Multi-model Ensemble Prediction for Boreal Summer Intraseasonal Oscillation (BSISO)

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1. IPRC and Department of Meteorology, University of Hawaii, USA
2. Centre for Australian Weather and Climate Research, Australia
3. JIFRESSE, University of California, Los Angeles, USA
4. Seoul National University, Seoul, Korea

The ISVHE Project

Intraseasonal Variability Hindcast Experiment

ISVHE is a coordinated multi-institutional ISV hindcast experiment supported by **APCC, A CTB, CLIVAR/AAMP & MJO TF, and AMY.**

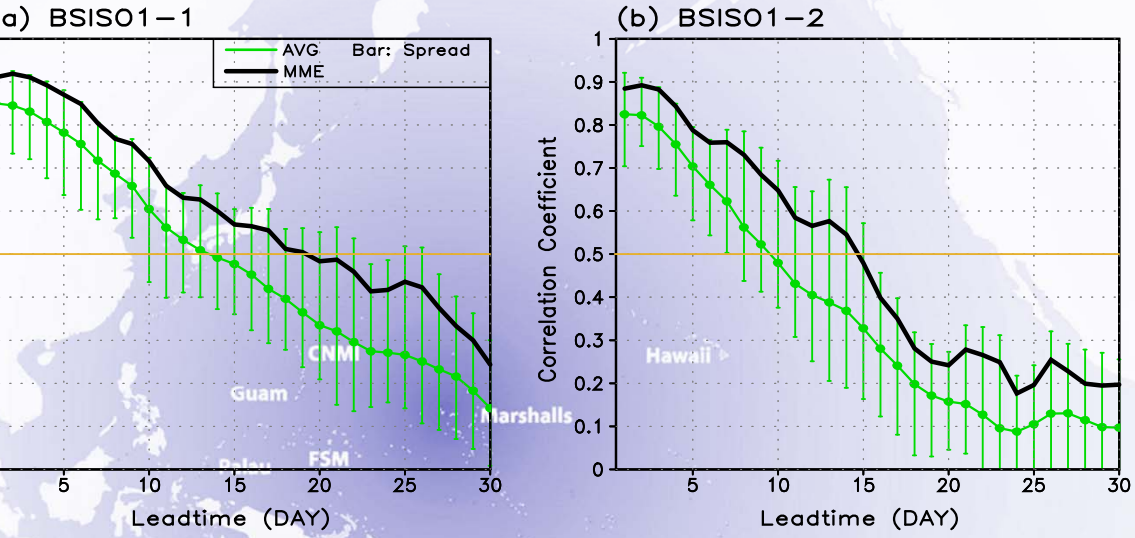
http://iprc.soest.hawaii.edu/users/jylee/clipas.htm

Supporters

MME and Individual Models' Skill for BSISO

omaly Correlation Coefficients (1989-2008, MJJASO)

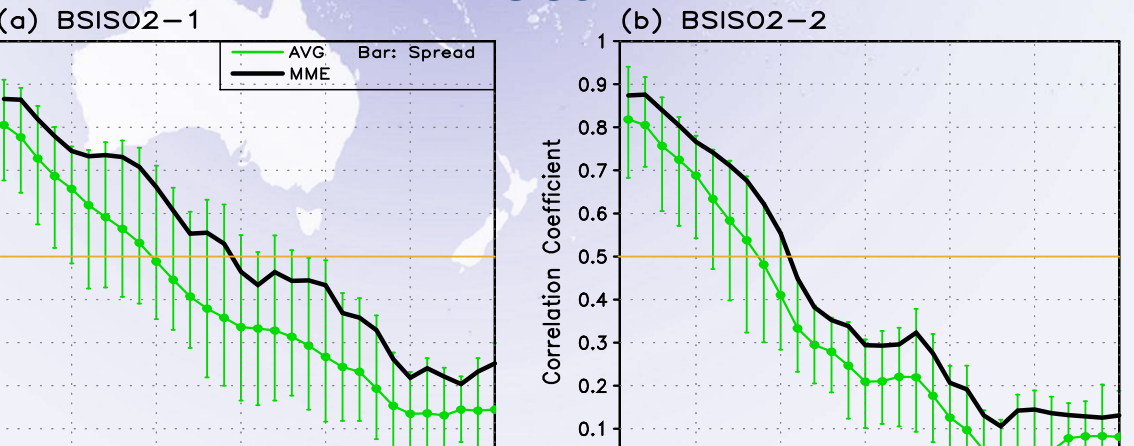
BSISO1



Common Period: 1989-2008
Initial Condition: 1st day of each month from Oct to March

MME: Simple composite with all models

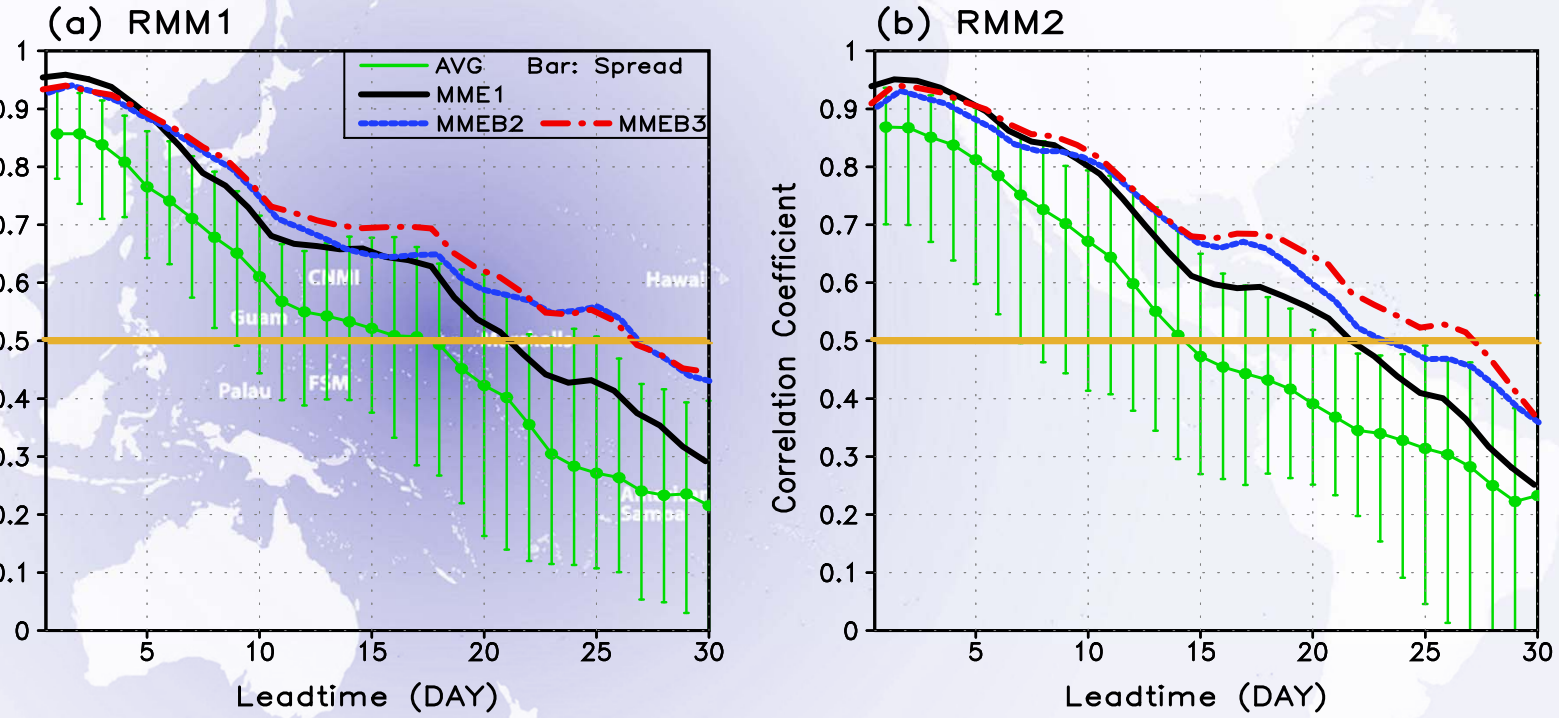
BSISO2



Using the MME, forecast skill for BSISO1 reaches 0.5 at 15 to 20-day forecast lead and for BSISO2 at 10- to 15-day forecast lead.

MME and Individual Model Skills for MJO

Anomaly Correlation Coefficients (1989-2008, NDJFMA)



mon Period: 1989-2008
l Condition: 1st day of each month from Oct to March
1: Simple composite with all models
B2: Simple composite using the best two models

ntraseasonal Forecasting of the MJO During DYNAMO/CINDY Period

Joshua Xiouhua Fu

Observed MJO Events

Strengths and Weaknesses of Operational Forecasts

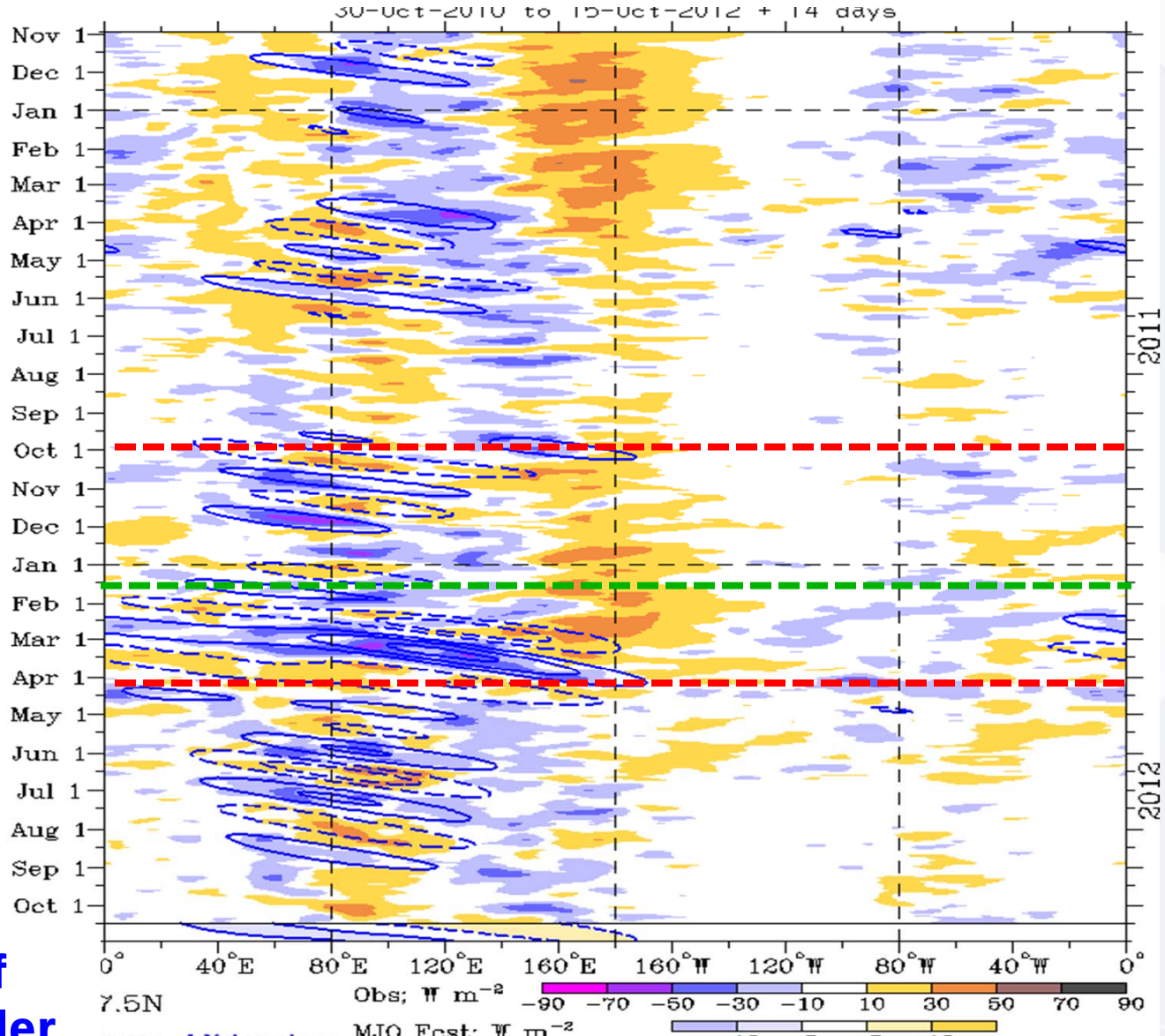
Forecast Skills in GFS, CFSv2, and UH Models

Summary

aborators at NCEP/CPC: WQ Wang, S. Weaver; and at UH/IPRC: B. g, JY Lee, PC Hsu, O. Shieh, H. Taniguchi

DYNAMO/CINDY Field Campaign (Oct 2011-Mar 2012)

