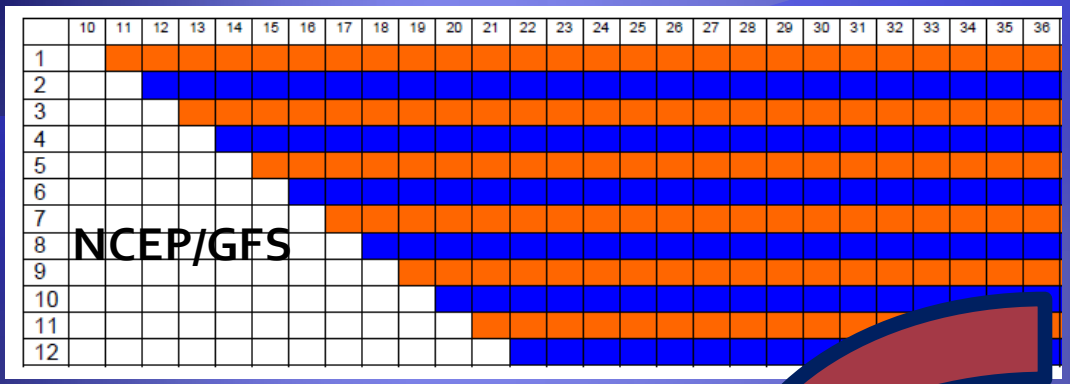
IMPROVING THE RELIABILITY OF SEASONAL CLIMATE FORECASTS THROUGH EMPIRICAL DOWNSCALING AND MULTI-MODEL CONSIDERATIONS

