

Seasonal forecasts

presented by:

Tel: +27(82)644-5304
Willem.Landman@up.ac.za



<https://tinyurl.com/ybrb3a72>



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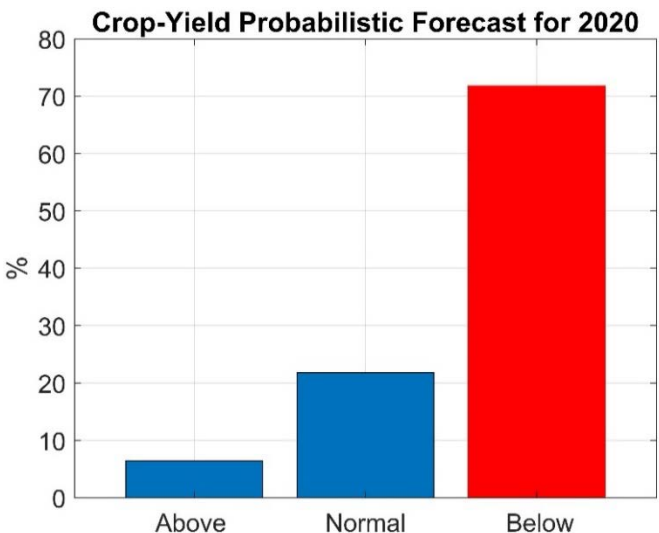
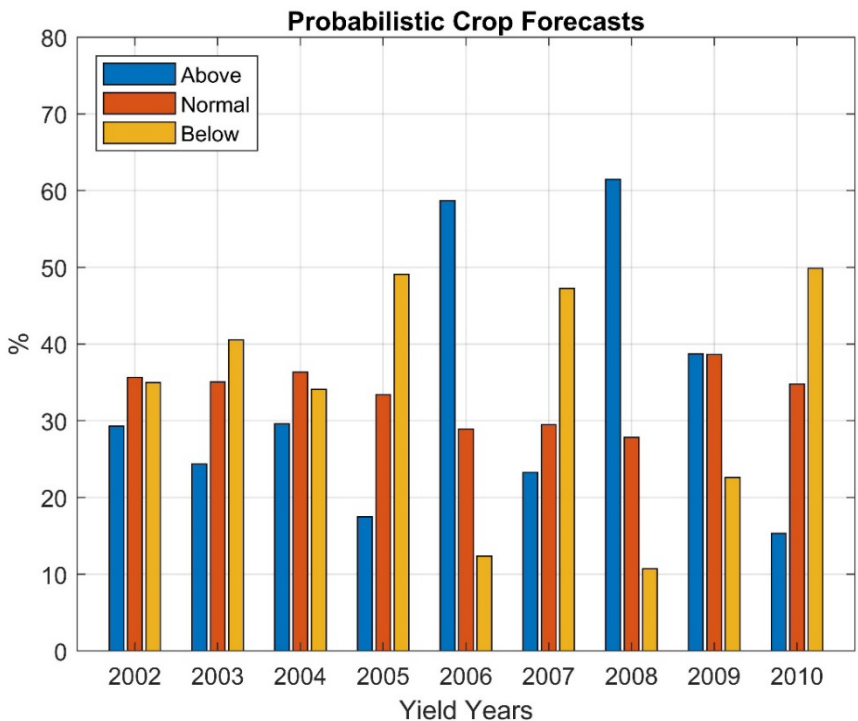
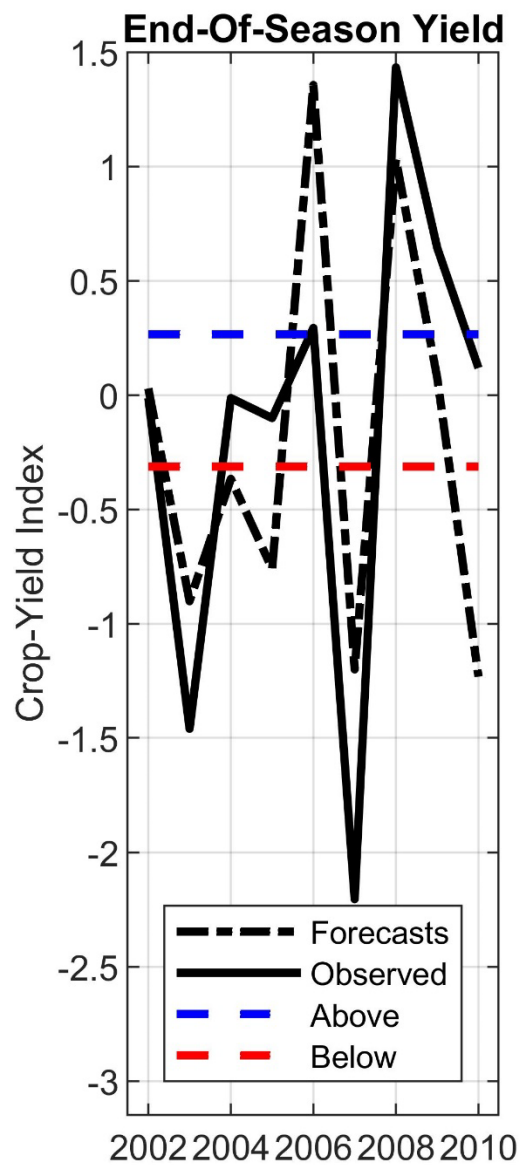


Seasonal Forecast Worx

Latest Update: 16 March 2020

Are you a farmer who wants to make use of science-based seasonal predictions for your farm? If you are interested to be part of an initiative at the University of Pretoria that involves the development of seasonal forecast systems for farms, specifically tailored to farmers' needs, please send an email to WALandman1981@gmail.com

Have a look at this example of end-of-season crop yield forecasts for a farm near Bapsfontein. The farmer provided several decades of crop-yield data and these data were subsequently used to create a crop forecast model specific to the farm



Above is the crop-yield forecast for the coming season. The forecast is for enhanced probabilities of **below-normal** (low) crop yield for the farm. The farmer may be able with support to use this forecast information to plan for the coming season

On the left are time series of forecast and observed crop yields at the time of harvest for the years indicated. Next to the time series are probabilistic forecasts over the same 9-years for below- (low yields), near- (about average) and above-normal (high yields). For example, in 2008 the forecast and observed index values are high and positive (figure on the left), and the highest predicted probability is for above-normal yield (figure in the middle).

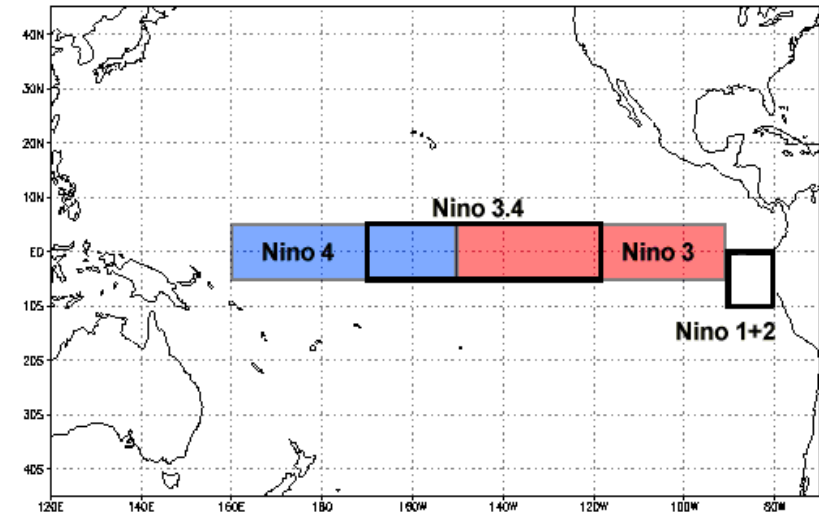
Share your data and become part of this initiative

- 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?
 “...**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/images/data/longrange/gfcsa/scw.pdf>

ENSO and Global SST Forecasts

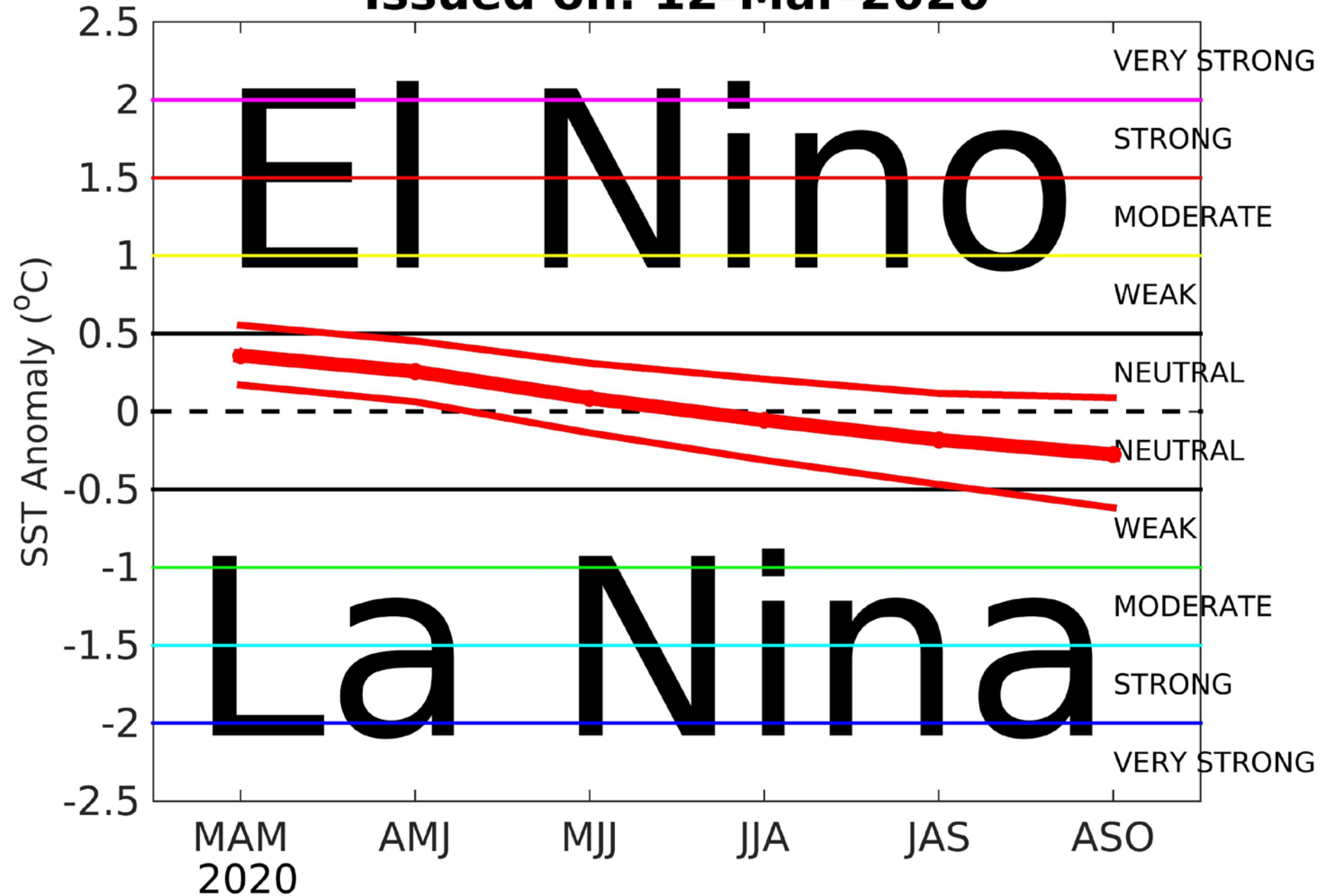
Prediction Method

- 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 a predictor (Landman et al. 2011). Forecasts for the Niño3.4 area (see insert) are derived from the global forecasts.
- SST forecasts from the NMME models are variance and bias corrected.
- 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



