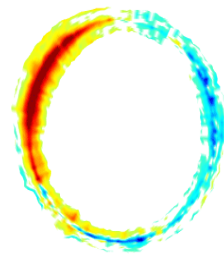


Seasonal Prediction of Extreme Rainfall Events

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International Research Institute for Climate and Society
The Earth Institute of Columbia University

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Fort Worth, TX, 03 – 06 October 2011



A PARTNERSHIP TO SAVE LIVES



 International Federation
of Red Cross and Red Crescent Societies

 The International Research Institute
for Climate and Society

Bringing communities to the same desk rather than to
the same table.



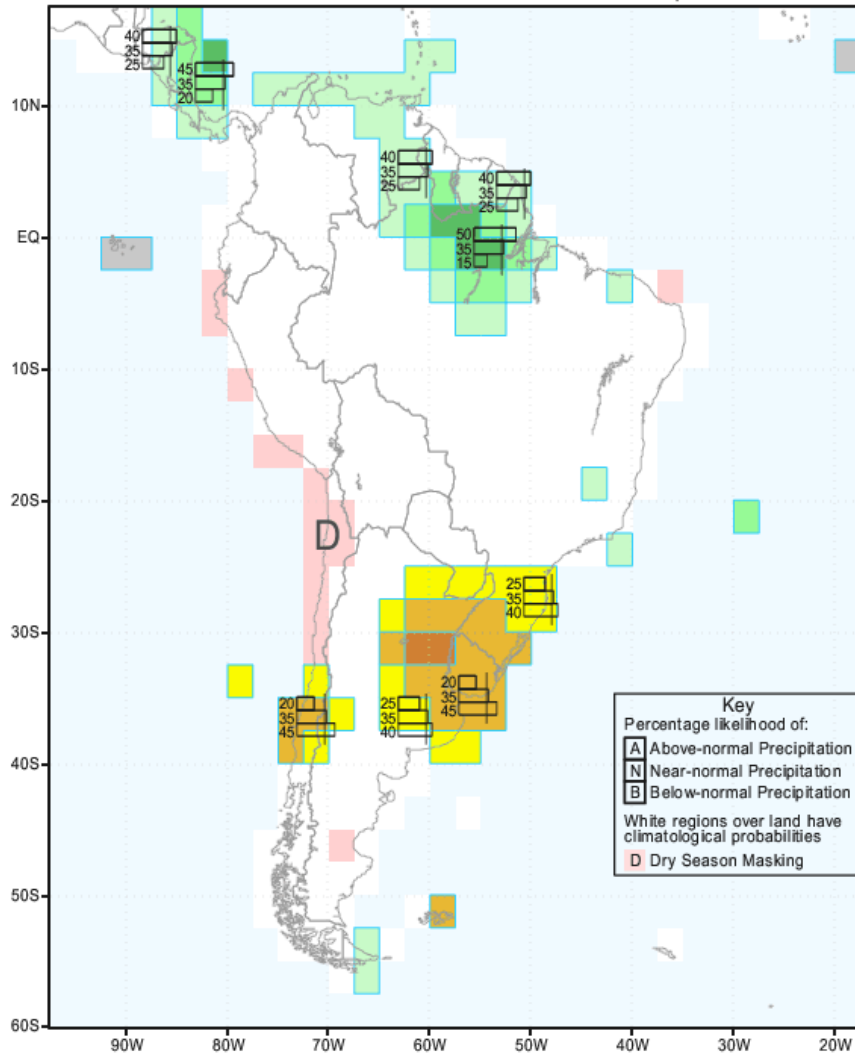
Climate Information

- Climate information is like a hospital gown:
one size fits nobody.
- Seasonal climate information is *potentially* extremely valuable.
- But in reality it generally provides only very vague answers to decision questions...



