

# Year of Tropical Convection (YOTC)

## *Climate Variability and Weather Highlights*

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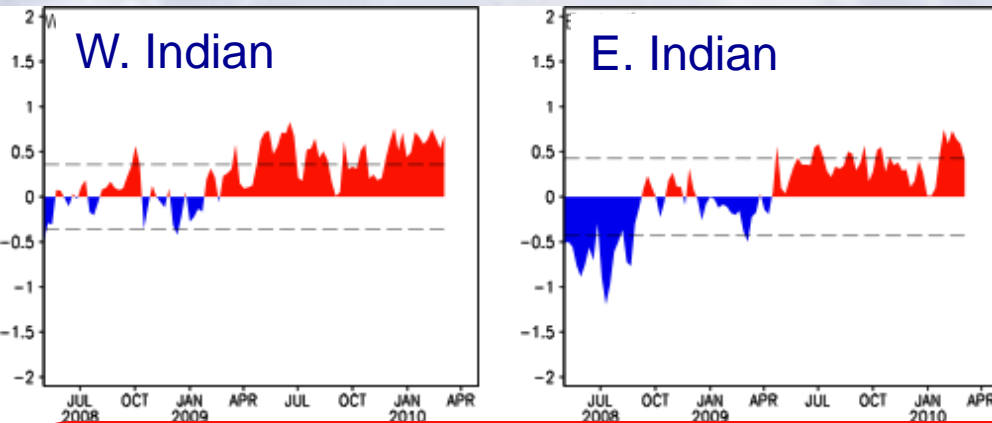
*Submitted to BAMS*



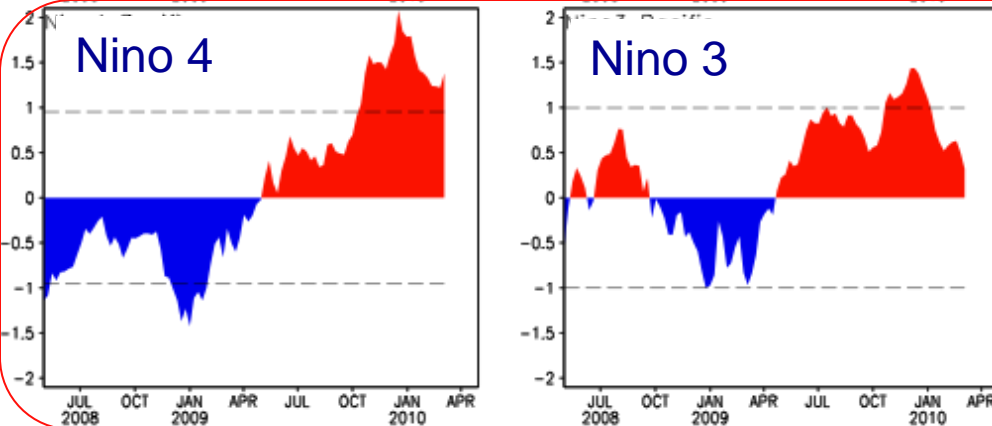
A Contribution to Seamless  
Weather-Climate Prediction

# Background Conditions & Low Frequency SST

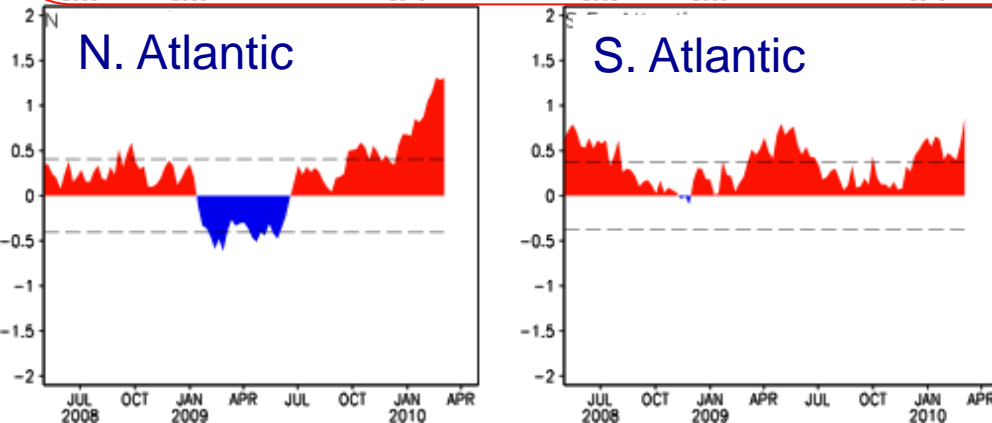
## Tropical SSTs



Warm in Year 2  
Mostly +DMI



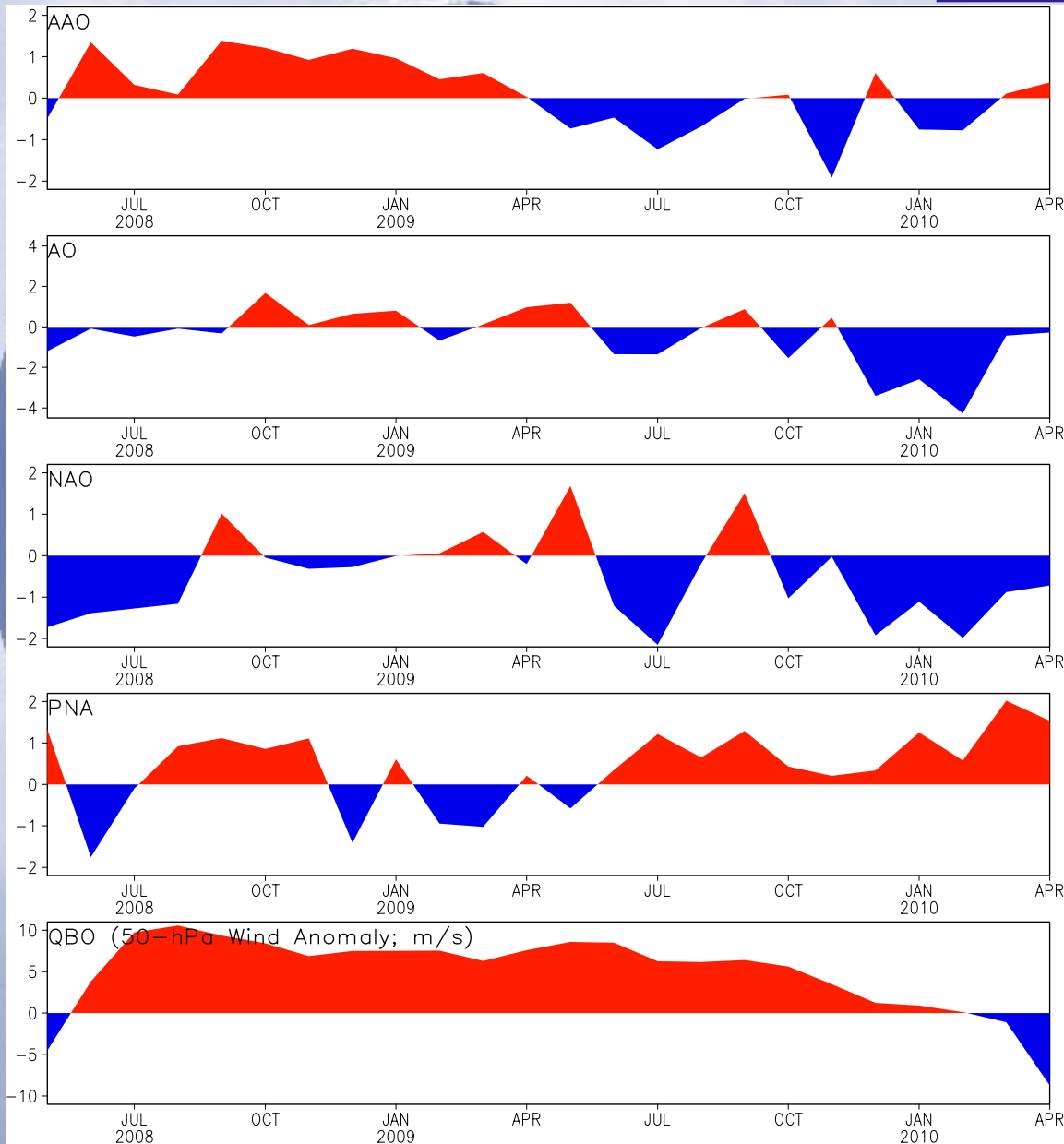
Year 1 – Modest La Nina  
Year 2 – Modest El Nino



