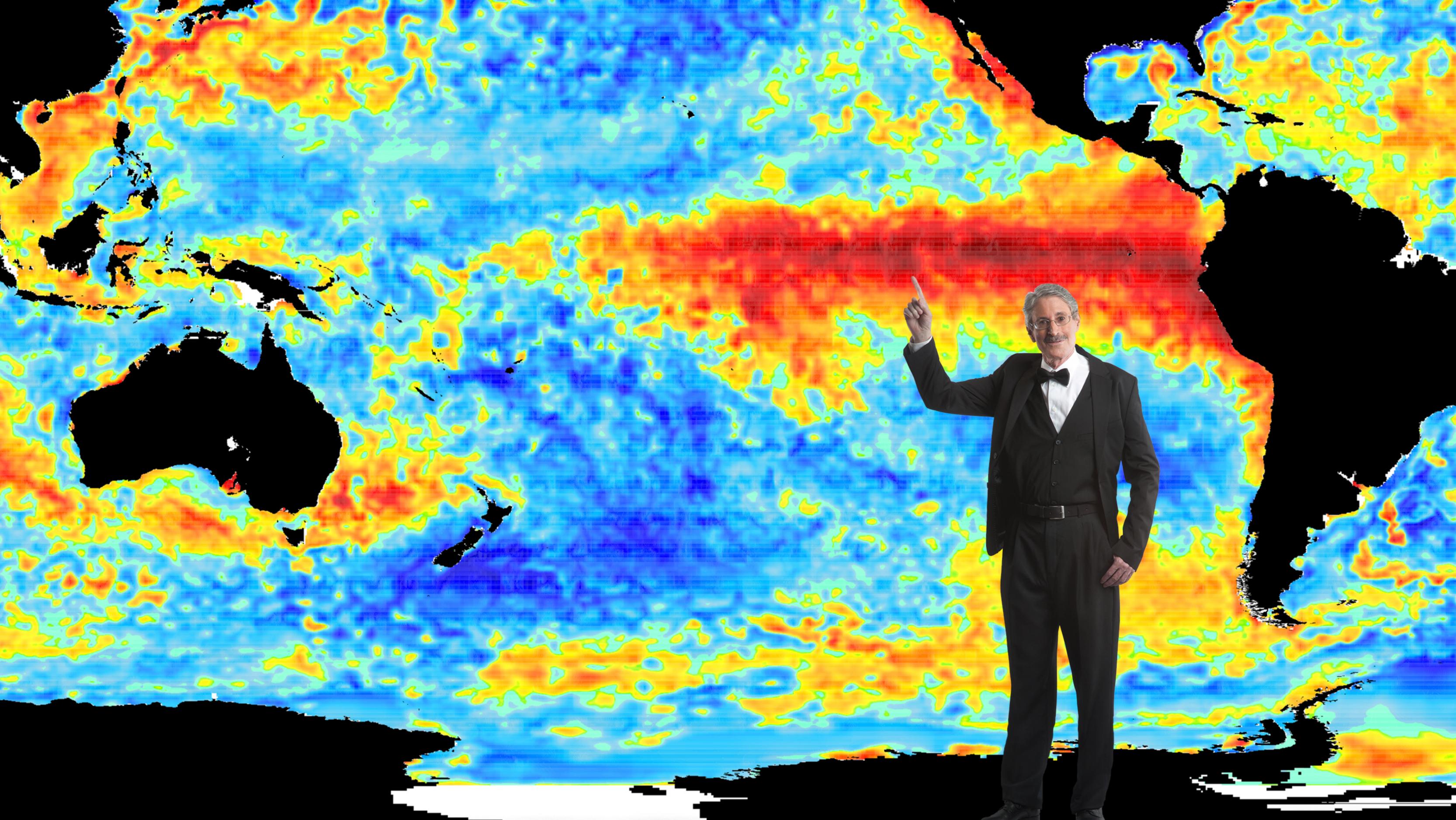


# The evolution of IRI's seasonal forecasting under Chief Forecaster Tony Barnston

Andrew W. Robertson



NINO3.4

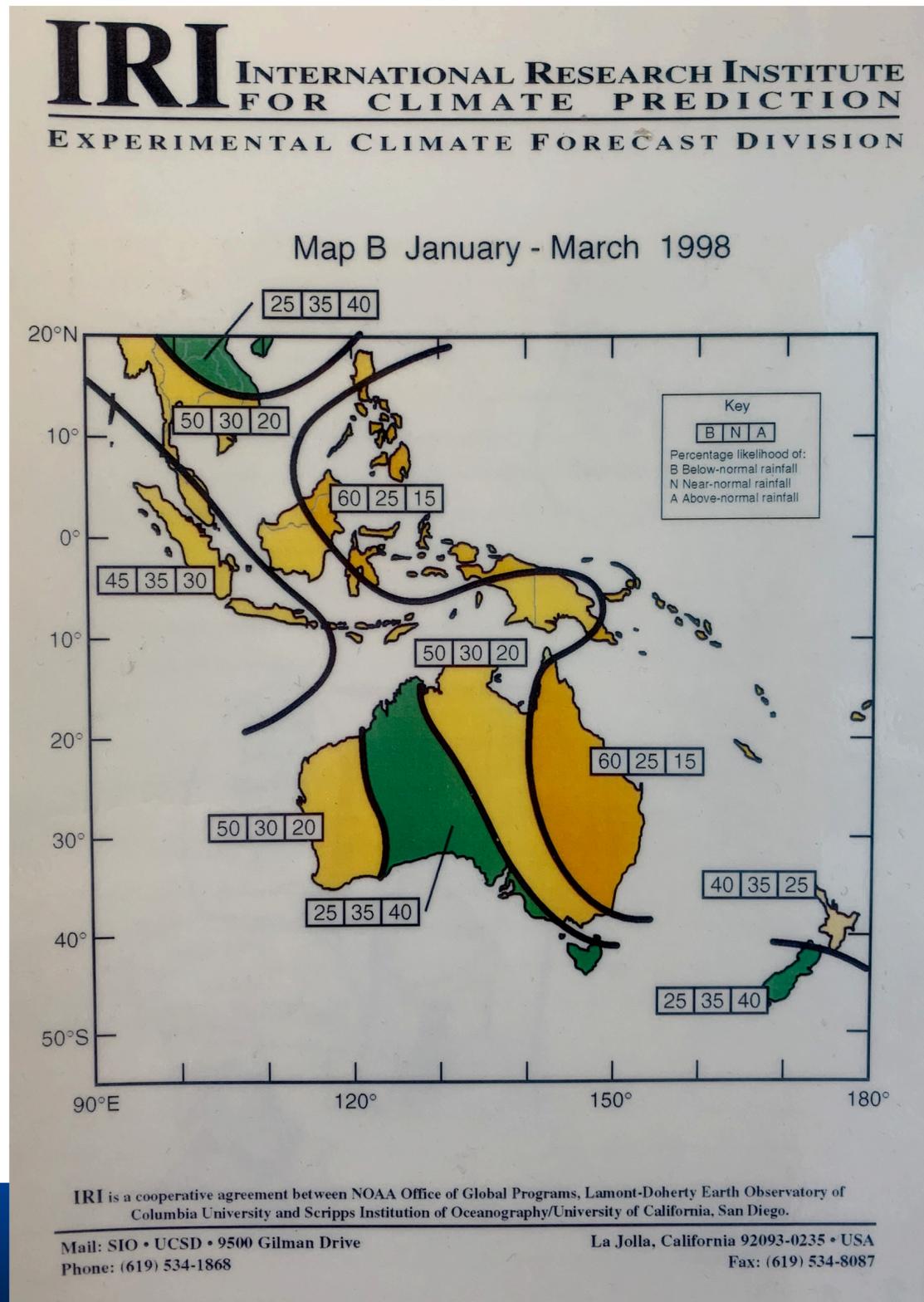


map source: [wikimedia/Dmthoth](https://commons.wikimedia.org/wiki/File:Pacific_Ocean_NINO3.4_region.png)

