JAMSTEC
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY

# Application Laboratory

Innovations from Earth Science

# Seasonal to Interannual Climate Predictions and Applications Activities at JAMSTEC

Swadhin Behera


Agriculture

Economy

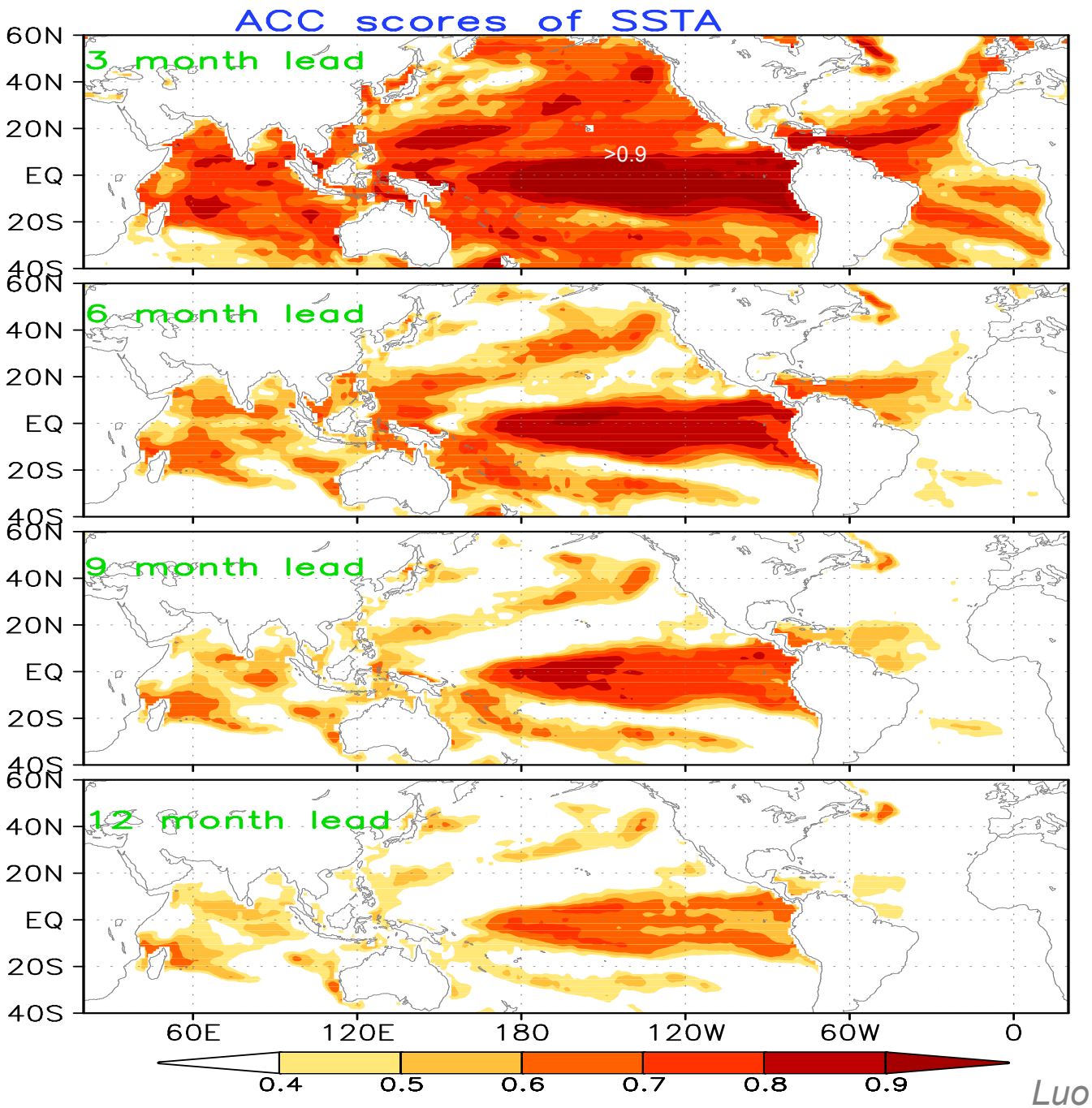
Education

Energy

Environment

Health

Water



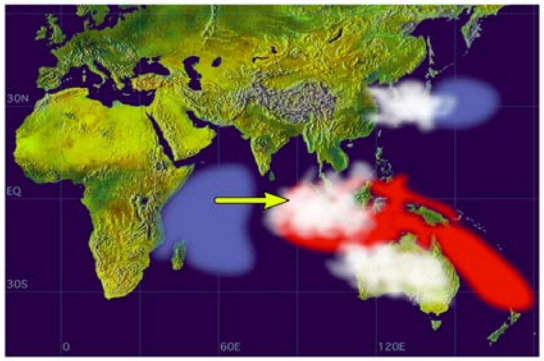

9-member mean (1982-2004)

