



# IRI Activities Update for WGSIP 18

**Andrew W Robertson**

International Research Institute  
for Climate and Society  
EARTH INSTITUTE | COLUMBIA UNIVERSITY

ANACIM, Dakar, 23-25 Nov 2016

# Outline

- Real-time seasonal forecast development
- S2S work
- Tool development



# ENSO Forecast Plume

Figure 1 is based on a consensus of CPC and IRI forecasters, in association with the official CPC/IRI ENSO Diagnostic Discussion

Figure 3 is purely objective, based on regression, using equally weighted model predictions from the plume

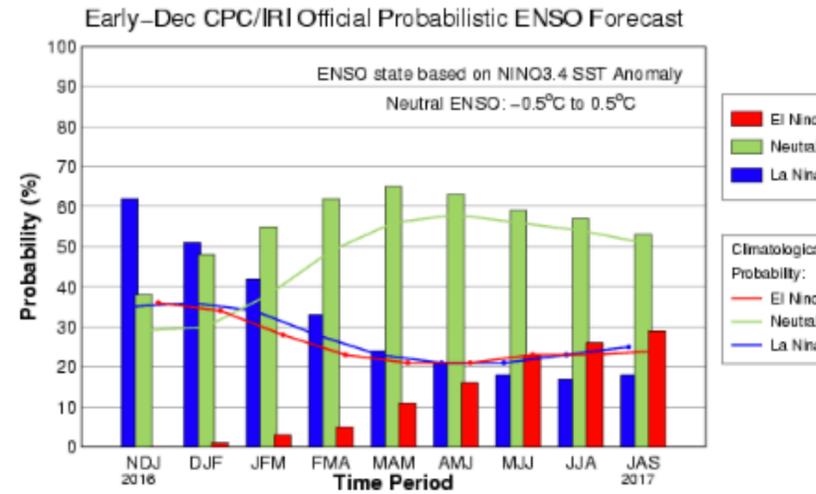


Figure 1

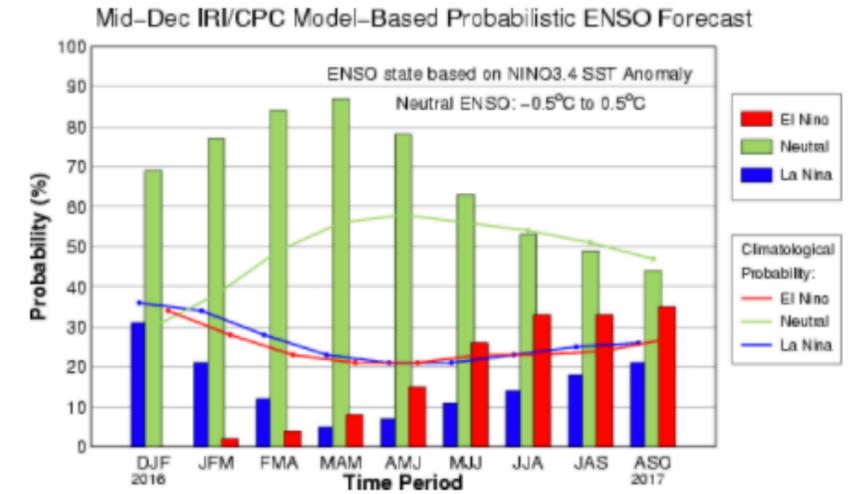


Figure 3

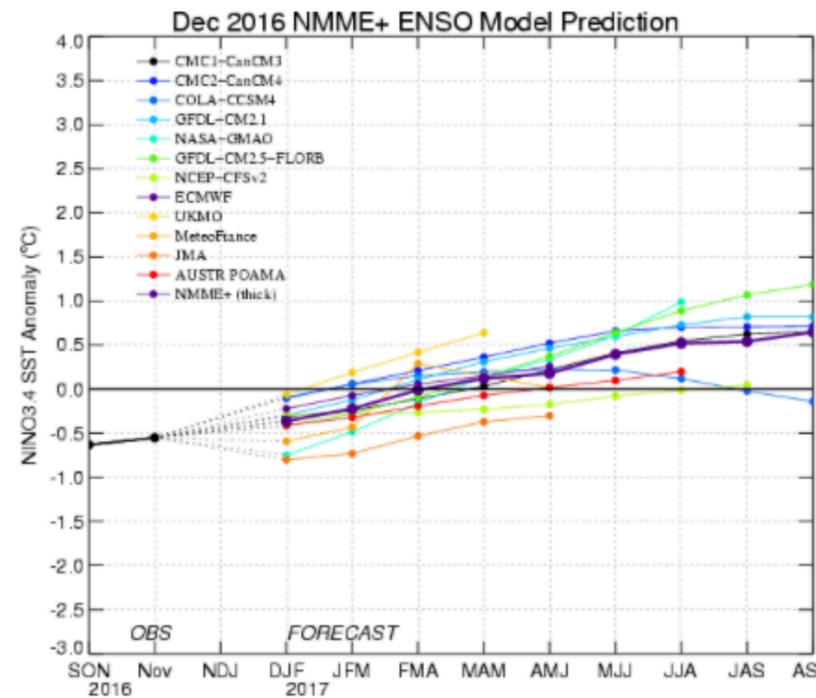


Figure 2

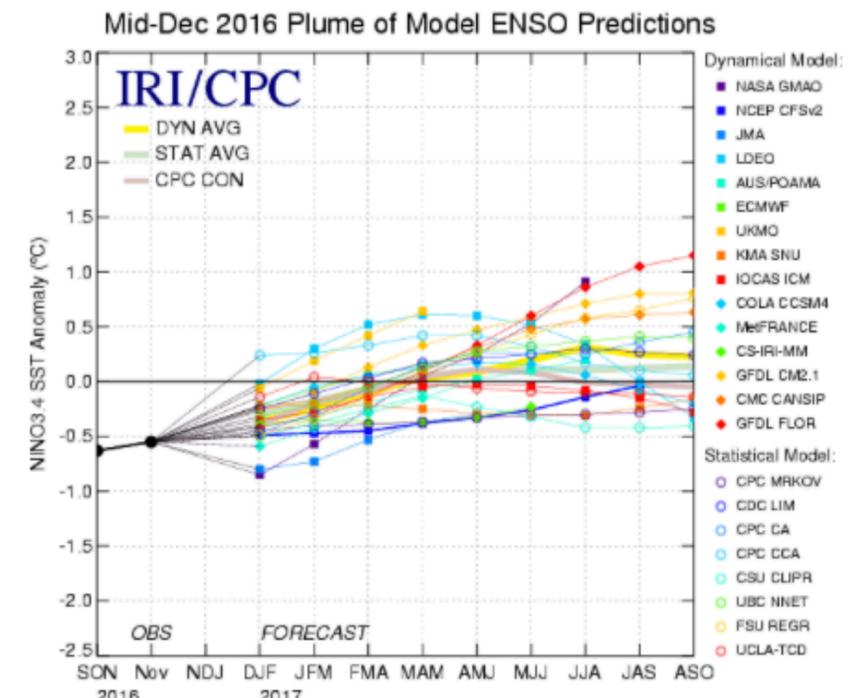


Figure 4



## Current “2-Tier” IRI Seasonal Forecast System

Ocean - {LDEO + CA + CFSv2} mean & 2 additional scenarios based on historical errors

