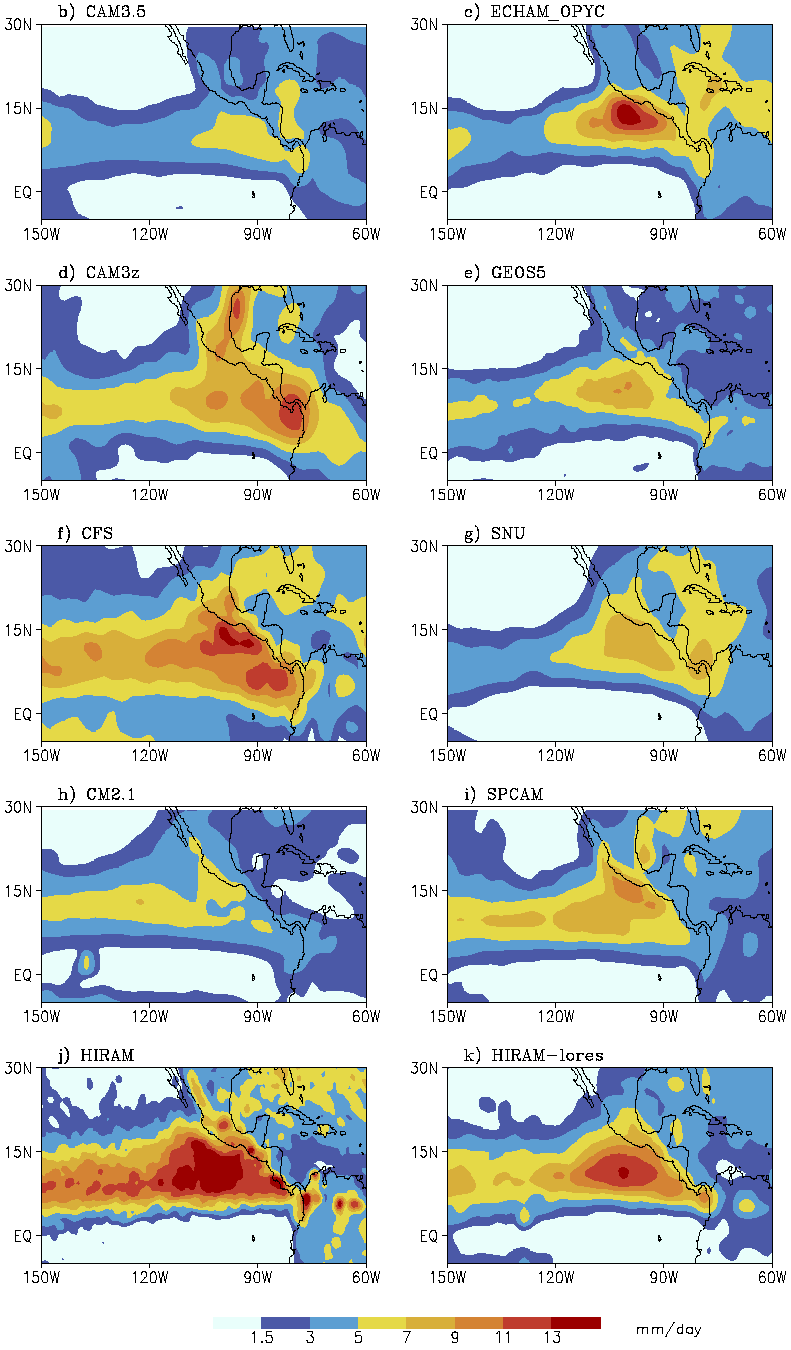
Summer (JJAS) mean rainfall



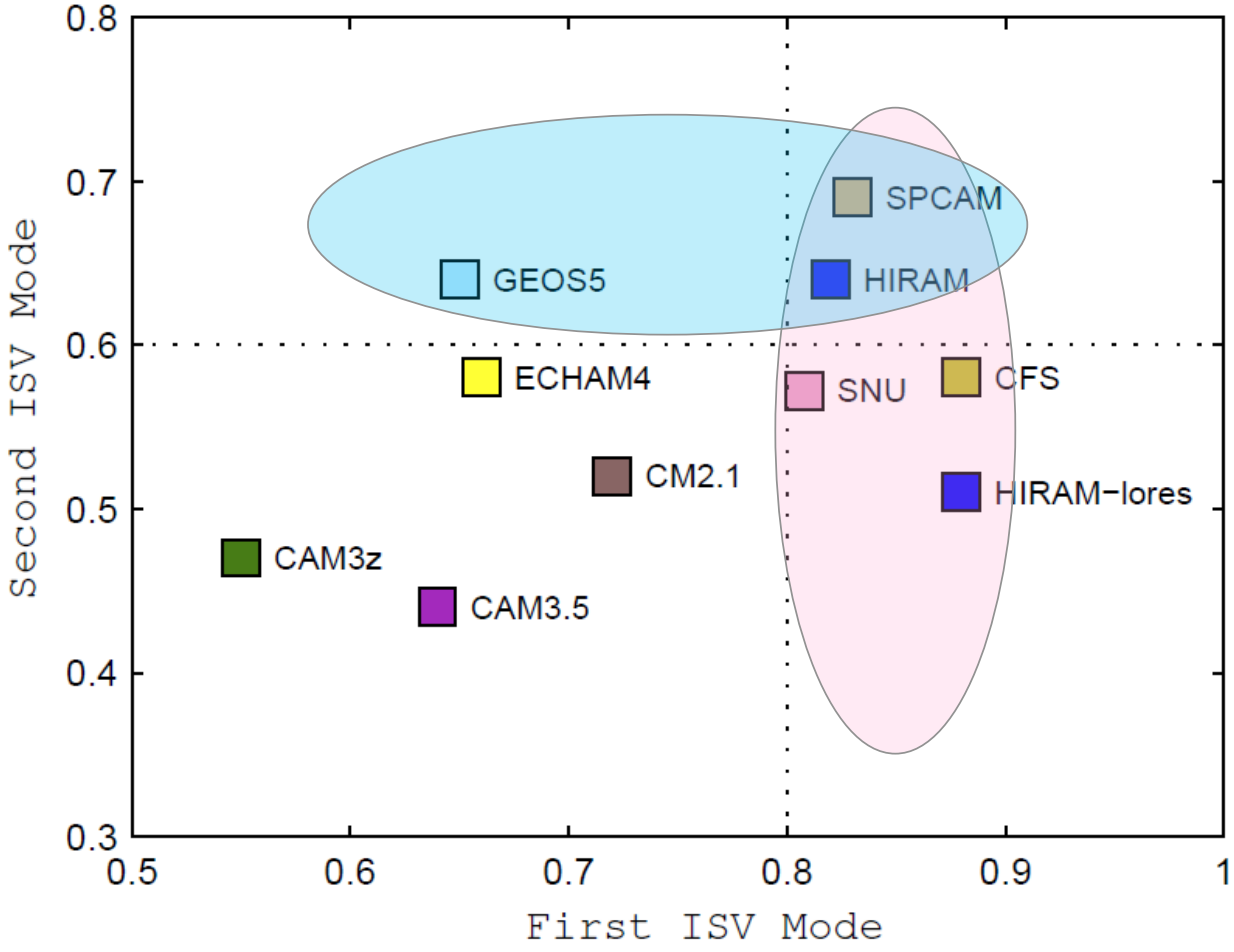


