

# Seasonal forecasts

presented by:

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



<https://tinyurl.com/ybrb3a72>



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA



# Seasonal Forecast Worx

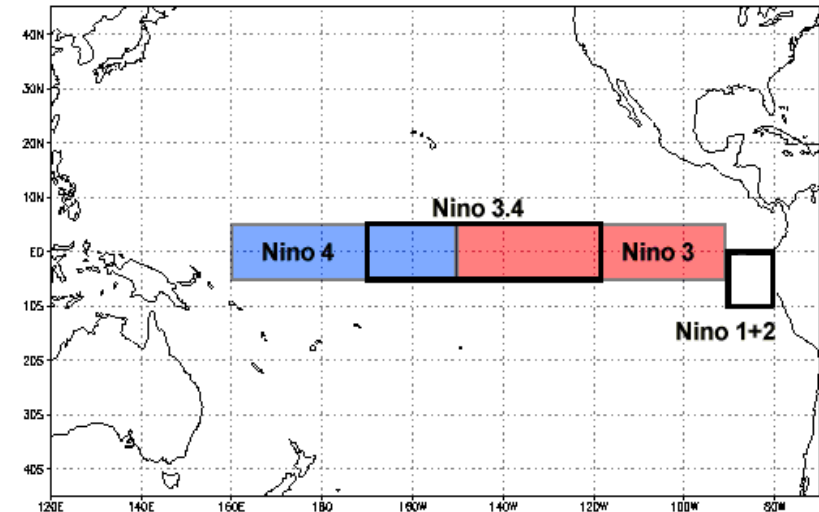
Latest Update: 9 August 2019

- 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

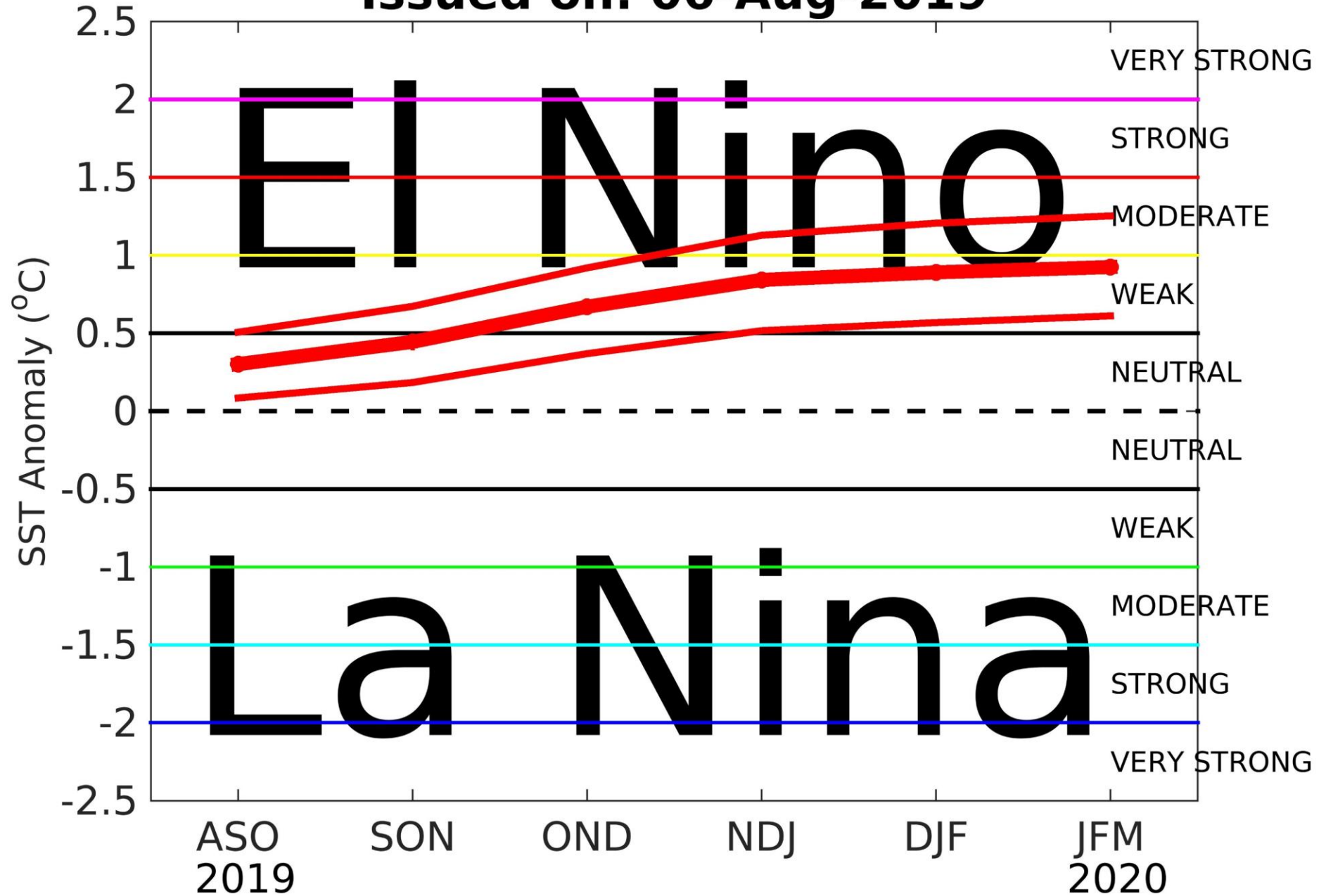
# Prediction Method

- 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 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



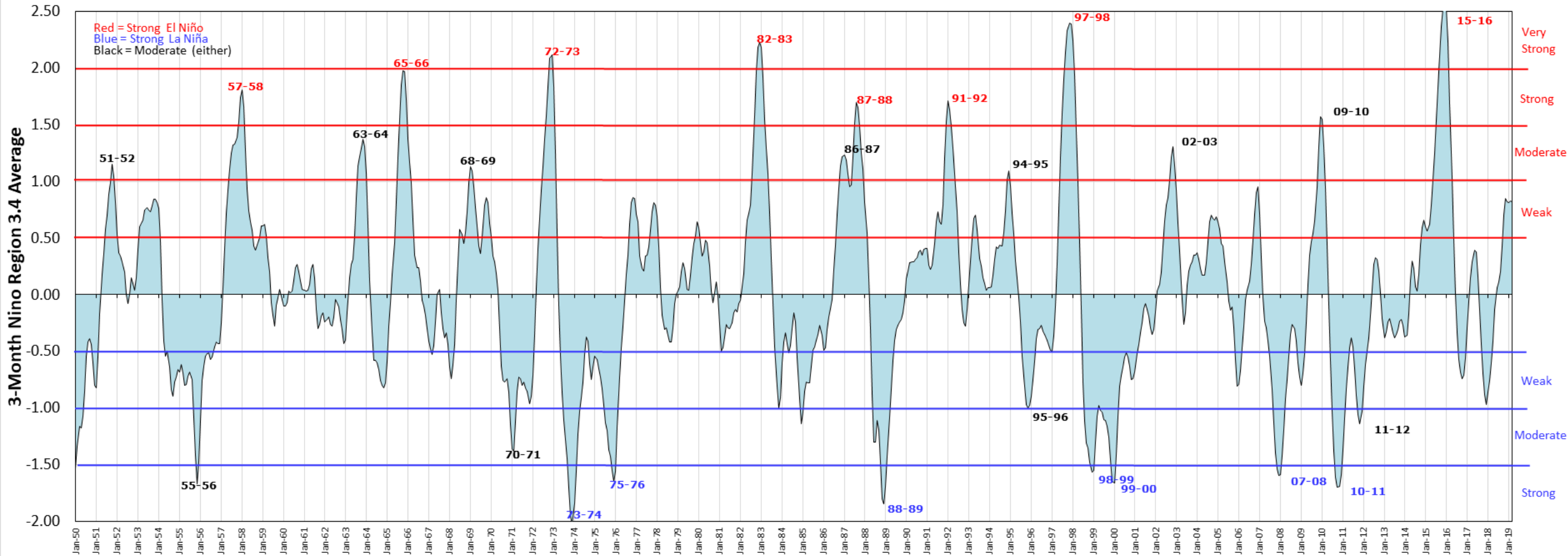
# CSiriMM Nino3.4 SST Forecast

Issued on: 06-Aug-2019



# Oceanic Niño Index (ONI)

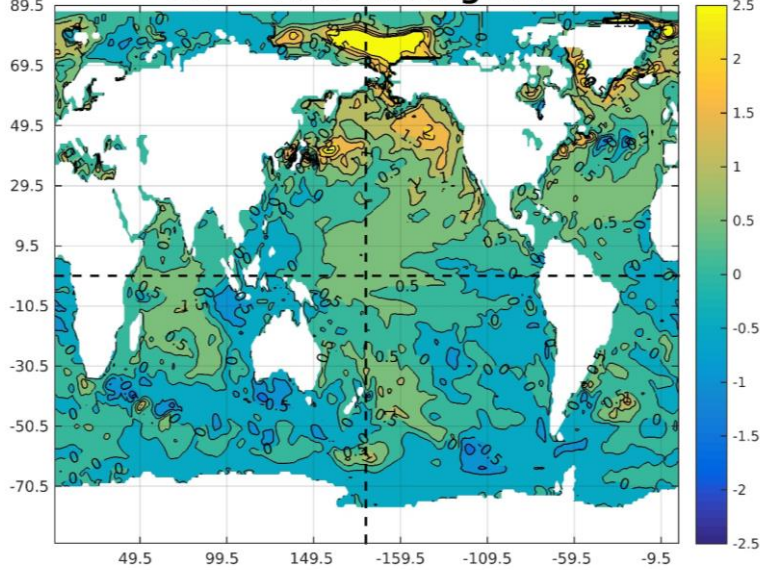
[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ensostuff/ensoyears.shtml](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml)