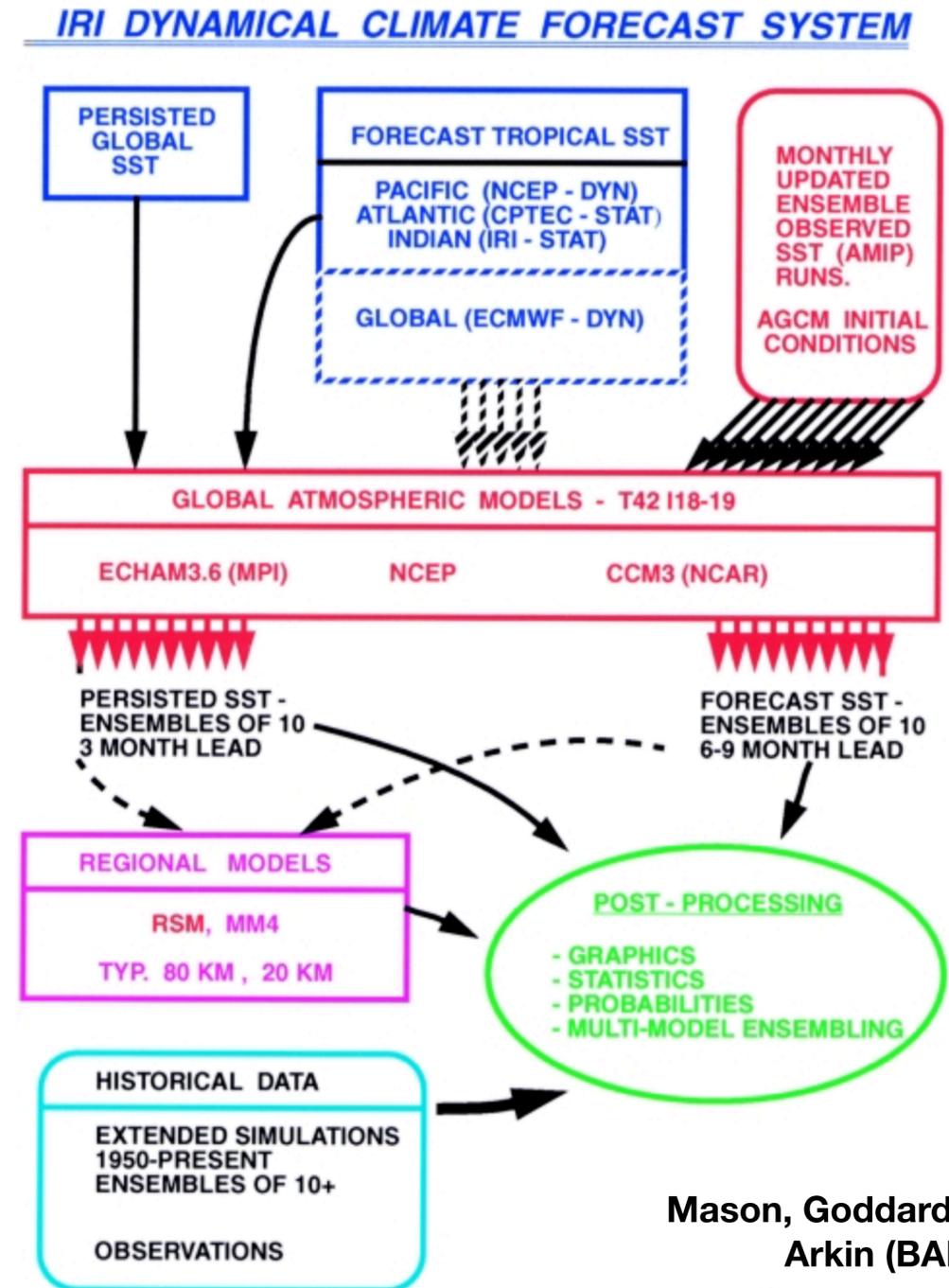


# The Early Days at Scripps, ca 1998

## “Net Assessment” Probabilistic Forecast



## Two-Tiered Multi-model Ensemble Prediction System



The IRI consolidates to Lamont  
in 1999.

Tony Barnston is lured away  
from CPC to be Head of Forecast  
Operations in June 2000.



Exterior view



# More objective Net Assessments quickly followed

## Issued each month and for all four overlapping 3-month periods between the first and second seasons

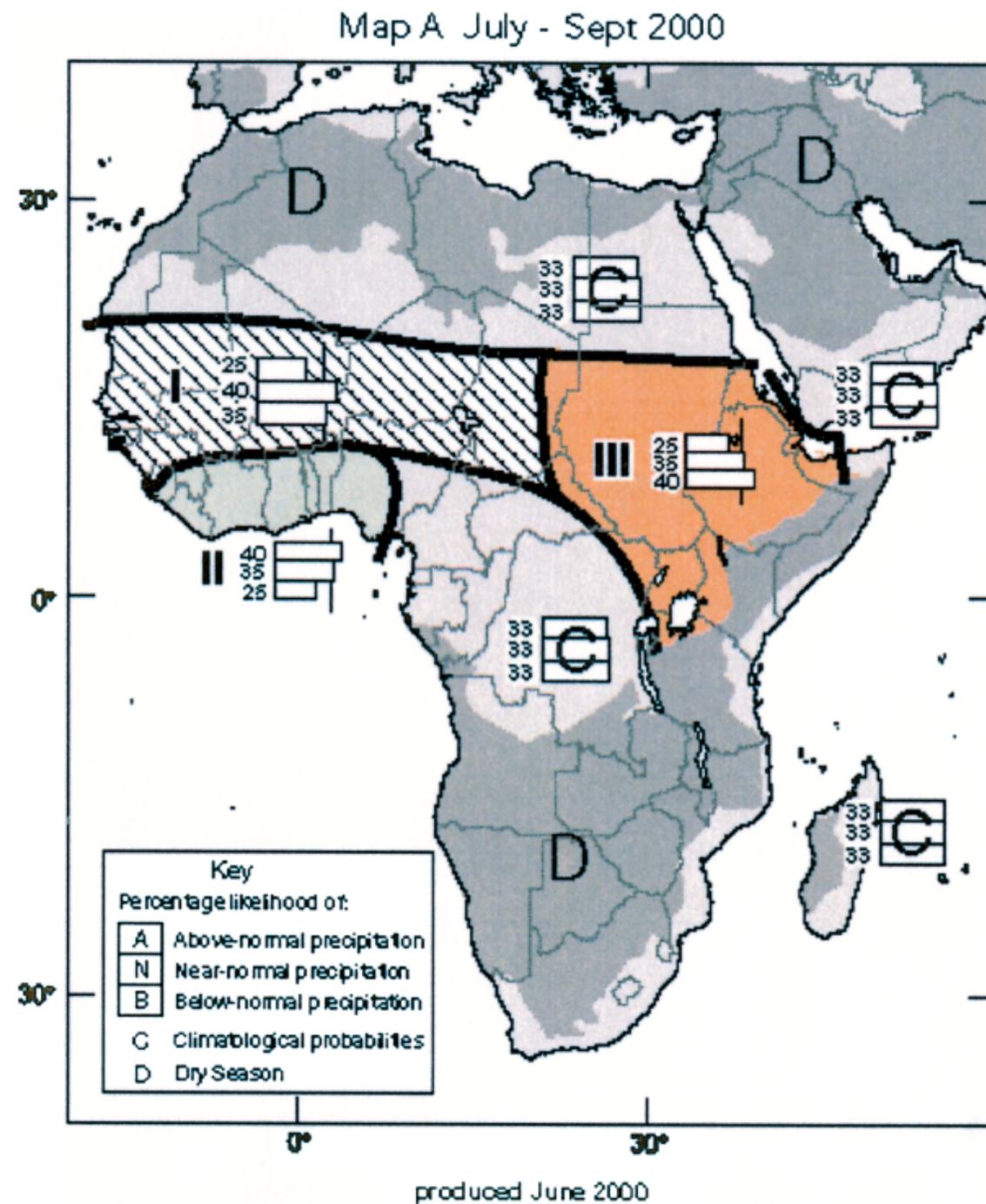
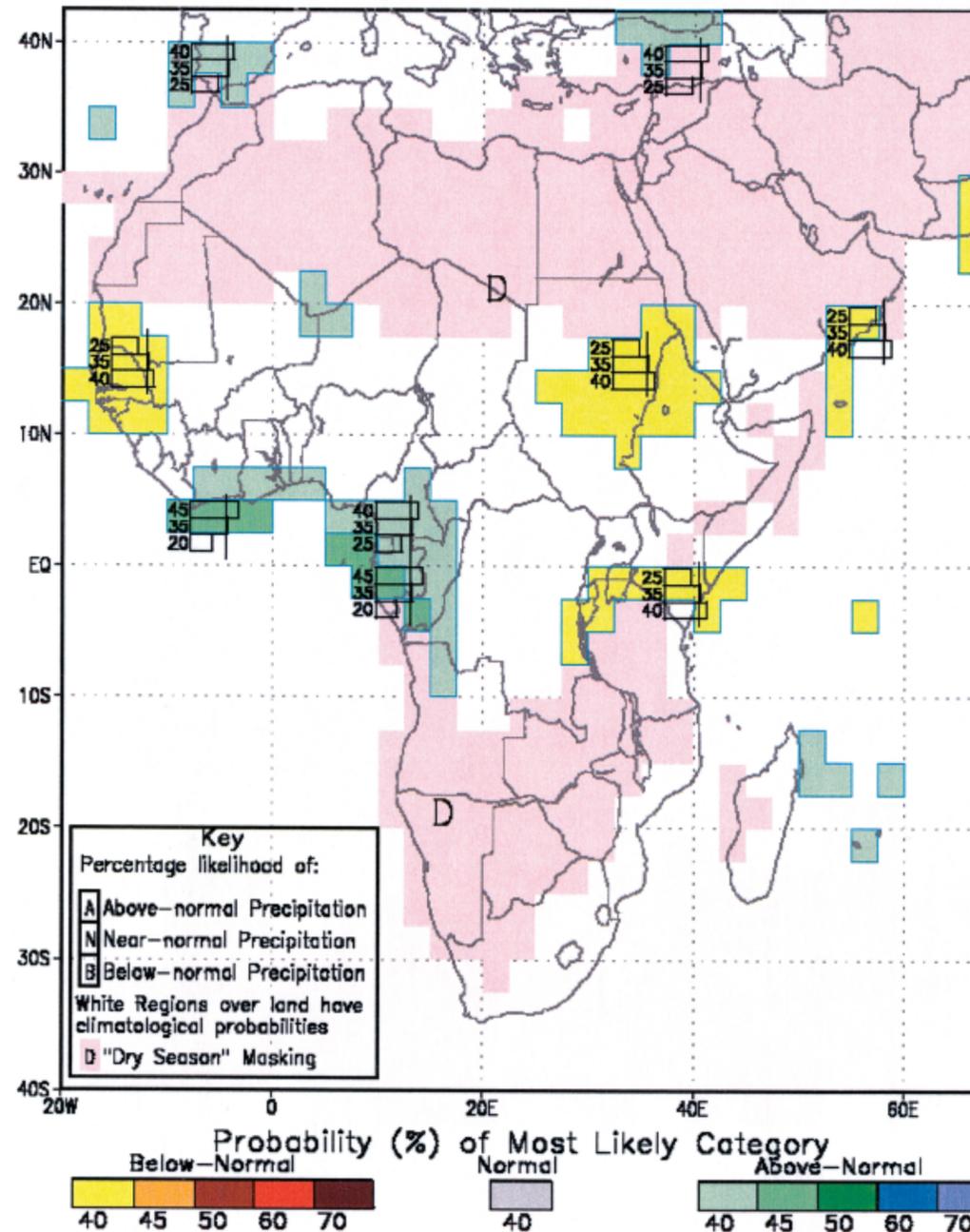


FIG. 2. Illustration of the IRI's forecast map graphic used before Jun 2001.

IRI Multi-Model Probability Forecast for Precipitation  
July-August-September 2002 made June 2002



2.5-deg precip  
2-deg temp  
(matching NOAA CMAP & CAMS resp.)

FIG. 3. Illustration of the IRI's forecast map graphic used since Jun 2001.