STDs of 10-90-day summer (JJAS) rainfall



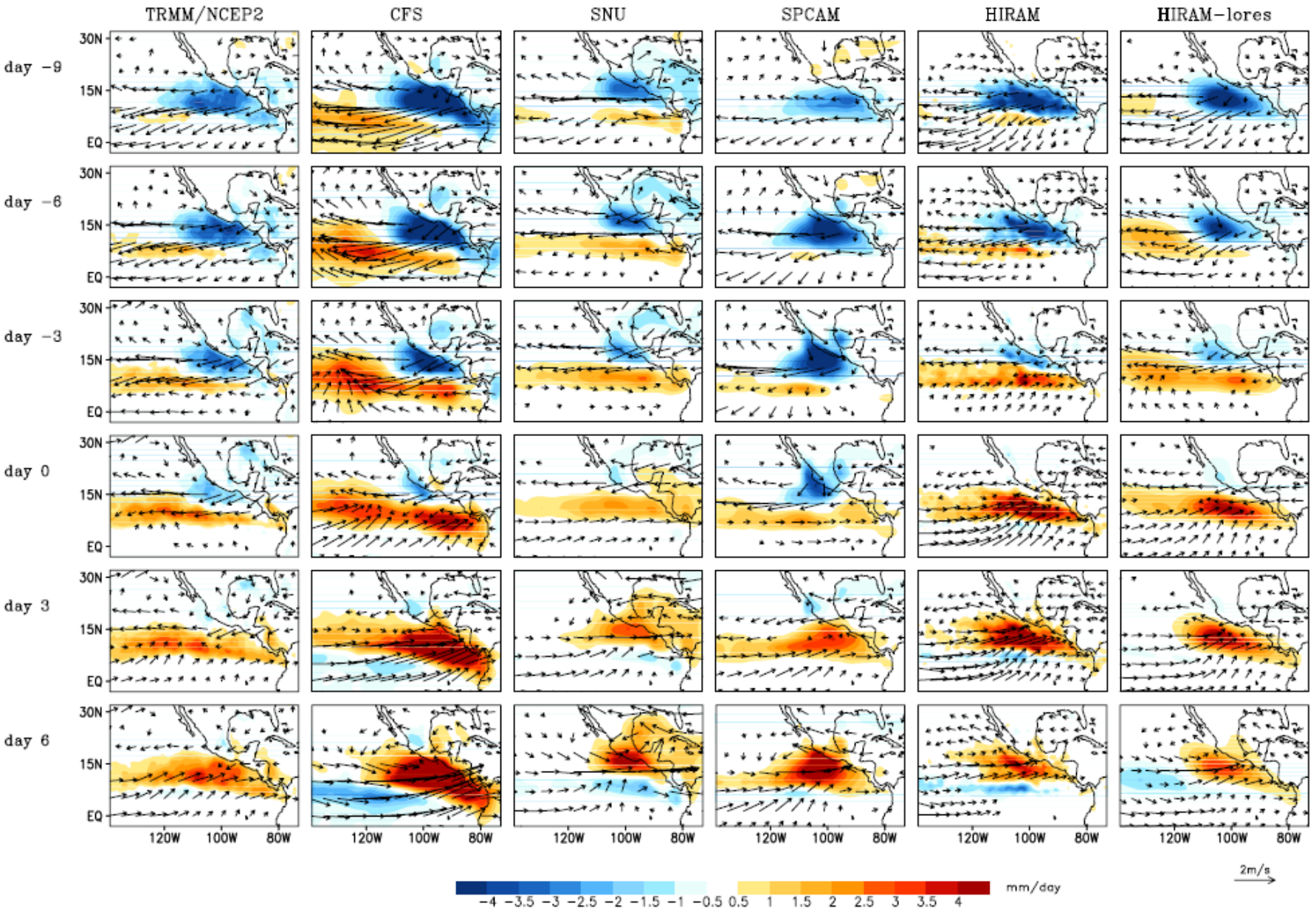


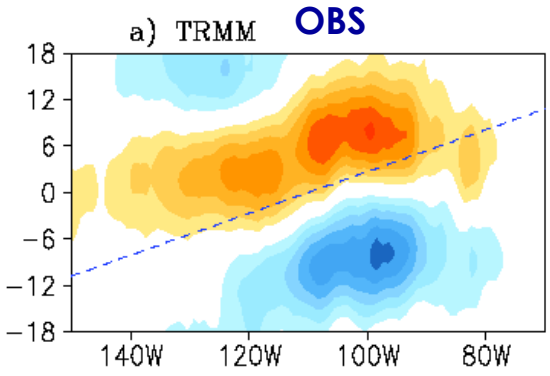
