Seasonal forecasts

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https://tinyurl.com/ybrb3a72

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Seasonal Forecast Worx

Latest Update: 10 March 2018

- The seasonal forecasts presented here by **Seasonal Forecast Worx** are based on forecast output of the coupled ocean-atmosphere models administered through the North American Multi-Model Ensemble (NMME) prediction experiment (http://www.cpc.ncep.noaa.gov/products/NMME/; Kirtman et al. 2014). NMME real-time seasonal forecast and hindcast (re-forecast) data are obtained from the data library (http://iridl.ldeo.columbia.edu/) of the International Research Institute for Climate and Society (IRI; http://iri.columbia.edu/).
- NMME forecasts are routinely produced and are statistically improved and tailored for southern Africa and for global sea-surface temperatures by employees and post-graduate students in the Department of Geography, Geoinformatics and Meteorology at the University of Pretoria (http://www.up.ac.za/en/geography-geoinformatics-and-meteorology/). Statistical post-processing is performed with the CPT software (http://iri.columbia.edu/our-expertise/climate/tools/cpt/).
- Why do we apply statistical methods to climate model forecasts?
- "…statistical correction methods treating individual locations (e.g. multiple regression or principal component regression) may be recommended for today's coupled climate model forecasts". (Barnston and Tippett, 2017).
- Why do we not use just a single model in our forecasts for southern Africa?
- "…multi-model forecasts outperform the single model forecasts…" (Landman and Beraki, 2012).

- For the official seasonal forecast for South Africa, visit the South African Weather Service website at http://www.weathersa.co.za/home/seasonal

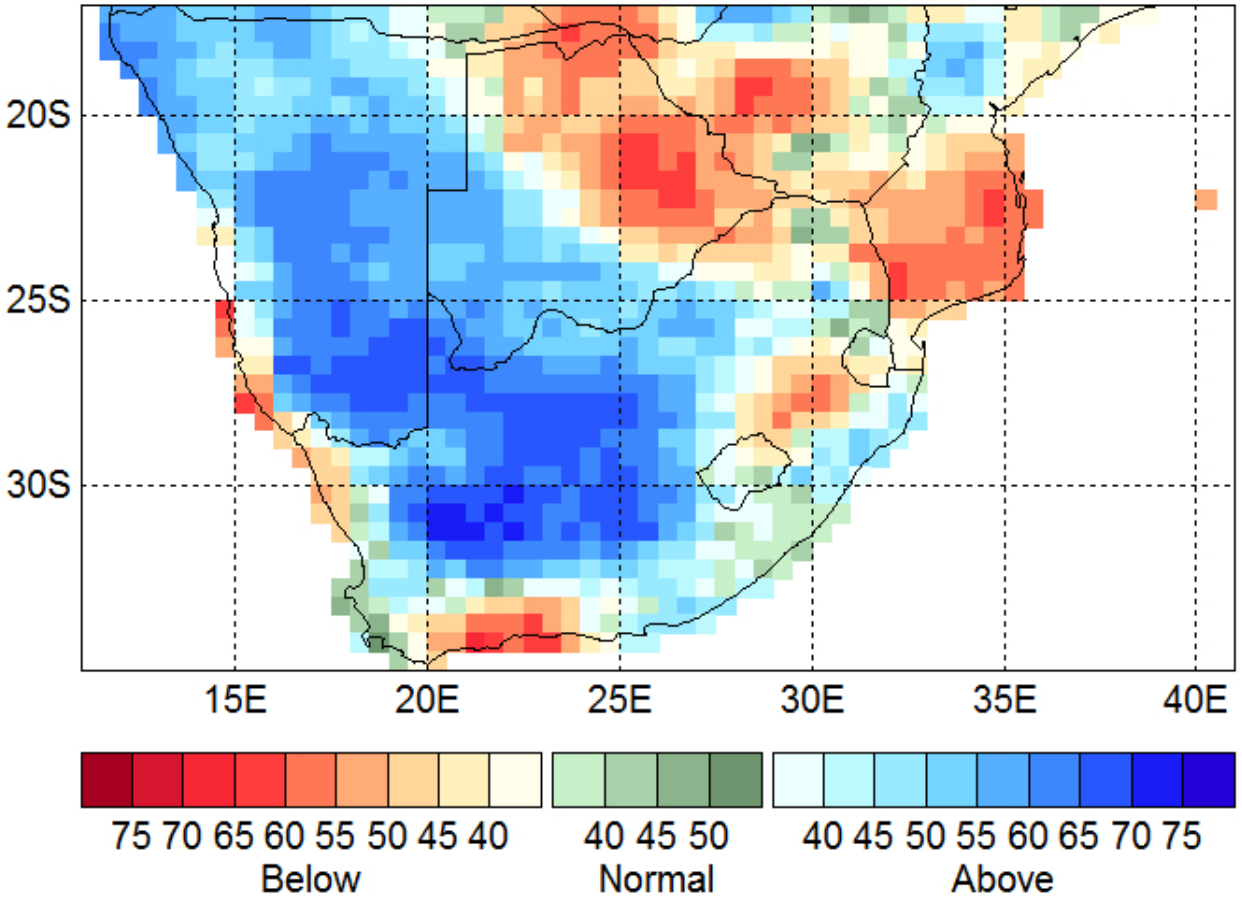
South African Weather Service
ISO 9001 Certified Organisation

Southern Africa Forecasts

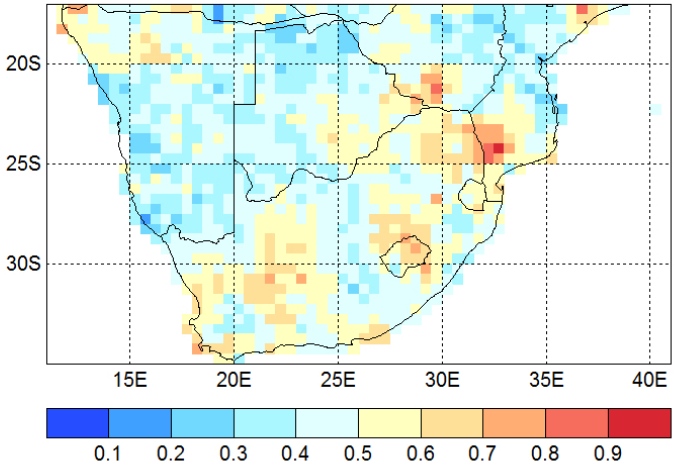
Prediction Method

- Three-month seasons for seasonal rainfall totals and average maximum temperatures of NMME ensemble mean forecasts are interpolated to Climatic Research Unit (CRU; Harris et al. 2014) grids (0.5°x0.5°) by correcting the mean and variance biases of the NMME forecasts. Probabilistic forecasts are subsequently produced from the error variance obtained from a 5-year-out cross-validation process (Troccoli et al. 2008). Forecasts cover a 6-month period.
- Forecasts are produced for three categories:
  - **Above:** Above-normal ("wet" / "hot", rainfall totals / maximum temperatures higher than the 75th percentile of the climatological record)
  - **Below:** Below-normal ("dry" / "cool", rainfall totals / maximum temperatures lower than the 25th percentile of the climatological record)
  - **Normal:** Near-normal ("average" season)
- Verification:
  - ROC Area (Below-Normal) – The forecast system's ability to discriminate dry or cool seasons from the rest of the seasons over a 32-year test period. ROC values should be higher than 0.5 for a forecast system to be considered skilful.
  - ROC Area (Above-Normal) – The forecast system's ability to discriminate wet or hot seasons from the rest of the seasons over a 32-year test period. ROC values should be higher than 0.5 for a forecast system to be considered skilful.