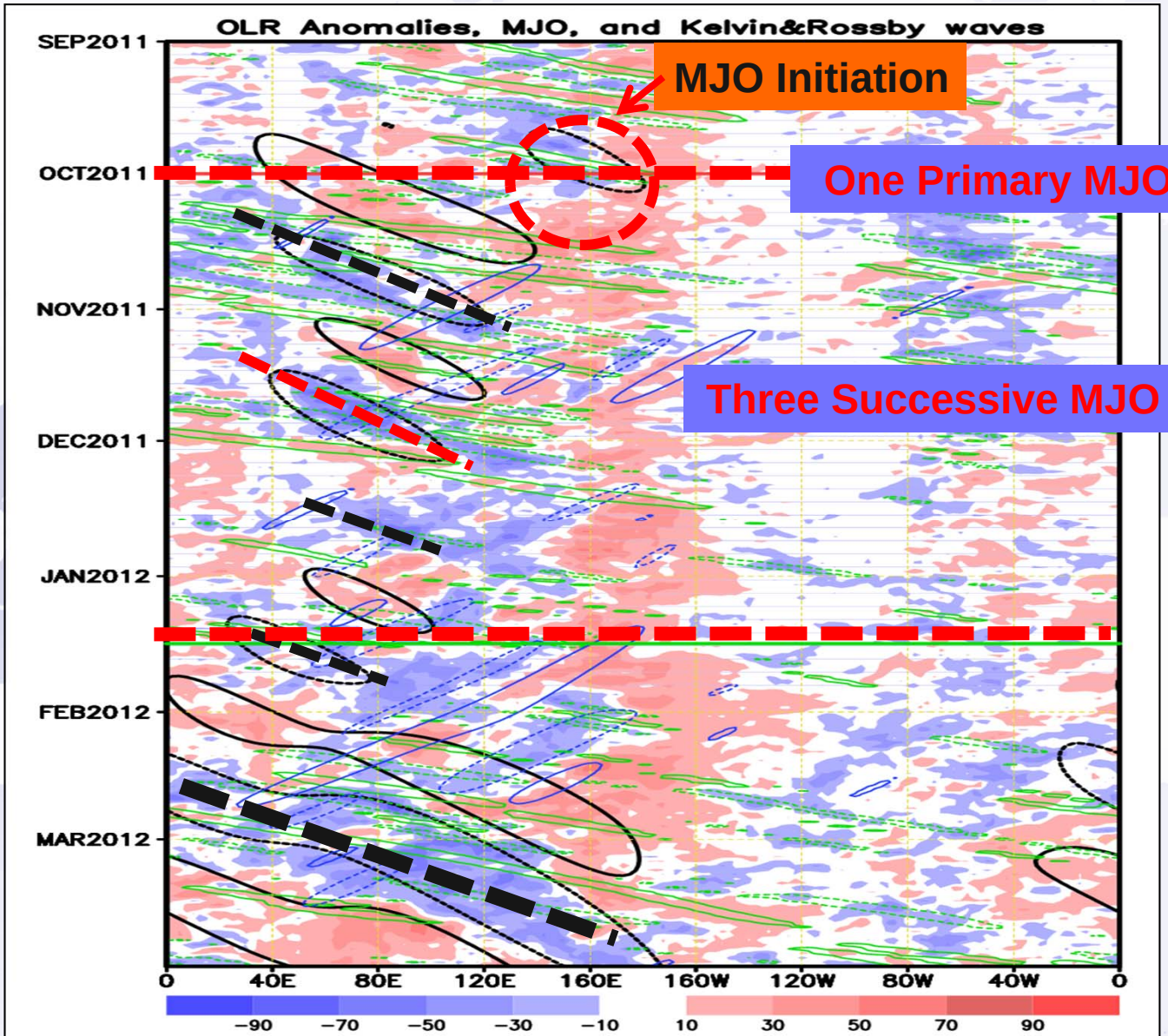
OLR Anomalies and MJO in 2011-2012



MO IOP

rtesy of
t Wheeler

LR Anomalies, MJO, and K/R Waves during DYNAMO



-I

-II

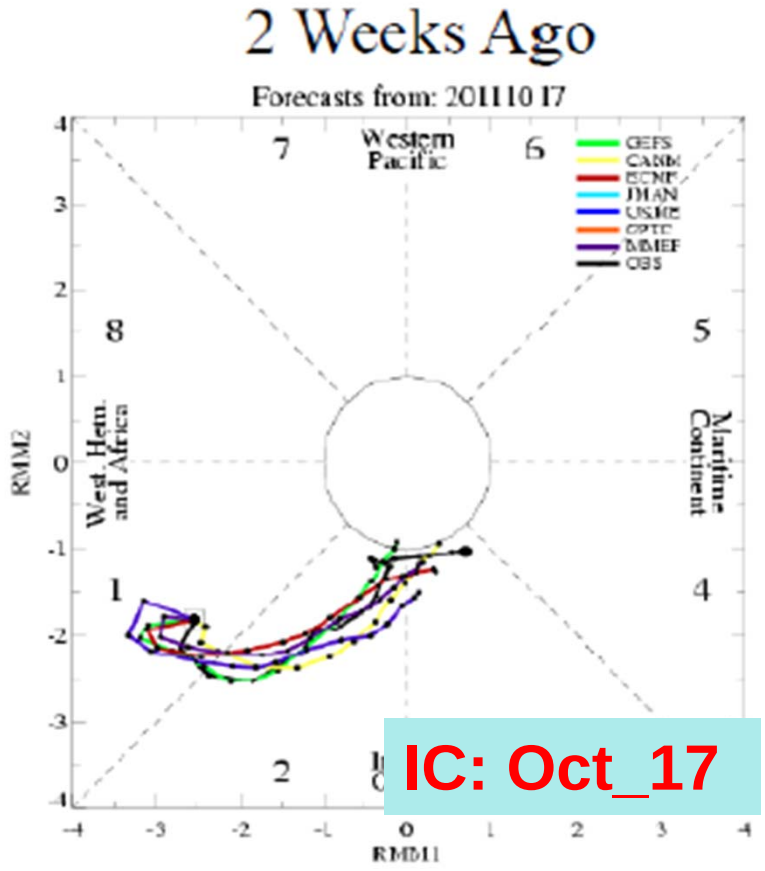
-III

-IV

-V

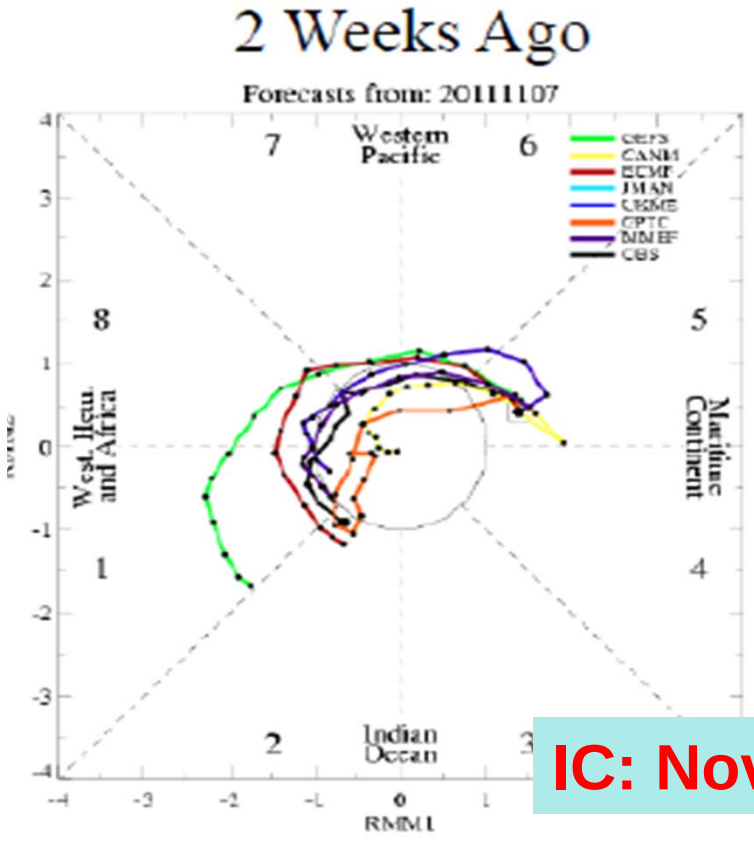
MJO Forecasts during DYNAMO/ CINDY period by Operational Centers

“Good”



IC: Oct_17

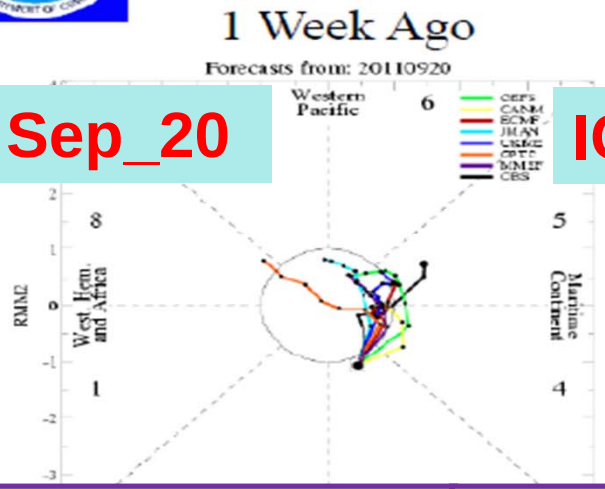
“Good”



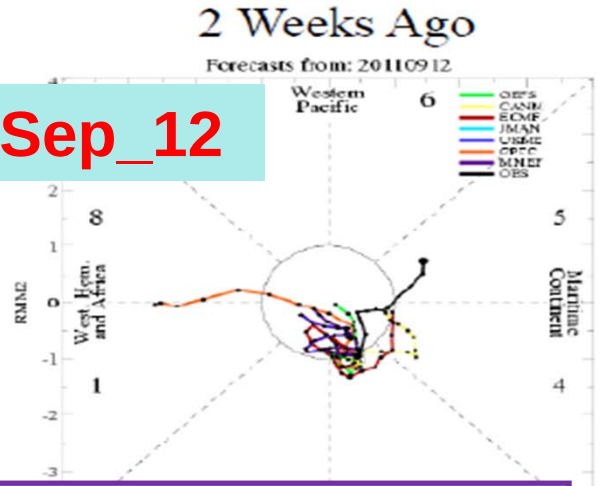
IC: Nov_07

rtesy of NCEP MJO Discussion
mary led by Jon Gottschalck et al.

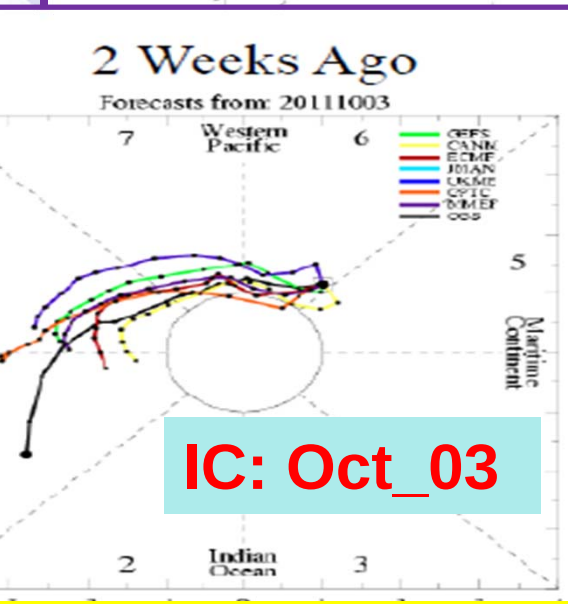
Failed to Predict "the Initiation of a Primary MJO Event"



