

Weather and Climate in South Africa – Analysis and projections

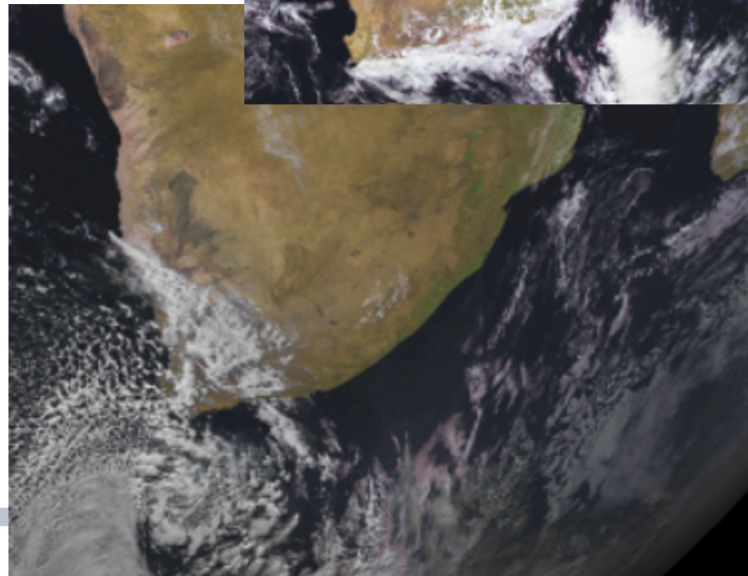
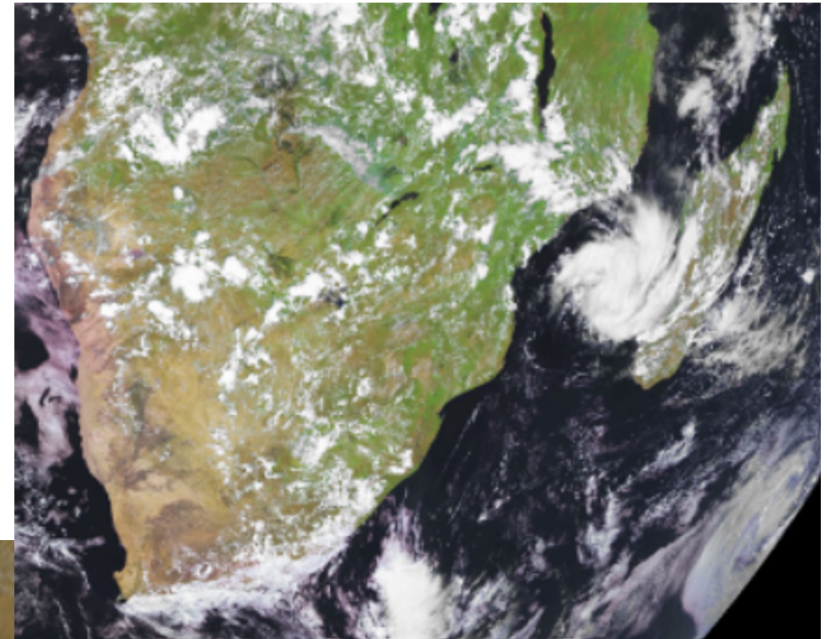
Presidential Climate Commission

17 November 2023

SAEON and SAWS teams

Weather Systems Influencing South Africa

- Influenced by tropical, subtropical and mid-latitude systems
- Tropical cyclones – landfall along the east coast
- Subtropical high pressure systems – transport moisture into SA
- Mid-latitude systems – northward migration in winter
- Warmer Indian ocean and cooler Atlantic ocean
- Topography



Early Warnings

23 March 2022 | Climate and Environment

The UN set an ambitious five year deadline on Wednesday for countries to ensure that citizens worldwide are protected by warning systems against extreme weather and climate change, the UN chief announced, marking [World Meteorological Day](#)



2022 report

- 110 million directly affected
- 5000 fatalities
- Over US\$8.5 billion in damages
- Droughts – lead in deaths & people affected
- Floods lead in economic damages



Investing in early warnings and early actions is a priority for saving lives, promoting economic development, valuing development gains and livelihoods, protecting the environment, and reducing the cost of disaster responses.

