IRI Activities Update for WGSIP 17

Andrew W Robertson

International Research Institute
for Climate and Society
Earth Institute | Columbia University

SMHI, Norrköping, 13-14 Sept 2015

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International Research Institute for Climate and Society | Climate and Forecast Products

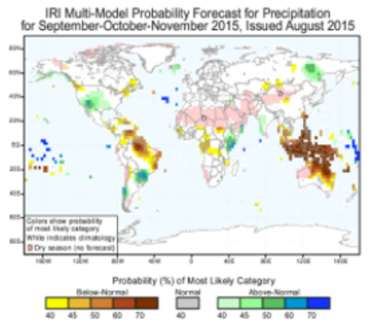
s2sprediction.net/workshop/files/program/Monsoons_Jeju.pdf

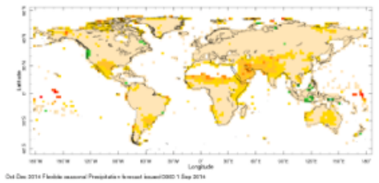
Climate and Forecast Products

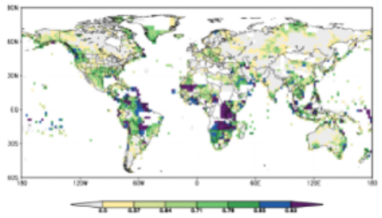
Access IRI's extensive collection of forecast, monitoring, and analysis products, including IRI's real-time seasonal climate and ENSO forecasts.

Seasonal Climate Forecasts | **ENSO Forecasts** | **GCM and SST Forecast Model Outputs** | **Tailored Climate Products** | **Climate Change and Decade-Scale Information**

Seasonal Climate Forecasts







IRI's Seasonal Climate Forecasts (*Net Assessments*) are updated every month for the next 6 months into the future. They give probabilistic outlooks for temperature and precipitation to be in the above-normal, near-normal, or below-normal tercile categories, which are defined from the previous 30 years

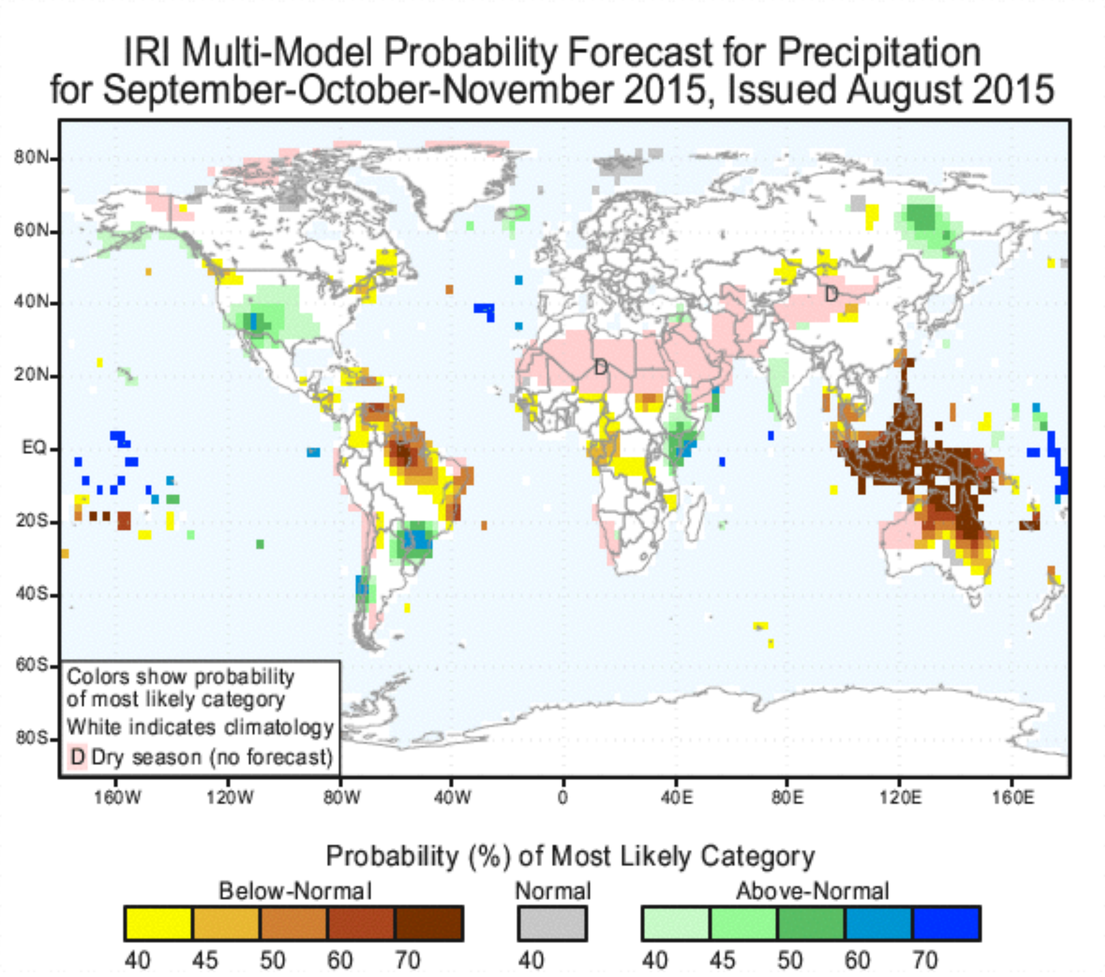
Flexible Format Seasonal Climate Forecasts are based on the same forecast information as the *Net Assessments*. They give probabilistic outlooks for temperature and precipation based on categories or thresholds chosen by the user.

The Seasonal Forecast Verifications page provides skill assessment of IRI's Net Assessment forecasts 1997-present.