Mostly Warm Atlantic

# Extra-Tropical Modes & QBO

# Background Conditions & Low Frequency Modes



Reflects Tropical SST Forcing

Mostly Positive QBO Phase Throughout

# MJO & CCEWs

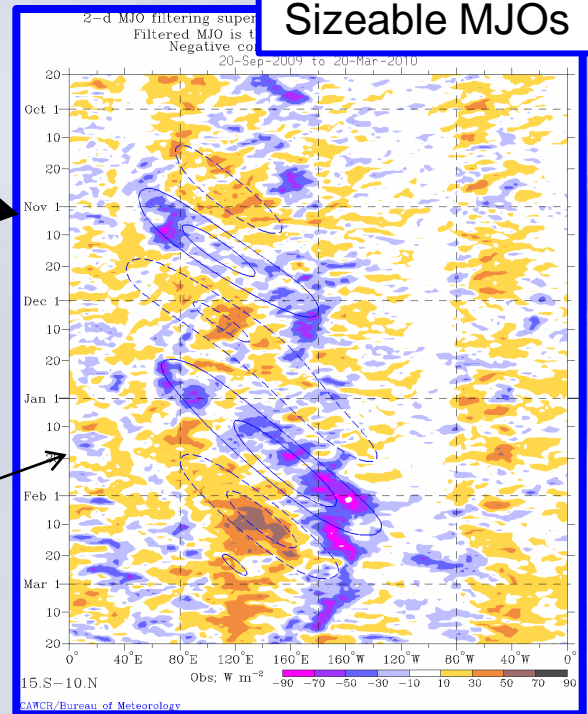
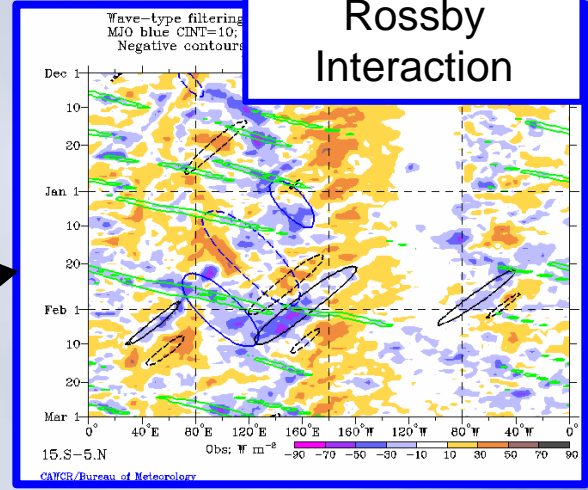
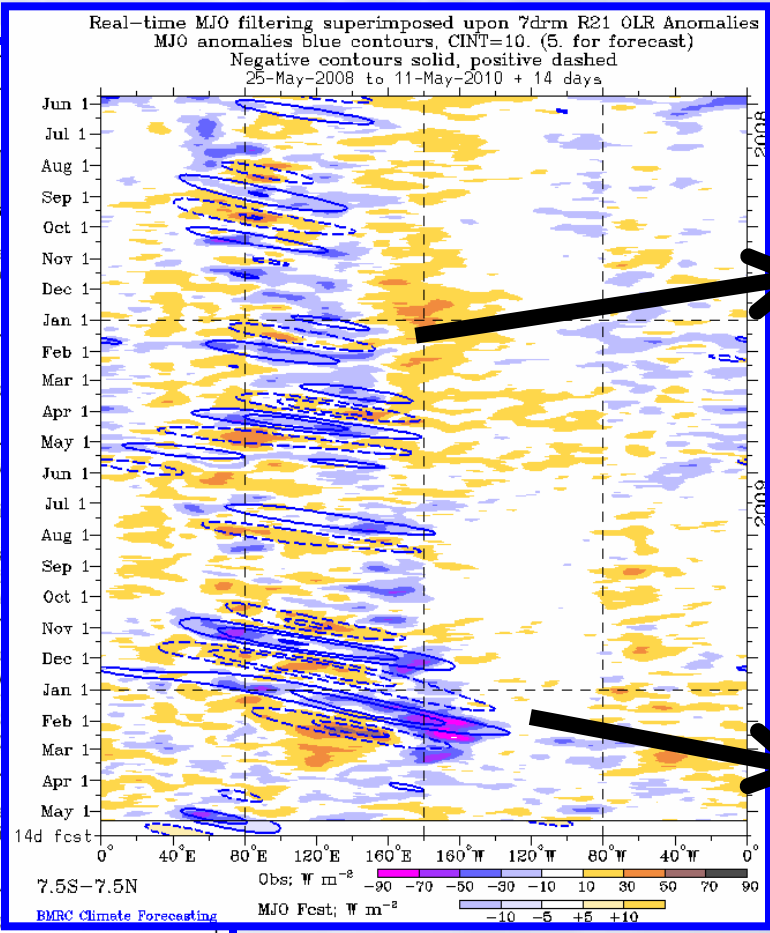
M. Wheeler

Kelvin & Rossby Interaction

Sizeable MJOs

Case Studies for MJO TF & GCSS Diabatic Heating Expt

Target Periods (priority)	Features
a) 01MAY2008 - 30JUN2008 (4)	- fast propagation of MJO into Bay of Bengal - caused strong modulation of eastern Pacific embedded TCs.
b) 15AUG2008 - 01NOV2008 (5)	- MJO convective onset (in central IO) suppressed period in mid-Sept, the second Ocean occurred around Oct 12.
c) 01JAN2009 - 28FEB2009 (3)	- Weak sequence of the MJO that started w IO from about 10-20 Jan. - MJO convection onset then followed propagating into N Australia in early Feb; Australia; strong compensating descent to s temperature in NSW/Victoria that affected the cyclones, i.e., association with severe weather
d) 01APR2009 - 31MAY2009 (2)	- strongest MJO in the YOTC period confined to Indian Ocean and Tropical W propagation; convectively coupled Kelvin westerly anomalies in Pacific; basin-wide S for MJO between La Nina and El Nino; MJO
e) 20OCT2009 - 20DEC2009 (1)	- strong MJO onset in Indian ocean; propagation El Nino conditions; effects on N-hemispheric climate.
f) 20DEC2009 - 20FEB2010 (1)	- strong MJO onset in Indian Ocean; propagation southward in mid-Pacific region.

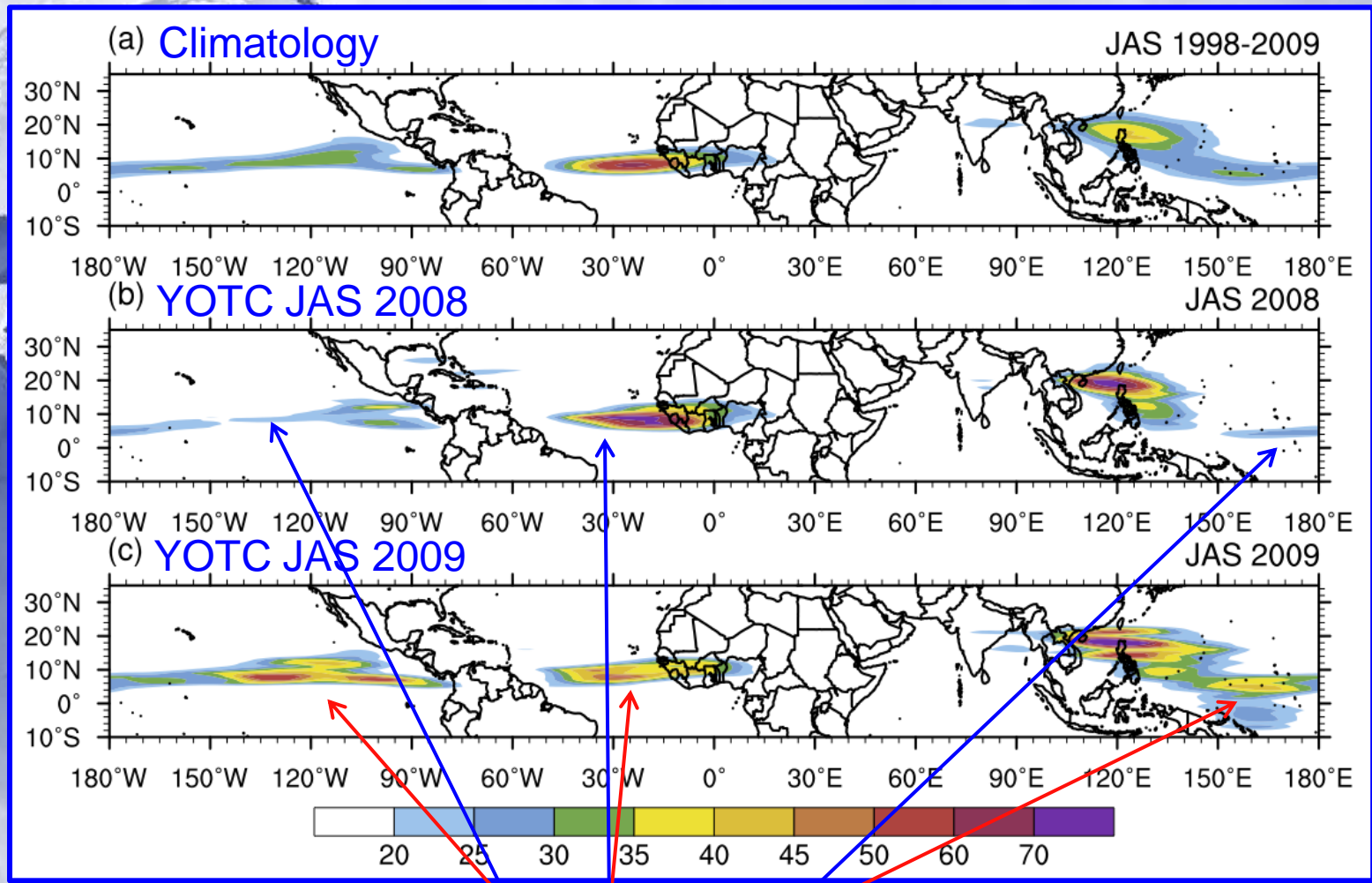




C. Thorncroft  
Y. Serra  
M. Janiga  
H. Nguyen

# Easterly Wave Activity

Variance of TRMM3B42 TD-filtered RainRate  
Wavenumber -20 To -6 & Period 2 To 5 Days

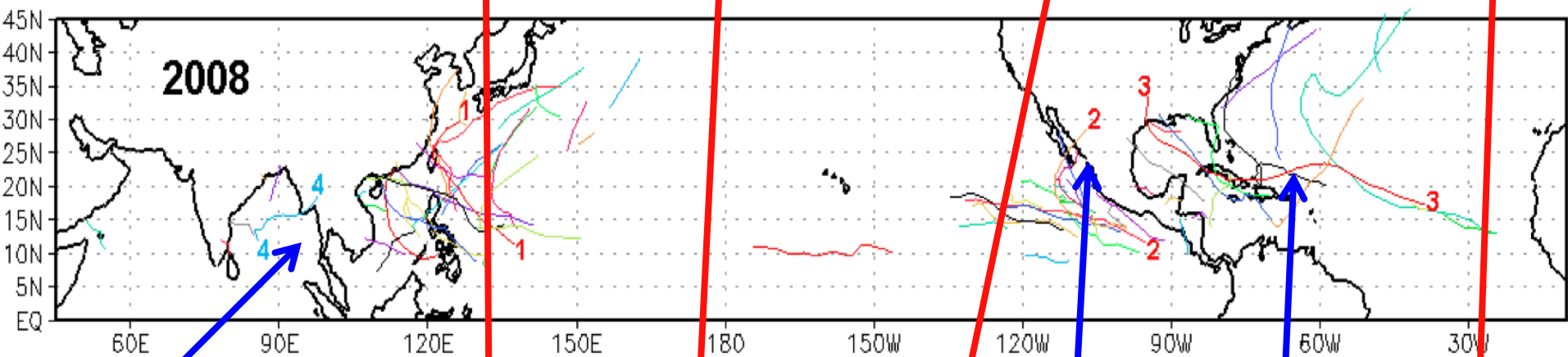
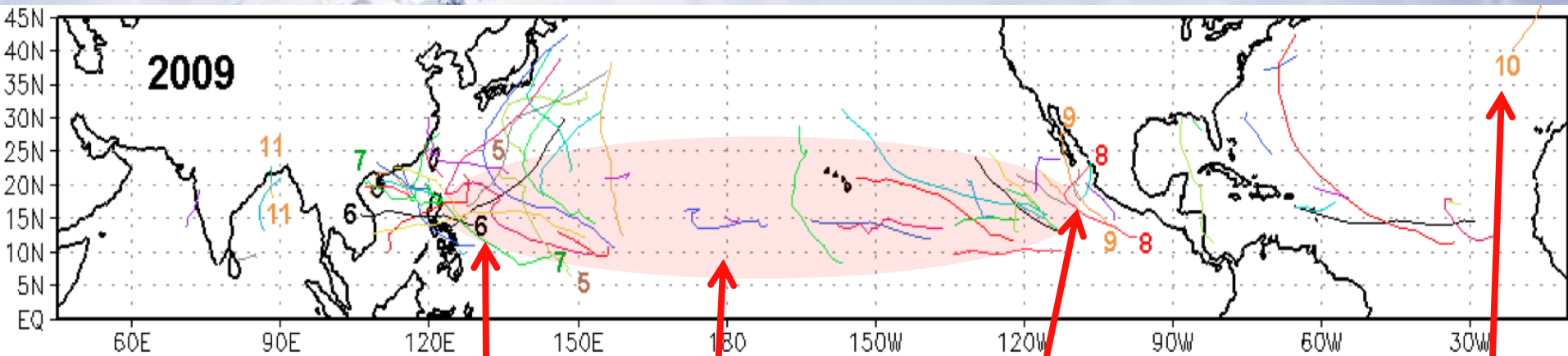