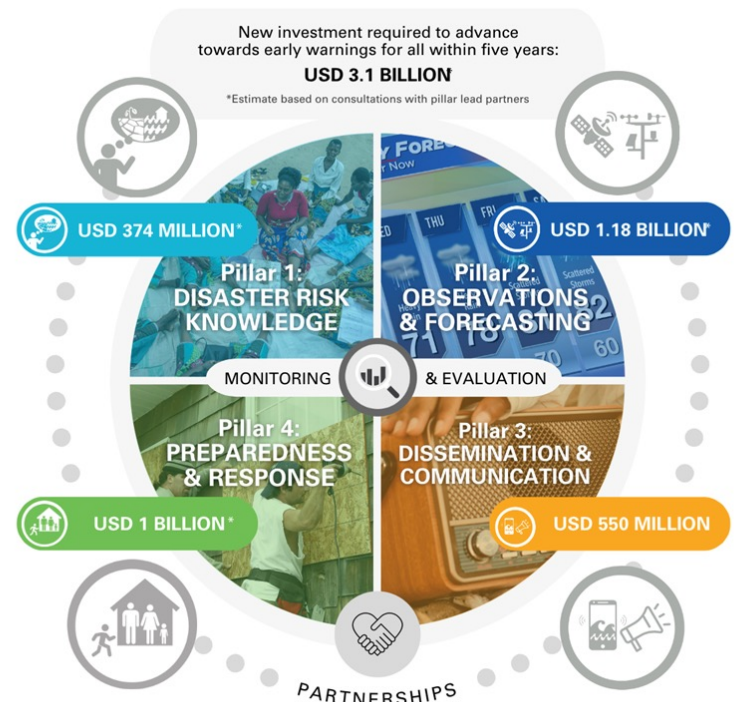
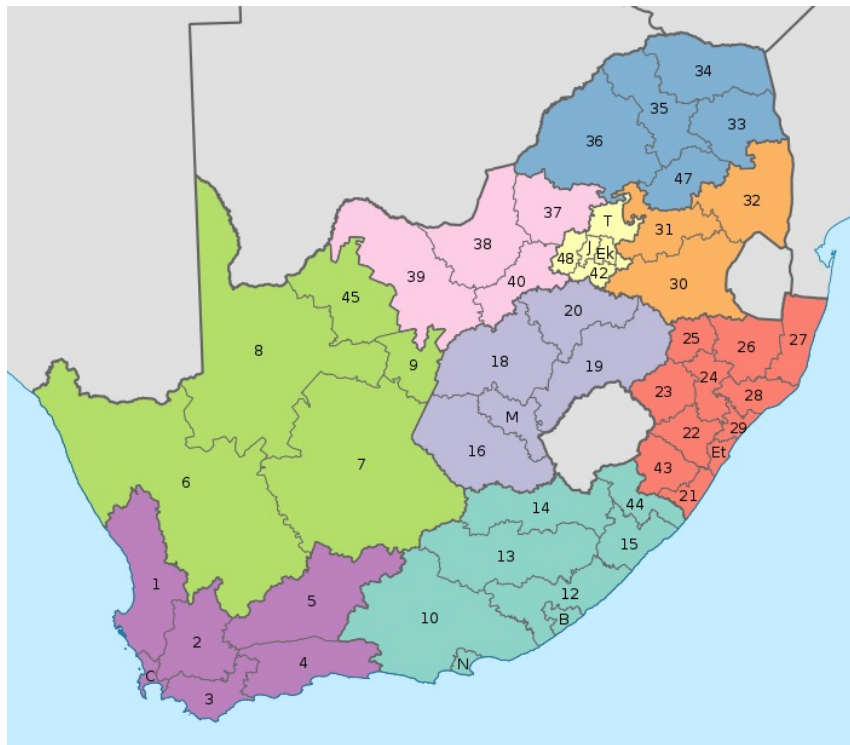