Outline

- Real-time seasonal forecast development
- Maproom development
- Tool development

IRI's "Classical" Seasonal Forecasts



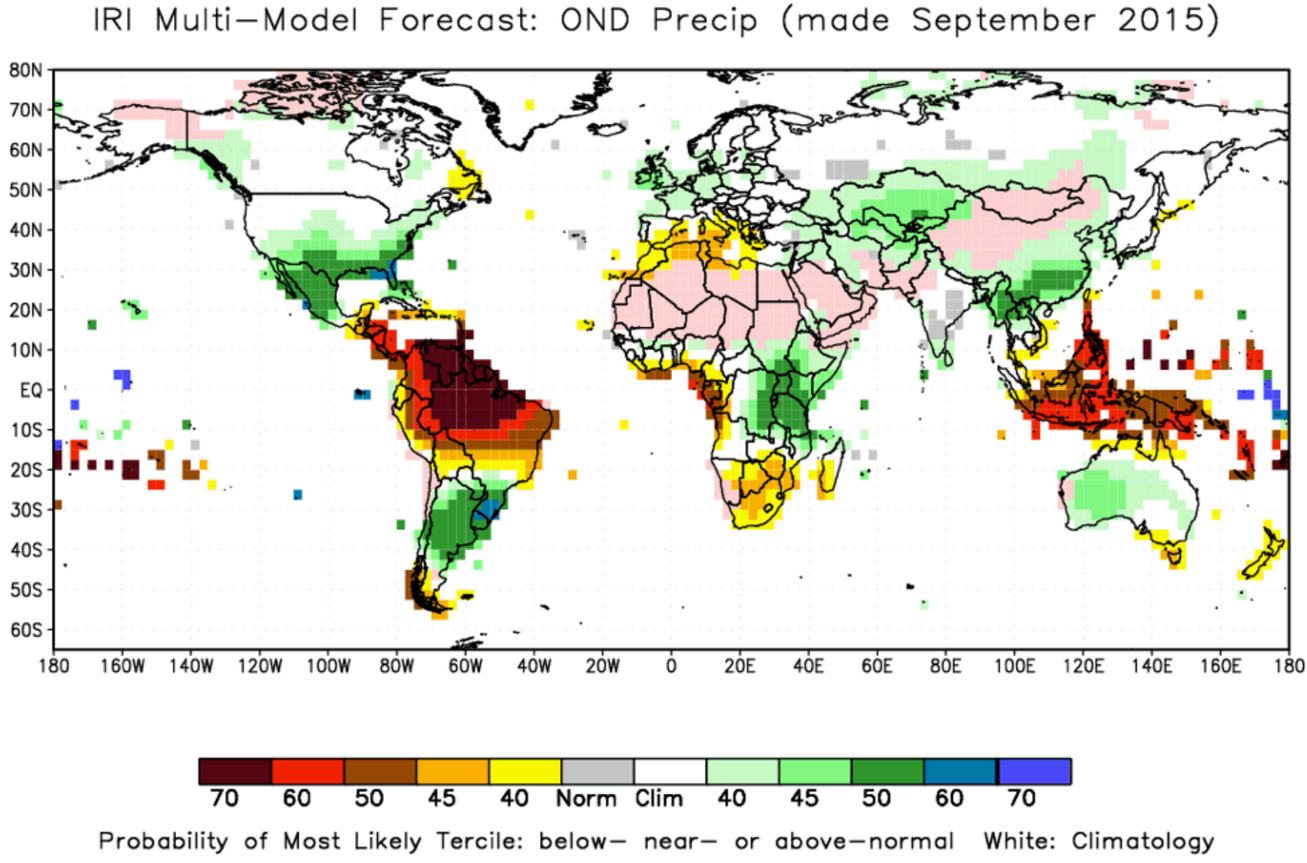
2-Tier:
Ocean - {LDEO + CA + CFSv2} mean & 2 additional scenarios based on historical errors
Atmos - {Echam4.5, CCM3.6, COLA, GFDL}
1-tier: CFSv2

Post-Proc:
- Pattern-based correction of ensemble means
  - Regression based on historical model runs
  - Spread estimate from historical forecasts with forecast SST
- Equal weighting of corrected models
- Parametric forecast probabilities (T - Gaussian, P - transformed Gaussian)

1-tiered MME Forecast System Development (NMME)

- NMME models: CMC1, CMC2, CFSv2, GFDL-FLOR + POAMA (Australia BoM)
- Ensemble size: 10-10-24-12; 33
- Climatology period: 1982-2010
- Tercile category: B-N-A normal (by counting and pooled MME)

- Bias correction to individual NMME models (Linear regression & CCA patterns)
- Based on corrected ensemble mean of each model, develop a parametric multi-ensemble forecast according to historic errors and covariance between different leads.
- Tercile-category or flexible-format forecasts on the basis of multi-ensemble products.



Flexible Format Probabilistic Forecasts

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Precipitation Flexible Seasonal Forecast | s2sprediction.net/workshop/files/program/Monsoons_Jeju.pdf

Climate: Forecasts | Flexible Forecasts: Precipitation Flexible Seasonal Forecast | Region: Global | Model: Forecast | Target Time: Sep-Nov 2015 | Climatology (1979 to 2011): 1981 to 2010

Probability: non-exceeding | Percentile | 20.0 %-ile | Precipitation Units: mm

Description | Dataset Documentation | More Information | Instructions | Contact Us