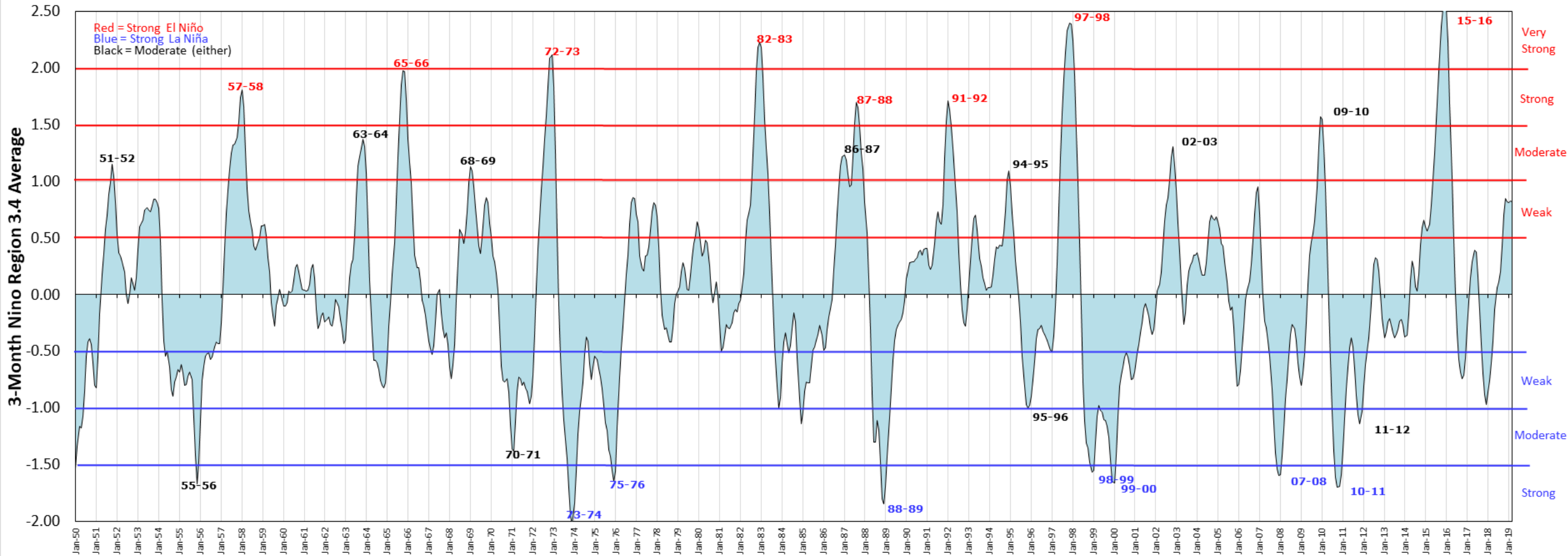
CSiriMM Nino3.4 SST Forecast

Issued on: 12-Mar-2020



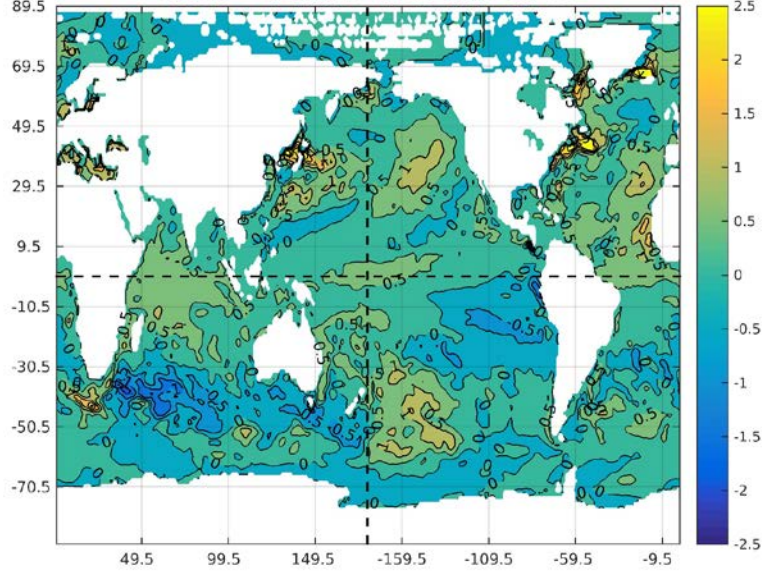
Oceanic Niño Index (ONI)