Figure 1: Budget overview for the four Pillars of the Early Warnings for All Initiative

<https://public.wmo.int/en/media/press-release/early-warnings-all-action-plan-unveiled-cop27>

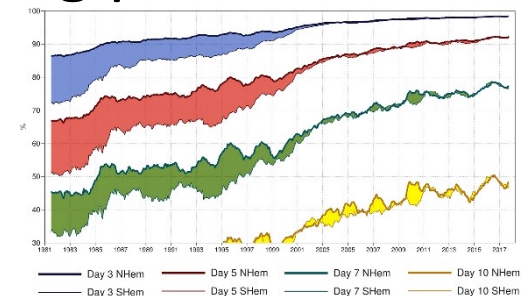
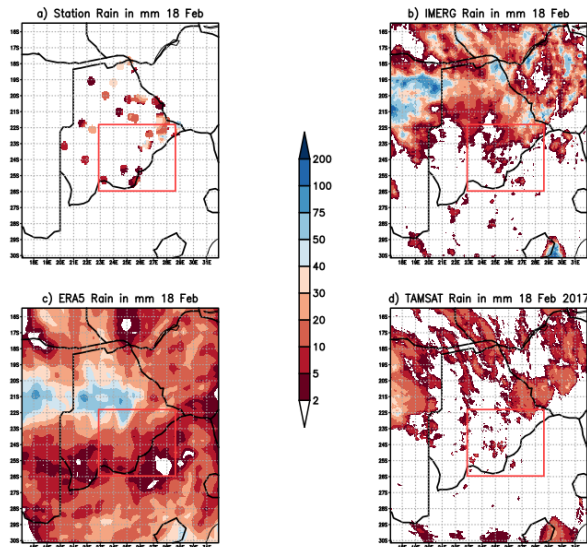
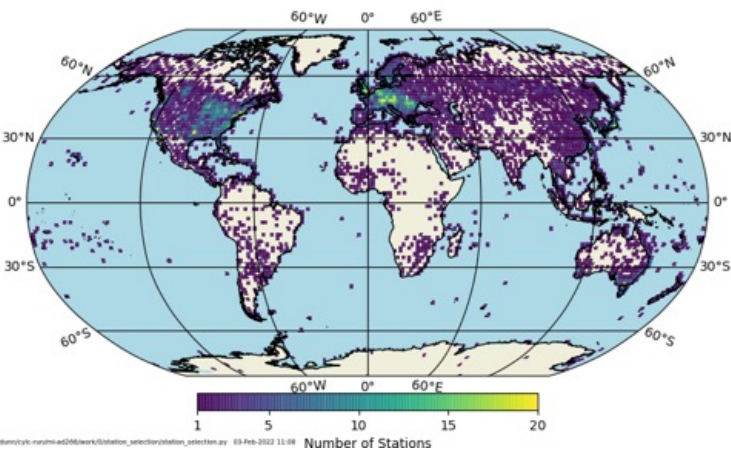
South Africa – region of interest



Observations

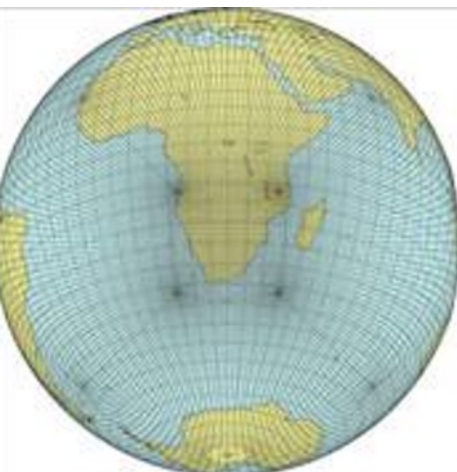
- Improvements in forecast skill in southern hemisphere with introduction of satellite information
- Disparities still exist in remote sensing products
 - IMERG
 - TAMSAT
 - ERA5
- Ground truth only from ground observations