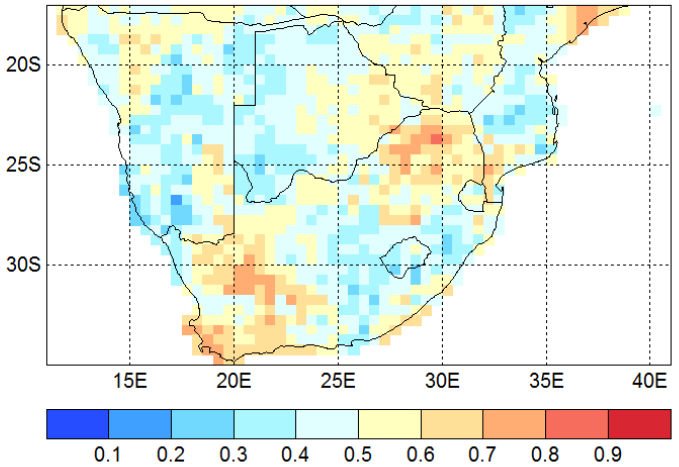
MAM 2018 Rainfall; ICs: Mar



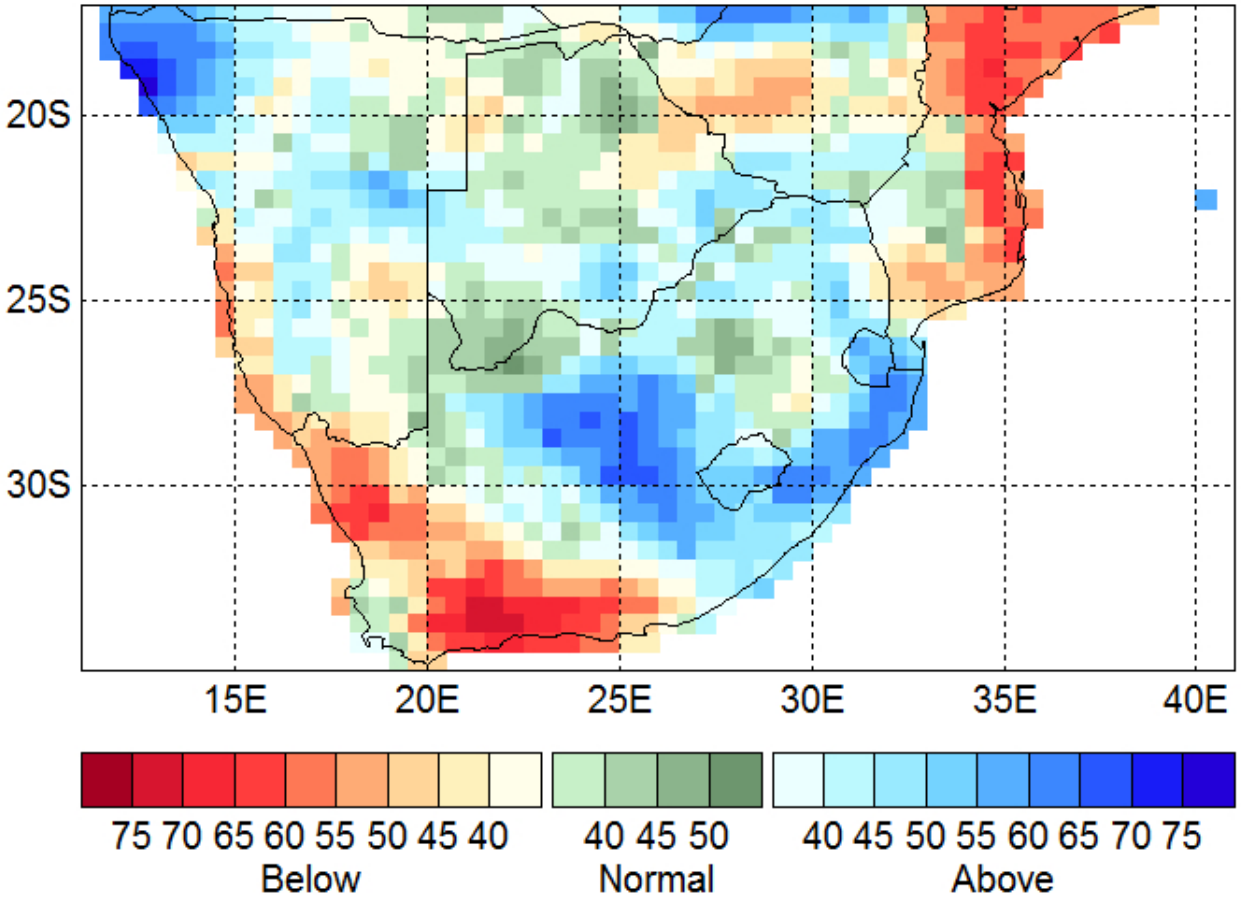
ROC Area (Above-Normal): MAM Rainfall



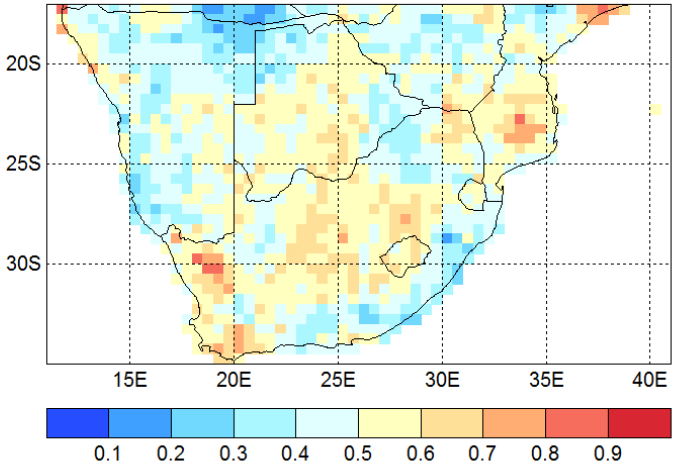
ROC Area (Below-Normal): MAM Rainfall



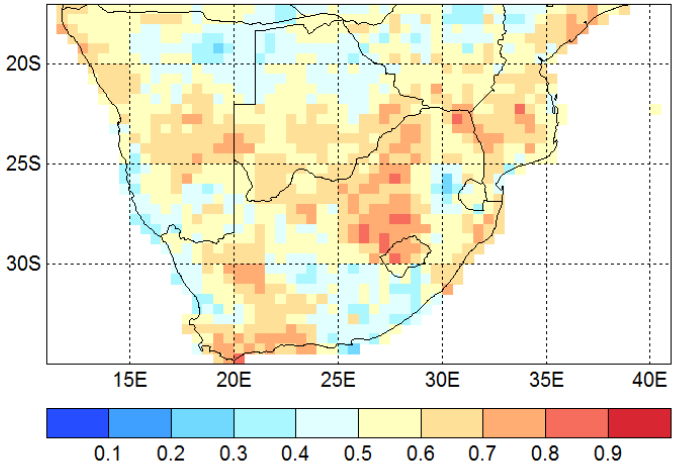
AMJ 2018 Rainfall; ICs: Mar



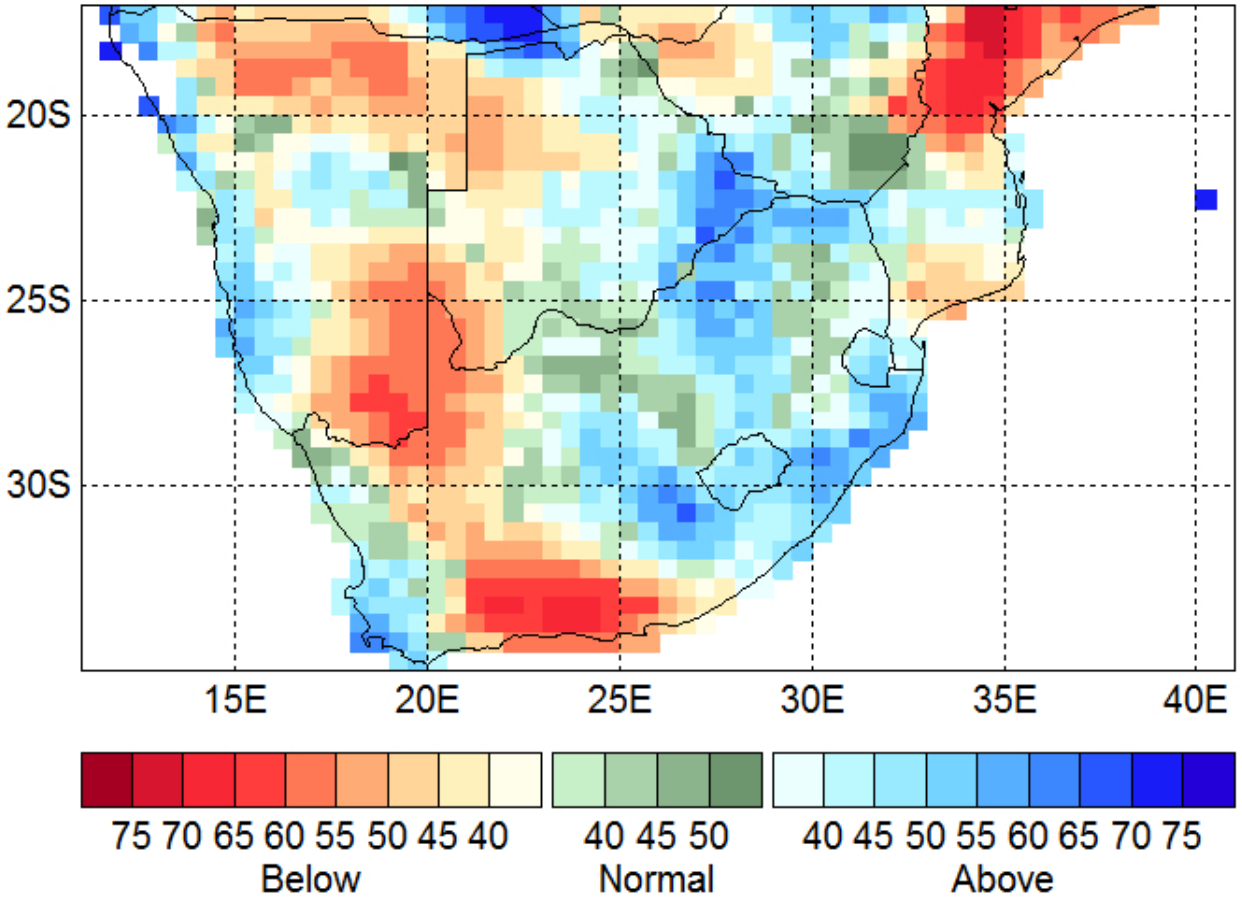
ROC Area (Above-Normal): AMJ Rainfall



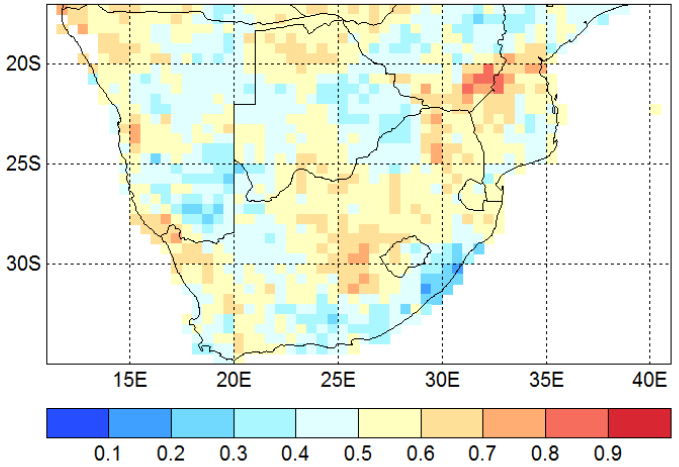
ROC Area (Below-Normal): AMJ Rainfall



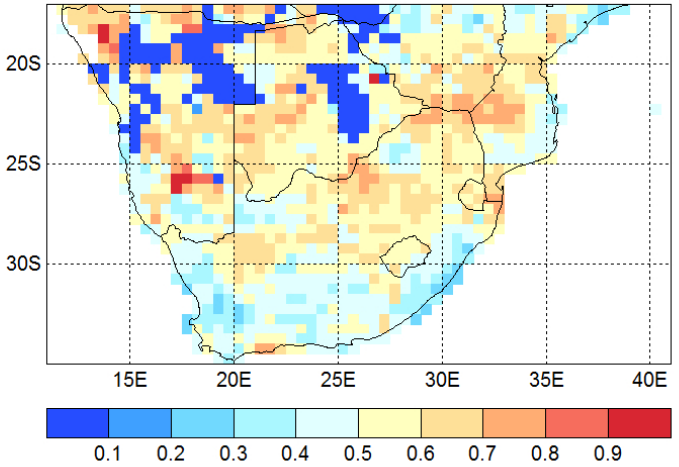
MJJ 2018 Rainfall; ICs: Mar

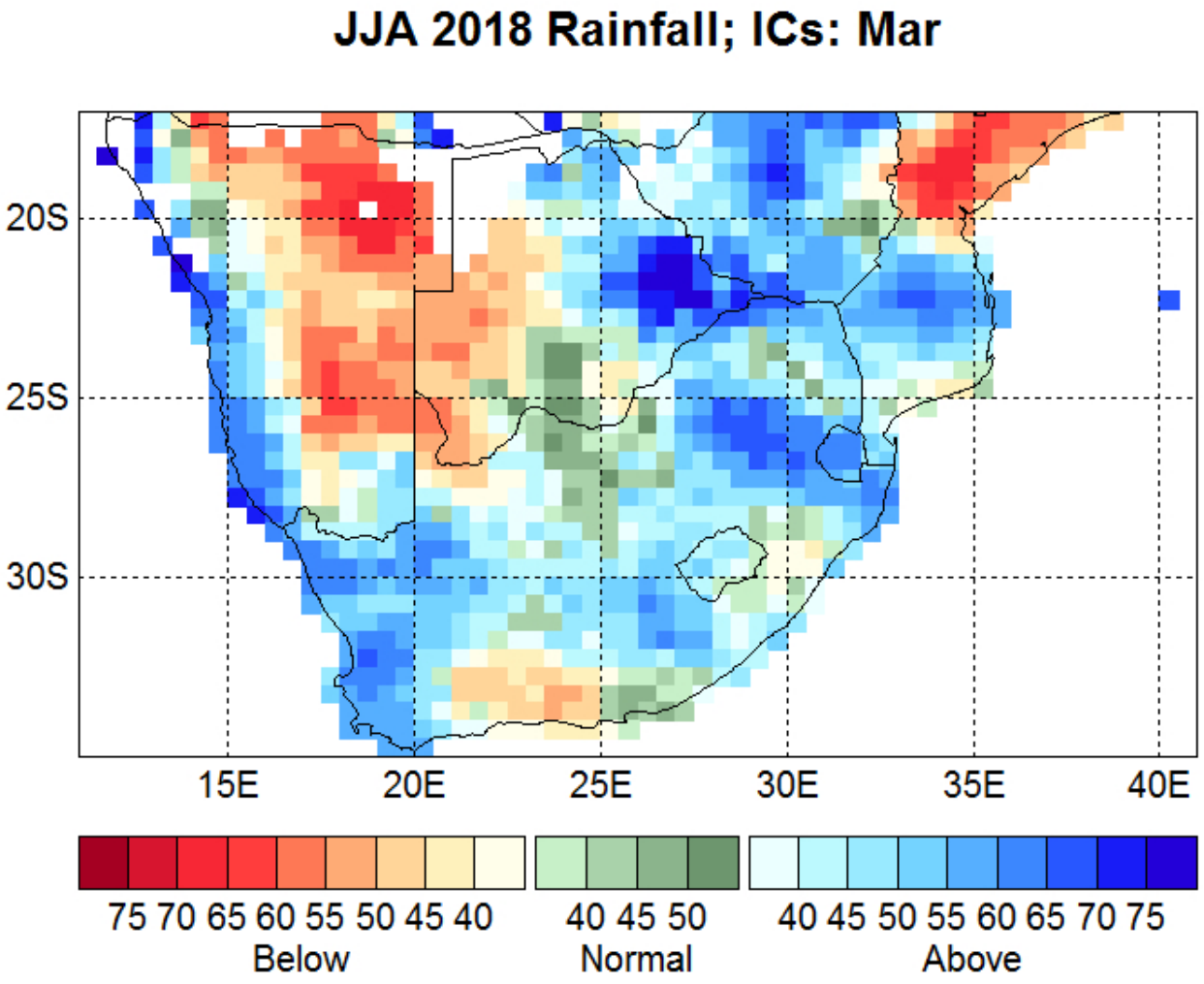