Atmos - {Echam4.5, CCM3.6, COLA, GFDL} + CFSv2

### Post-Proc:

- Pattern-based correction of ensemble means
  - PC Regression based on tropical precip EOFs
  - Spread estimate from historical forecasts with forecast SST
- Equal weighting of corrected models
- Parametric forecast probabilities (T - Gaussian, P - transformed Gaussian)

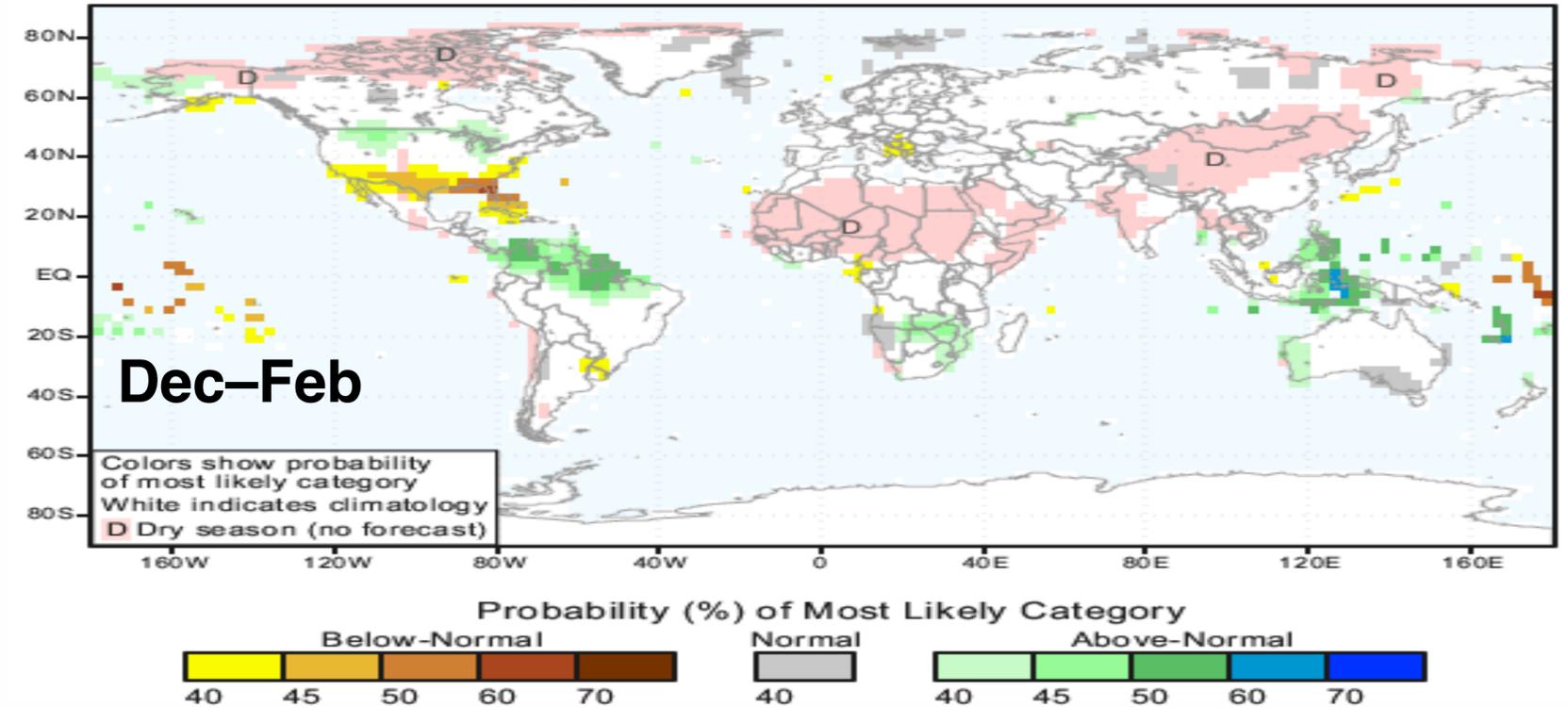
## New NMME-based System

So far: Simple pooling and counting

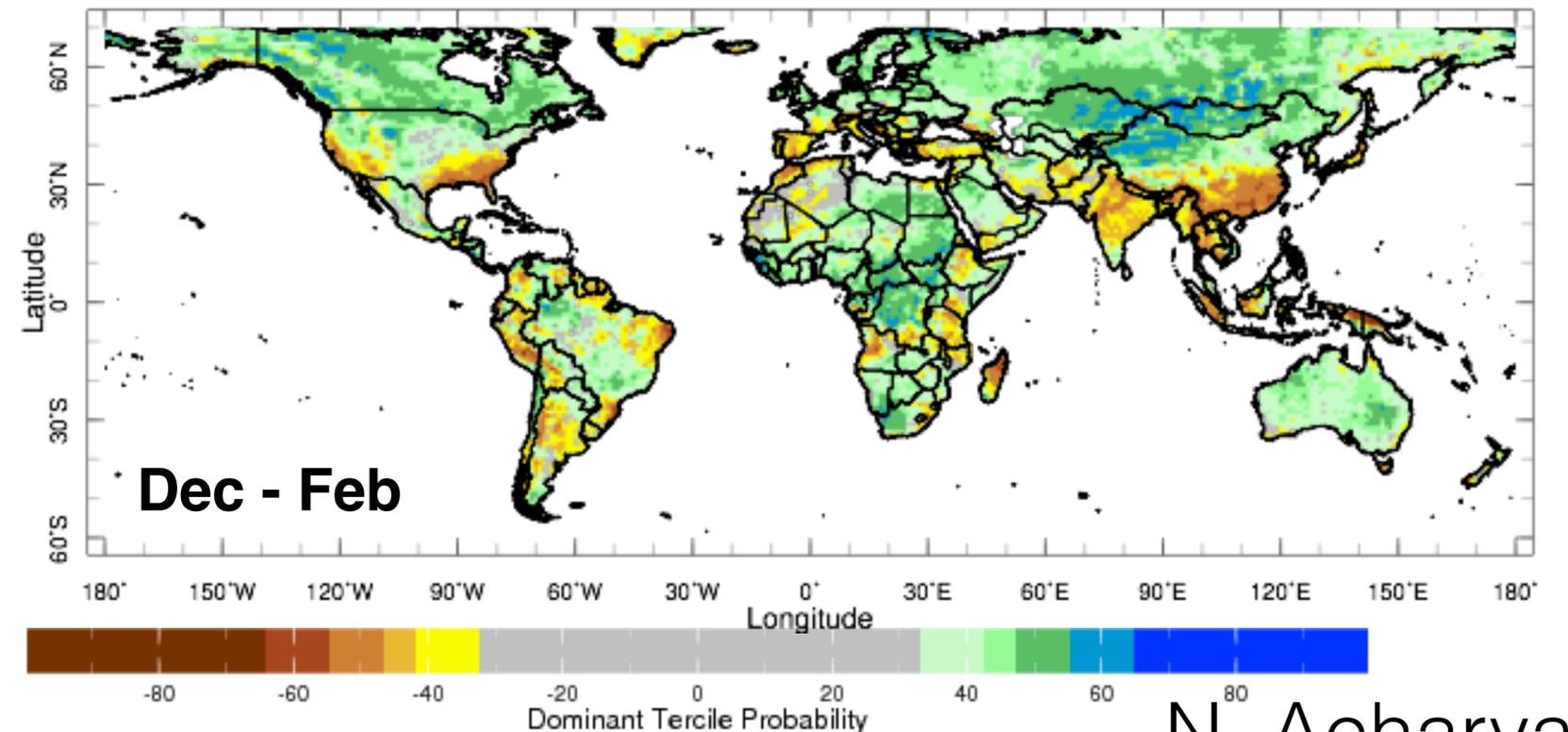
Next:

- (1) Ordinary regression of predicted versus observed probabilities for each tercile (van den Dool)
- (2) Extended logistic regression or PCR

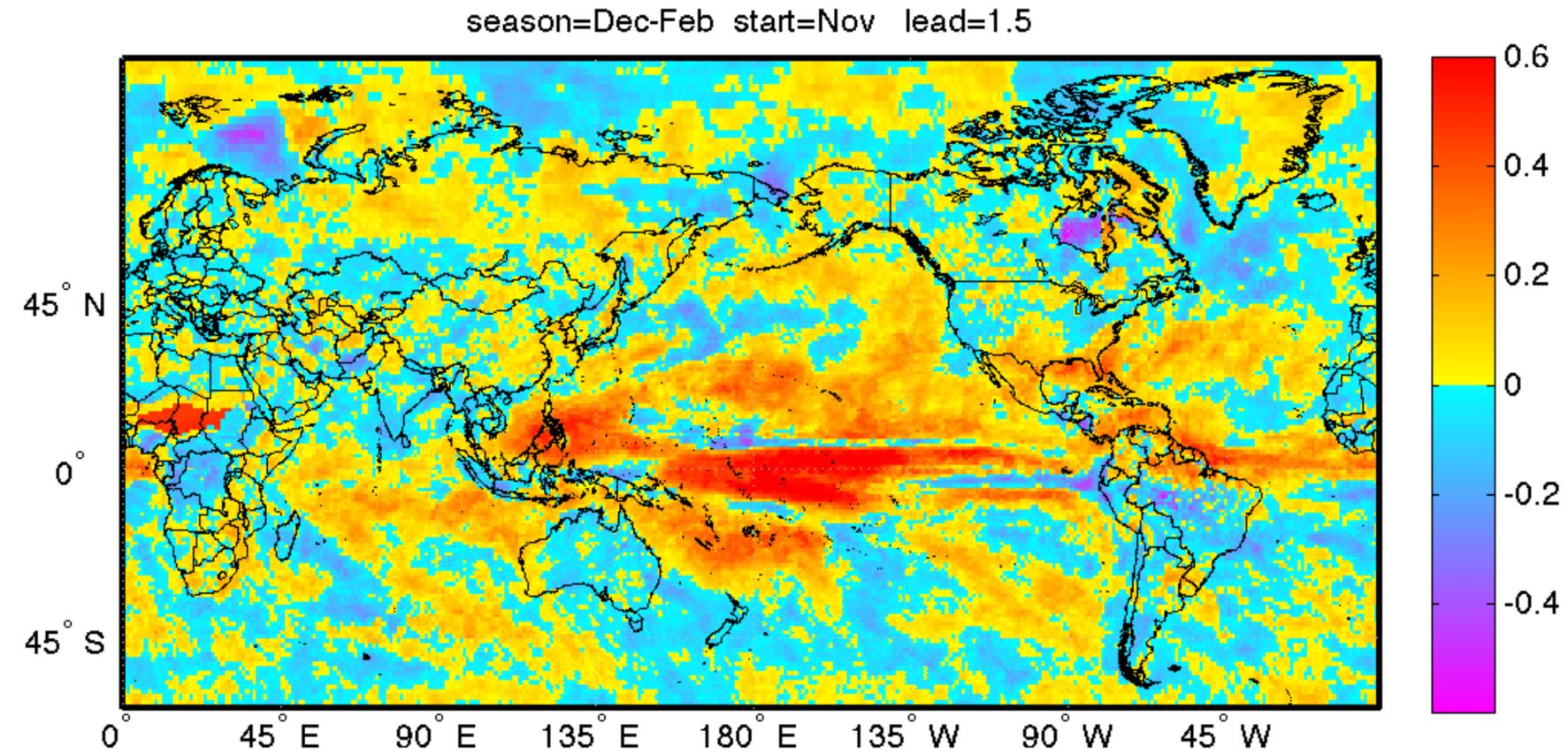
IRI Multi-Model Probability Forecast for Precipitation for December-January-February 2017, Issued November 2016



Experimental NMME based Seasonal Precipitation Forecast issued Nov 2016



# RPSS Skill of Prototype NMME-based forecast





## SCIPEA Climate Data Portal – to be hosted at ICPAC

Strengthening Climate Information Partnerships - East Africa is a UKaid-funded project of the WISER programme (Weather and climate Information and SERVICES for Africa).

**SCIPEA** aims to strengthen partnerships between organisations involved in production, use, research and training activities regarding seasonal climate forecast information, toward increased capacity for national/regional early warning and effective early actions. SCIPEA is led by the Met Office (UK), together with the IRI, the IGAD Climate Prediction and Applications Centre (ICPAC), and national meteorological services and universities/training and other centres from Ethiopia, Kenya, Tanzania and Uganda.