ions reporting at least 6hly



Weather and Climate Numerical Modelling

- Weather forecasting and climate predictions beyond 2 hours rely on the use of numerical models
- Different components of the earth system should be represented
- Expensive computationally and therefore require supercomputers



$$\frac{DV}{Dt} = -\frac{1}{\rho} \nabla p - f \mathbf{k} \times \mathbf{V} - g \mathbf{k} + \mathbf{F}$$

$$\frac{D\rho}{Dt} = -\rho \nabla \cdot \mathbf{V}$$

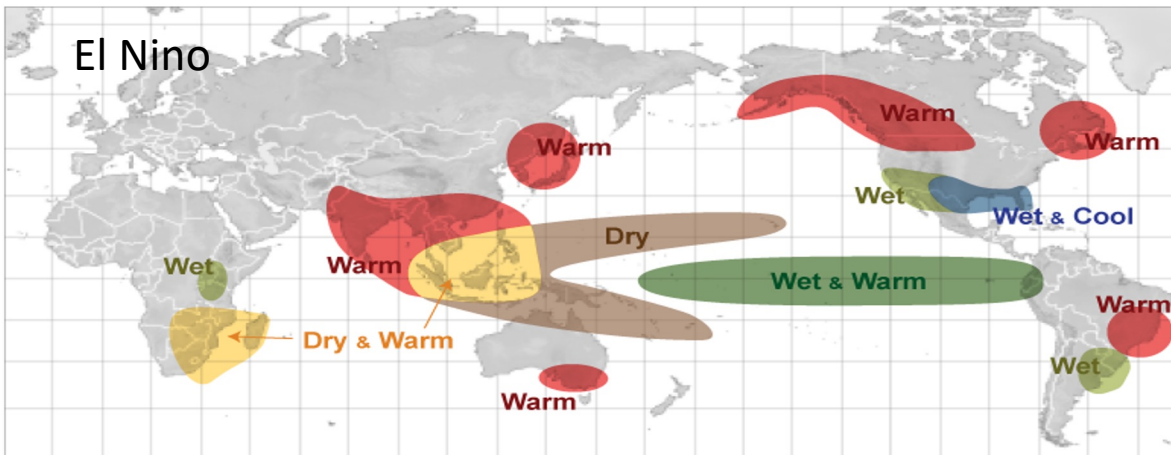
$$c_p \frac{DT}{Dt} - \alpha \frac{Dp}{Dt} = 0$$



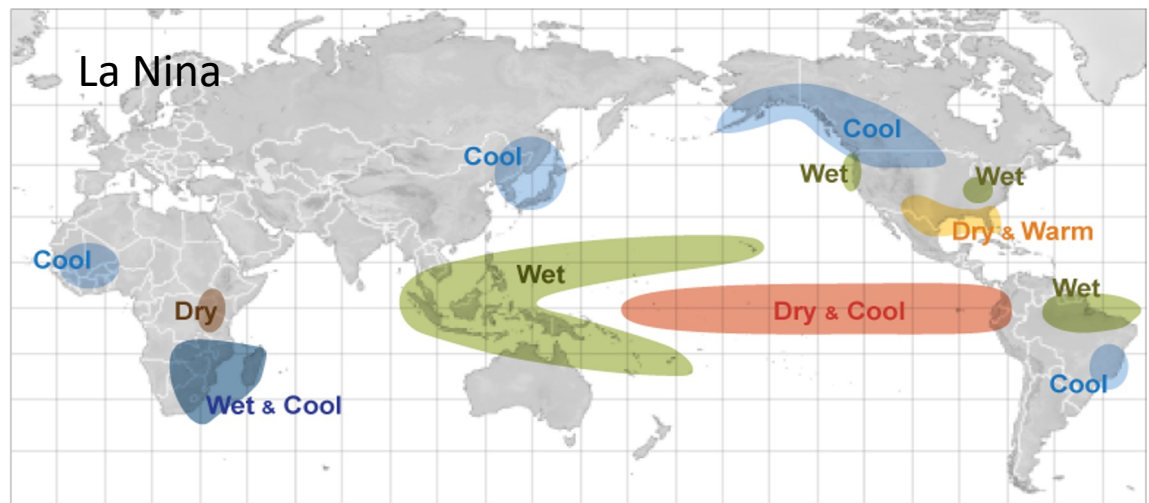
El Nino Southern Oscillation (ENSO)