ENSO Impacts

# Tropical Cyclone Occurrence During YOTC

*Boreal Summer*

Julian Hemming



Nargis, landfall over Myanmar, huge storm surge, 100,000 lives

Parma-1.8 m Rainfall

El Nino Modulation

Rick, 2<sup>nd</sup> Strongest In E. Pacific Ever

3 landfalls in Mexico

Ike - Largest size & Marko - smallest TC ever in this basin.

Grace

# Summer Monsoons During YOTC

India  
BN Goswami

S. America  
Jose Marengo

2008

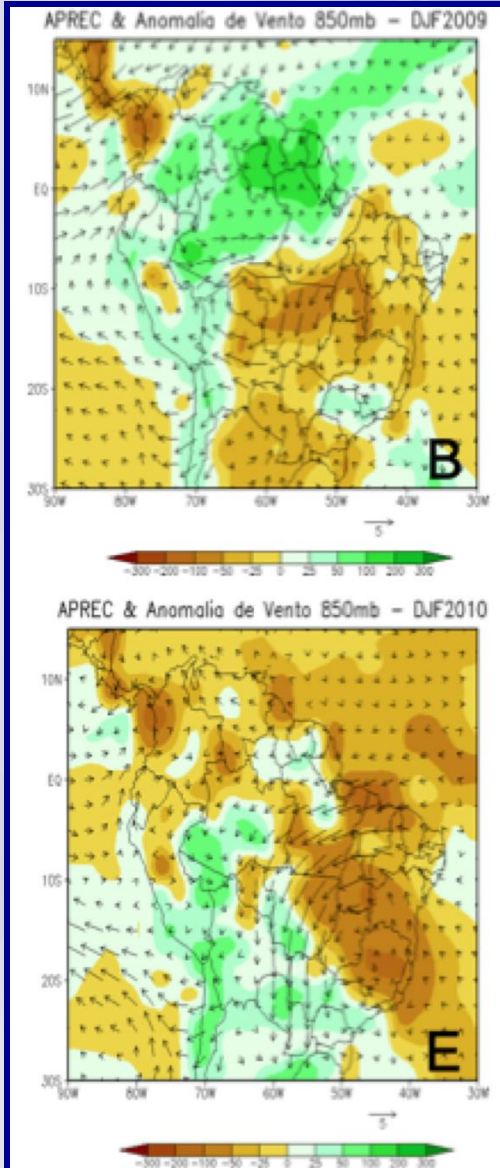
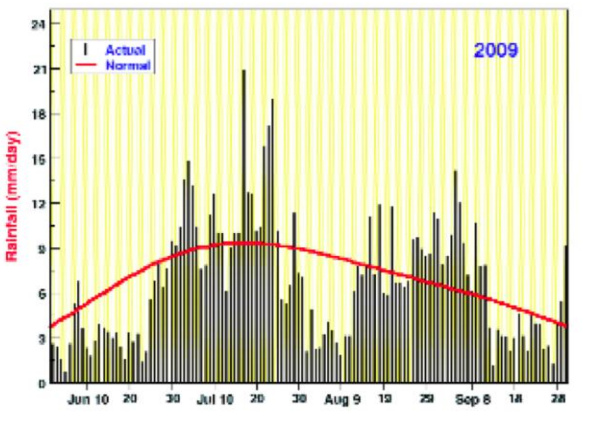
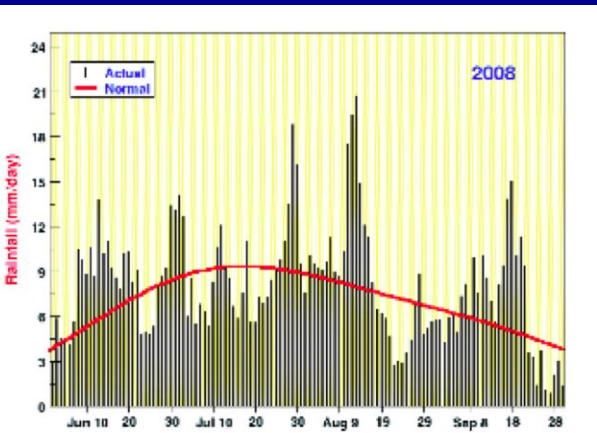
“Normal”  
98% AIR