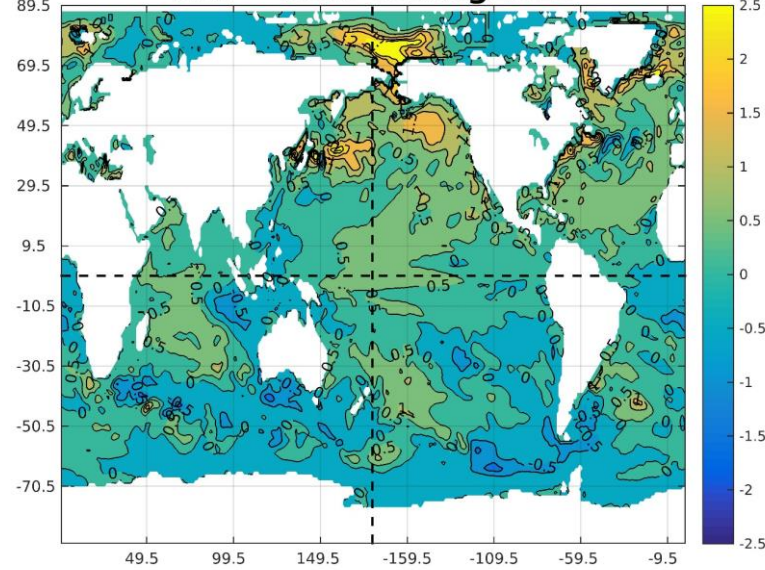


# SST anomalies

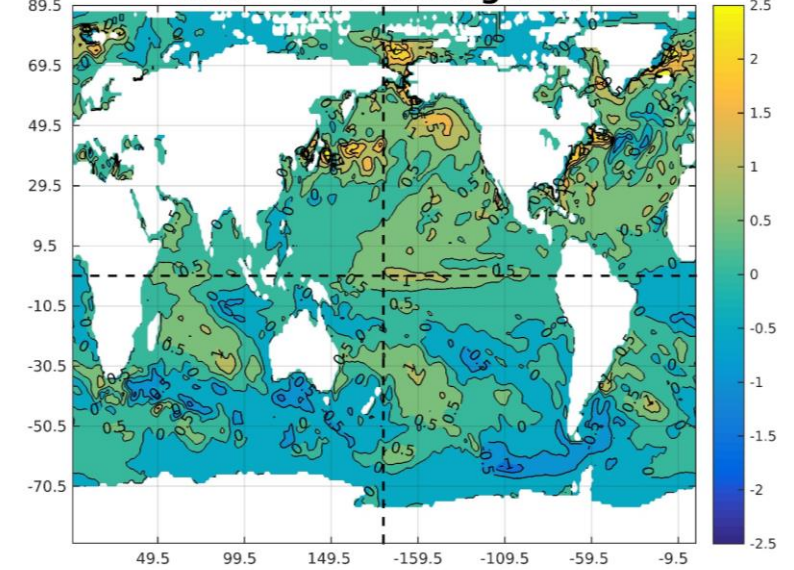
**SST ASO IC:Aug2019**



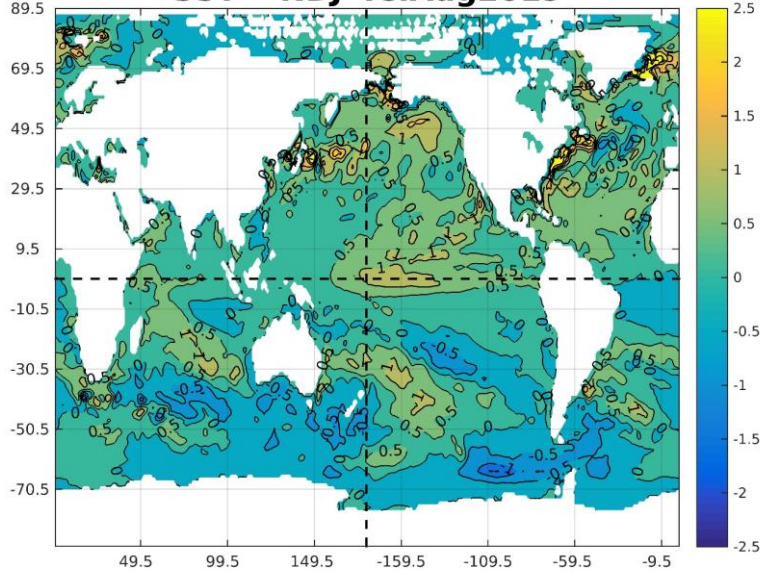
**SST SON IC:Aug2019**



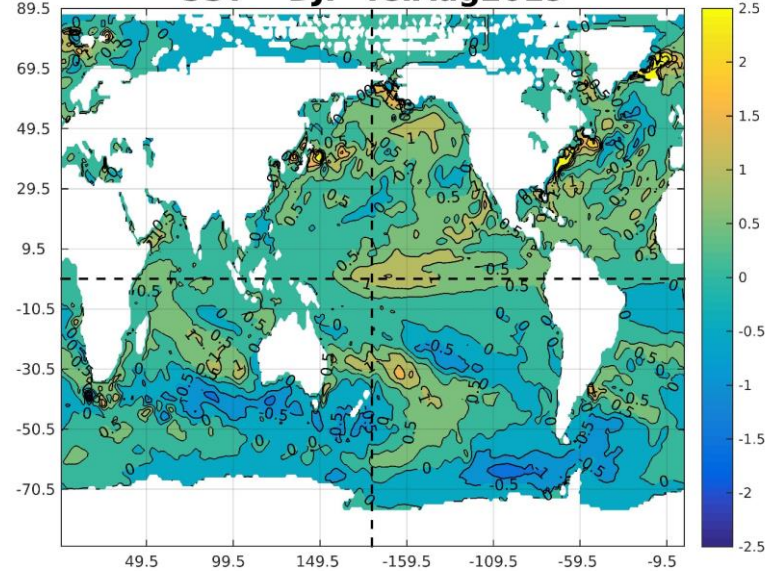
**SST OND IC:Aug2019**



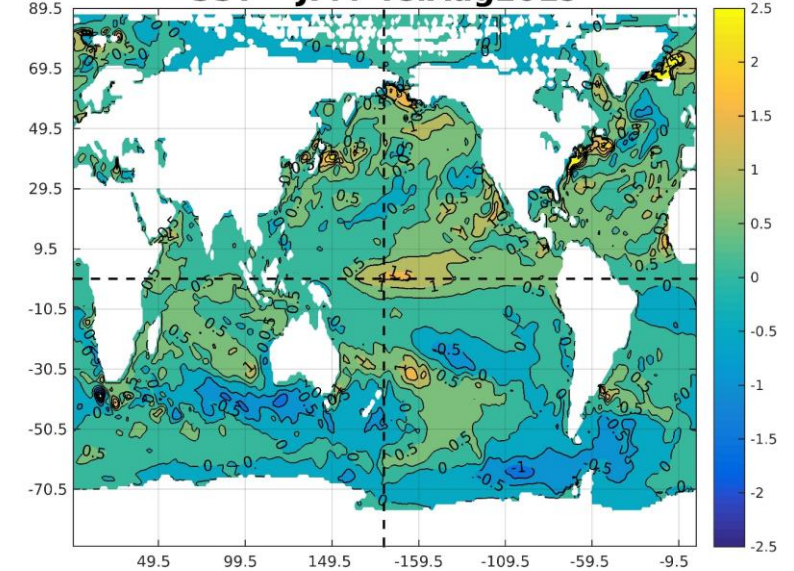
**SST NDJ IC:Aug2019**



**SST DJF IC:Aug2019**



**SST JFM IC:Aug2019**



# Round-up: ENSO

- Predicted warming of central Pacific Ocean SST suggests a weak to moderate El Niño event towards summer.
- *From the CPC/IRI El Niño Watch in August: El Niño has transitioned to ENSO-neutral, which is most likely to continue through Northern Hemisphere winter 2019-20 (50-55% chance). [This statement disagrees with the UP forecast]*