based on a semi-multi-model ensemble prediction system of SINTEX-F

*Luo et al., J. Climate, 2005b.*

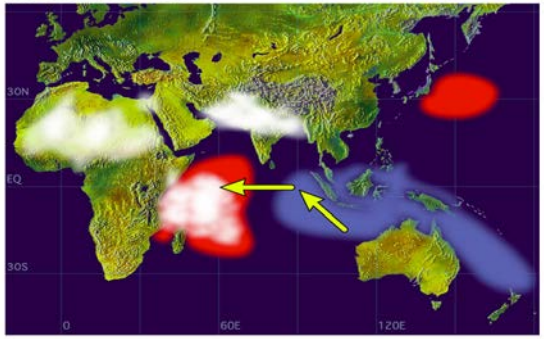
# Recent SINTEX-F Seasonal Predictions

Negative Dipole Mode



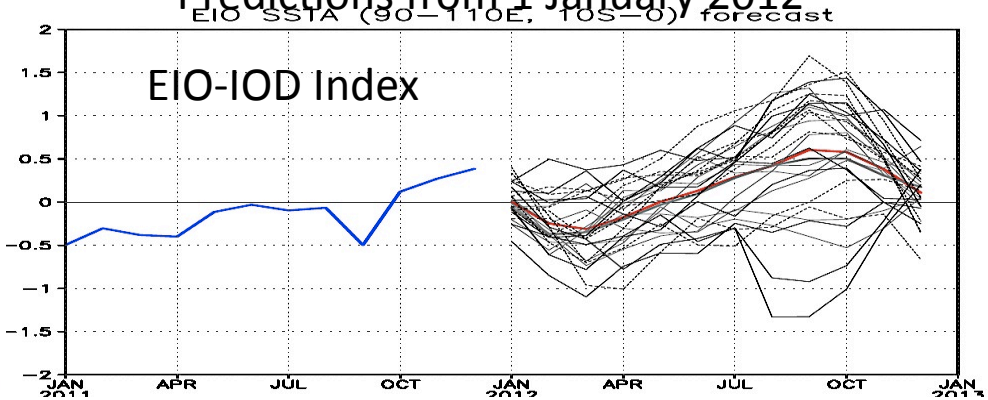
Negative Indian Ocean Dipole

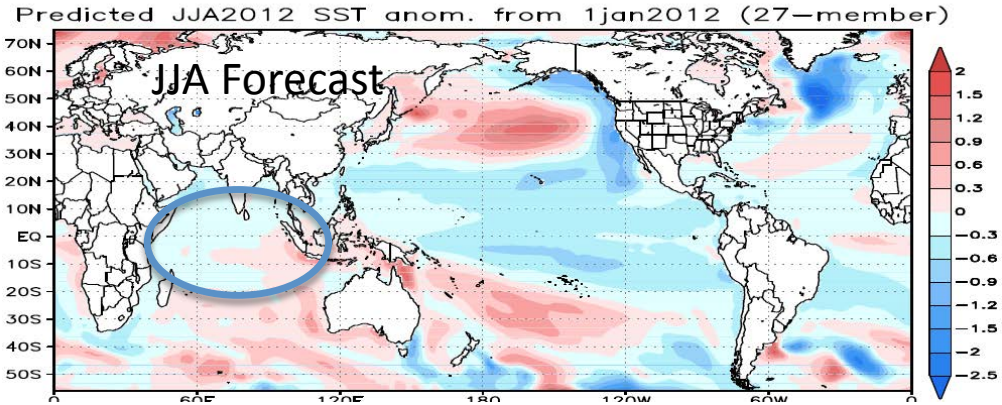
Positive Dipole Mode



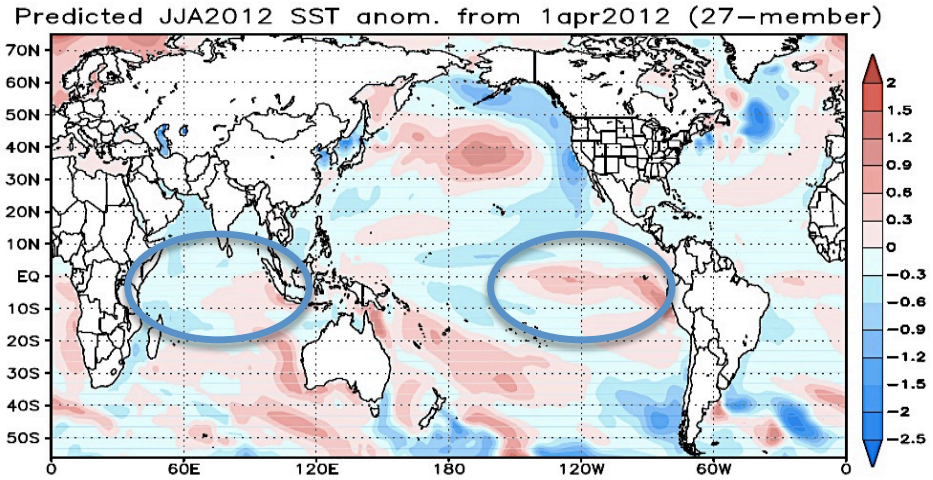
Positive Indian Ocean Dipole

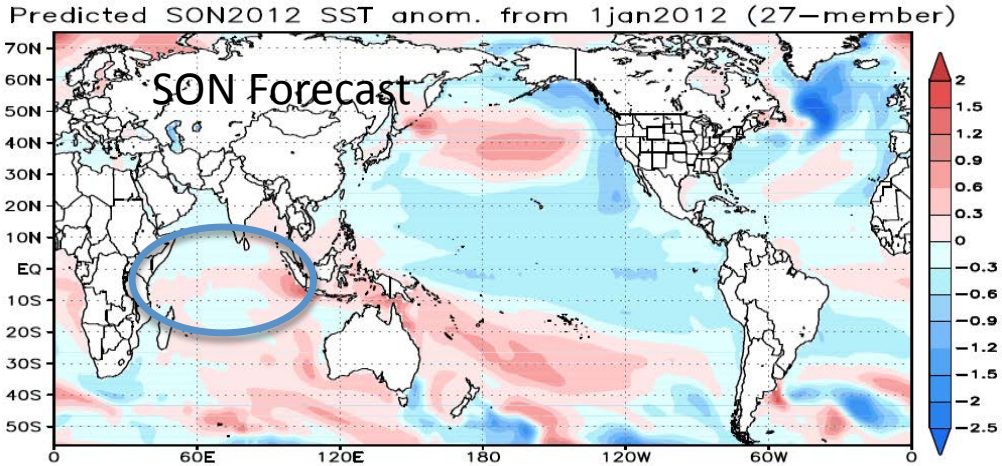
Predictions from 1 January 2012



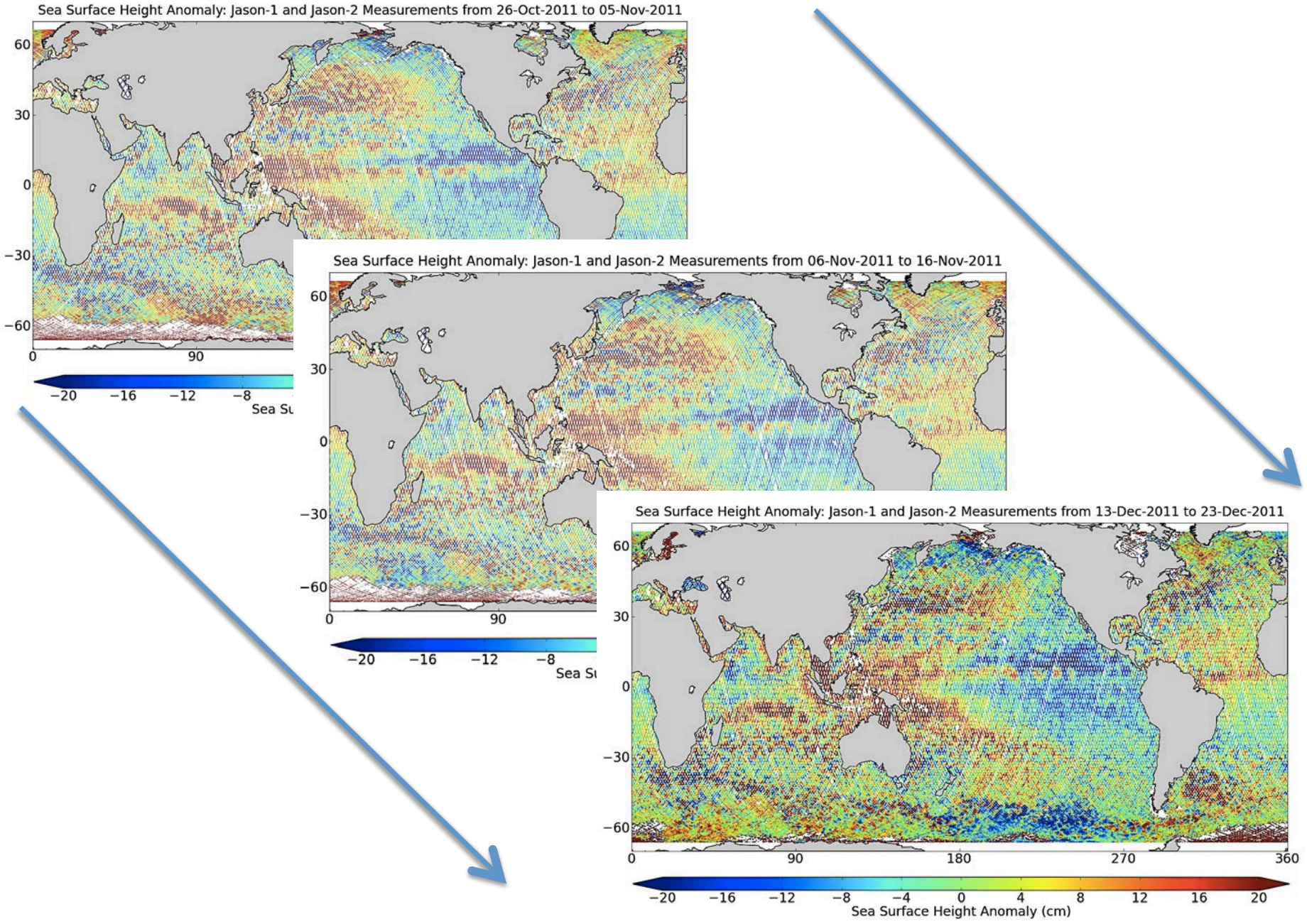




Jun-August Forecasts from 1 Apr 2012



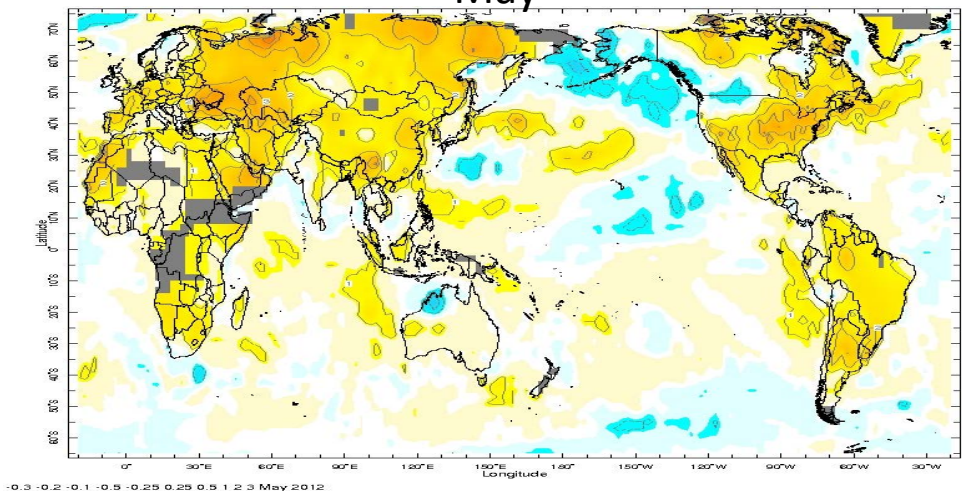



# SSH Anomalies Oct-Dec 2011

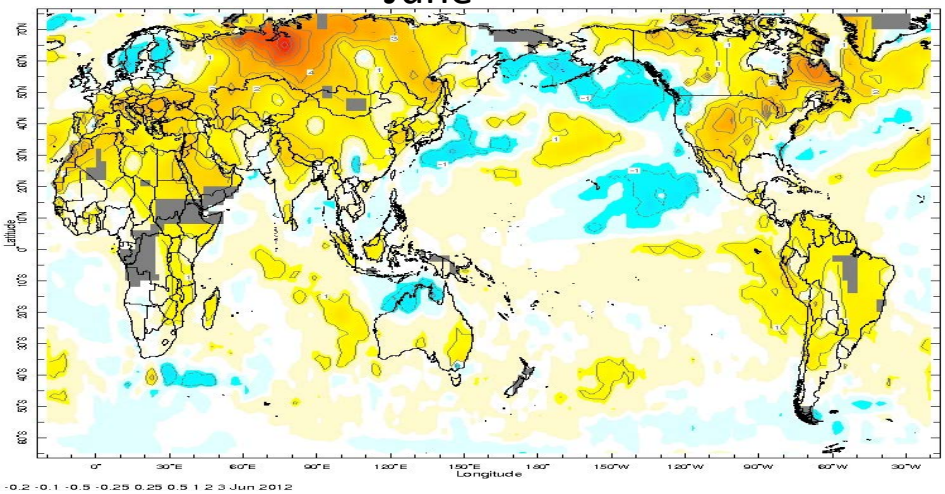


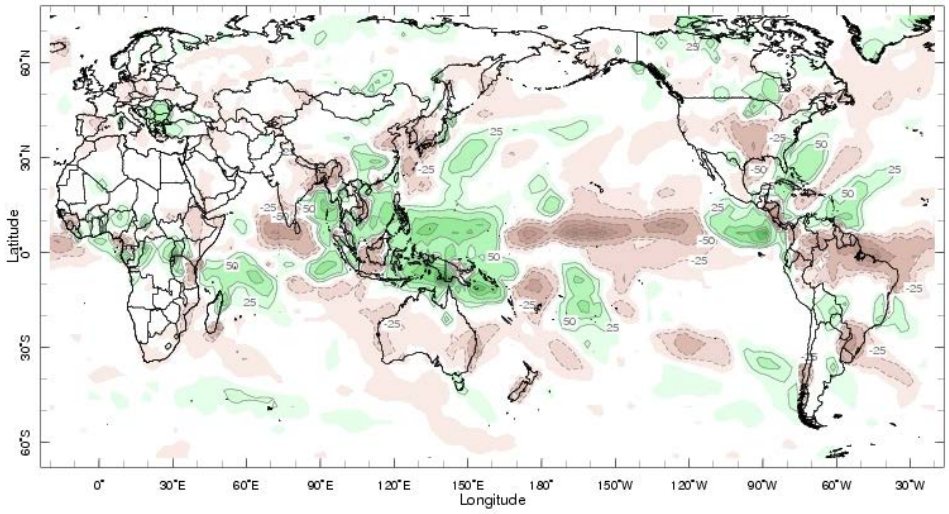
# Observed Anomalies of SST and Precipitation

May

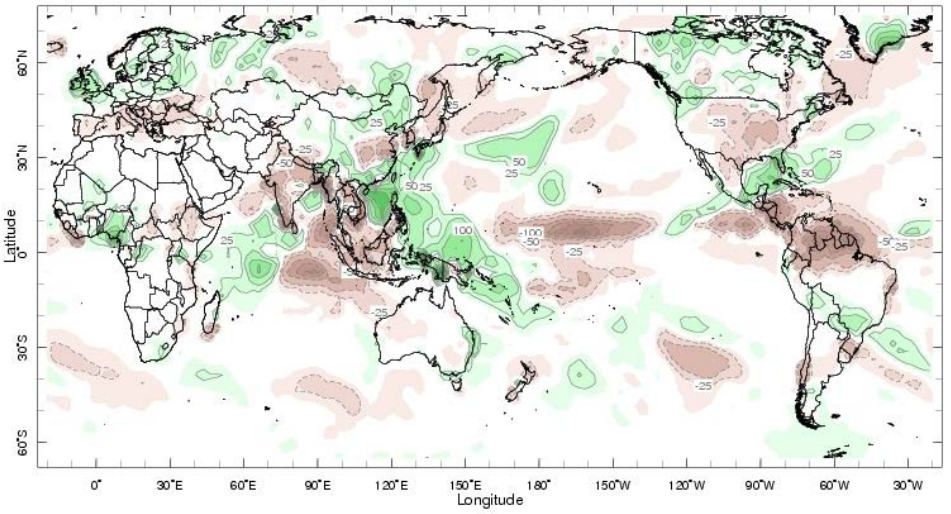



June




May 2012




2012

The Hindu
Business-line

# Japanese expert warns of deficit monsoon for India

Vinson Kurian

*Thiruvananthapuram, Feb. 1*

A widely respected Japanese researcher-cum-scientist has warned that India might be faced with a deficit monsoon this year.

The warning comes from Prof (Dr) Toshio Yamagata, Dean of University of Tokyo Graduate School of Science, and Head of the Application Laboratory of Japan Agency for Marine-Earth Science and Technology (Jamstec).

**DEFICIT IN NORTHWEST**

It is not yet known from the forecast, since made available to *Business Line*, the likely extent of deficit.

It was as high as 23 per cent during the latest lean monsoon year of 2009. That was also the worst monsoon deficit to be recorded in more than three decades.

Dr Yamagata's latest forecast indicates deficit in north-west India, adjoining parts of central India and east-central India during the crucial June to August this year.

State-wise, deficits are indicated for almost entire Rajasthan, Haryana-Delhi-west Uttar Pradesh, Andhra Pradesh and adjoining east Maharashtra.

**NORMAL FOR SOUTH**

Monsoon rains are indicated to be normal to excess for Jammu and Kashmir, Himachal Pradesh and Uttarakhand in the rest of the northwest; Bihar, Gangetic West Bengal and Orissa in the east; Gujarat in the west; and most of southern peninsula.

North-west India, except possibly Uttar Pradesh, will get its share of rains in the September to November period, the forecast says. Deficit is indicated for adjoining east and central India during this period.

Once again, southern peninsula is forecast to receive normal to excess rainfall during this latter three-month period.

**IOD EXPLAINED**

Dr Yamagata blamed 'an unexpected developing' Indian Ocean Dipole (IOD) for the likely poor performance of the Indian monsoon this year.

The Indian Ocean event mimics the El Nino-La Nina phenomena, its mega-sized cousin in the east equatorial Pacific, but has a more immediate impact for Indian monsoon.

The IOD has positive and negative phases. During a positive phase, sea-surface temperatures are comparably high to the west of the Indian Ocean. It has a benign influence on the concurrent Indian monsoon.

The situation is exactly reversed in the case of a negative event, when the temperature anomaly shifts to the east and with it associated convection and

**MOISTURE ROBBED**

This robs the ap monsoon current fr west and west Ind of the moisture nee down over land.

It would also tra above normal wi over Indonesia and which are current the forecast true.

Dr Yamagata sa ongoing La Nina would start decayi ensuing summer was this La Nina t turn out a succes monsoon last year.

The La Nina sustain the colde mal condition parts of the worl ing seasons. North and the US will warmer-than-nor in the spring.

*Vinson@thehi*

# Japanese model retains below-normal rain outlook

Vinson Kurian

*Thiruvananthapuram, May 27*

Updated Japanese model forecasts have retained a 'flop-show' watch for summer rains here even as the southwest monsoon inched closer to Kerala coast.

"Our Sintex-F model continues to predict a negative Indian Ocean Dipole (IOD) during this summer and fall.

"I am afraid this is not good news for the India," Dr Swadhin Behera at the Tokyo-based Research Institute for Global Change (RIGC) wrote to *Business Line* on Sunday.

**JULY RAINS**

The RIGC specifically mentioned about the June-July-August phase, during when the rains are likely to fail the

Dr Behera is team leader, Low-altitude climate prediction research under the Climate variation predictability and applicability research programme at RIGC.

The RIGC team had been warning about a 'cool summer' for India this year (since proved true) followed by a below-normal monsoon right from February.

Its outlook is predicated on the expected evolution of a negative IOD, which mimics El Nino-La Nina pattern nearer home in the Indian Ocean. And for this very reason, the IOD phenomenon has a more direct and immediate impact on the Indian monsoon.

**WARM SEAS**

warmer to the east Indian Ocean relative to the west, which robs mainland of convection and moisture.

Exactly reverse is the case of a positive IOD when the west Indian ocean warms up, and aids the monsoon current approaching the Kerala coast.

The RIGC update came on a day when India Meteorological Department (IMD) assessed conditions as favourable for advance of monsoon into nearby seas to the southwest.

**NEUTRAL PACIFIC**

The IMD gave a two-day window for the current to enter parts of southeast Arabian Sea and more parts of the Maldives and the Comorin areas

Business Standard, India

## Consistently inconsistent

Back in February, a Japanese scientist made a forecast which should have had India worried right away**. Toshio Yamagata**, head of the **Application Laboratory of Japan Agency for Marine-Earth Science and Technology**, warned that the Indian sub-continent will experience a weaker monsoon this year. Around the same time, World Weather Inc. in the US cautioned that India should brace up for a relatively dry spell in August and September.

## Indian village holds a warts-an-all wedding in the hope of bringing rain

By TAMMY HUGHES

**PUBLISHED:** 14:53 GMT, 14 June 2012 | **UPDATED:** 14:04 GMT, 15 June 2012

Comments (29) | Share +1 8 Like 208

No matter how confident they feel about their relationship every bride worries their future spouse will croak at the alter come the big day.

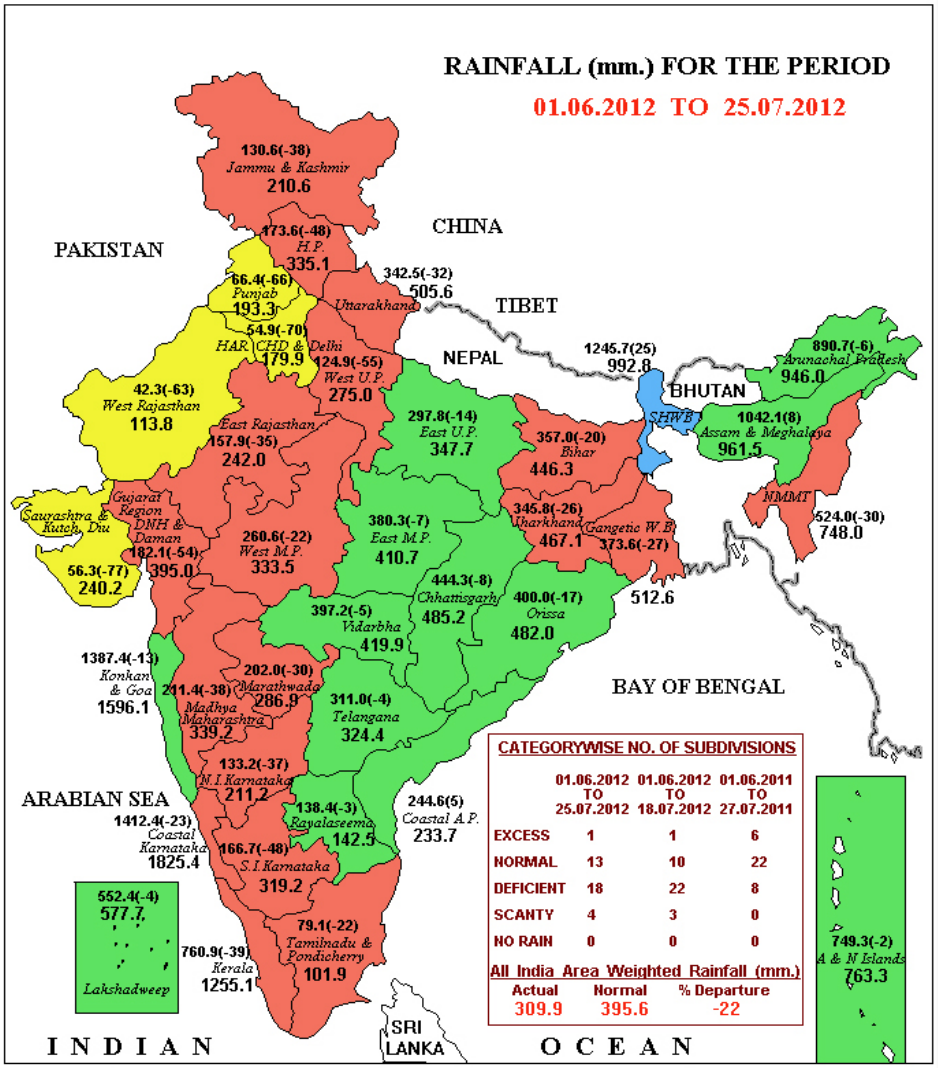
But in the remote village of Takhatpur, India, croaking is the norm during the much-celebrated frog weddings.