# Three additional AGCMs were added to the EPS in 2001

## MULTIMODEL ENSEMBLING IN SEASONAL CLIMATE FORECASTING AT IRI

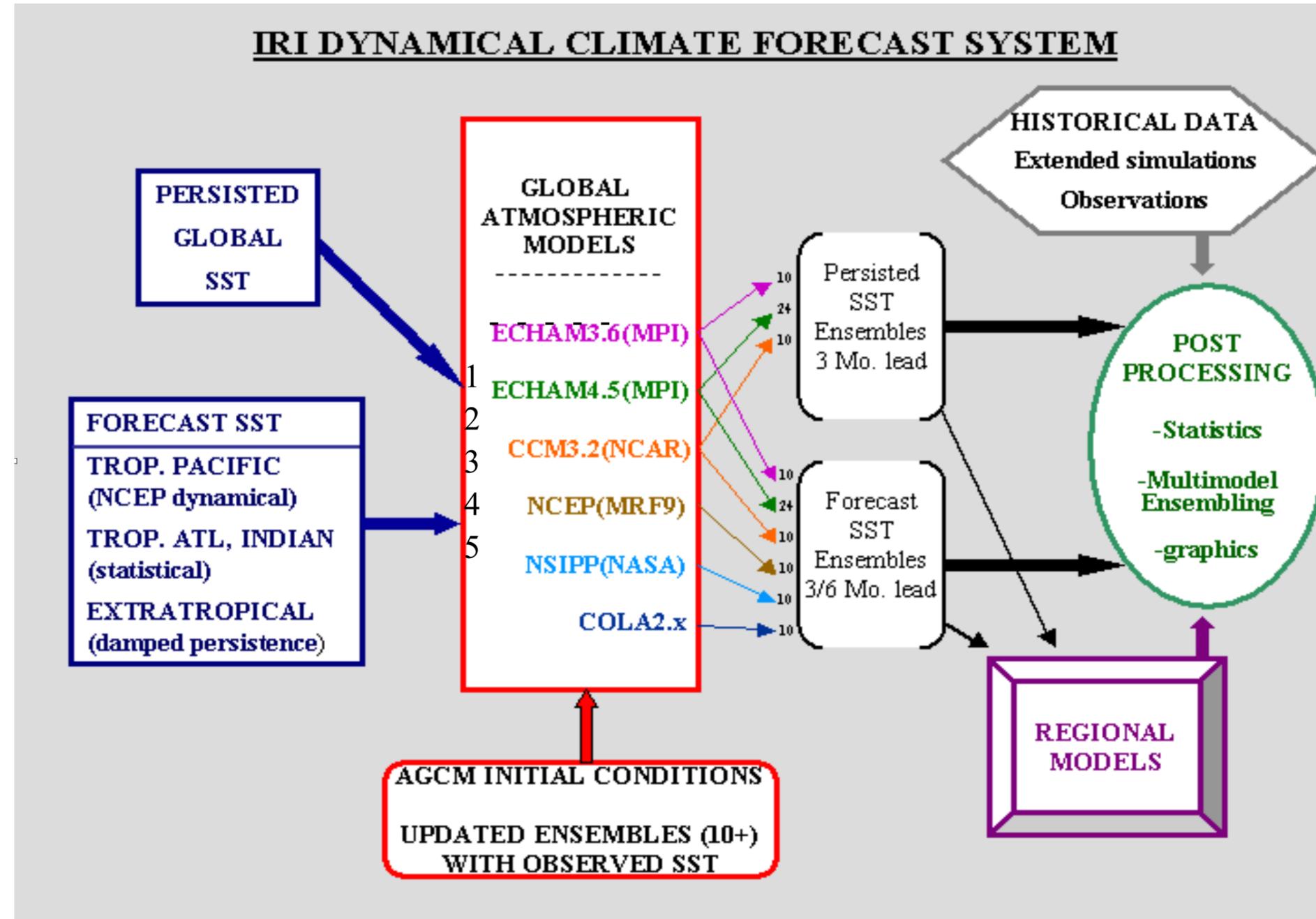
BY ANTHONY G. BARNSTON, SIMON J. MASON, LISA GODDARD,  
DAVID G. DEWITT, AND STEPHEN E. ZEBIAK

The evolution of methods used by the IRI to combine predictions of several models into a single global climate forecast is described.

TABLE 1. The AGCMs used at IRI's forecast operation in Oct 2001, with their associated references. Revision of this list by Aug 2003 is indicated in Fig. 1.

Model	Where model was developed	Where model is run monthly
CCM 3.2	NCAR, Boulder, CO <sup>a</sup>	IRI, Palisades, NY
NCEP/MRF9	NCEP, Washington, DC <sup>b</sup>	QDNR, Queensland, Australia
ECHAM 3.6	Max Planck Institute, Hamburg, Germany <sup>c</sup>	IRI, Palisades, NY
ECHAM 4.5	Max Planck Institute, Hamburg, Germany <sup>d</sup>	IRI, Palisades, NY
NSIPP	NASA GSFC, Greenbelt, MD <sup>e</sup>	NASA GSFC, Greenbelt, MD
COLA	Center for Ocean-Land-Atmosphere Studies (COLA), Calverton, MD <sup>f</sup>	COLA, Calverton, MD

Barnston, Mason, Goddard, DeWitt & Zebiak  
(BAMS, 2003)



# Probabilistic Skill

Average RPSS : Precipitation Fcsts  
OND 1998–2001 (1-month lead)

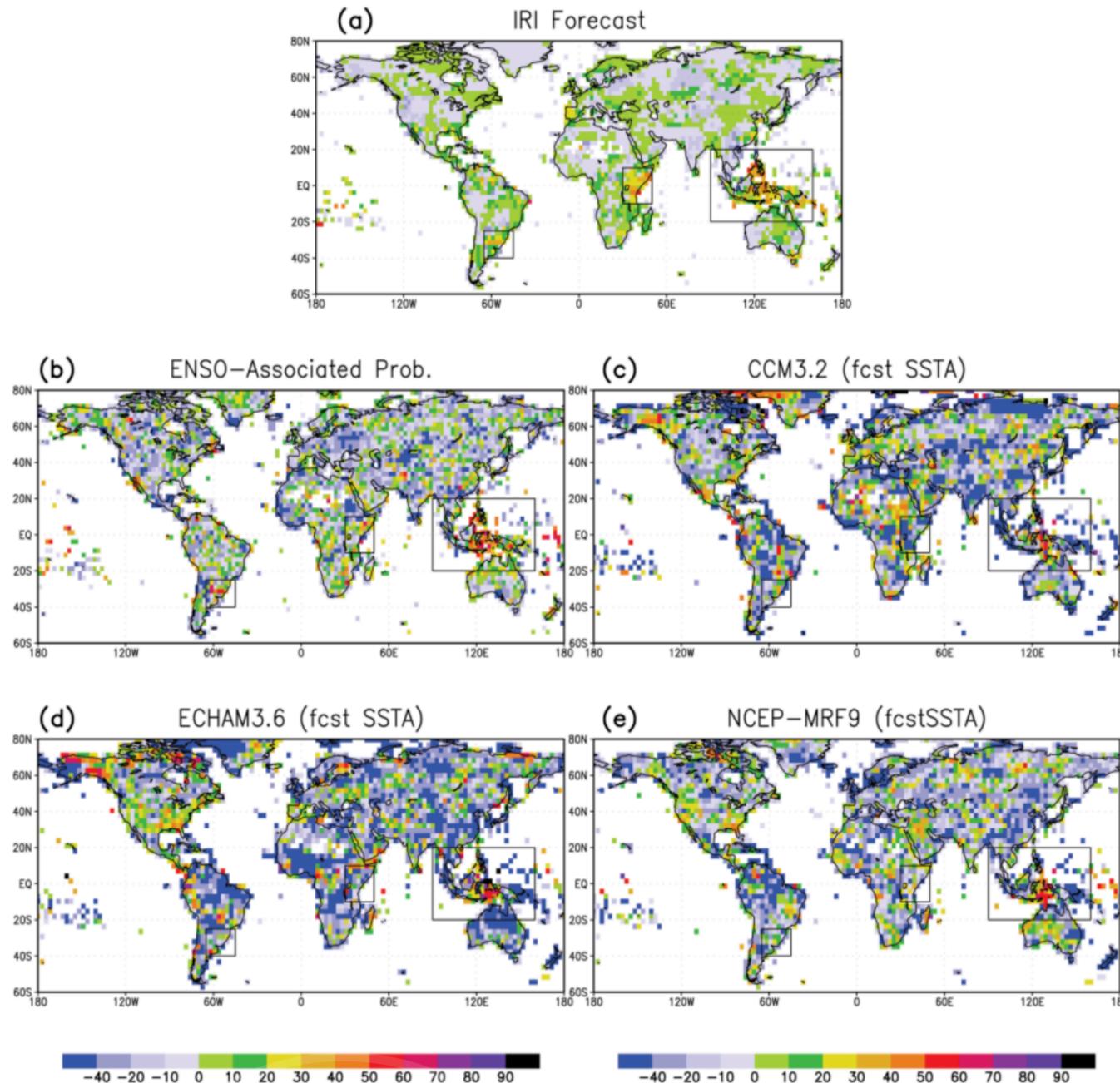
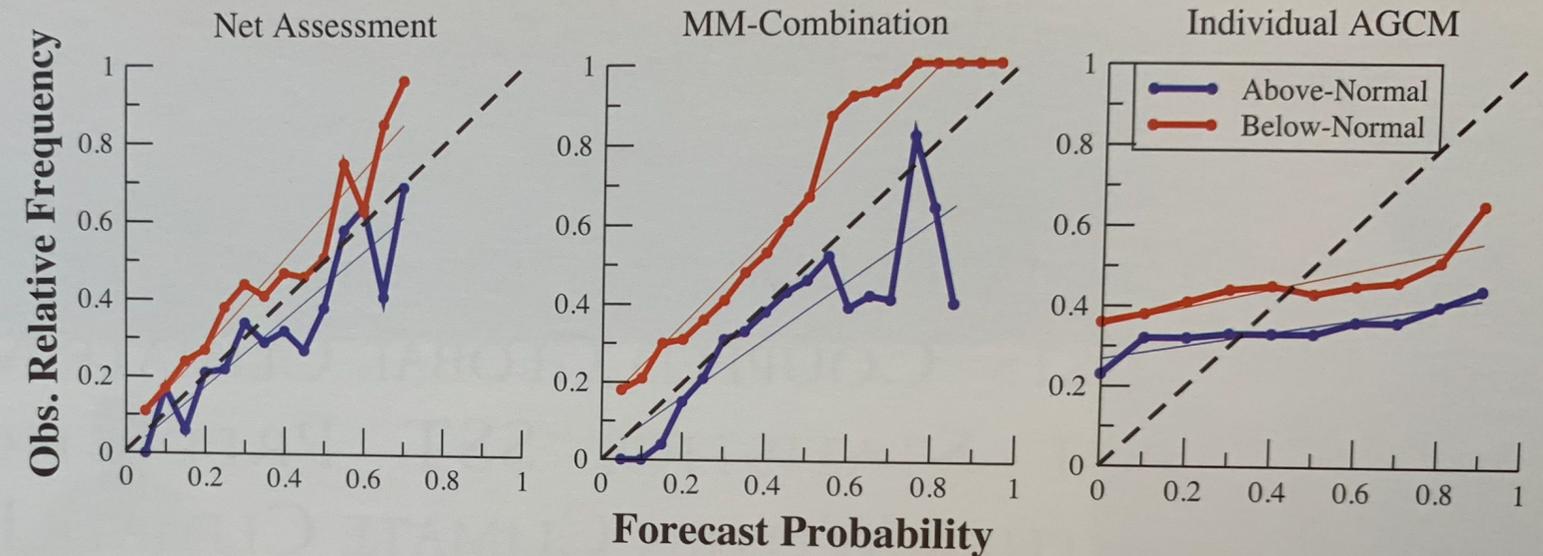