Pattern correlations between GCM simulated and observed First & Second EEOF of rainfall



Jiang et al. 2010

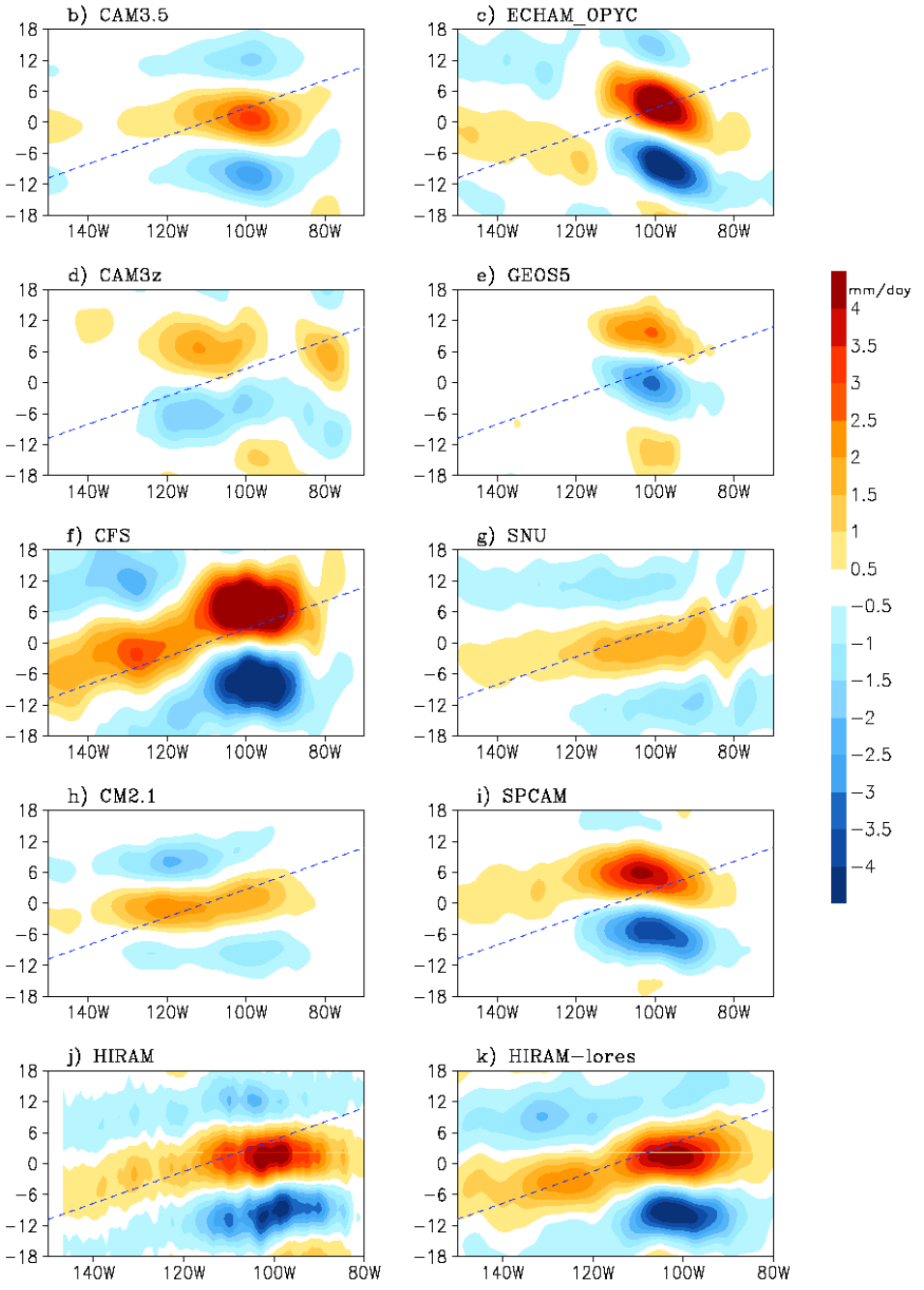
Evolution of Rainfall & 850mb wind associated with 40-day mode