Residents believe these unusual nuptials will bring rain to relieve them of water shortages brought on by severe drought.

End of July: -22%

भारत मौसम विज्ञान विभाग

INDIA METEOROLOGICAL DEPARTMENT




LEGEND: EXCESS (+20% OR MORE) | NORMAL (+19% TO -19%) | DEFICIENT (-20% TO -59%) | SCANTY (-60% TO -99%) | NO RAIN (-100%) | NO DATA

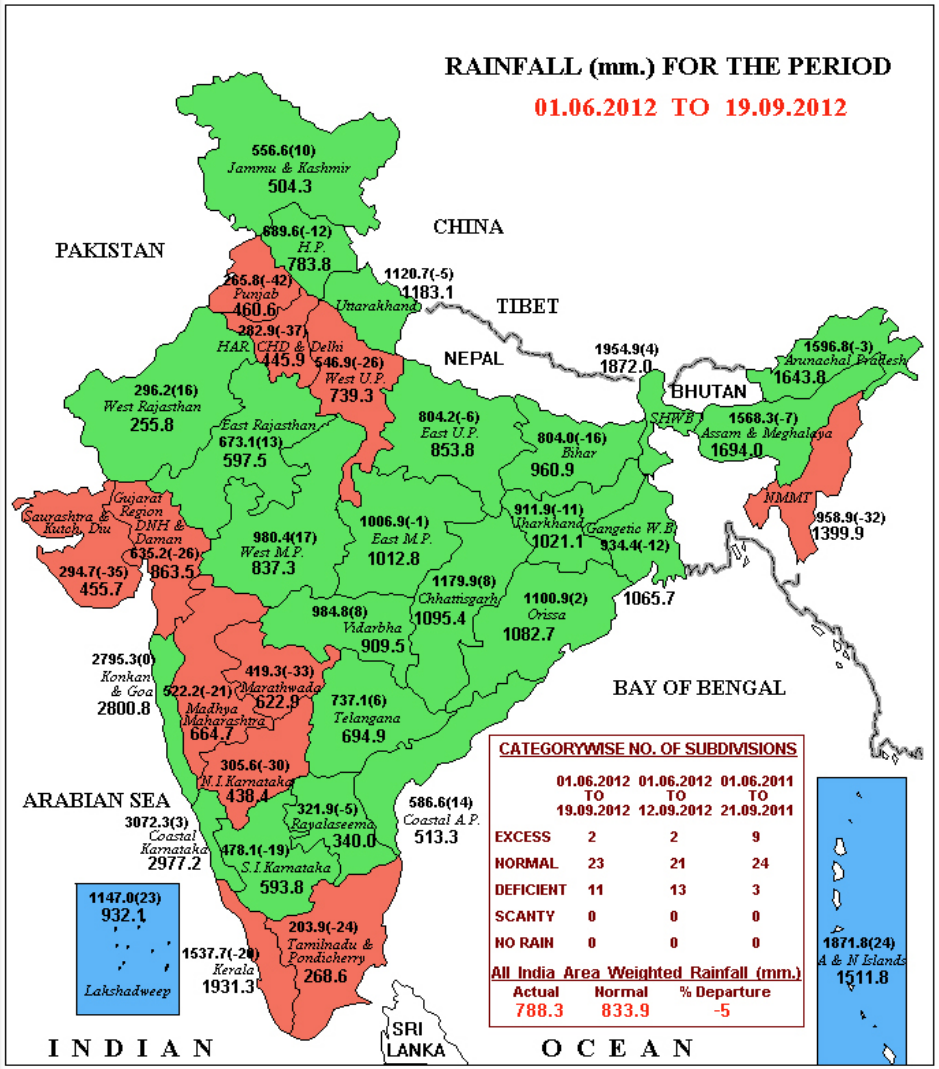
NOTES:

(a) Rainfall figures are based on operational data.
(b) Small figures indicate actual rainfall (mm.), while bold figures indicate Normal rainfall (mm.)
Percentage Departures of Rainfall are shown in Brackets.

End of September: Near normal

भारत मौसम विज्ञान विभाग

INDIA METEOROLOGICAL DEPARTMENT

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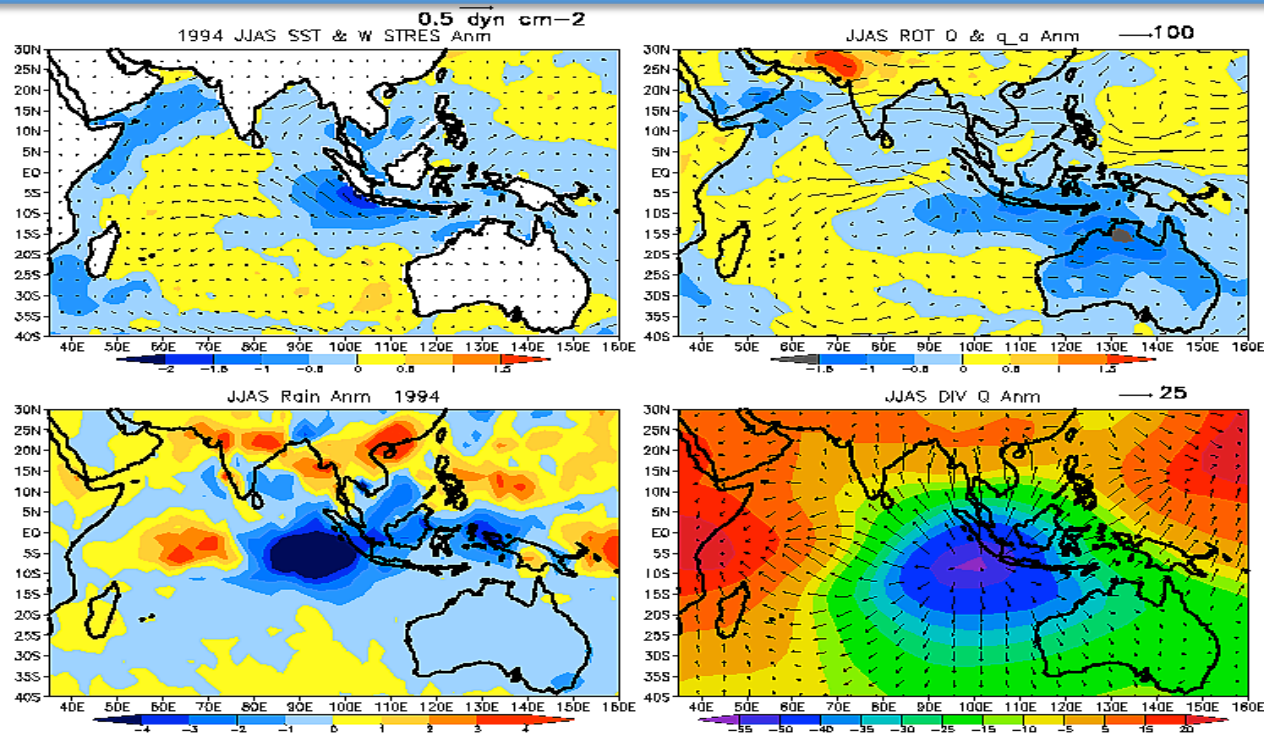
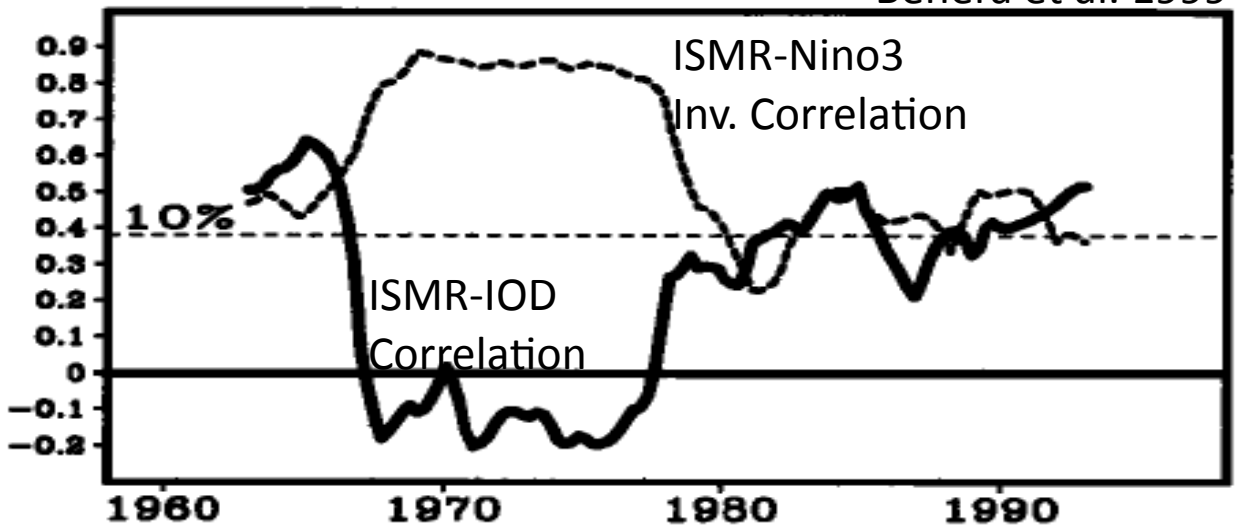
# IOD influences the Indian summer monsoon rainfall.

**Moisture transports from the eastern Indian Ocean strengthen the monsoon trough giving rise to abundant rainfall over India and several parts of Southeast Asia.**




Behera et al. 1999



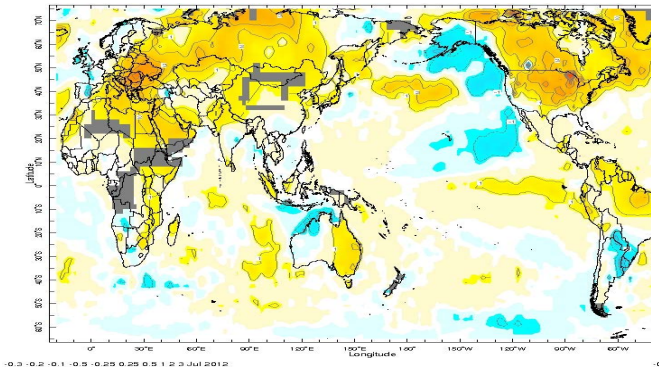

Ashok et al. 2001

The influence of IOD on Indian summer monsoon rainfall has strengthened when El Nino influence has weakened.

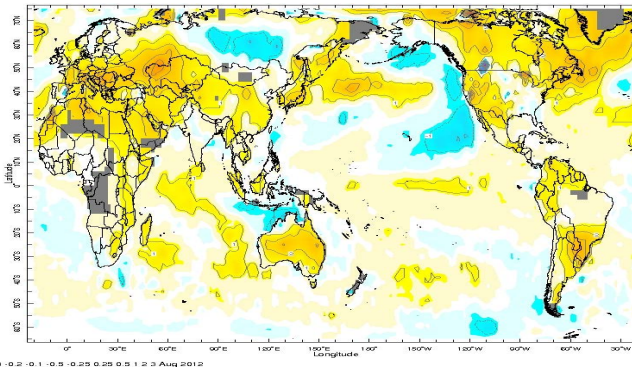
# Observed SST, SSH and Precipitation Anomalies