Seasonal climate information

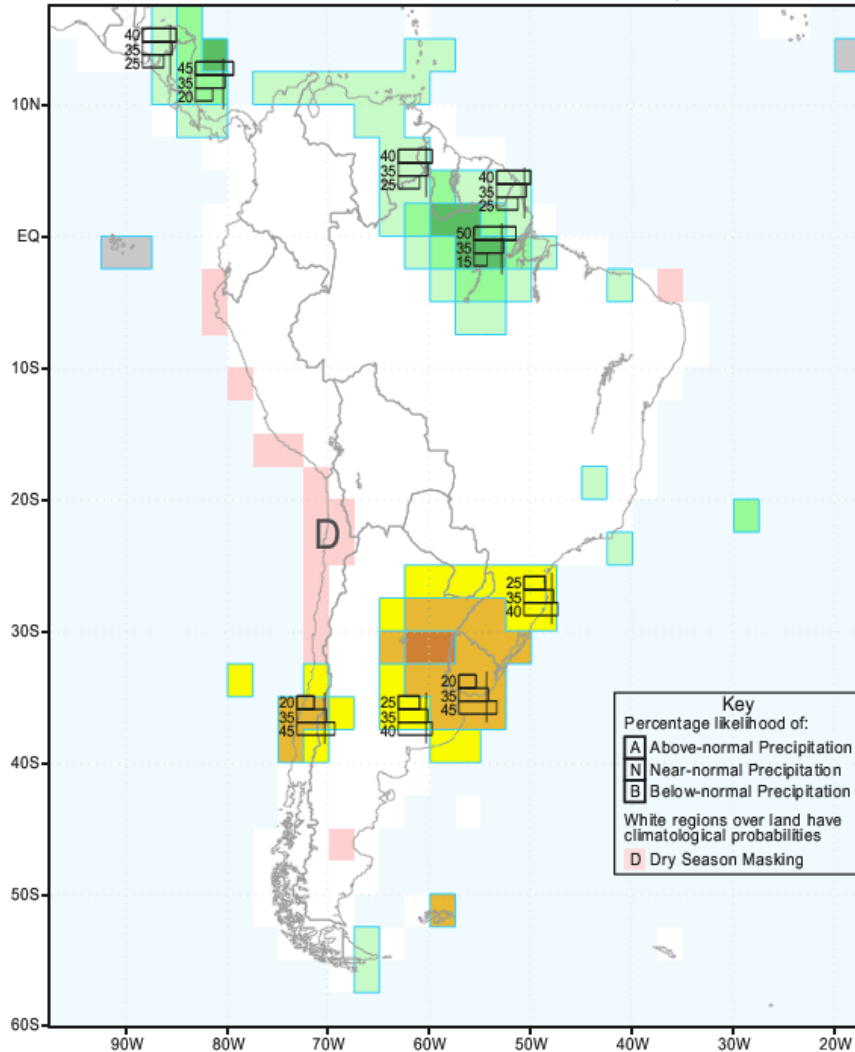
IRI Multi-Model Probability Forecast for Precipitation
for October-November-December 2011, Issued September 2011



- Will there be flooding in Managua over the next few months?
- For the next 3 months, measure the rainfall over about half the country.
- The amount of rainfall we think there will be in 2011 will make it amongst the 10 driest years we measured between 1971 and 2000 (but ...

Seasonal climate information

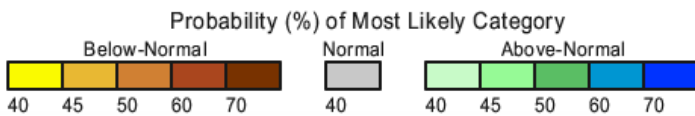
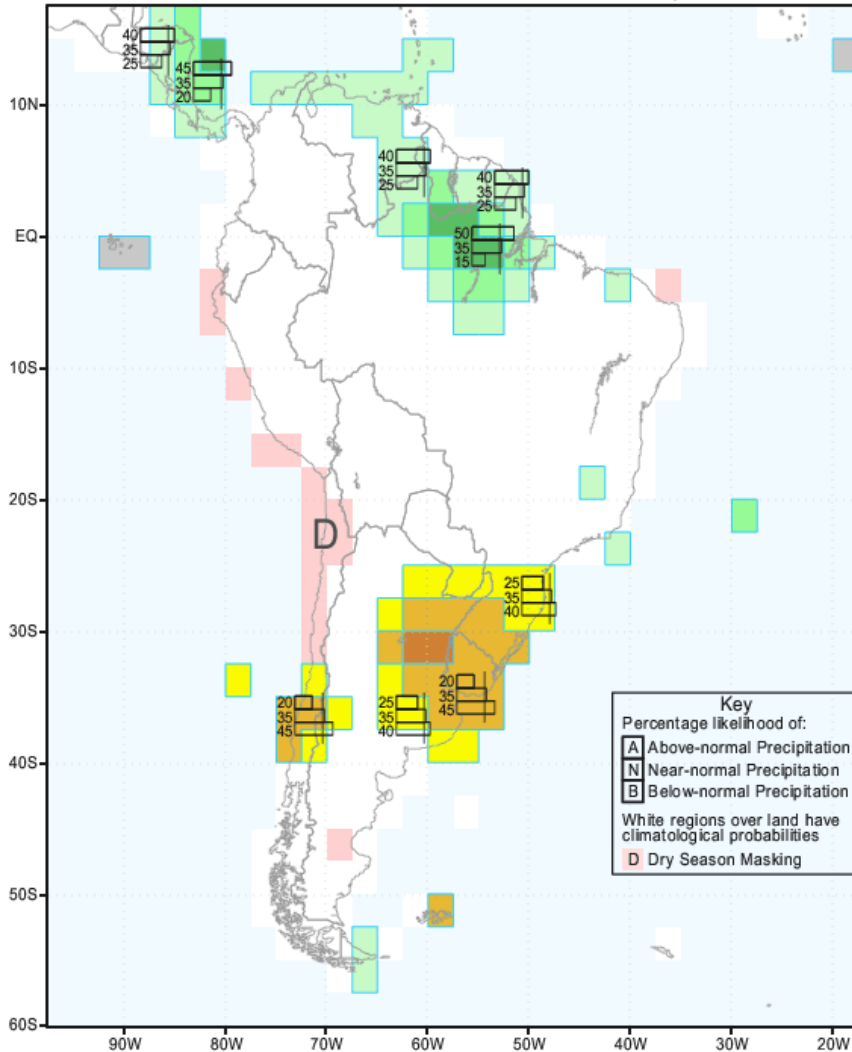
IRI Multi-Model Probability Forecast for Precipitation
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- ... the probability is only 45%, so we're more likely to be wrong than right, and ...
- even if we are right there may be floods because it may rain heavily but not frequently (and there may not be floods even if we're wrong), and ...
- we might be wrong about the 45%).
- Consider yourselves forewarned.