Wet-north  
Dry-south

2009

Very Large  
Drought  
78% AIR

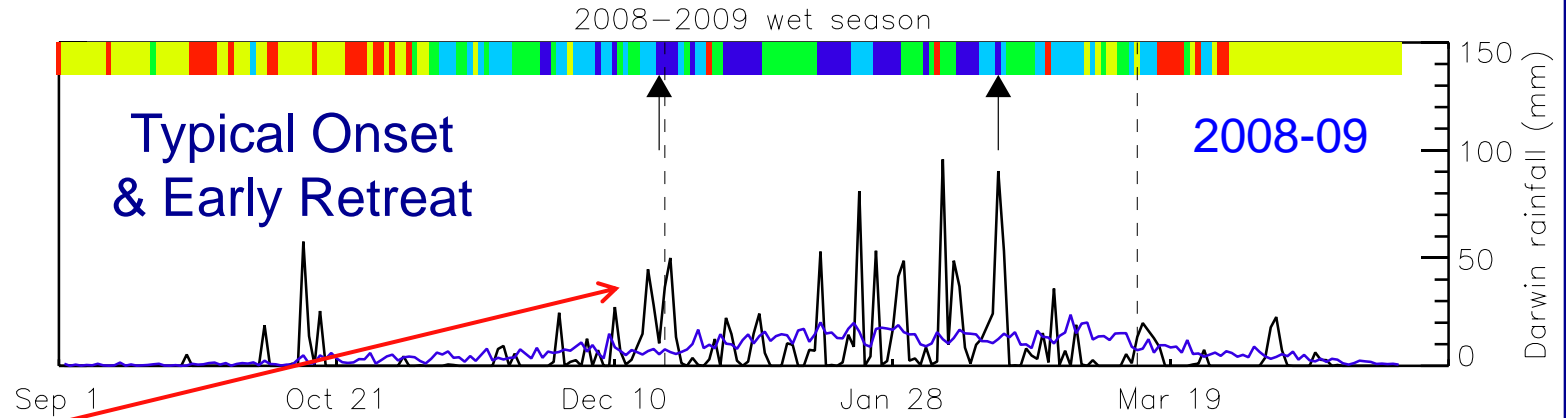
Dry-northeast  
Wet-south



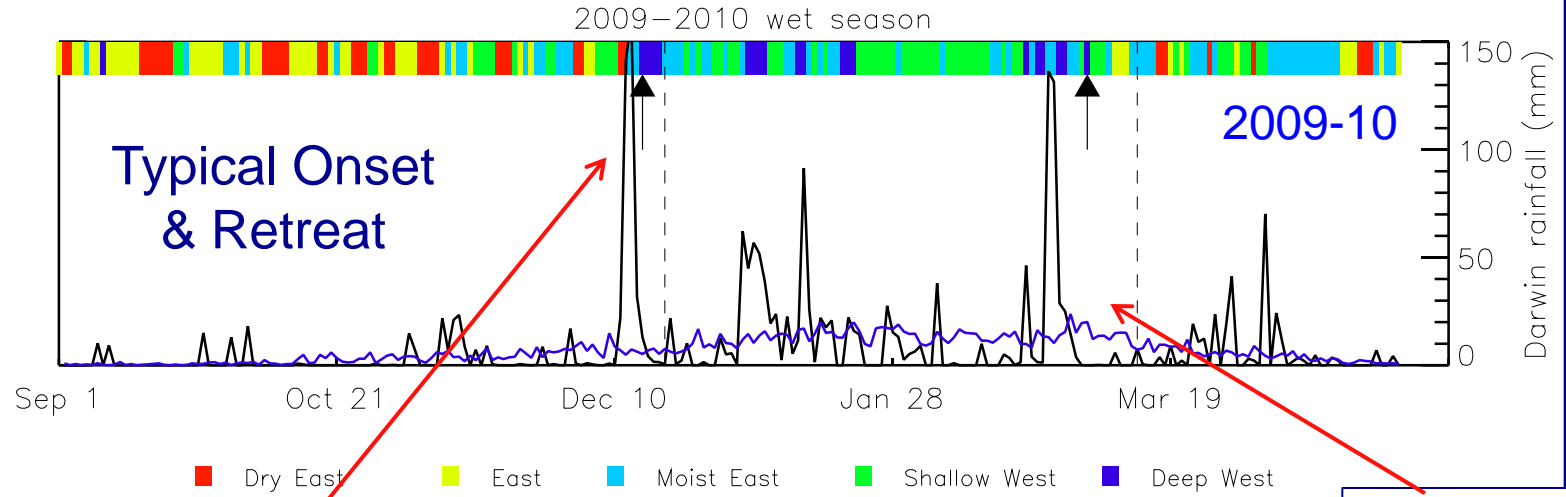
*Breaks influenced by ISV*

# Summer Monsoons During YOTC

Australia, C. Jakob & M. Pope



TC Billy



TC Lawrence

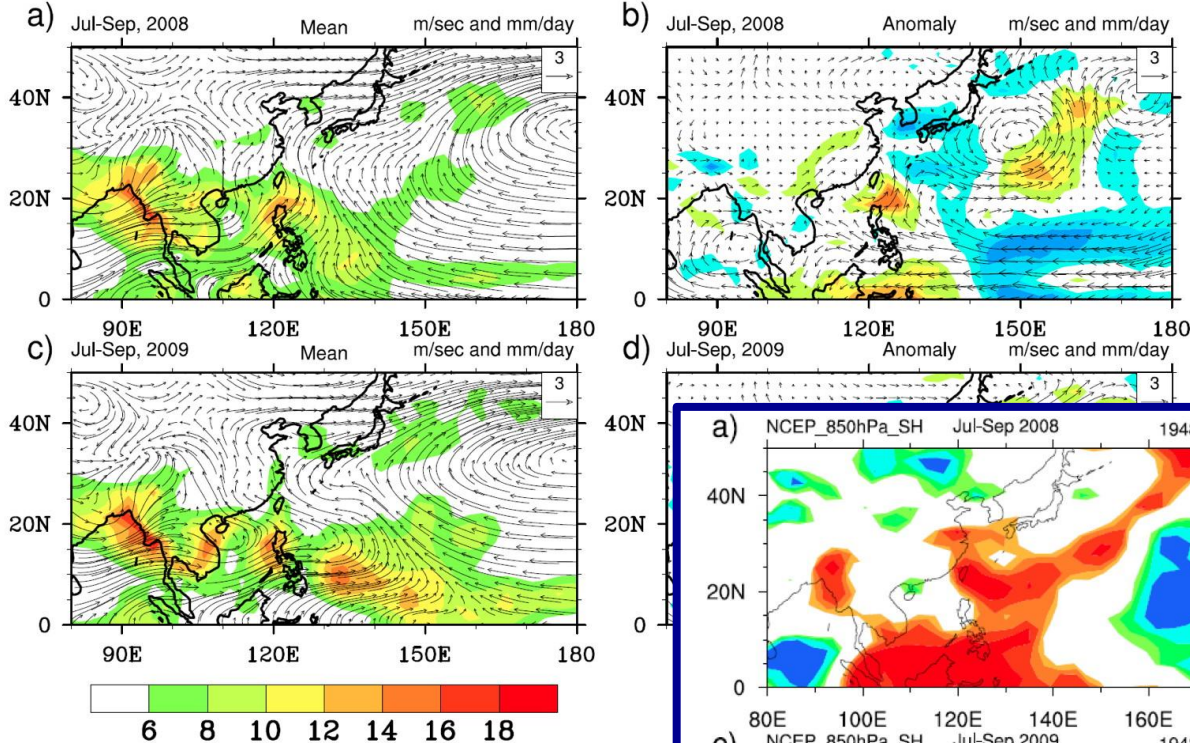
Ex-TC Paula



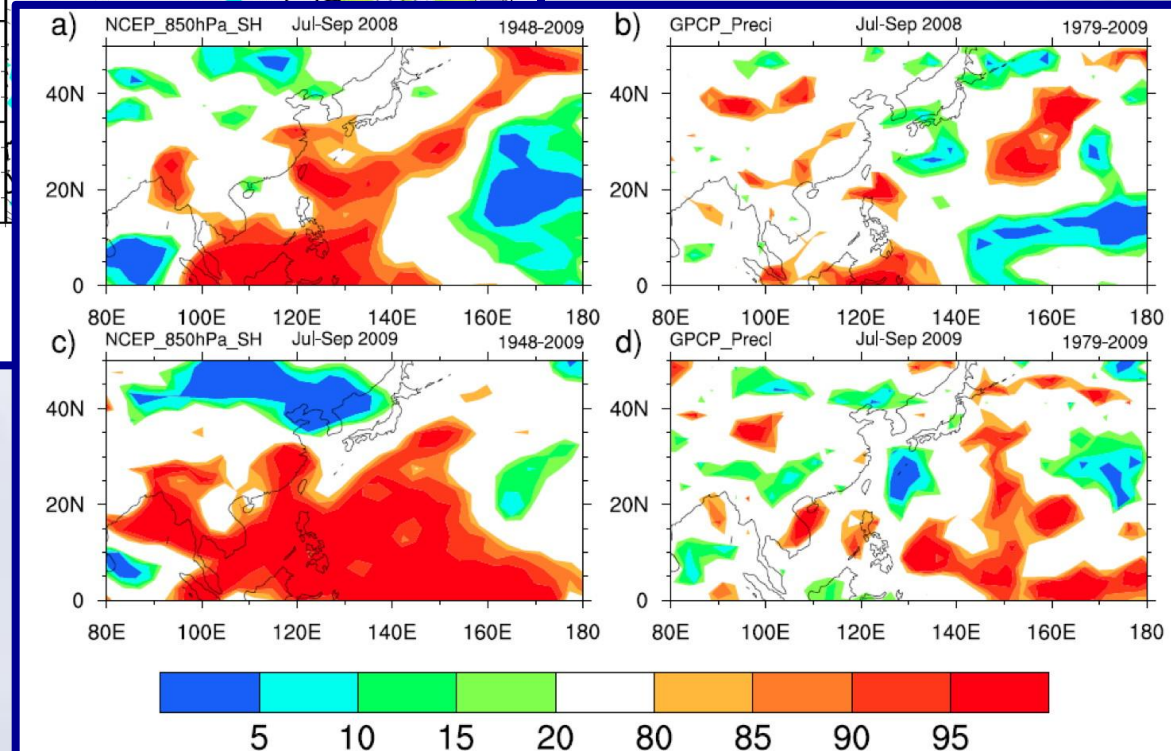
# Summer Monsoons During YOTC

E. Asian, H.H. Hsu

Distinct  
Circulation  
Modulation by  
ENSO



Little Effect  
On Seasonal  
Mean Precip  
Over E. Asia

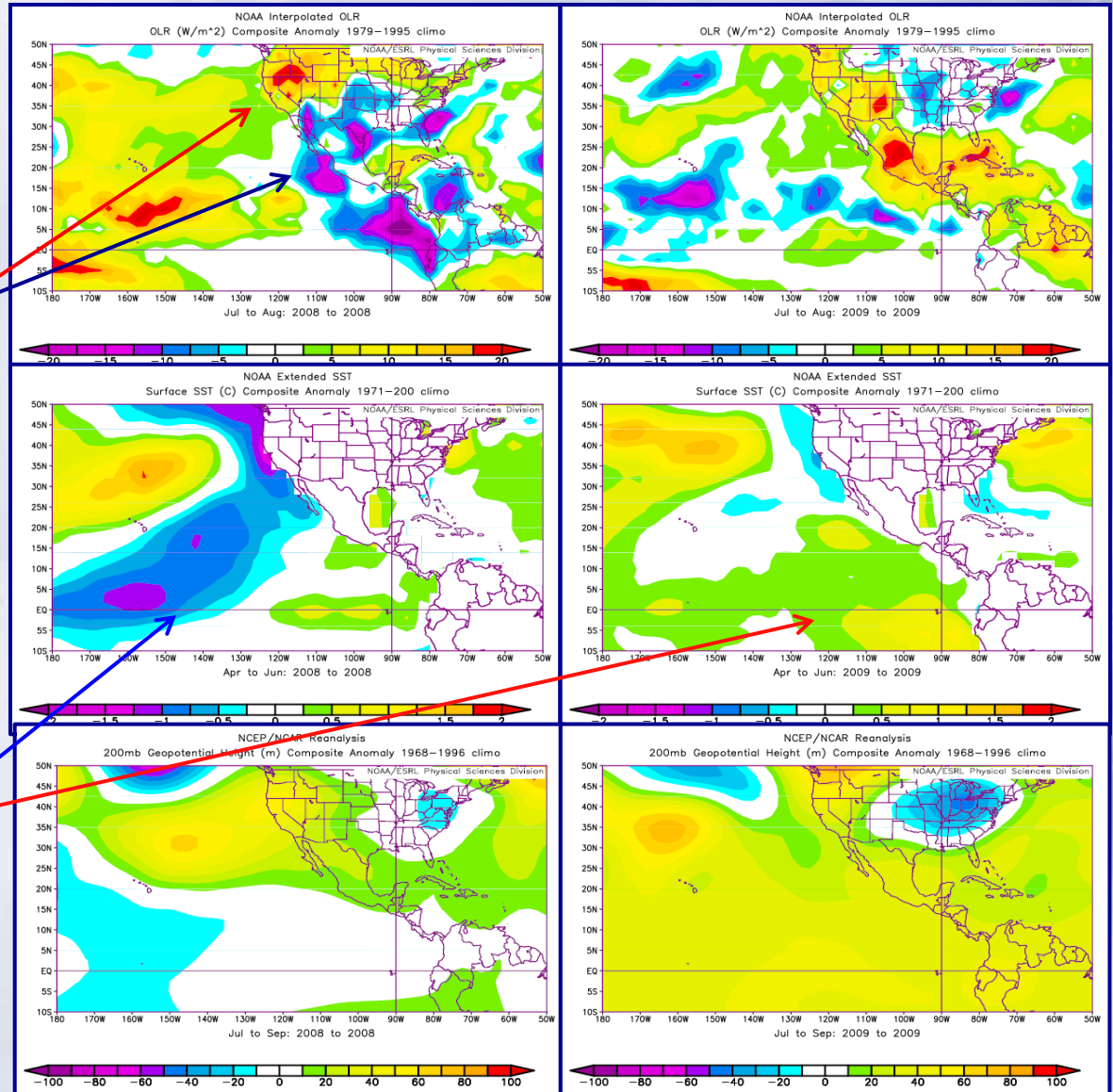


# Summer Monsoons During YOTC

N. America, D. Gochis

Large-Scale  
N-S Dipole  