SSTA

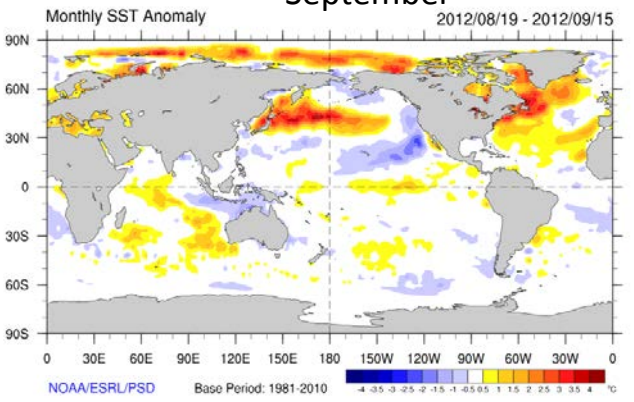
July



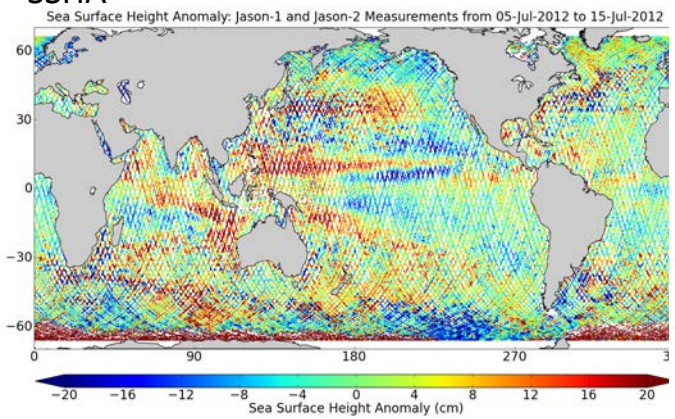
August

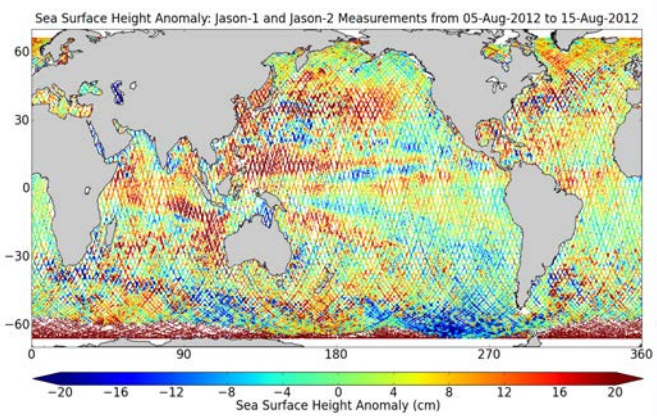


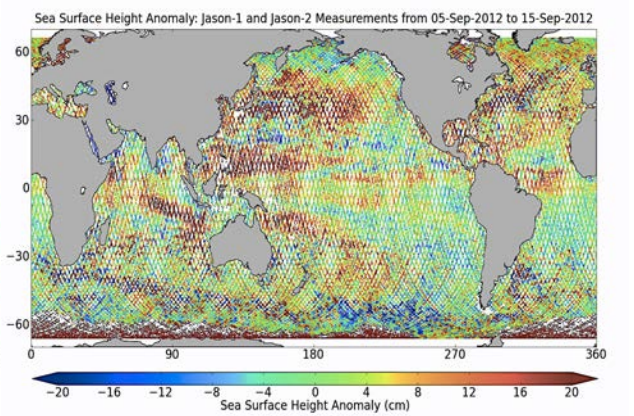
September



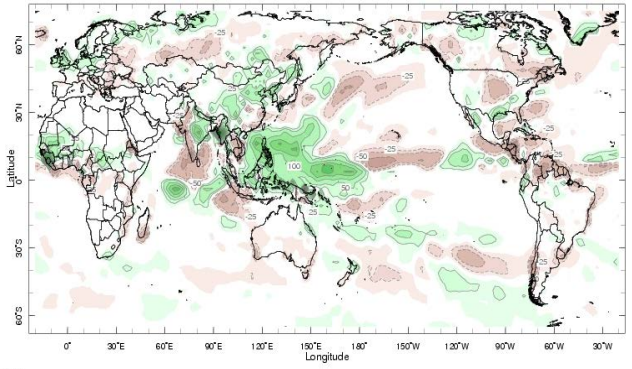

SSHA

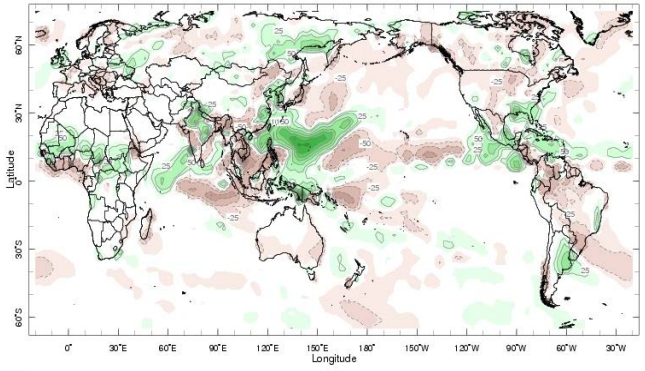


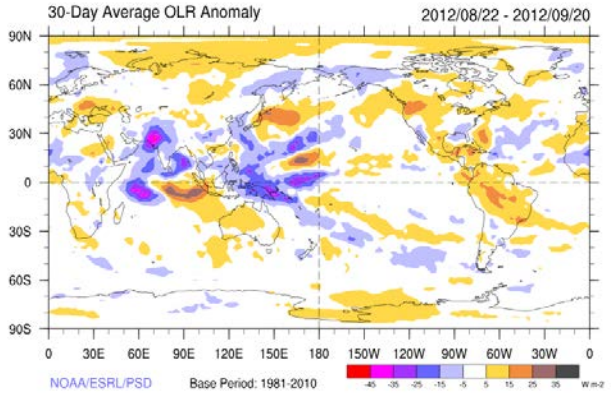




PRECIPA




OLRA



**Unusual turnaround in monsoon, say Japanese scientists**

**THIRUVANANTHAPURAM, SEPT. 4:**
**Japanese researchers/scientists** have **admitted** that the Indian monsoon is undergoing an **'uncharacteristic' turnaround**.
And they attribute it to a backyard phenomenon **called Indian Ocean Dipole (IOD)** that nearly mimics the El Nino-La Nina event in the east equatorial Pacific.
TWO PHASES
**The IOD has positive and negative phases; the former aids the Indian monsoon** thanks to raised surface temperatures of the south-west Indian Ocean.
This warmth in turn helps evaporation and convection (cloud-building).
The seasonal south-westerly monsoon winds push clouds into the land to rain it down all over.
The scenario is exactly reversed in the negative phase, which drives the rains out of the country, leading to a deficient monsoon.
The Japanese scientists had warned from February onwards that a negative IOD could build this year, which could harm Indian monsoon prospects this year.
"But in a very uncharacteristic turnaround, the negative IOD has been terminated and replaced by a positive IOD," said Tokyo-based Toshio Yamagata, Director, Application Laboratory, Jamstec (Japan Agency for Marine-Earth Science and Technology), and Swadhin Behera, Team Leader, RIGC (Regional Institute for Global Change) under Jamstec.

**El Nino to hit monsoon in Sept, North to feel pinch**
**TIMES NEWS NETWORK**

New Delhi: Expecting the manifestation of weak to moderate El Nino conditions in September, sources in the Indian Meteorological Department have said that the last month of the monsoon is likely to have below 90% of the long period average rain. Northwest India, where the rain of the past two days has brought down deficiency from 23% on Tuesday to 17% on Thursday, can expect only another couple of good spells of rain and might end up with a 20% plus deficiency for the season.

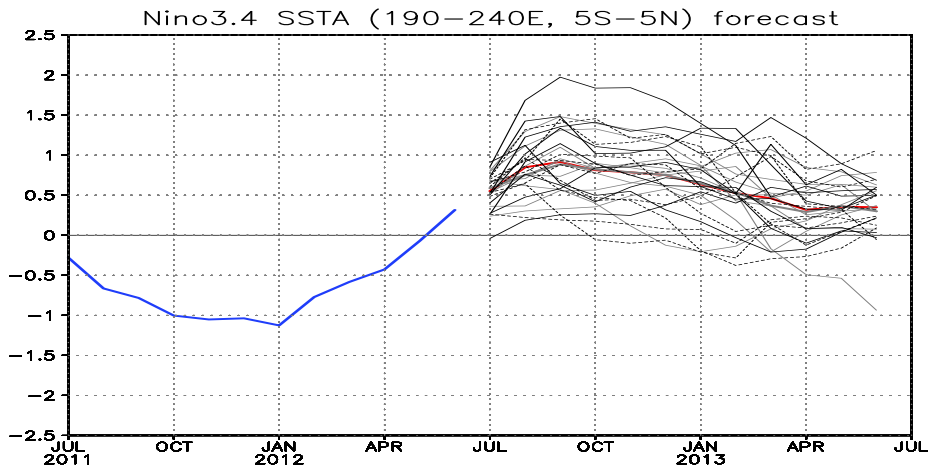
"We are expecting that heating of the east Pacific Ocean waters to the tune of +.6 degrees which is likely to have an impact on the southwest monsoon in September. In any case, the monsoon starts withdrawing from the country in the beginning of September and northwest India experiences only 10-12 days of rain," said Dr LS Rathore, DG, IMD.

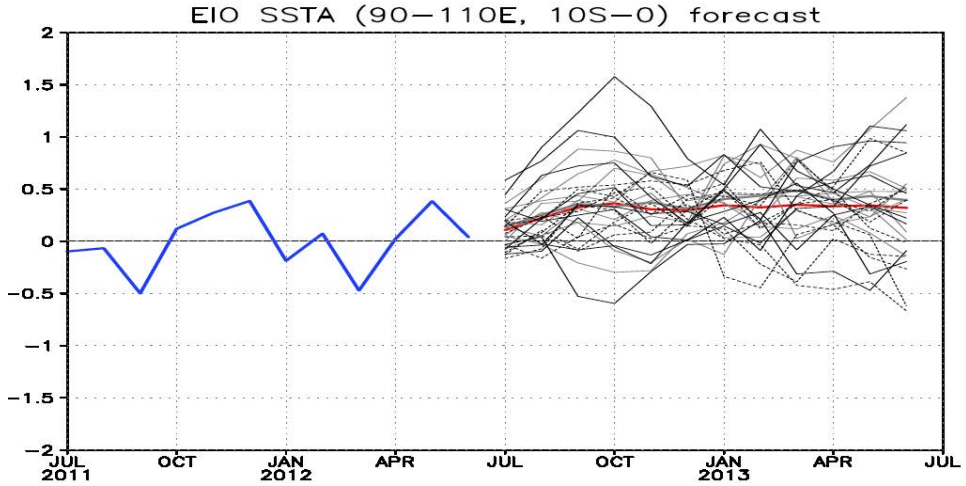
**IMD getting monsoon forecasts wrong: Govt**

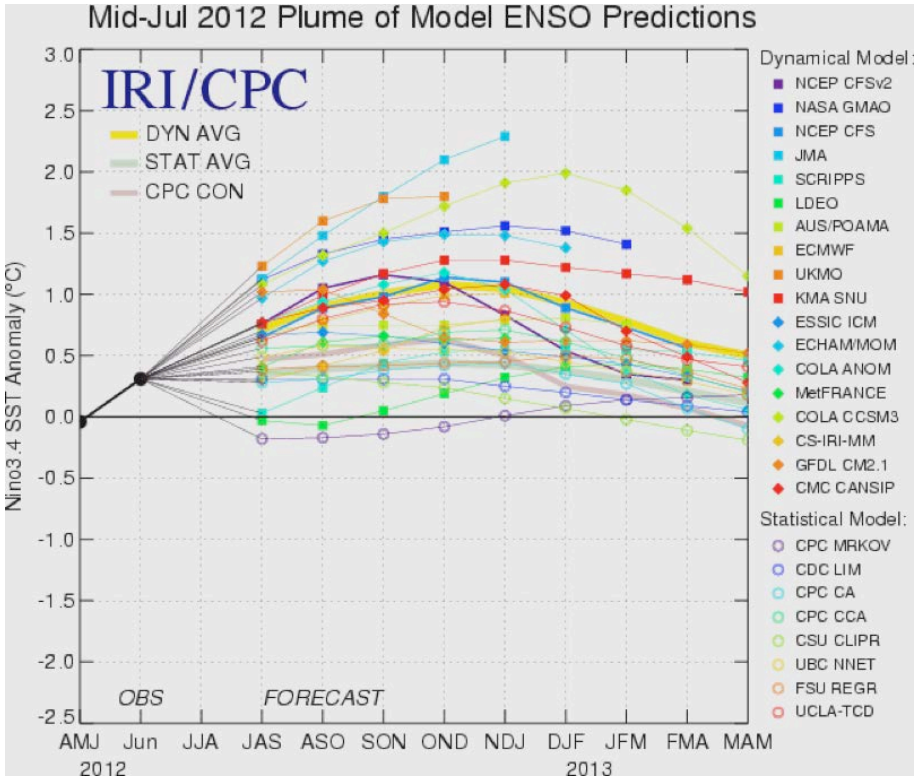
The government conceded in Parliament Wednesday that the accuracy of long-range monsoon forecasts in the last four years had only been about 50 per cent, an admission that is expected to strengthen critics of the Met department who have questioned the credibility of its estimates. Every year, the India Meteorological Department (IMD) tries to predict in April the total rainfall the country is likely to get in the June-September monsoon season. This year, the IMD seems to have got it doubly wrong.

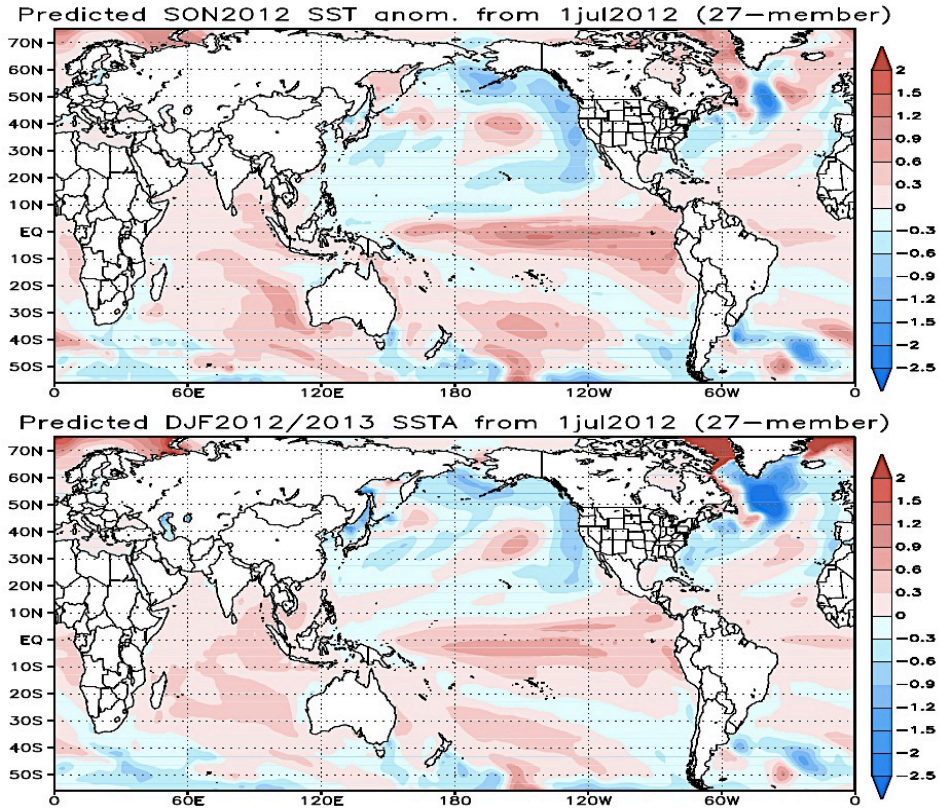
In April-end, it said rainfall would be 99 per cent of the long period average. In June, it revised this to about 96 per cent. But when it hardly rained in June and July, the IMD drastically cut its prediction and said total rainfall was not likely to be more than 85 per cent of average.