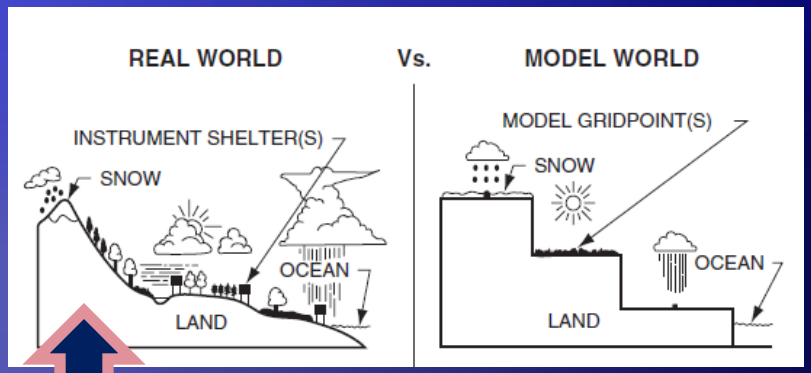
Willem A. Landman
Simon J. Mason

Prediction Strategy at CSIR

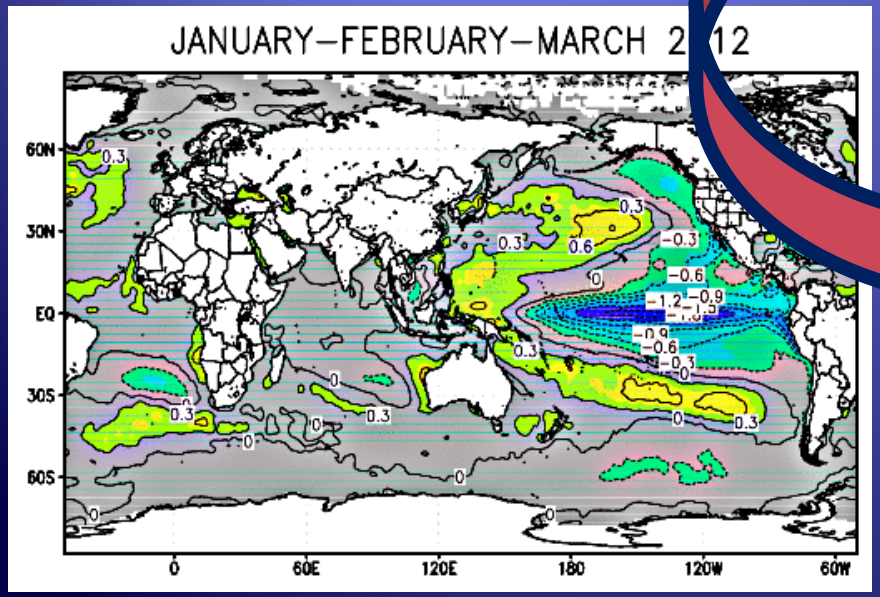
Atmospheric ICs



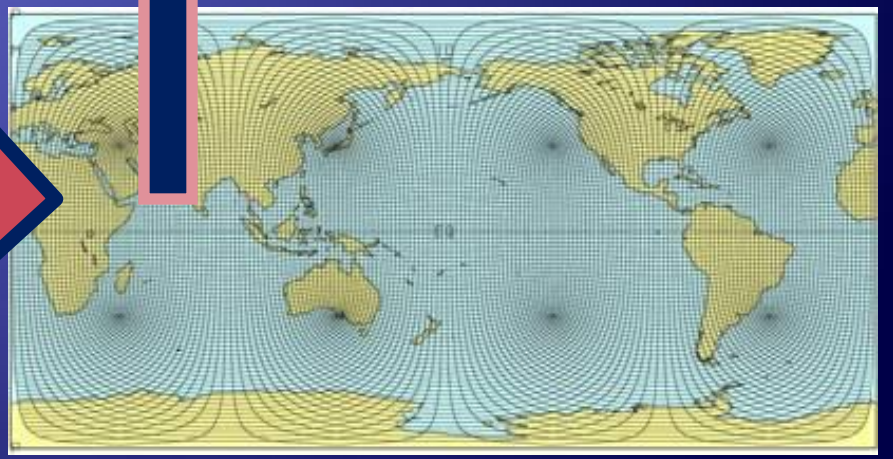
Model Output Statistics



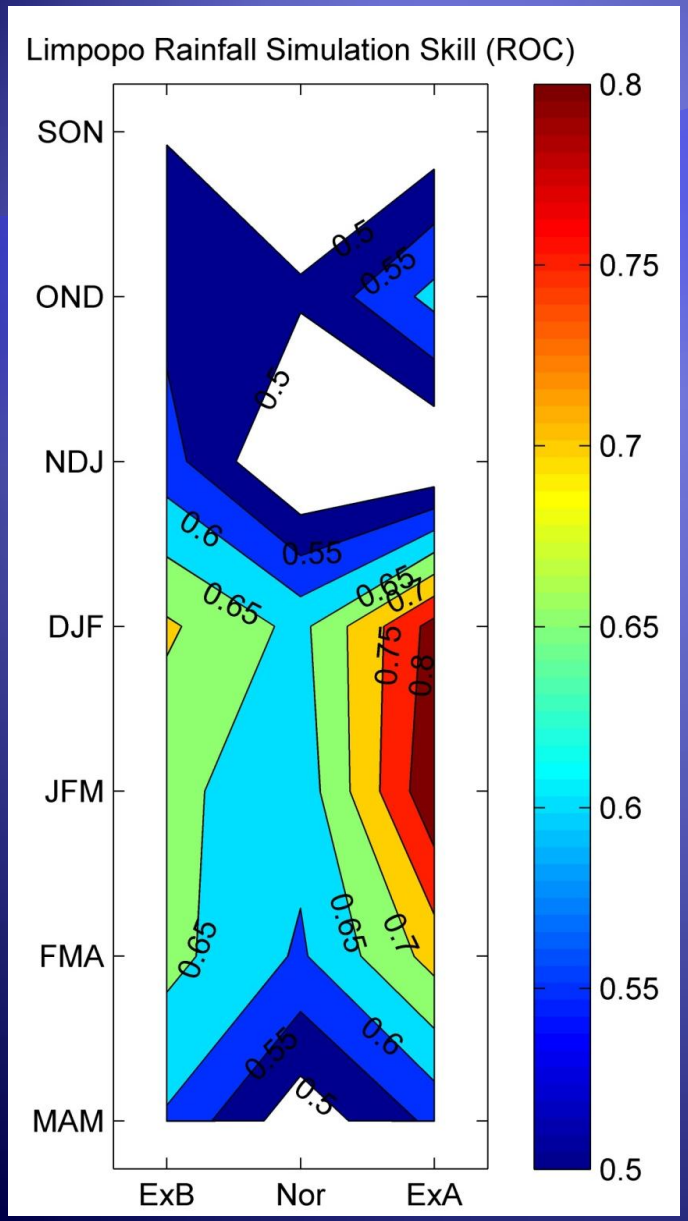
Boundary Conditions

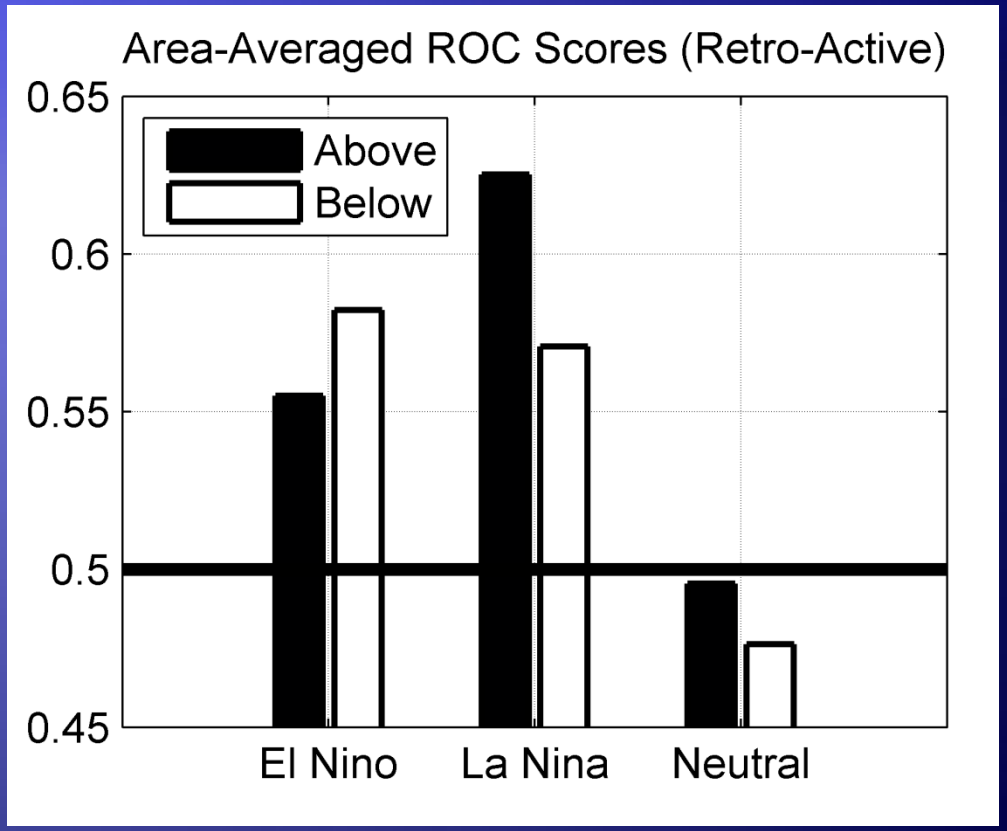


Resolution ~200km



Prediction Skill (Rainfall)





Statistical Correction of Tropical Pacific Sea Surface Temperature Forecasts

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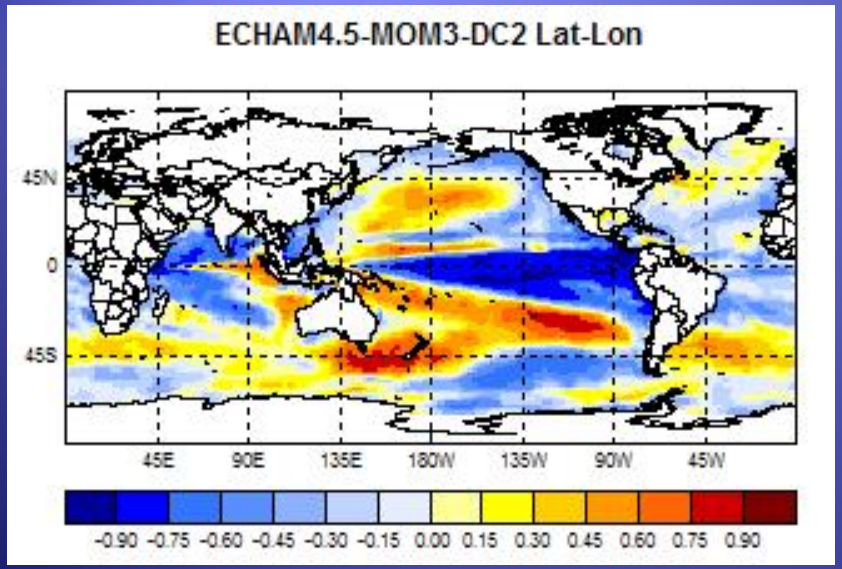
(Manuscript received 17 December 2004, in final form 20 June 2005)