FIG. 11. Same as in Fig. 6, but for OND precipitation. Score is averaged over five cases (1997–2001). Boxes outline the regions for which skill comparisons are highlighted in text.

Precipitation Forecasts (30S–30N)

IRI Annual Report, 2003–04



Reliable forecast probabilities

Advantage of MME

Goddard, Barnston & Mason (BAMS, 2003)

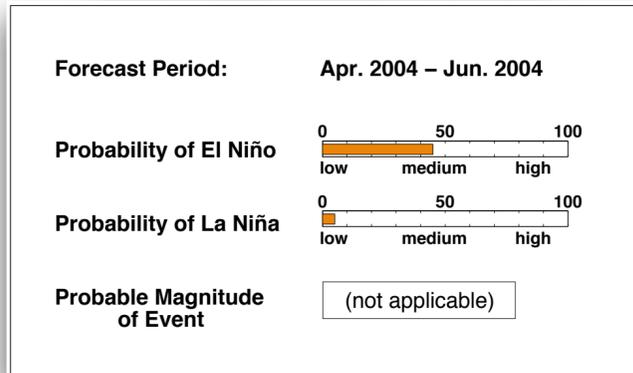


# ENSO QUICK LOOK December 18, 2003

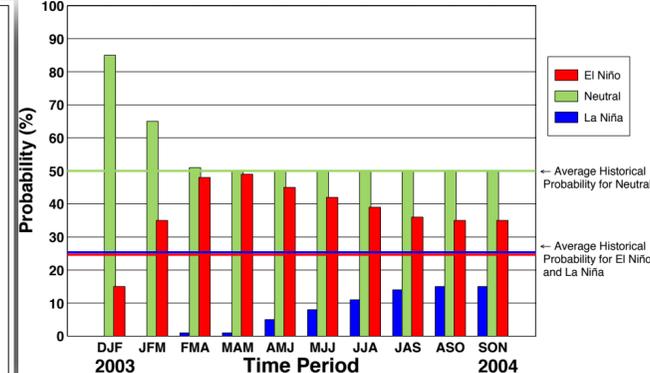
A monthly summary of the status of El Niño, La Niña and the Southern Oscillation, or "ENSO"

Overall conditions in the tropical Pacific are mostly above average, although not strongly enough to qualify as El Niño conditions. Based on the latest observations and forecasts, while chances of El Niño are slightly above their average, it is most likely that near-neutral conditions will continue through the remainder of 2003 and into the first half of 2004.

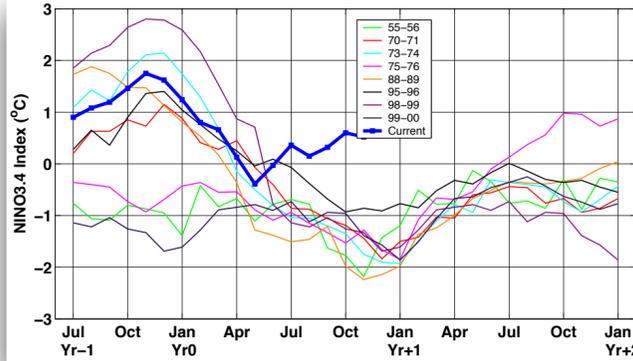
## Current ENSO Forecast Summary<sup>1</sup>



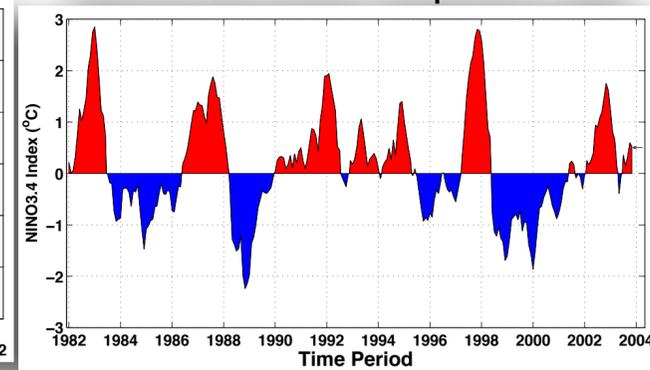
## IRI Probabilistic ENSO Forecast<sup>2</sup>



## Current Conditions vs. La Niña<sup>2</sup>



## Historical Sea Surface Temperature Index<sup>2</sup>



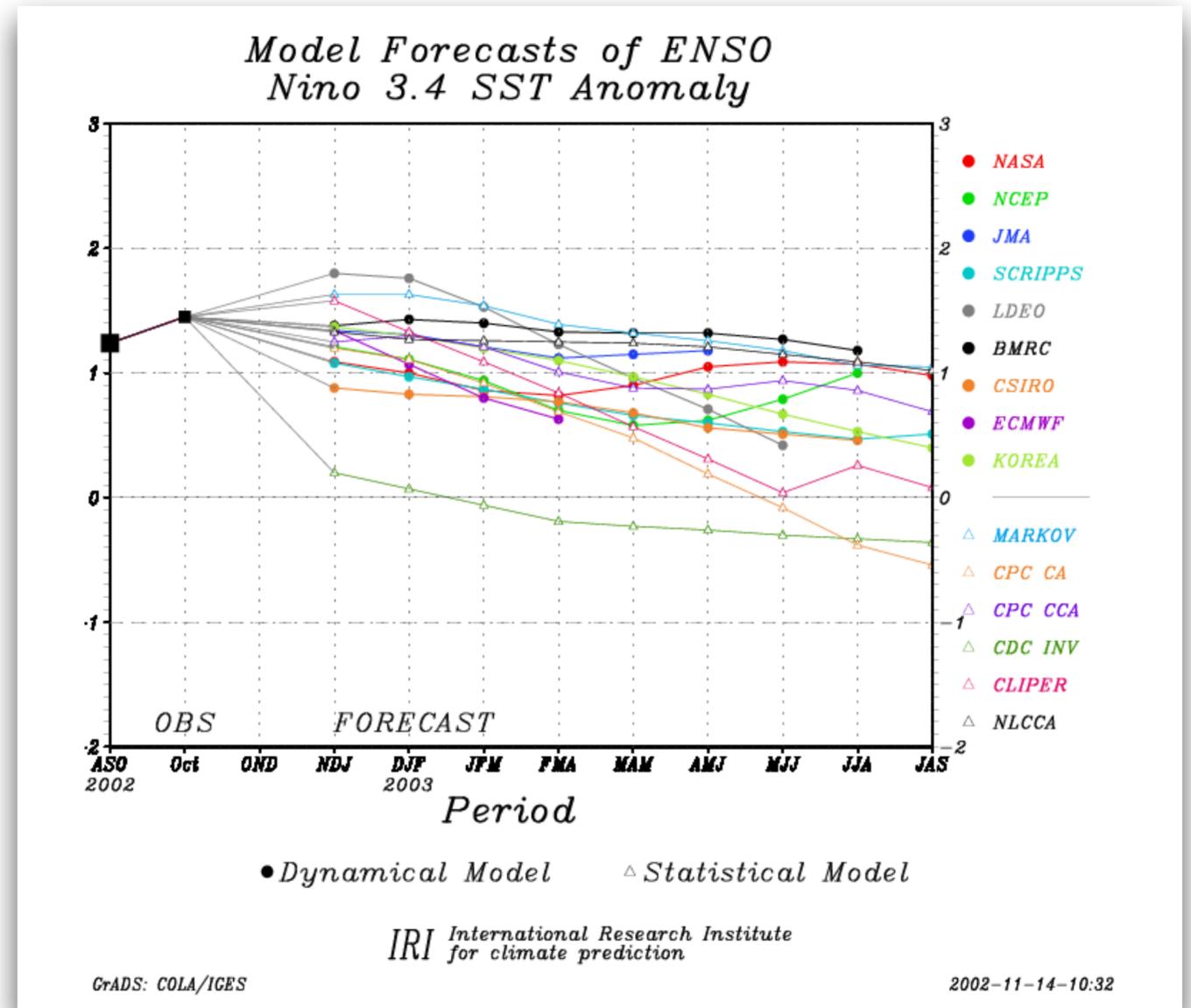
## Historically Speaking

- El Niño and La Niña events tend to develop during the period Apr-Jun and they:
- Tend to reach their maximum strength during Dec-Feb
  - Typically persist for 9-12 months, though occasionally persisting for up to 2 years
  - Typically recur every 2 to 7 years

<sup>1</sup>Probability of an El Niño refers to the likelihood of a sustained (that is, over several seasons) warming across a broad region of the eastern and central tropical Pacific, not just along coastal South America.