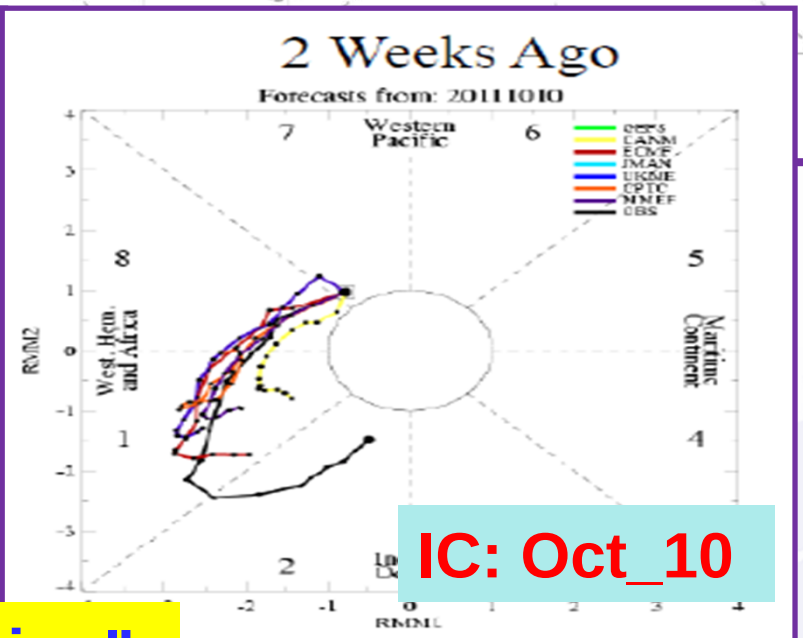
IC: Sep_20



IC: Sep_12



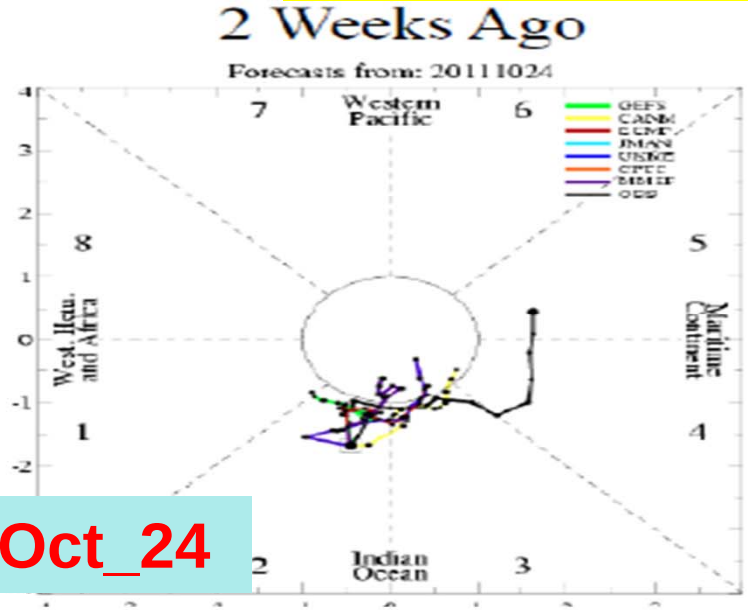
IC: Oct_03



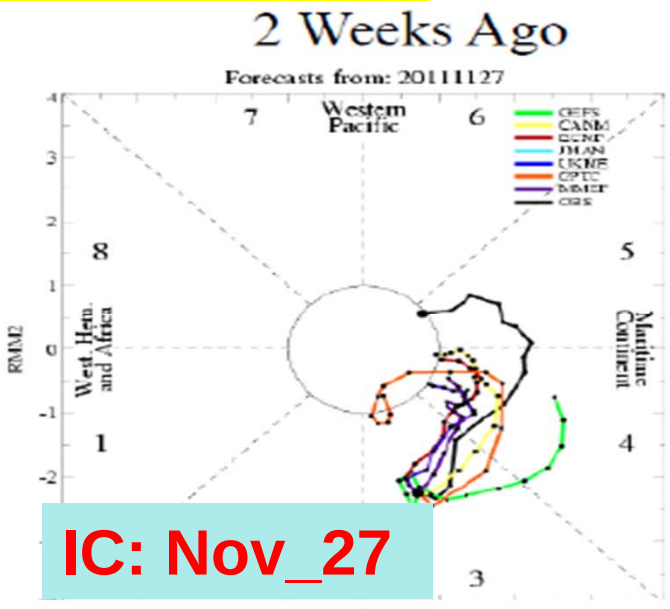
IC: Oct_10

v Eastward Propagation"

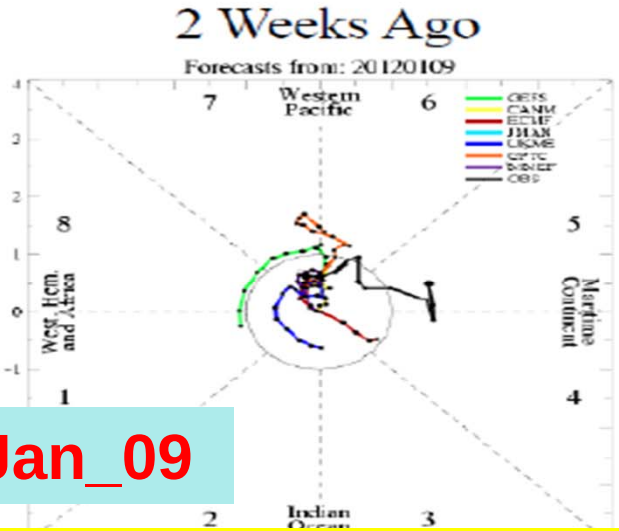
“Maritime Continent Barrier”



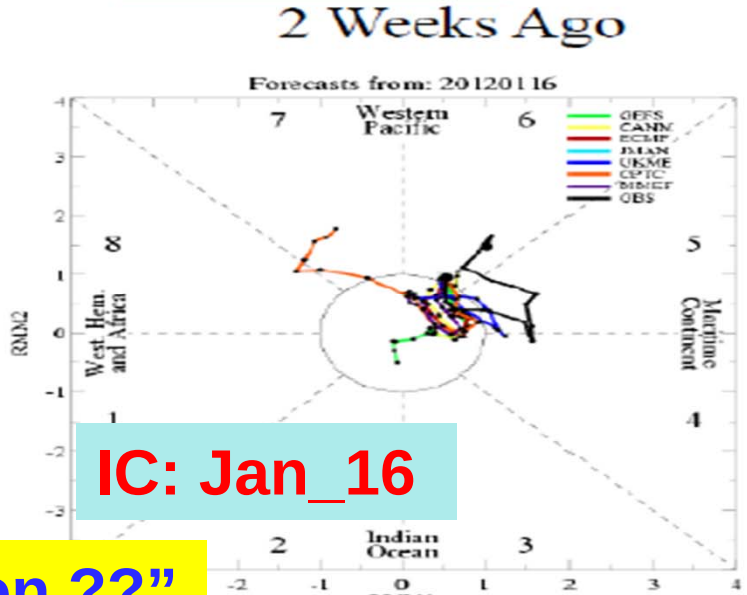
Oct_24



IC: Nov_27



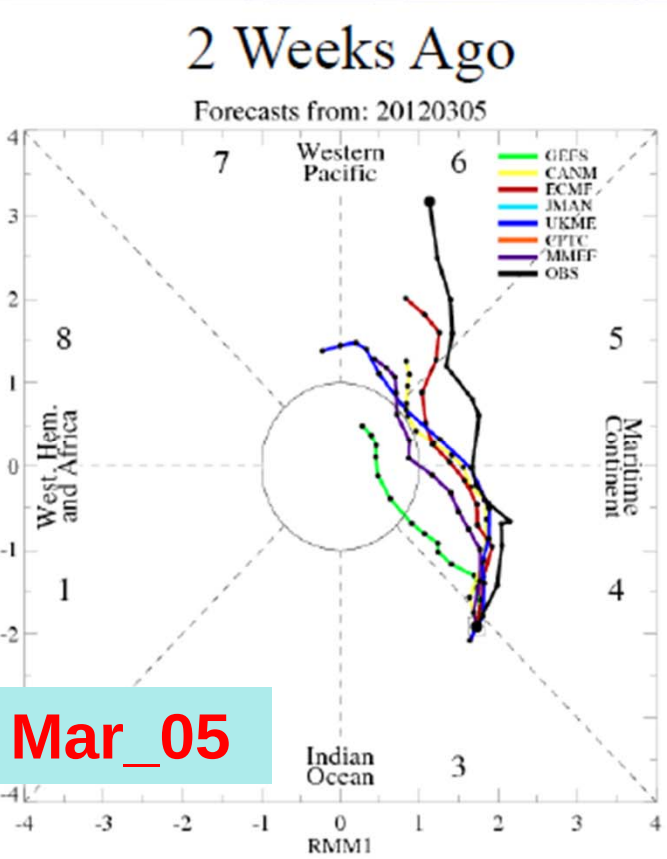
Jan_09



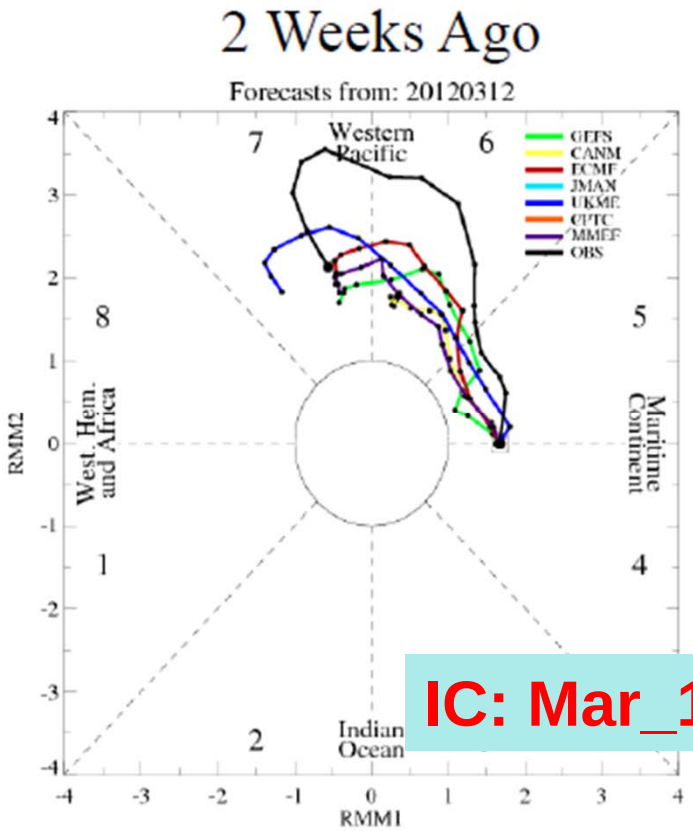
IC: Jan_16

sshy-wave MJO Initiation 22”

“Good but weaker intensity”



Mar_05



IC: Mar_12

Inter-comparison of GFS, CFSv2, and UH Models

DYNAMO/CINDY Period: Sep-2011 to Mar-2012

Forecast Interval: Daily (GFS, CFSv2), Weekly (UH)

Ensemble Mean: 4/4x4 ensembles daily (GFS/CFSv2), 10 ensembles (UH)