### Model Datasets

- [GPC Montreal](#)
- [GPC Washington](#)
- [GPC Exeter](#)
- [NASA](#)
- [GFDL](#)
- [CCSM4](#)

### Observation Datasets

- [CAM5 OPI Precipitation](#)
- [GHCN CAM5 Temperature](#)
- [ERSST Sea Surface Temperature](#)
- [Reanalysis Mean Sea Level Pressure](#)

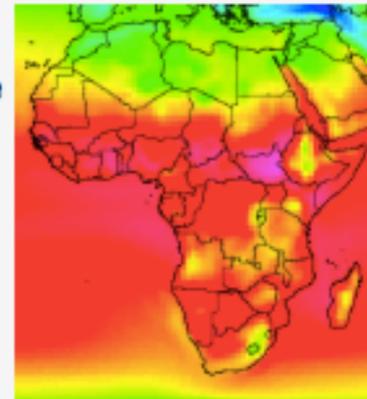
Forecasts

Observations

## Forecasts

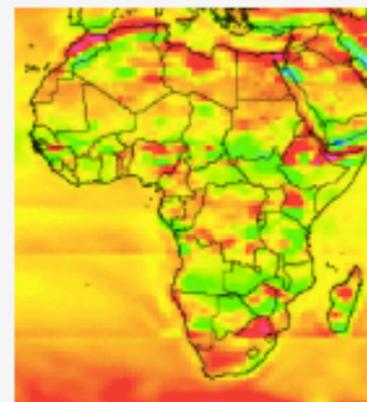
### GCM Forecast Climatology

These maps display climatological values of forecast 2-meter temperature, sea surface temperature, and precipitation at multiple leads and start times during the year for a selection of climate models. The climatological base period is 1982-2010 for CFSv2 and 1981-2010 for CMC1 and CMC2.



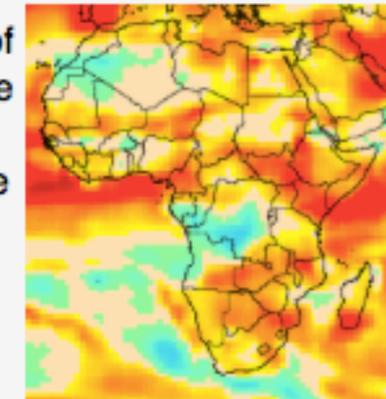
### GCM Forecast Anomaly

These maps display anomaly values of forecast 2-meter temperature, sea surface temperature, and precipitation at multiple leads for a selection of climate models. The climatological base period is 1982-2010 for CFSv2 and 1981-2010 for CMC1 and CMC2.



### Forecast Anomaly Correlation

These maps display anomaly correlations between hindcasts of 2-meter temperature, sea surface temperature, and observed values of the same variables at multiple leads for a selection of climate models. The range of years over which the correlation is calculated is 1982-2010 for CFSv2 and 1981-2010 for CMC1 and CMC2.



Portal: Portal  
Forecasts: Forecast Anomaly Correlation  
Region: Africa  
Timescale: Seasonal  
Model: CFSv2 (selected), CMC1, CMC2  
Variable: Precipitation  
Seasonal Lead Time: Seasonal Lead 1

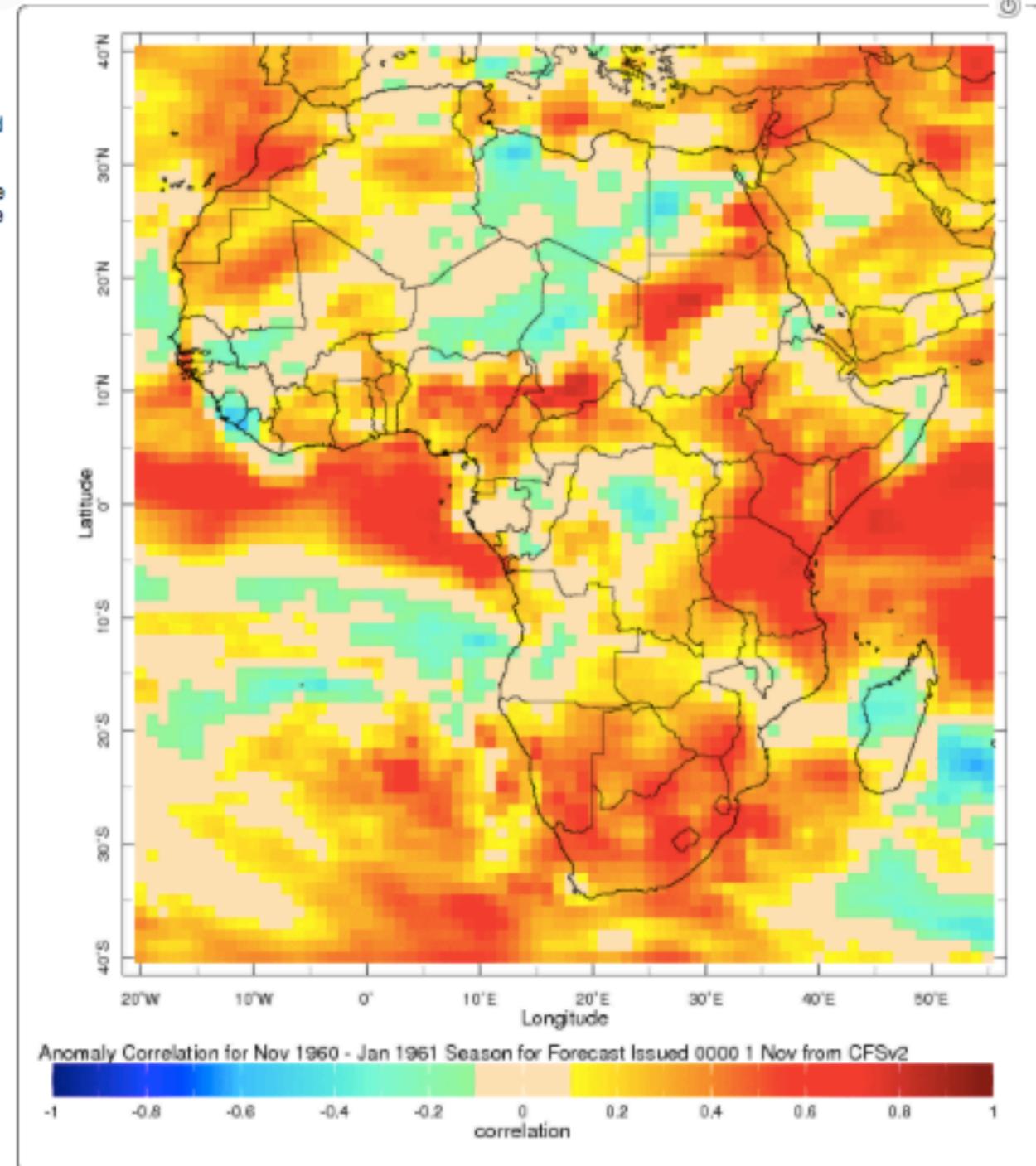
Description Instructions Contact Us

### Forecast Anomaly Correlation

These maps display anomaly correlations between hindcasts of 2-meter temperature, sea surface temperature, and precipitation and observed values of the same variables at multiple leads for a selection of climate models. The range of years over which the correlation is calculated is 1982-2010 for CFSv2 and 1981-2010 for CMC1 and CMC2.