- December to February (DJF) impacts

El Nino



La Nina



https://www.noaa.gov/jetstream/enso_impacts

ENSO Forecasts

SST Anomalies (°C)
01 NOV 2023

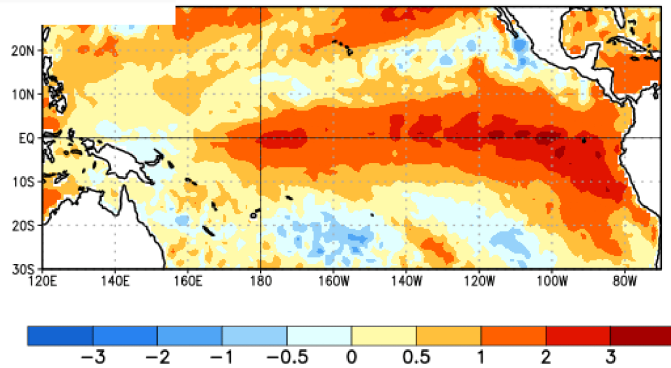
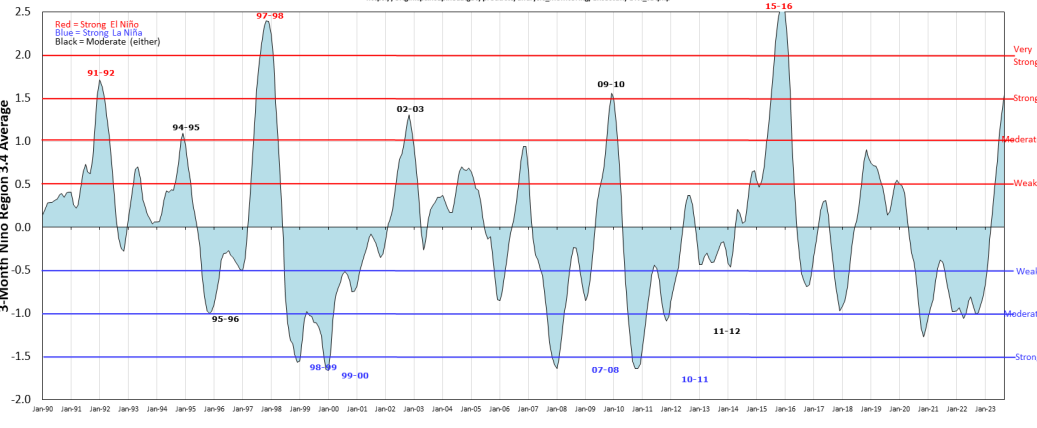


Figure 1. Average sea surface temperature (SST) anomalies (°C) for the week centered on 1 November 2023. Anomalies are computed with respect to the 1991-2020 base period weekly means.