<sup>2</sup>Based on sea surface temperature departures from the long-term average over the "NINO3.4" region (120-170W, 5S-5N).

# ENSO Outlooks



"The plume came about because of the push, organized by Antonio Moura and Chet Ropelewski, called "preparing for the next El Nino". A few years had gone by since the 1997-98 event and the IRI started getting scared that another El Nino might come and the IRI would be caught off guard with nothing to say about it, and no visible forecasts of it." Tony Barnston



# Today's IRI/CPC Plume

## IRI ENSO Forecast

### 2018 October Quick Look

Published: October 19, 2018

A monthly summary of the status of El Niño, La Niña, and the Southern Oscillation, or **ENSO**, based on the NINO3.4 index (120-170W, 5S-5N)

Use the navigation menu on the right to navigate to the different forecast sections

While ENSO-neutral conditions prevailed in September, signs of El Niño increased in early October 2018 as east-central tropical Pacific SSTs warmed to weak El Niño levels. Also, low level winds showed westerly anomalies in most of the last three weeks. The subsurface water temperature continued to be above-average, and increased further recently. The official CPC/IRI outlook calls for a 70-75% chance of El Niño development during October/November, continuing through winter 2018-19. An El Niño watch is in effect. New forecasts of statistical and dynamical models collectively favor imminent El Niño development, most likely weak to moderate strength, continuing through winter.

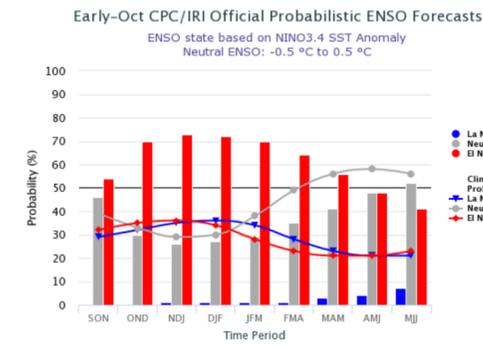
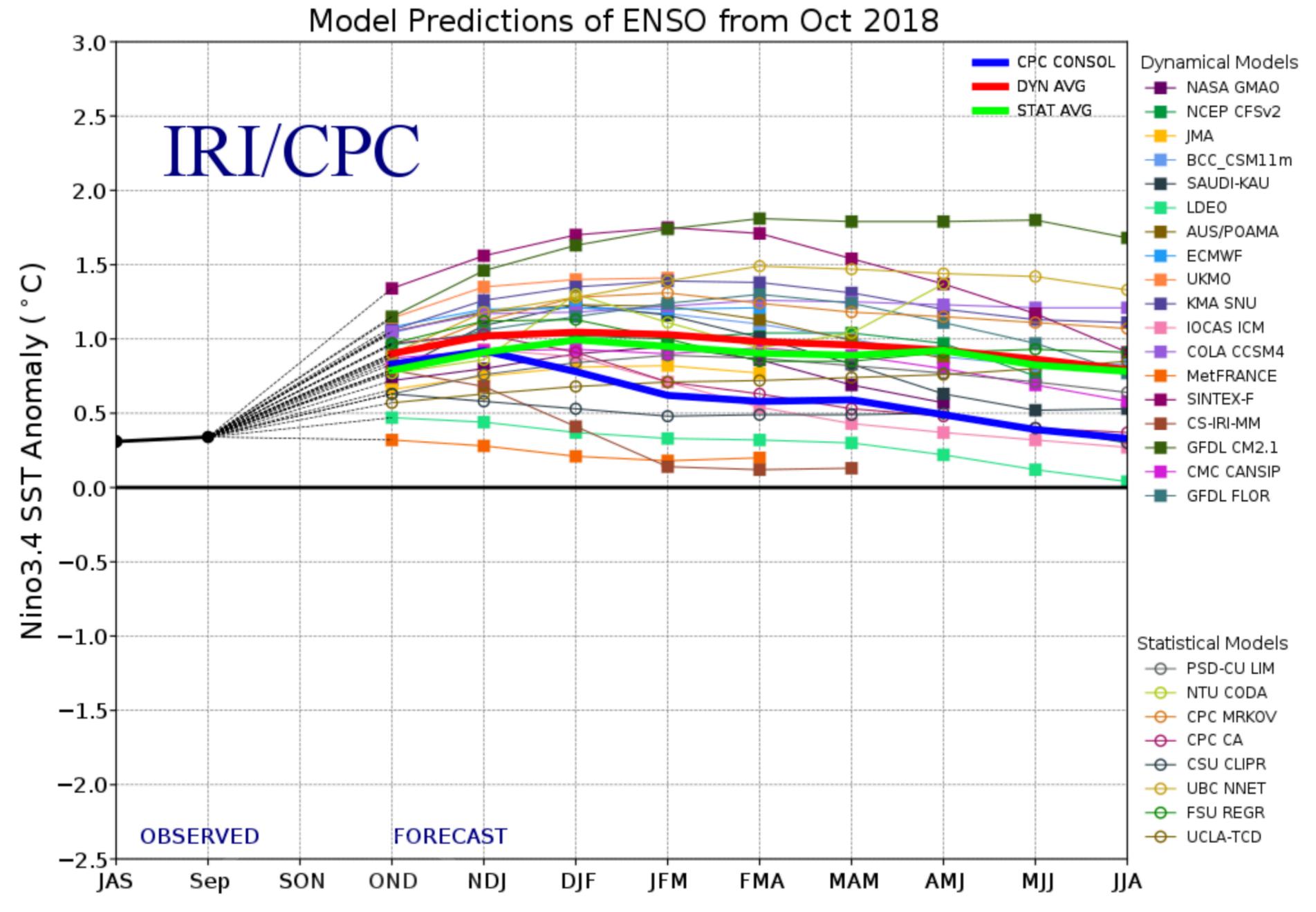