# SINTEX-F Seasonal Predictions from 1 July 2012

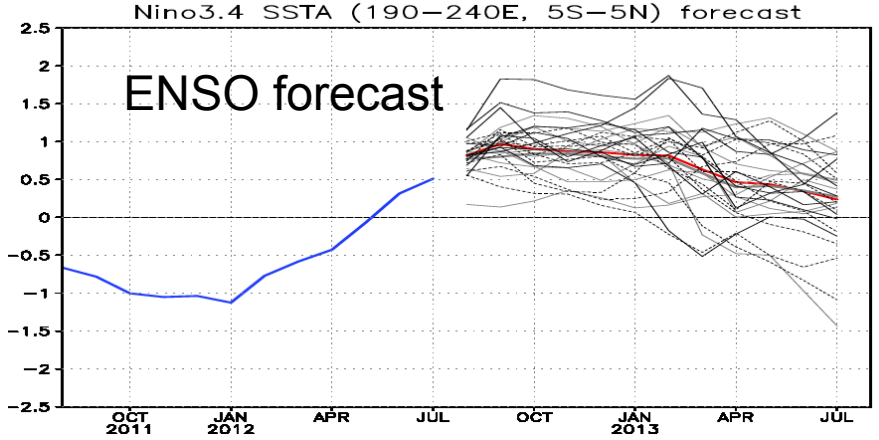


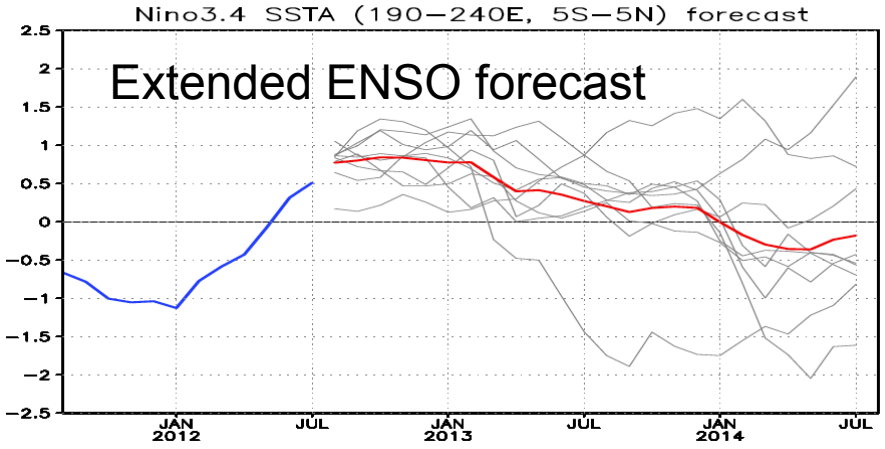



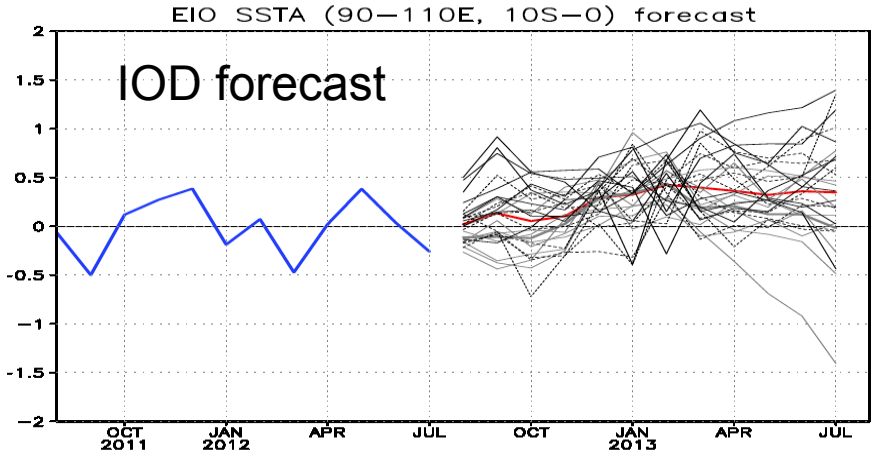



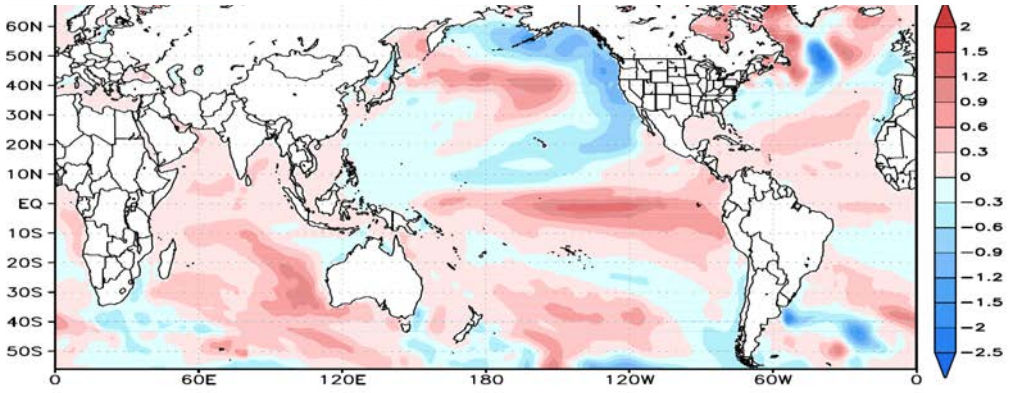
# SINTEX-F Seasonal Predictions from 1 August 2012

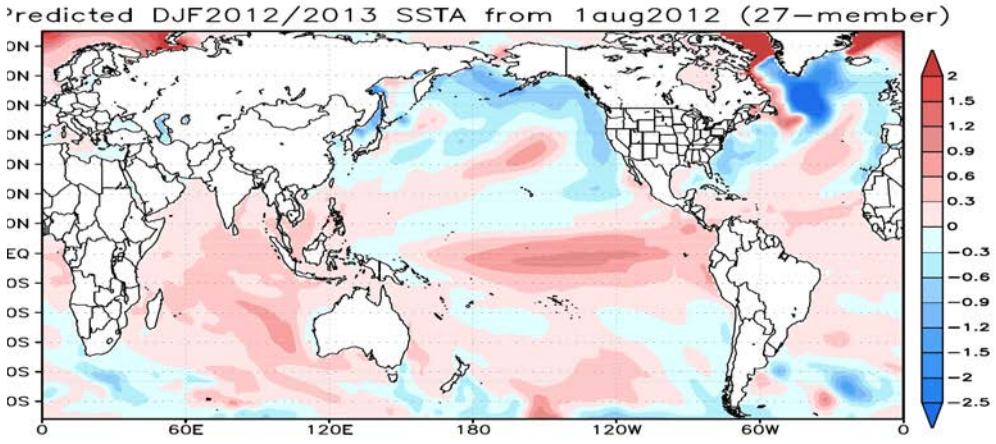


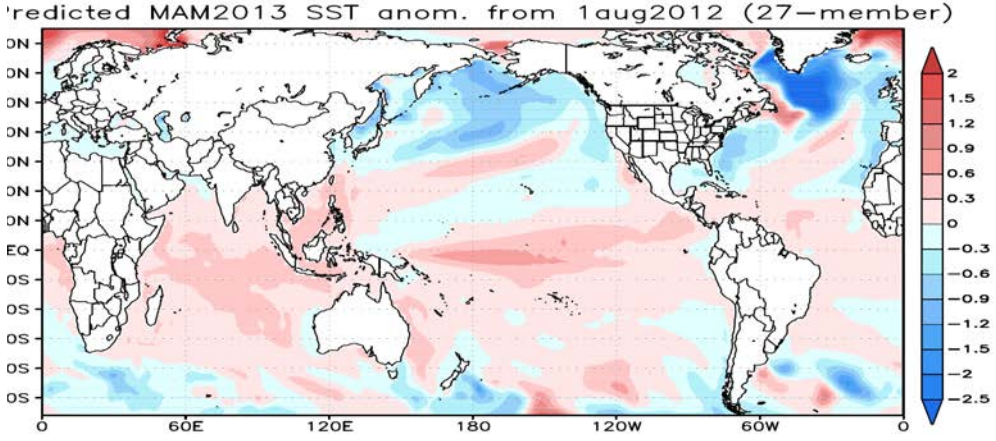



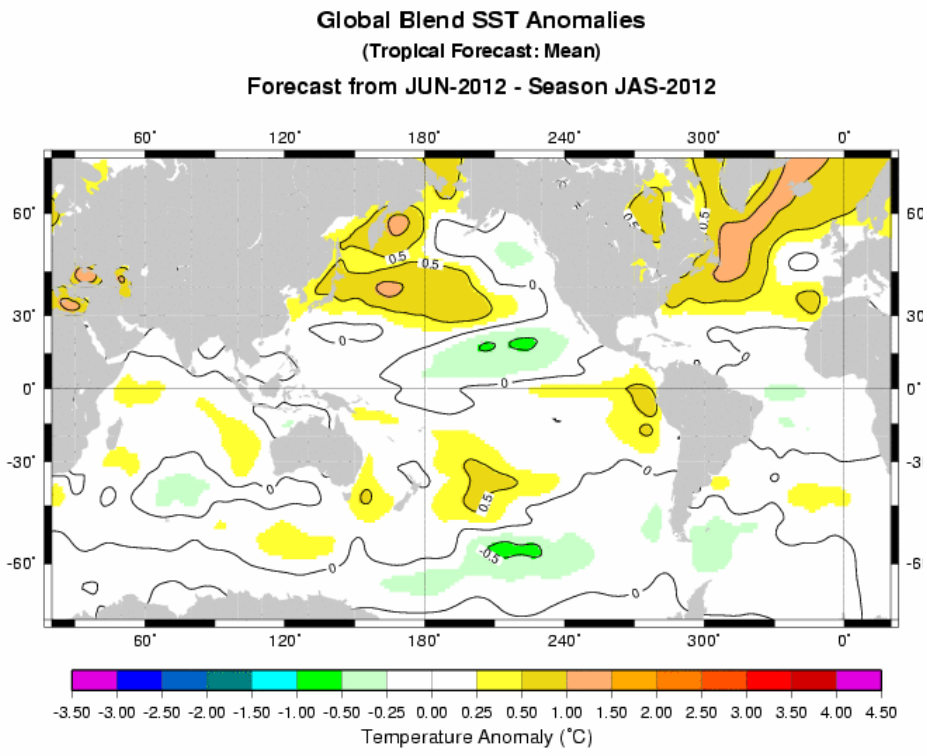



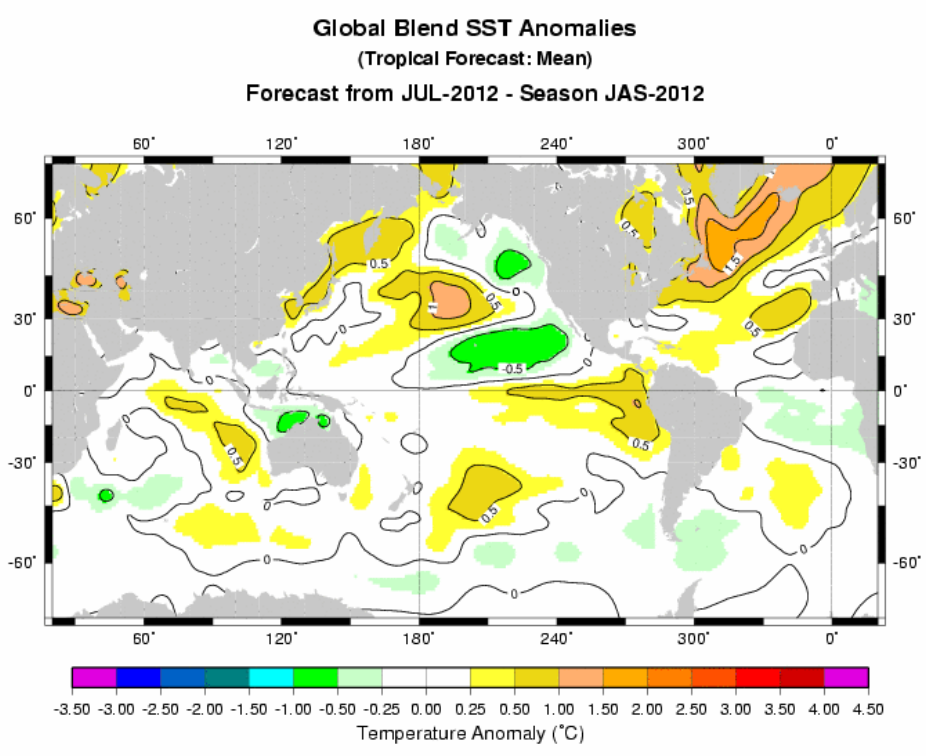

Predicted SST Anomalies for SON, DJF and MAM



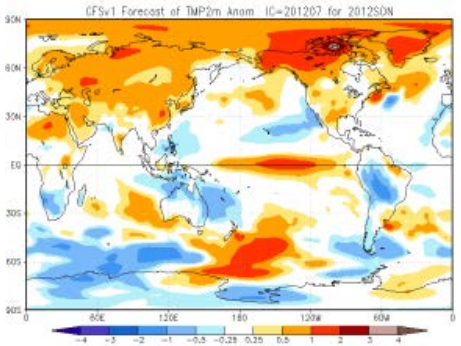




Global Blend SST Anomalies
(Tropical Forecast: Mean)
Forecast from JUN-2012 - Season JAS-2012
60° 120° 180° 240° 300° 0°
60° 30° 0° -30° -60°
-3.50 -3.00 -2.50 -2.00 -1.50 -1.00 -0.50 -0.25 0.00 0.25 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50
Temperature Anomaly (°C)

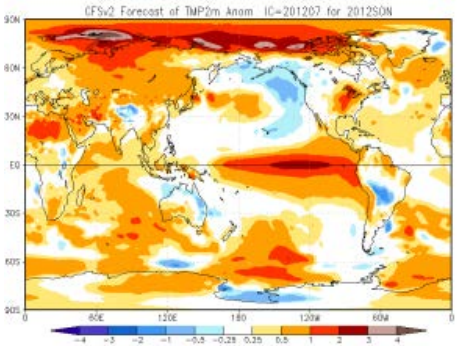

Global Blend SST Anomalies
(Tropical Forecast: Mean)
Forecast from JUL-2012 - Season JAS-2012
60° 120° 180° 240° 300° 0°
60° 30° 0° -30° -60°
-3.50 -3.00 -2.50 -2.00 -1.50 -1.00 -0.50 -0.25 0.00 0.25 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50
Temperature Anomaly (°C)

# SON 2012 predicted temp2 from 7.1.2012 ini.

CFSv1




CFSv2

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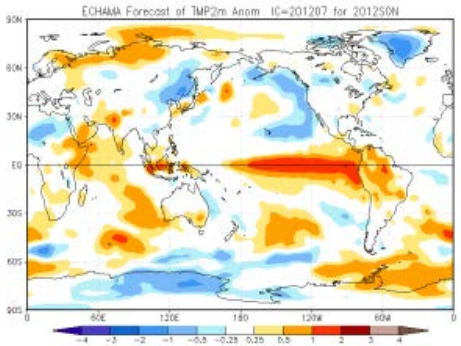


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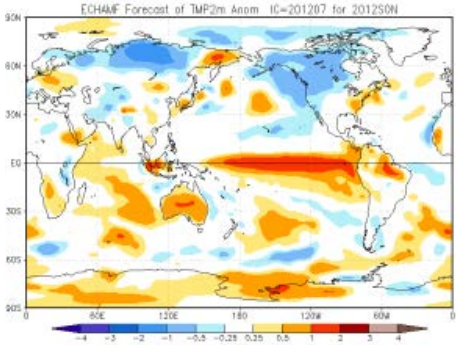