https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-cpc_update

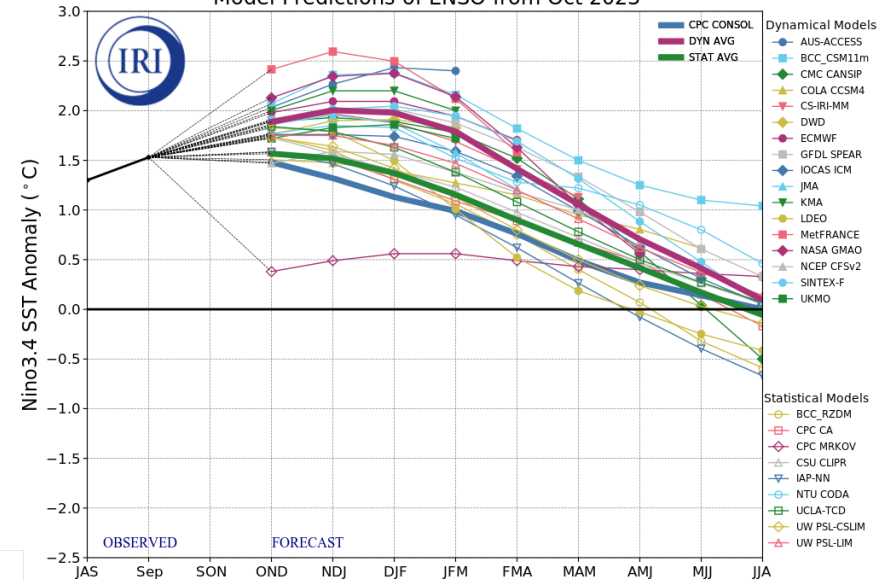
Oceanic Niño Index (ONI) - 1990-present

https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php



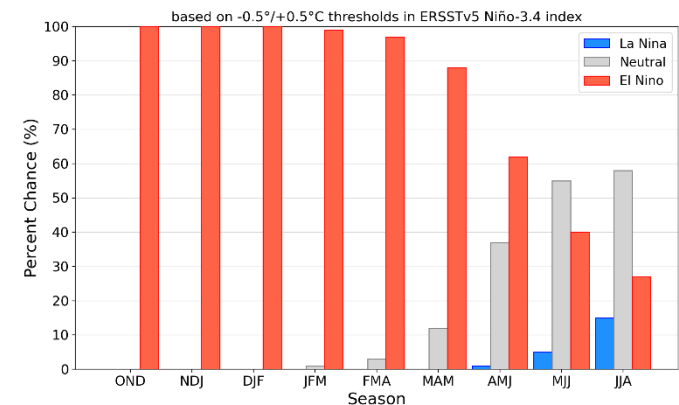
<https://ggweather.com/enso/oni.htm>

Model Predictions of ENSO from Oct 2023



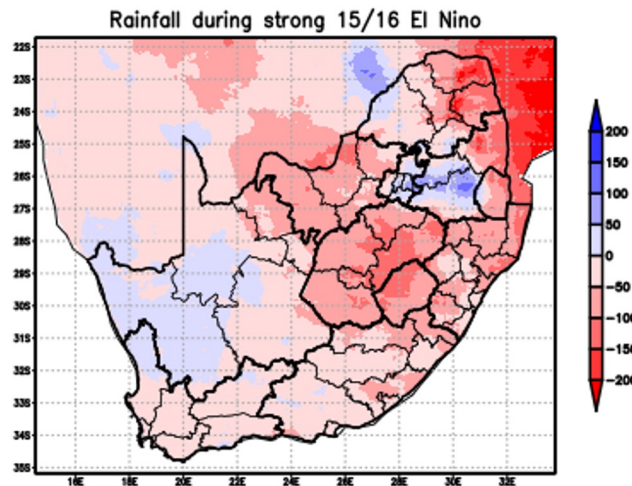
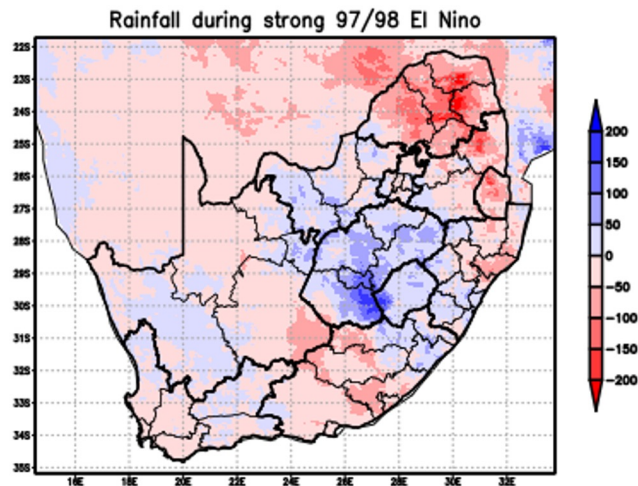