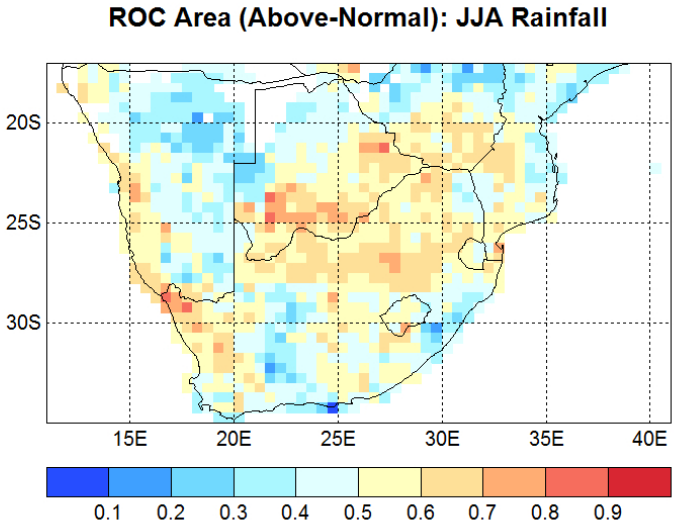
ROC Area (Above-Normal): MJJ Rainfall

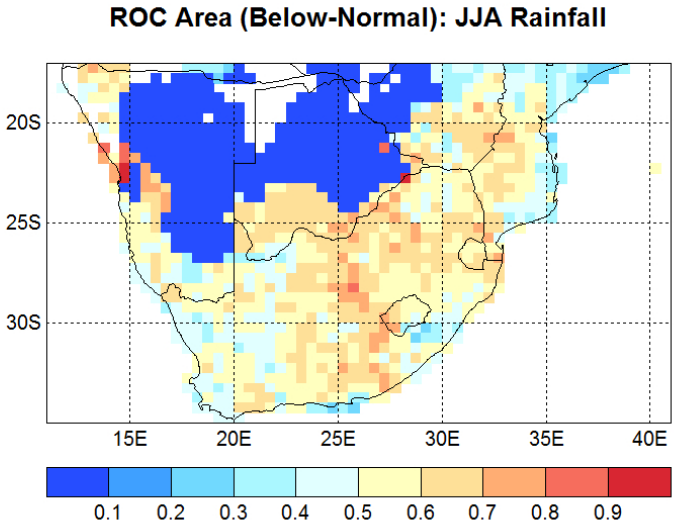


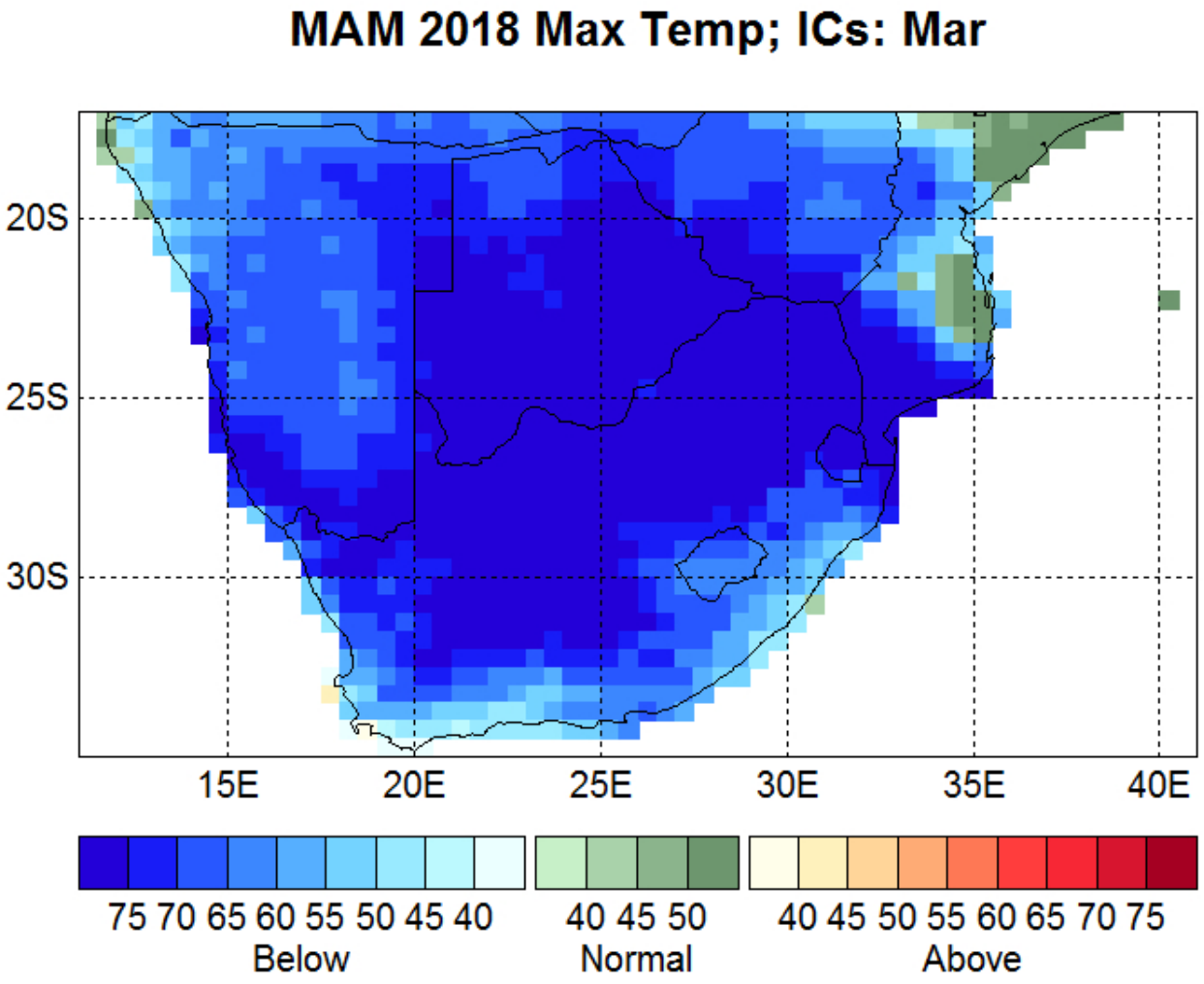
ROC Area (Below-Normal): MJJ Rainfall

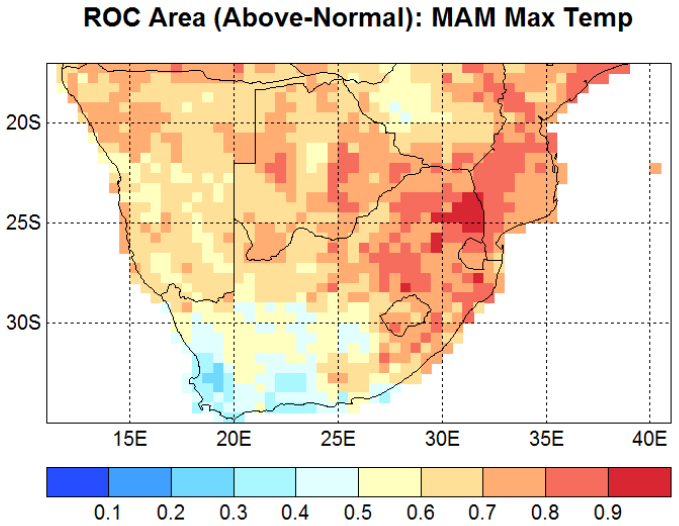


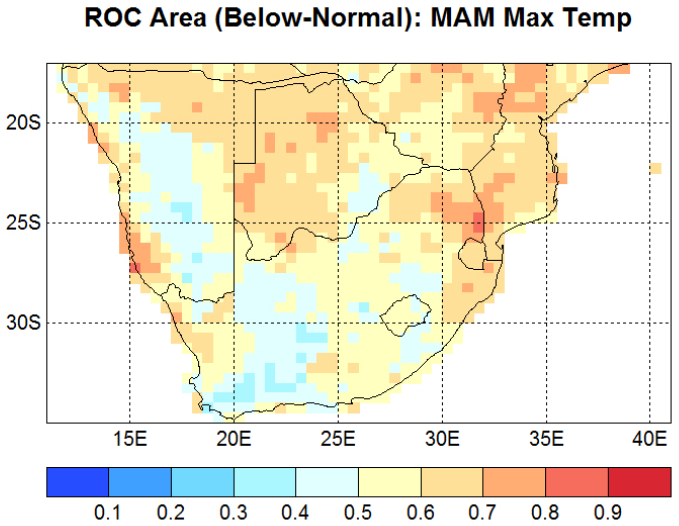

JJA 2018 Rainfall; ICs: Mar
20S
25S
30S
15E
20E
25E
30E
35E
40E
75 70 65 60 55 50 45 40
Below
40 45 50
Normal
40 45 50 55 60 65 70 75
Above

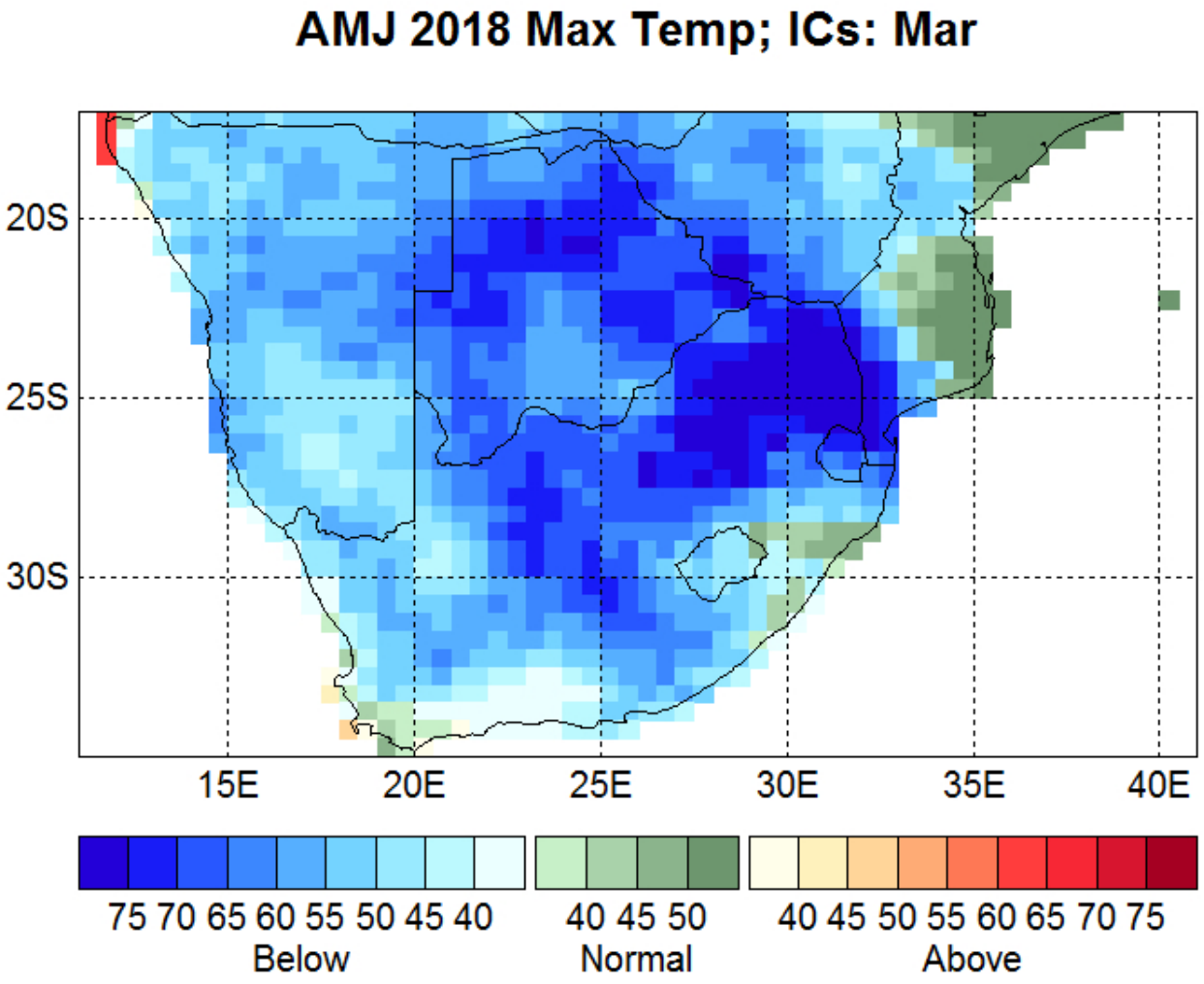

ROC Area (Above-Normal): JJA Rainfall
20S
25S
30S
15E
20E
25E
30E
35E
40E
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9


ROC Area (Below-Normal): JJA Rainfall
20S
25S
30S
15E
20E
25E
30E
35E
40E
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9


MAM 2018 Max Temp; ICs: Mar
20S
25S
30S
15E
20E
25E
30E
35E
40E
75 70 65 60 55 50 45 40
Below
40 45 50
Normal
40 45 50 55 60 65 70 75
Above


ROC Area (Above-Normal): MAM Max Temp
20S
25S
30S
15E
20E
25E
30E
35E
40E
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9


ROC Area (Below-Normal): MAM Max Temp
20S
25S
30S
15E
20E
25E
30E
35E
40E
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9