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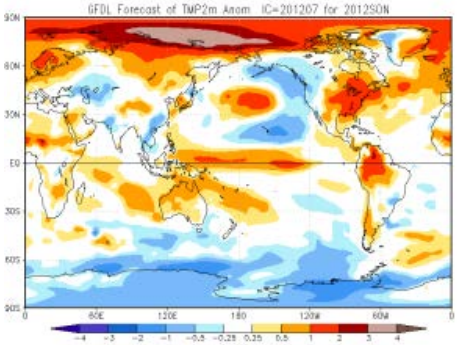


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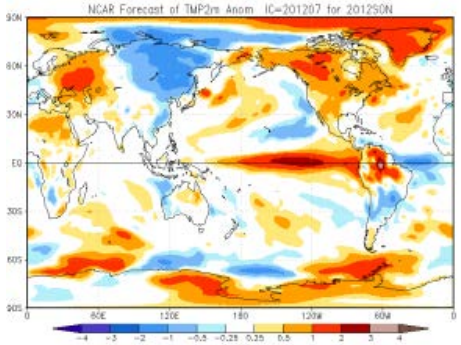


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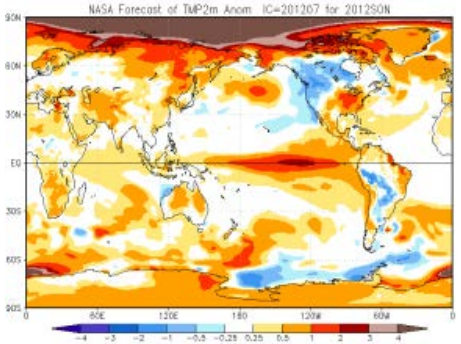


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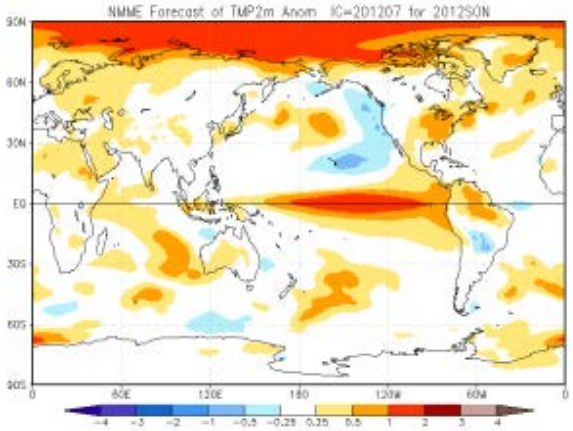
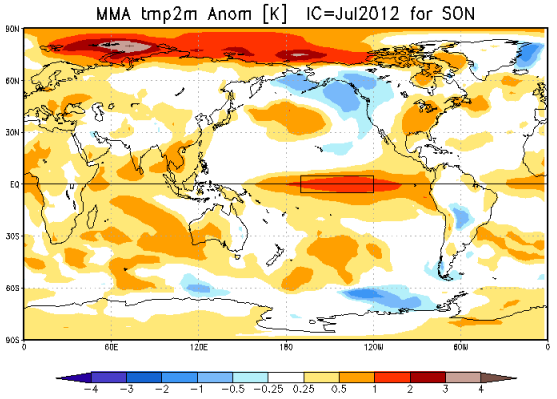
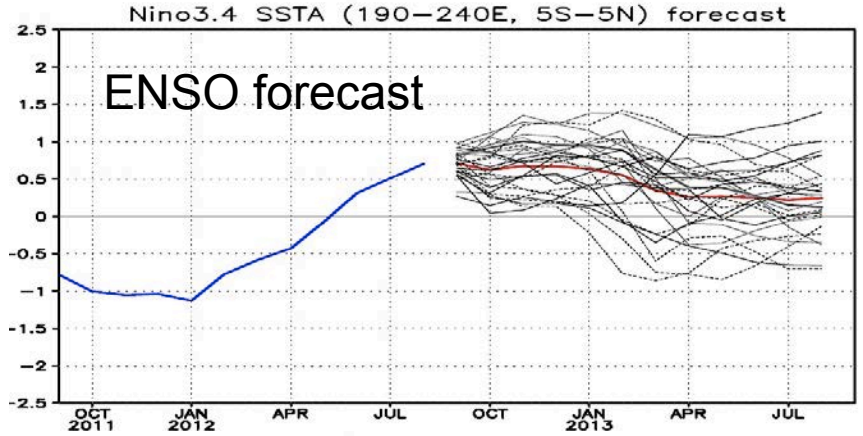
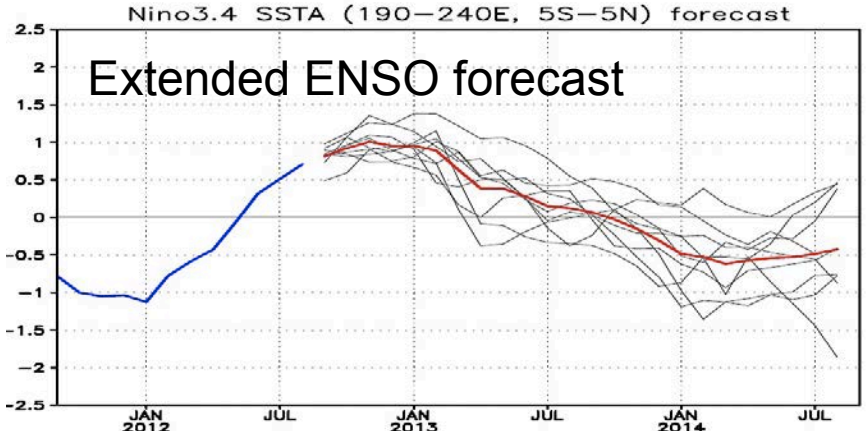


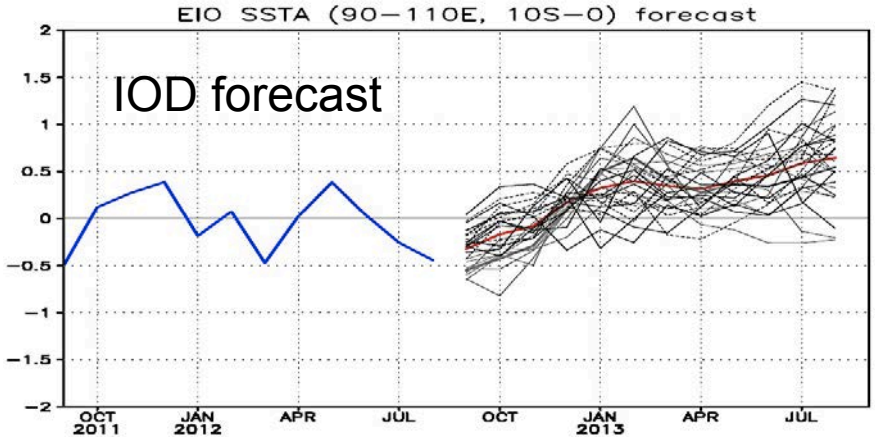

IMME



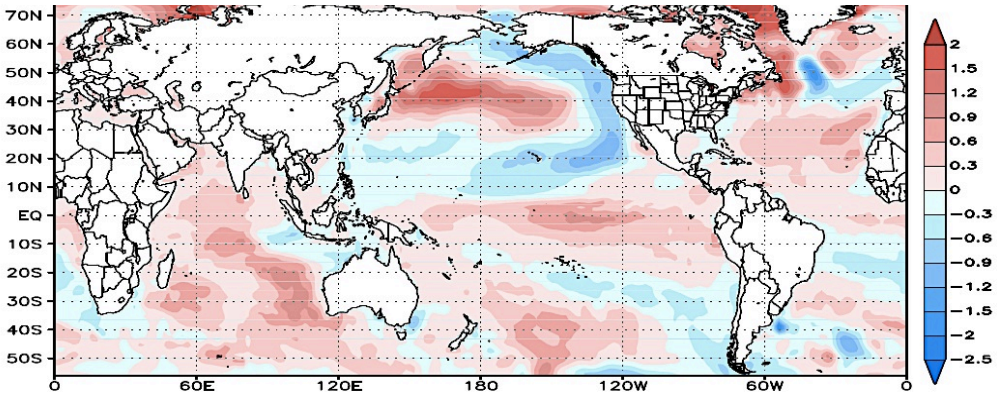
# SINTEX-F Seasonal Predictions from 1 September 2012