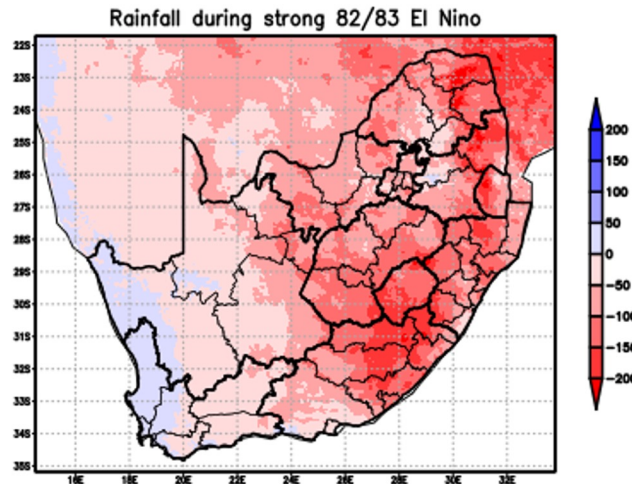
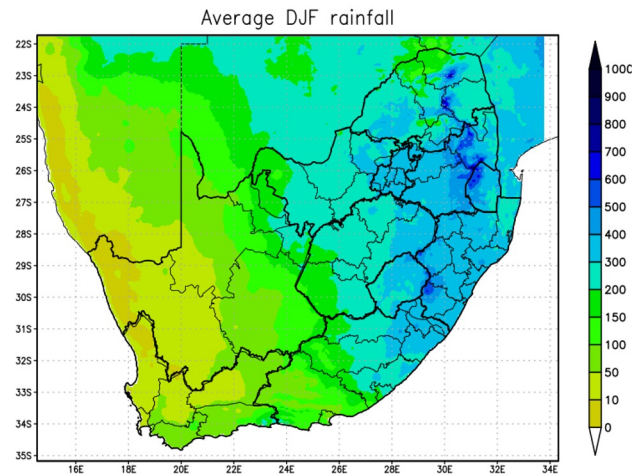
https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-cpc_plume

Official NOAA CPC ENSO Probabilities (issued Nov. 2023)





Very Strong EL Nino Years



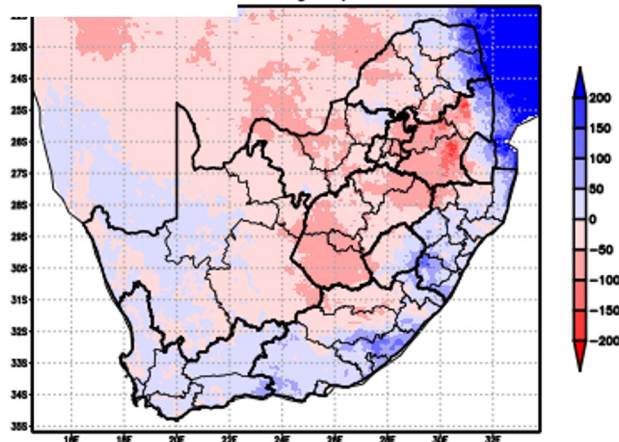
- Impacts of El Nino stronger during 82/83 and 15/16 summer seasons
- 97/98 was a normal rainfall year in SA