In Precipitation

ENSO SST  
Changes



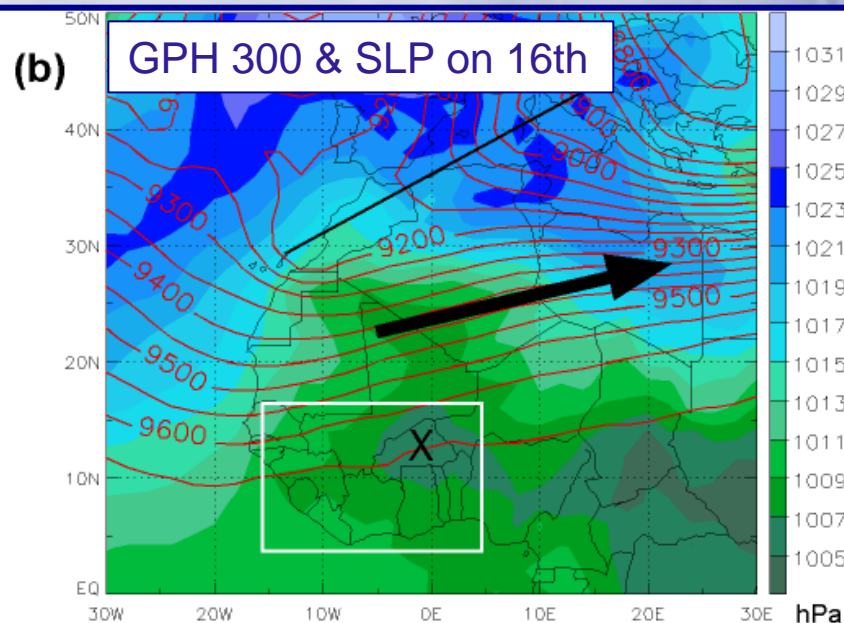
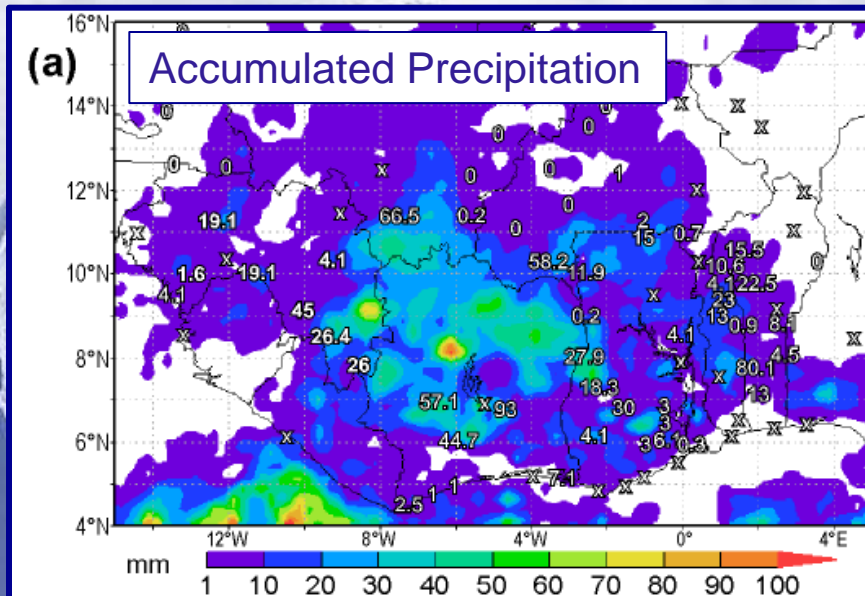


# Extra-Tropical Impact on Tropical Convection

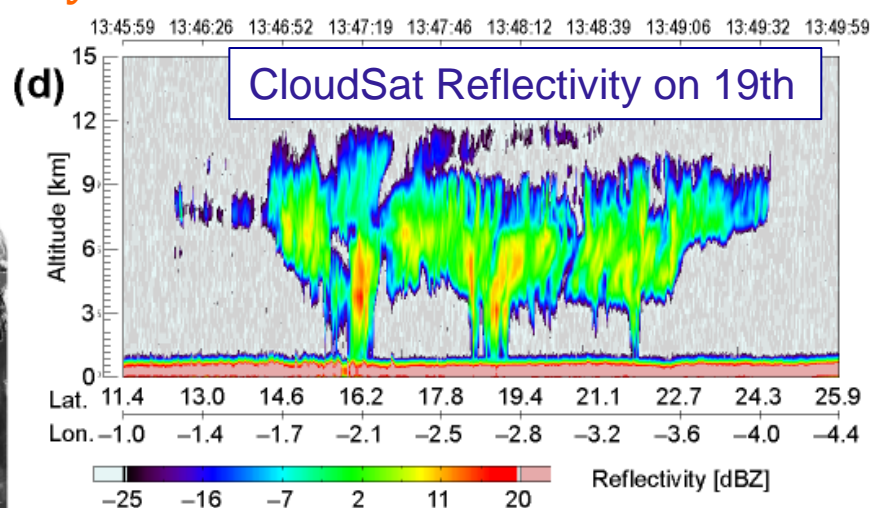
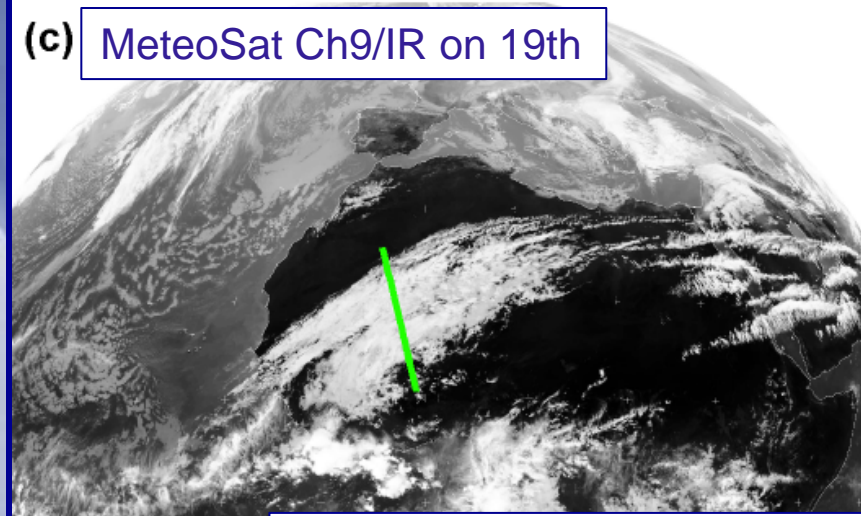
Peter Knippertz

Andrea Fink

## 5 Significant DRY-Season Wet Episodes in W. Africa During YOTC



16-19 February 2009

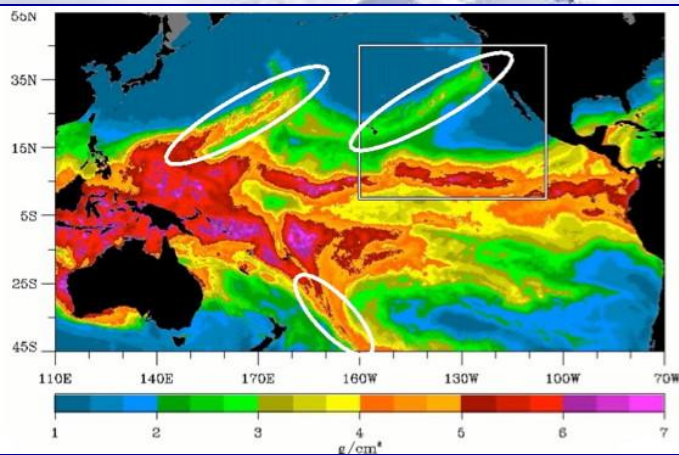


Synergistic Use of YOTC ECMWF and Giovanni Satellite Data

# Atmospheric Rivers During YOTC

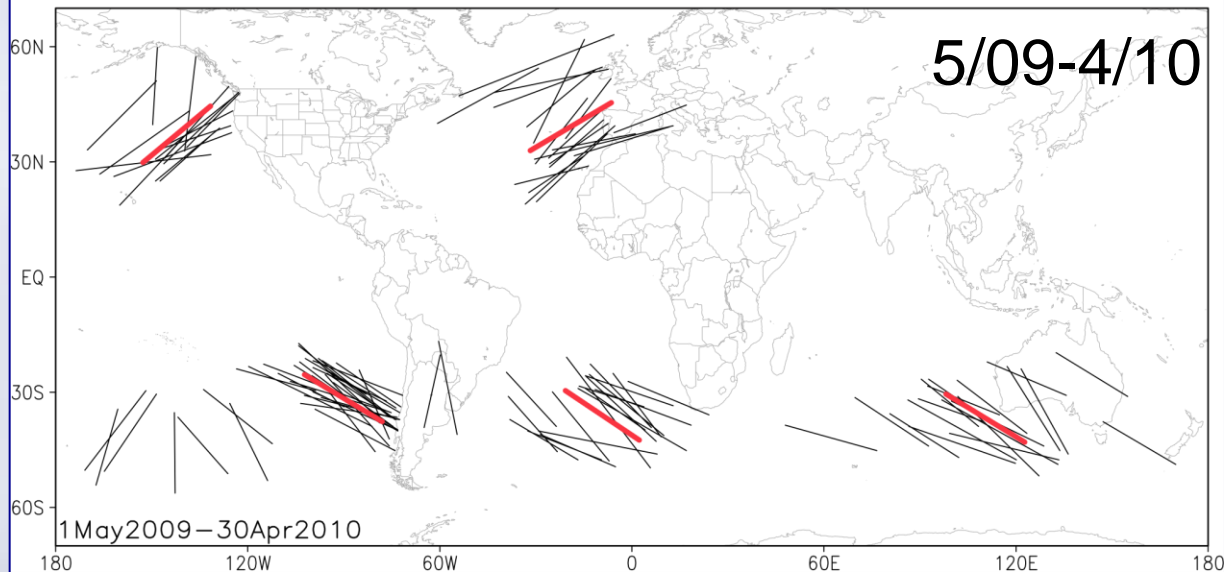
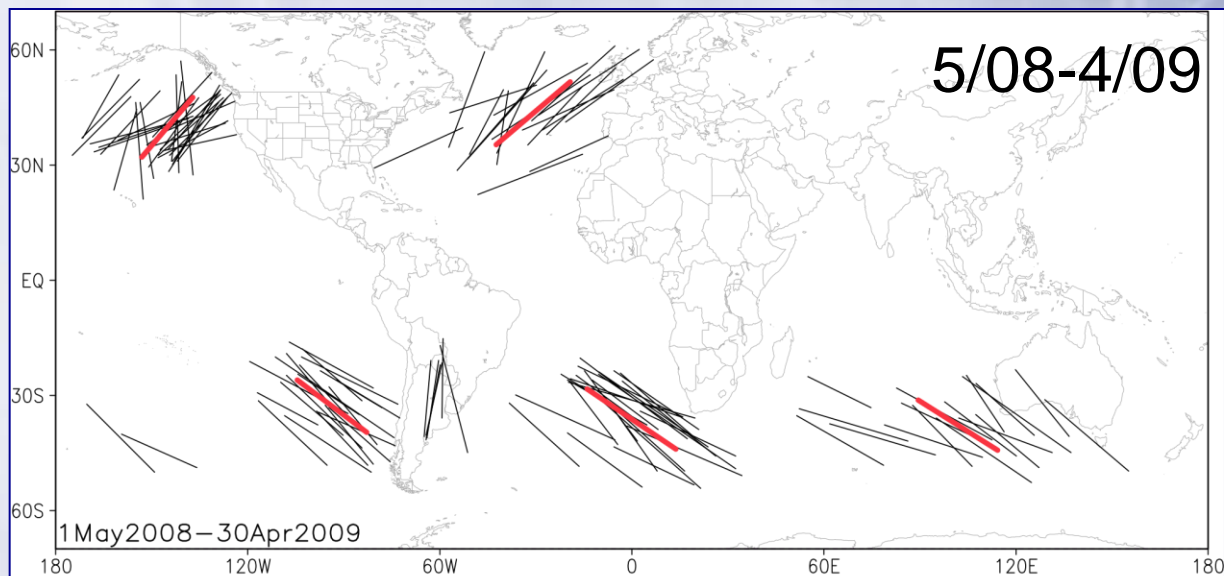
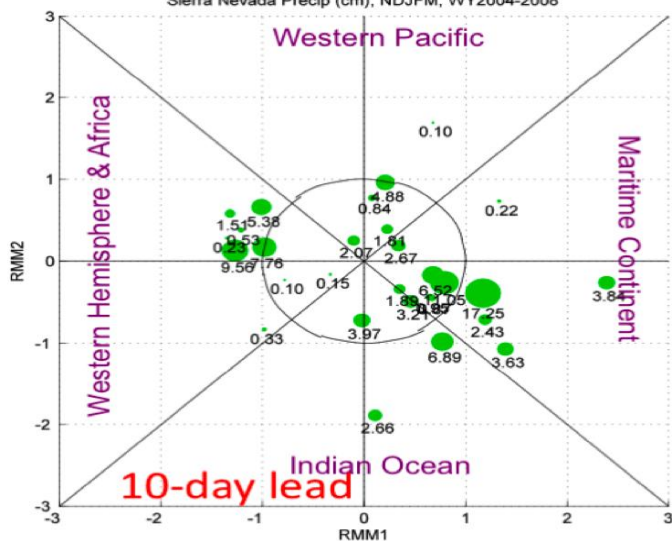
## *Tropical-Extratropical Interactions*