AMJ 2018 Max Temp; ICs: Mar
20S
25S
30S
15E
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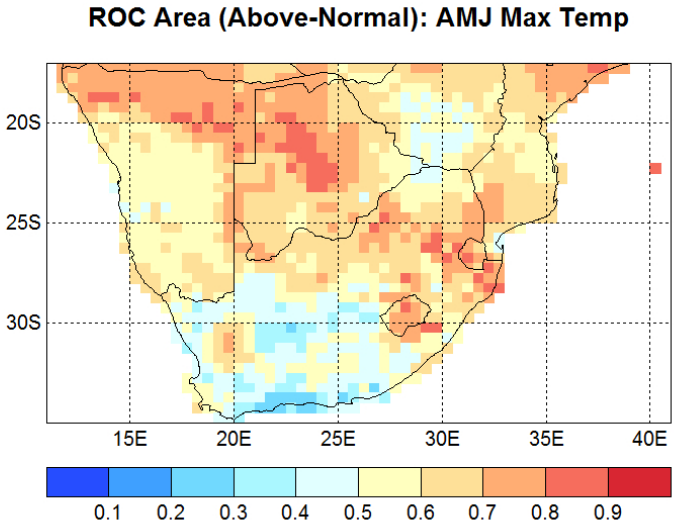
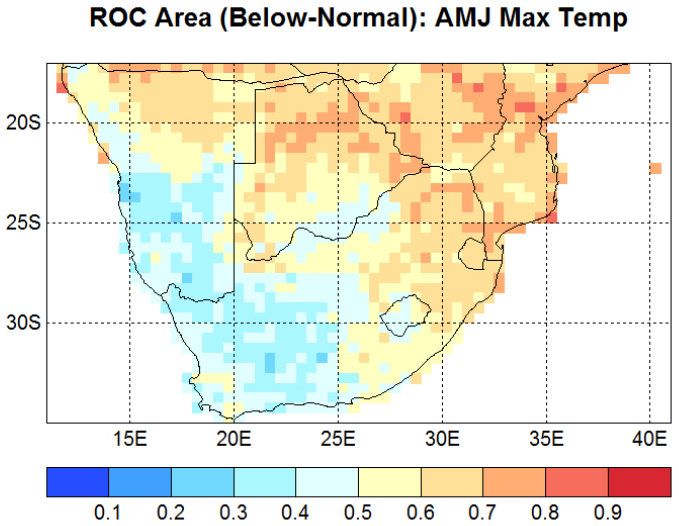
25E
30E
35E
40E
75 70 65 60 55 50 45 40
Below
40 45 50
Normal
40 45 50 55 60 65 70 75
Above


ROC Area (Above-Normal): AMJ Max Temp
20S
25S
30S
15E
20E
25E
30E
35E
40E
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9


ROC Area (Below-Normal): AMJ Max Temp
20S
25S
30S
15E
20E
25E
30E
35E
40E
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0.8
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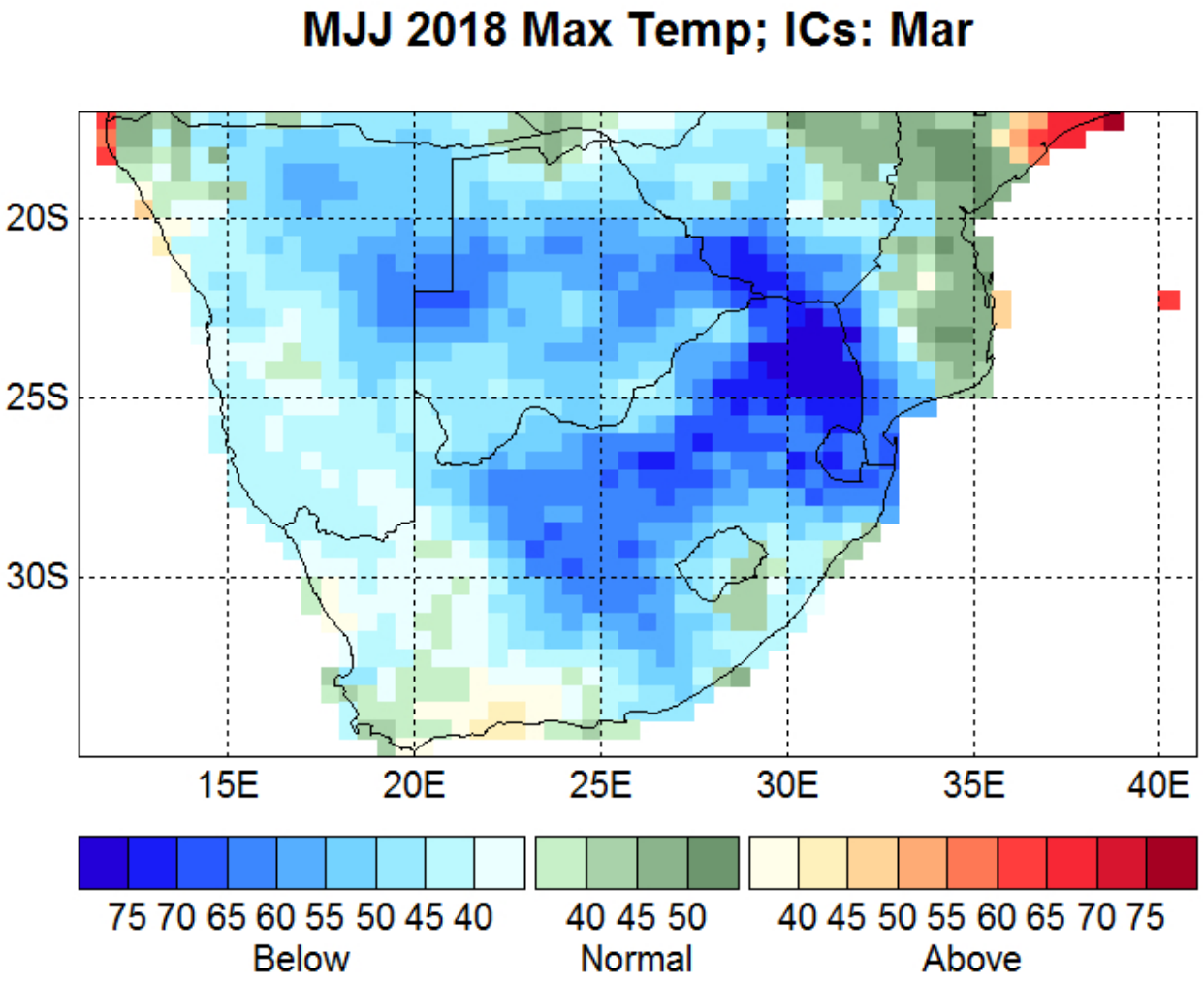
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25E
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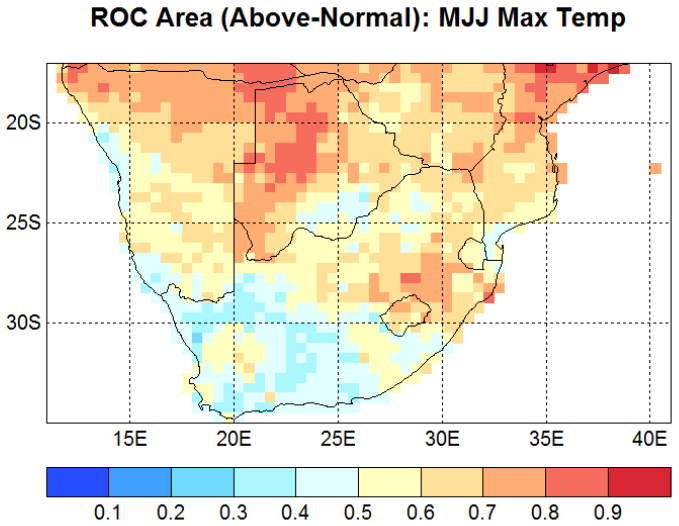
ROC Area (Above-Normal): MJJ Max Temp
20S
25S
30S
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20E
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0.1
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0.5
0.6
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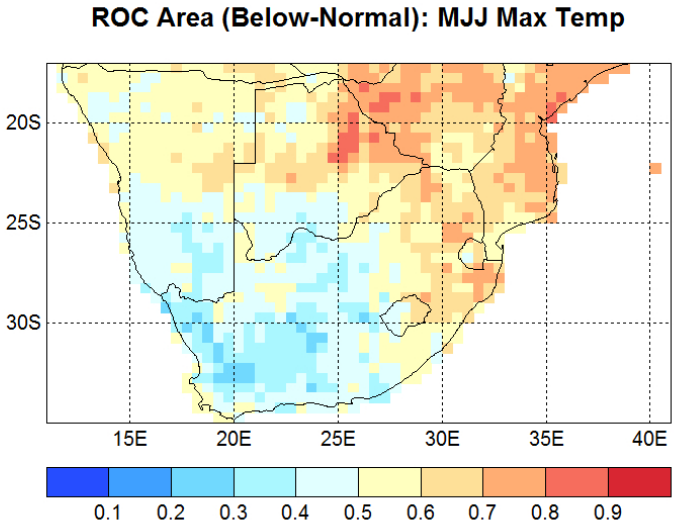
0.9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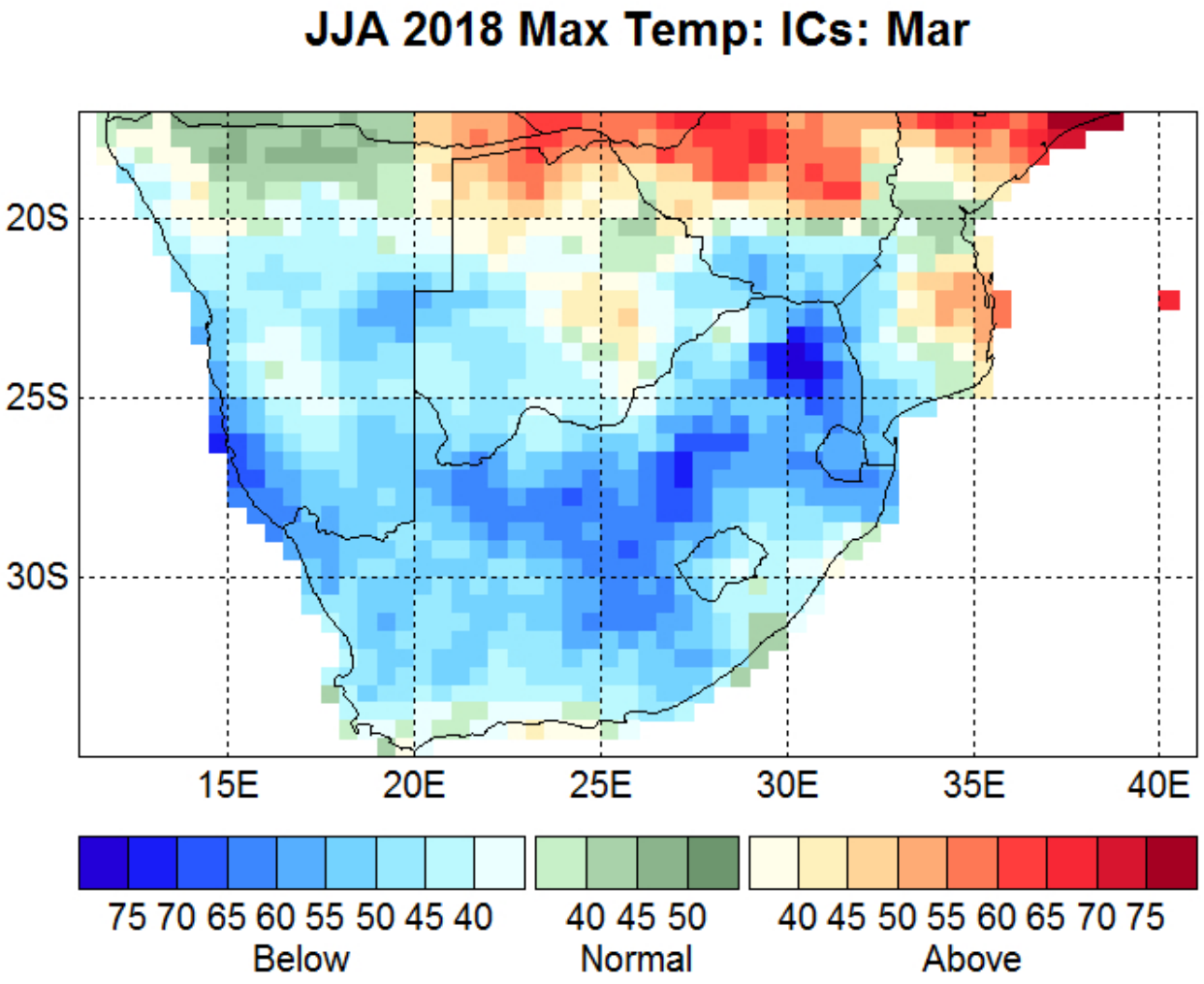
35E
40E
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9