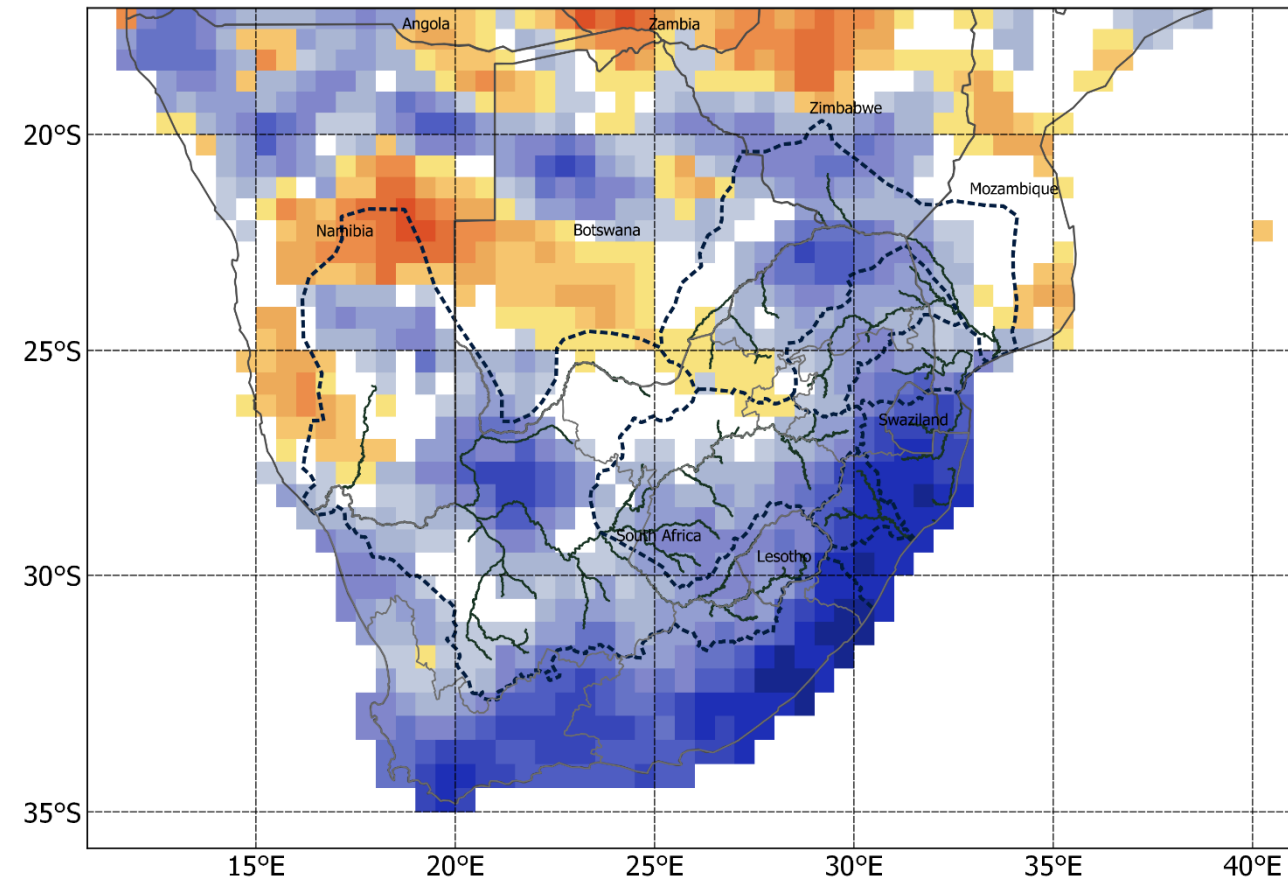


# Southern Africa Forecasts

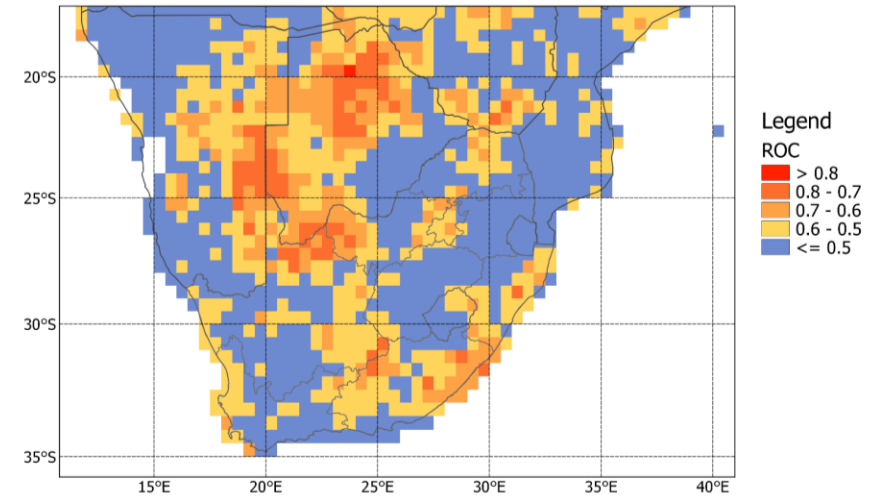
# Prediction Method

- 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.

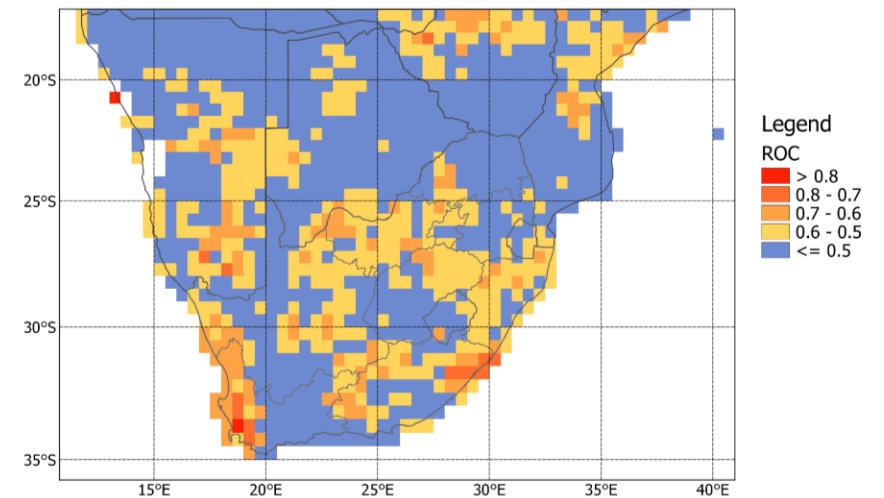
# ASO 2019 Rainfall; ICs: Aug



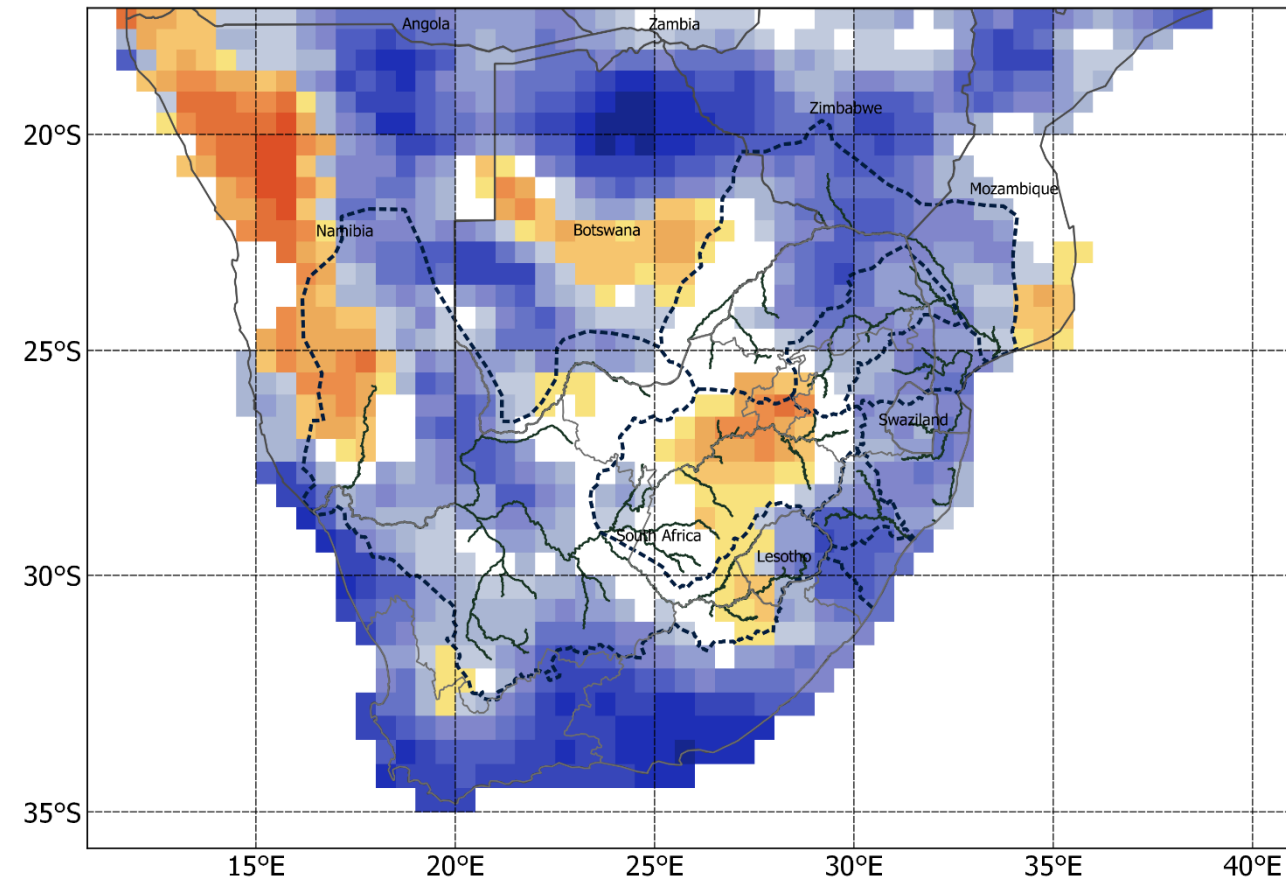
## ROC Area (Above-Normal): ASO Rainfall