Seasonal climate information

IRI Multi-Model Probability Forecast for Precipitation
for October-November-December 2011, Issued September 2011



Wrong answer to the wrong question ...

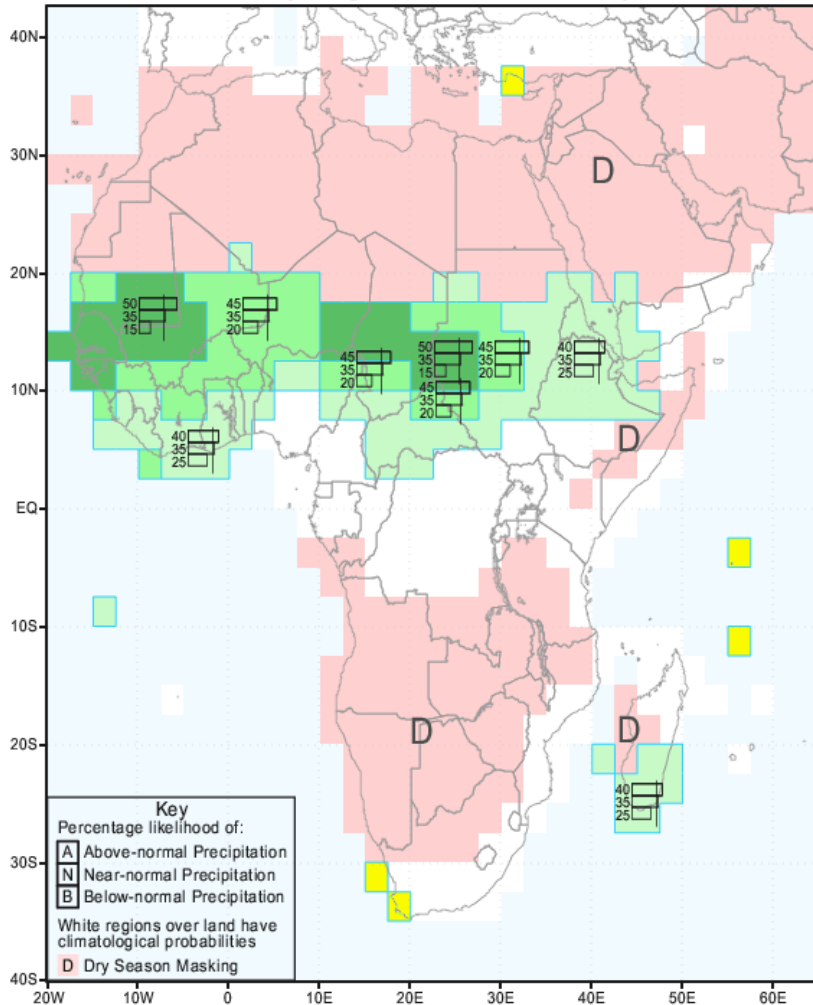
“I think the problem, to be quite honest with you is that you've never actually known what the question was.”

Douglas Adams

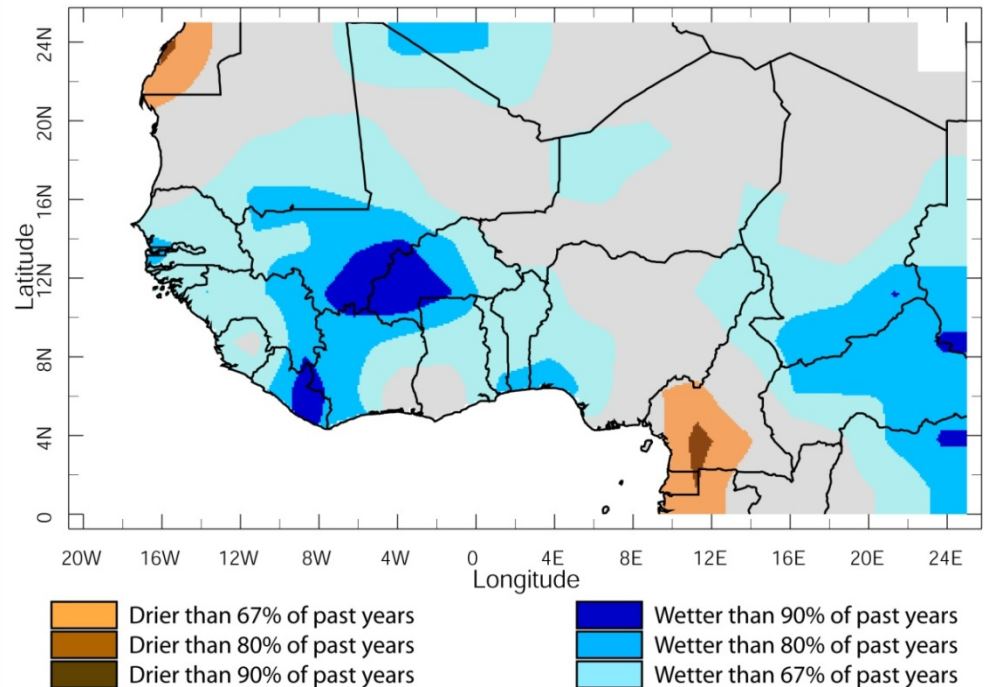


West Africa Preparedness Appeal

IRI Multi-Model Probability Forecast for Precipitation for June-July-August 2008, Issued May 2008