JJA 2018 Max Temp: ICs: Mar
20S
25S
30S
15E
20E
25E
30E
35E
40E
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Below
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Normal
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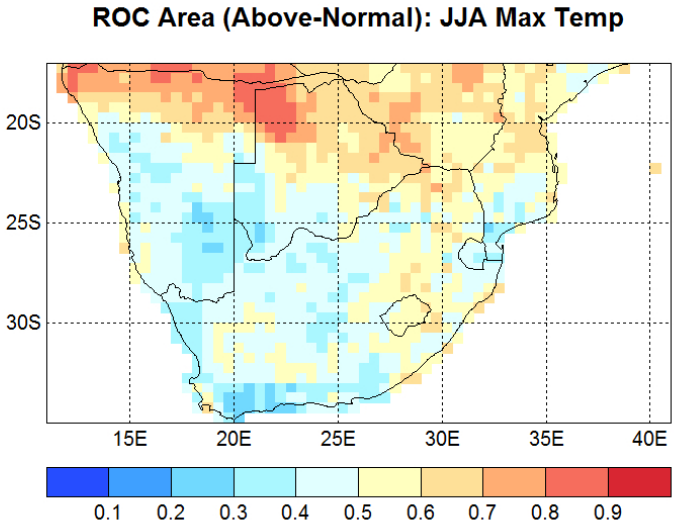
Above


ROC Area (Above-Normal): JJA Max Temp
20S
25S
30S
15E
20E
25E
30E
35E
40E
0.1
0.2
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0.4
0.5
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0.7
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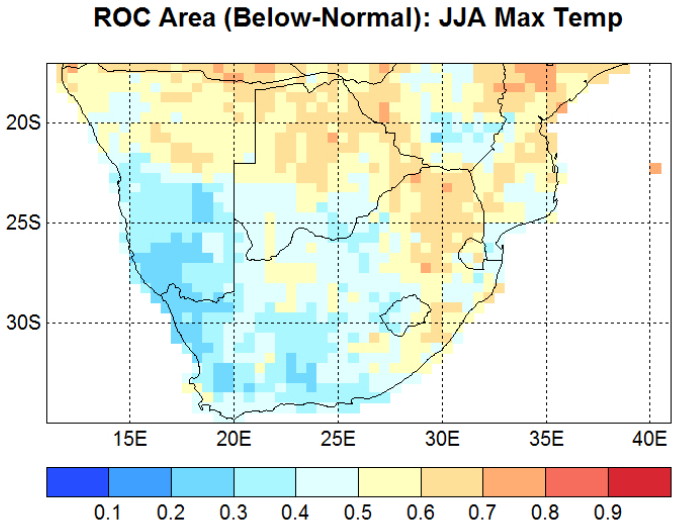
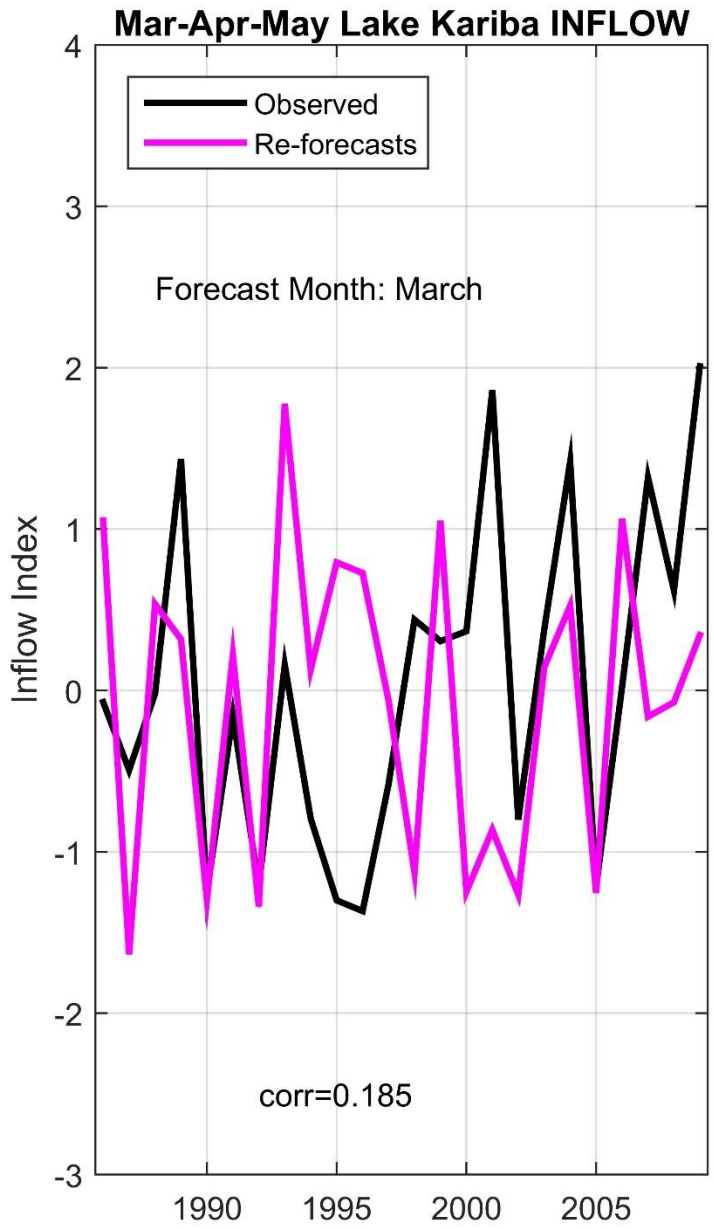
0.9