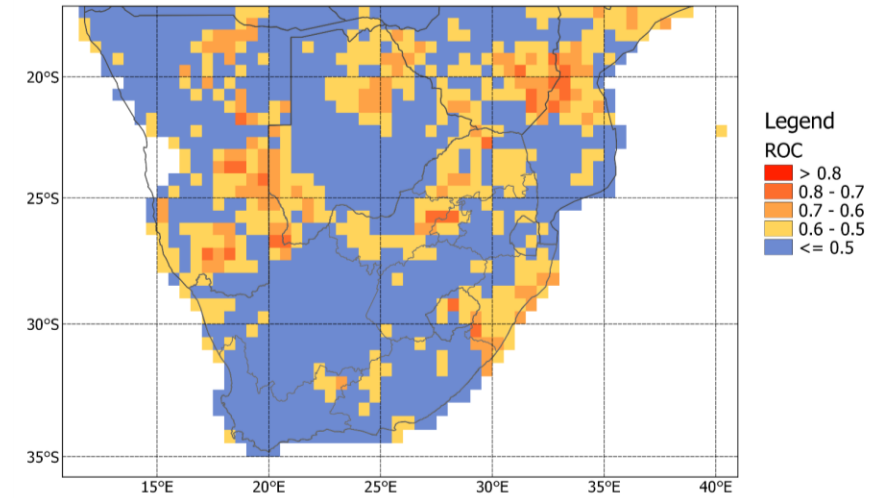
## ROC Area (Below-Normal): ASO Rainfall