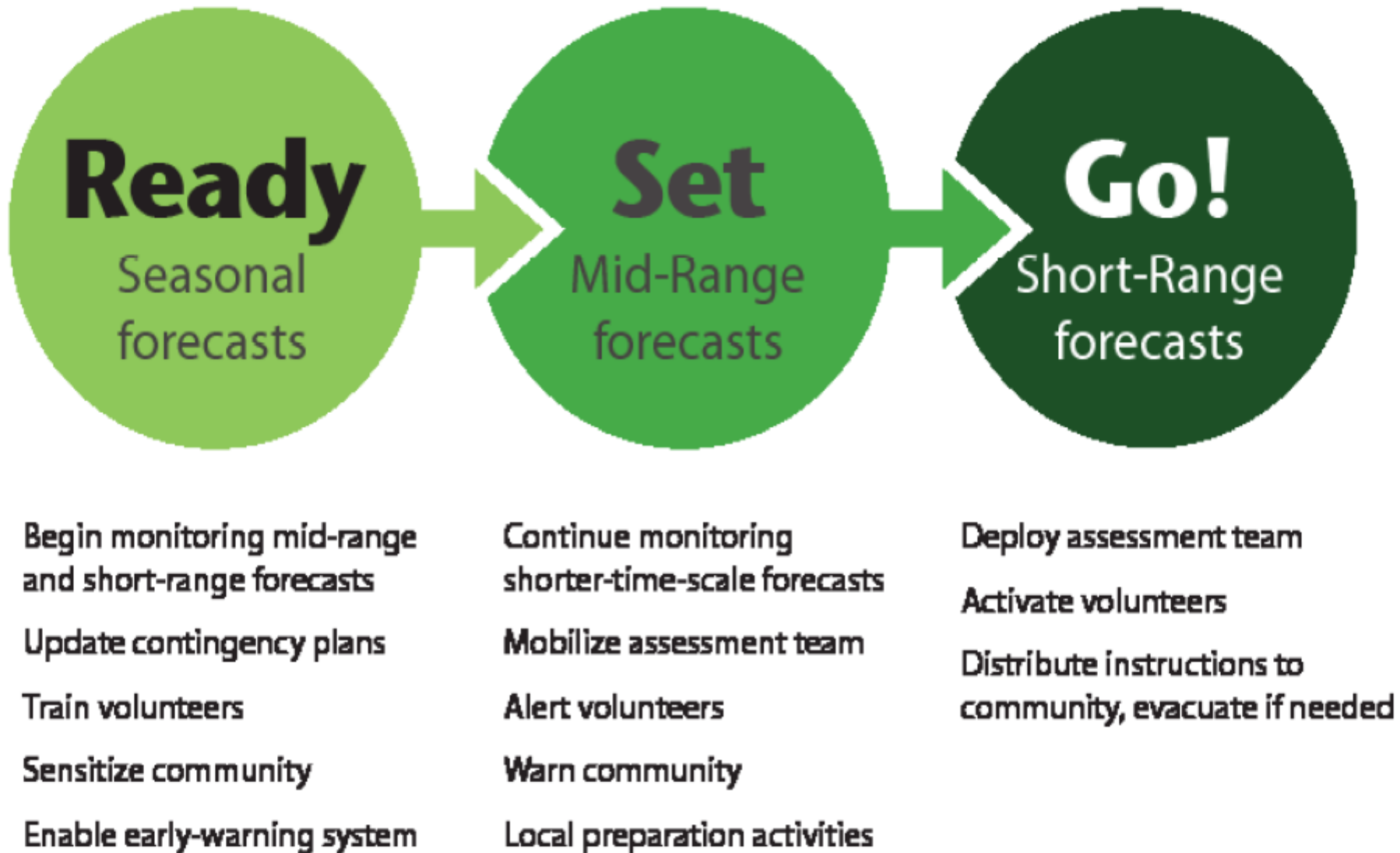
Is there an increased chance of flooding anywhere in West Africa?