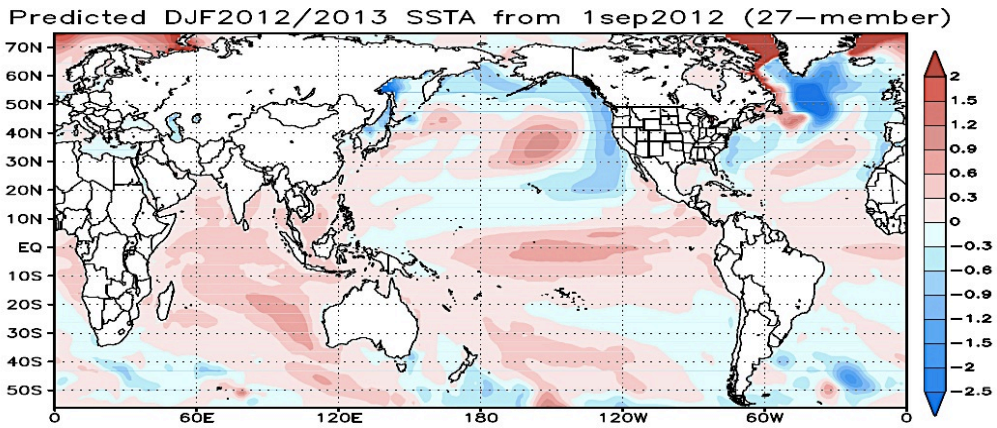


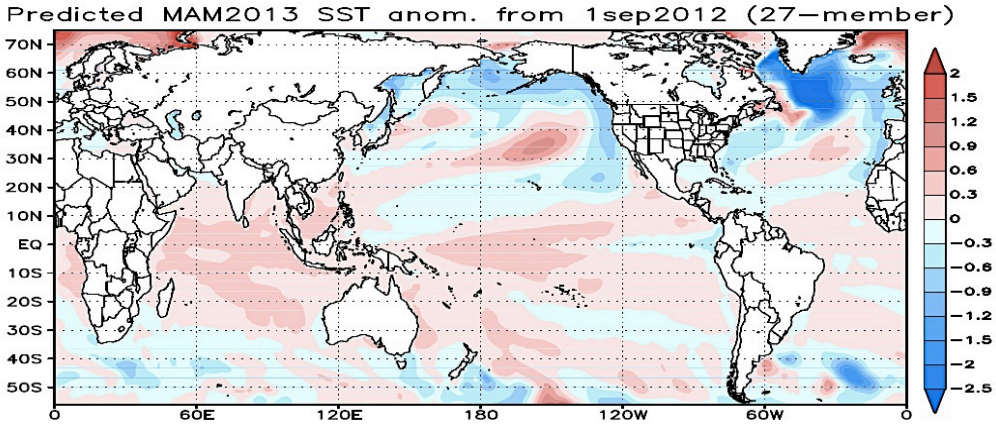



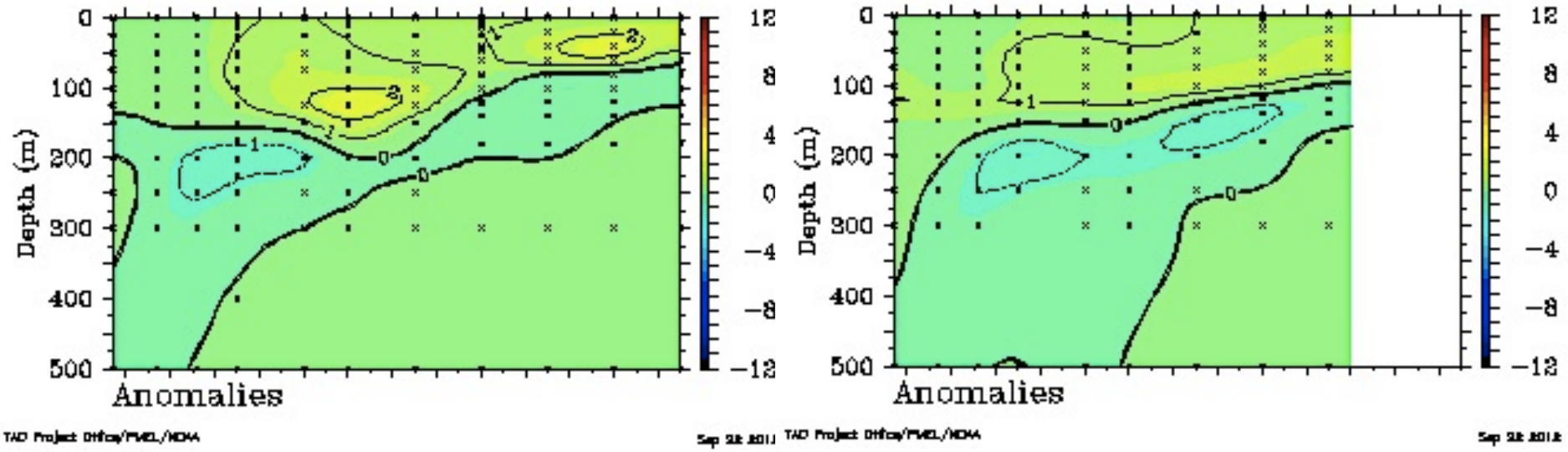

Predicted SST Anomalies for SON, DJF and MAM

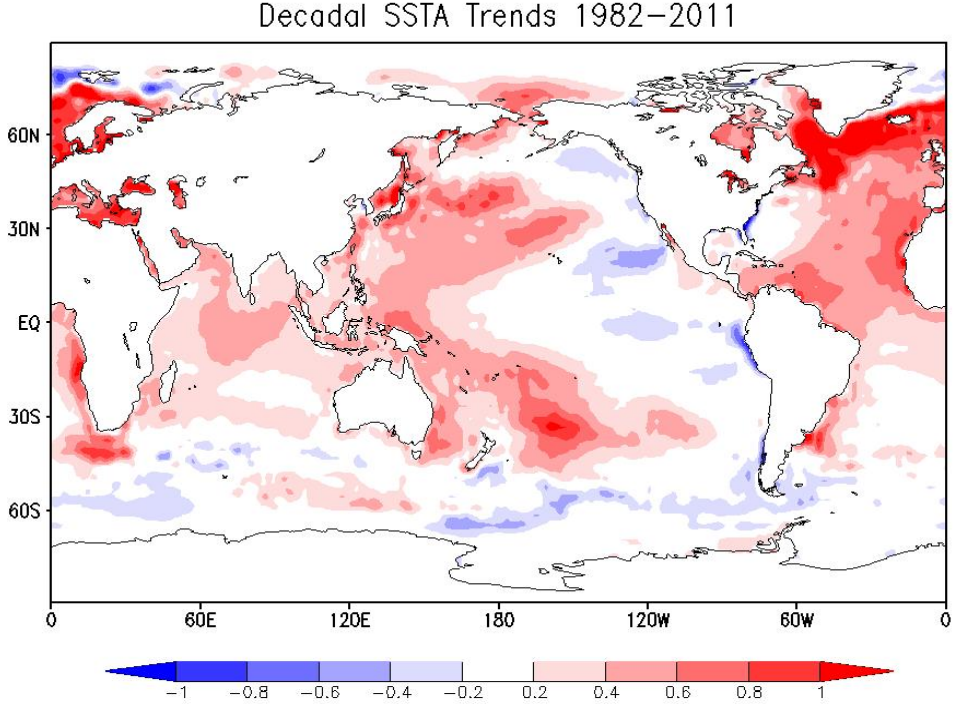




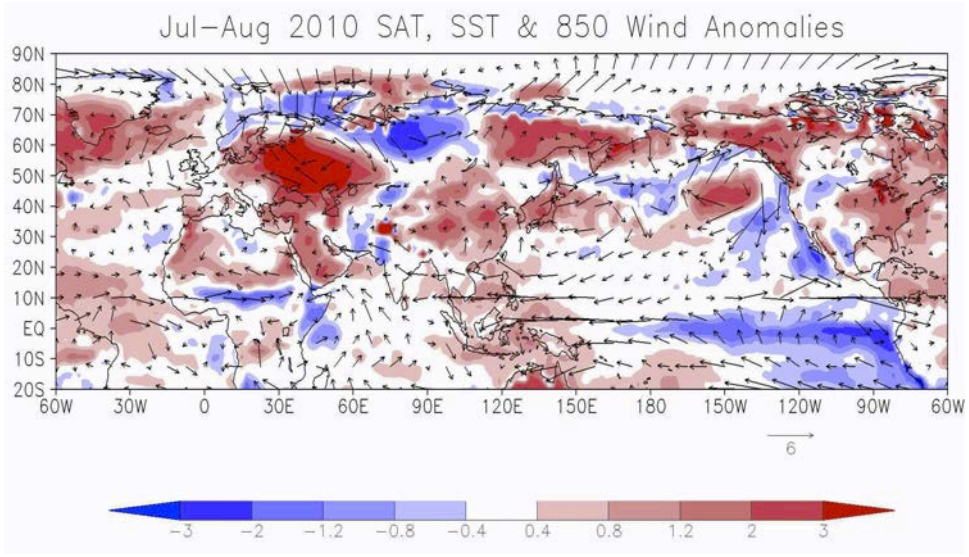



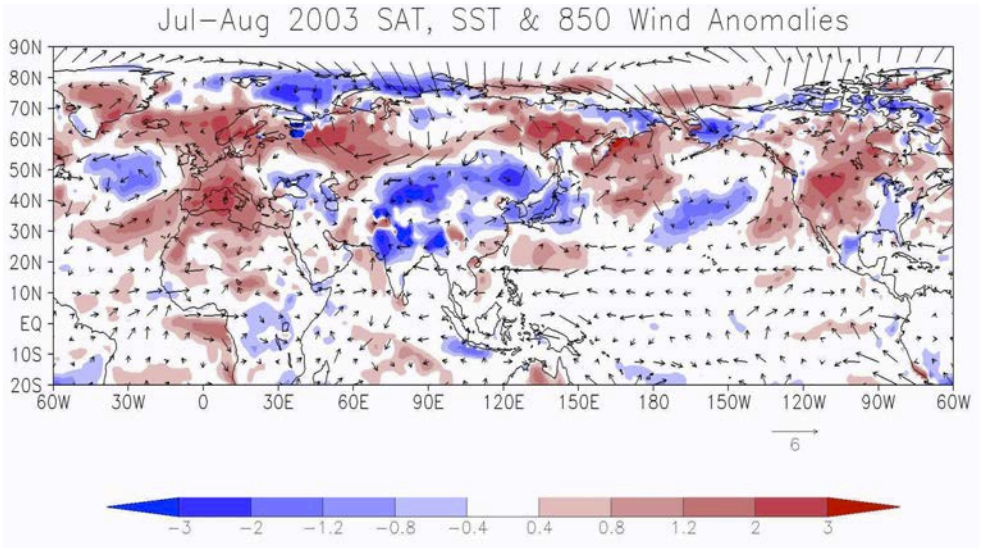
# Observed anomalies in September



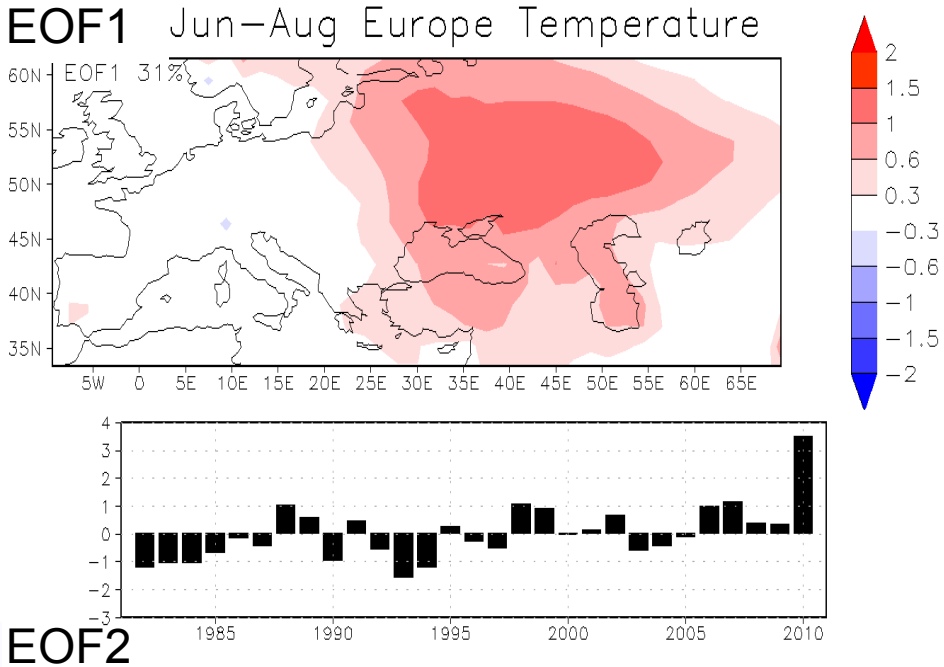



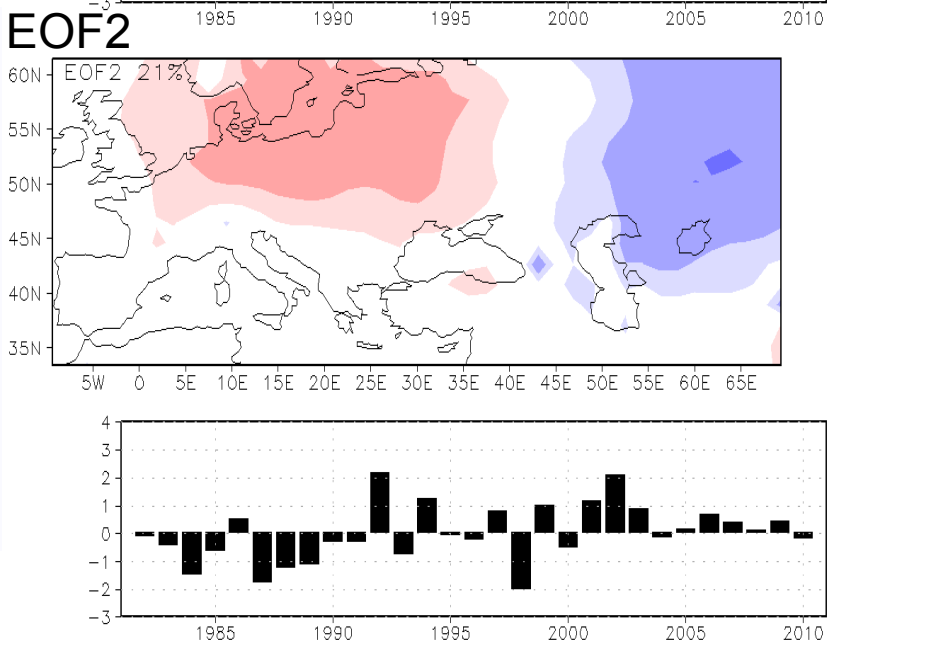
# Extreme European Summers: Role of Tropical Climate Variations

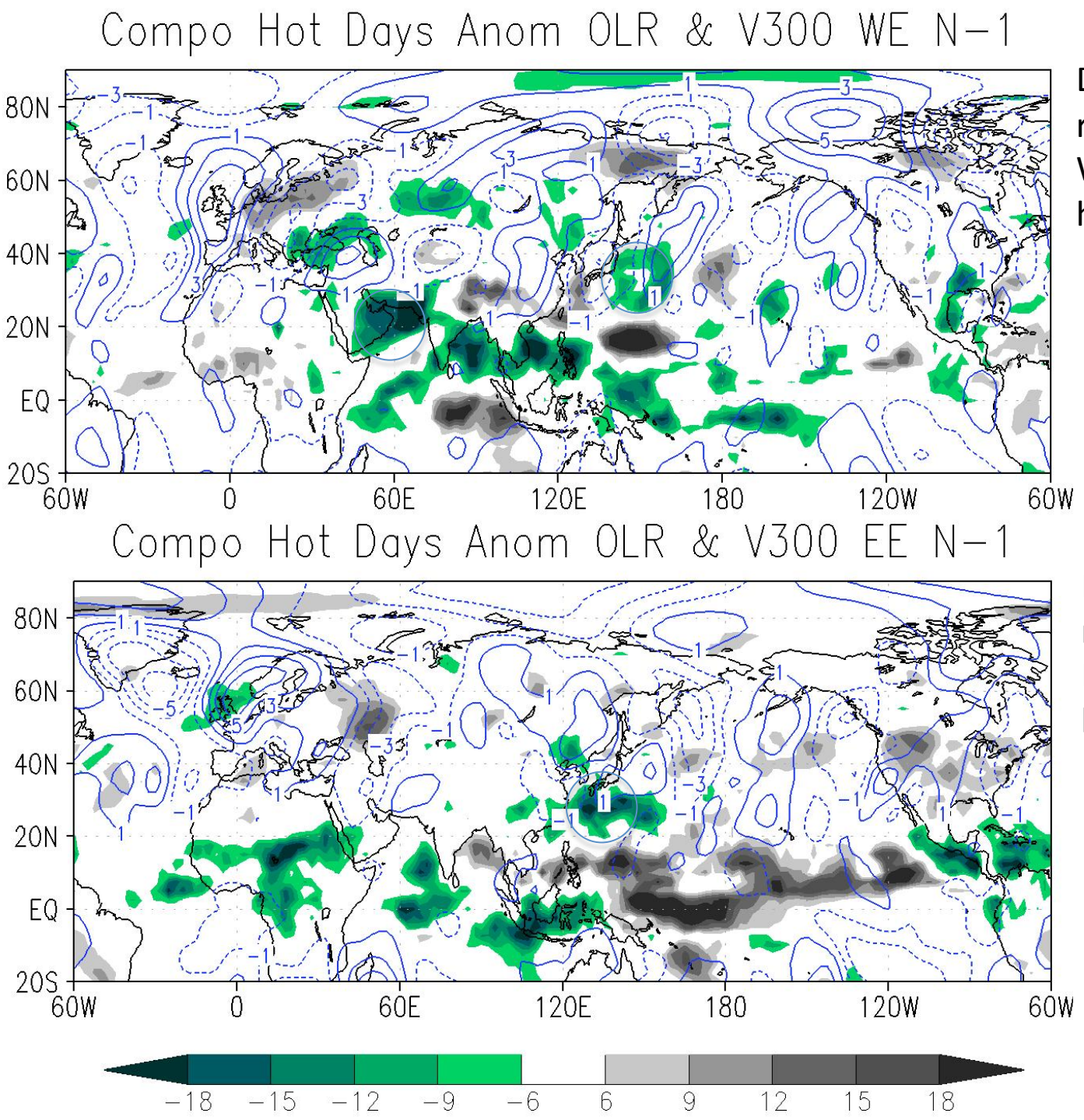



Behera et al. 2012, Clim Dyn.