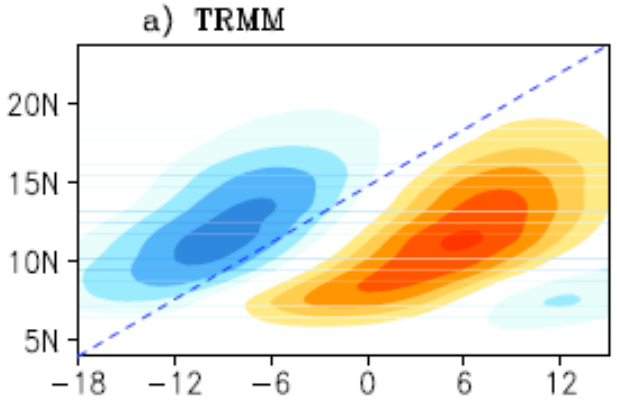




Eastward propagation associated with 1st ISV mode over the EPAC

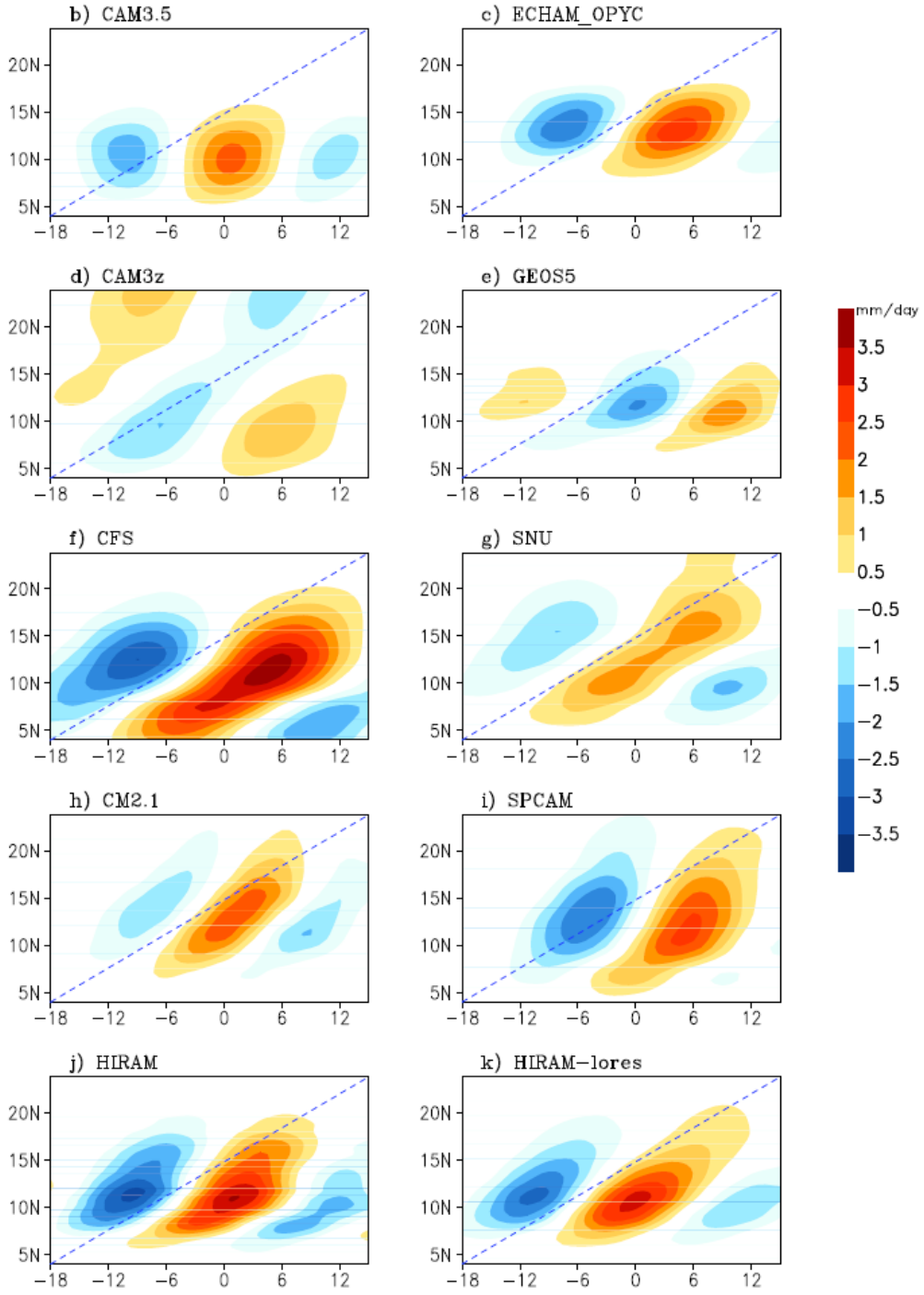
(5°N-15°N)