Observed rainfall for
Jun-Aug 2008



Decision-making across timescales

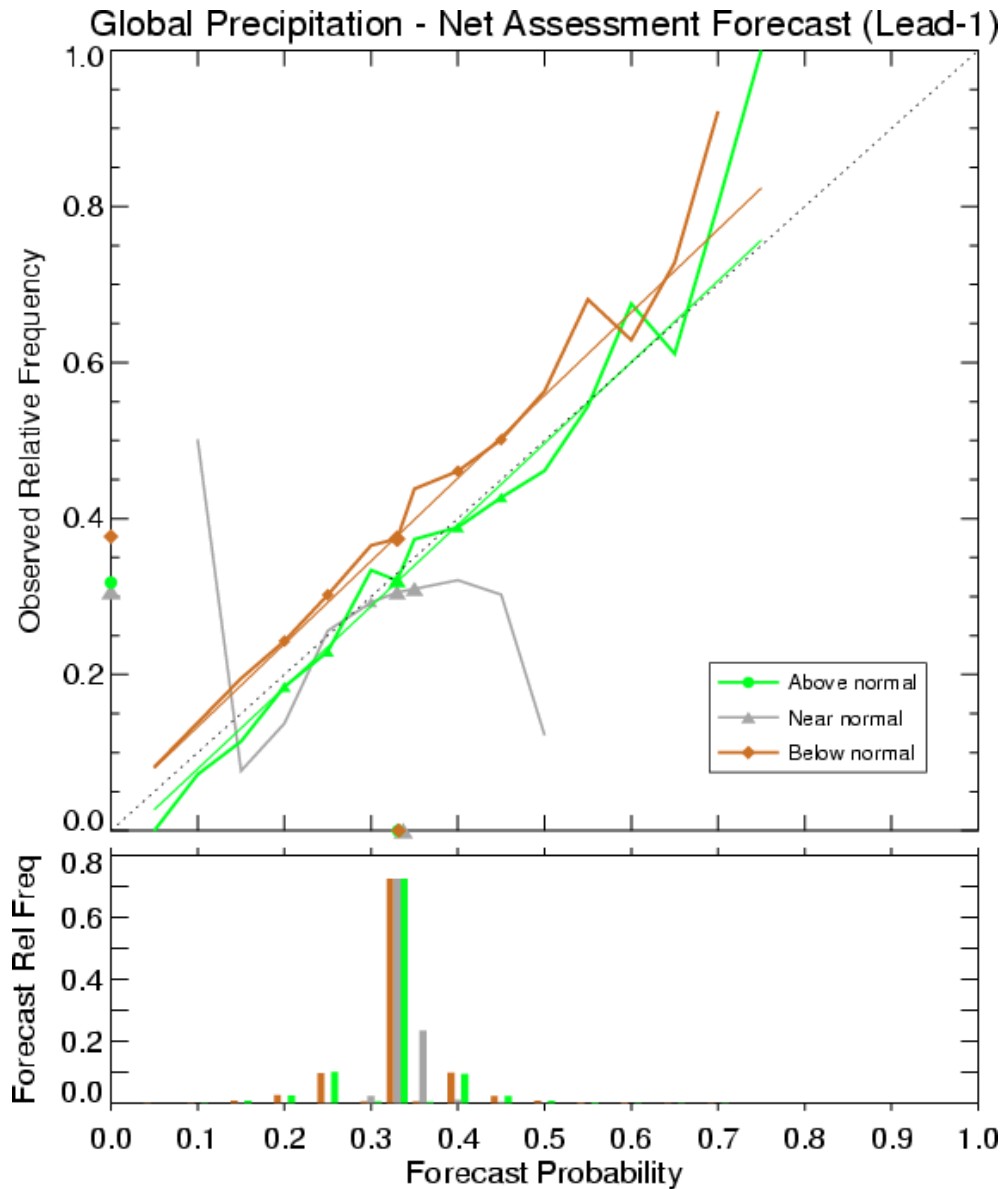


Theory and method

- In long-range forecasting we avoid forecasting the precise timing of events. Why not also avoid forecasting the precise location of events?
- For each location define a threshold for “heavy” rainfall based on percentiles of a climatological distribution of k -day totals.
- Over a large number of locations count the number of exceedances during each season. Years with high values will have frequent and/or widespread heavy rains.
- Construct a model to predict the year-to-year variability in this value.