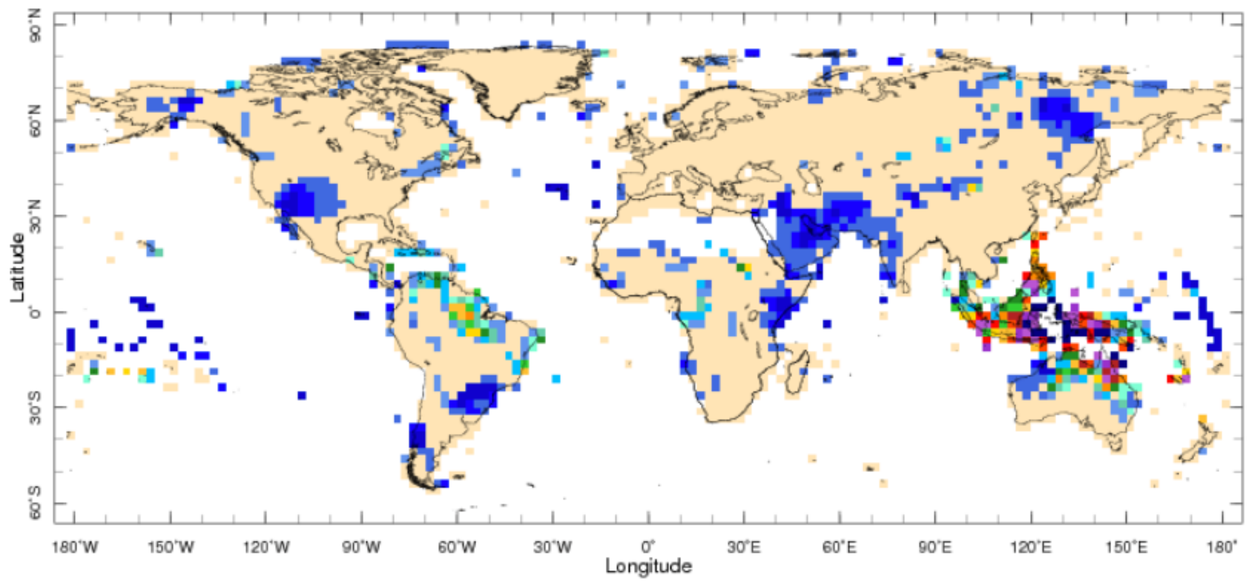
Precipitation Flexible Seasonal Forecast

This seasonal forecasting system consists of probabilistic precipitation seasonal forecasts based on the full estimate of the probability distribution.

Probabilistic seasonal forecasts from multi-model ensembles through the use of *statistical recalibration*, based on the historical performance of those models, provide reliable information to a wide range of climate risk and decision making communities, as well as the forecast community. The flexibility of the full probability distributions allows to deliver interactive maps and point-wise distributions that become relevant to user-determined needs.

The default map shows globally the seasonal precipitation forecast probability (colors between 0 and 1) of exceeding the 50th percentile of the distribution from historical 1981-2010 climatology. The quantitative value (in mm/day) of that percentile is indicated by the contours. The forecast shown is the latest forecast made (e.g. Sep 2012) for the next season to come (e.g. Oct-Dec 2012). Five different seasons are forecasted and it is also possible to consult forecasts made previously. What makes the forecast flexible is that underlying the default map is the full probability distribution for the forecast and climatology. Therefore, the user can specify the historical percentile or a quantitative value (here precipitation in mm/day) for probability of exceedance or non-exceedance. The climatological reference on which the forecast probability of (non-)exceeding is computed can be tailored by defining its starting and ending years.

Clicking on a point on the map will show the local culmulative distribution and probability distribution fucntions of the forecast (green) together with the climatological distribution (black).