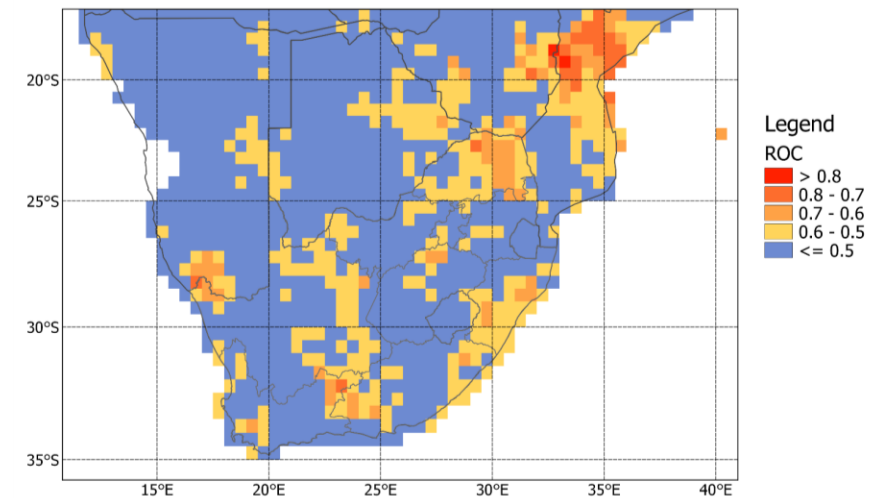
# SON 2019 Rainfall; ICs: Aug



## ROC Area (Above-Normal): SON Rainfall

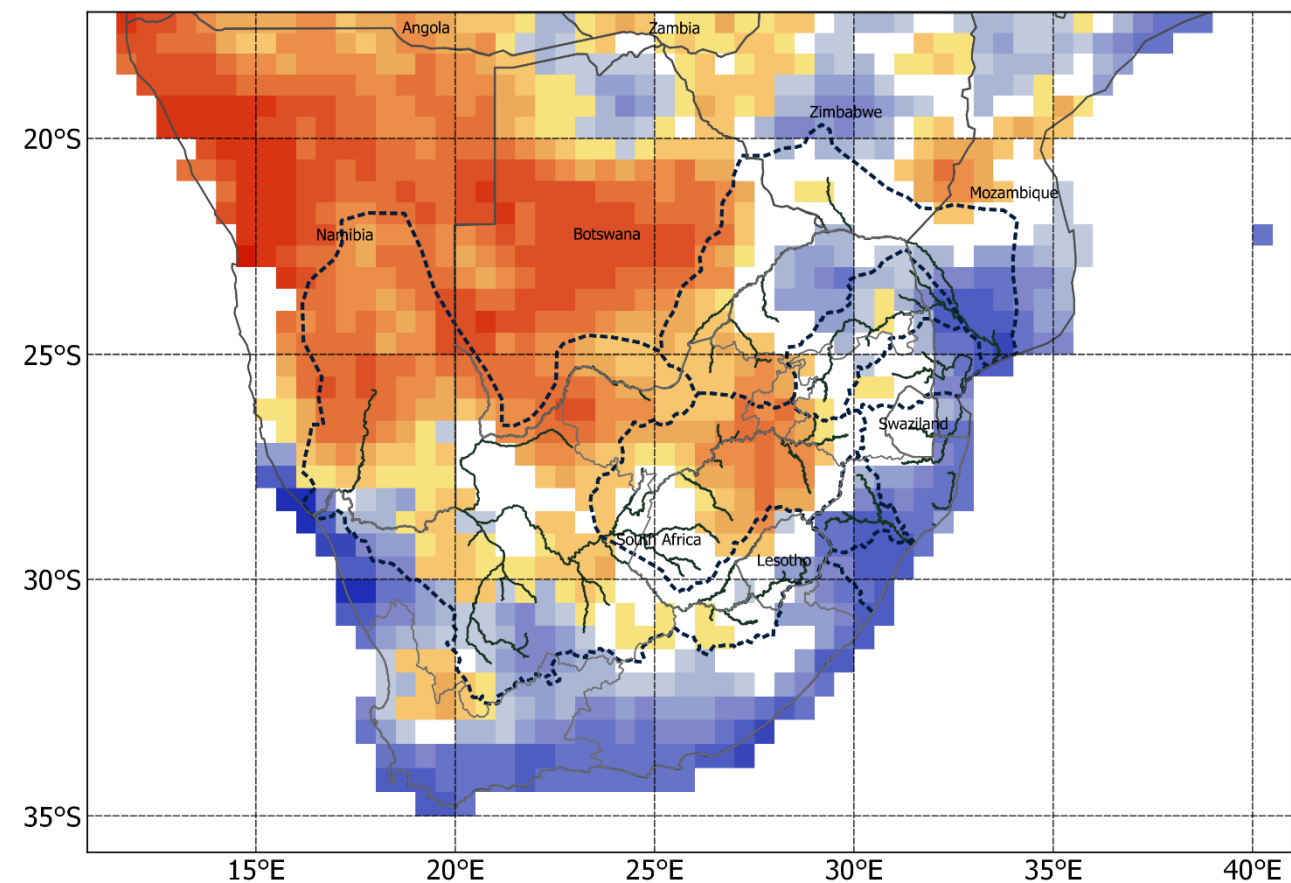


## ROC Area (Below-Normal): SON Rainfall

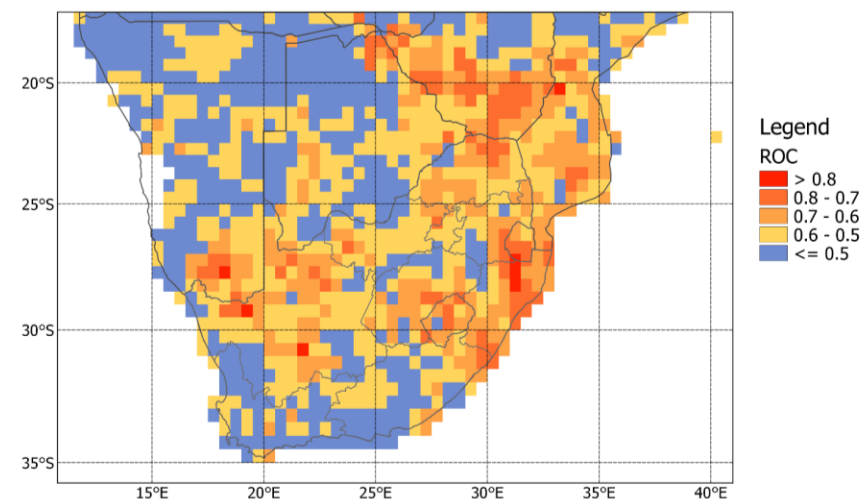




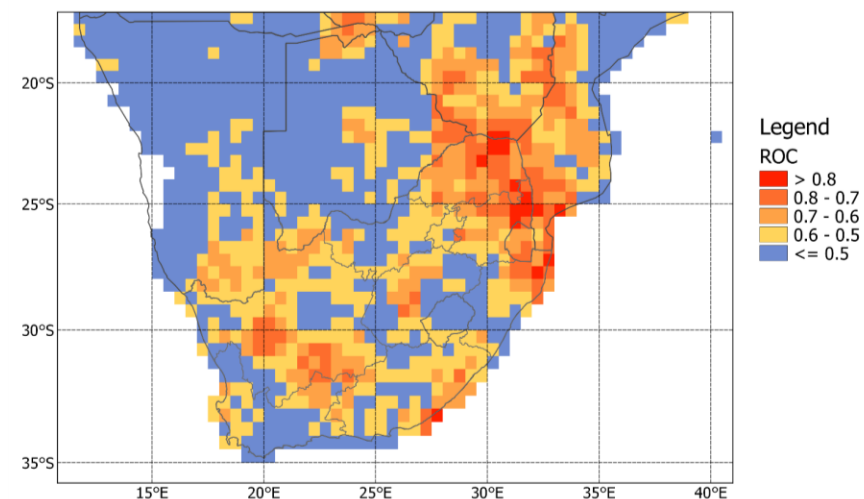
# OND 2019 Rainfall; ICs: Aug



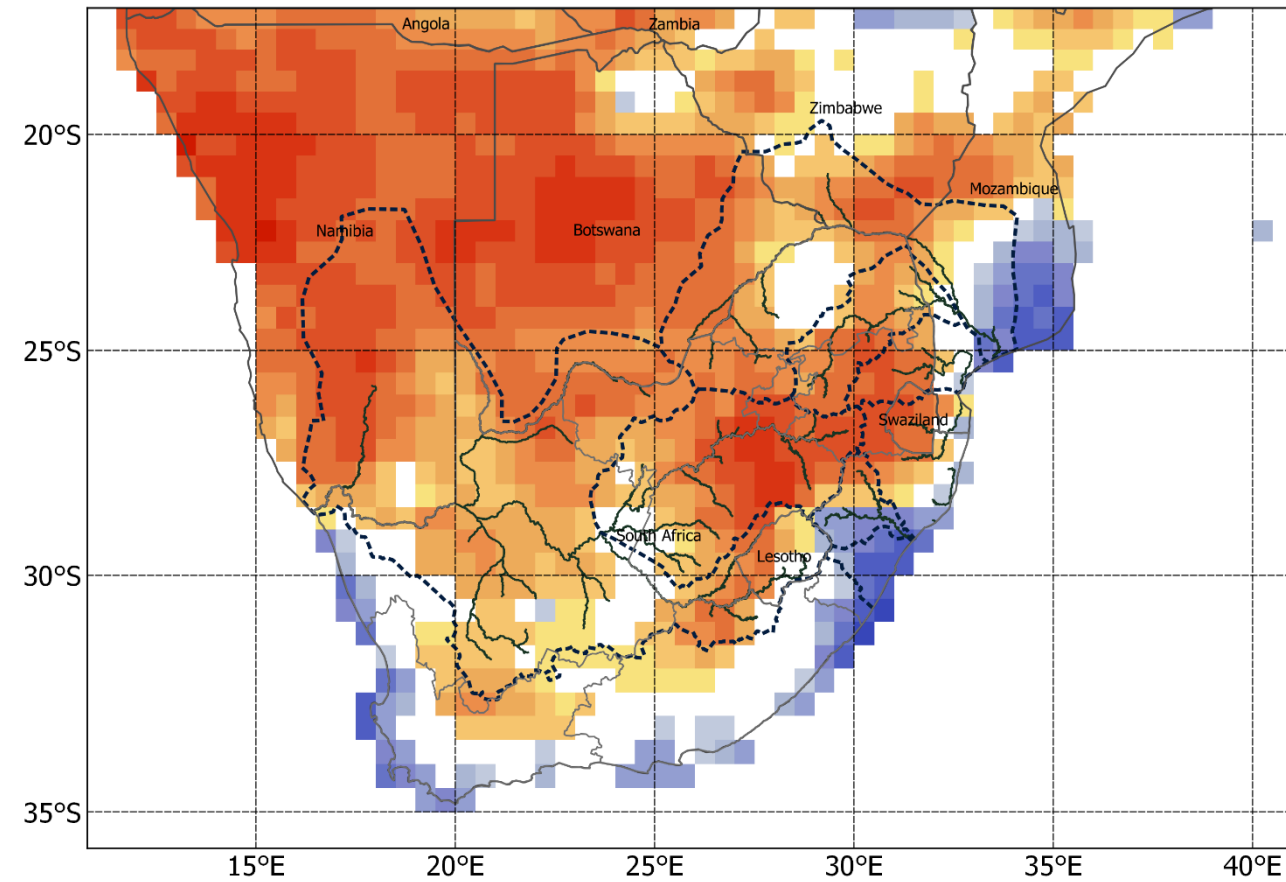
## ROC Area (Above-Normal): OND Rainfall



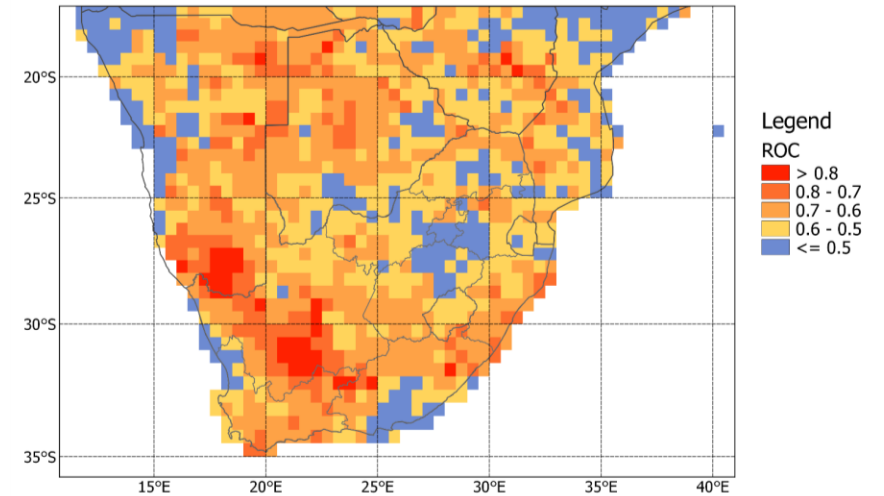
## ROC Area (Below-Normal): OND Rainfall



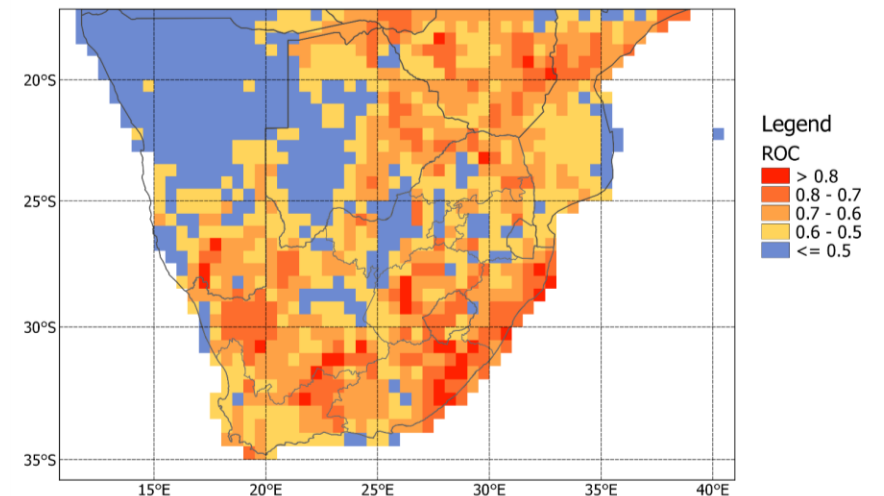
# NDJ 2019/20 Rainfall; ICs: Aug



## ROC Area (Above-Normal): NDJ Rainfall



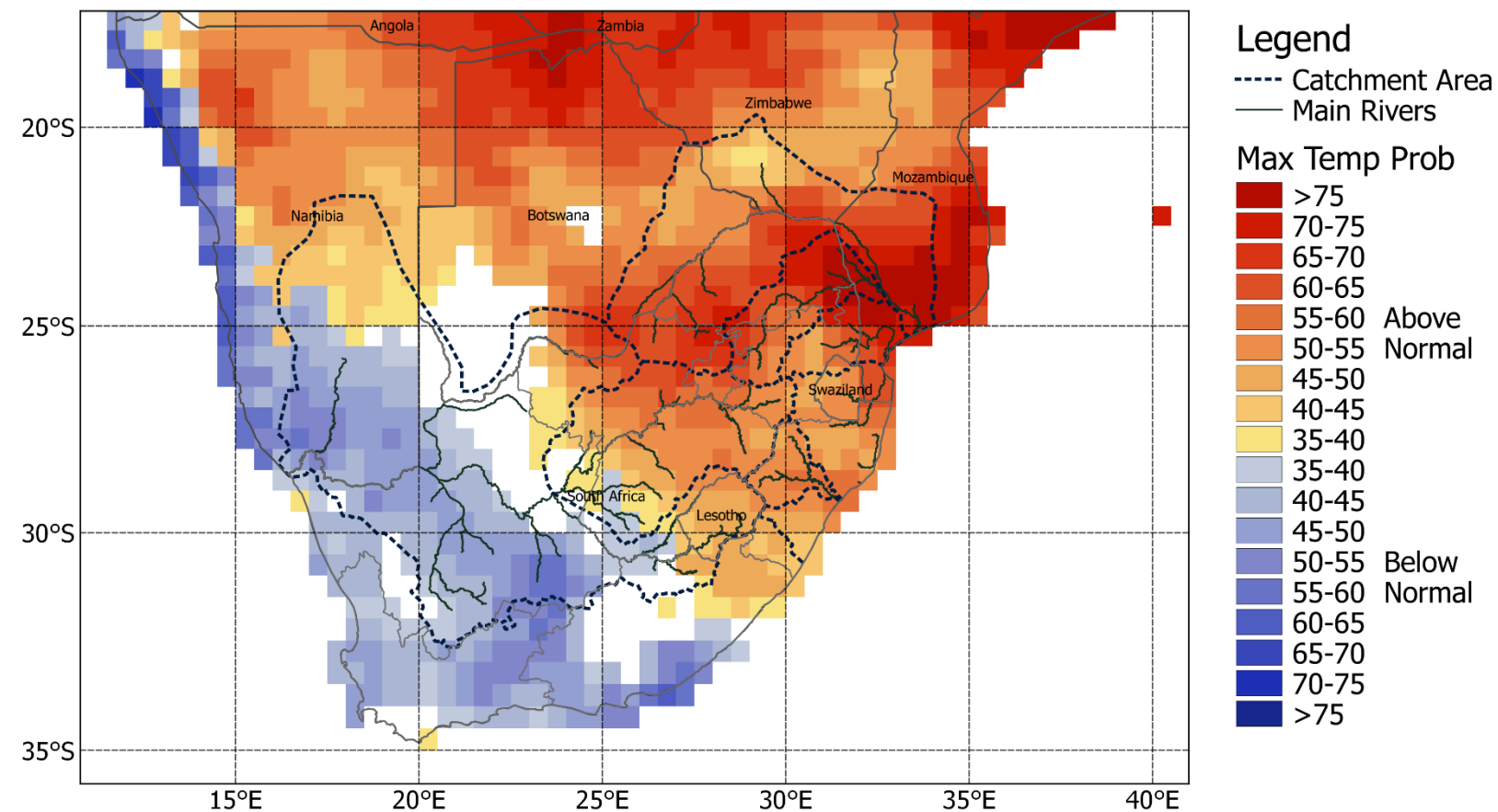
## ROC Area (Below-Normal): NDJ Rainfall