Figure 1

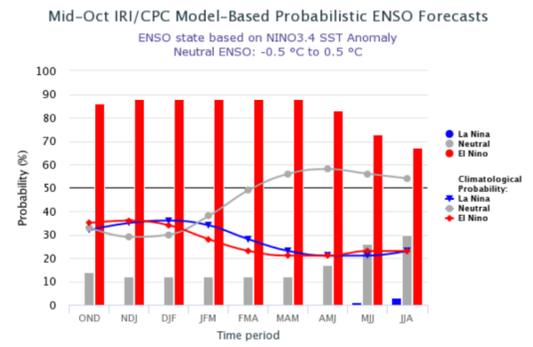


Figure 3

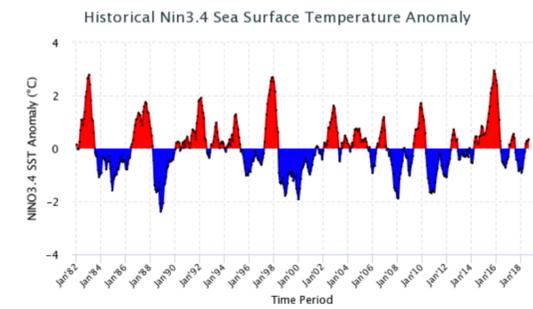
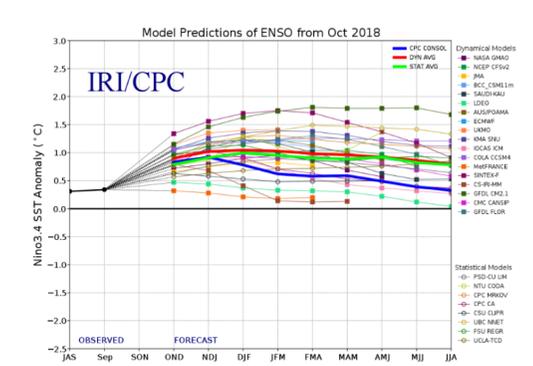
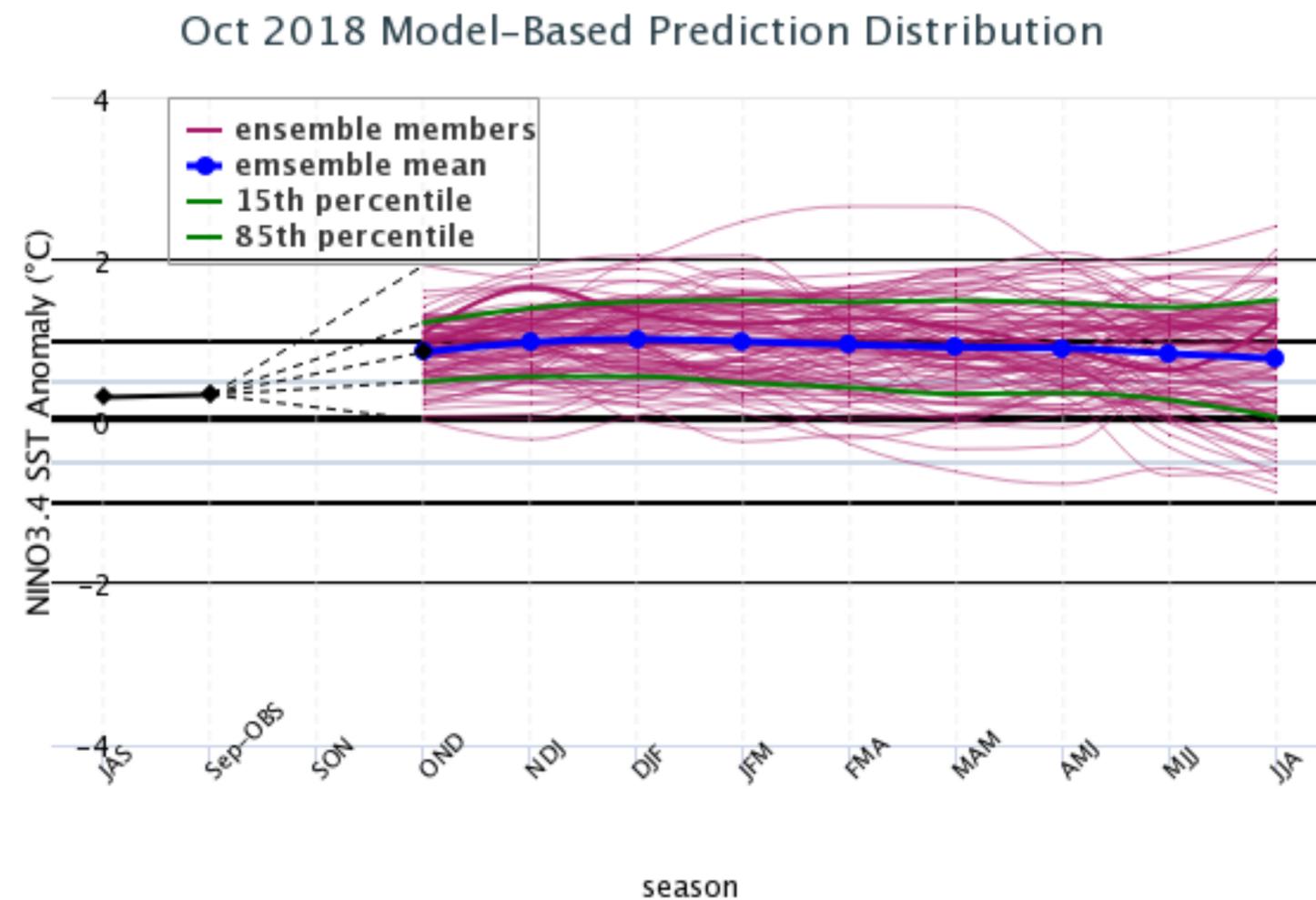
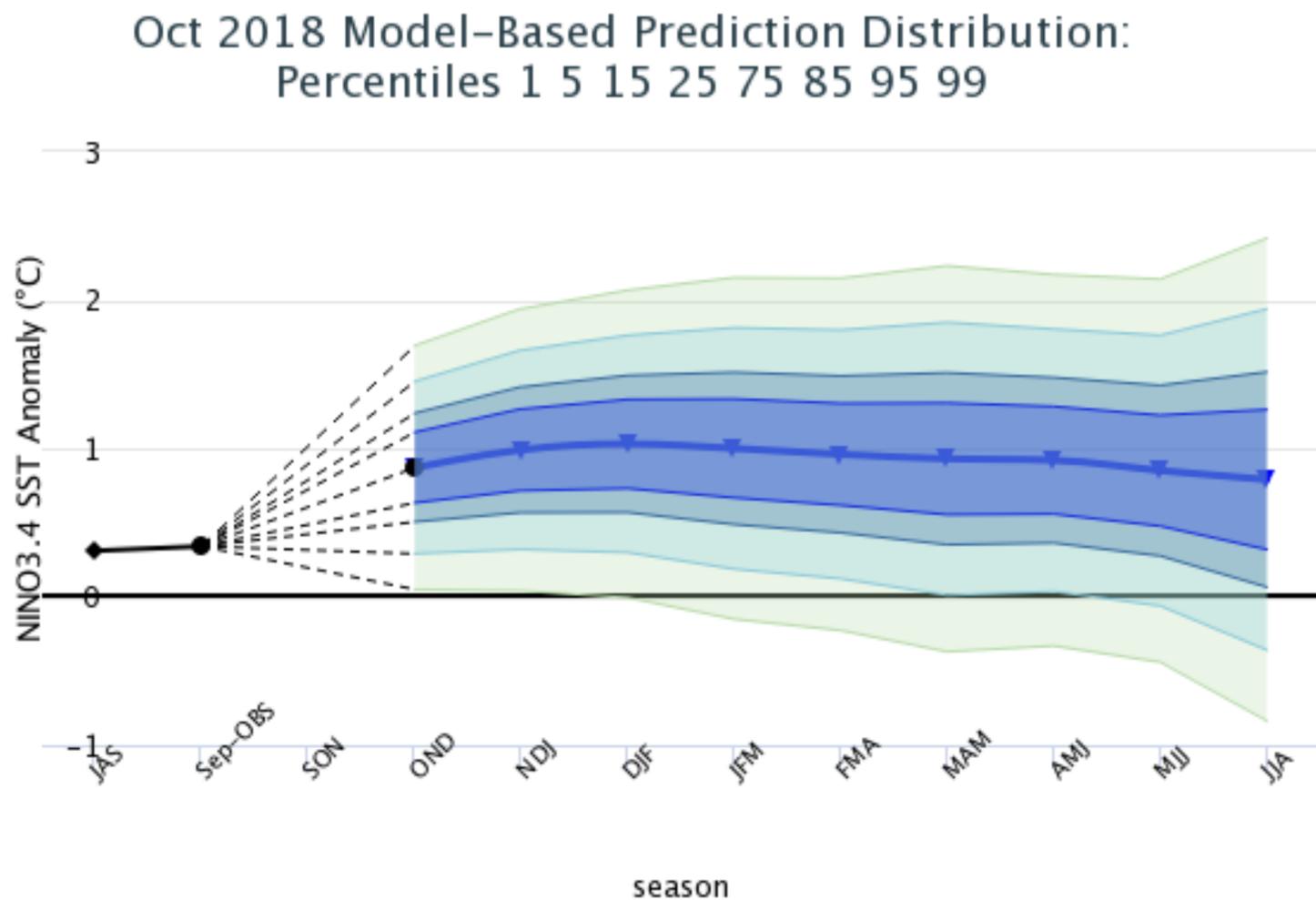


Figure 2



# Model-based Prediction Distributions



Barnston & Tippett.

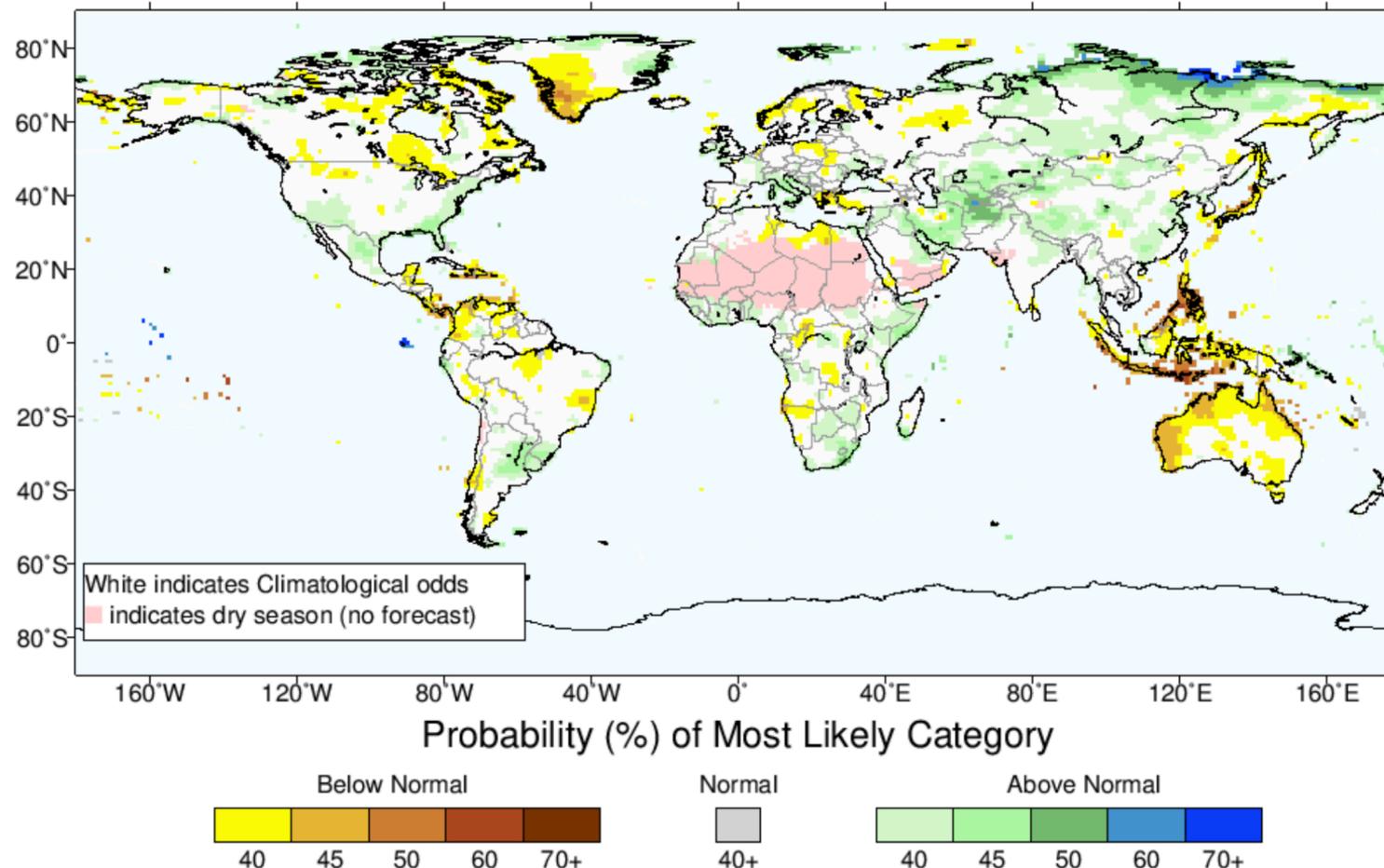
# NMME-based Seasonal Forecasts - Since April 2017

Please refer to our [licensing agreement](#) for permission to use any IRI forecast material.