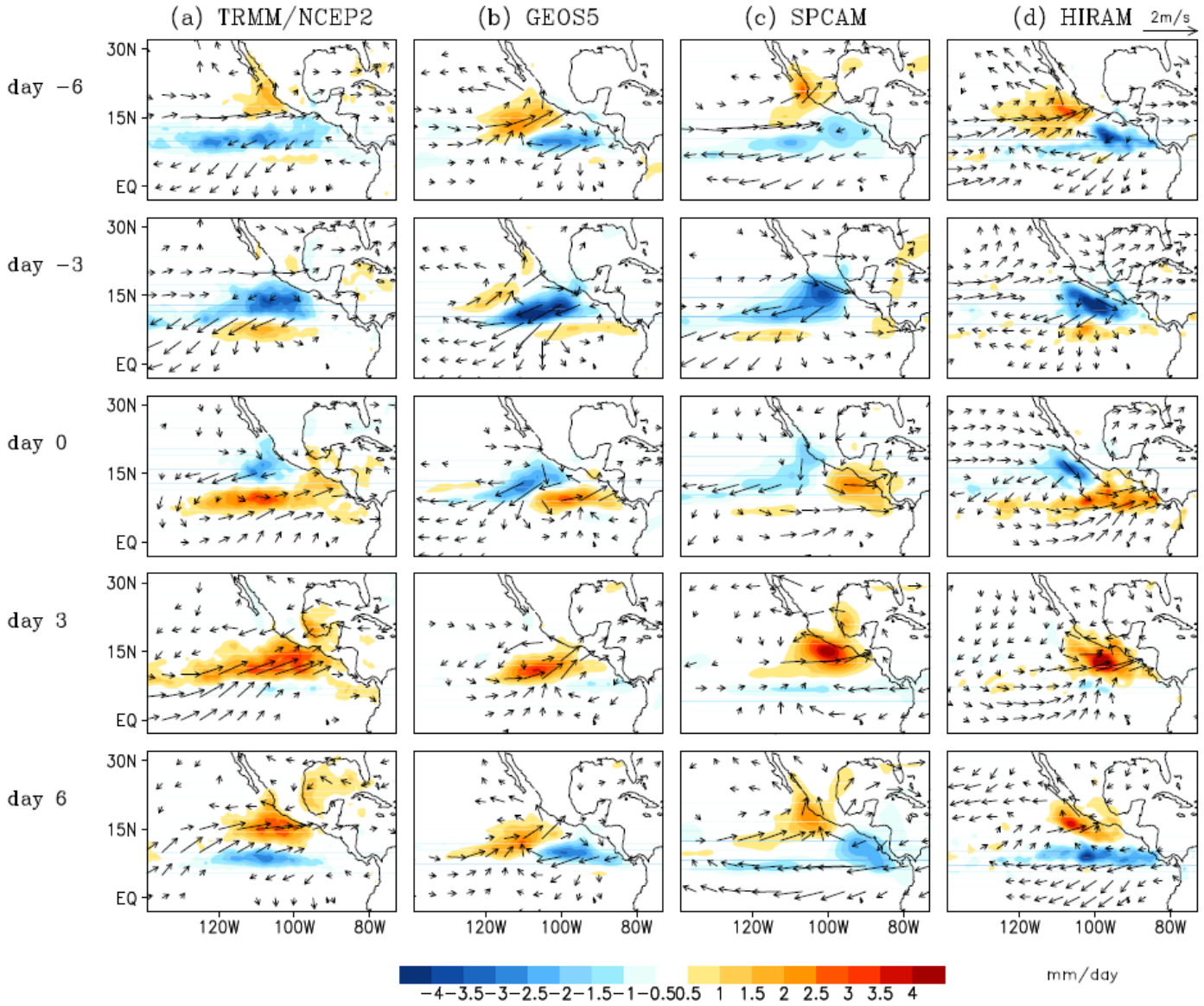


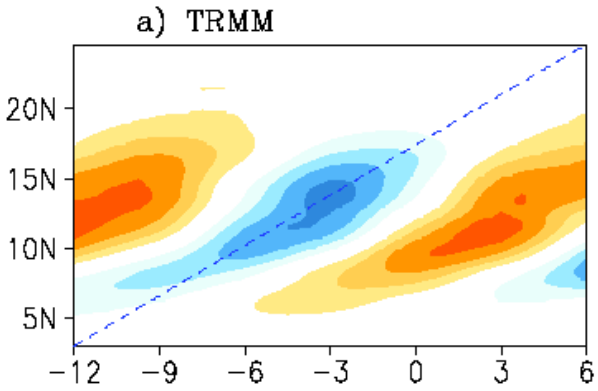
Northward propagation associated with 1st ISV mode over the EPAC

(130°W-90°W)