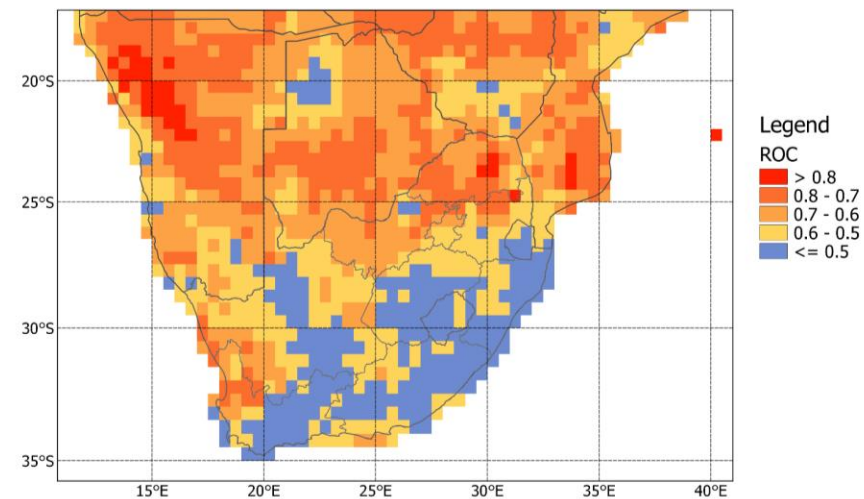
# Round-up: SADC Rainfall

- Favourable spring rain is possible over the larger part of the region
- However, as we approach mid-summer, the chances for dry conditions increase over the larger part of the summer rainfall region