Use the drop-down menus at the top of the page to select the model, variable, and seasonal lead. Mouse over the map to select the forecast start time from the control that appears just above the map. Select a combination of the forecast start time and the 3-month seasonal lead time to produce a map for a target season of the year. The forecast starts occur at the beginning of a month of the year, and adding together the forecast start time and the lead time (3-month seasonal lead) determines the season for which the hindcast is valid.

For example, for a seasonal forecast, the combination of a forecast start time of 0000 1 Sep and a 3-month seasonal lead of 1.5 months (the first seasonal lead) will produce a correlation anomaly map for the September-November 3-month season. The combination of a forecast start time of 0000 1 Sep and a 3-month seasonal lead of 2.5 months (the second seasonal lead) will produce a correlation anomaly map for the October-December season. The target season and start time will appear at the bottom of the map -- note that the displayed year of 1960 or 1961 is not relevant -- the correlation is calculated over 1982-2010 for CFSv2 and 1981-2010 for CMC1 and CMC2.



# S2S Data @ IRIDL

IRI Data Library ECMWF S2S

Language: english

Description Expert Mode

SOURCES ECMWF S2S

## ECMWF S2S

ECMWF S2S: Sub-seasonal to Seasonal P

### Documents

[overview](#) an outline showing sub-dataset  
[ECMWF](#) ECMWF S2S Wiki Page  
[S2S Project](#) S2S Project Page

### Datasets and Variables

[CMA](#) Beijing Climate Center (BCC) Climat  
[ECMF](#) ECMWF Ensemble.  
[NCEP](#) NCEP CFSv2 Ensemble.

Last updated: Tue, 15 Mar 2016 21:48:35 C

Share

Twitter Facebook Like 0 G+1

IRI Data Library ECMWF S2S ECMF forecast control

Description Views Data Selection Data Files Data Tables Expert Mode

SOURCES ECMWF S2S ECMF forecast control

## ECMWF S2S ECMF forecast control

forecast control from ECMWF S2S ECMF: ECMWF Ensemble.

### Documents

[outline](#) an outline showing all sub-datasets and variables contained in this dataset

### Datasets and Variables

<a href="#">10_m_above_ground</a>	ECMWF S2S ECMF forecast control 10_m_above_ground[10u 10v
<a href="#">Surface Air Temperature</a>	ECMWF S2S ECMF forecast control 2t[ X Y I LA S]
<a href="#">320_K_isentropic_level</a>	ECMWF S2S ECMF forecast control 320_K_isentropic_level[pv ]
<a href="#">Convective Available Potential Energy</a>	ECMWF S2S ECMF forecast control cape[ X Y I LA S]
<a href="#">mean_sea_level</a>	ECMWF S2S ECMF forecast control mean_sea_level[msl ]
<a href="#">pressure_level</a>	ECMWF S2S ECMF forecast control pressure_level[q v w u gh ]
<a href="#">surface</a>	ECMWF S2S ECMF forecast control surface[tp ]
<a href="#">top_of_atmosphere</a>	ECMWF S2S ECMF forecast control top_of_atmosphere[ttr ]

### Independent Variables (Grids)

Lead (forecast_period)	grid: /L (days) ordered (0.0 days) to (46.0 days) by 1.0 N= 47
Lead (forecast_period)	grid: /LA (days) ordered (0.5 days) to (45.5 days) by 1.0 N= 4
Pressure level (air_pressure)	grid: /P (mb) ordered [ (850) ] :grid
Pressure level (air_pressure)	grid: /P (mb) ordered [ (850) (500) (200) ] :grid
Pressure level (air_pressure)	grid: /P (mb) ordered [ (500) ] :grid
Pressure level (air_pressure)	grid: /P (mb) ordered [ (850) ] :grid
forecast start time (forecast_reference_time)	grid: /S (days since 1960-01-01) ordered (0000 1 Jun 2015) 1
longitude (longitude)	grid: /X (degree_east) periodic (0) to (1.5W) by 1.5 N= 240 pt
latitude (latitude)	grid: /Y (degree_north) ordered (90N) to (90S) by 1.5 N= 121

iridl.ideo.columbia.edu

CentrealAfrica wiki IRI Projects MC-S2S CU Global Travel Benno's Home Page ICPAC Portal Global Support

IRI Wiki Pages | Climate / 2016 Workshop on Sub-Seasonal to sea... DLAAuth - Sign in

Local OpenID Social

### Social sign in

Google

Sign in Cancel

IRI Data Library ECMWF S2S ECMF reforecast perturbed

Description Views Data Selection Data Files Data Tables Expert Mode

SOURCES ECMWF S2S ECMF reforecast perturbed

## ECMWF S2S ECMF reforecast perturbed

reforecast perturbed from ECMWF S2S ECMF: ECMWF Ensemble.

### Documents

[outline](#) an outline showing all sub-datasets and variables contained in this dataset

### Datasets and Variables

<a href="#">10_m_above_ground</a>	ECMWF S2S ECMF reforecast perturbed 10_m_above_ground[10u 10v ]
<a href="#">Surface Air Temperature</a>	ECMWF S2S ECMF reforecast perturbed 2t[ X Y I M LA S hdate]
<a href="#">320_K_isentropic_level</a>	ECMWF S2S ECMF reforecast perturbed 320_K_isentropic_level[pv ]
<a href="#">Convective Available Potential Energy</a>	ECMWF S2S ECMF reforecast perturbed cape[ X Y I M LA S hdate]
<a href="#">mean_sea_level</a>	ECMWF S2S ECMF reforecast perturbed mean_sea_level[msl ]
<a href="#">pressure_level</a>	ECMWF S2S ECMF reforecast perturbed pressure_level[q v gh u w ]
<a href="#">surface</a>	ECMWF S2S ECMF reforecast perturbed surface[tp ]
<a href="#">top_of_atmosphere</a>	ECMWF S2S ECMF reforecast perturbed top_of_atmosphere[ttr ]