## Seasonal Climate Forecast

Region:  Type:  Issue Year:  Issue Month:  Leads:

### IRI Multi-Model Probability Forecast for Precipitation for November-December-January 2019, Issued October 2018



## Overview

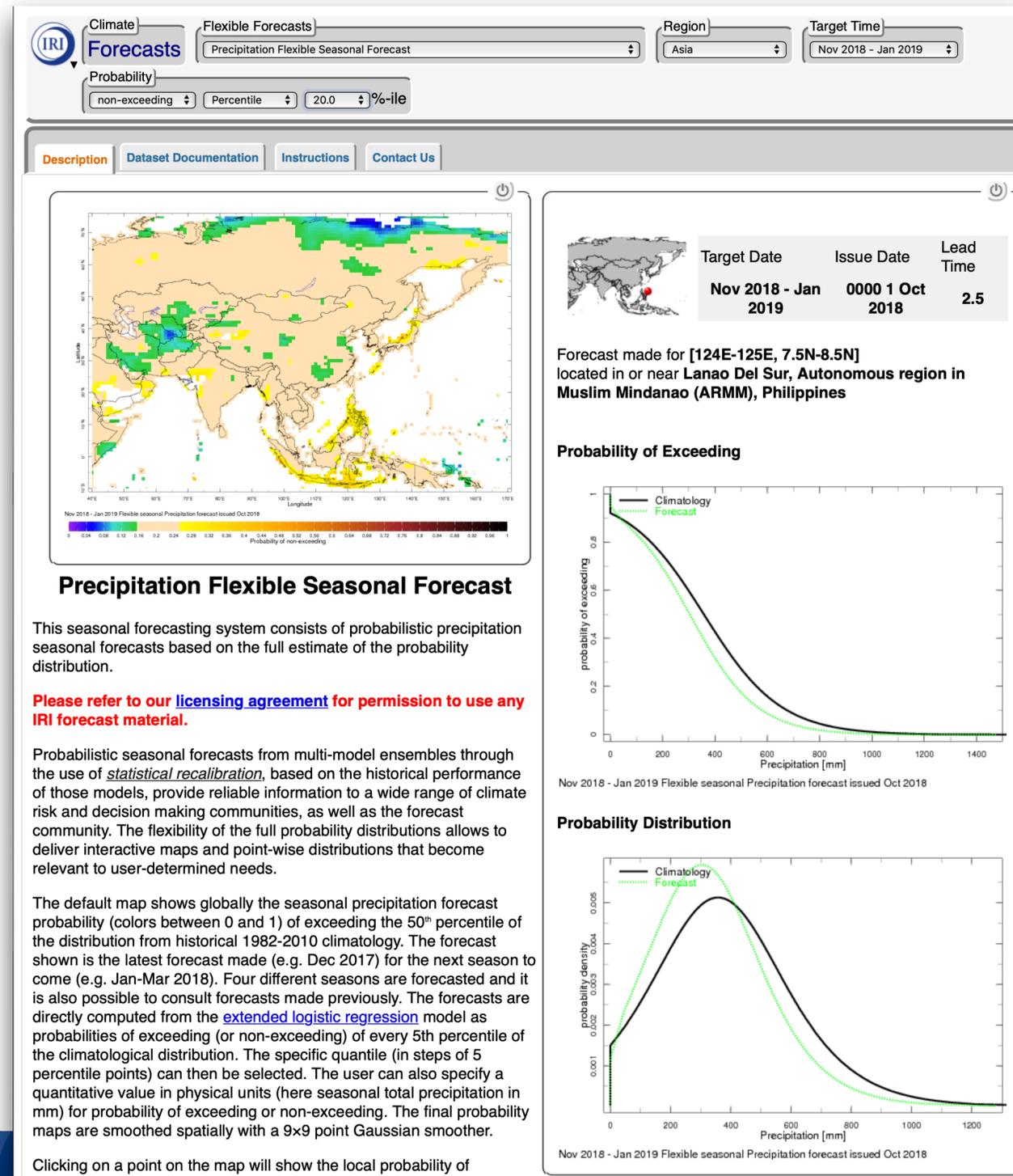
Starting in April 2017, the IRI probabilistic seasonal climate forecast product is based on a re-calibration of model output from the [U.S. National Oceanographic and Atmospheric Administration \(NOAA's North American Multi-Model Ensemble Project \(NMME\)\)](#).

This includes the ensemble seasonal prediction systems of [NOAA's National Centers for Environmental Prediction](#), [Environment and Climate Change Canada](#), [NOAA/Geophysical Fluid Dynamics Laboratory](#), [NASA](#), [NCAR](#) and [COLA/University of Miami](#). The output from each NMME model is re-calibrated prior to multi-model ensembling to form reliable probability forecasts. The forecasts are now presented on a 1-degree latitude-longitude grid.

**Disclaimer:** *The IRI seasonal forecast is a research product. Please see the NOAA CPC forecast for the official seasonal forecast over the U.S. Please consult your country's national meteorological service for the official forecast for your country.*

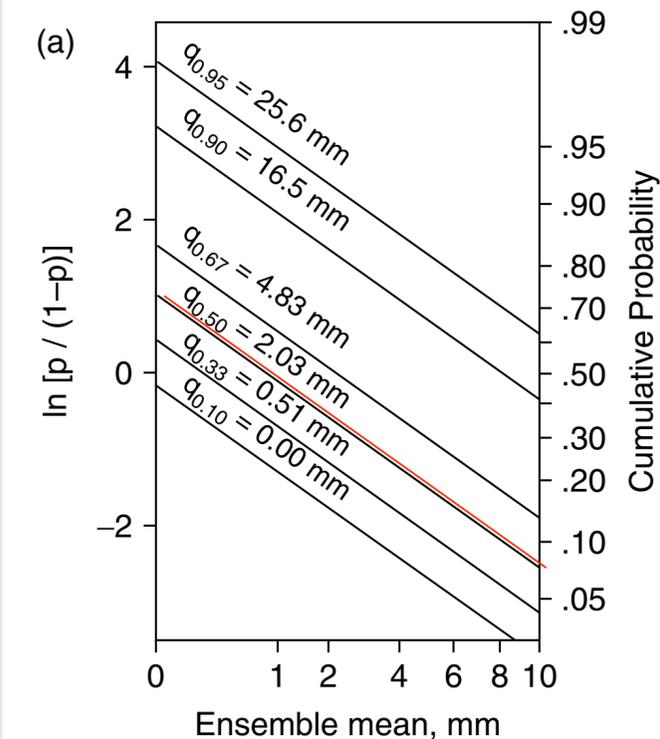
Please see the 'Discussion' item for an overview of the individual forecasts.

# Flexible Format Maproom



## Extended Logistic Regression

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

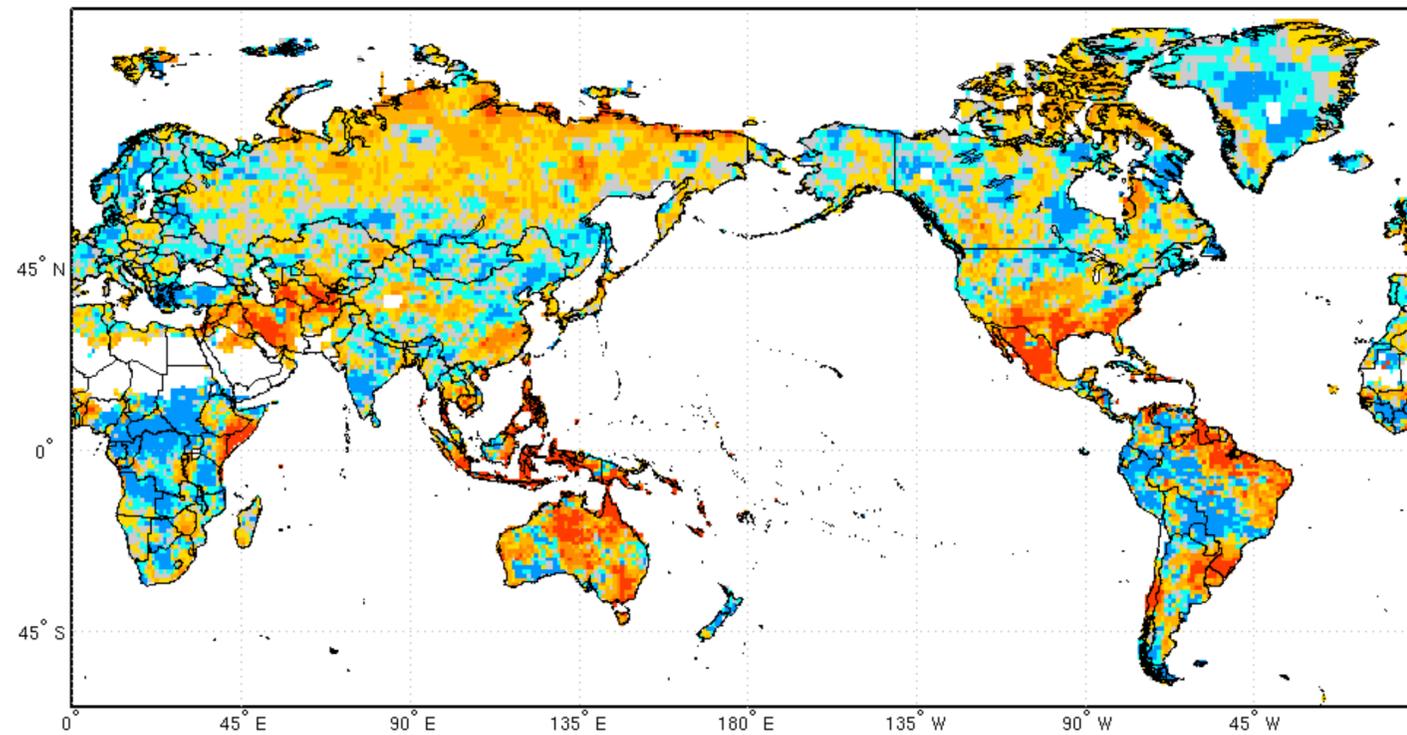


Applied at each grid point, using forecast ensemble mean.