1.5°

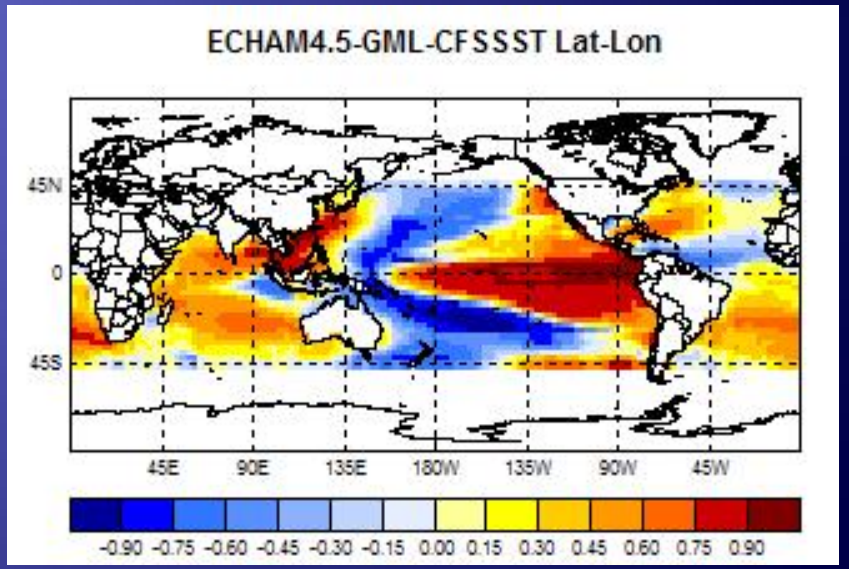


1.5°

0.5°

1.5°

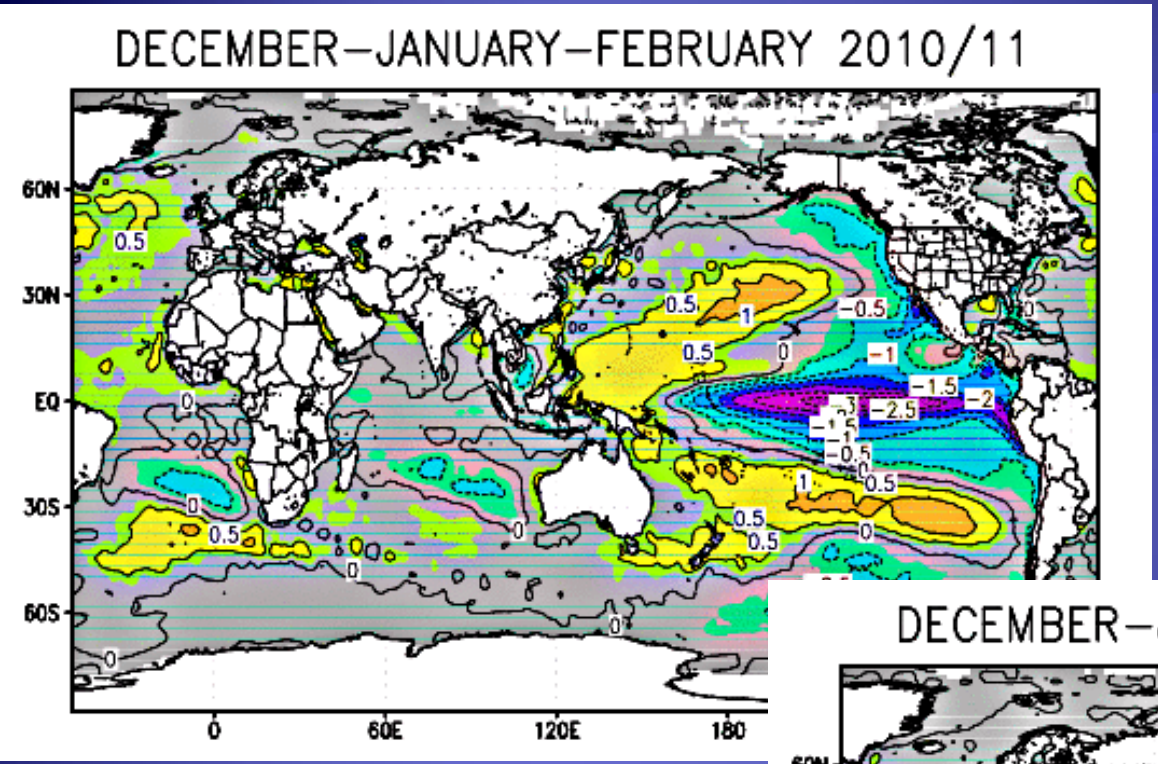
2.8°



2.8°

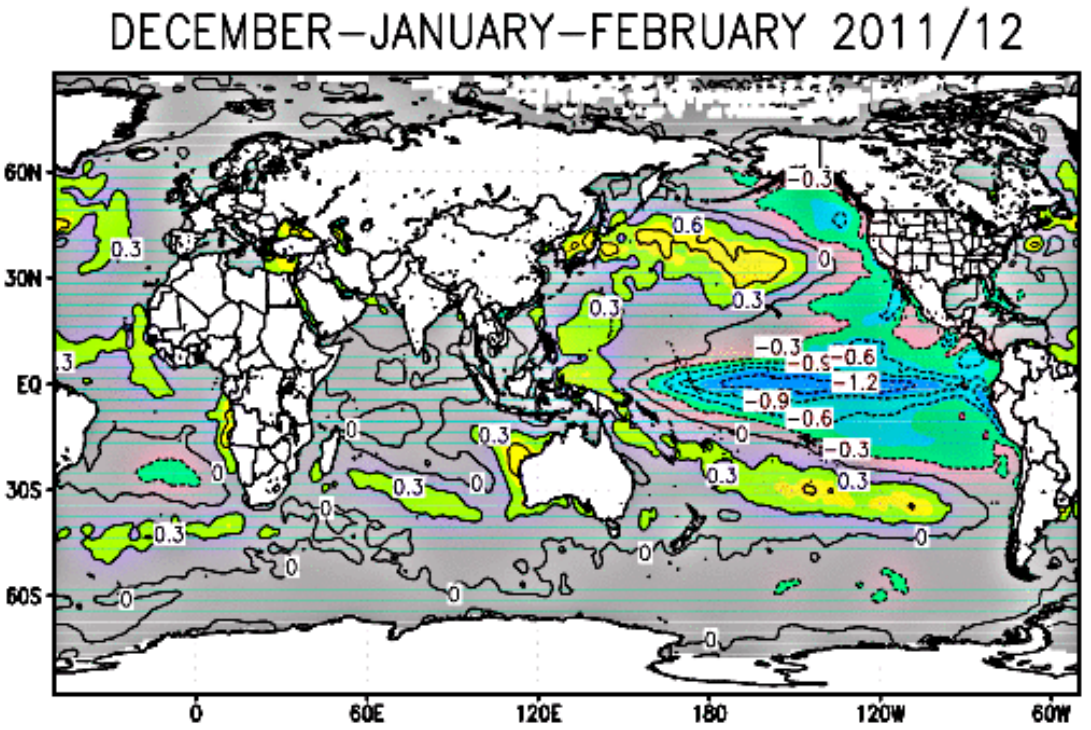
- MOS correction improves equatorial SST predictions
- MOS interpolates to common 1° x 1° OIv2 resolution
- MOS extrapolates outside CGCM domains