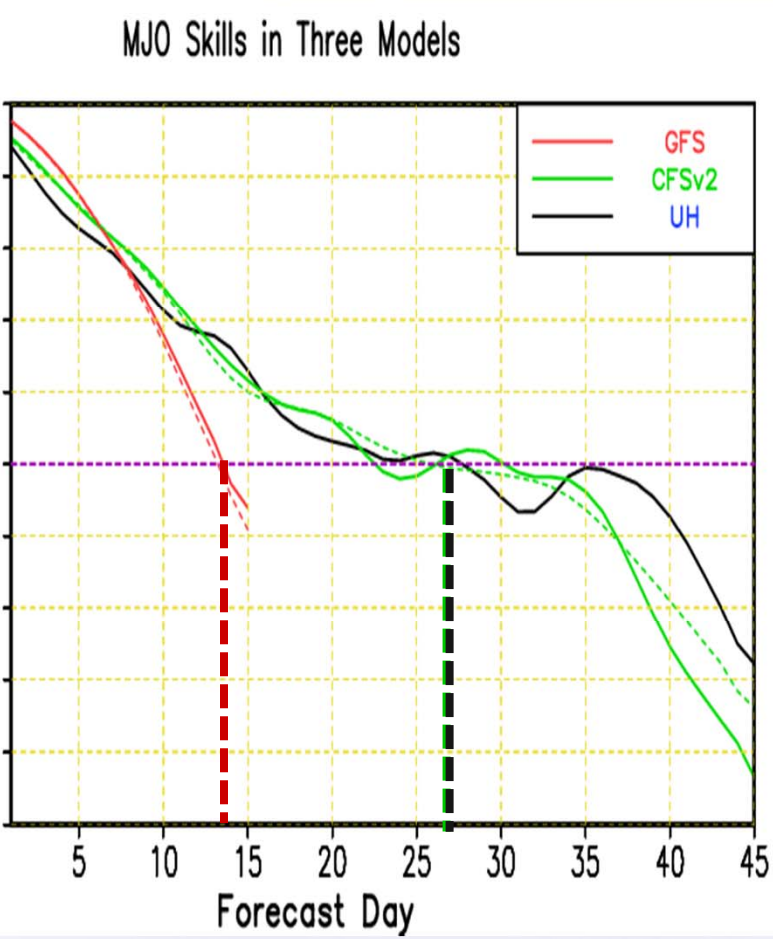
Integration Length: 15/45 days

Initial Conditions: NCEP GDAS/CFSR/FNL

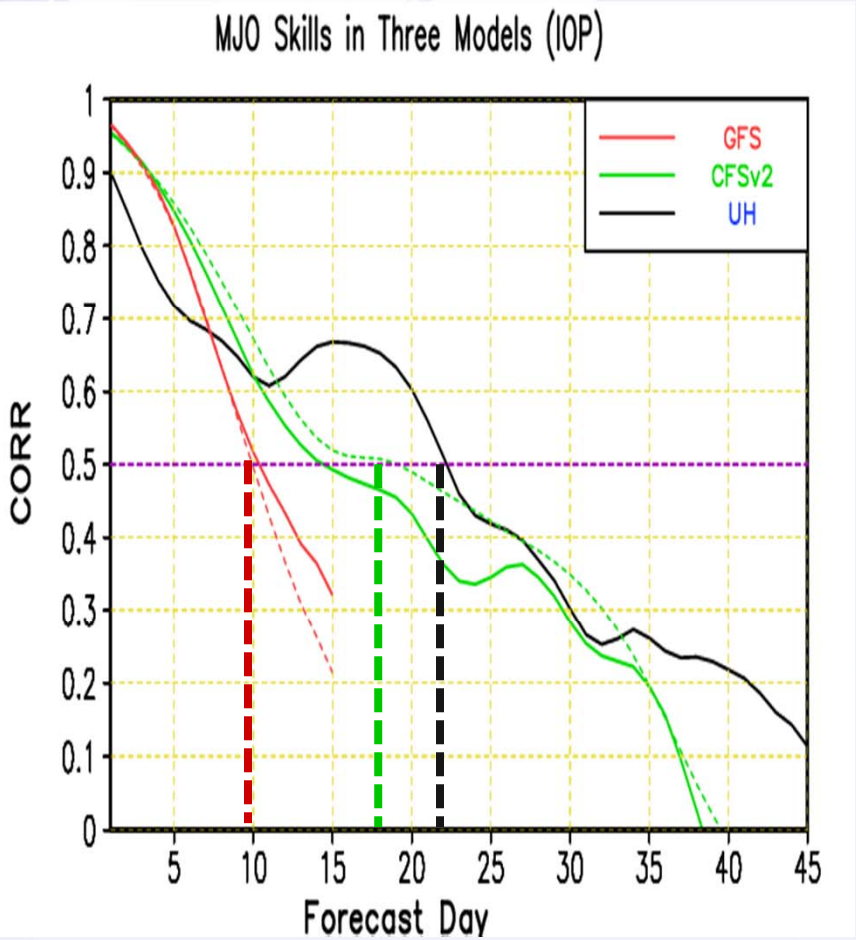
MJO Skill Measure: Wheeler-Hendon RMM Index

MJO Skills of Three GCMs During DYNAMO/CINDY

(Sep 2011- Mar 2012)



(IOP: Sep 2011- Jan 2012)



Impacts of Air-sea Coupling and Stratiform Rainfall on MJO Forecasts

- **Air-sea Coupling:** **Coherent structure, Propagation, Intensity, Predictability, and Prediction Skill et al.**

rishnamurti et al. (1988); Flatau et al. (1997); Wang and Xie (1998); Waliser et al. (1999); Fu and Wang (2004); Woolnough et al. (2007); Fu et al. (2007); Pegion and Kirtman (2008); Fu et al. (2008) et al.

Sensitivity Experiments:

CPL: Coupled control run

Fcst_SST: Atmosphere-only run forced with forecasted daily SST

Pers_SST: Atmosphere-only run forced with persistent SST

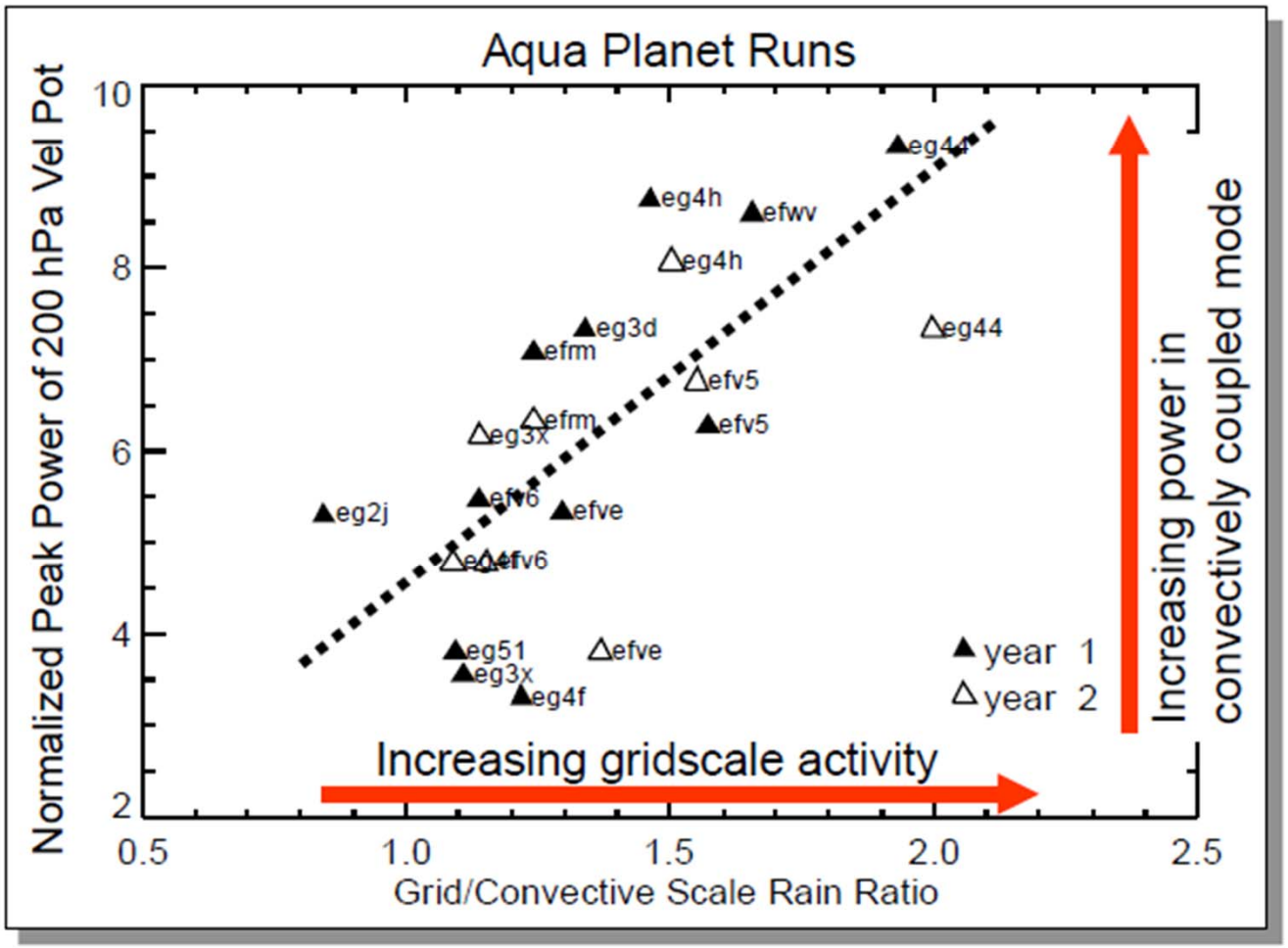
TMI_SST: Atmosphere-only run forced with observed daily SST

- **Fraction of Stratiform Rainfall:** **Intensity et al.**

Tompkins et al. (2003); Fu and Wang (2009); Seo and Wang (2010); Benedict et al. (2012)

Sensitivity Experiments: Modifying detrainment rate

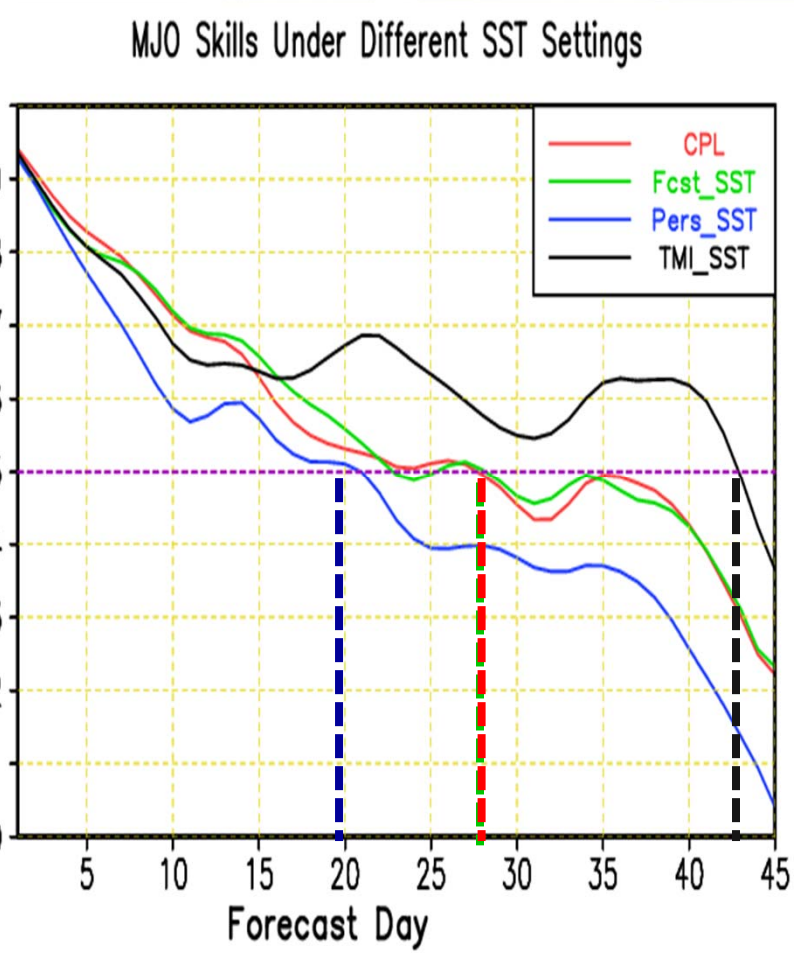
ncreasing Large-scale activity increases peak power (K=1,2,3 15 days<p<120 days)



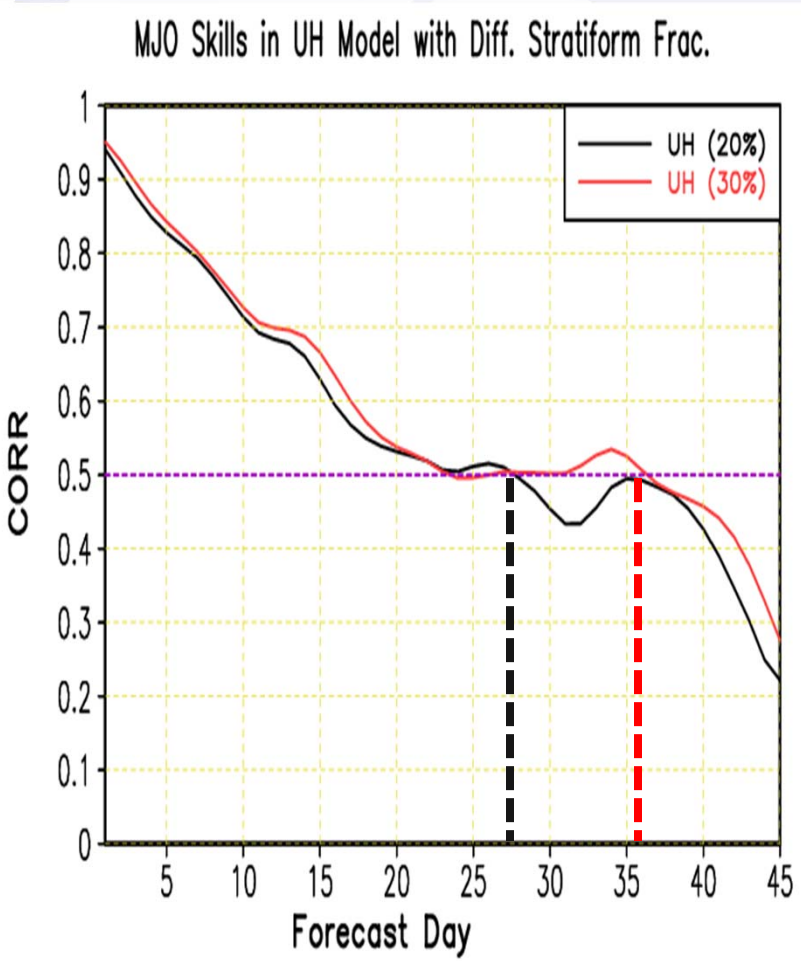
Tompkins et al. (2003)