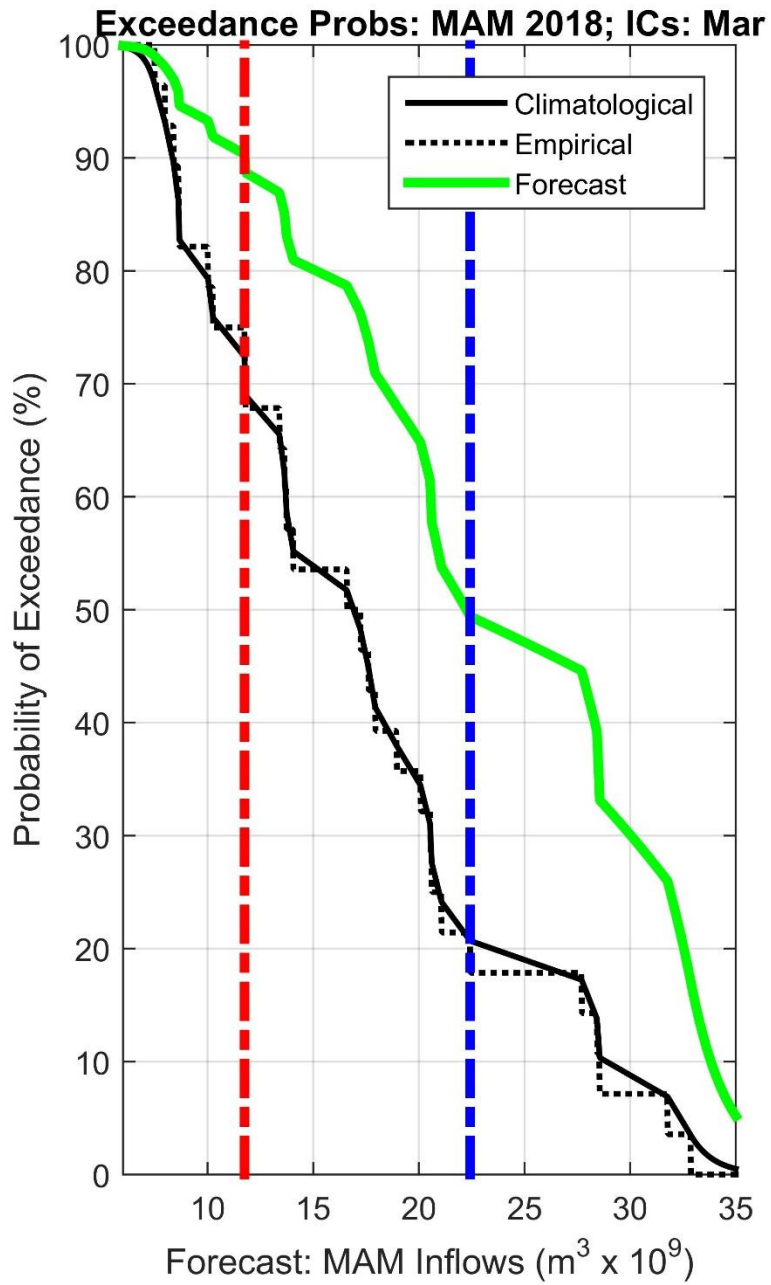

ROC Area (Below-Normal): JJA Max Temp
20S
25S
30S
15E
20E
25E
30E
35E
40E
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

Tailored Forecasts

Prediction Method

- NMME ensemble mean forecasts are interpolated to inflows into Lake Kariba on the border between Zimbabwe and Zambia (Muchuru et al. 2014).
- Forecasts are produced for three categories:
  - **Above:** Above-normal (higher than the 75th percentile of the climatological record)
  - **Below:** Below-normal (lower than the 25th percentile of the climatological record)
  - **Normal:** Near-normal (“average” season)

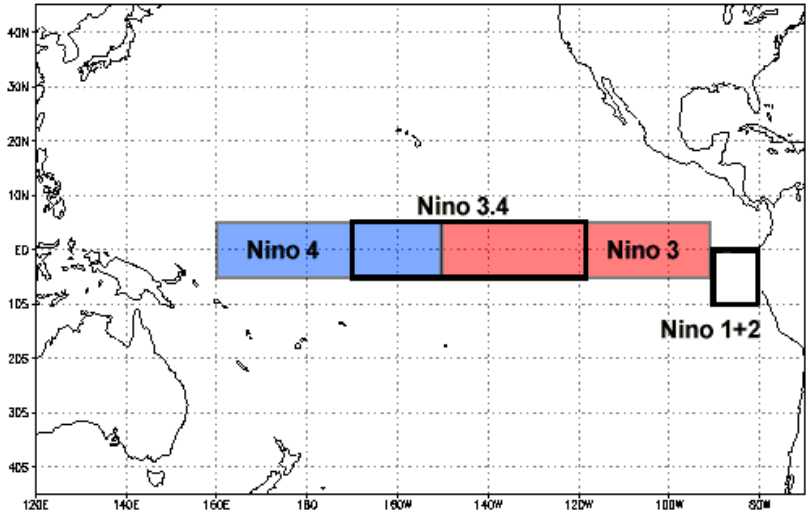

Mar-Apr-May Lake Kariba INFLOW
Observed
Re-forecasts
Forecast Month: March
corr=0.185
Inflow Index
4
3
2
1
0
-1
-2
-3
1990
1995
2000
2005


Exceedance Probs: MAM 2018; ICs: Mar
Climatological
Empirical
Forecast
Probability of Exceedance (%)
100
90
80
70
60
50
40
30
20
10
0
10
15
20
25
30
35
Forecast: MAM Inflows (m3 x 109)

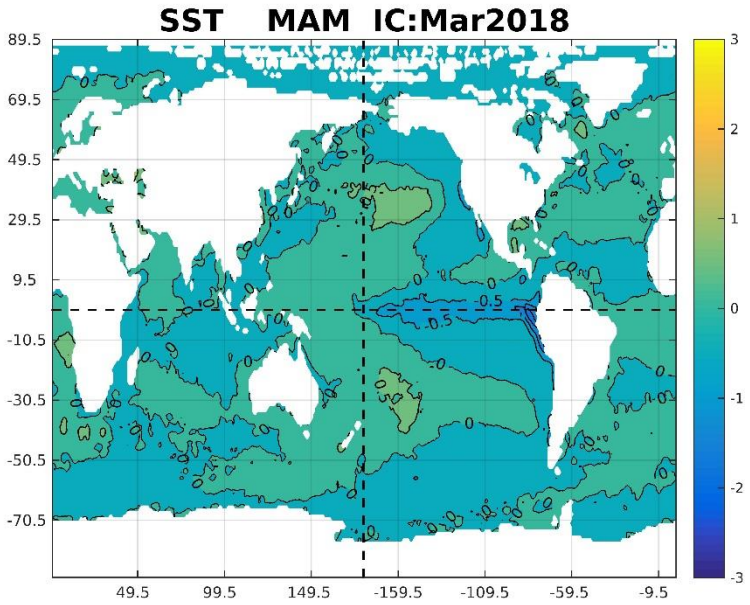
Global SST and ENSO Forecasts

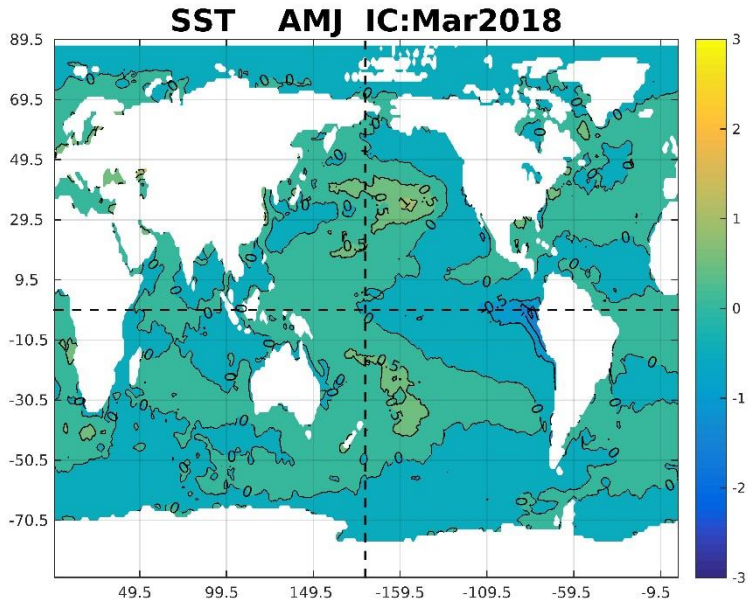
Prediction Method

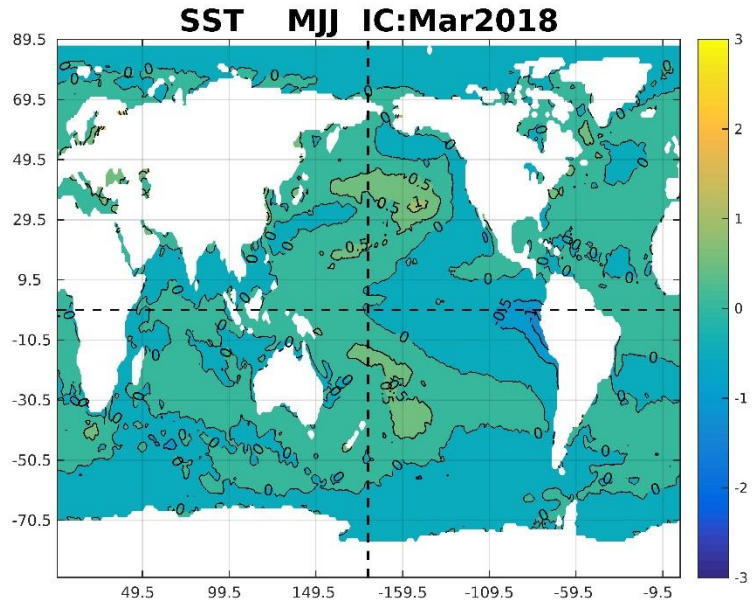
- Forecasts for global sea-surface temperature (SST) fields are obtained through a combination of NMME models and a linear statistical model that uses antecedent SST as predictor (Landman et al. 2011). Forecasts for the Niño3.4 area (see insert) are derived from the global forecasts.
- Three-month Niño3.4 SST forecasts are produced for three categories:
  - **El Niño:** SST above the 75th percentile
  - **La Niña:** SST below the 25th percentile
  - **Neutral:** Neither El Niño nor La Niña