http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml

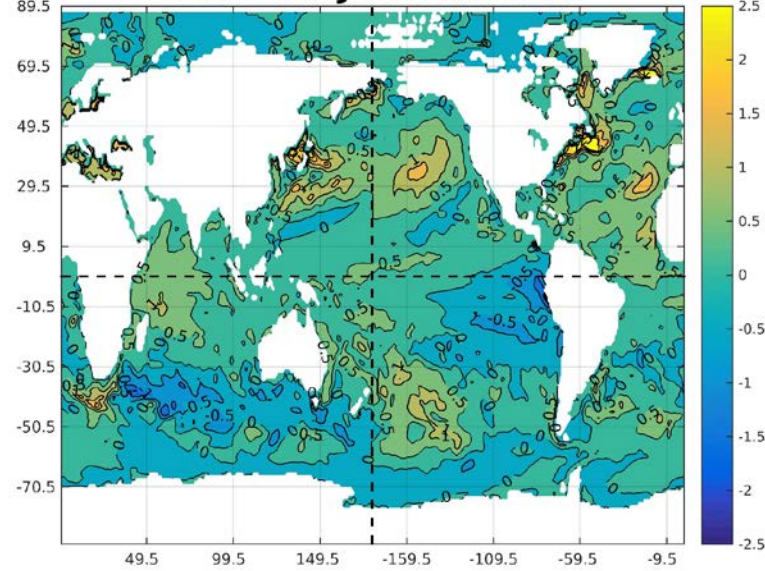


SST anomalies

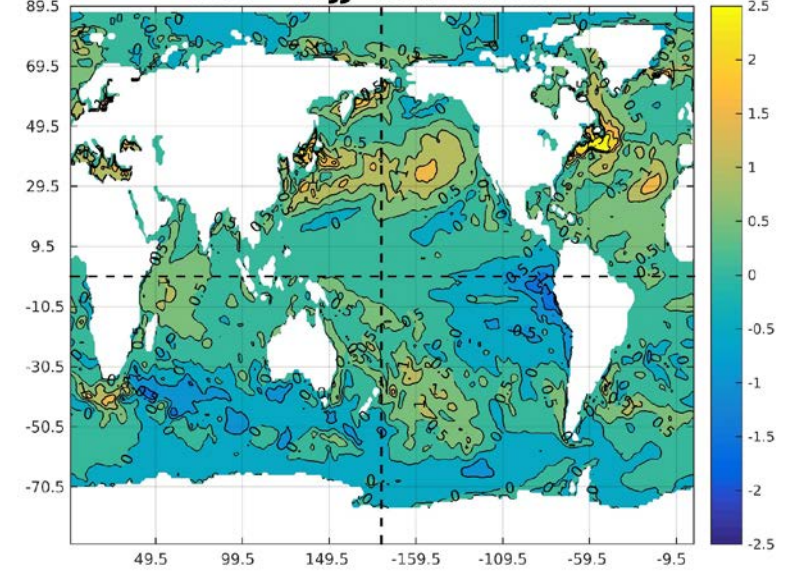
SST MAM IC:Mar2020



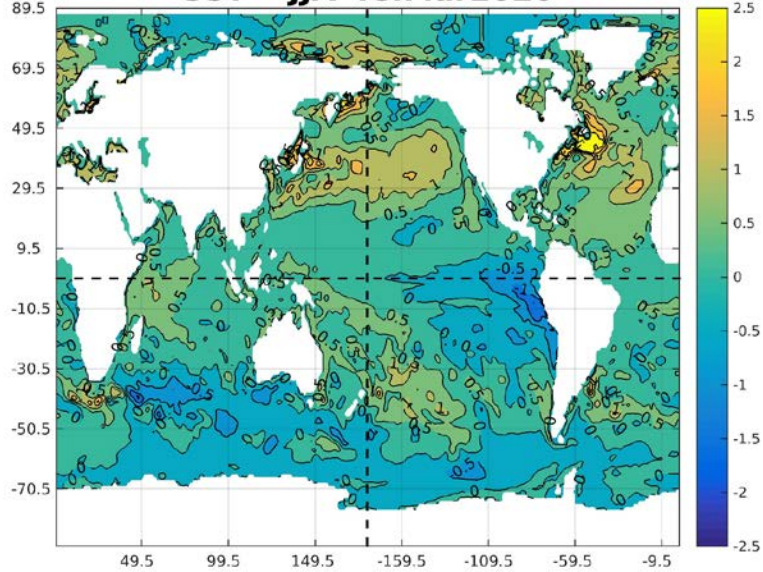
SST AMJ IC:Mar2020



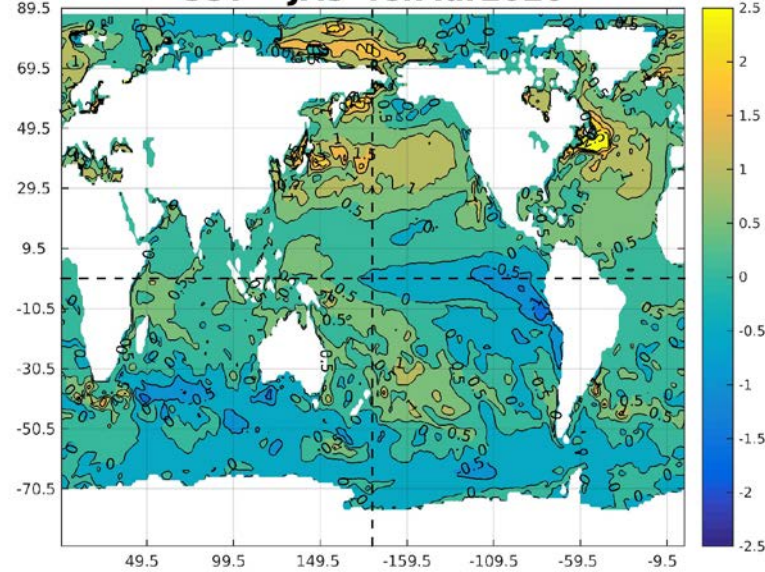
SST MJJ IC:Mar2020



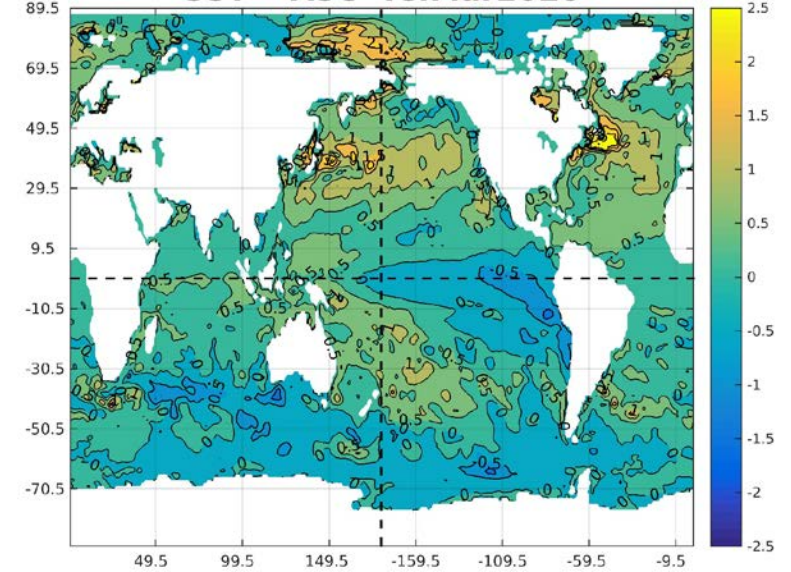
SST JJA IC:Mar2020



SST JAS IC:Mar2020



SST ASO IC:Mar2020



Round-up: ENSO

- ENSO-neutral is slightly more favoured throughout this forecast period, but there is some indication of cooling towards La Niña by the end of the year.
- Take note: during the Southern Hemisphere autumn, predictability of ENSO events for the coming summer is low.

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 ($0.5^{\circ} \times 0.5^{\circ}$), 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.

Forecasts are probabilistic

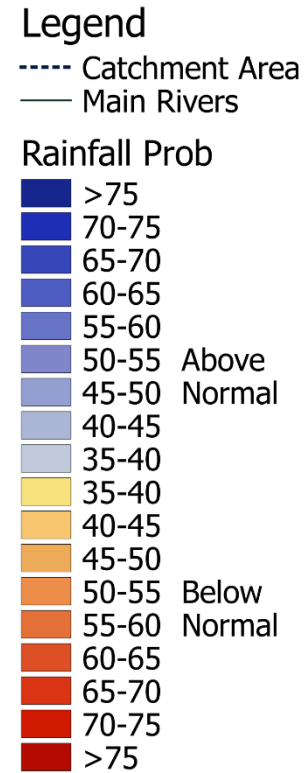
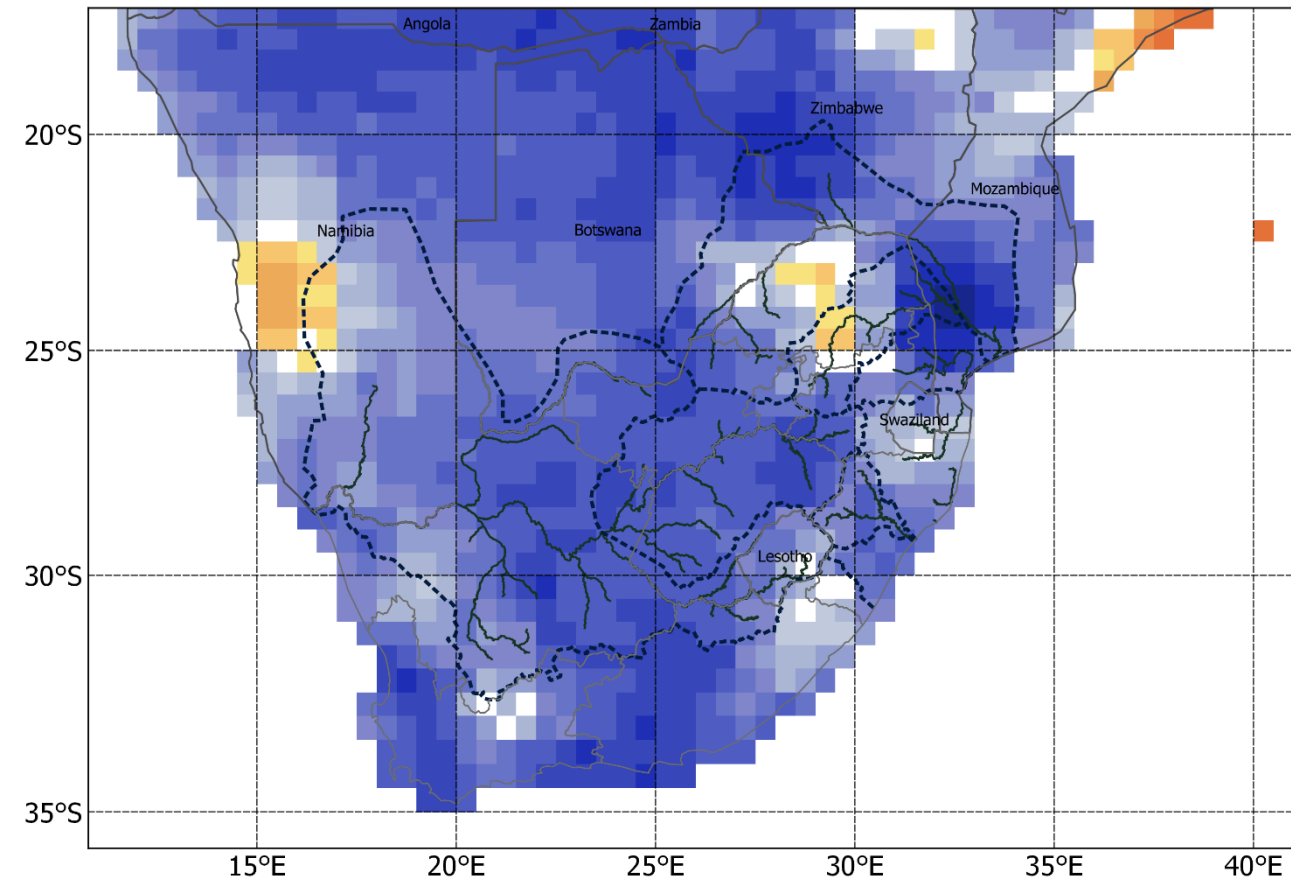
Probabilistic forecasts can help users understand risks and opportunities (forewarned is forearmed) in order to make more informed decisions.

The seasonal rainfall and maximum temperature forecast to follow are probabilities (% chance) of only the most likely outcome for below-, near-, or above-normal (B, N or A). The probabilities shown are always less than 100% - so there is no absolute certainty that the less favoured outcome will not occur. For example, if the forecast claims a 75% of below-normal rainfall totals for a season (i.e. drought), it means that 1 out of 4 times it will not develop into a drought.

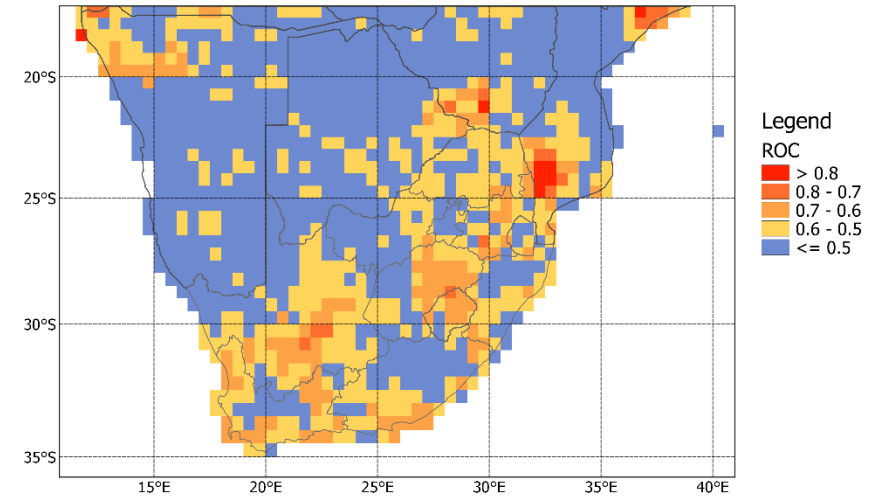
The nature of a probabilistic forecast implies that the less likely outcomes are always possible. In fact, for the probabilistic forecasts to be considered reliable, the less likely outcomes will and must occasionally occur.