IRI forecast verification

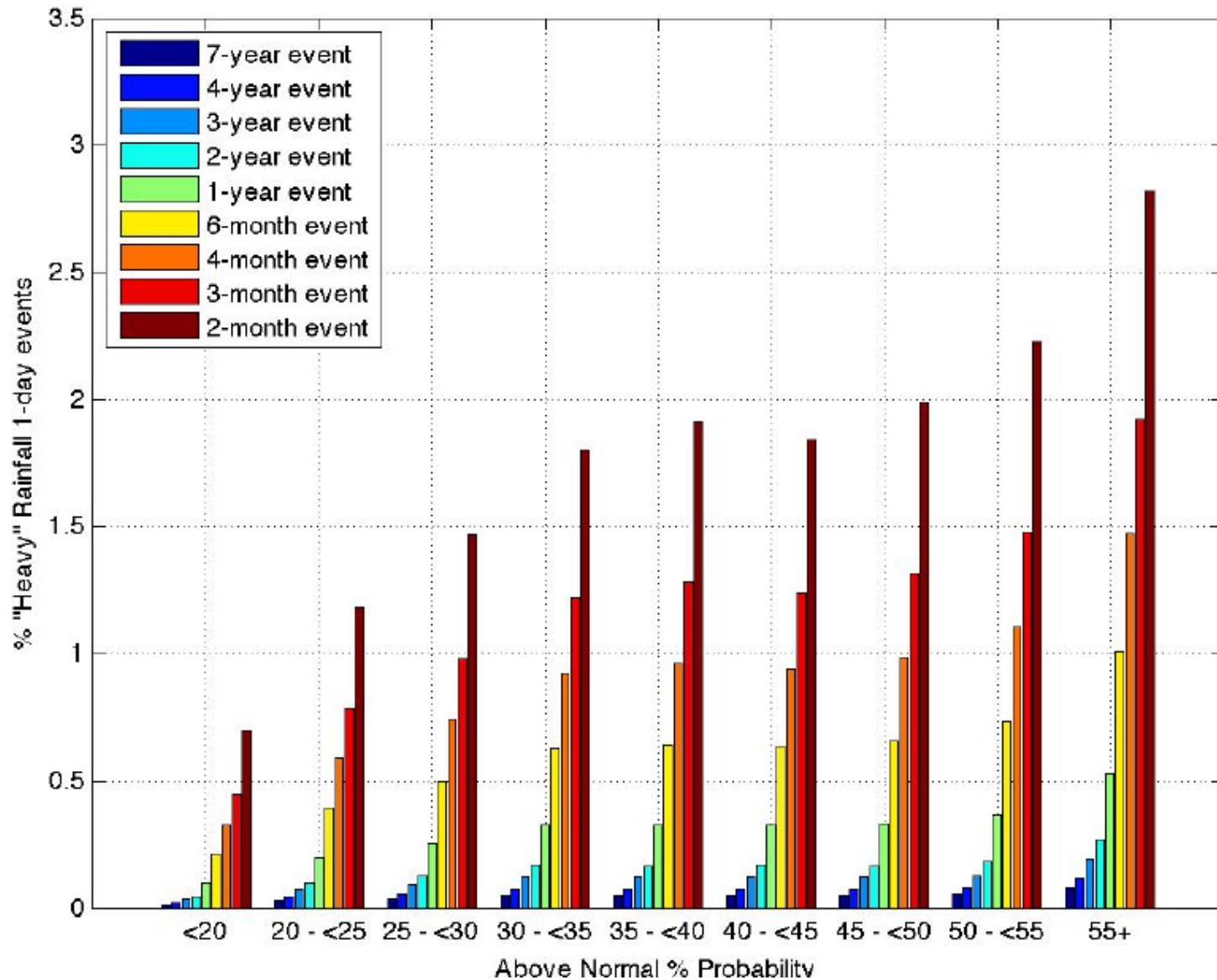


IRI seasonal forecasts of above-normal precipitation show very good reliability.