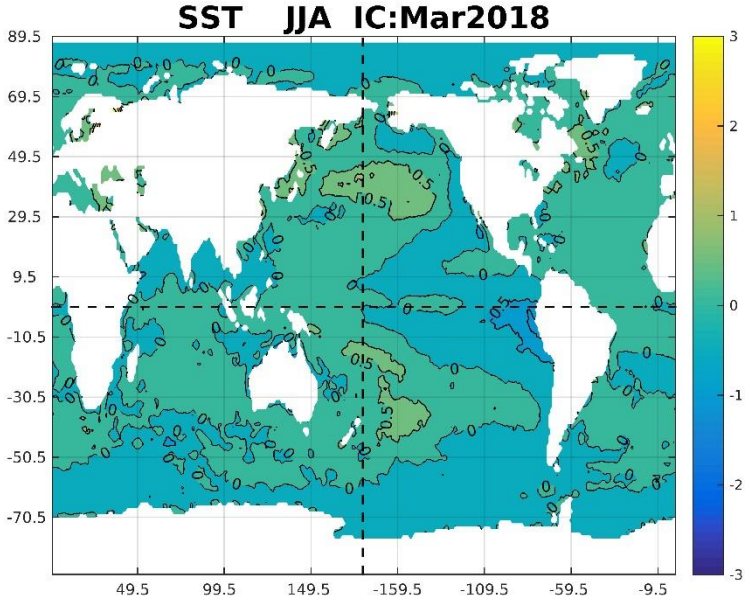


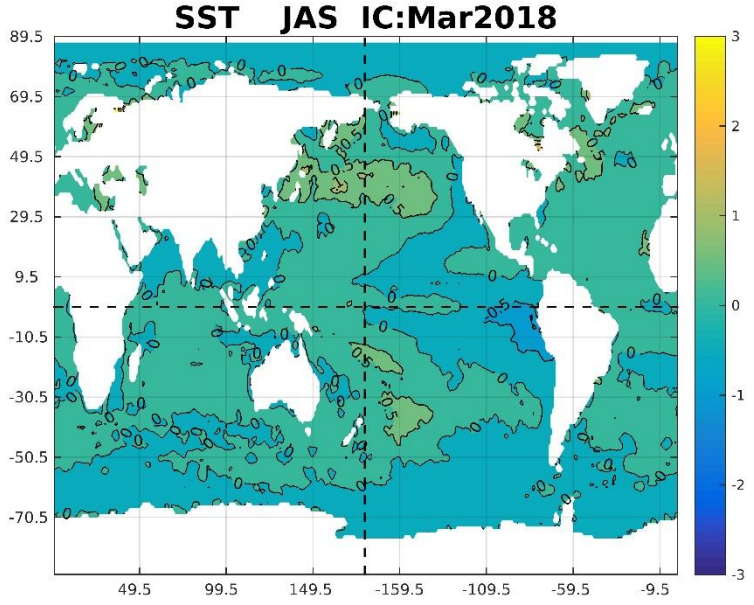
SST anomalies

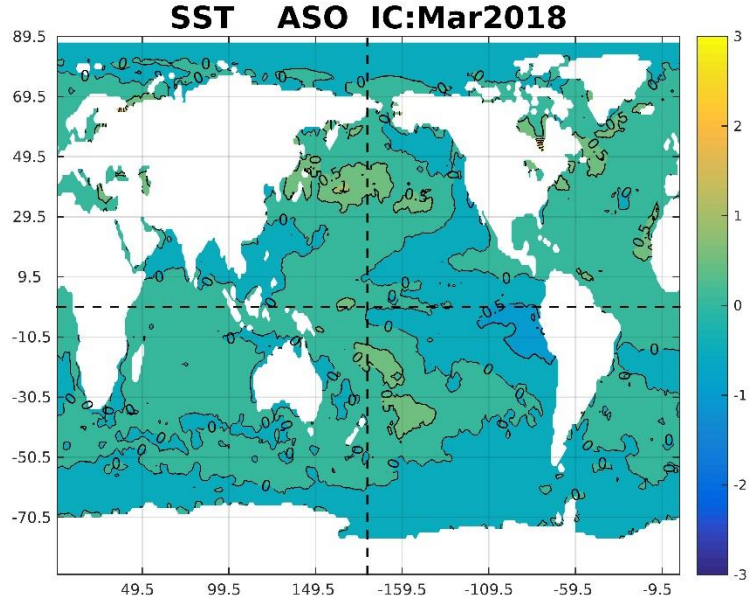


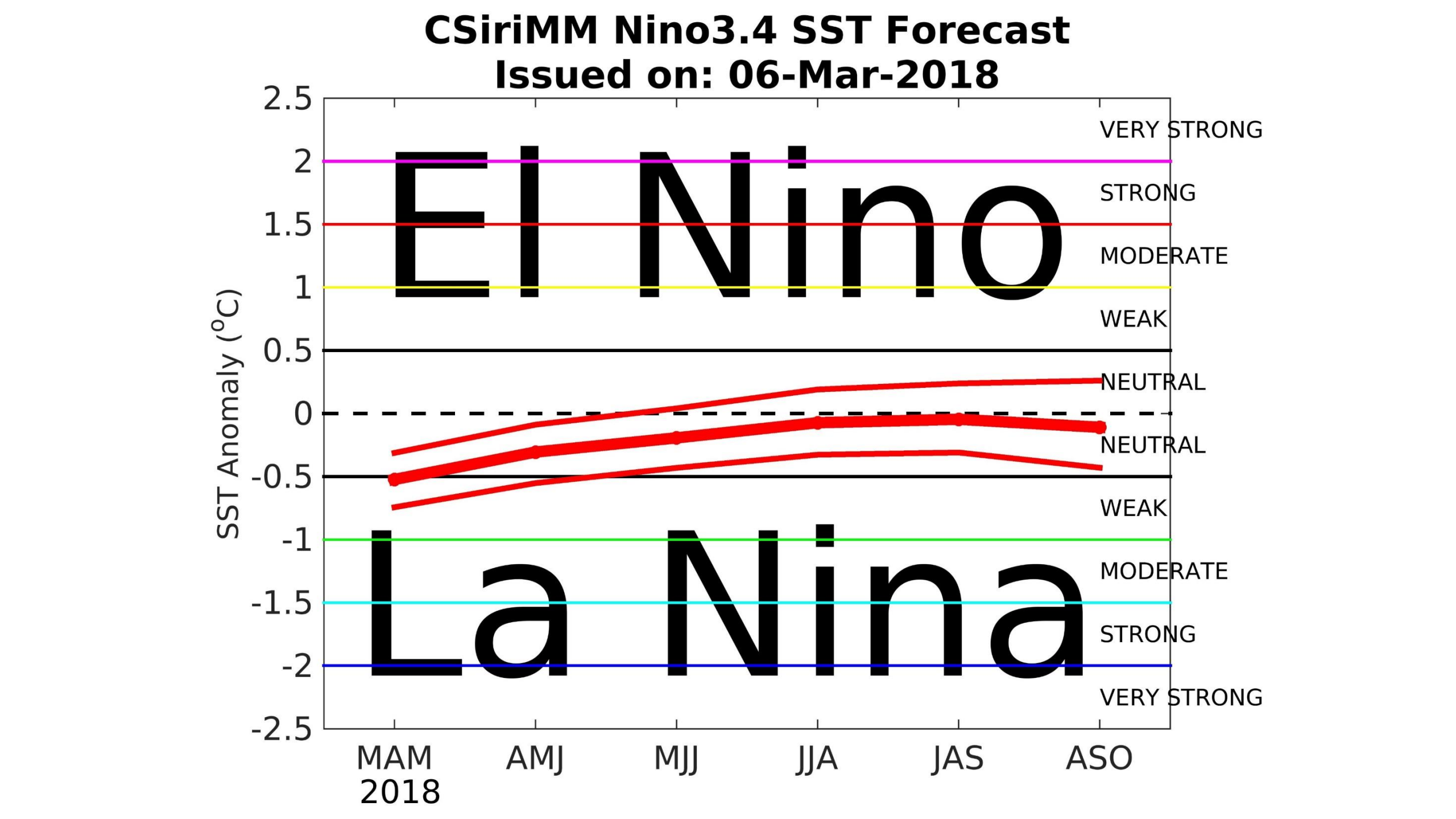











CSiriMM Nino3.4 SST Forecast
Issued on: 06-Mar-2018
SST Anomaly (°C)
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
El Nino
La Nina
VERY STRONG
STRONG
MODERATE
WEAK
NEUTRAL
NEUTRAL
WEAK
MODERATE
STRONG
VERY STRONG
MAM
2018
AMJ
MJJ
JJA
JAS
ASO

References

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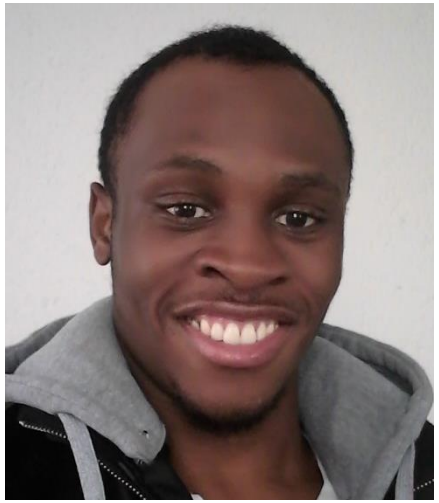
Financial support from...

- The National Research Foundation through the Incentive Funding for Rated Researchers

- ACCESS (Alliance for Collaboration on Climate and Earth System Science) through the project “Investigating predictability of seasonal anomalies for societal benefit”

Student participation in forecast system development

Stephanie Hinze, BSc (Honours)(Meteorology):
Statistical downscaling using large and high-resolution data sets, forecast displays for SADC rainfall and maximum temperatures, forecast verification



Surprise Mhlongo, BSc (Honours)(Meteorology):
Improving on SST forecast system through pattern correction, correlation vs covariance approaches, forecast output combination (multi-model approaches), mean and bias correction, and correct for skill