Sensitivity Experiments During DYNAMO/CINDY

Diff. SST Settings

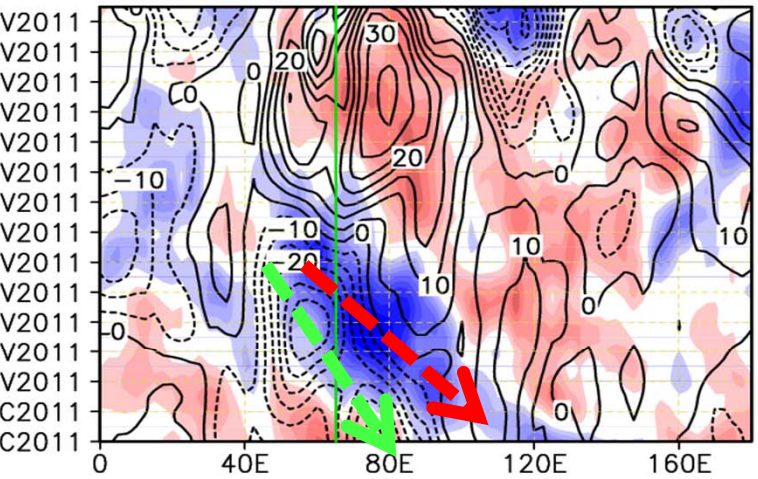


Diff. Stratiform Fraction

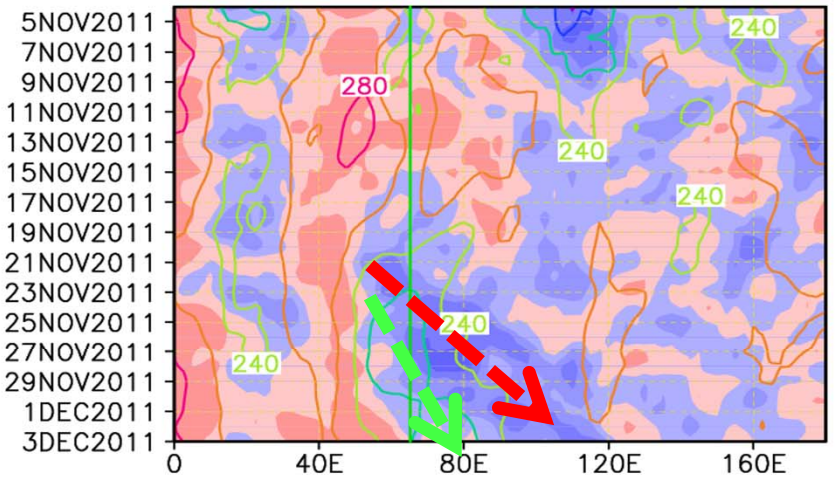


Forecasts Initialized on Nov. 4, 2011

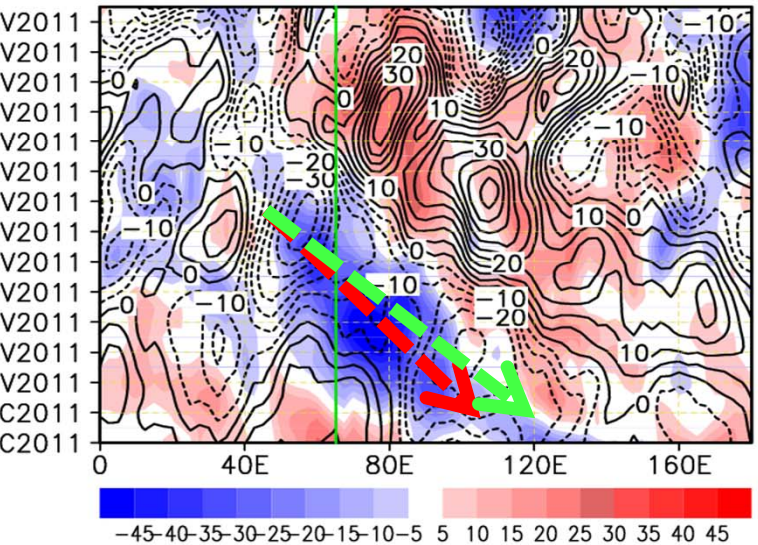
(a) OBS vs. CFSv2



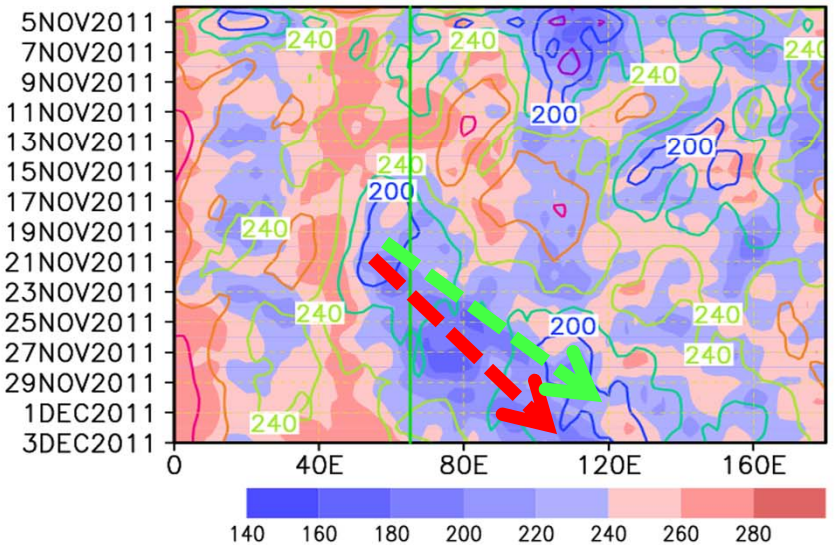
(b) OBS vs. CFSv2



(c) OBS vs. UH

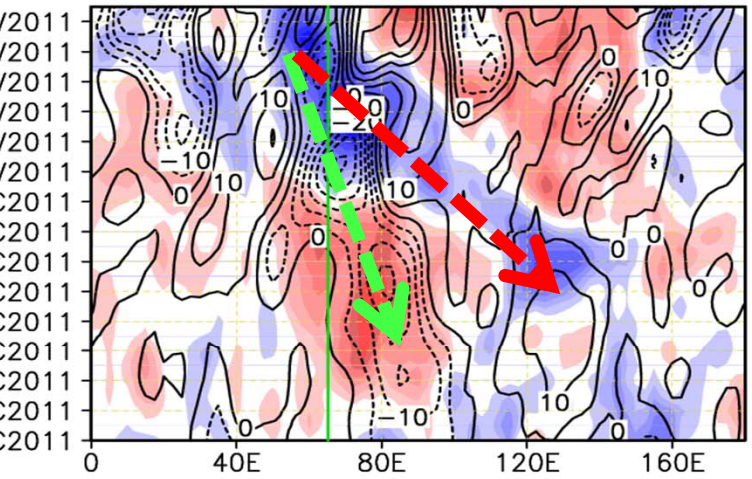


(d) OBS vs. UH

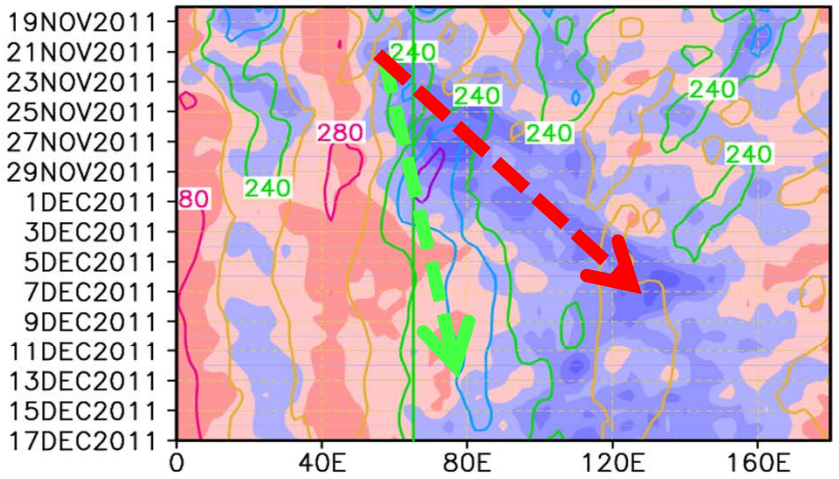


Forecasts Initialized on Nov. 18, 2011

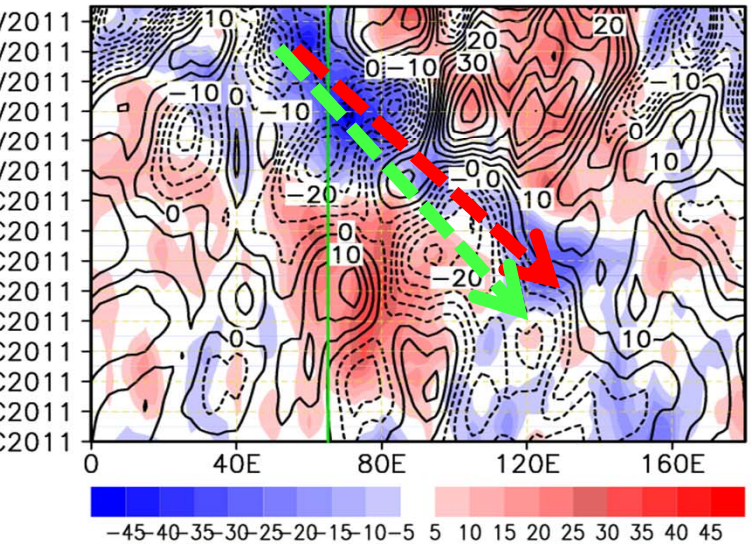
(a) OBS vs. CFSv2



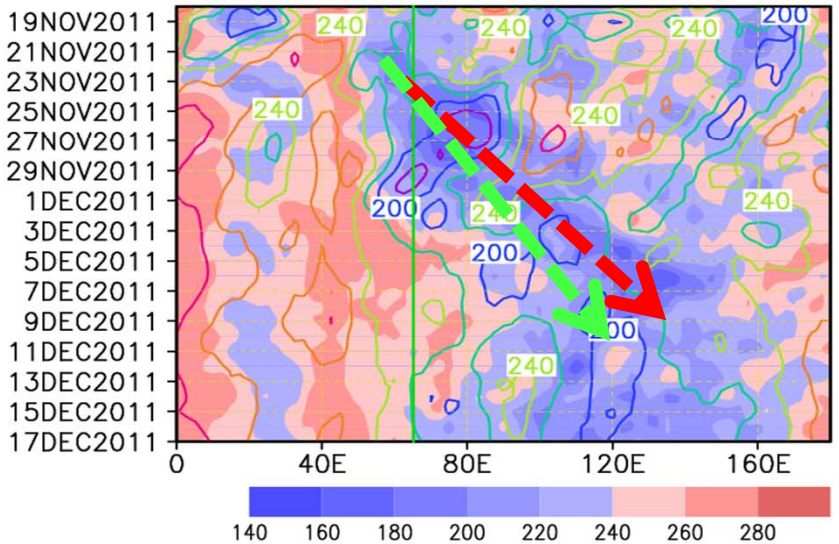
(b) OBS vs. CFSv2



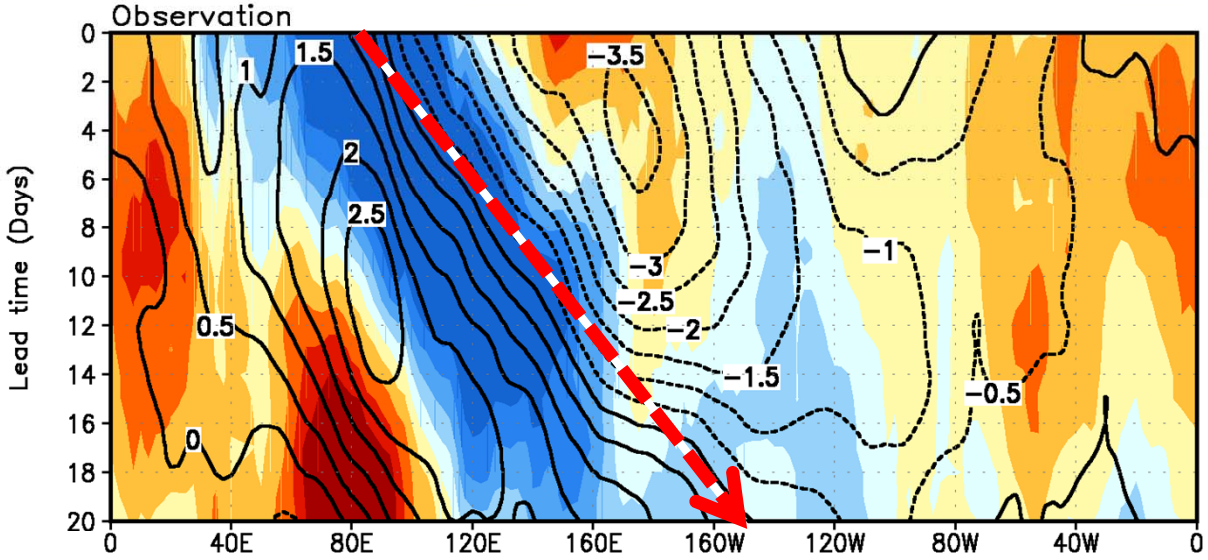
(c) OBS vs. UH

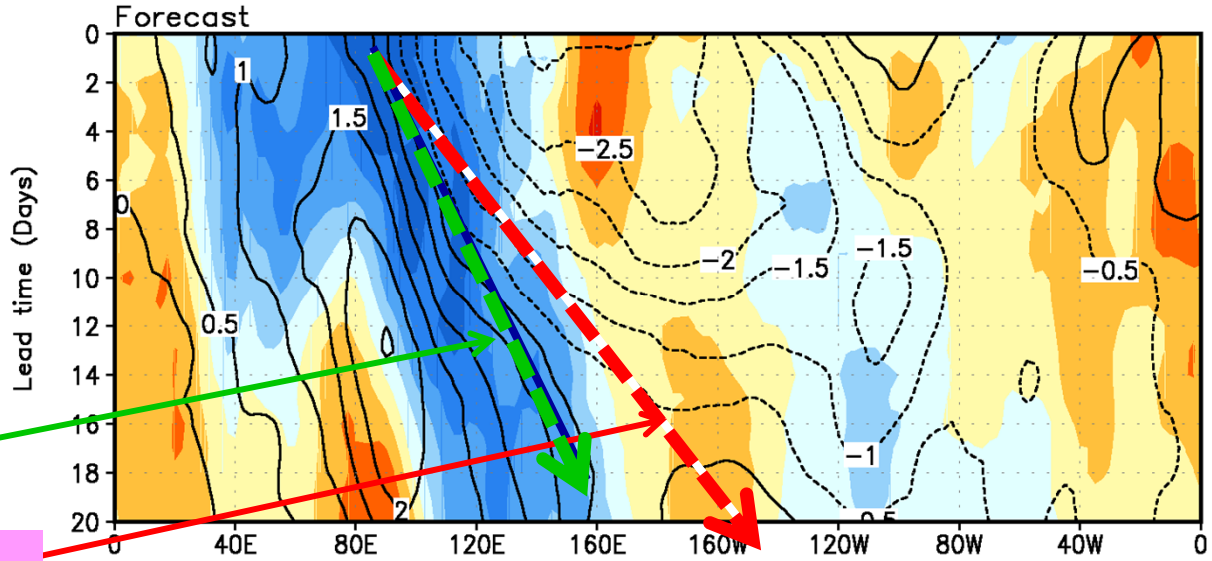


(d) OBS vs. UH



nposite for initial MJO phase 3 in CFSv2 (1999-2010)





Contours: u850
Shadings: OLR

st

vation

Summary

uccessive MJO is more predictable than primary
O. Major problems of operational models are: Slow
ward propagation, Maritime Continent barrier, and
k intensity.

IJO forecast skills are about 14 days in GFS and 25