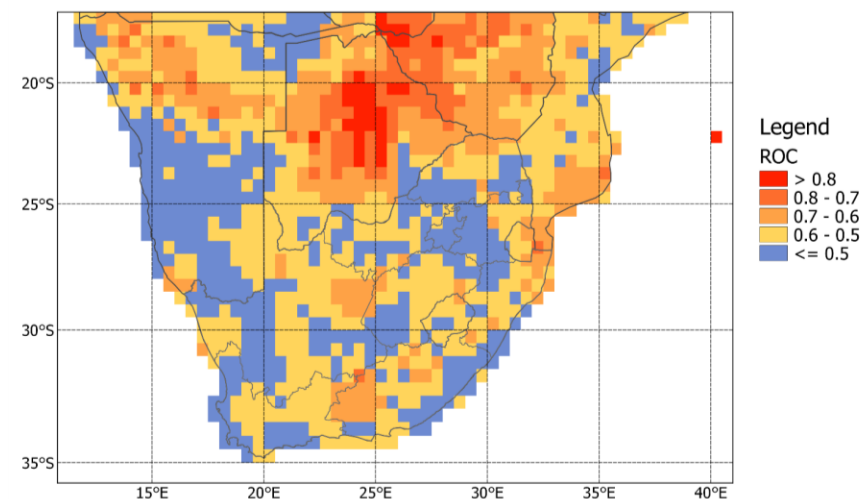
# ASO 2019 Max Temp; ICs: Aug



## ROC Area (Above-Normal): ASO Max Temp

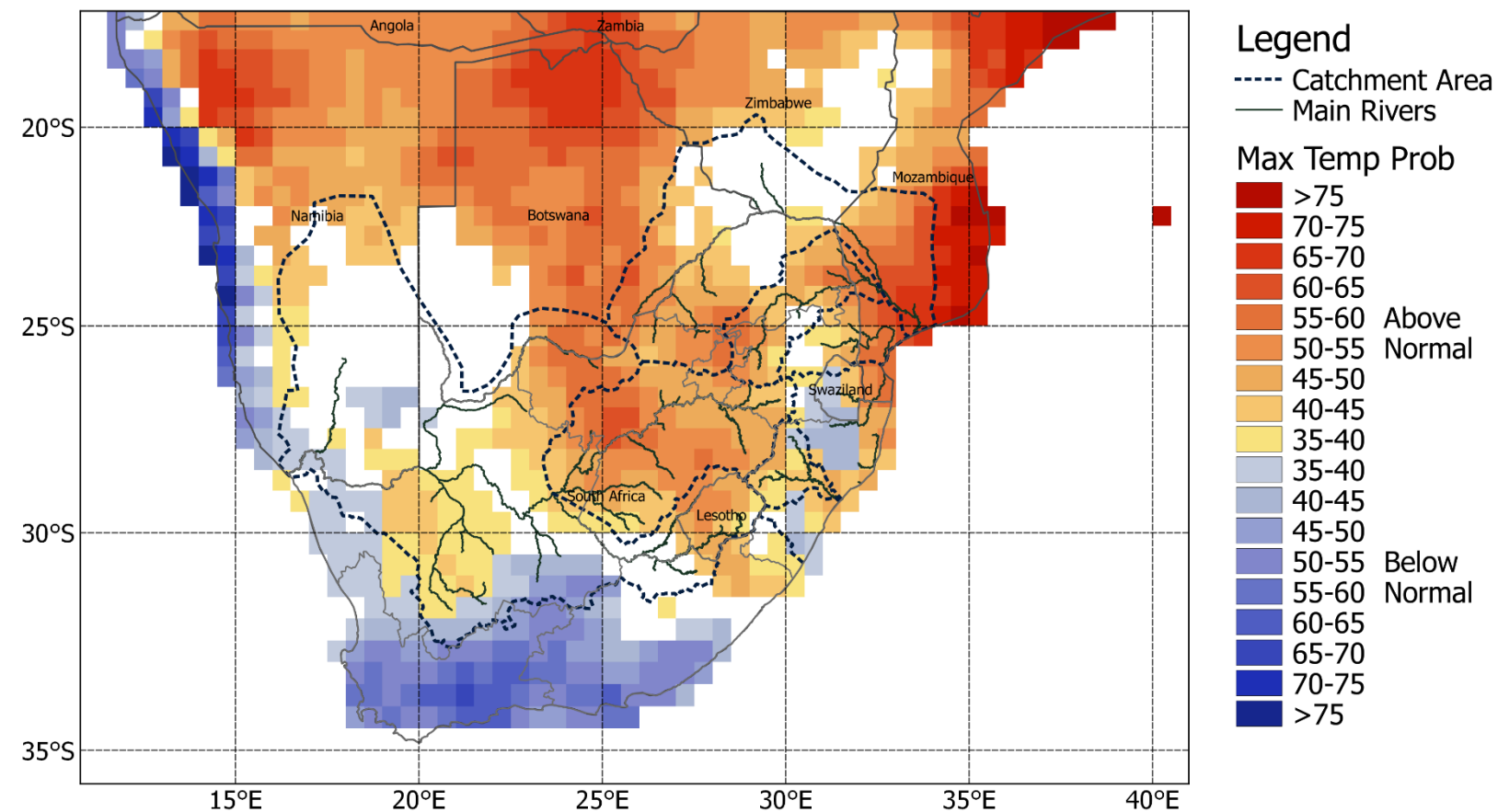


## ROC Area (Below-Normal): ASO Max Temp

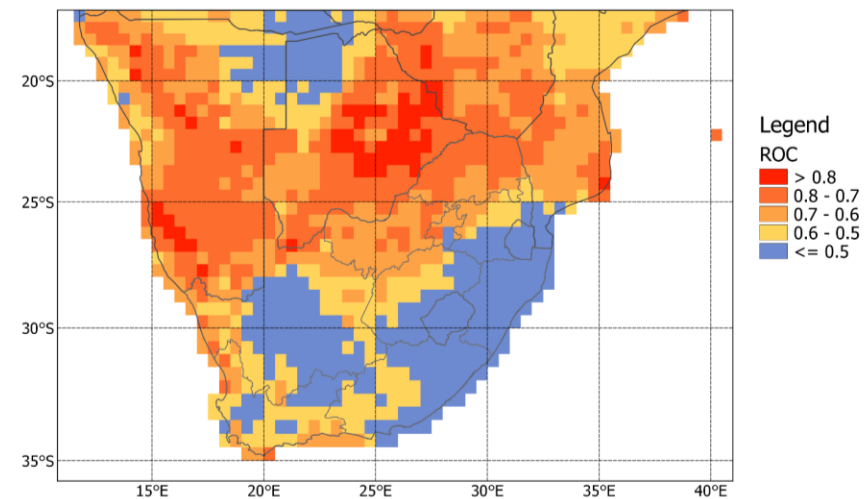




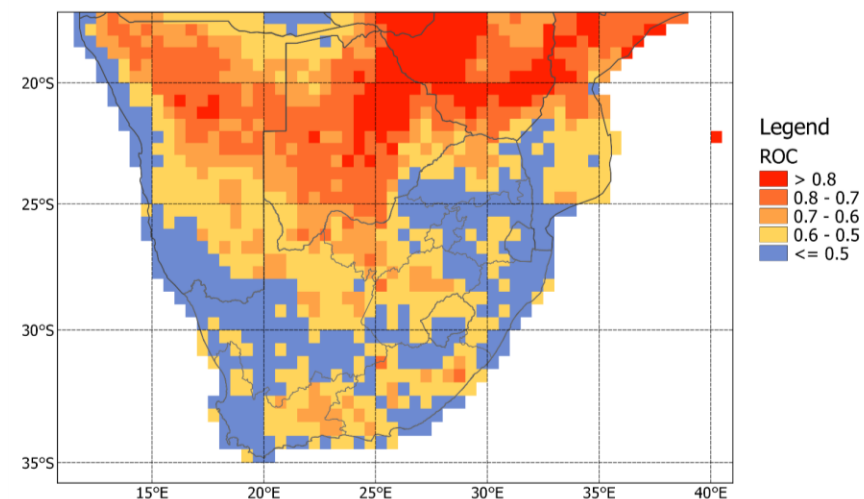
# SON 2019 Max Temp; ICs: Aug



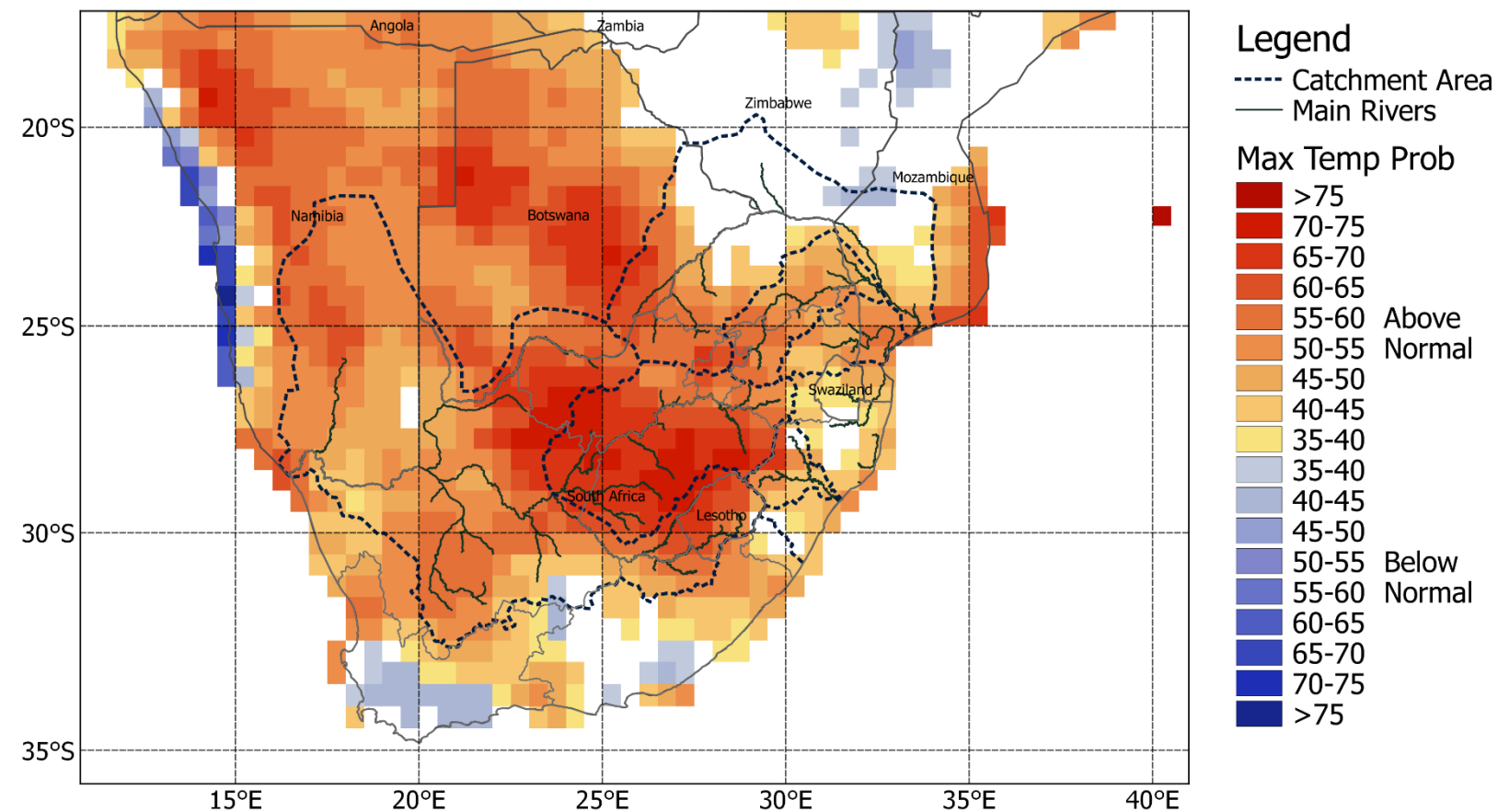
## ROC Area (Above-Normal): SON Max Temp



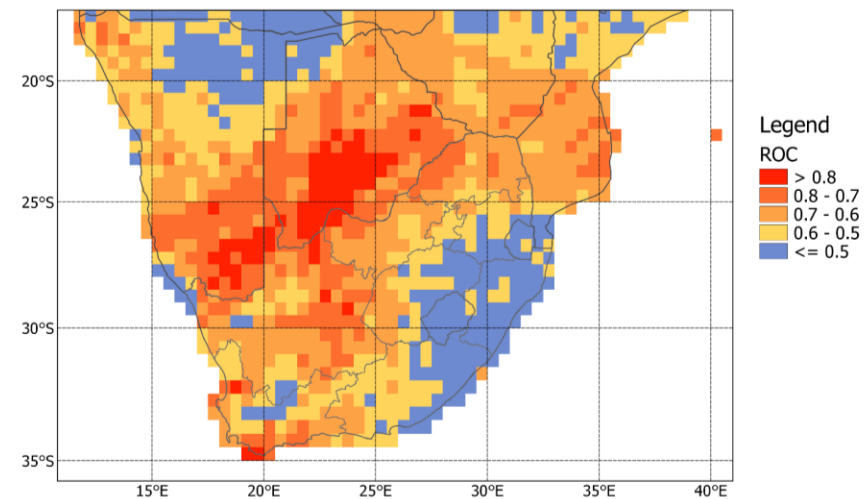
## ROC Area (Below-Normal): SON Max Temp