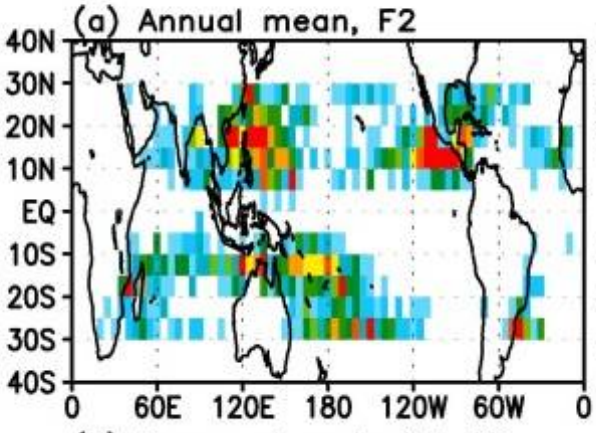



Diabatic heating related to Western Europe hot summers

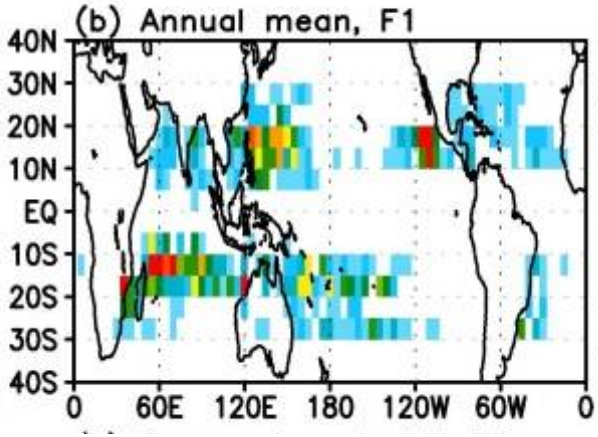
Diabatic heating related to Eastern Europe hot summers

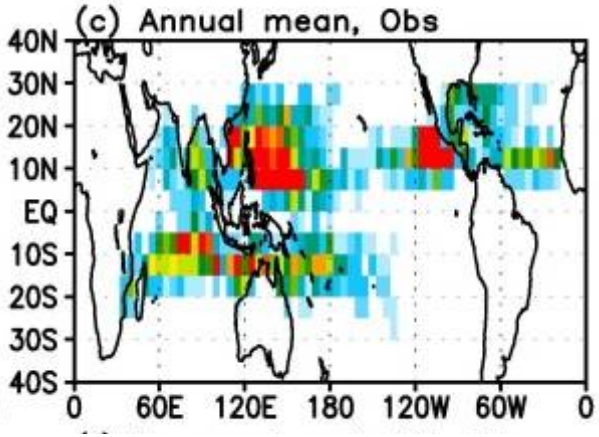
# Tropical cyclone simulations in SINTEX-F2

T319 (31L) + ORCA025 (46L)




T106 (19L) + ORCA2~0.5 (31L)



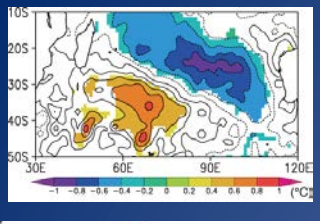


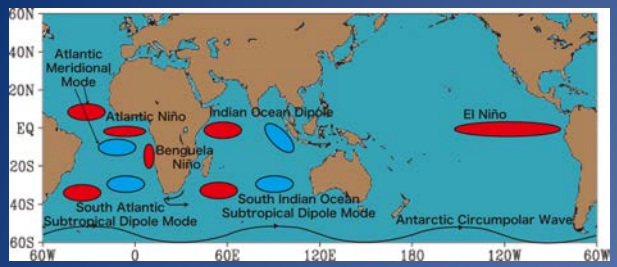
TC count X 10

| | Global | WNP | ENP | NI | AT | SI | SP |
|---|---|---|---|---|---|---|---|
| **SINTEX-F2 (hires)** | **85** | **21.5** | **15.5** | **3.7** | **9.3** | 14.2 | 20.7 |
| **SINTEX-F1** | 46.6 | 10.3 | 5.2 | 2.4 | 3.3 | **15** | **9.6** |
| **Observation** | 81.4 | 27.6 | 15.6 | 4.6 | 9.1 | 16.8 | 9.8 |

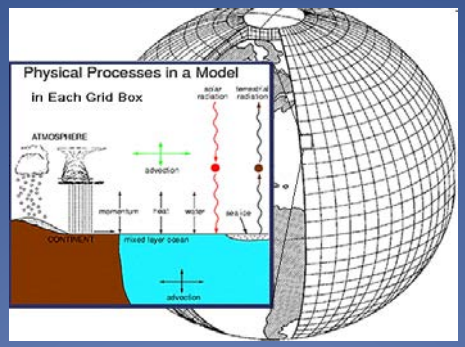
- TC genesis location is generally simulated by SINTEX-F2 and F1.
- The SINTEX-F2 well simulates the annual mean of TC genesis frequency as observed.

# SATREPS South Africa Project

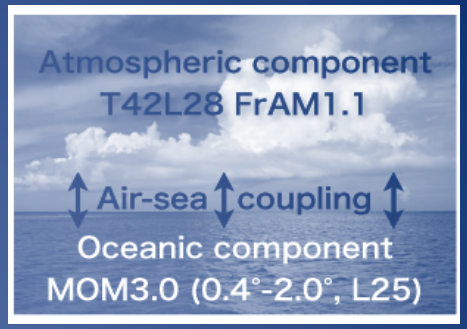





**Evaluating Predictability**




**Global-scale climate prediction**




**Improving CGCMs**

**Network**

**Regional climate prediction**

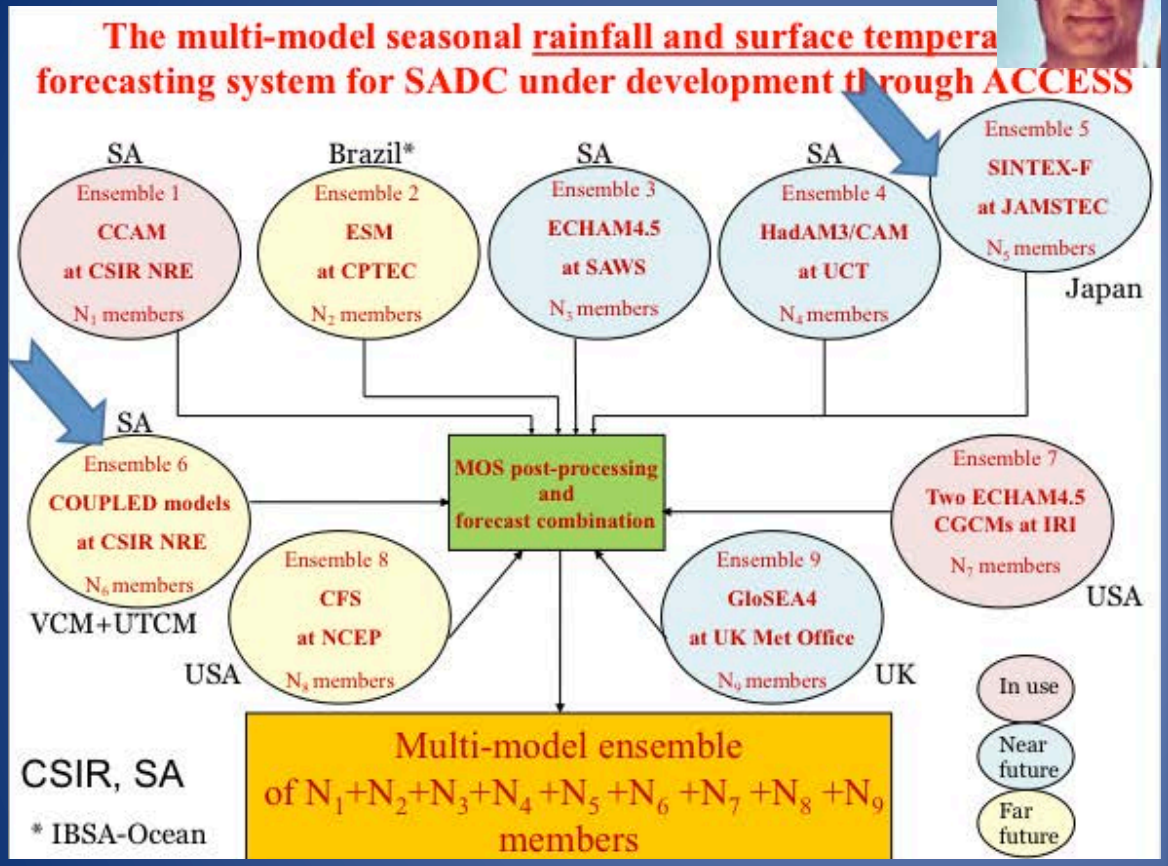
JAMSTEC, U. Tokyo, ACCESS, U. Cape Town, U. Pretoria, ARC, CSIR

Science and Technology Research Partnership for Sustainable Development

**Capacity of seasonal climate prediction in South Africa is enhanced so that it can be applied to management of environmental problems in the Southern African Region.**

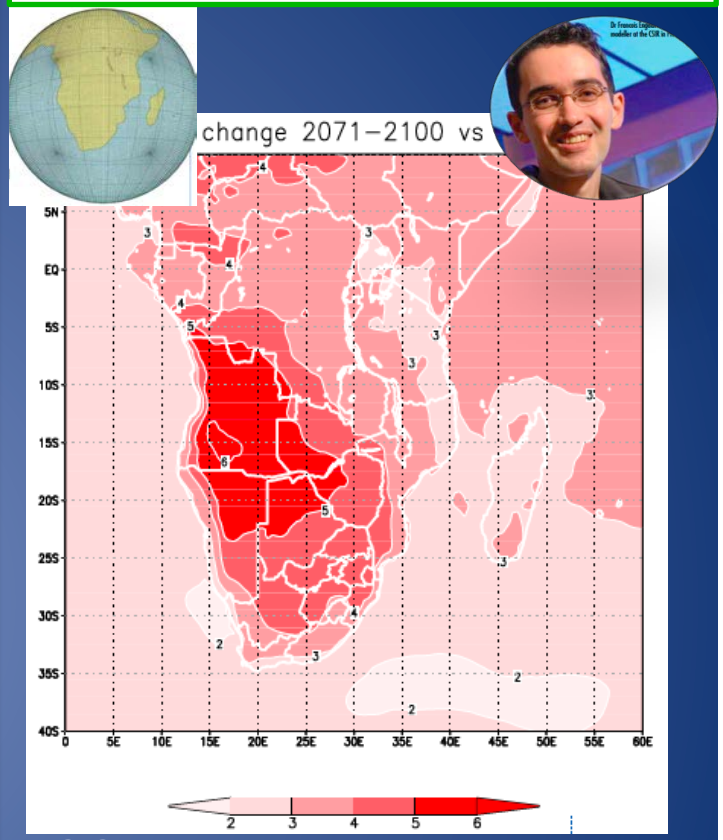
**Improving Early Prediction System**

## JAMSTEC and U. Tokyo Collaborative Studies for Climate Variations Predictions




Development of multi-model seasonal to interannual climate prediction system in South Africa.

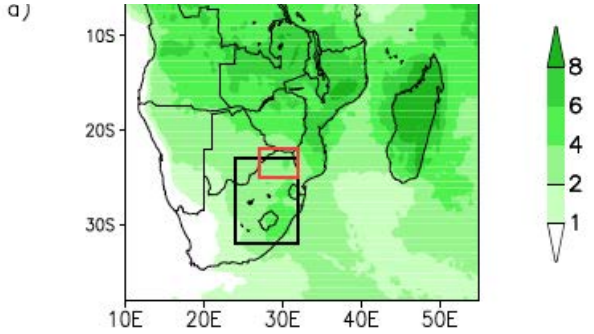
## U. Tokyo Collaborative Study for Climate Change Projections.




CCAM ensemble average projected change in mid-summer temperature (°C) over southern Africa. The model projection for the period 2071-2100 relative to 1961-1990 is more than 4°C.

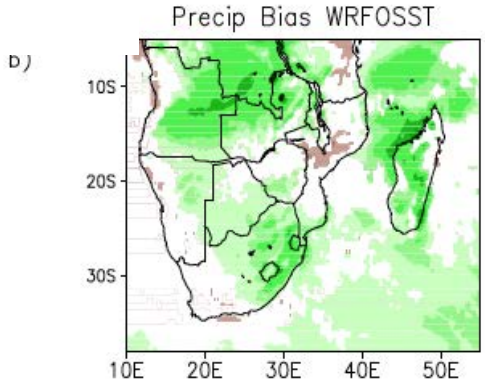
# Downscaling Experiments with WRF Coupled to ML Model

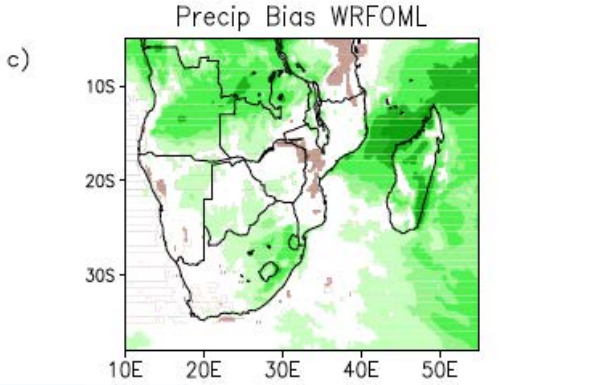
TRMM DJF1998-99 to DJF2009-10 mean precipitation (mm/day)

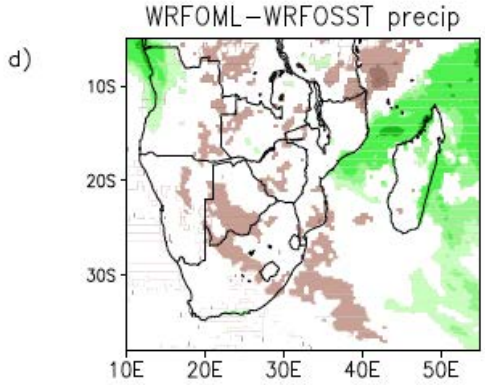


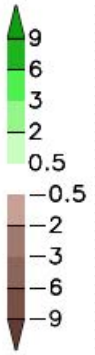






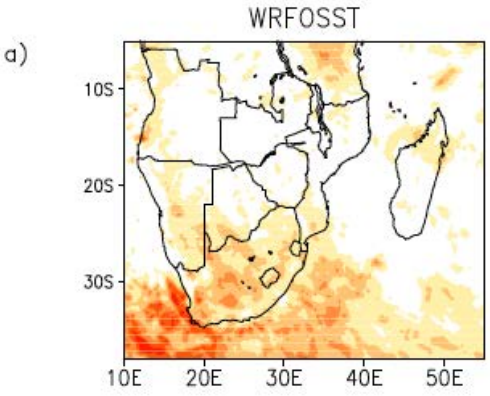



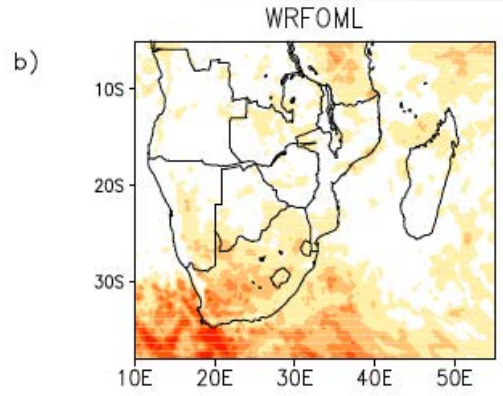

WRFOML: WRF with ocean mixed layer

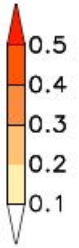
WRFOSST: WRF with obs Reynolds daily SST

Horizontal resolution 30Km with 23 vertical levels

Kain-Fritsch cumulus parameterization scheme




Daily precipitation correlations

Ratnam et al. 2012

# Meetings

- COP17 side events; 2-9 Dec 2011, Durban
- APEC Workshop on Climate Change Adaptation in the Asia-Pacific: Observations and Modeling Tools for Better Planning,  August 16-17, 2012, Singapore

- South Africa – Japan SATREPS Workshop/Symposium scheduled on October 19/20 2012
- International Symposium on Climate Applications scheduled for February 20-21 2013

# Climate Prediction Intercomparison Project Initiated by CLIVAR/WCRP WGSIP

## http://chfps.cima.fcen.uba.ar/