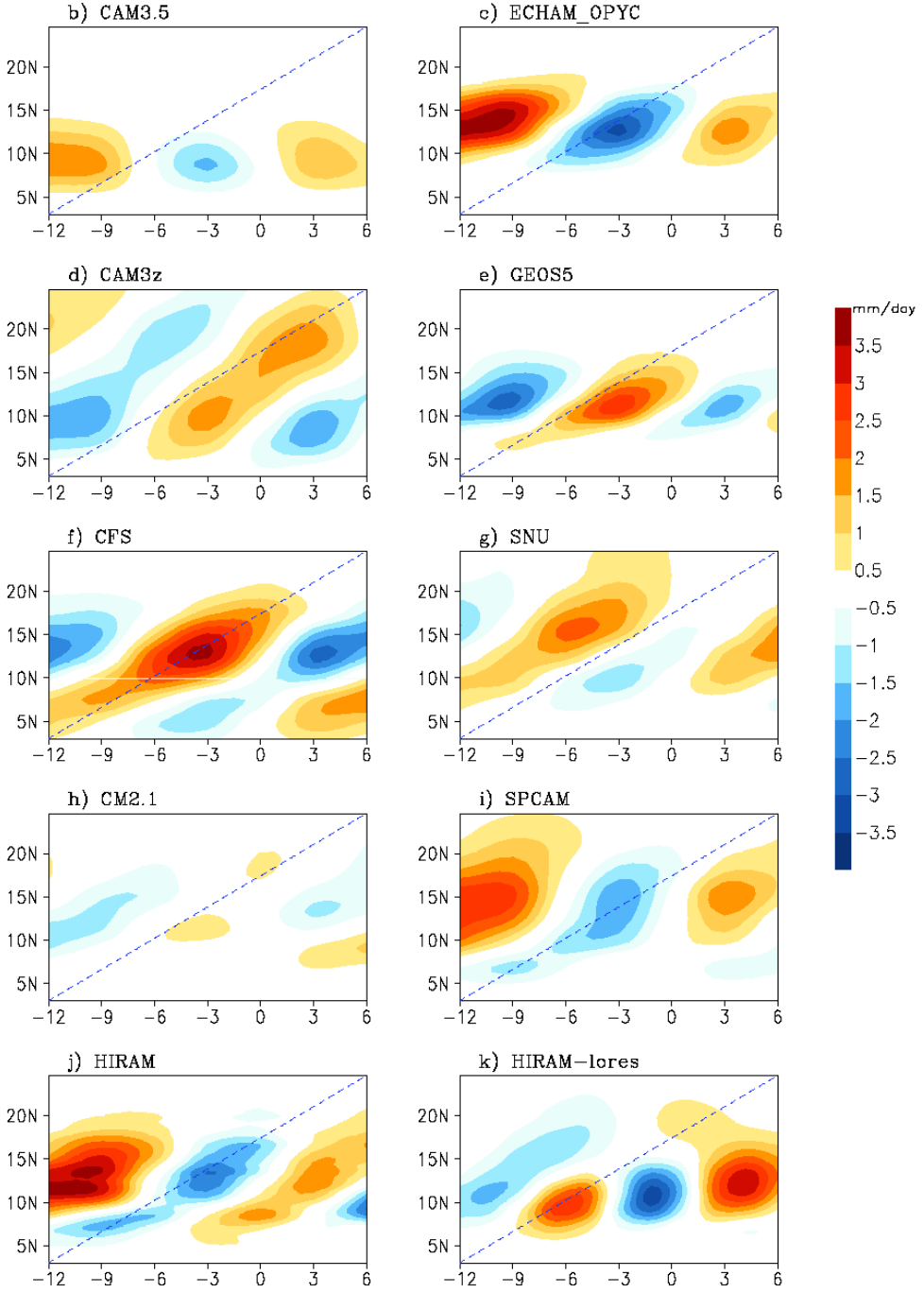
Evolution of Rainfall & 850mb winds associated with the QBM





Northward propagation associated with 2nd ISV over the EPAC

(130°W-90°W)



Summaries

- **While it remains challenging for GCMs in faithfully representing both of the two ISV modes over the EPAC including their amplitude, evolution patterns, and periodicities, encouraging simulation results are also noted. In general, SPCAM and GFDL HIRAM exhibit relatively superior skills in representing both of the two ISV modes.**
- **While model physics are found to be critical, sensitivity tests based on HIRAM also suggest that fine horizontal resolution could also be conducive in realistically capturing the ISV over the EPAC, particularly for the QBM mode.**

Some references

- Jiang, X., and D. E. Waliser, 2008: Northward propagation of the subseasonal variability over the Eastern Pacific Warm Pool. *Geophys. Res. Lett.*, **35**, L09814, doi: 10.1029/2008GL033723.
- Jiang, X., and D. E. Waliser, 2009: Two dominant subseasonal variability modes of the eastern Pacific ITCZ, *Geophys. Res. Lett*., 36, L04704, doi:10.1029/2008GL036820
- Jiang, X., and coauthors, 2010: Simulation of the intraseasonal oscillation over the Eastern Pacific ITCZ in climate models, *Climate Dynamics*, under revision.