Bin Guan



MJO -> AR -> CA Precip

MJO (10-Day Lead) and Atmospheric Rivers.  
Sierra Nevada Precip (cm), NDJFM, WY2004-2008

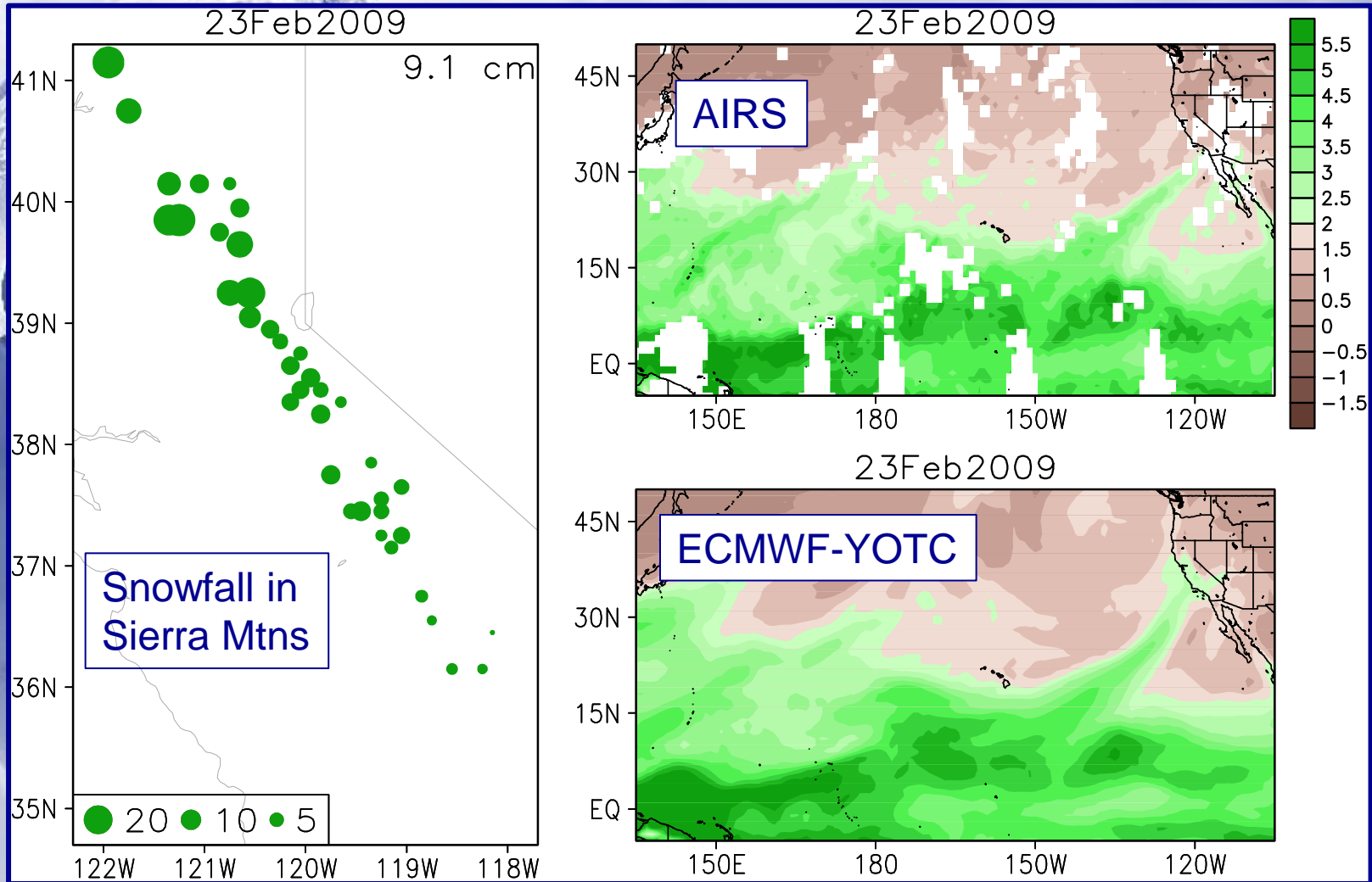




# Atmospheric Rivers During YOTC

## *Tropical-Extratropical Interactions*

Bin Guan



# VOCALS & YOTC

## Shallow Convection Processes

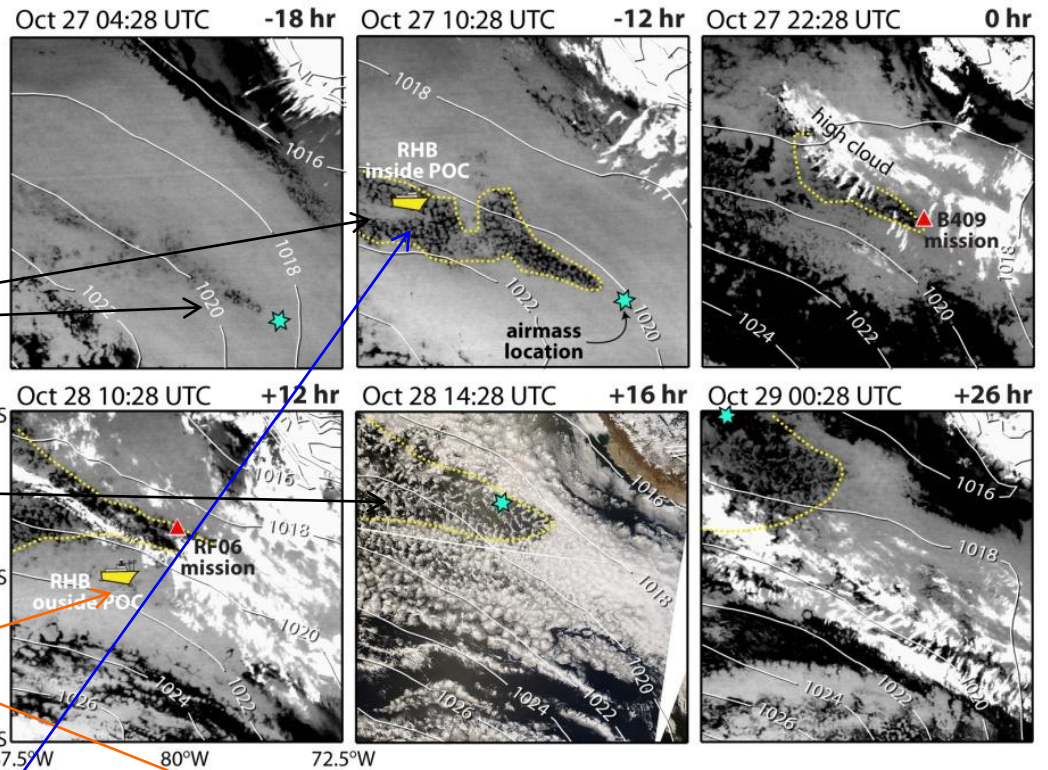
POC  
Develops;  
Advects NW  
& Expands

Outside POC  
Rain Weak/Diffuse

Inside POC  
Rain Locally  
Intense

Rob Wood

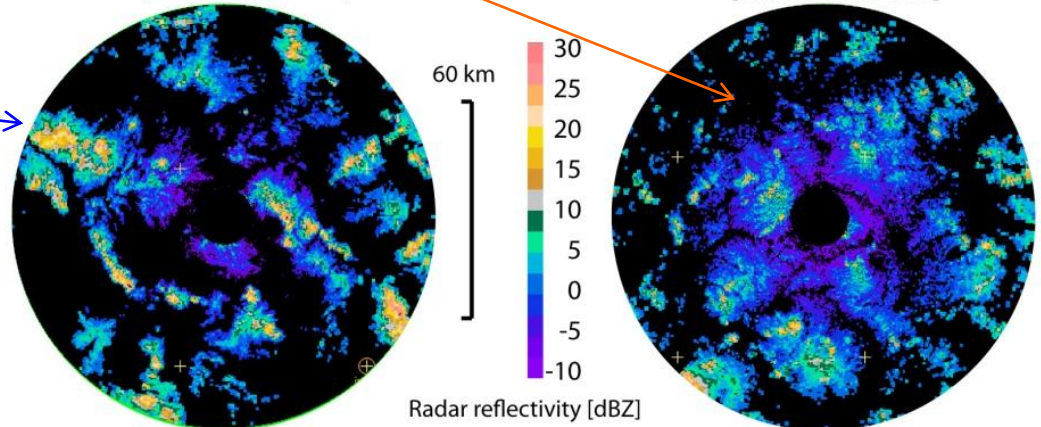
### (a) Geostationary satellite imagery



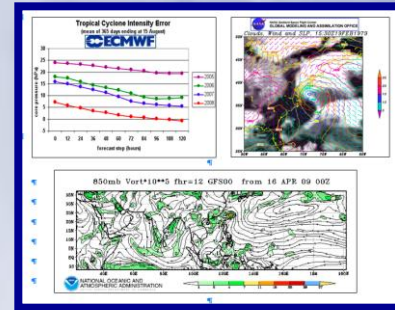
### C-band radar imagery from the Ronald H Brown