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●●●○○ AT&T 15:19 82%

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Climate

Forecasts

Flexible Forecasts

Precipitation Flexible Seasonal Forecast

Region: Global

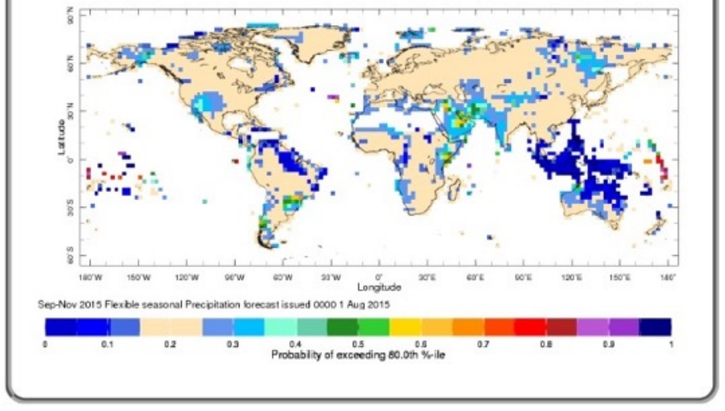
Model: Forecast

Target Time: Sep-Nov 2015

Climatology (1979 to 2011): 1981 to 2010

Probability: exceeding | Percentile | 80.0 %-ile

Precipitation Units: mm



Precipitation Flexible Seasonal Forecast

This seasonal forecasting system consists of

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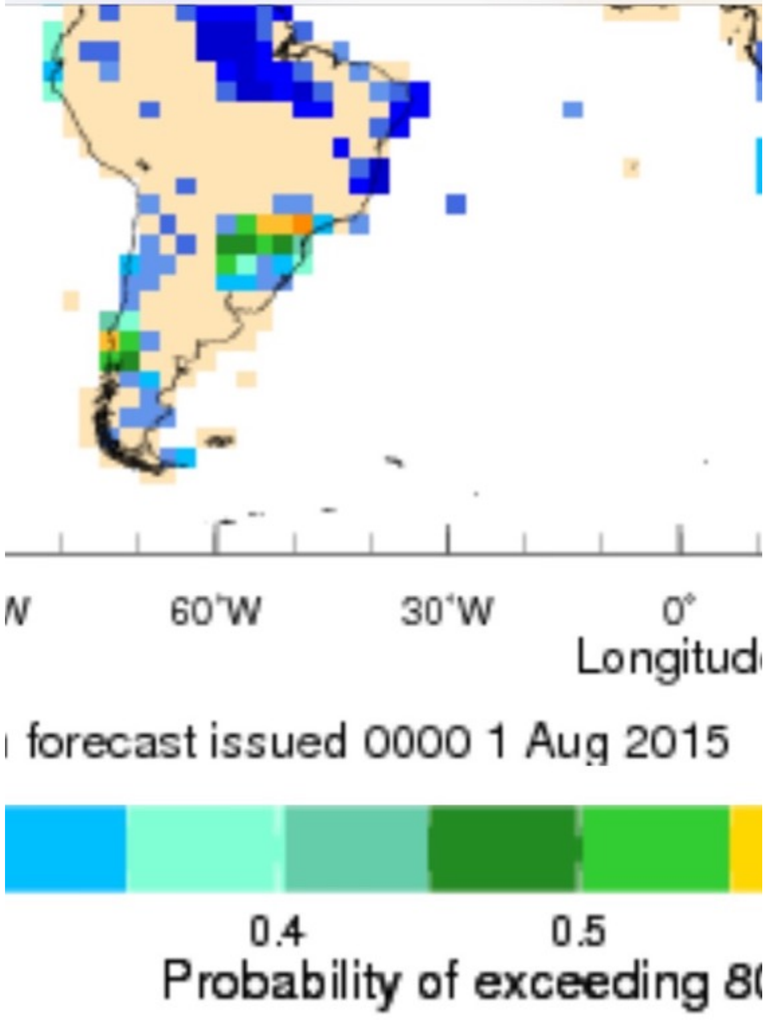

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ety | Seasonal Climate Verifications

s2sprediction.net/workshop/files/program/Monsoons_Jeju.pdf

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Seasonal Climate Verifications

Download: Descriptions of the IRI Climate Forecast Verification Scores

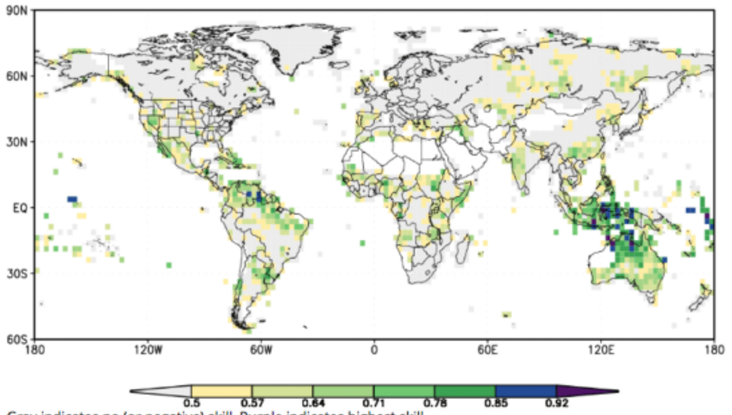
Verification of IRI's Seasonal Climate Forecast

Skill Category: Measures of Discrimination
Score: GROC
Variable: Precipitation
Season: Sep-Oct-Nov
Lead: 0.5 month Leac

Description of Score

The generalized ROC score (GROC), like the ROC, shows the degree of correct probabilistic forecast discrimination, even if the forecasts have biases or calibration problems. However, unlike ROC, GROC is generalized to encompass all forecast categories (below, near, and above normal) collectively, rather than being specific to a single category.

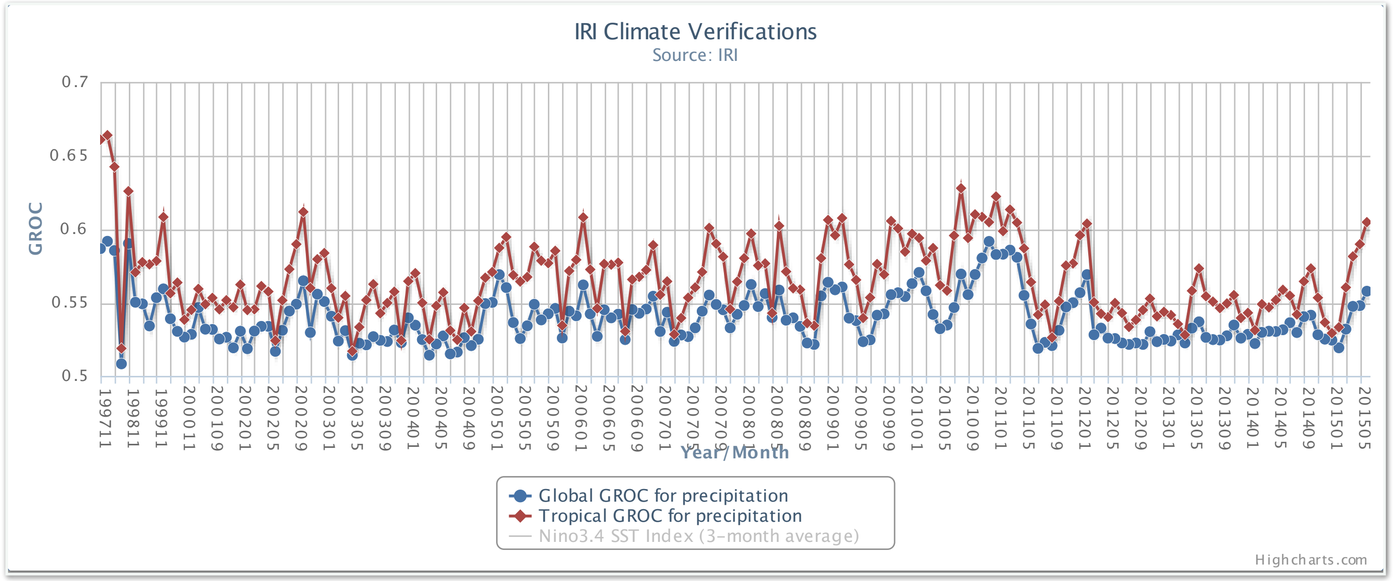
Generalized ROC (GROC): Lead 0.5 months, Precipitation Forecast Skill: SON



Gray indicates no (or negative) skill, Purple indicates highest skill.