s in CFSv2 and UH models for entire DYNAMO
od. CFSv2 model has lower skill during IOP due to
v eastward propagation.

ntraseasonal SST anomaly (or air-sea coupling) and
anced stratiform rainfall significantly improve MJO
cast skill.

Thank You Very Much!

INTERNATIONAL PACIFIC RESEARCH CENTER

Tropical Cyclone “ARB04” (Nov 26 - Dec 1, 2011)

30 fishermen missing owing to prevailing weather conditions

Eight persons killed and 50 injured in Matara

dden-Julian Conversation
log by a small group of climate
entists about the Madden-
ian Oscillation and the
NAMO field campaign in the
ian Ocean.

NDAY, NOVEMBER 28, 2011
hermen died unnecessarily in
pical Cyclone ARB04

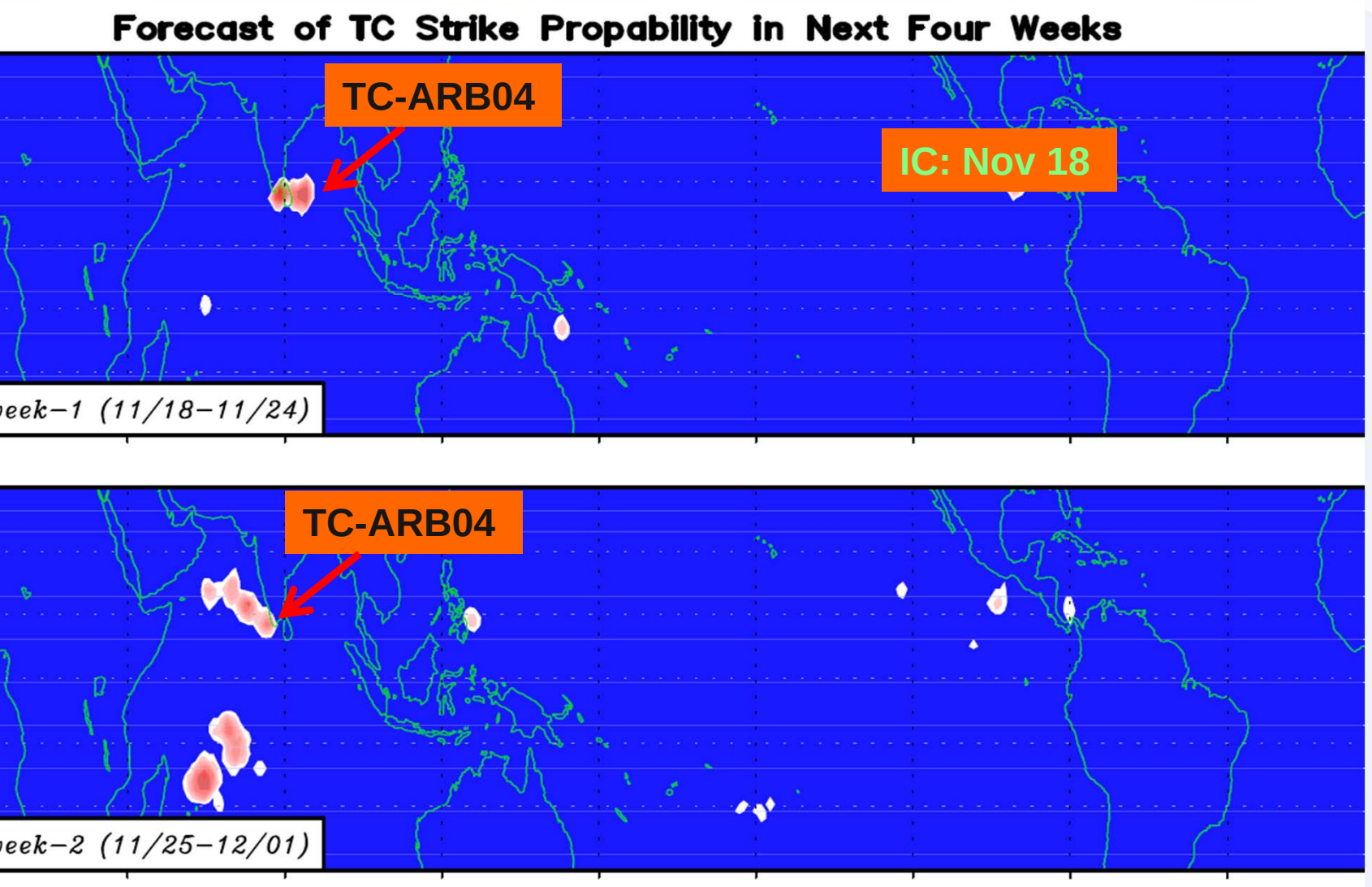
Update - Govt. to launch probe into storm disaster

FRIDAY, 25 NOVEMBER 2011 11:24

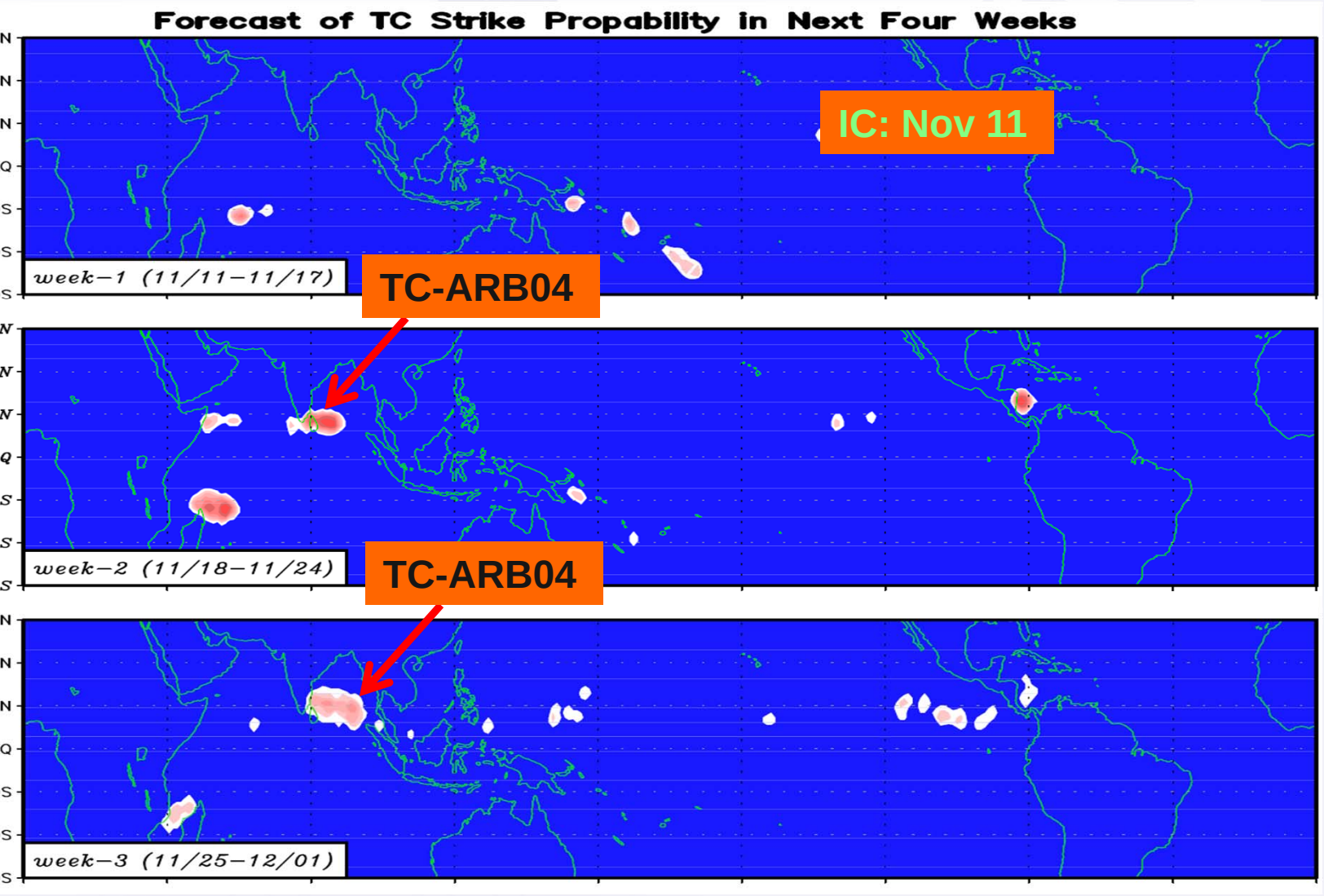
Nov. 25, 2011

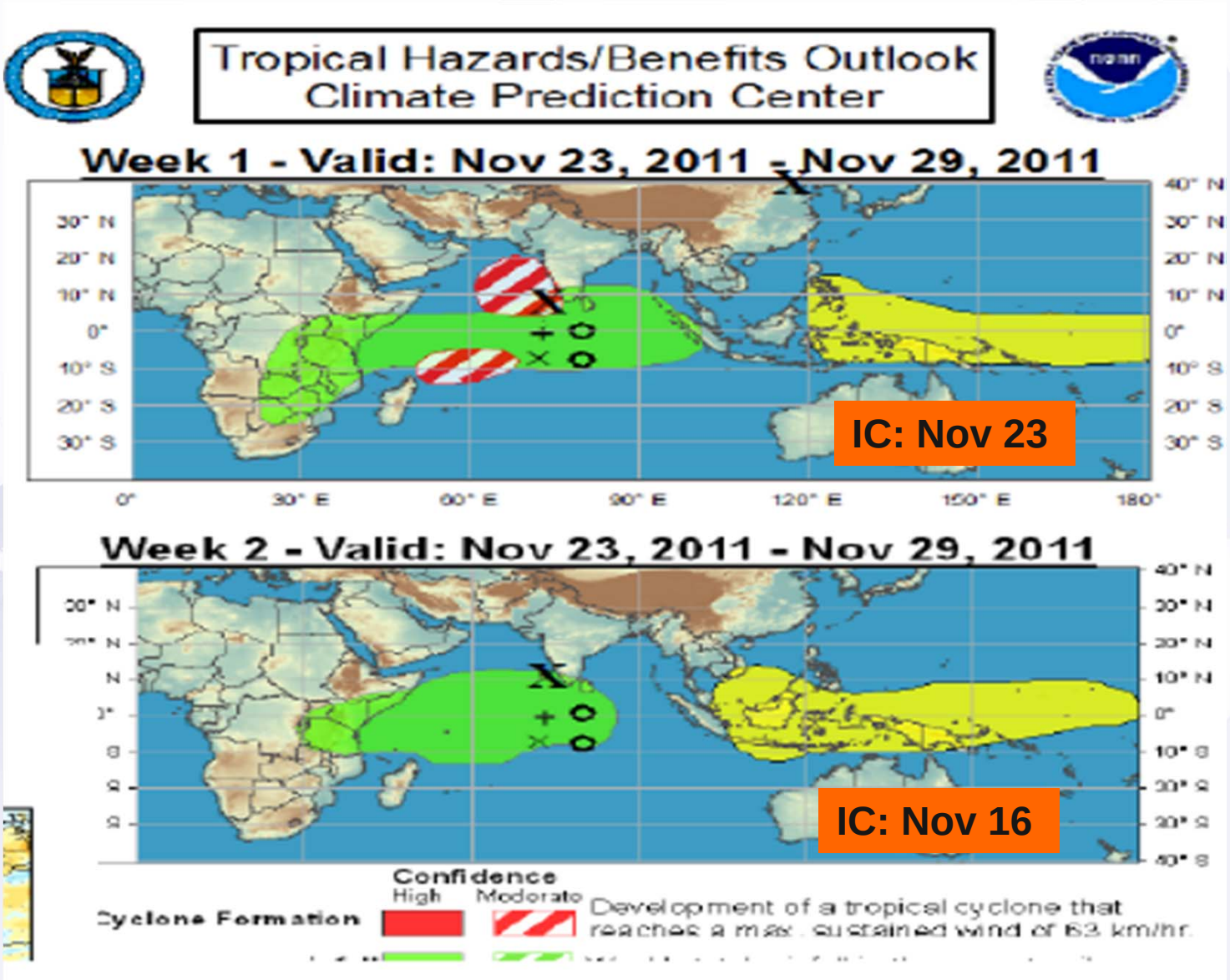
The government today announced it would launch a full probe into this week's storm disaster in the south that has left 19