Note: Probabilistic forecasts are considered reliable when the forecast probability is an accurate estimation of the relative frequency of the predicted outcome. In other words, forecasts are reliable if the observation falls within the category (B, N or A) as frequently as the forecast implies

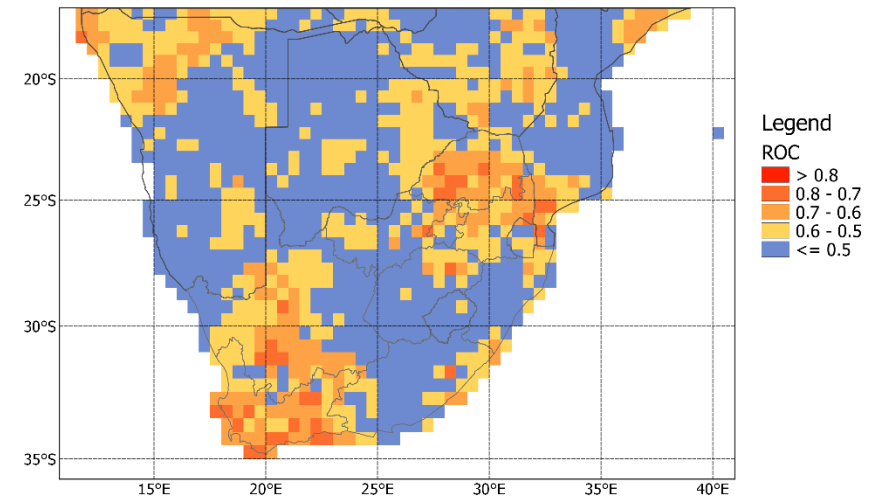
MAM 2020 Rainfall; ICs: Mar



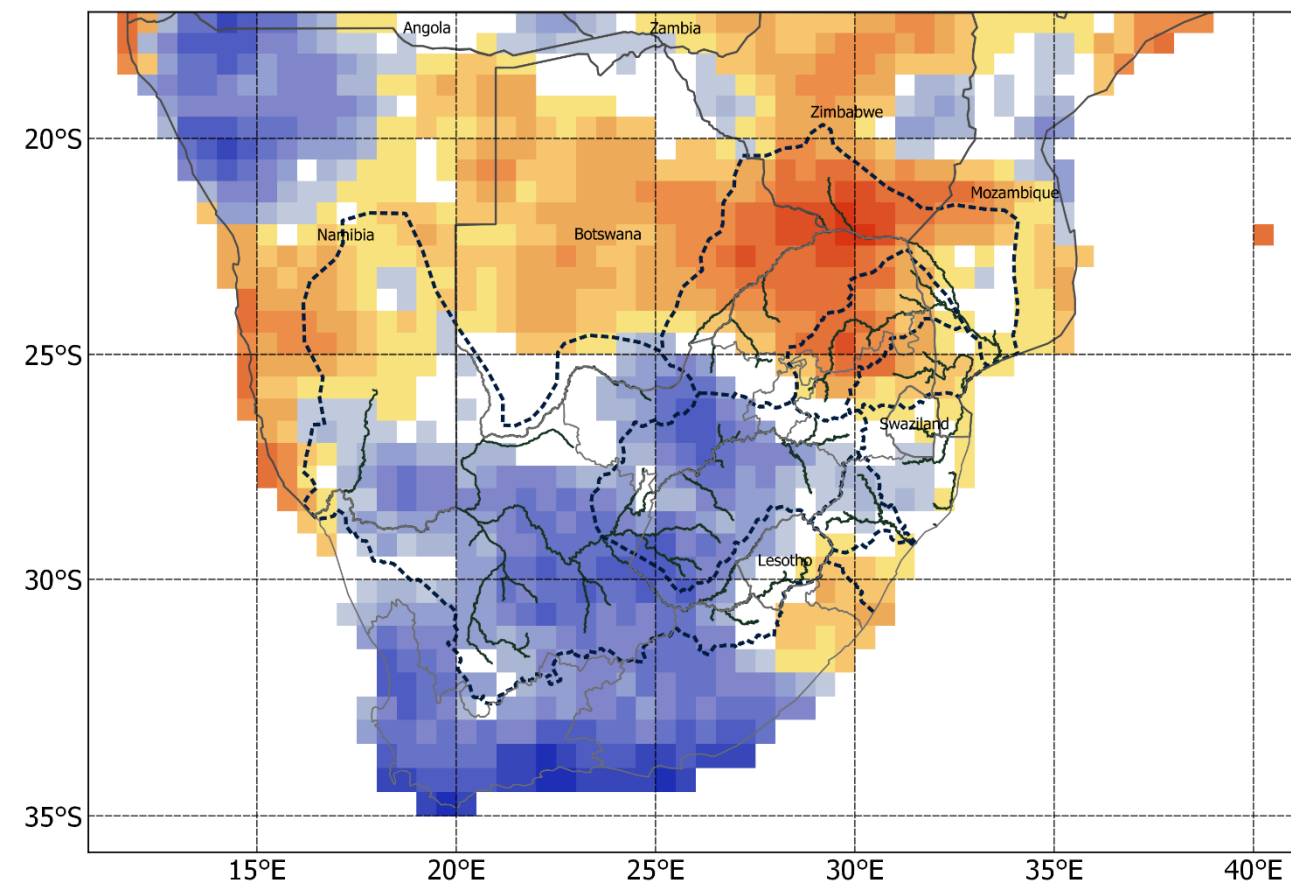
ROC Area (Above-Normal): MAM Rainfall



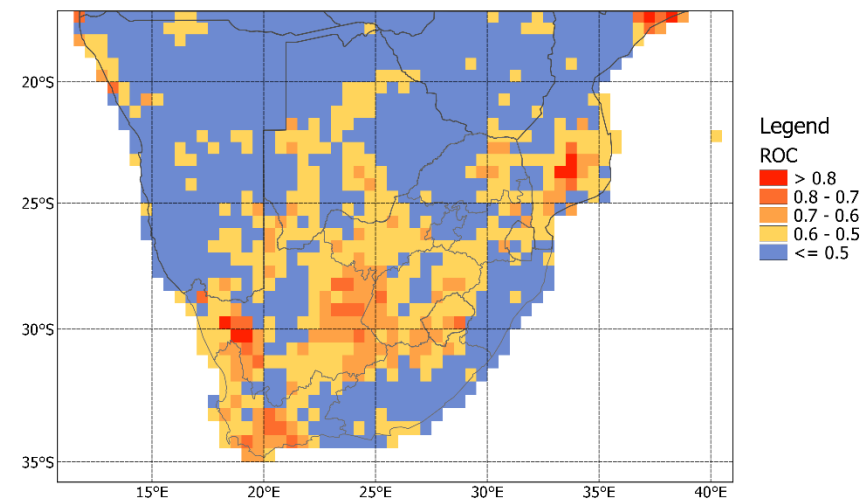