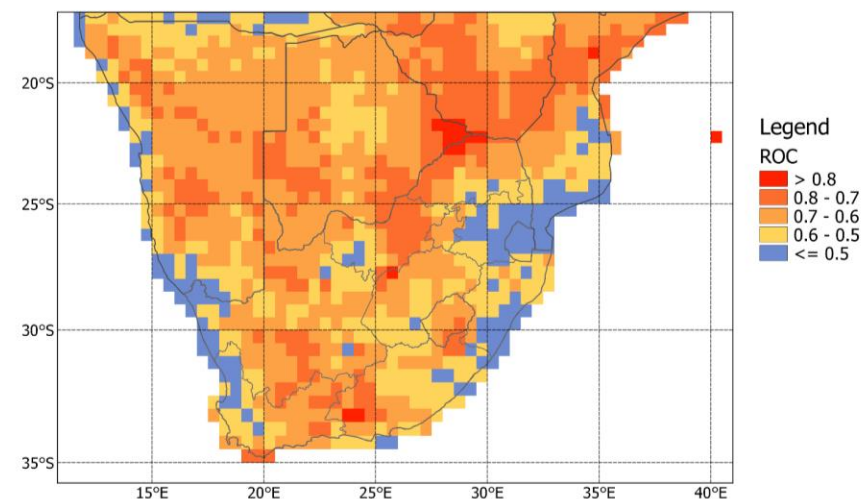
# OND 2019 Max Temp; ICs: Aug



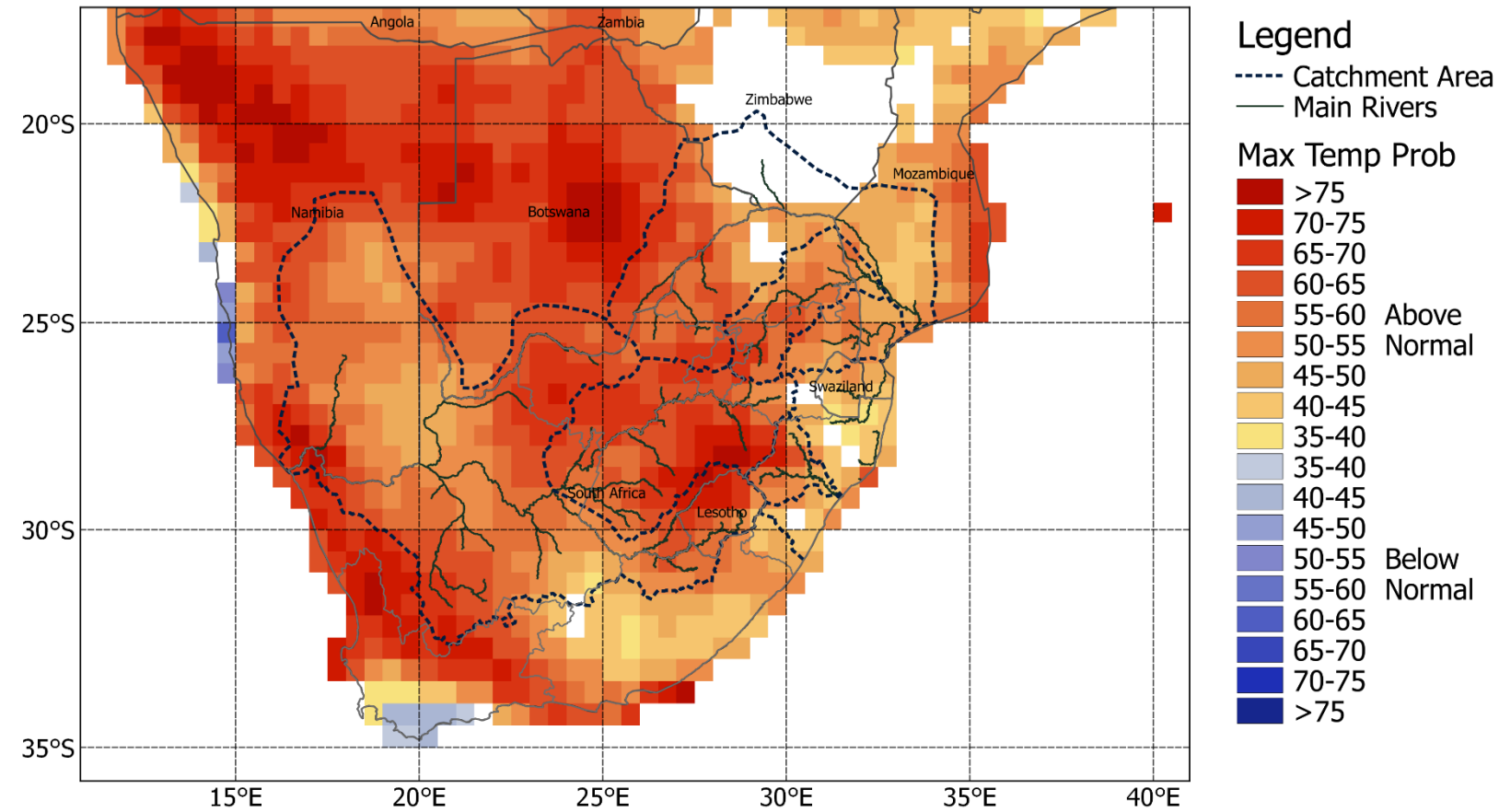
## ROC Area (Above-Normal): OND Max Temp



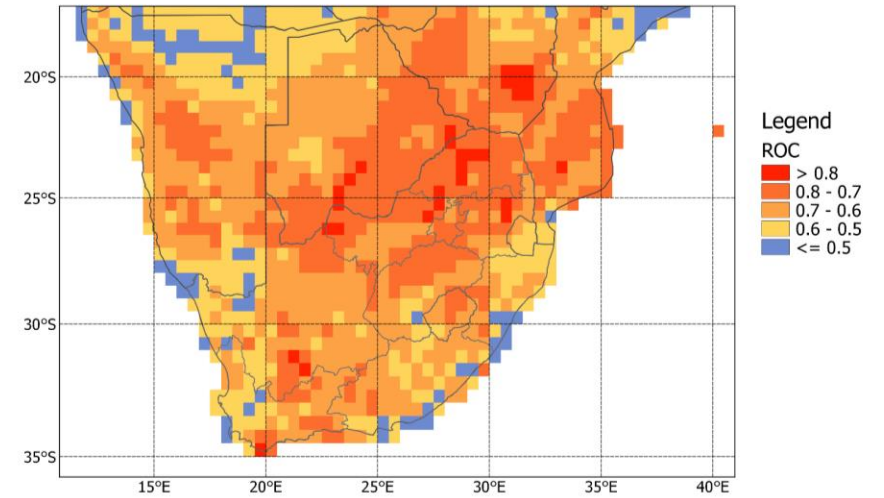
## ROC Area (Below-Normal): OND Max Temp



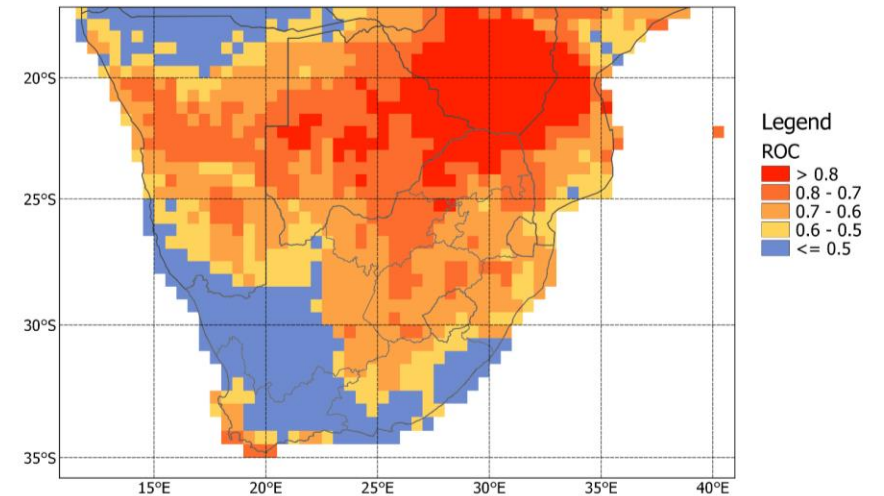
# NDJ 2019/20 Max Temp; ICs: Aug



## ROC Area (Above-Normal): NDJ Max Temp



## ROC Area (Below-Normal): NDJ Max Temp



# Round-up: SADC Max Temp

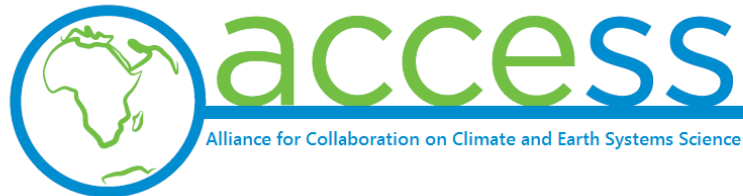
- Cool maximum temperatures are likely along the south-western and southern parts during spring
- High maximum temperatures may be expected during mid-summer



- Barnston, A.G. and Tippett, M.K., 2017: Do statistical pattern corrections improve seasonal climate predictions in the North American Multimodel Ensemble models? *Journal of Climate*, 30: 8335-8355. doi: 10.1175/JCLI-D-17-0054.1
- Harris, I., Jones, P. D., Osborn, T. J., and Lister, D. H., 2014: Updated high-resolution grids of monthly climatic observations - the CRU TS3.10 Dataset. *International Journal of Climatology*, 34: 623-642. doi: 10.1002/joc.3711
- Kirtman, B. P. and Co-authors 2014: The North American Multimodel Ensemble: Phase-1 seasonal-to-interannual prediction; Phase-2 toward developing intraseasonal prediction. *Bulletin of the American Meteorological Society*. 95, 585–601. doi: <http://dx.doi.org/10.1175/BAMS-D-12-00050.1>
- Landman, W.A., and Beraki, A., 2012: Multi-model forecast skill for midsummer rainfall over southern Africa. *International Journal of Climatology*, 32: 303-314. doi: 10.1002/joc.2273.
- Landman, W.A., Archer, E. and Tadross, M., 2016: Decision-relevant information on seasonal time scales – the case of a farm in northern Namibia. *Conference Proceedings of the 32nd Annual Conference of the South African Society for Atmospheric Science*, Cape Town, 31 October to 1 November 2016, pp 69-72. ISBN 978-0-620-72974-1.
- Landman, W.A., DeWitt, D., and Lee, D.-E., 2011: The high-resolution global SST forecast set of the CSIR. *Conference Proceedings of the 27th Annual Conference of South African Society for Atmospheric Sciences*, 22-23 September 2011, Hartbeespoort, North-West Province, South Africa. ISBN 978-0-620-50849-0
- Landman, W.A., DeWitt, D. Lee, D.-E., Beraki, A. and Lötter, D., 2012: Seasonal rainfall prediction skill over South Africa: 1- vs. 2-tiered forecasting systems. *Weather and Forecasting*, 27: 489-501. DOI: 10.1175/WAF-D-11-00078.1
- Muchuru, S., Landman, W.A. and DeWitt, D., 2016: Prediction of inflows into Lake Kariba using a combination of physical and empirical models. *International Journal of Climatology*, 36: 2570–2581, DOI: 10.1002/joc.4513.
- Troccoli, A., Harrison, M., Anderson, D.L.T. and Mason, S.J., 2008: *Seasonal Climate: Forecasting and Managing Risk*. NATO Science Series on Earth and Environmental Sciences, Vol. 82, Springer, 467 pp.

# 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