Three-week-lead forecasts of TC strike propability

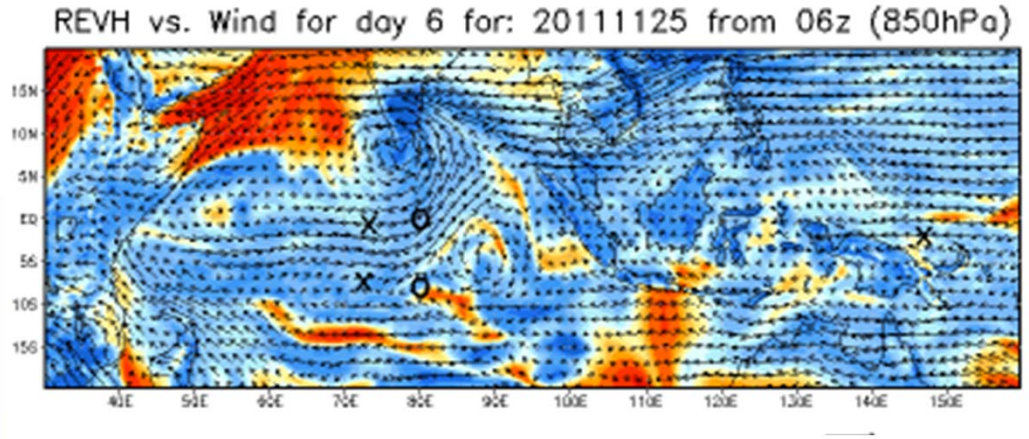


Three-week-lead forecasts of TC strike propability

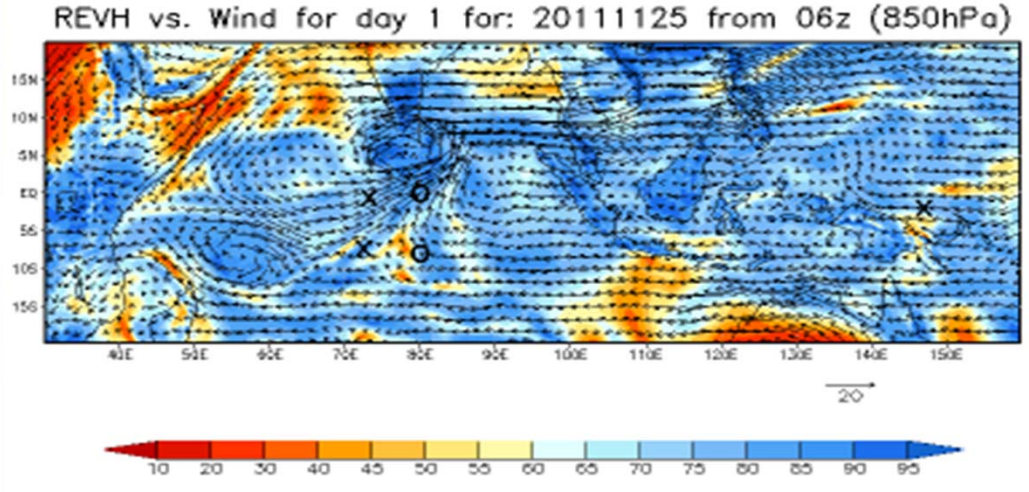



Tropical Hazards/Benefits Outlook
Climate Prediction Center
Week 1 - Valid: Nov 23, 2011 - Nov 29, 2011
40° N
30° N
20° N
10° N
0°
10° S
20° S
30° S
0°
30° E
60° E
90° E
120° E
150° E
180°
IC: Nov 23
Week 2 - Valid: Nov 23, 2011 - Nov 29, 2011
IC: Nov 16
Confidence
High
Moderate
Cyclone Formation
Development of a tropical cyclone that
reaches a max. sustained wind of 63 km/hr

NCEP GFS Forecast



6-day lead



1-day lead

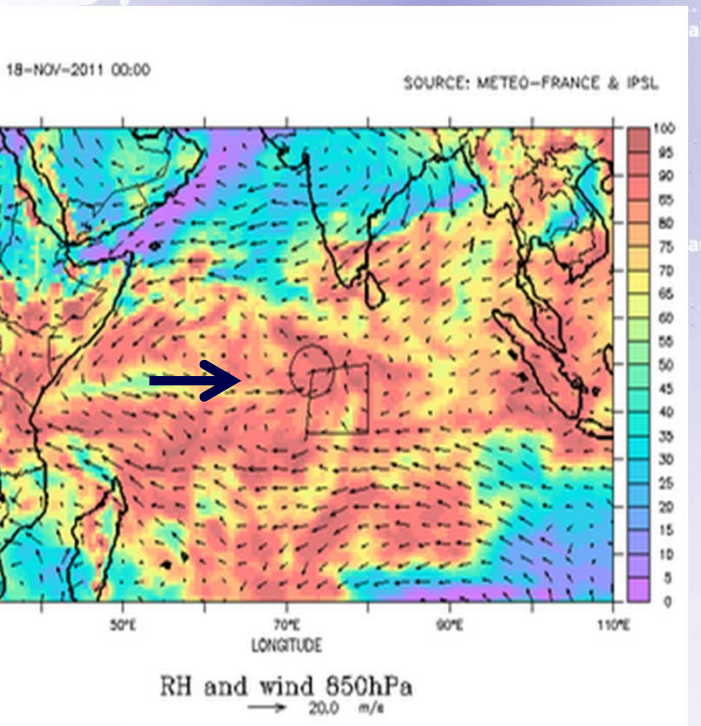
Kelvin Wave vs. Madden and Julian Oscillation?

Madden-Julian Conversation

A blog by a small group of climate scientists about the Madden-Julian Oscillation and the DYNAMO field campaign in the Indian Ocean.

Friday, November 18, 2011

Kelvin vs. Madden and Julian ?



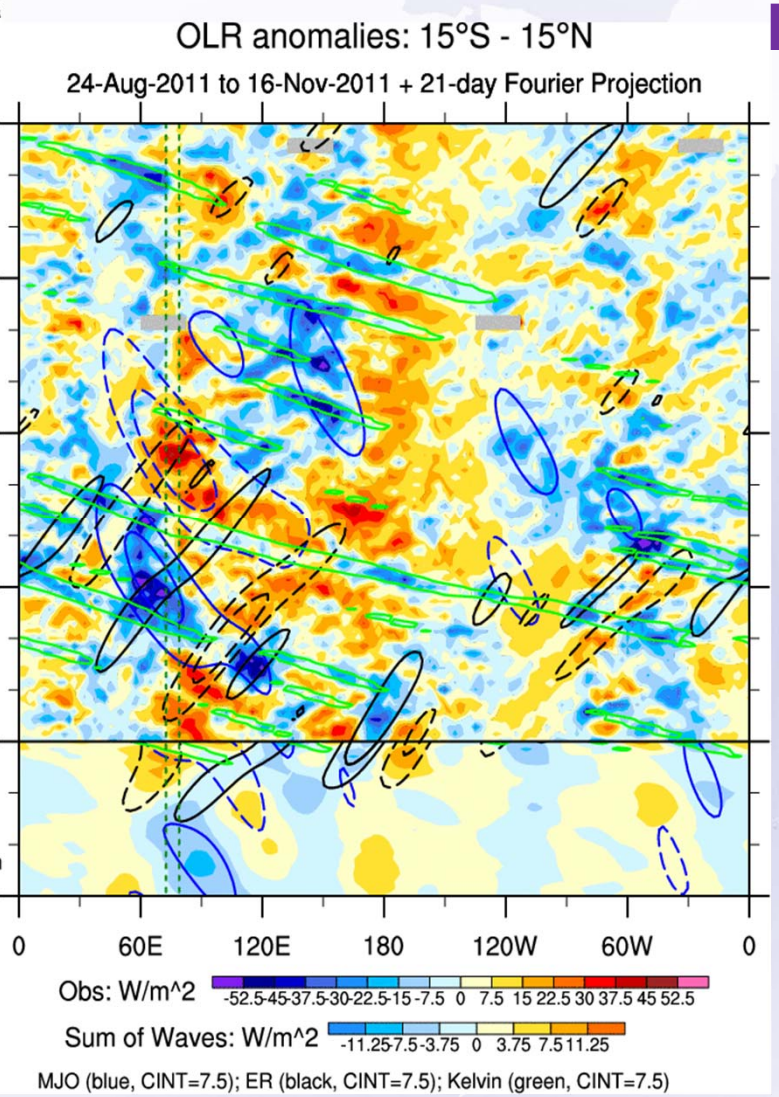
Michelle **Nov 18, 2011 05:26 AM**

Hey Adam,

I think you're right about the Kelvin wave. You can see it pretty well here on Carl Schreck's webpage: http://monitor.cicsnc.org/mjo/current/hov/olr.waves.EQ.gif

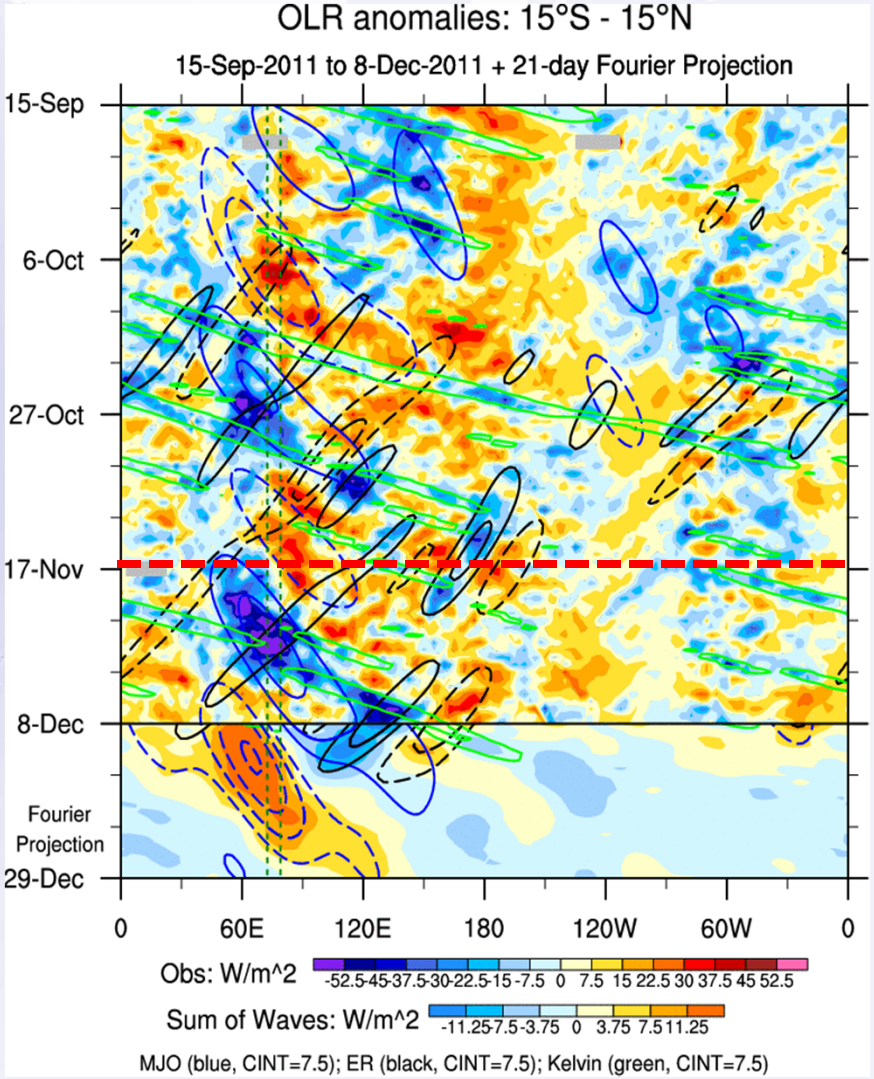
See the green contours impinging onto the DYNAMO domain (shown by the vertical dashed line