September 2010



La Niña events of 2010/11 and 2011/12

September 2011

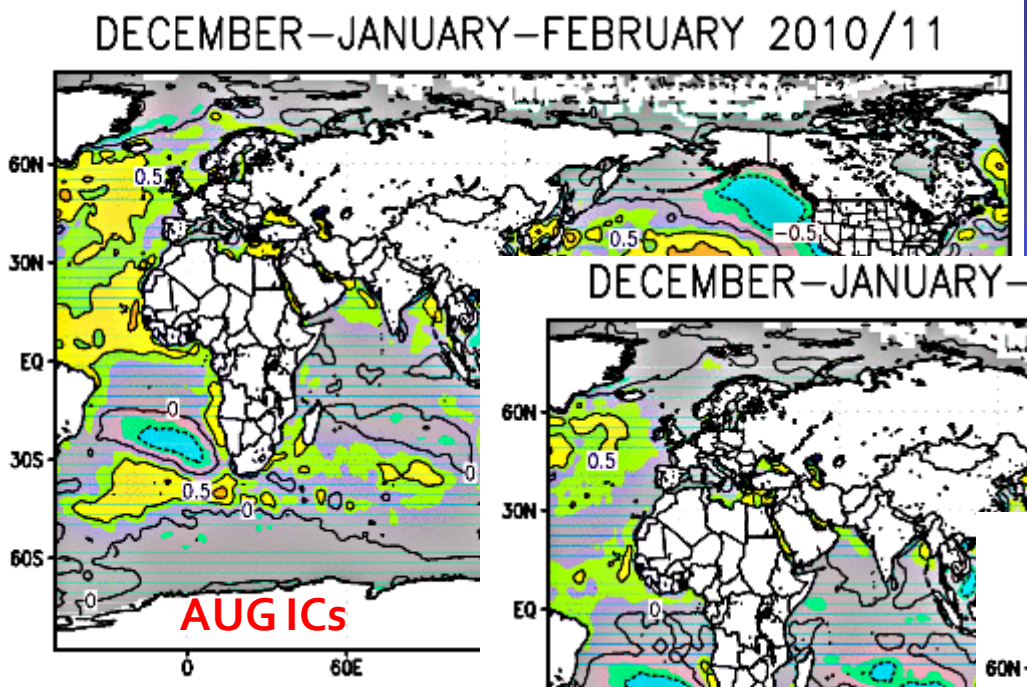


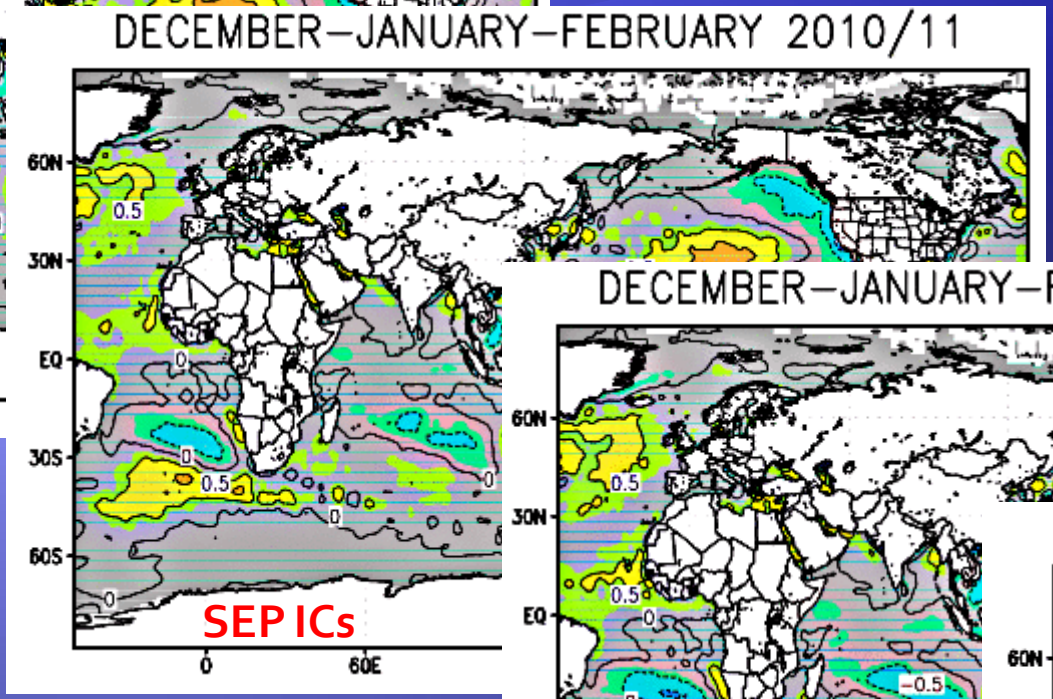
Oceanic Niño Index:

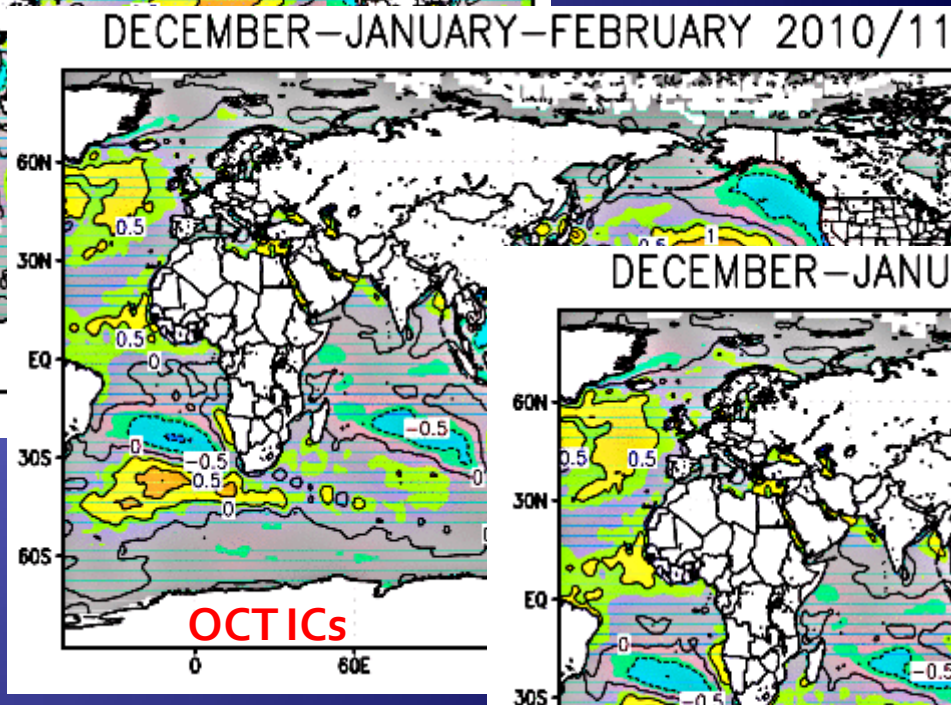
DJF 2010/11 **-1.4**

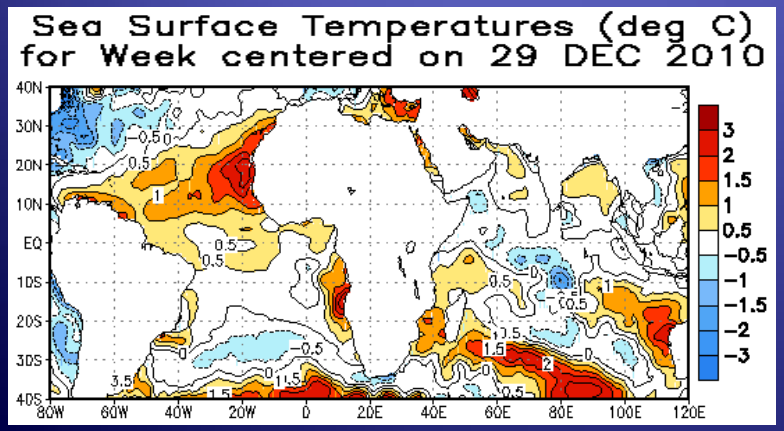
DJF 2011/12 **-0.9**

Predicted Subtropical Dipole Modes during 2010/11



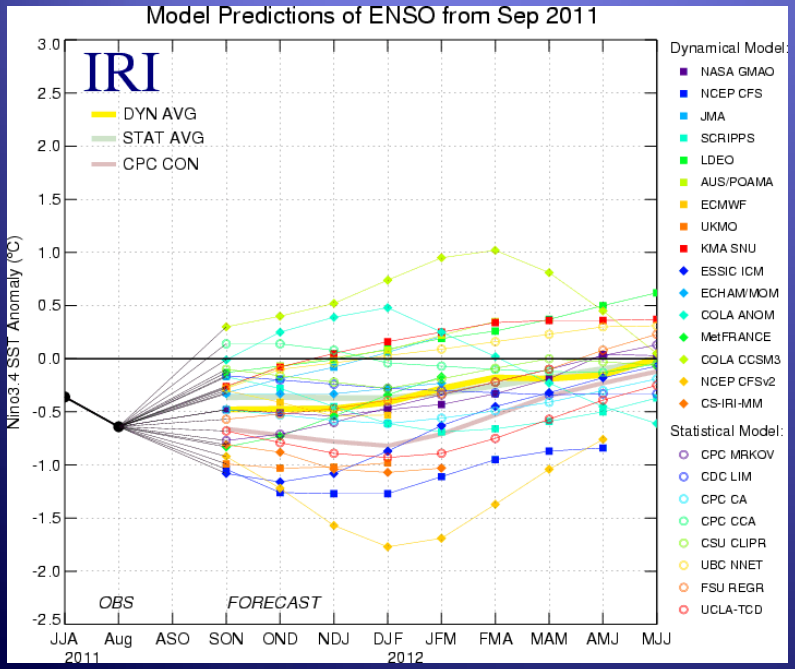




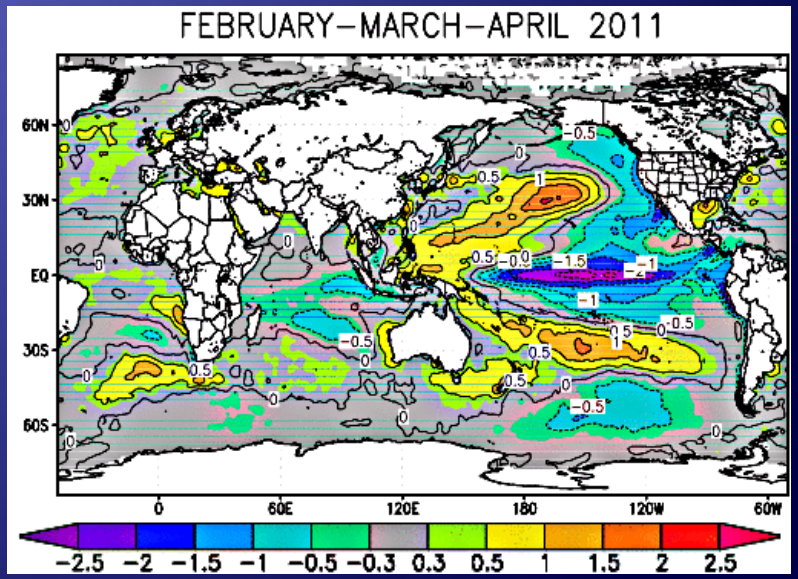


More reasons to produce SST forecasts

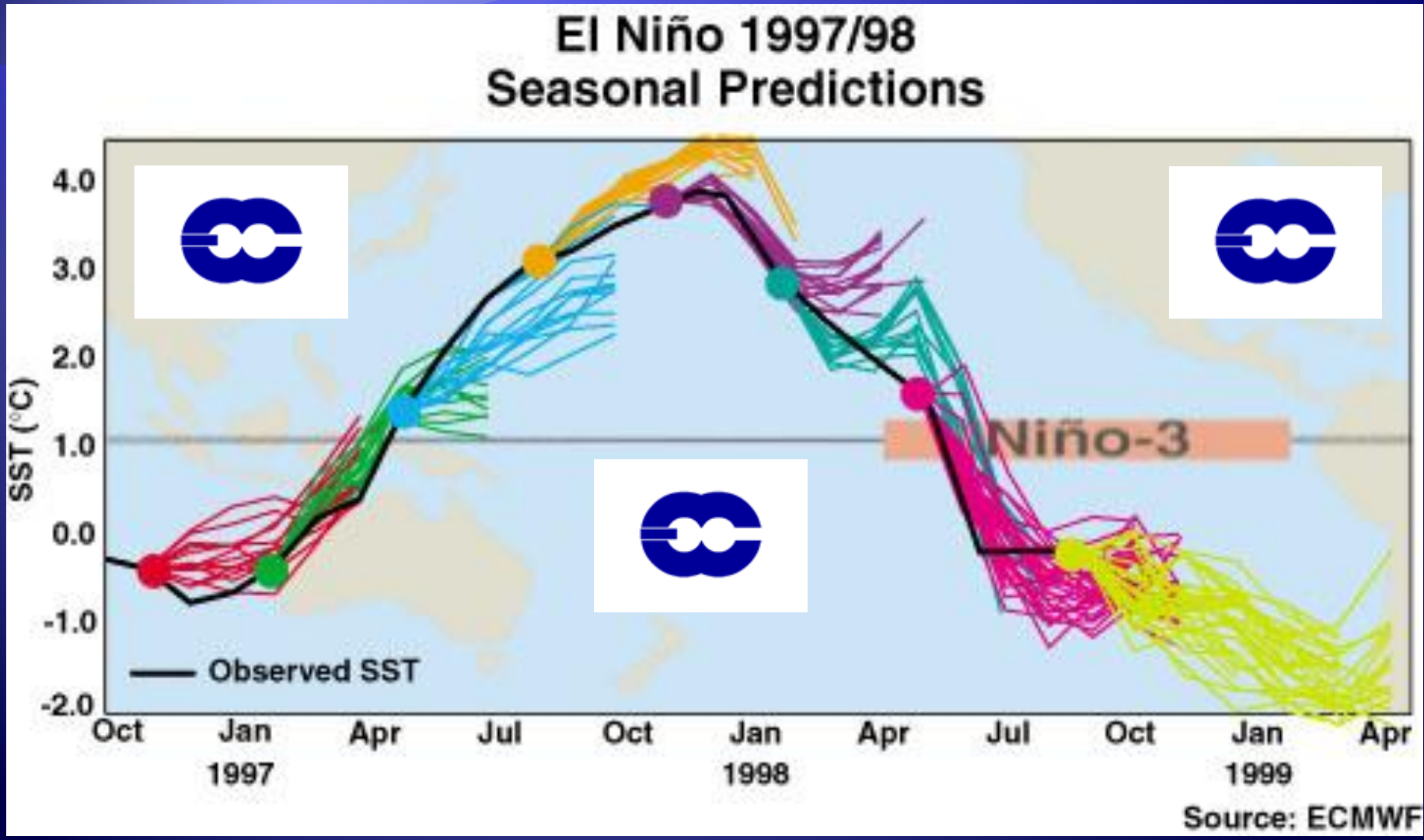
- UCT-CSAG's HadAM3P
- SAWS's ECHAM4.5
- CSIR's CCAM
- Contributing to IRI's NIÑO3.4 forecast plume:

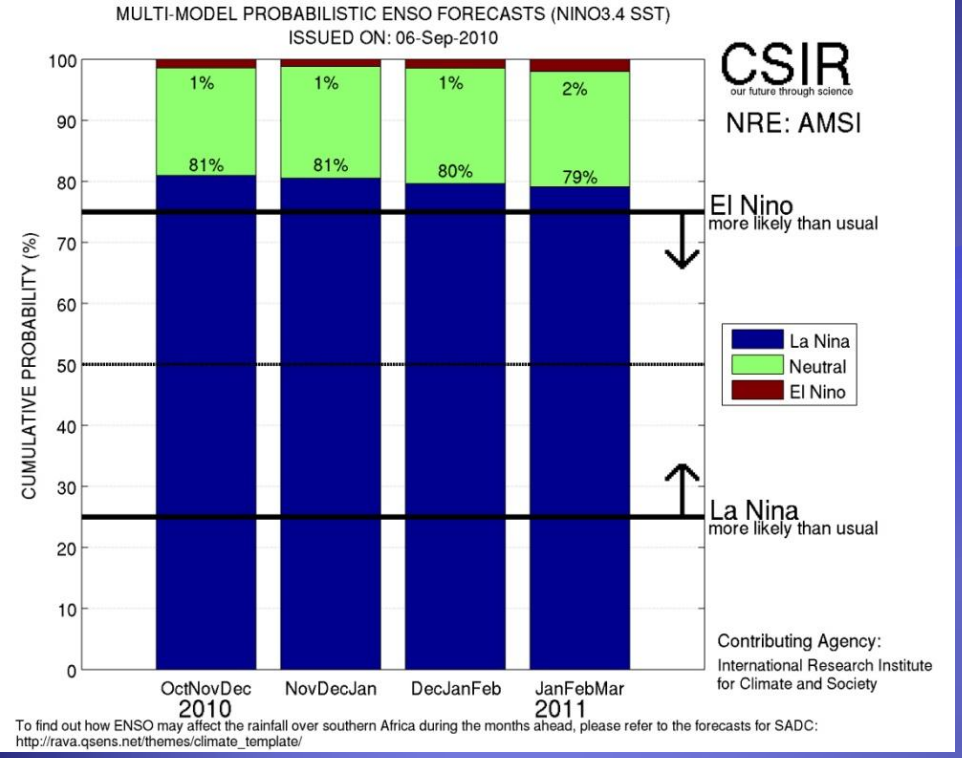


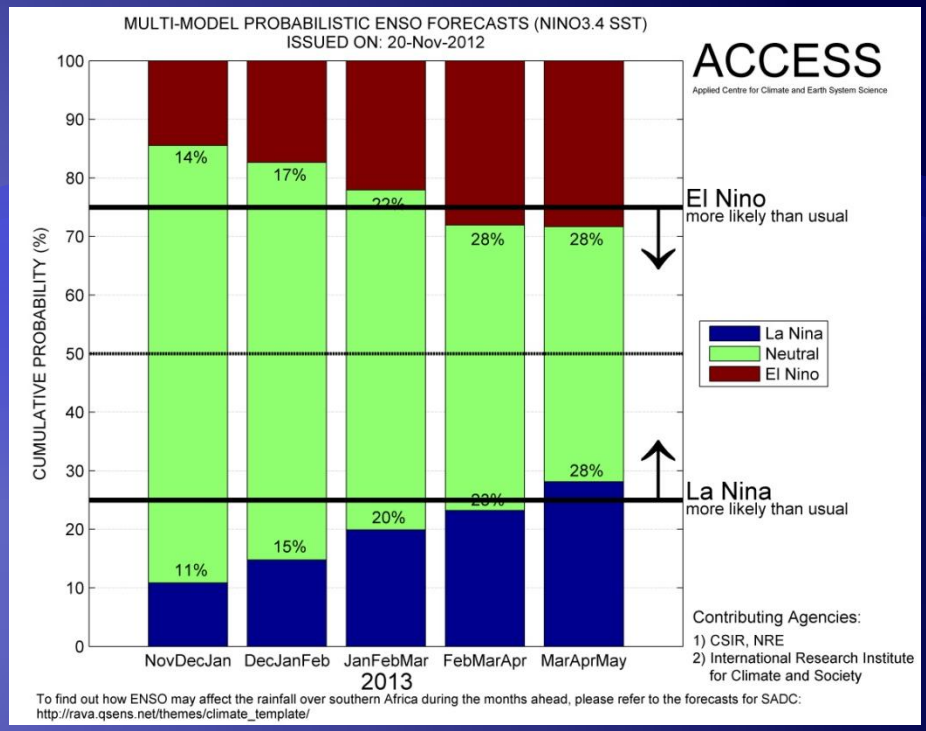
- 1° x 1° resolution global SSTA available from 1982
  - Hindcast
  - Operational
- Available from CSIR's FTP site

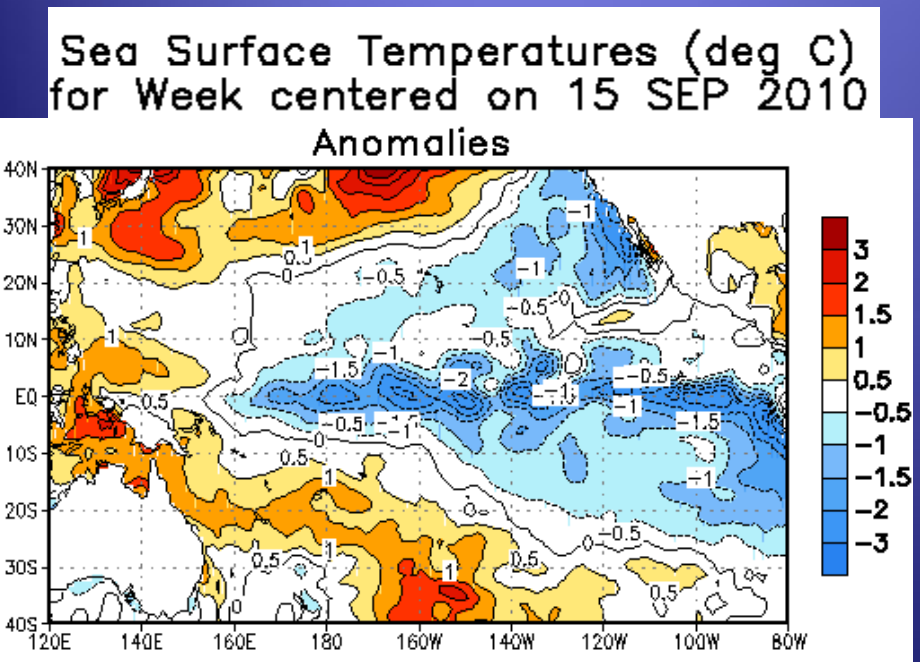


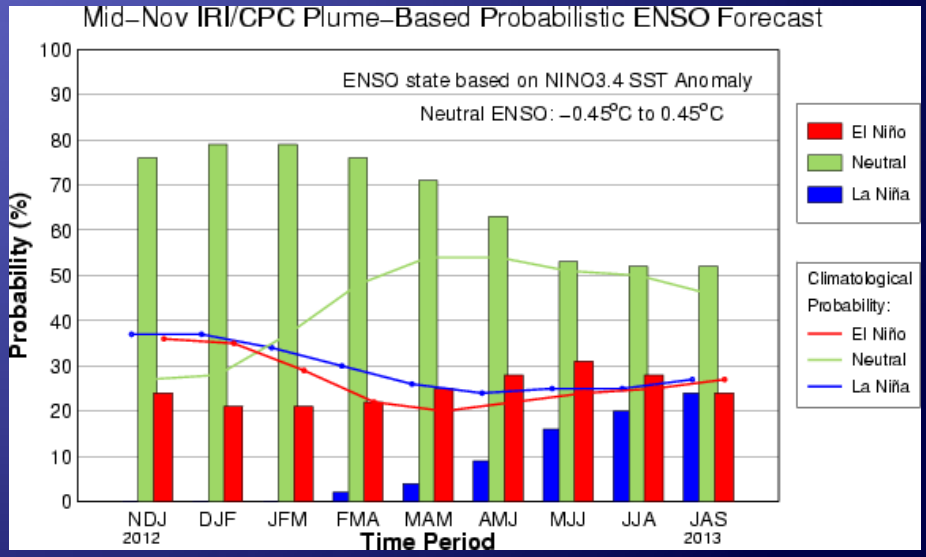
ENSO forecasts are (also) probabilistic




MULTI-MODEL PROBABILISTIC ENSO FORECASTS (NINO3.4 SST)
ISSUED ON: 06-Sep-2010
CSIR
our future through science
NRE: AMSI
CUMULATIVE PROBABILITY (%)
1%
1%
1%
2%
81%
81%
80%
79%
El Nino
more likely than usual
La Nina
more likely than usual
La Nina
Neutral
El Nino
Contributing Agency:
International Research Institute
for Climate and Society
OctNovDec
2010
NovDecJan
DecJanFeb
JanFebMar
2011
To find out how ENSO may affect the rainfall over southern Africa during the months ahead, please refer to the forecasts for SADC:
http://rava.qsens.net/themes/climate_template/