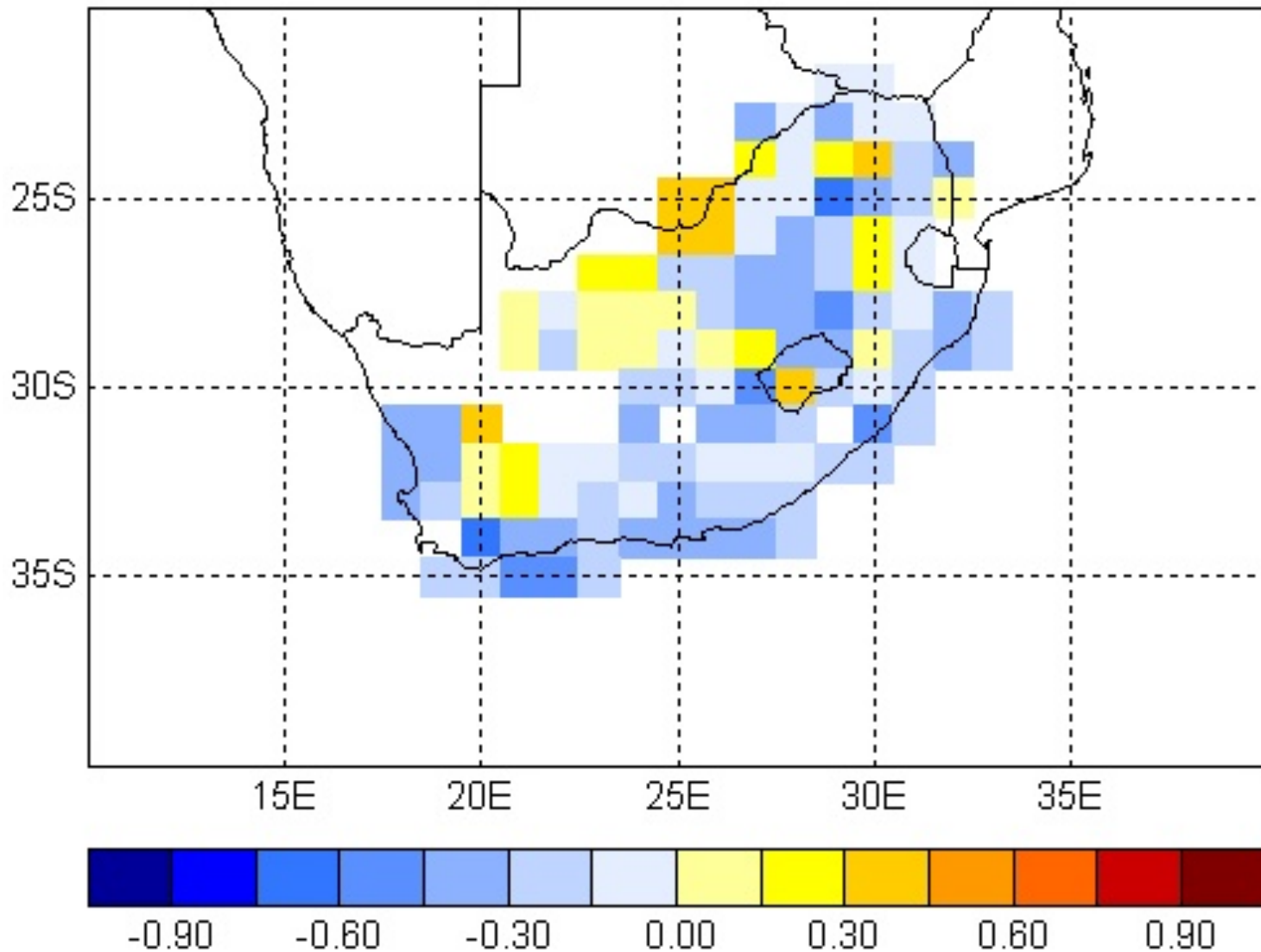
Seasonal forecasts and heavy rain

% 1-day Heavy Rainfall Events (various definitions) -- Sep 1997 - May 2011



Local frequencies

Pearson's Correlation



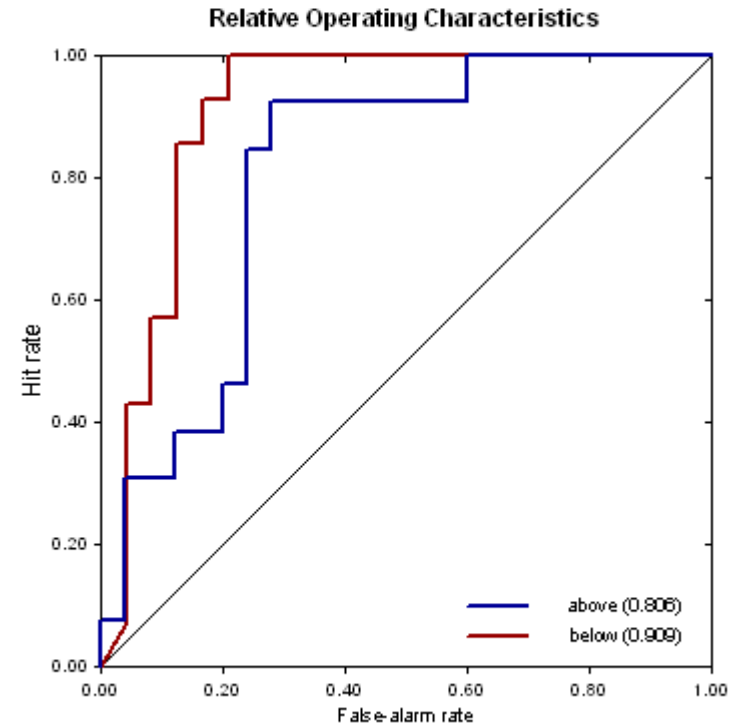
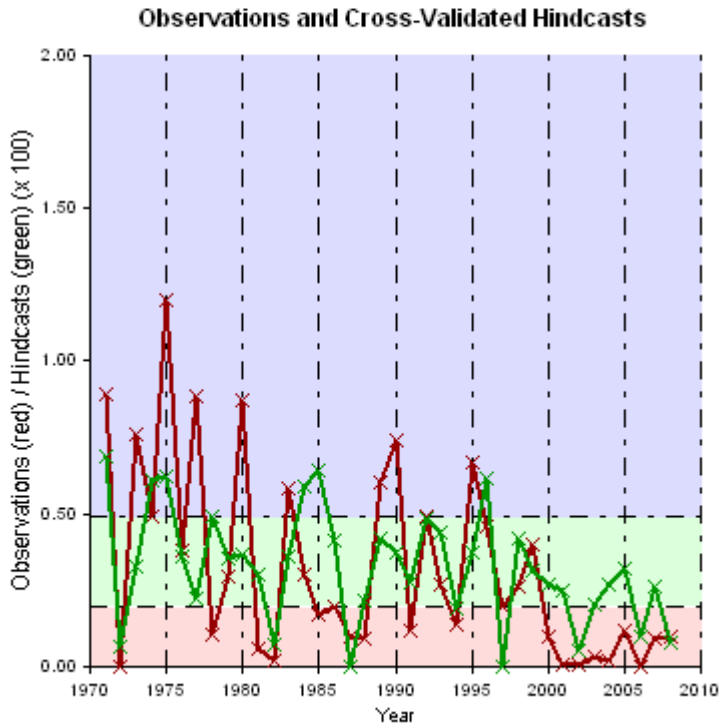
Country-wide frequencies