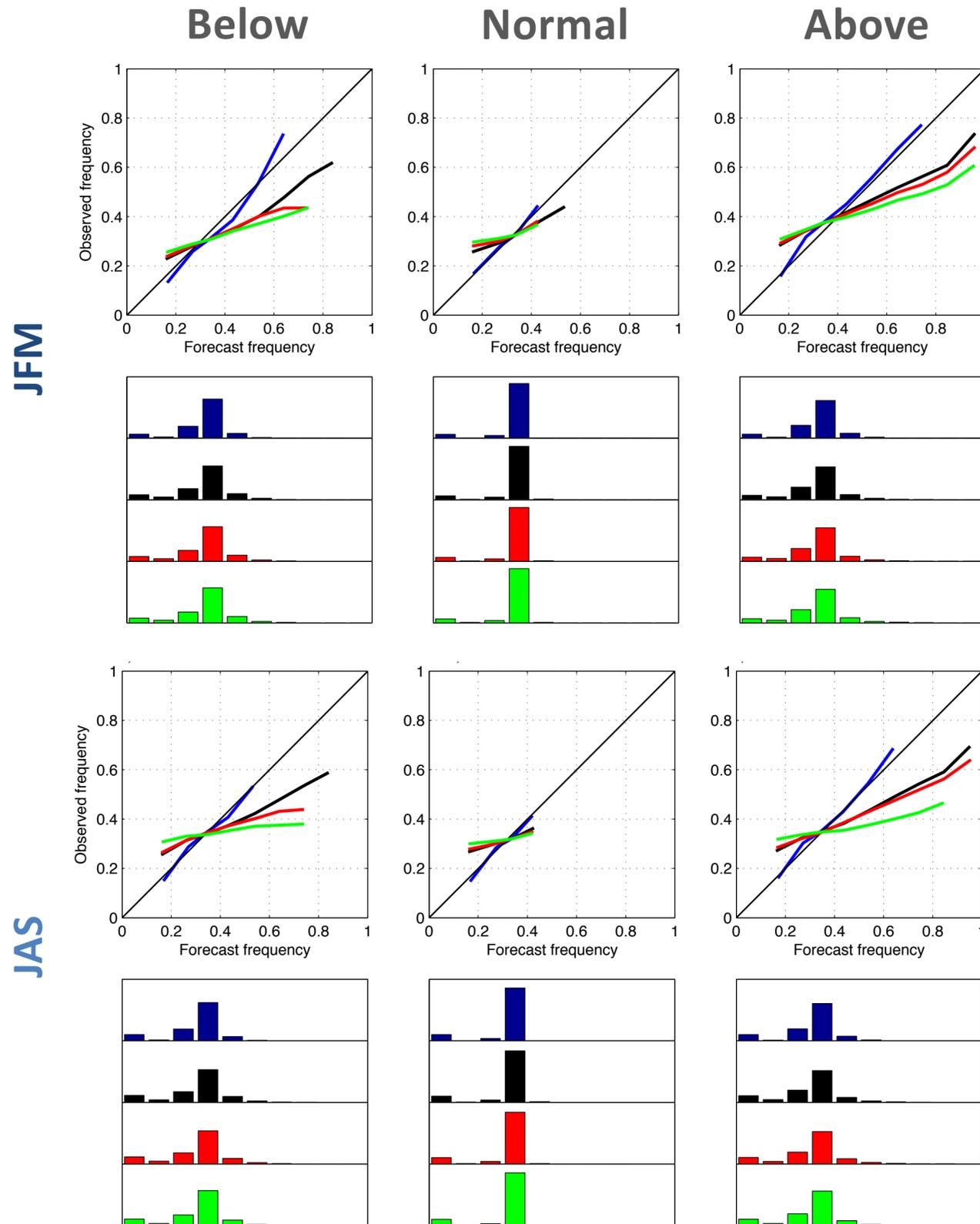
### Independent Variables (Grids)

hdate	grid: /hdate (months since 1960-01-01) ordered (1995) to (2015) by 12.0 N= 21 pts :grid
Lead (forecast_period)	grid: /L (days) ordered (0.0 days) to (46.0 days) by 1.0 N= 47 pts :grid
Lead (forecast_period)	grid: /LA (days) ordered (0.5 days) to (45.5 days) by 1.0 N= 46 pts :grid
Ensemble Member (realization)	grid: /M (unitless) ordered (1.0) to (10.0) by 1.0 N= 10 pts :grid
Ensemble Member (realization)	grid: /M (unitless) ordered (1.0) to (10.0) by 1.0 N= 10 pts :grid
Pressure level (air_pressure)	grid: /P (mb) ordered [ (850) ] :grid
Pressure level (air_pressure)	grid: /P (mb) ordered [ (850) (500) (200) ] :grid
Pressure level (air_pressure)	grid: /P (mb) ordered [ (500) ] :grid
Pressure level (air_pressure)	grid: /P (mb) ordered [ (850) ] :grid
forecast start time (forecast_reference_time)	grid: /S (days since 1960-01-01) ordered (0000 1 Jun 2015) to (0000 16 Jun 2016) by 1.0 N= 382 pts :grid
longitude (longitude)	grid: /X (degree_east) periodic (0) to (1.5W) by 1.5 N= 240 pts :grid
latitude (latitude)	grid: /Y (degree_north) ordered (90N) to (90S) by 1.5 N= 121 pts :grid

Last updated: Fri, 17 Jun 2016 14:53:52 GMT



# Multi-model ensemble of S2S forecasts

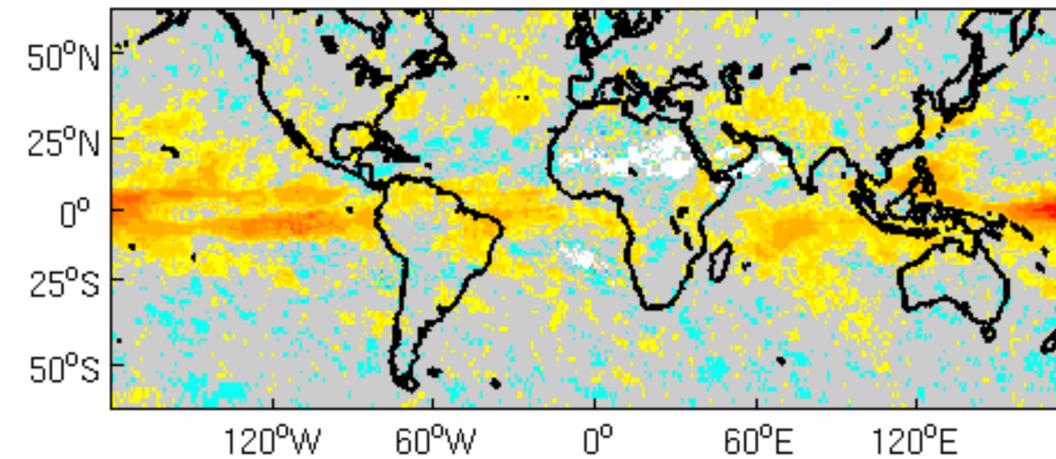


(6-week windows for terciles definition & ELR training)