MULTI-MODEL PROBABILISTIC ENSO FORECASTS (NINO3.4 SST)
ISSUED ON: 20-Nov-2012
ACCESS
Applied Centre for Climate and Earth System Science
CUMULATIVE PROBABILITY (%)
14%
17%
22%
28%
28%
11%
15%
20%
23%
28%
El Nino
more likely than usual
La Nina
more likely than usual
La Nina
Neutral
El Nino
Contributing Agencies:
1) CSIR, NRE
2) International Research Institute
for Climate and Society
NovDecJan
DecJanFeb
JanFebMar
2013
FebMarApr
MarAprMay
To find out how ENSO may affect the rainfall over southern Africa during the months ahead, please refer to the forecasts for SADC:
http://rava.qsens.net/themes/climate_template/


Sea Surface Temperatures (deg C)
for Week centered on 15 SEP 2010
Anomalies
40N
30N
20N
10N
EQ
10S
20S
30S
40S
120E
140E
160E
180
160W
140W
120W
100W
80W
3
2
1.5
1
0.5
−0.5
−1
−1.5
−2
−3


Mid−Nov IRI/CPC Plume−Based Probabilistic ENSO Forecast
ENSO state based on NINO3.4 SST Anomaly
Neutral ENSO: −0.45°C to 0.45°C
Probability (%)
El Niño
Neutral
La Niña
Climatological
Probability:
El Niño
Neutral
La Niña
NDJ
2012
DJF
JFM
FMA
MAM
AMJ
MJJ
JJA
JAS
2013
Time Period

Are these ENSO forecasts really the best we can do (at the moment)?

Three models

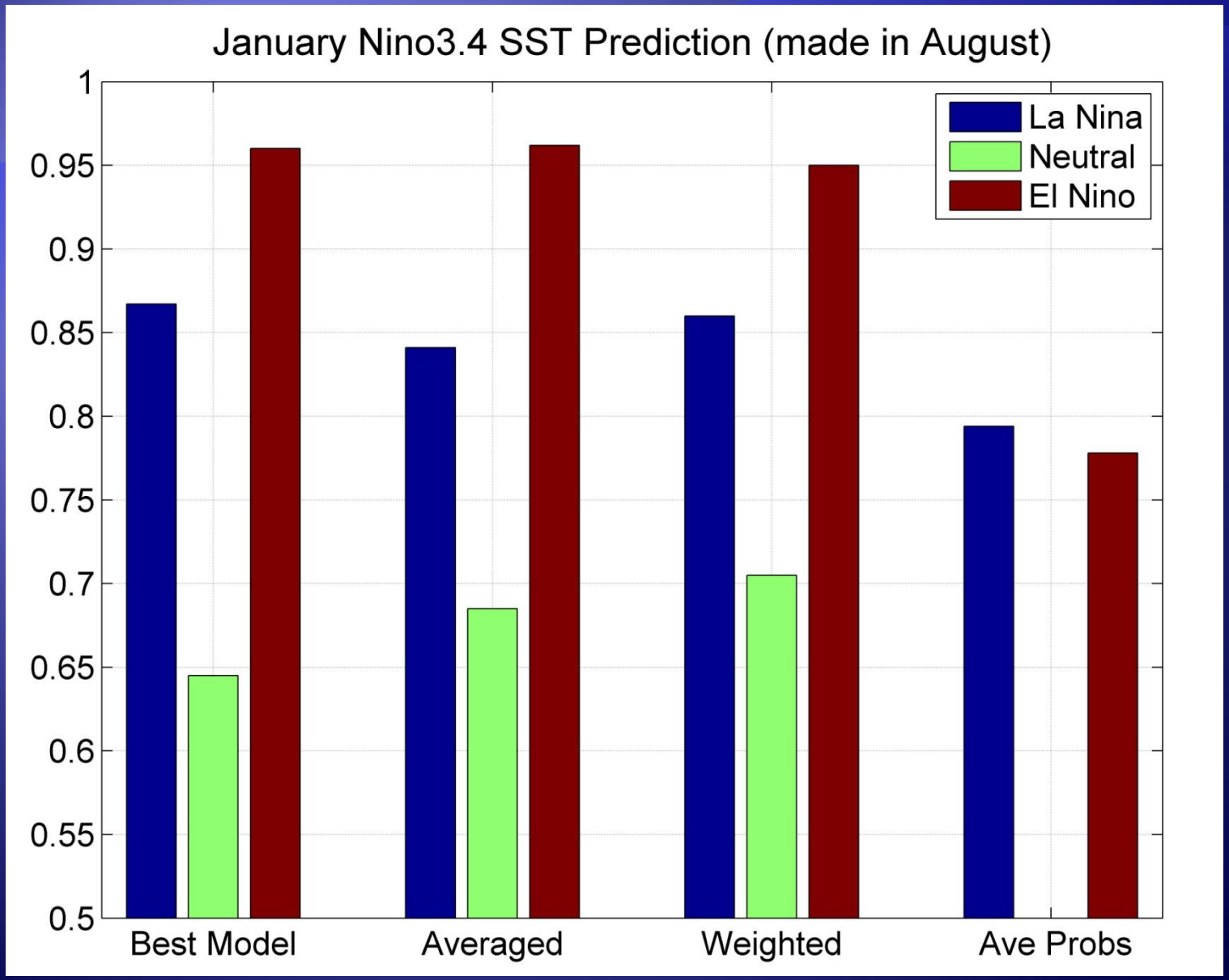
- CCA-SST (M-J-J SST as predictor in statistical model)
- COLA-RSMAS-CCSM3 (August initialization)
- ECHAM4.5-MOM3-DC2 (August initialization)

Three approaches

- Best model
- Average (two techniques)
- Weighted average

Discrimination (ROC)

(are the forecasts discernibly different given different outcomes?)