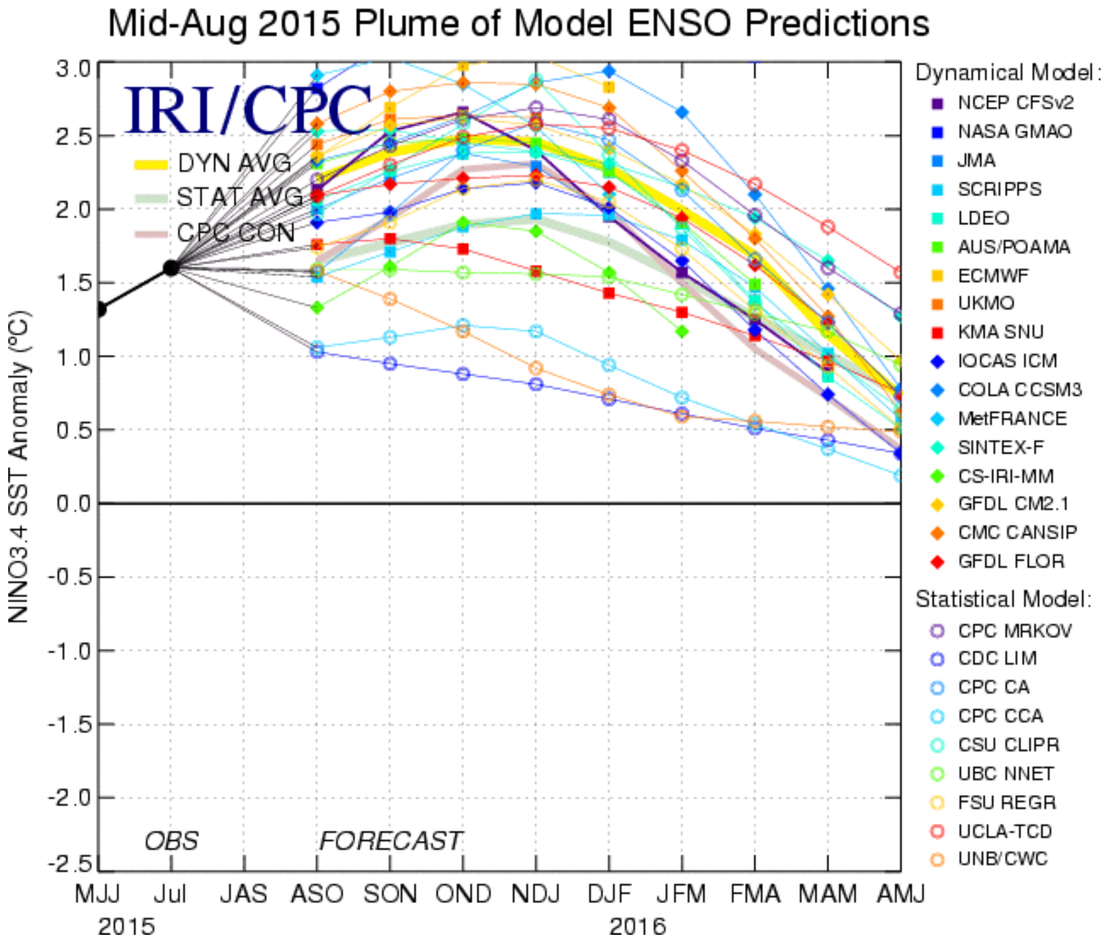
Individual Forecast Score

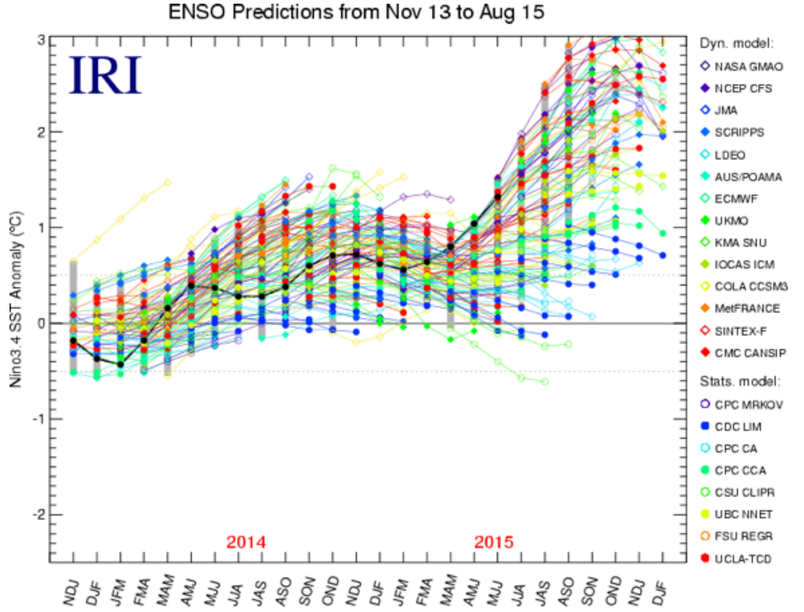
IRI Climate Verifications



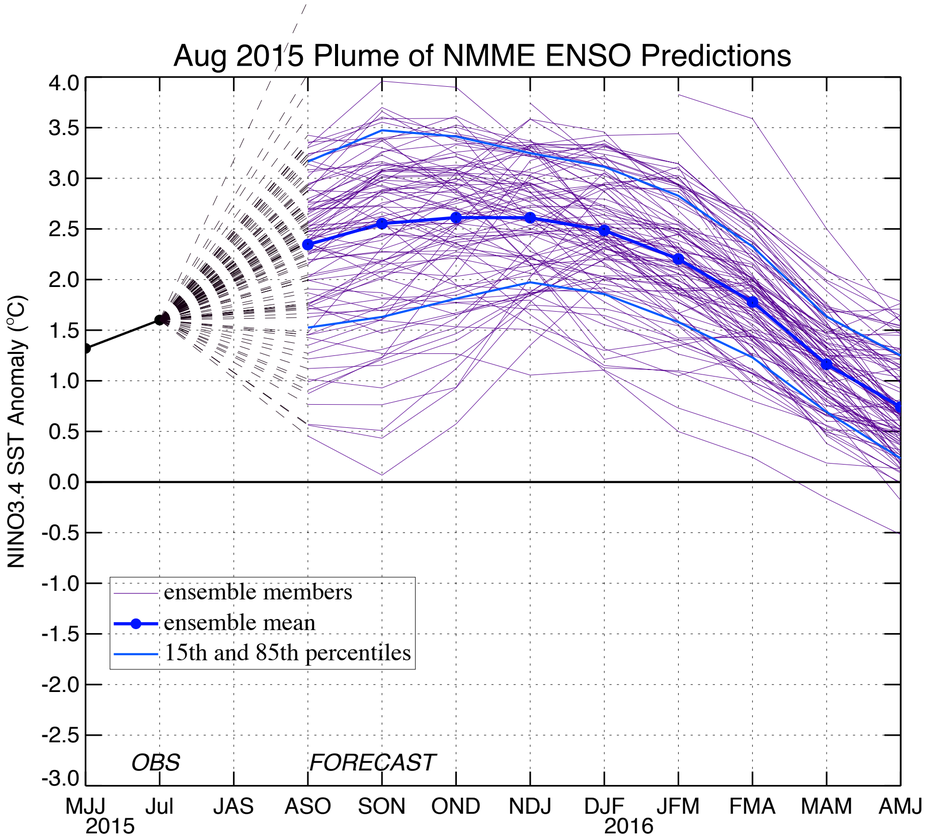
Verification Maproom

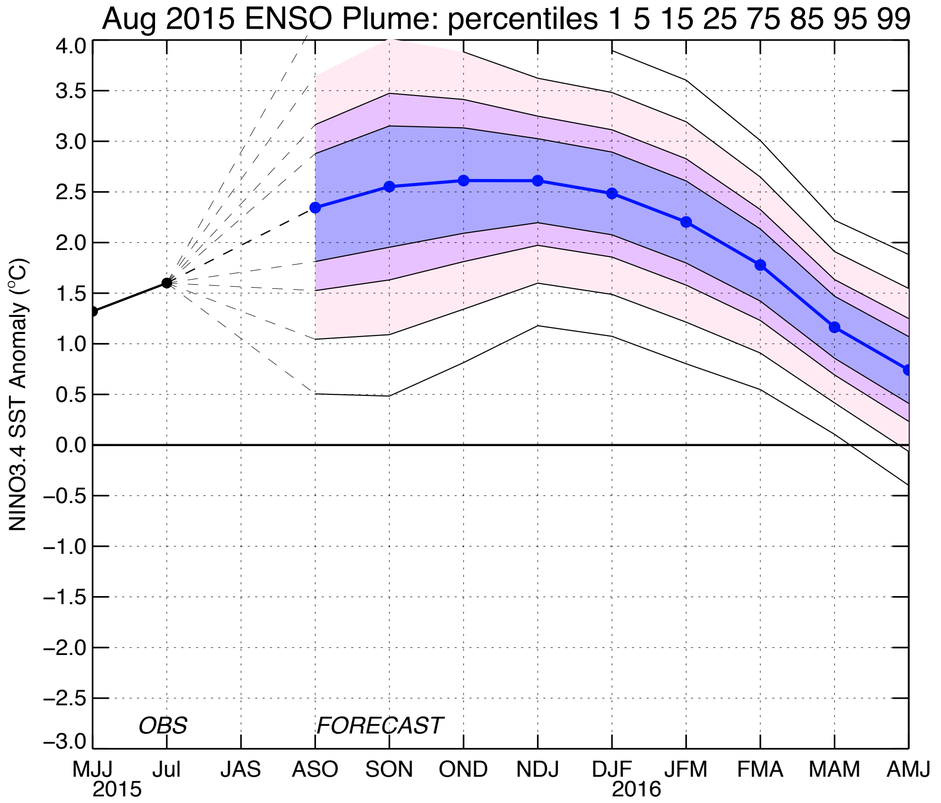
ENSO Plumes


Mid-Aug 2015 Plume of Model ENSO Predictions
IRI/CPC
DYN AVG
STAT AVG
CPC CON
NINO3.4 SST Anomaly (°C)
OBS
FORECAST
MJJ Jul JAS ASO SON OND NDJ DJF JFM FMA MAM AMJ
2015
2016
Dynamical Model:
NCEP CFSv2
NASA GMAO
JMA
SCRIPPS
LDEO
AUS/POAMA
ECMWF
UKMO
KMA SNU
IOCAS ICM
COLA CCSM3
MetFRANCE
SINTEX-F
CS-IRI-MM
GFDL CM2.1
CMC CANSIP
GFDL FLOR
Statistical Model:
CPC MRKOV
CDC LIM
CPC CA
CPC CCA
CSU CLIPR
UBC NNET
FSU REGR
UCLA-TCD
UNB/CWC


ENSO Predictions from Nov 13 to Aug 15
IRI
Nino3.4 SST Anomaly (°C)
2014
2015
Dyn. model:
NASA GMAO
NCEP CFS
JMA
SCRIPPS
LDEO
AUS/POAMA
ECMWF
UKMO
KMA SNU
IOCAS ICM
COLA CCSM3
MetFRANCE
SINTEX-F
CMC CANSIP
Stats. model:
CPC MRKOV
CDC LIM
CPC CA
CPC CCA
CSU CLIPR
UBC NNET
FSU REGR
UCLA-TCD

ENSO Plume with fitted distribution





- MME mean ENSO forecast for each lead time.
- Hindcast mme skill level as a correlation coefficient, making possible derivation of the standard error to be used for the spread (percentiles and spaghetti width).
- A third input: the auto covariance of the mme errors, which govern the degree to which the theoretical spaghetti lines persist on the same side of the mean between adjacent target periods (as opposed to being “refreshed” with each new target period, showing no persistence of deviation from the nmme mean forecast).