ROC Area (Below-Normal): MAM Rainfall



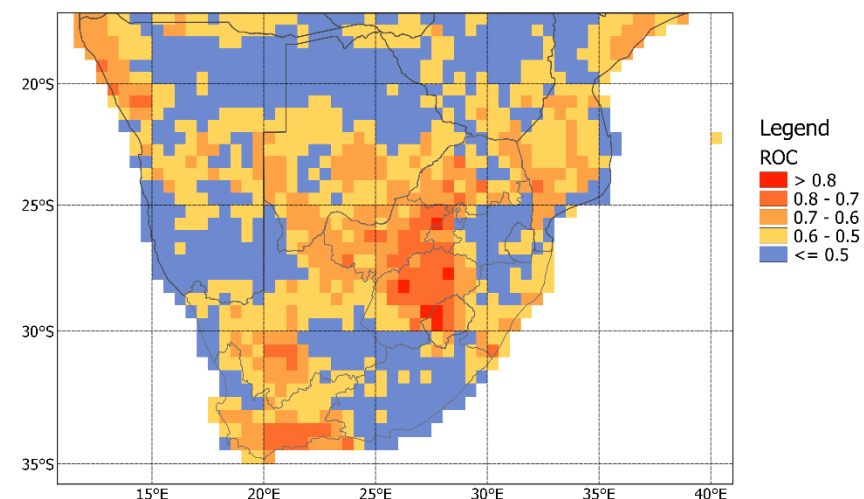
AMJ 2020 Rainfall; ICs: Mar



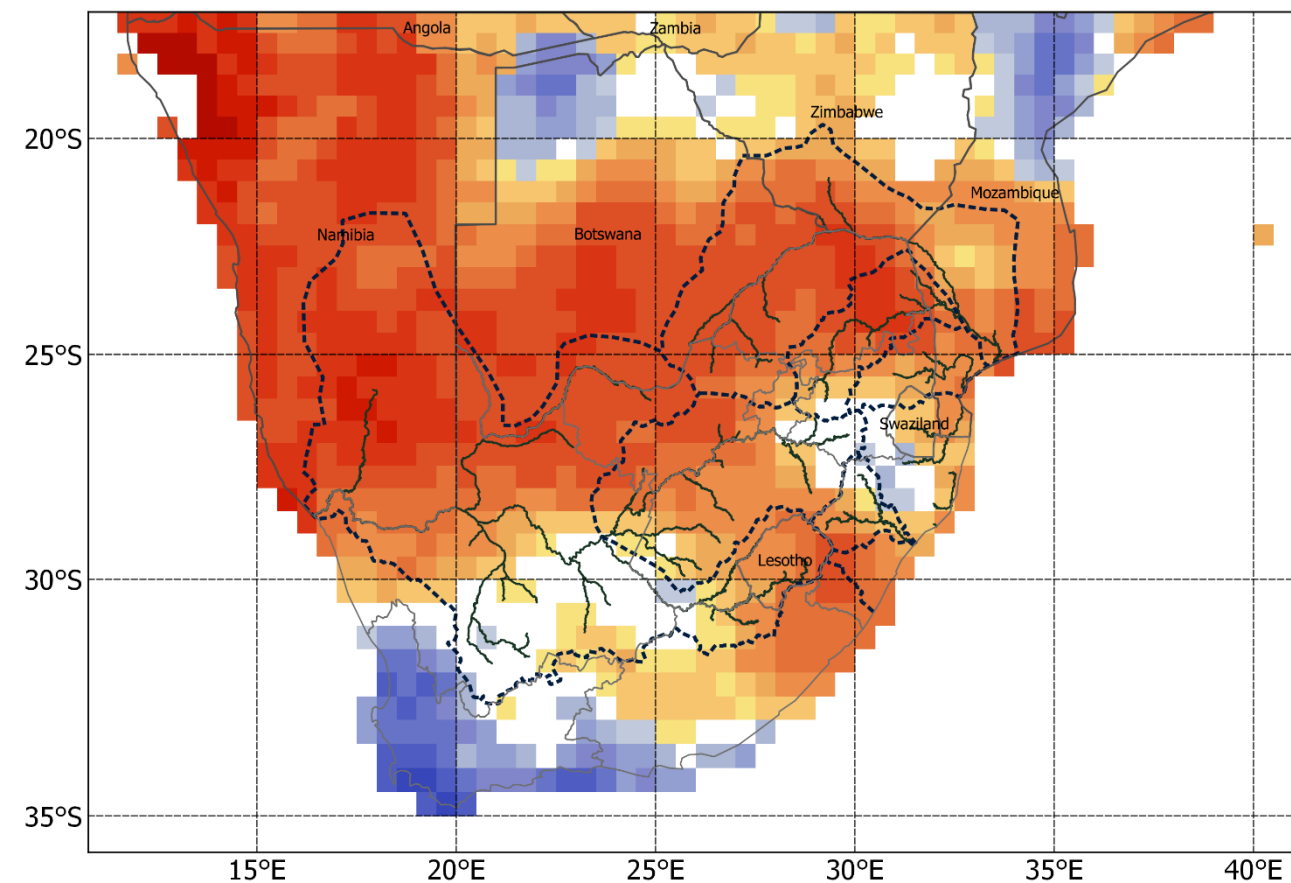
ROC Area (Above-Normal): AMJ Rainfall



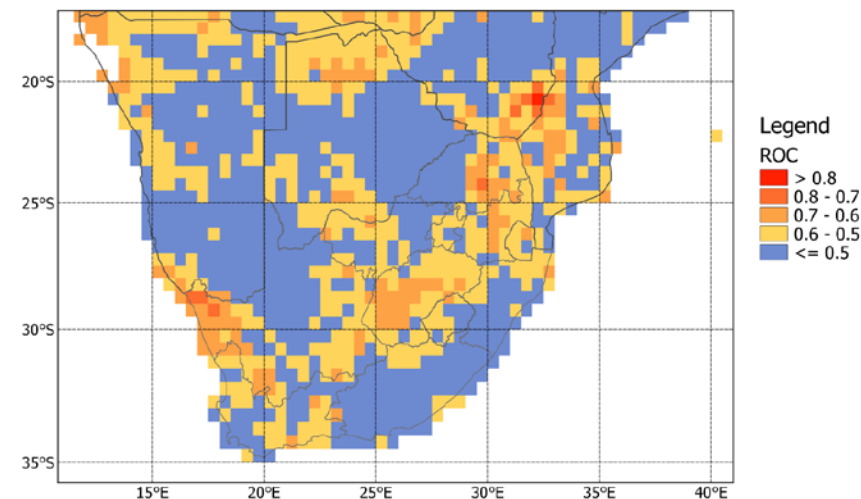
ROC Area (Below-Normal): AMJ Rainfall



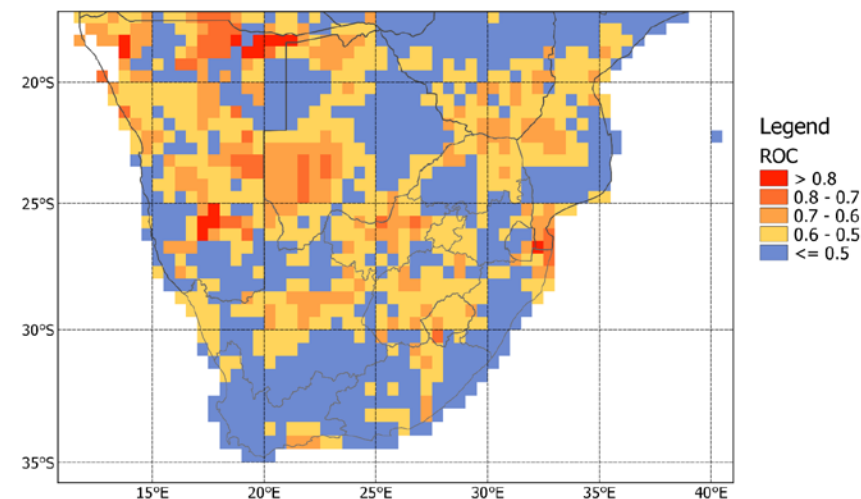
MJJ 2020 Rainfall; ICs: Mar



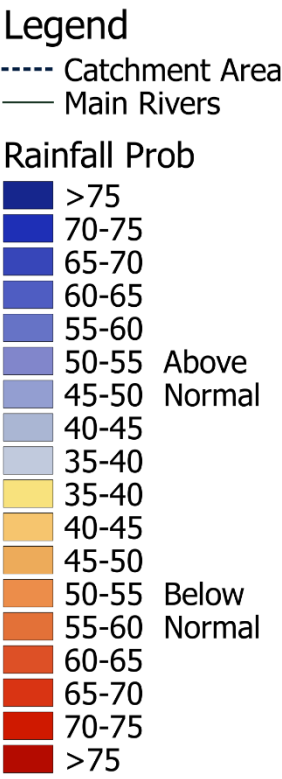
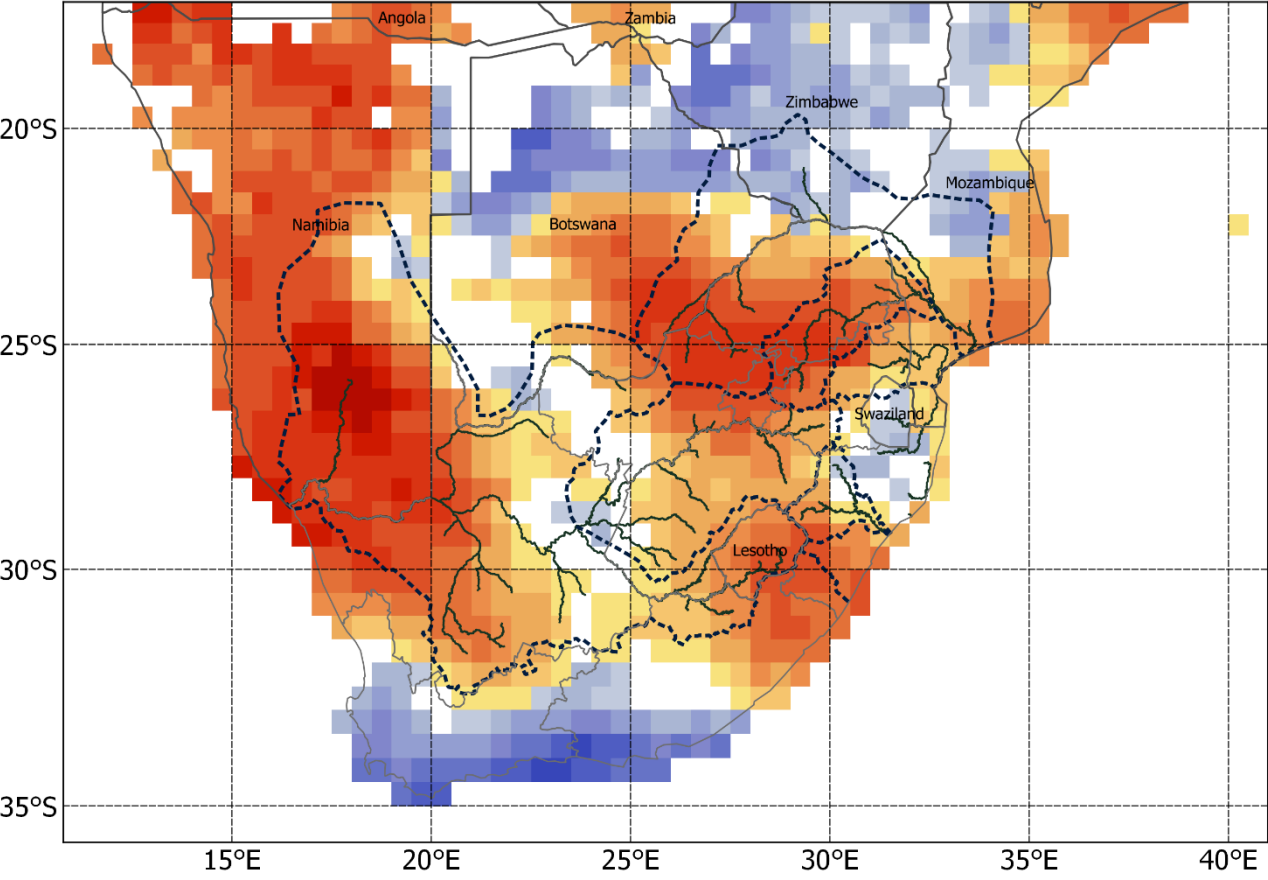
ROC Area (Above-Normal): MJJ Rainfall