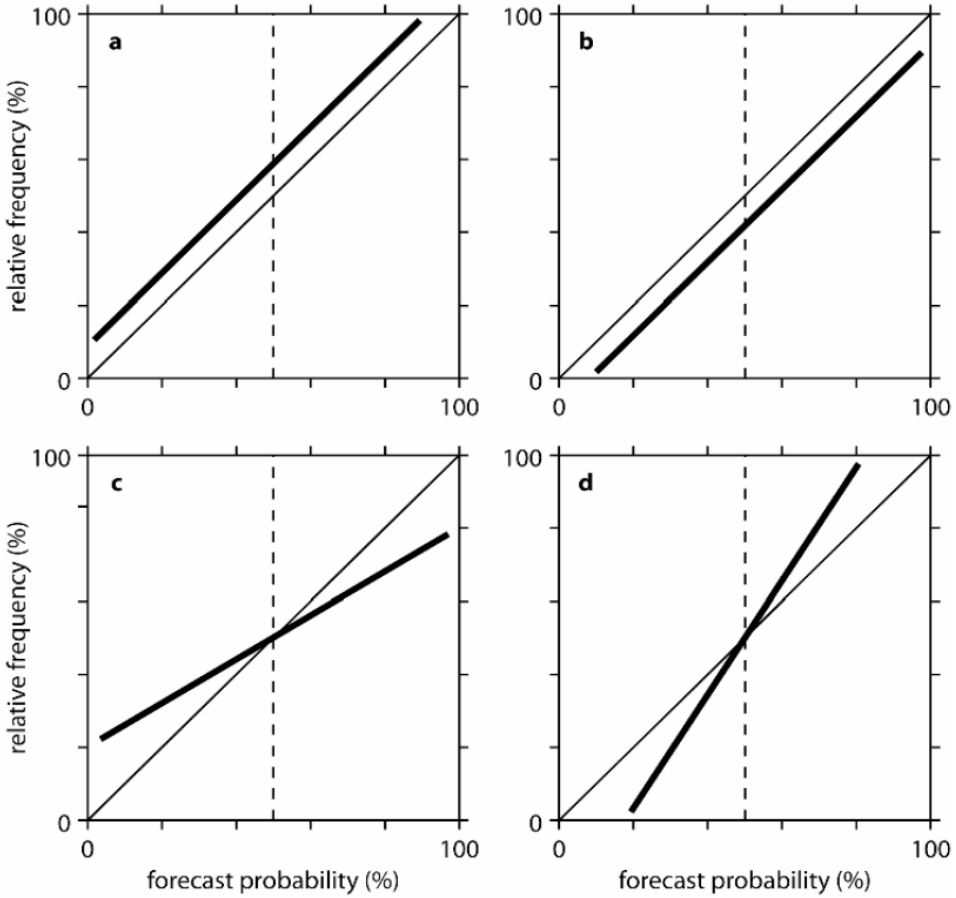
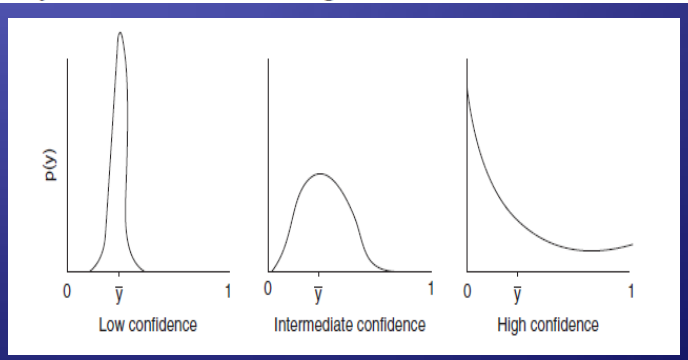
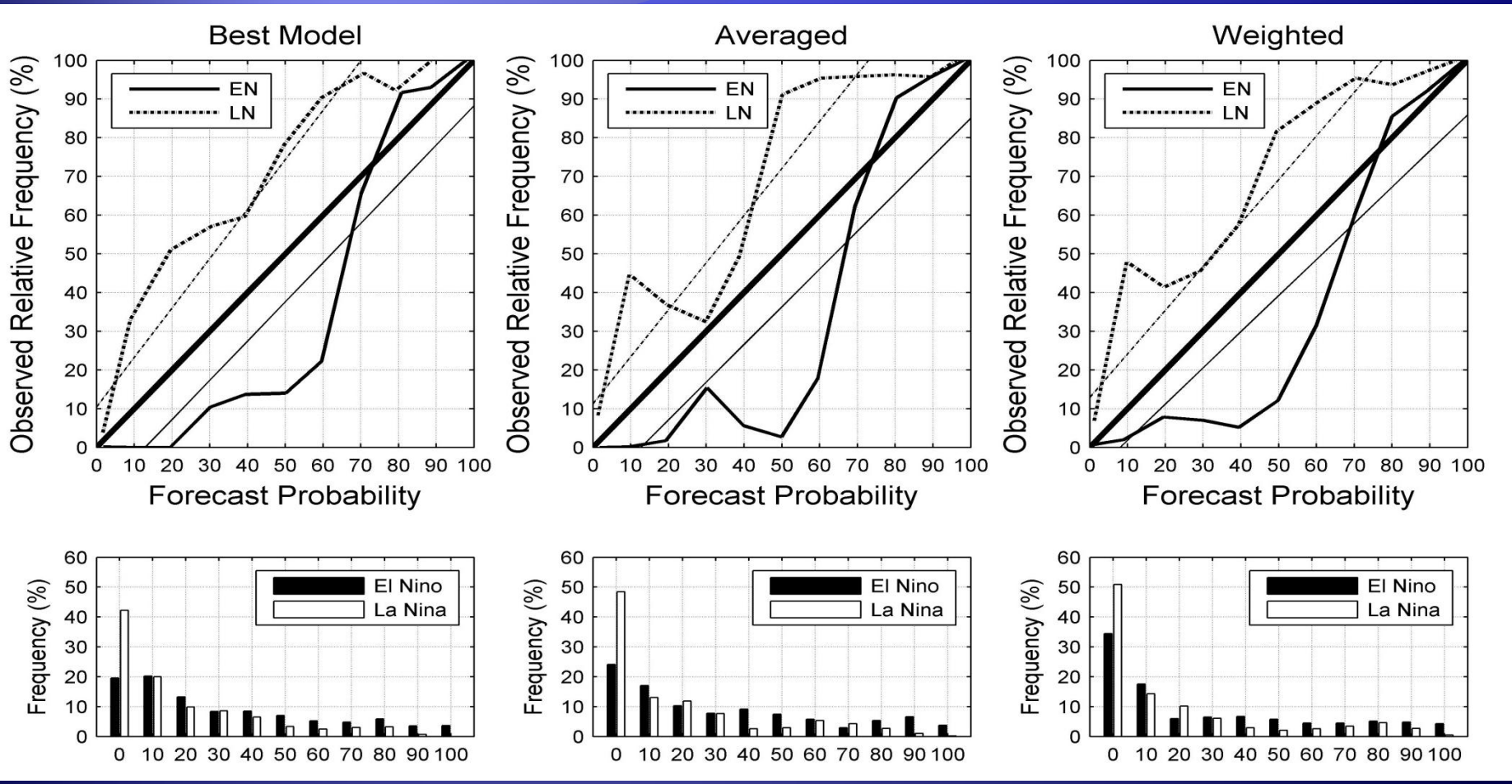


Fig. 10.1 Idealized reliability diagrams indicating cases of (a) under-forecasting, (b) over-forecasting, (c) over-confidence, (d) under-confidence. The vertical dotted line indicates the climatological probability of the event occurring, which in this case is set at 50%



Reliability

(is the confidence communicated in the forecast appropriate ?)



Challenge for coupled model developers

Conclusions

- One of the most predictable phenomena (ENSO) are not perfectly predictable, adding to the uncertainties in seasonal forecasts
- South African modellers are expending a significant amount of resources on model and system development
- Forecast verification essential
  - For users' confidence
  - To determine attributes of forecast systems
  - For the benefit of model developers