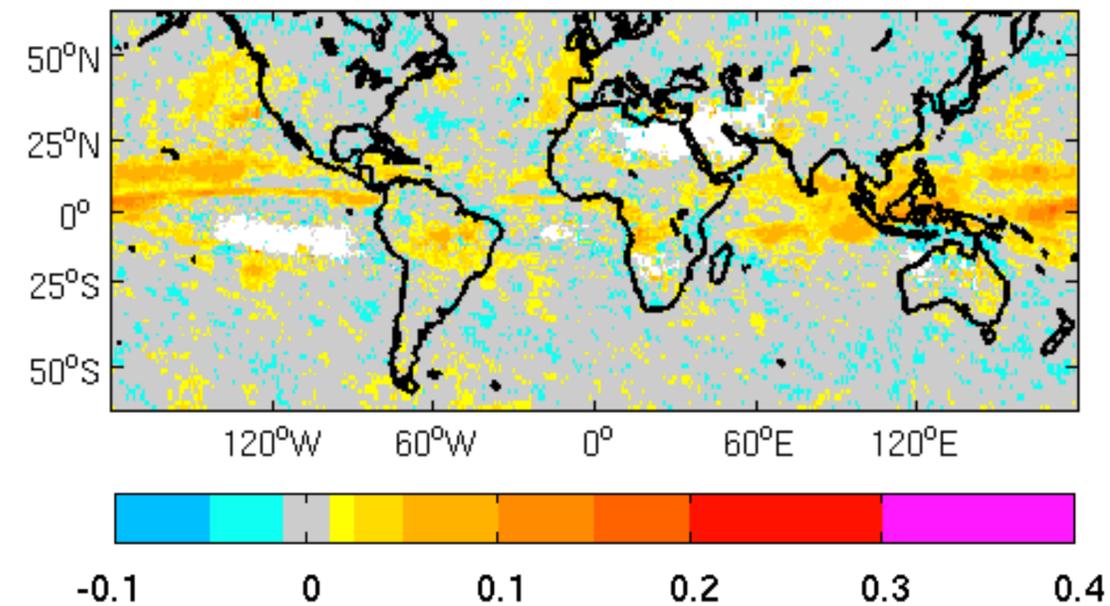
- MME Week3+4
- ECMF Week3+4
- CFS Week3+4
- CMA Week3+4

Reliability diagrams computed for all points within [60°S-60°N]

## JFM MME Week 3+4 RPSS



## JAS MME Week 3+4 RPSS

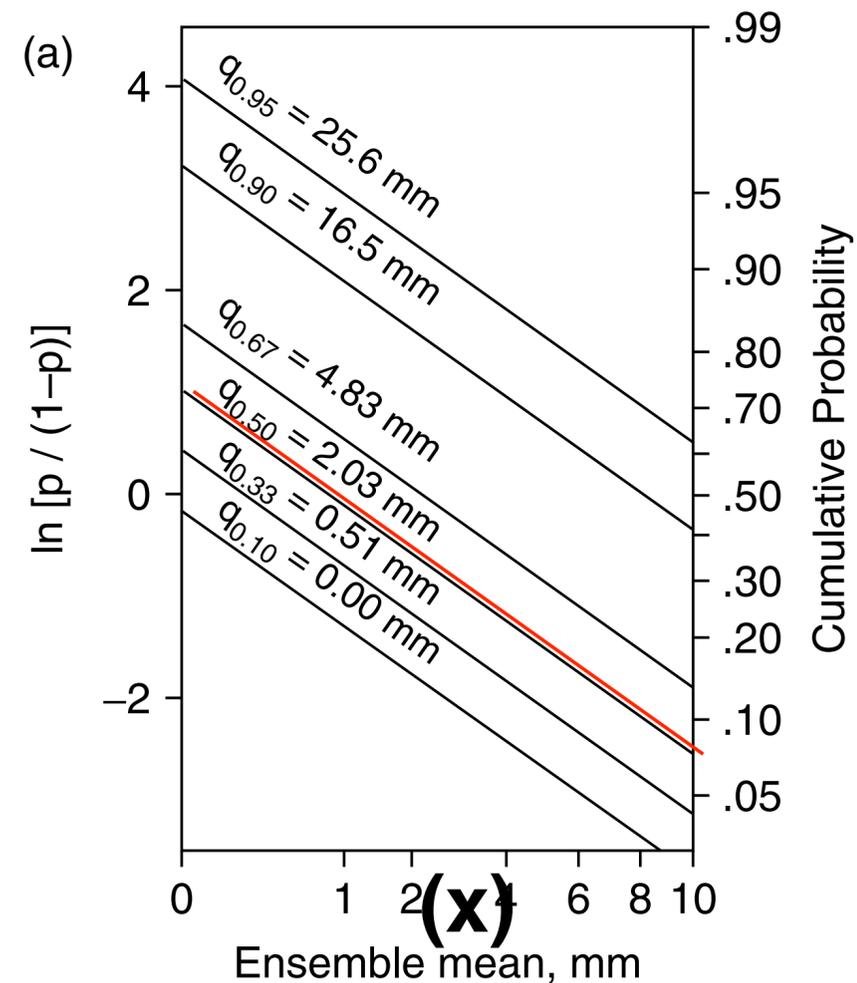


# Extended Logistic Regression (ELR)

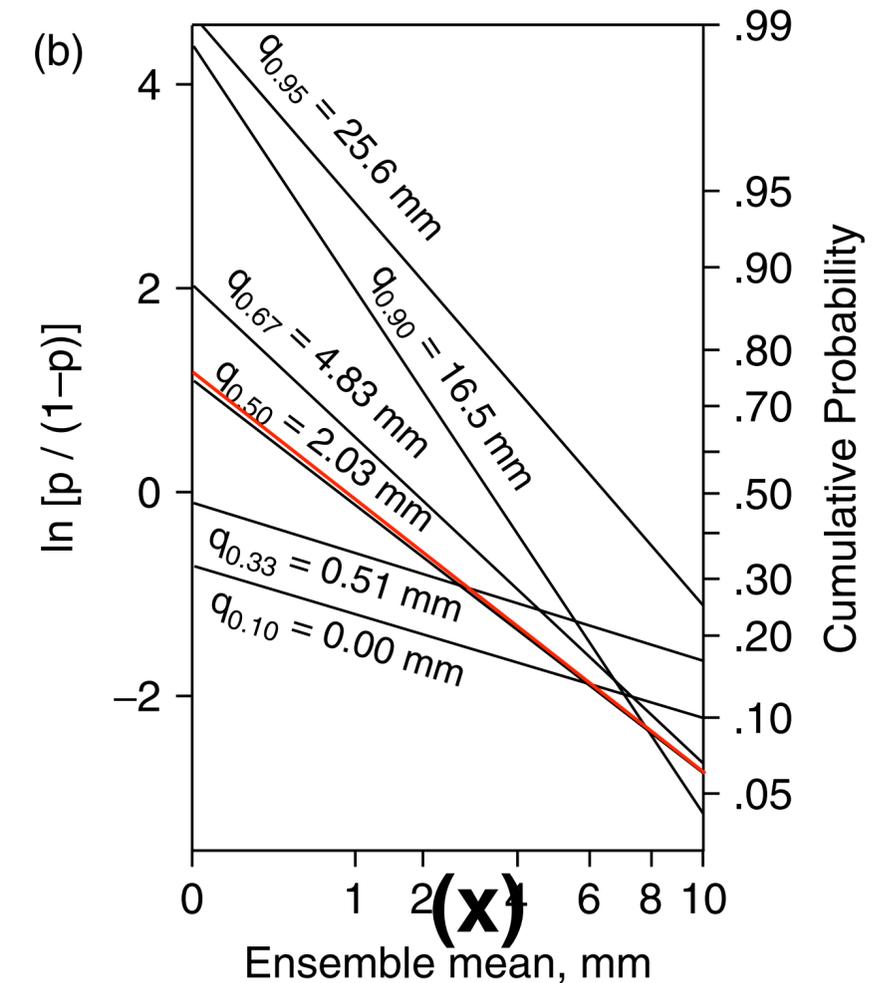
GFS Day 6–10 Precip  
Forecast for Minneapolis  
28 Nov – 2 Dec 2001