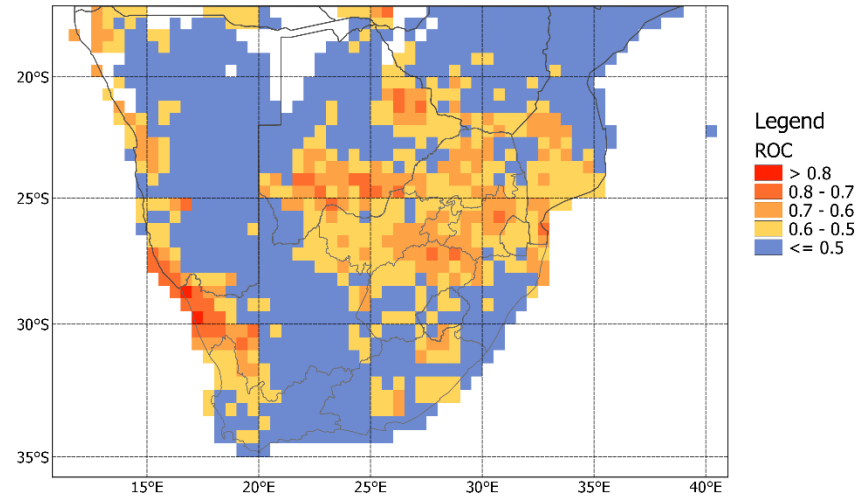
ROC Area (Below-Normal): MJJ Rainfall



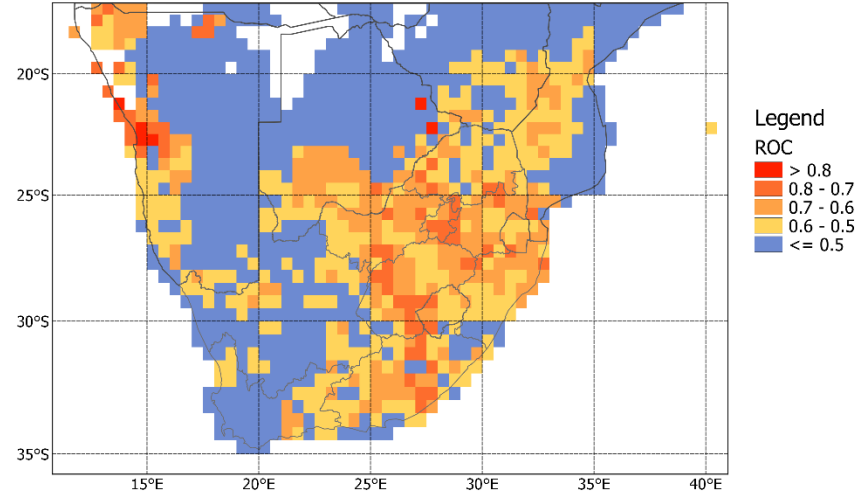
JJA 2020 Rainfall; ICs: Mar



ROC Area (Above-Normal): JJA Rainfall



ROC Area (Below-Normal): JJA Rainfall

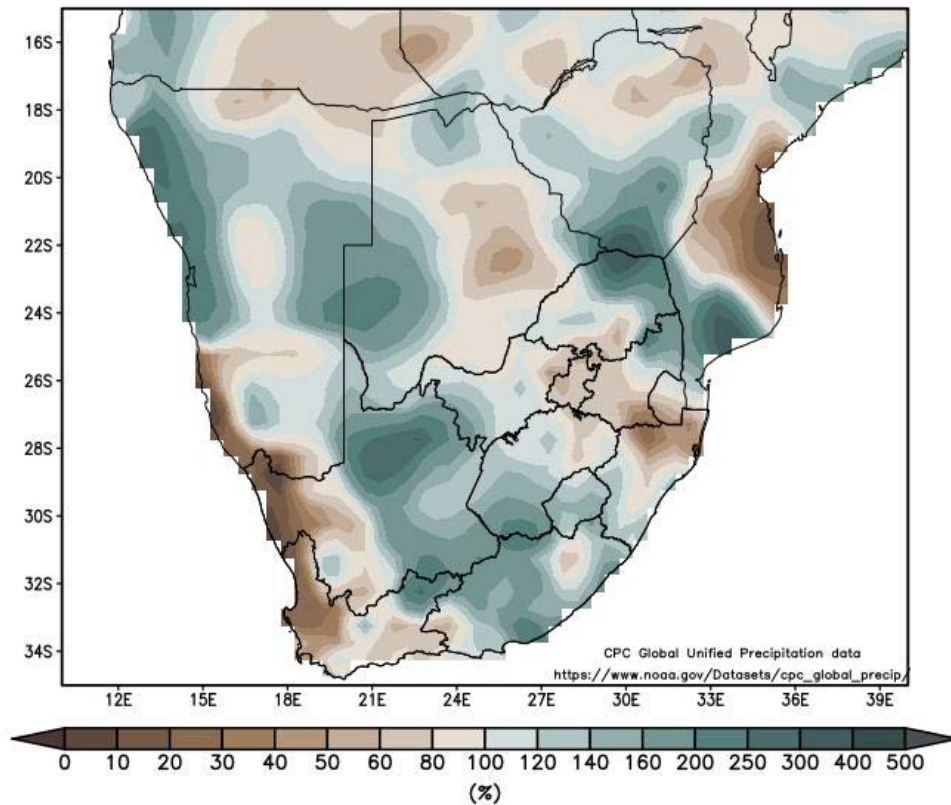


Round-up: SADC Rainfall

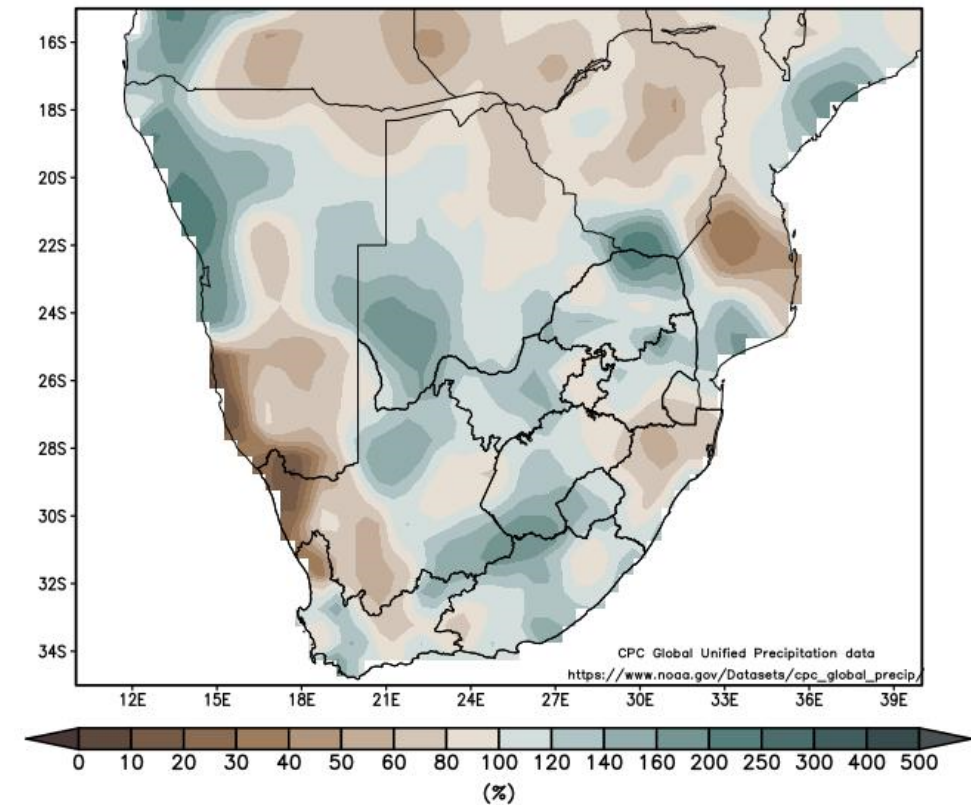
- A favourable end to the summer rainfall season.
- Favourable rainfall outcomes over the SW Cape during the winter rainfall season.

Observed SADC Rainfall

Rainfall (% of normal): February 2020
February long-term mean: 1981–2010

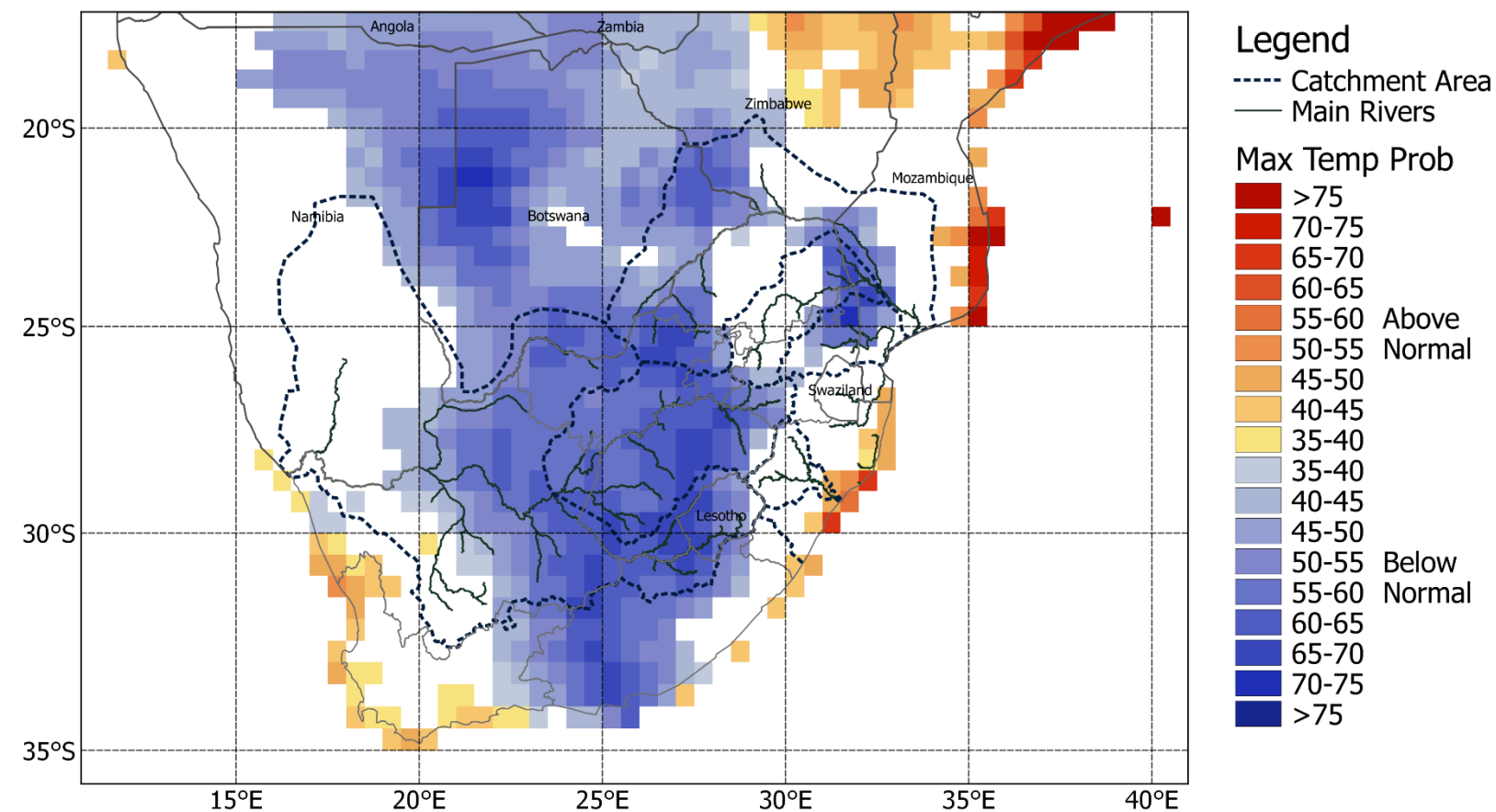


Rainfall (% of normal): Dec–Jan–Feb 2019/20
Relative to Dec–Jan–Feb 1981/82–2010/11 rainfall