(b) Inside POC  
[Oct 27 10:28 UTC]

(c) Overcast, outside POC  
[Oct 28 10:28 UTC]

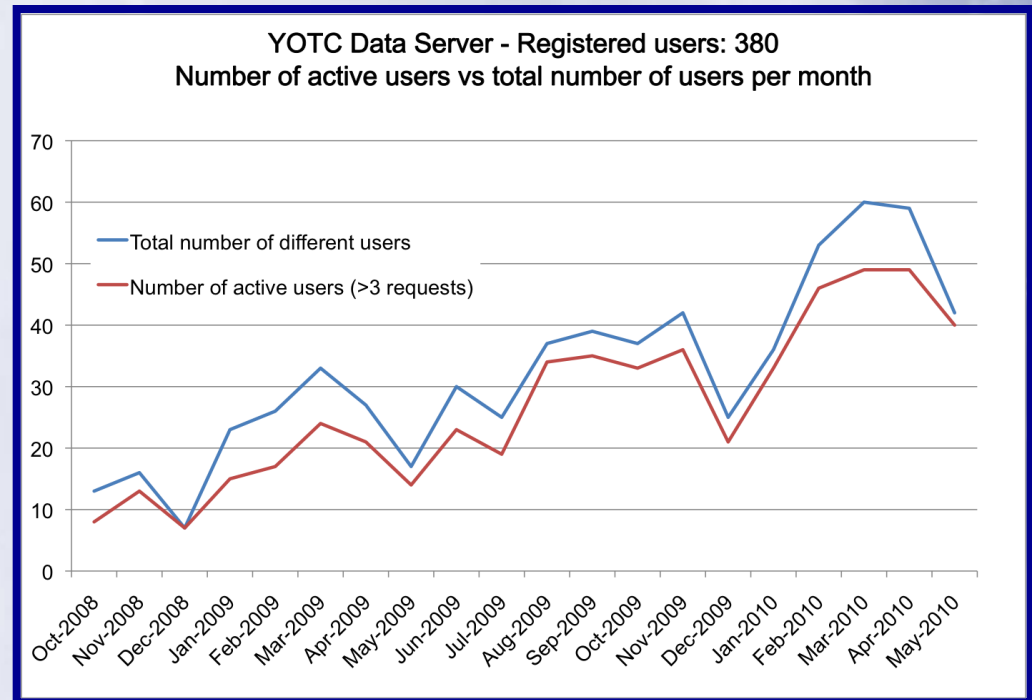


# YOTC: ANALYSES, FORECASTS & SPECIAL DIAGNOSTICS



- High-resolution, global analysis and forecast data sets are being made available to the community from ECMWF, NCEP and GMAO/NASA. e.g. T799 = 25km ECMWF + diagnostic fields (as of Jan'10, T1279 = 16kms)

The screenshot shows the ECMWF YOTC Data Retrieval web interface. It includes a navigation menu with links like 'Home', 'Your Room', 'Login', 'Contact', 'Feedback', 'Site Map', and 'Search'. The main content area is titled 'YOTC Data Retrieval' and contains several sections for user selection: 'Type' (Analysis, Forecast), 'Type of level' (Model levels, Pressure levels, Surface), 'Datasets' (ERA-Interim, YOTC), 'ENSEMBLES' (Daily Fields, Monthly Fields), 'Personal' (Your Requests), 'Data usage' (Conditions), and 'Select parameters' (a grid of checkboxes for various meteorological variables like Divergence, Geopotential, etc.).



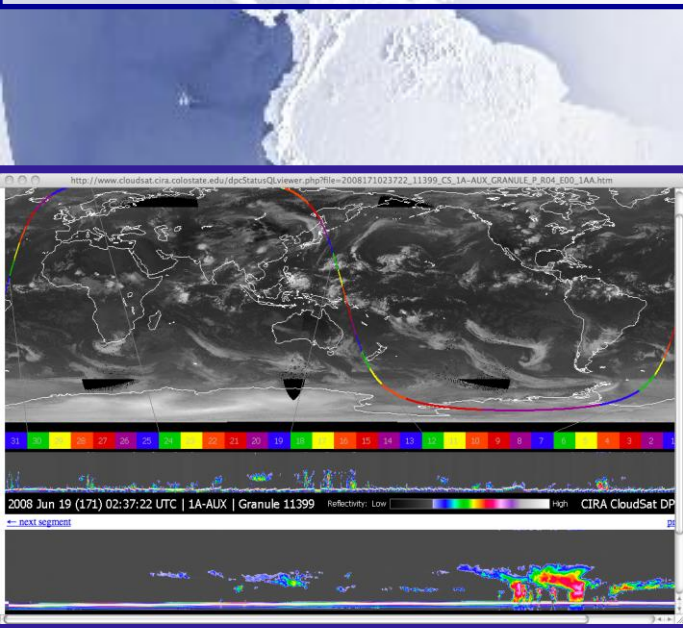
ECMWF-YOTC Replicated at NCAR.



# YOTC: SATELLITE DATA



- Key satellite data (e.g., NASA A-Train, TRMM) have been identified and funding secured from NASA for the:
  - Giovanni-based dissemination framework.
  - Multi-sensor CloudSat-Centric A-Train Data Set



**Giovanni Year of Tropical Convection**  
Alpha prototype

Select: Cursor Coordinates: 0.0000, 0.0000

Area of Interest: West: -180 North: 60 South: -60 East: 180 Update Select

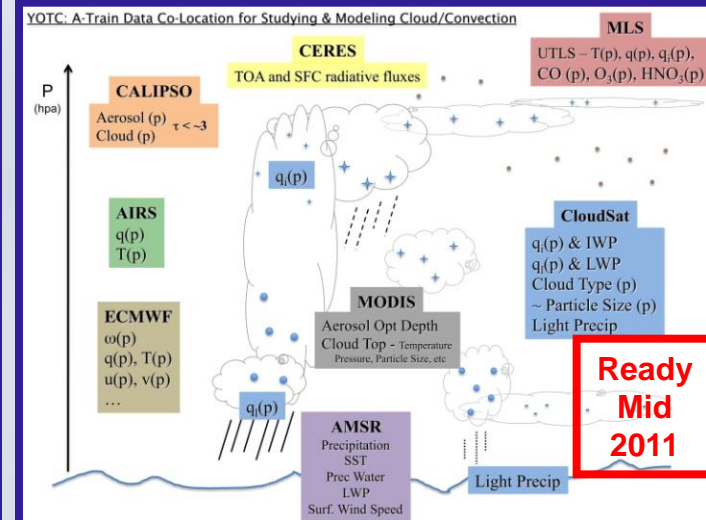
Vertical Profile: Select a vertical profile range. The range selection is disabled unless a qualifying parameter is selected. In order to enable this option (and optionally use 3D with values), select a 3D parameter. 3D parameters have at least three dimensions and are labeled with a (3D) in the NOTE. Selected 3D parameters must have the same vertical (i.e., 3rd dimension) units in order to enable the vertical level menu.

Upper Level: -23 Lower Level: -3

Parameters: Display: 27 Data Product Info Units Parameters with > 2 Dimensions

Parameter	Units	Dimensions
Temperature (area lat. ascending)		
surface skin temperature_descending	ARFK8TD.005	Aqua - AFRS standard 2002/08/01 - 2009/03/02
Total column liquid water_descending	ARFK8TD.005	Aqua - AFRS standard 2002/08/01 - 2009/03/02
Total column liquid water_descending	ARFK8TD.005	Aqua - AFRS standard 2002/08/01 - 2009/03/02
Total column water vapor_descending	ARFK8TD.005	Aqua - AFRS standard 2002/08/01 - 2009/03/02

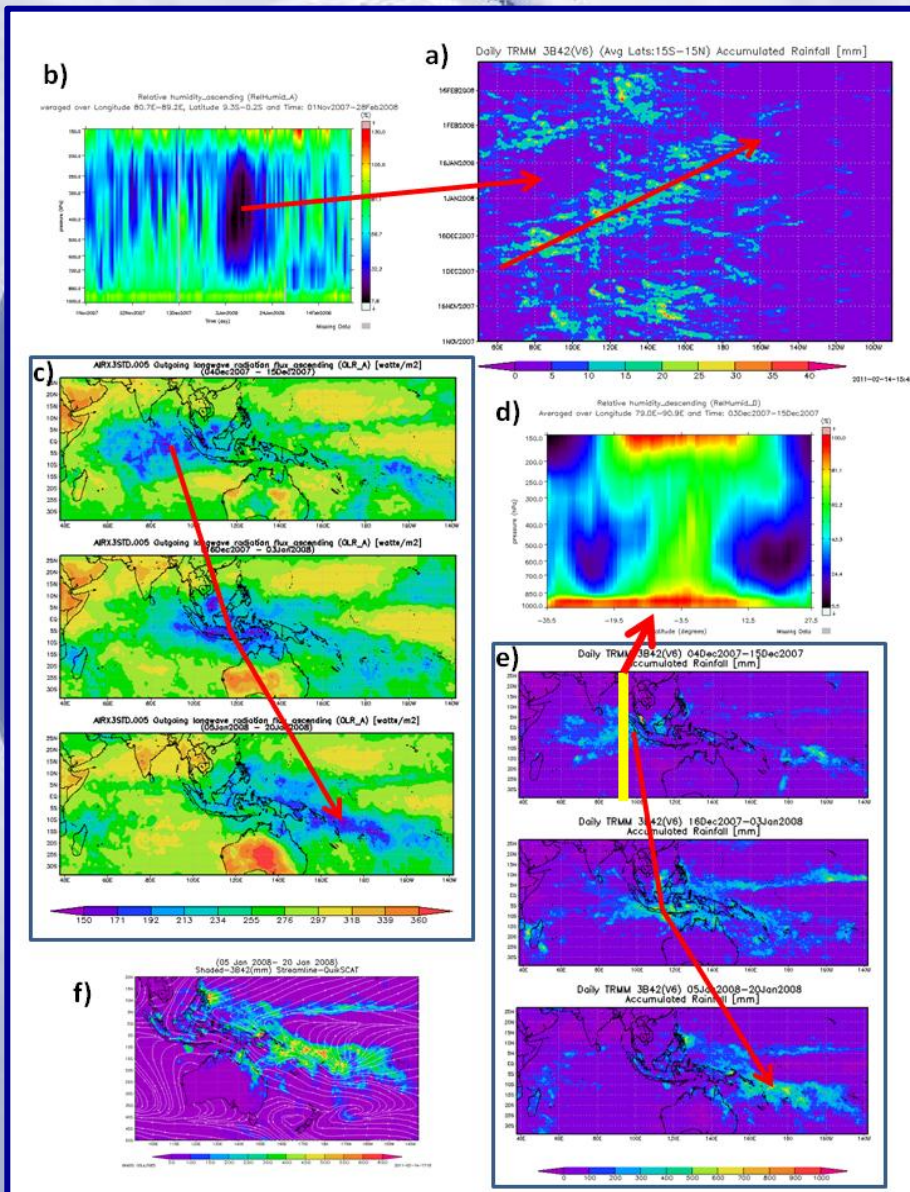
Temporal: Begin Date: Year [2009] Month [Jun] Day [17] Date Begin: 07 Nov 1978  
End Date: Year [2009] Month [Jun] Day [21] Date End: 23 Mar 2009