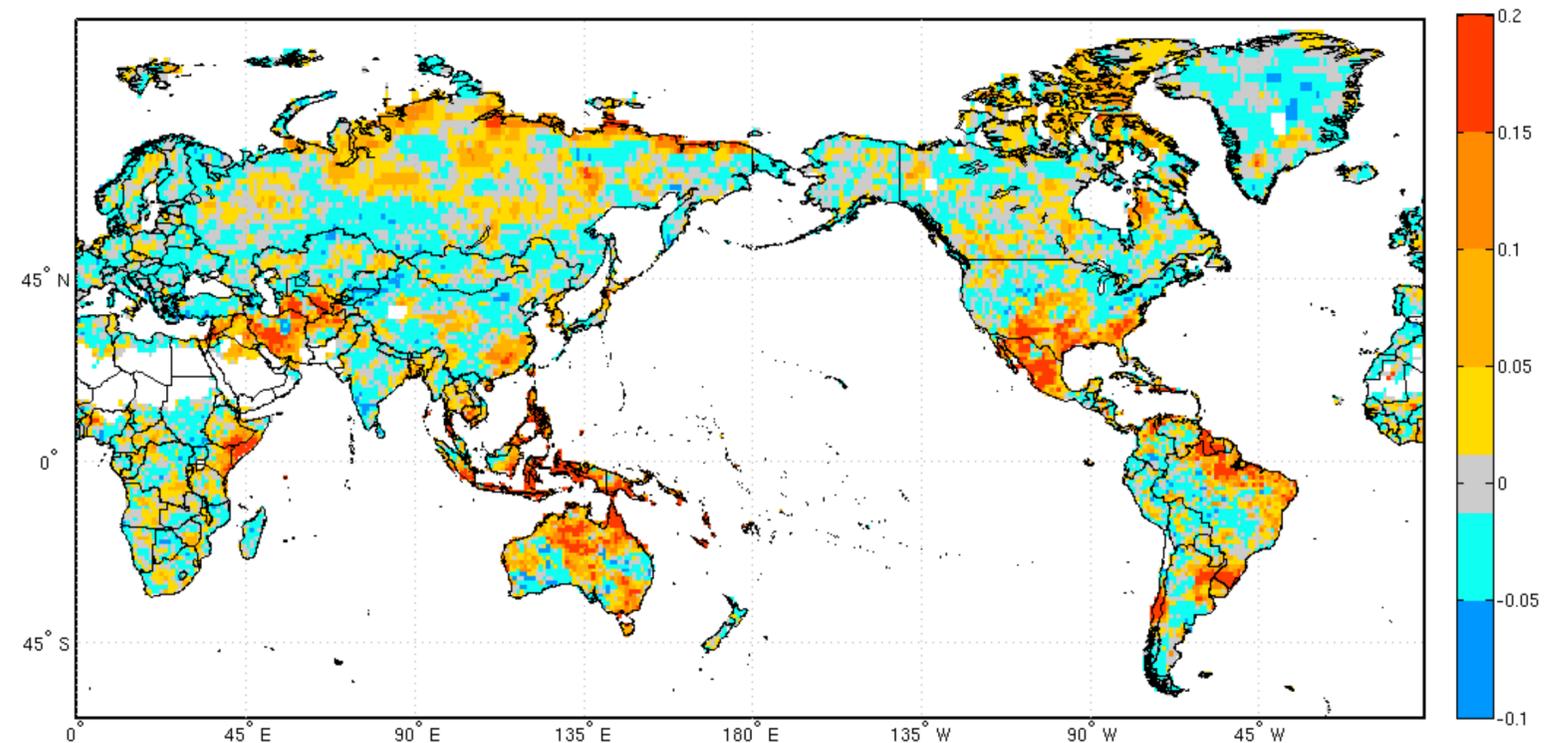
# RPSS Skill of NMME-based Precipitation Hindcasts

October–December

Counting

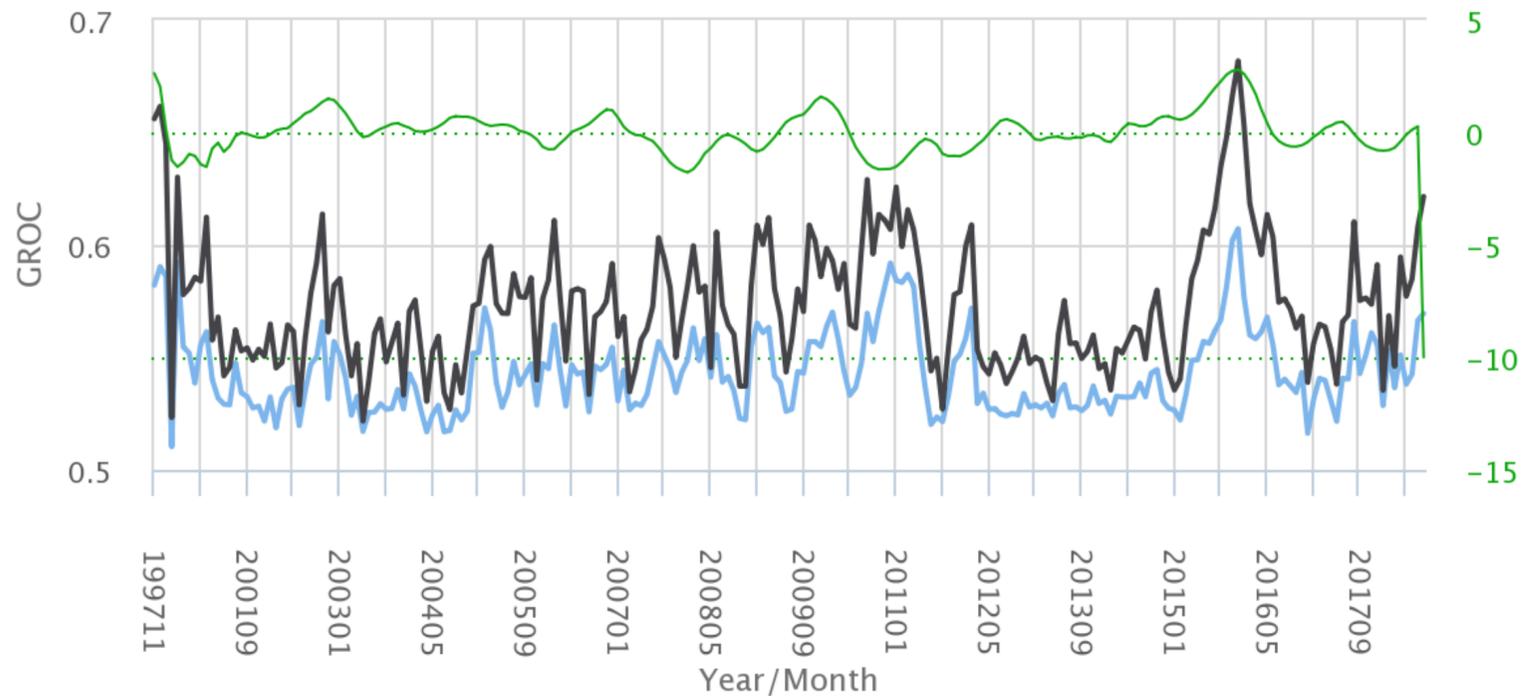


Extended Logistic Regression



# Evolution of IRI's Real-time skill

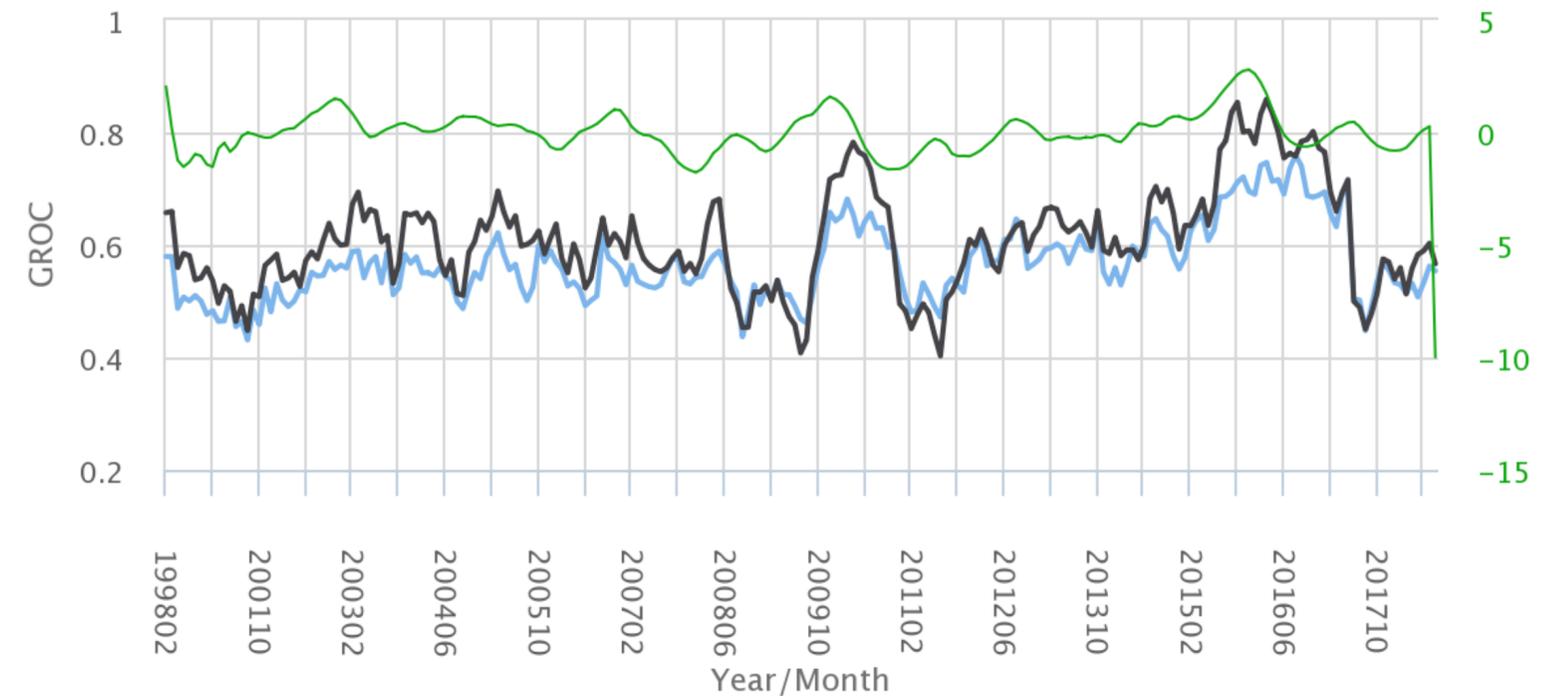
## Precipitation



- Global GROC for precipitation
- ◆ Tropical GROC for precipitation
- Nino3.4 SST Index (3-month average)

Highcharts.com

## Temperature



- Global GROC for temperature
- ◆ Tropical GROC for temperature
- Nino3.4 SST Index (3-month average)

Highcharts.com

<https://iri.columbia.edu/our-expertise/climate/forecasts/verification/>





F. Fiordella, IRI



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