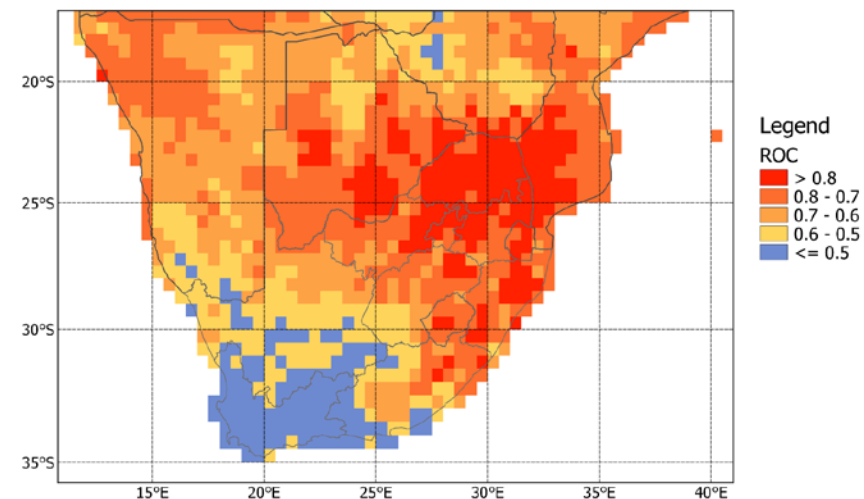


Maps prepared by Dr Christien Engelbrecht

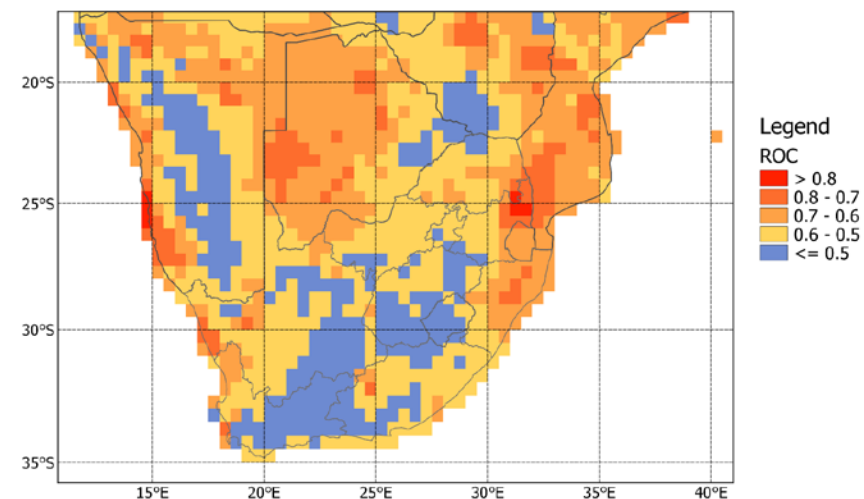
MAM 2020 Max Temp; ICs: Mar



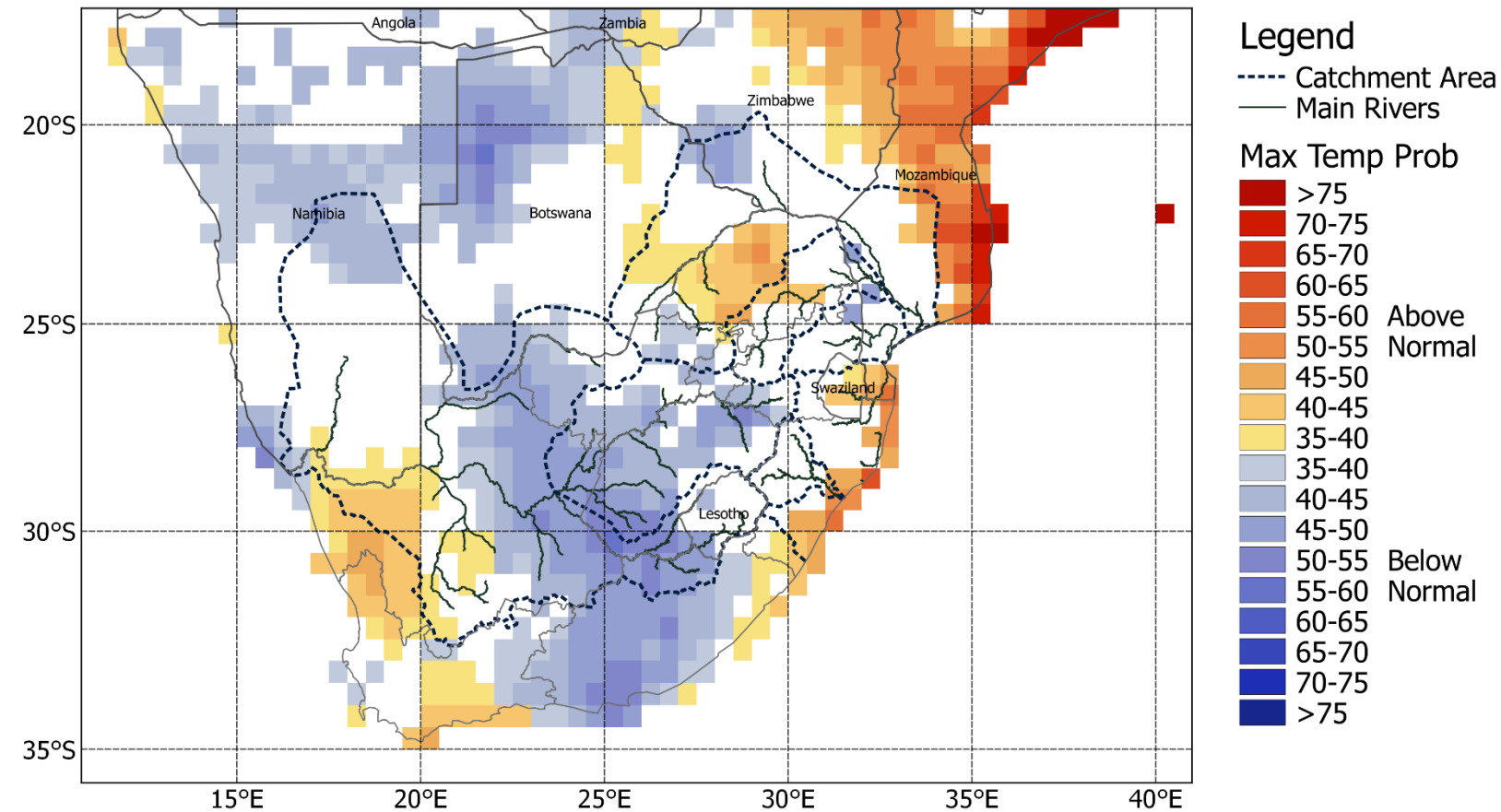
ROC Area (Above-Normal): MAM Max Temp



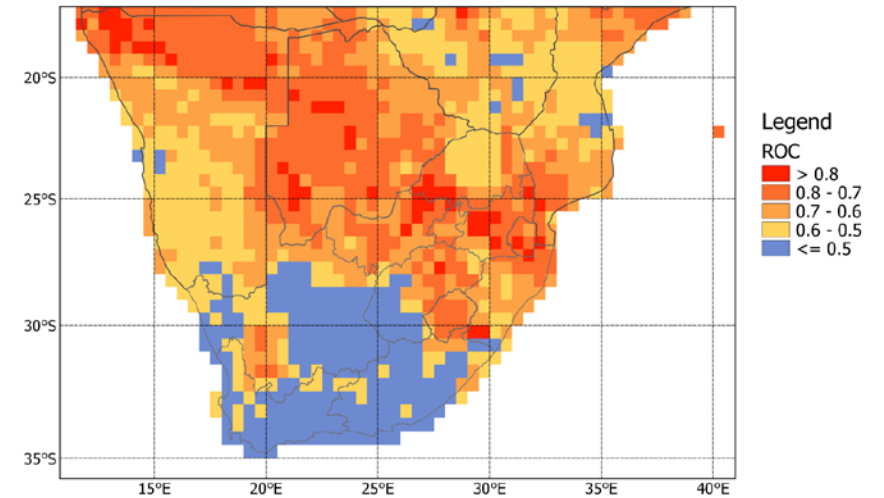
ROC Area (Below-Normal): MAM Max Temp



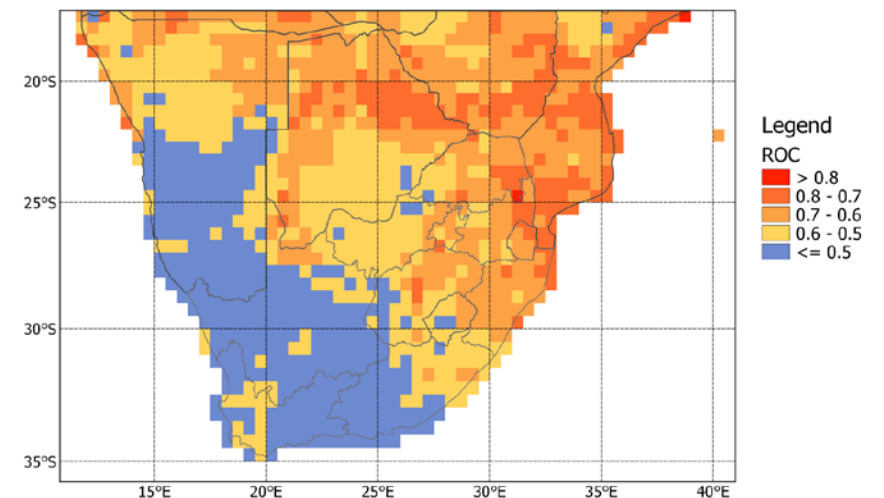
AMJ 2020 Max Temp; ICs: Mar



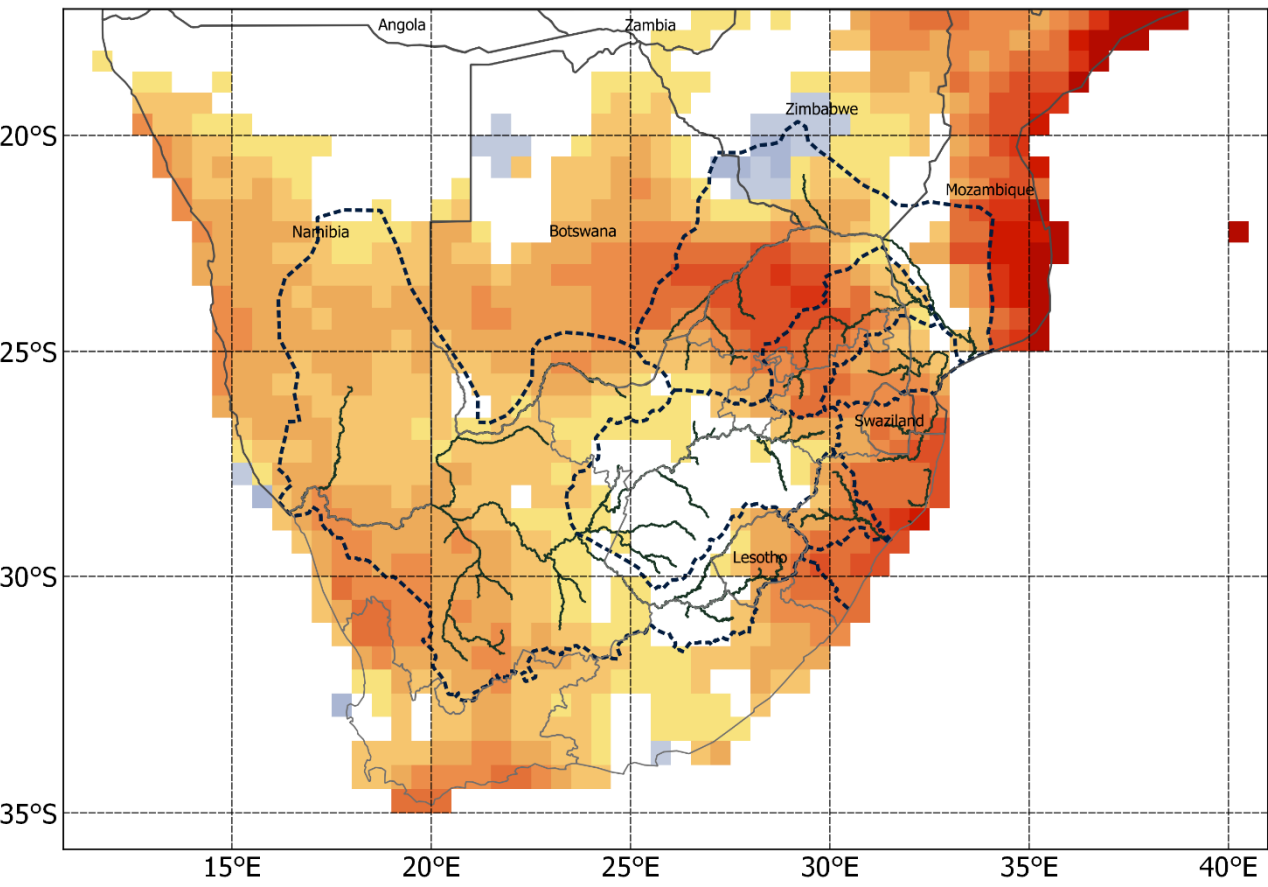
ROC Area (Above-Normal): AMJ Max Temp



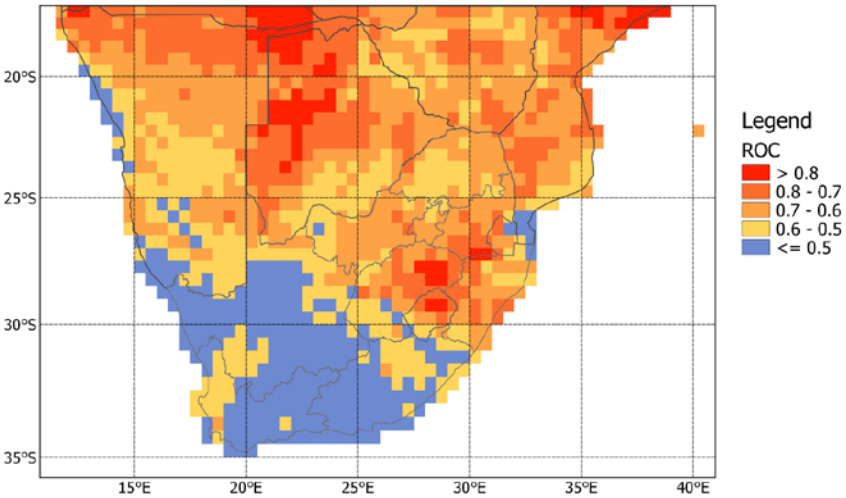
ROC Area (Below-Normal): AMJ Max Temp



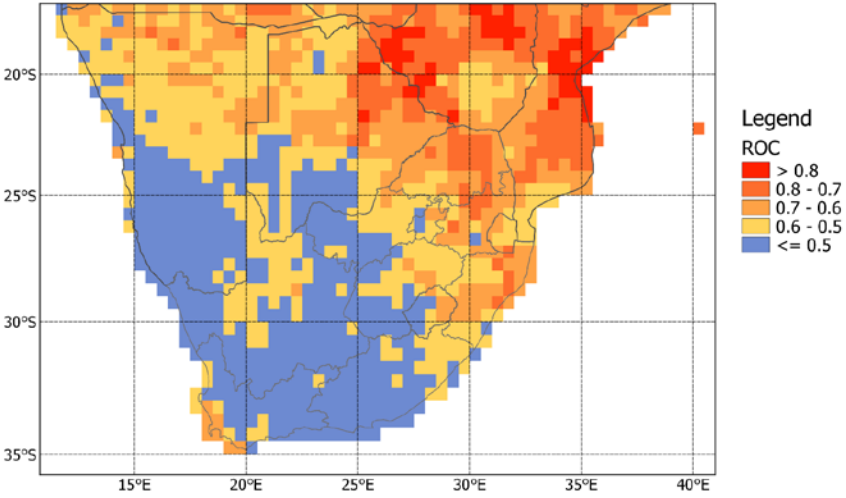