Wilks (2009)

$$\ln \left[ \frac{p(q)}{1 - p(q)} \right] = f(\mathbf{x}) + g(q)$$



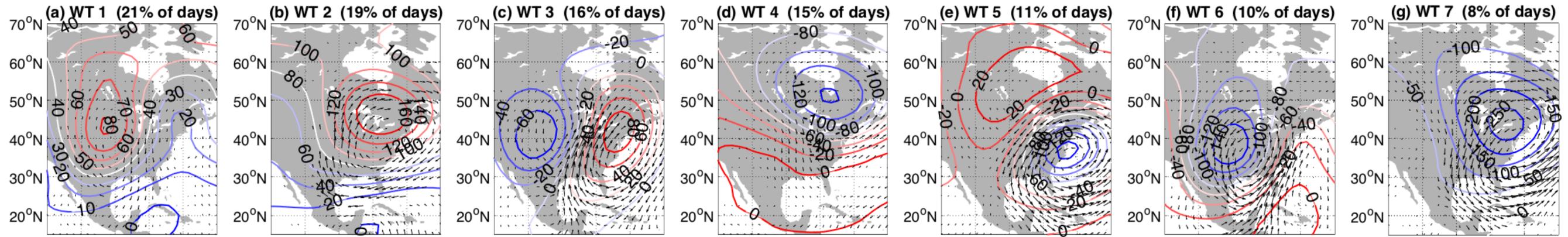
$$\ln \left[ \frac{p}{1 - p} \right] = f(\mathbf{x})$$



# Weather Types for GCM Diagnostics (MAM, 1981-2012, z500)

Muñoz *et al.*, in prep.

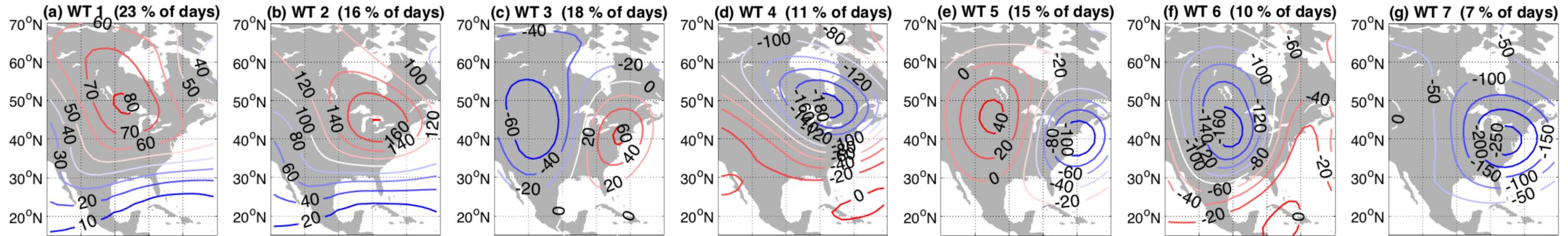
Obs



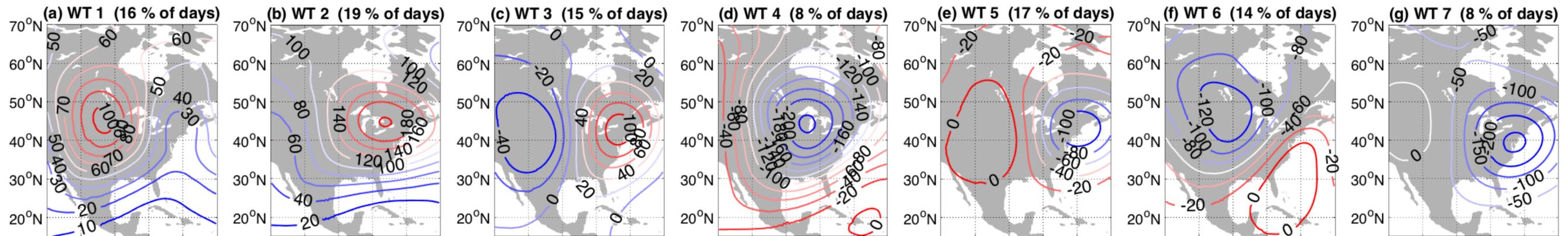
**Preferred transitions**

- 1->2->1
- 3->1->3
- 3->4->3
- 5->1,4,6
- 6->4,7
- 7->4

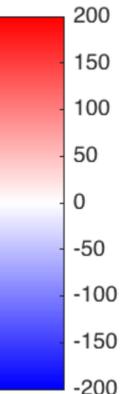
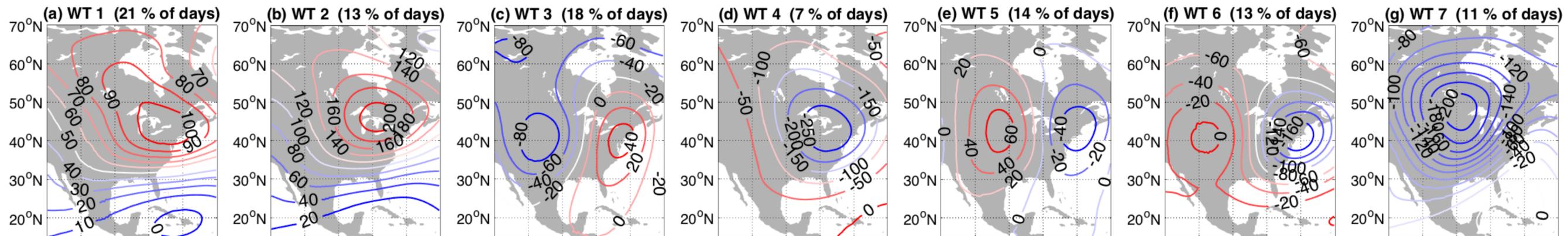
LOAR<sub>sst</sub>



FLOR<sub>sst</sub>



FLOR<sub>sst+strat</sub>



# Summary

- Experimental NMME-based seasonal forecast system
- GPC portal for East Africa
- S2S data in IRI Data Library
- Extended logistic regression for S2S forecast calibration