http://monitor.cicsnc.org/mjo/

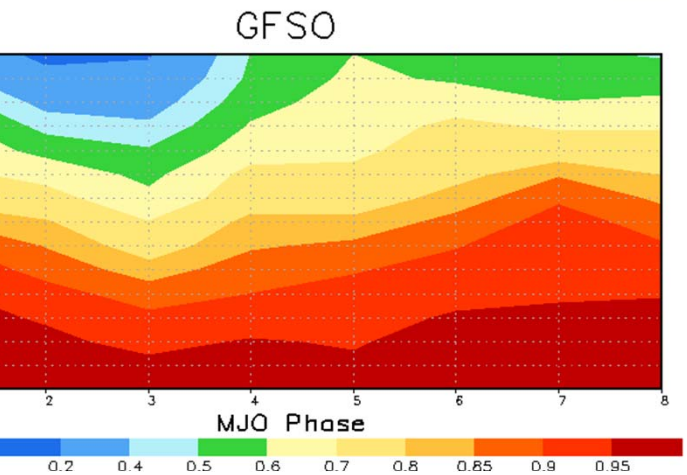


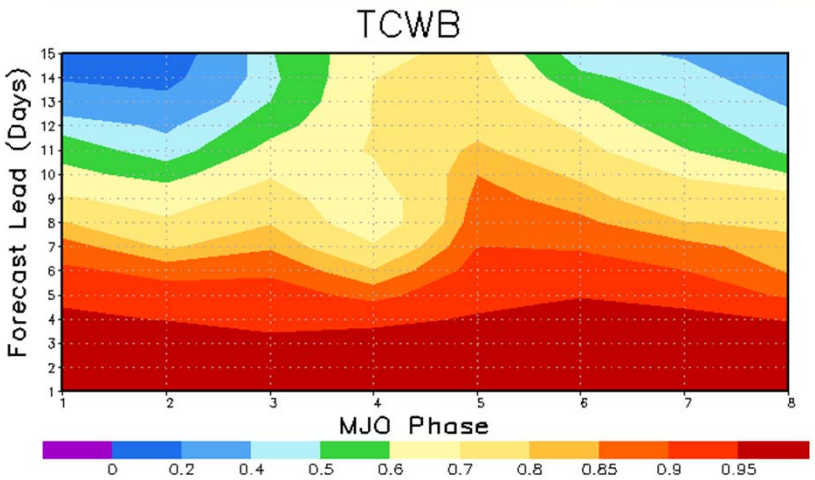
Wave Projection

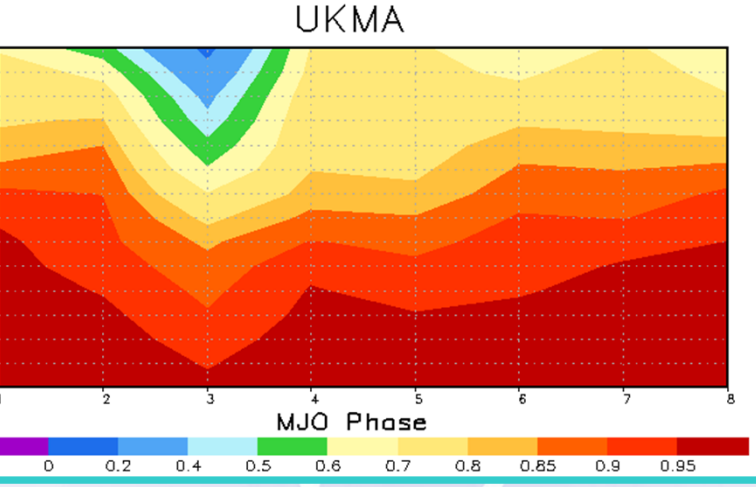
“Observations”



Correlation for MJO phase Sep 2011-Mar 2012



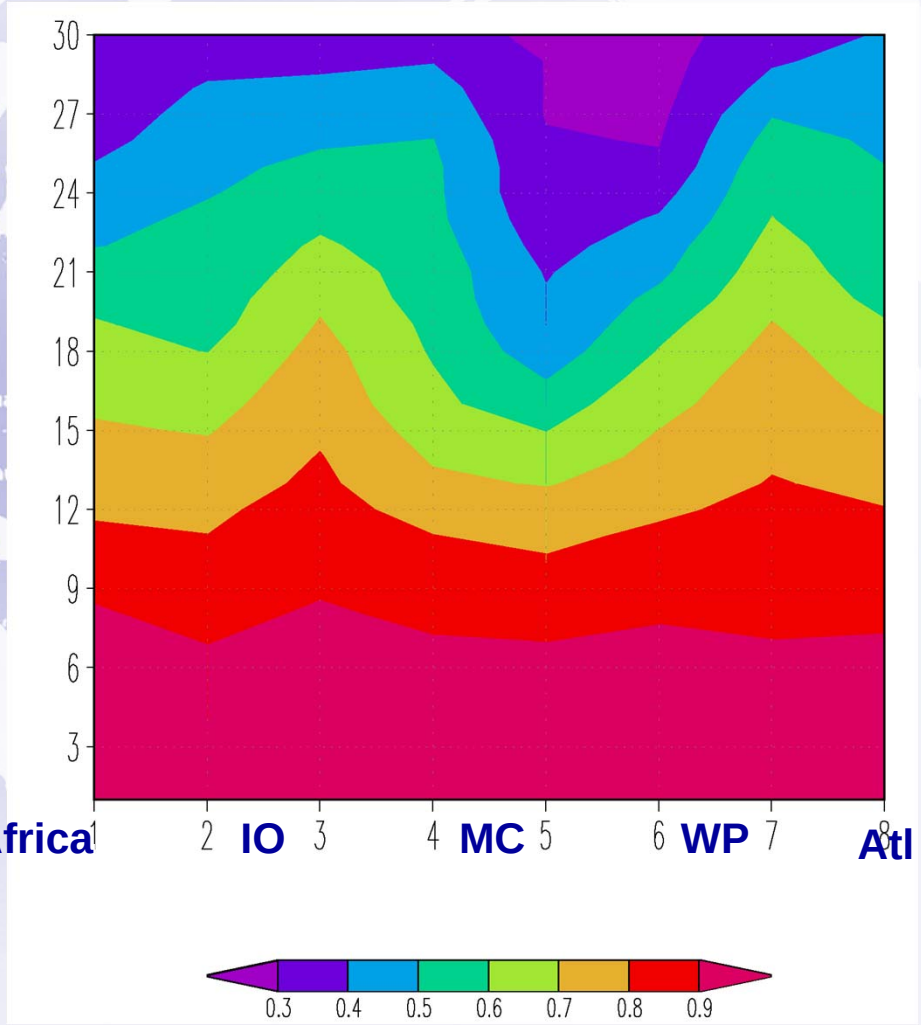




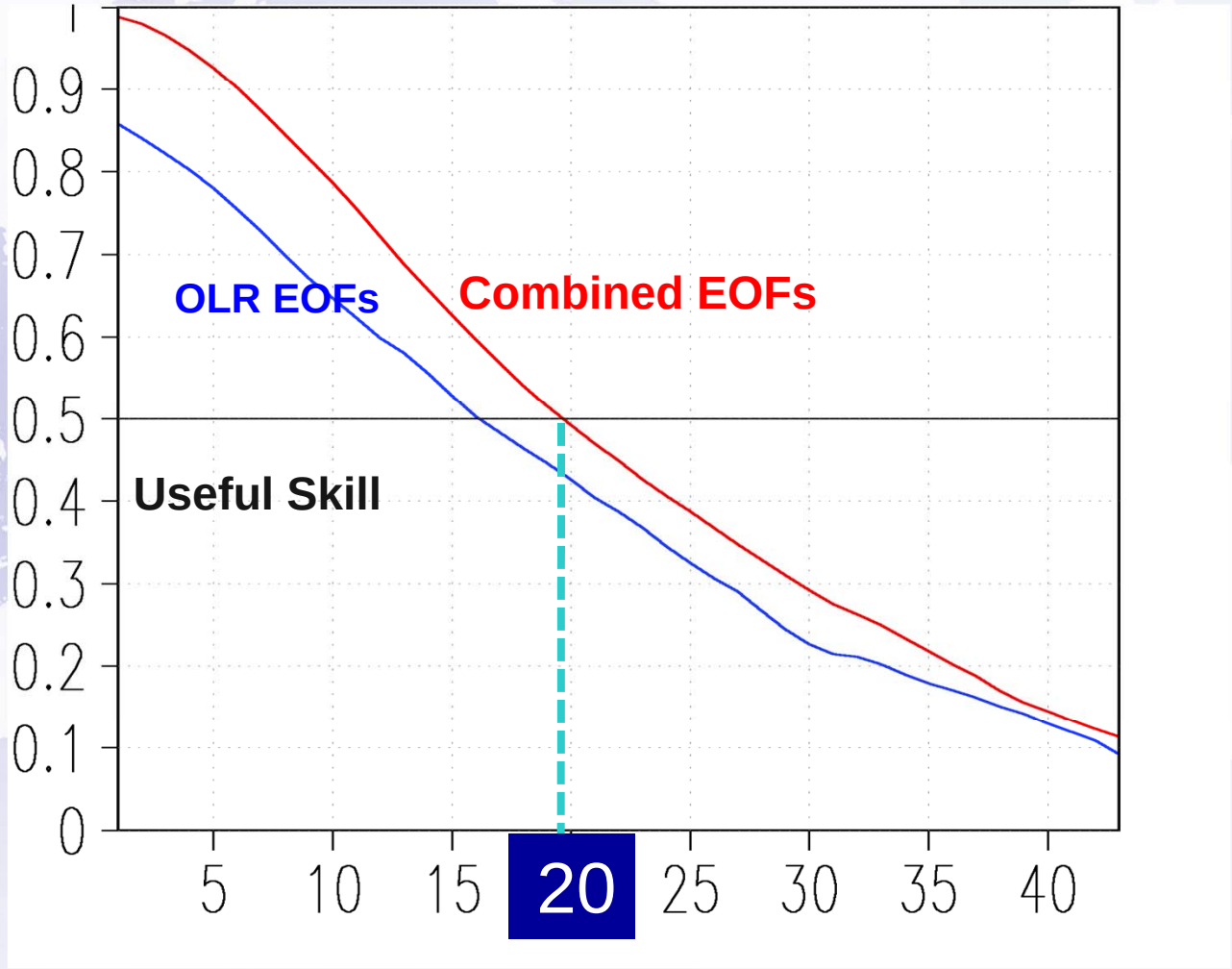
Courtesy of Jon Gottschalck
at NCEP/CPC

ved to initial MJO forecast phase
erational higher resolution forecast models
dels have a tendency for lower skill in Phases 1/2/3 and 8

MJO skill as a function of target phase
(MJO days during 1999-2010)



JO Skill of CFSv2 with 12-yr (1999-2010) Hindcasts



cription of Models and Experiments

One-Tier System

	Model	Control Run	ISO Hindcast		
			Period	Ens No	Initial Condition
BOM	POAMA 1.5 & 2.4 (ACOM2+BAM3)	CMIP (100yrs)	1980-2006	10	The first day of every month
MCC	CMCC (ECHAM5+OPA8.2)	CMIP (20yrs)	1989-2008	5	Every 10 days
CMWF	ECMWF (IFS+HOPE)	CMIP(11yrs)	1989-2008	15	Every 15 days
FDL	CM2 (AM2/LM2+MOM4)	CMIP (50yrs)	1982-2008	10	The first day of every month
MA	JMA CGCM	CMIP (20yrs)	1989-2008	6	Every 15 days
CEP/CPC	CFS v1 (GFS+MOM3) & v2	CMIP 100yrs	1981-2008	5	Every 10 days
NU	CFS with RAS scheme	CMIP (13yrs)	1981-2008	3	The first day of each month
NU	SNU CM (SNUAGCM+MOM3)	CMIP (20yrs)	1989-2008	1	Every 10 days
H/IPRC	UH HCM	CMIP (20yrs)	1994-2008	6	Every 10 days

Two-Tier System

	Model	Control Run	ISO Hindcast		
			Period	Ens No	Initial Condition
WB	CWB AGCM	AMIP (25yrs)	1981-2005	10	Every 10 days
RD/EC	GEM	AMIP (21yrs)	1985-2008	10	Every 10 days