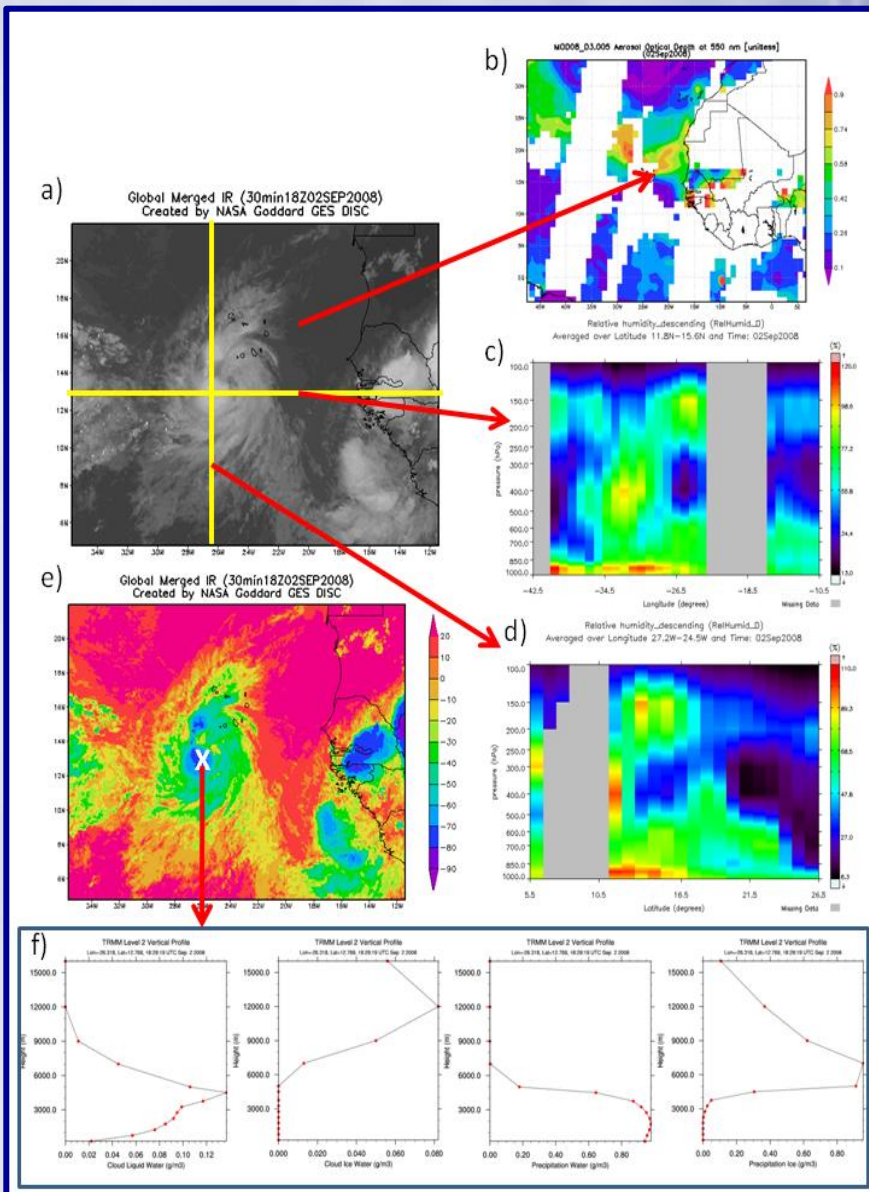


# YOTC: Satellite Data: Giovanni Enabled

## MJO Event Analysis



## Tropical Cyclone/SAL Analysis



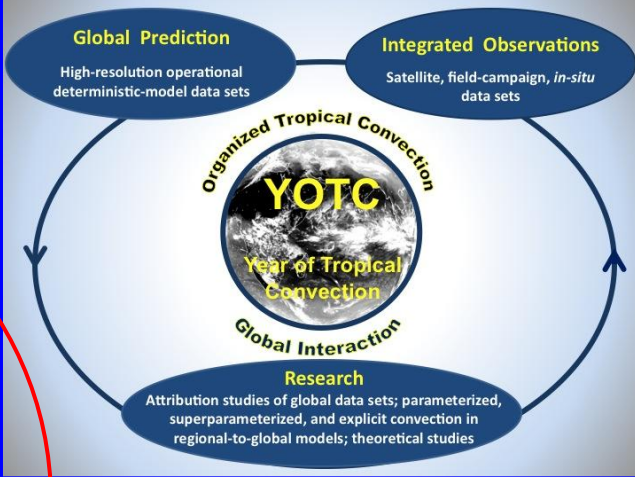
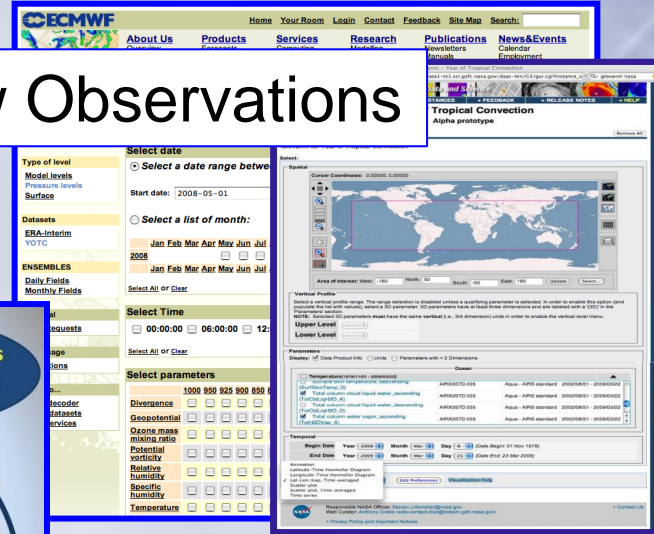
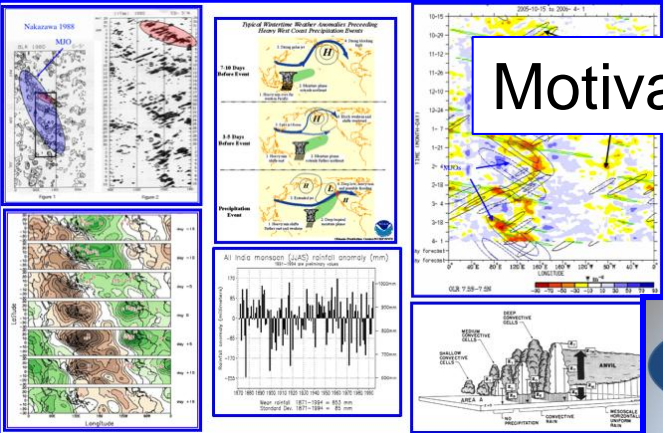


# YOTC

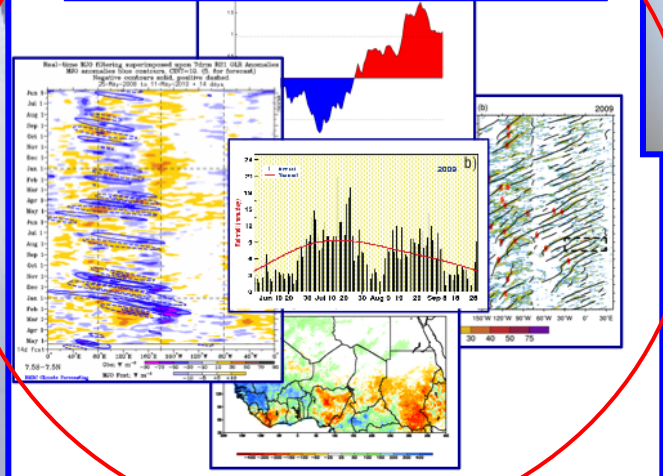
One Approach to Advancing our Understanding and Forecasting Capabilities of Tropical Convection

Motivation

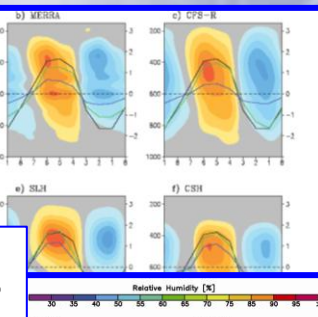
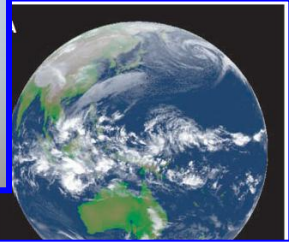
New Observations



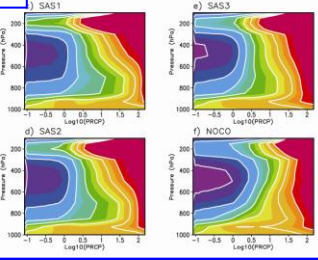
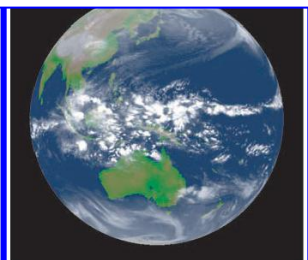
Events of Interest



Waliser et al. 2011; BAMS, Under Review



Models & Tools



Thank You