T. Barnston, M. Tippett

Enhancing National Climate Services (ENACTS) in Africa

Tufa Dinku

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ENACTS Approach: Three pillars

E N A C T S

Improve Availability

- Build capacity of NMHS
- Quality Control station data
- Combine station data with proxies
- Improve seasonal forecast

Enhance Access

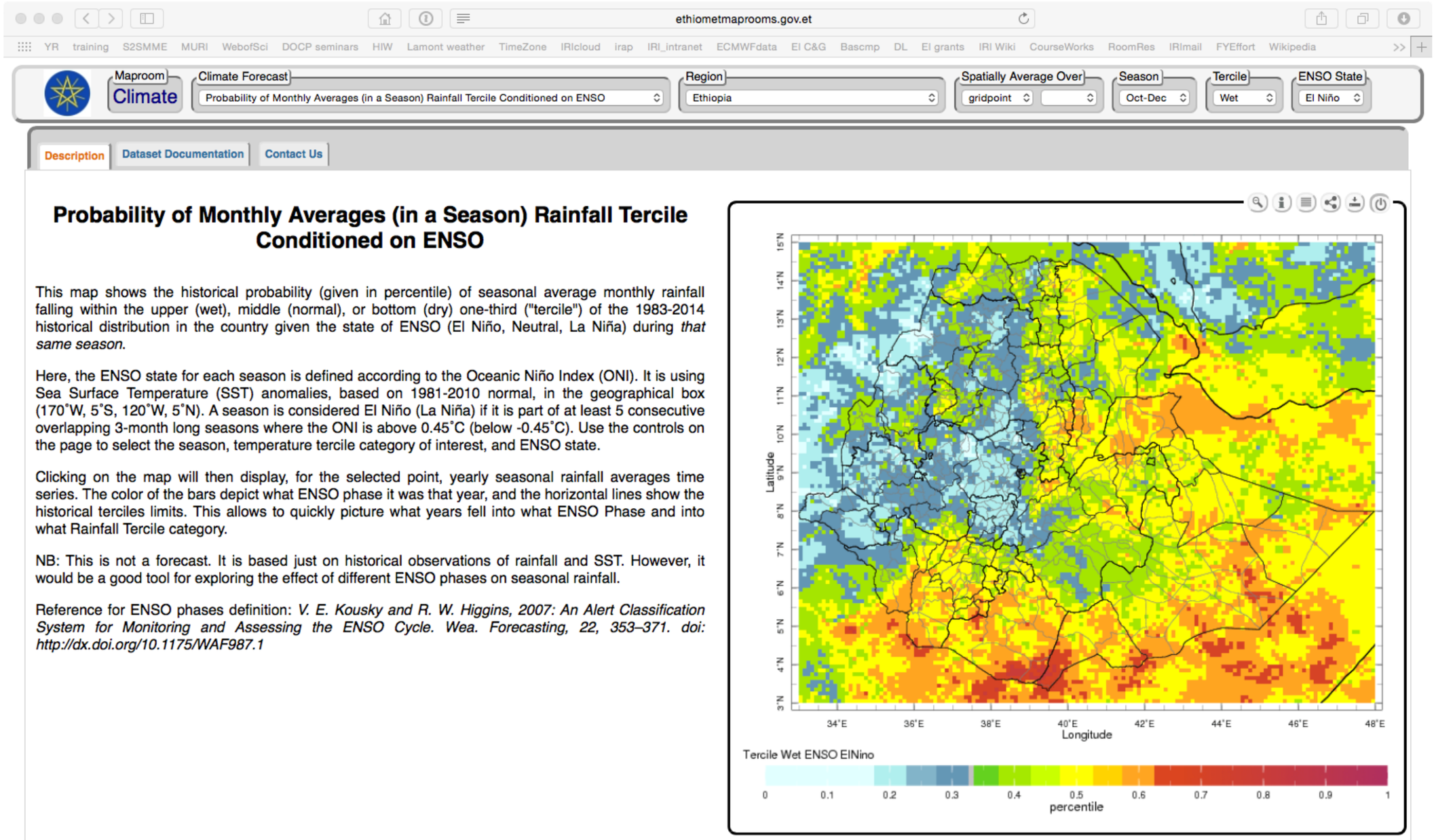
- Install IRI Data Library
- Develop online tools for data analysis and visualization
- Create mechanisms for data sharing

Promote Use

Engage users:

- *Raise* awareness
- Build capacity of users to understand and use climate info
- Involve users in product development