MJJ 2020 Max Temp; ICs: Mar



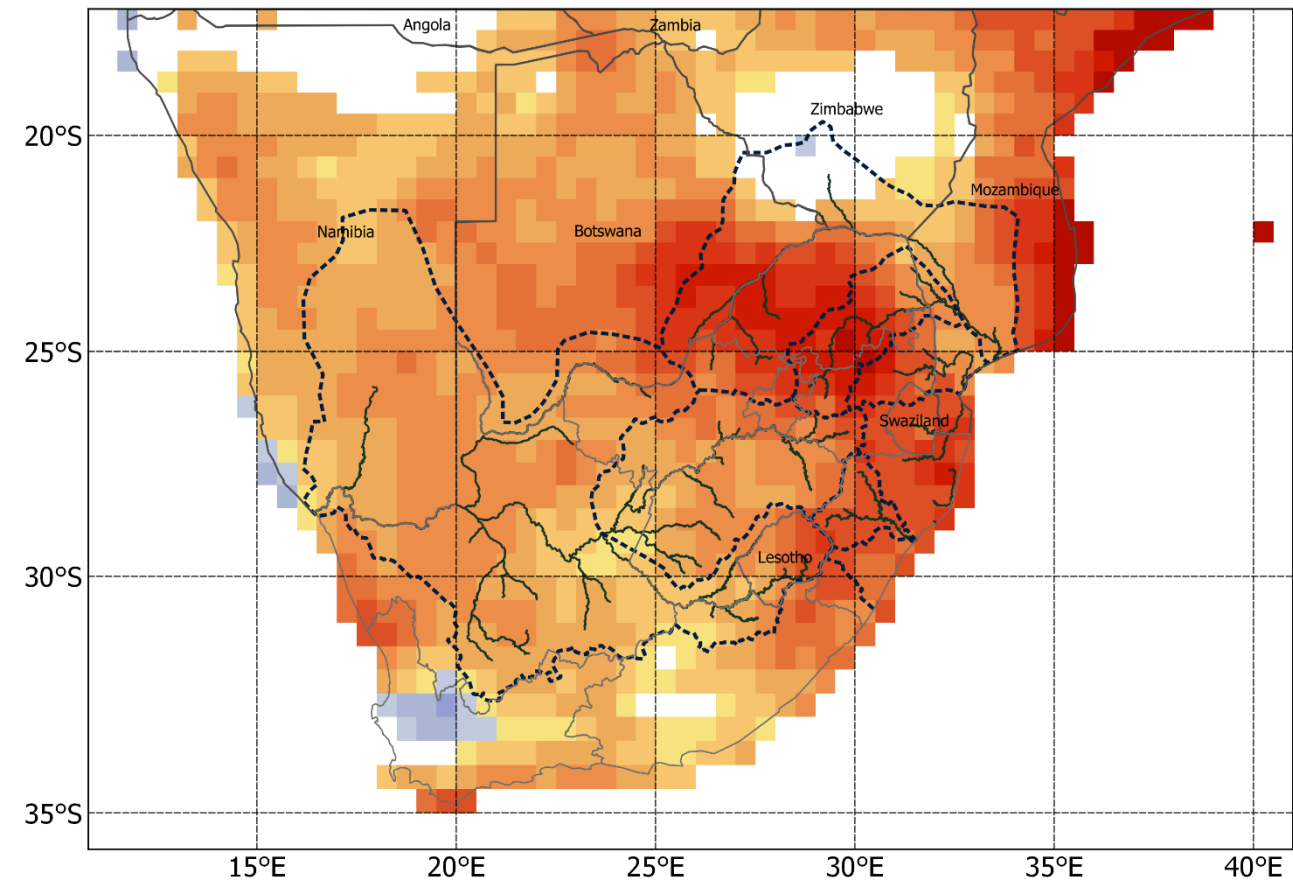
ROC Area (Above-Normal): MJJ Max Temp



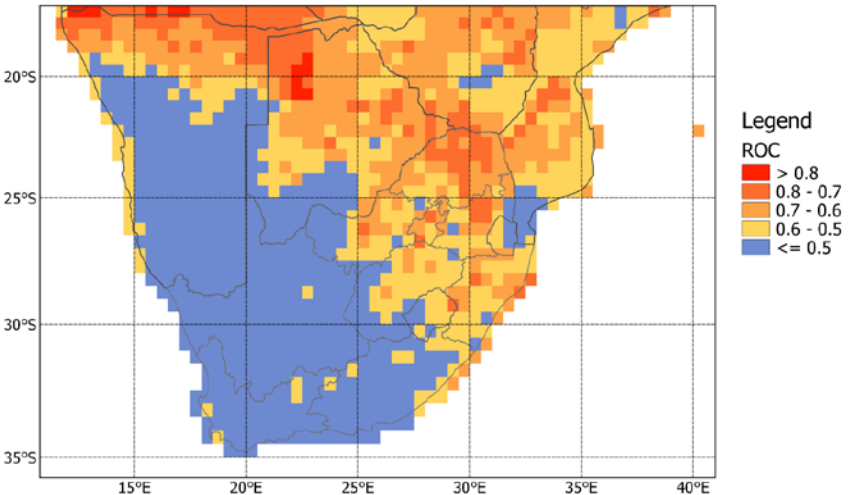
ROC Area (Below-Normal): MJJ Max Temp



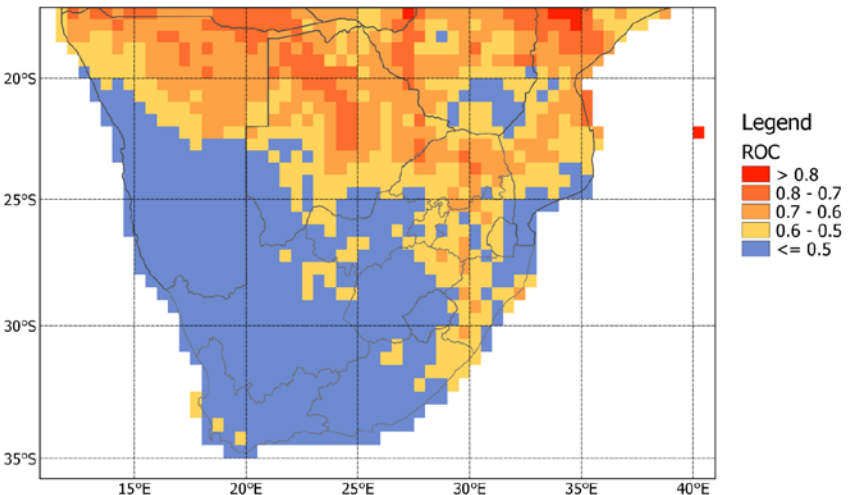
JJA 2020 Max Temp; ICs: Mar



ROC Area (Above-Normal): JJA Max Temp



ROC Area (Below-Normal): JJA Max Temp



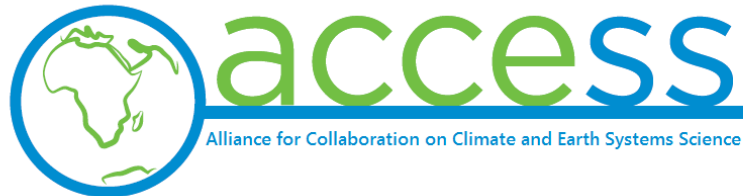
Round-up: SADC Max Temp

- Cool autumn conditions.
- Predominantly high maximum temperatures are likely during mid-winter.

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- 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