Continuous measures:

Pearson's correlation	0.5447
Spearman's correlation	0.6619
2AFC score	72.55%
% variance	29.67%
Variance ratio	0.3454
Mean bias	0.00
Root mean squared error	0.00
Mean absolute error	0.00

Categorical measures:

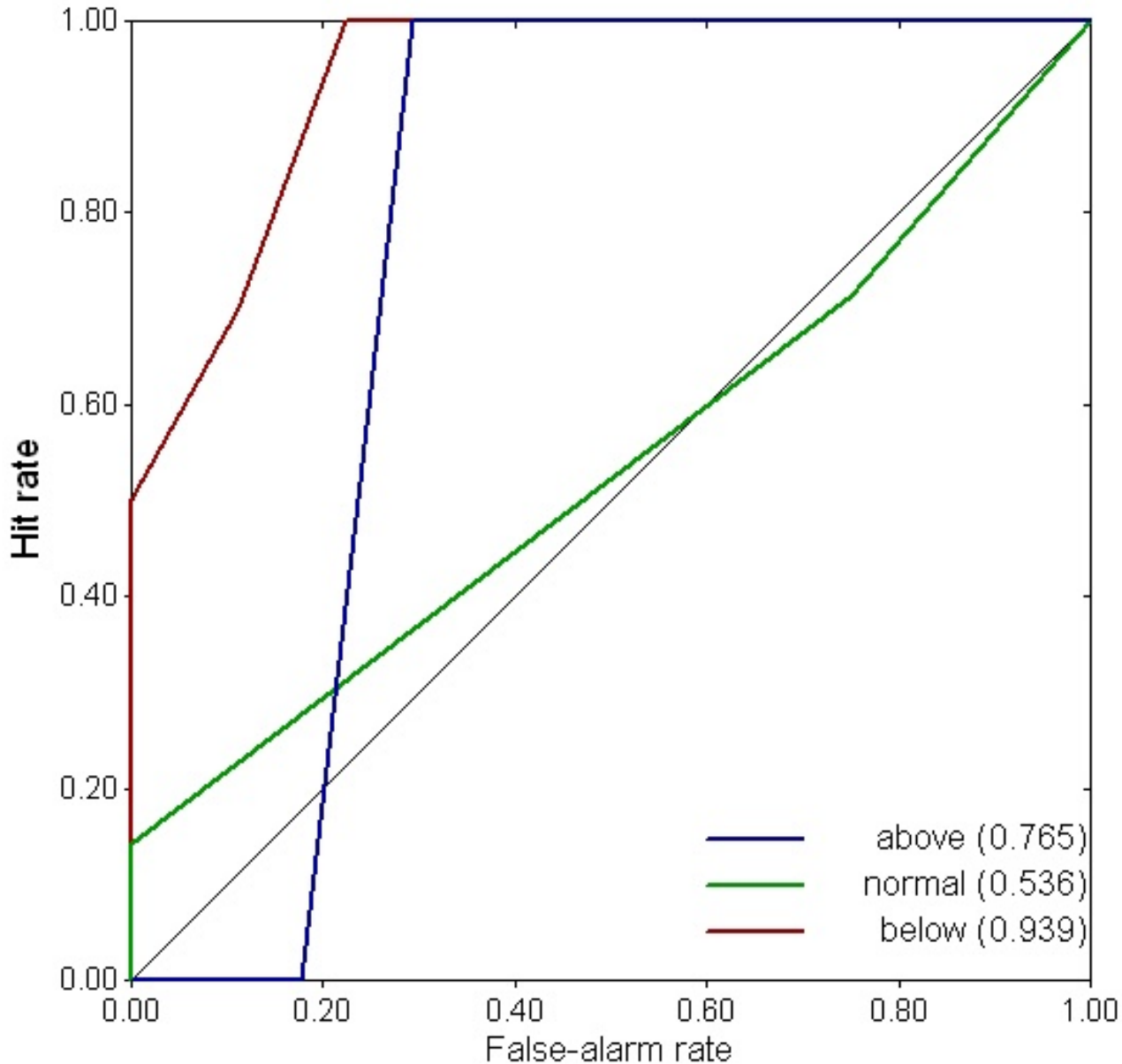
Hit score	55.26%
Hit skill score	32.89%
LEPS	48.32%
Gerrity score	45.96%
2AFC (forecast categories)	79.75%
2AFC (continuous forecasts)	81.73%
ROC area (below-normal)	0.9092
ROC Area (above-normal)	0.8062



Retroactive skill

ROC Diagram

- Con data
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- y
- Calc and resp
- Rep



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Conclusions

- Standard seasonal forecasts of above-normal precipitation probably provide a good indication of changes in risk of exceptionally heavy rainfall events, but we can do so much better than just making that assumption.
- Forecasting the local number of heavy rainfall events directly is unskillful because of sample-size problems
- Forecasting the number of heavy rainfall events over an area is skillful
- Useful decisions can be made despite the lack of geographical specificity