NMHS ENACTS Maprooms

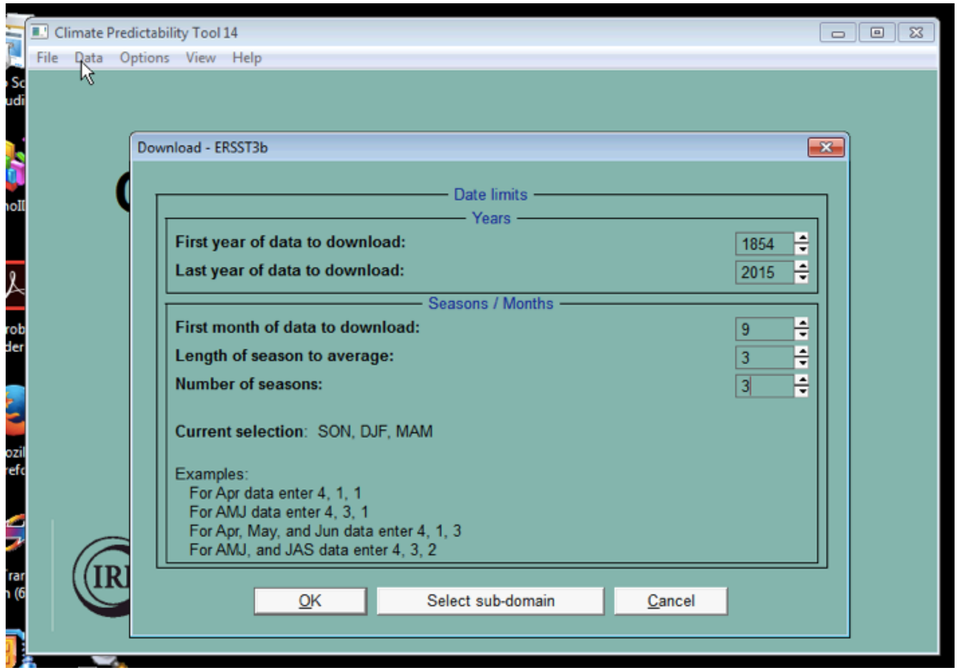


- Ethiopia
- Rwanda
- Tanzania

Climate Predictability Tool: new features

+ Data download interface: observations, reanalysis, GCM output.
+ Synchronous predictors option (e.g., for diagnostics).
+ Target season prompt: more user friendly.

+ Multiple calendar formats.
+ Rounding probability options.
+ Simplified interface for beginners. (version 15)
+ Skill maps in GrADS file format. (version 15)



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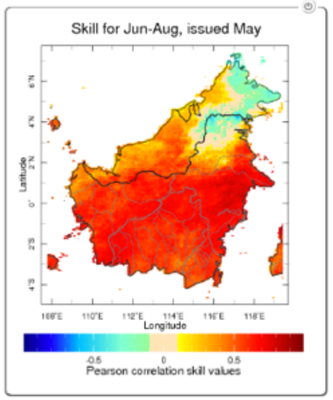
Historical Probability of Seasonal Average Rainfall Tercile Conditioned on ENSO (El Nino-Southern O... | Indonesia CPT Precipitation Forecast -- CHIRPS

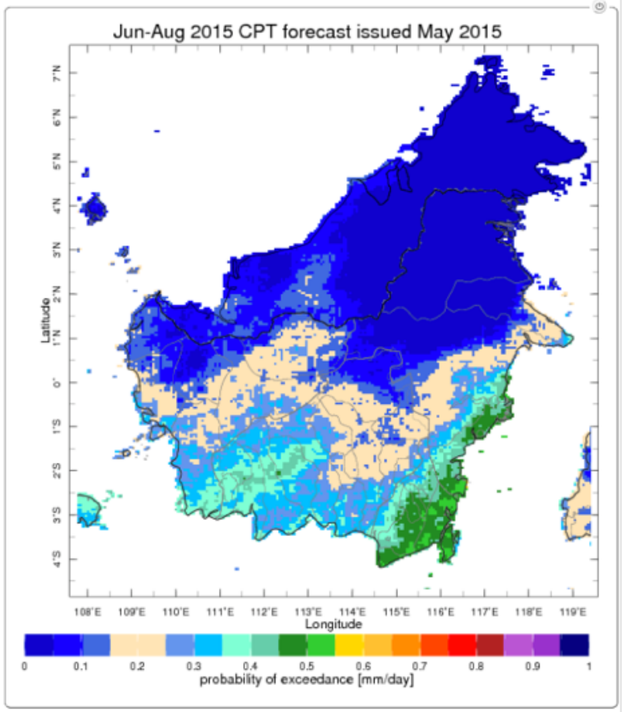
Climate and Agriculture: IFAD
Experimental Regional Seasonal Forecast: Indonesia CPT Precipitation Forecast -- CHIRPS
Target Season: Jun-Aug 2015
Field: Probability of non-exceeding | Percentile | 20.0 %-ile
Upper limit of probability of exceedance graph: 25 mm/day

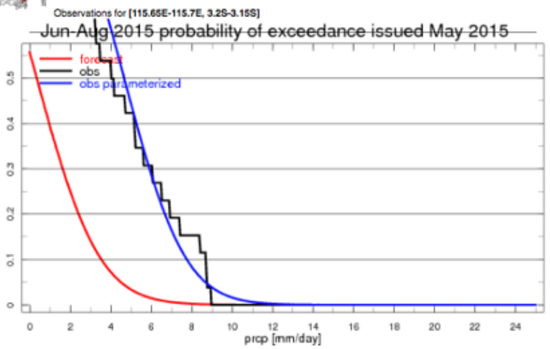
Description | Dataset Documentation | Contact Us

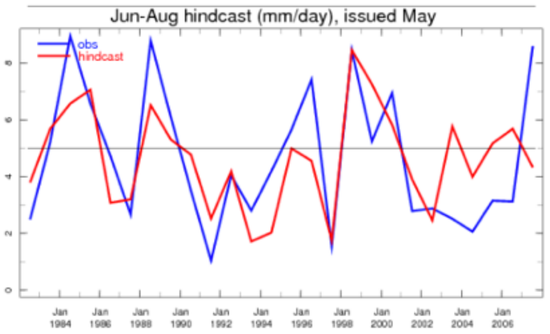
Indonesia CPT Precipitation Forecast -- CHIRPS

Experimental seasonal precipitation forecasts and a series of analysis to apply to a map of the region or to selected grid box









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Summary

- IRI Data Library infrastructure: data services + Maprooms
  - NMME, POAMA (fully open)
  - Met Office & (partial) S2S (with user registration)
- NMME for flexible-format seasonal forecasts
- CPT integration with DL Maprooms
- ENACTS + CPT for Africa