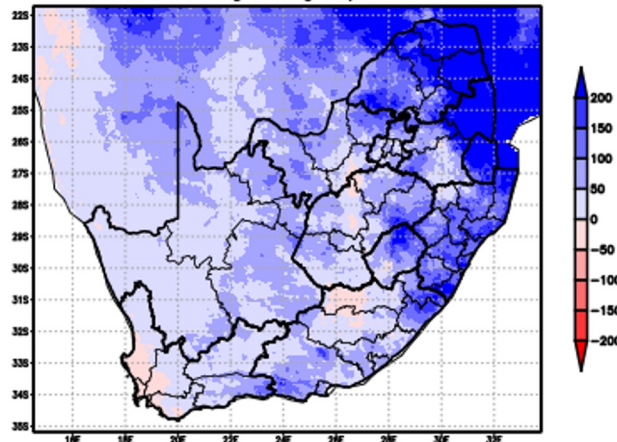
Strong La Nina Year



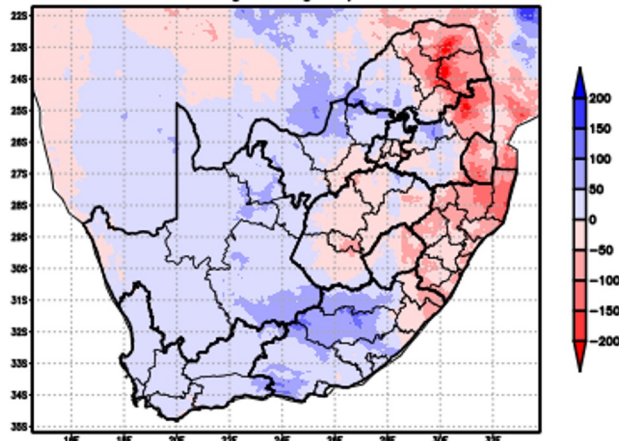
strong 98/99 La Nina



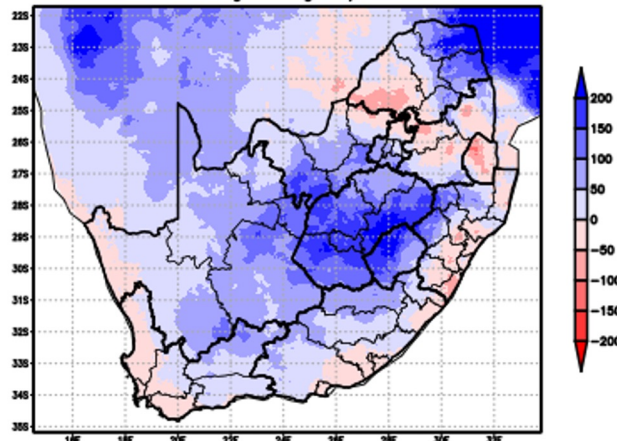
Rainfall during strong 99/00 La Nina



Rainfall during strong 07/08 La Nina



Rainfall during strong 10/11 La Nina

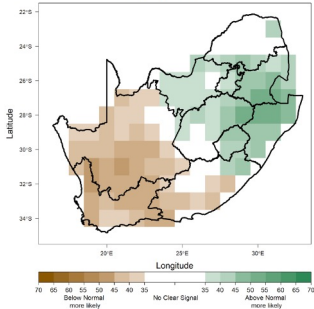


- Each year is different but La Ninas are generally associated with above normal rainfall

SAWS Seasonal Prediction System

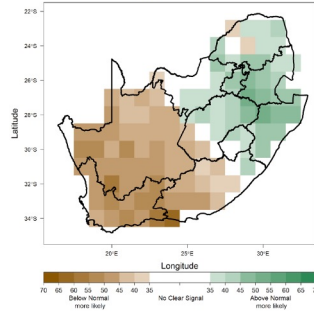
November-December-January

Expected Precipitation Conditions for NDJ 2023/24
Issued: Oct 2023



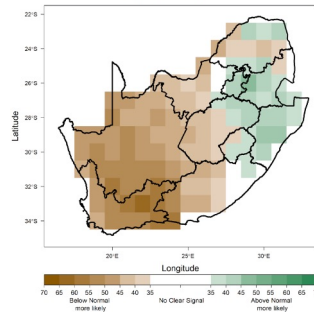
December-January-February

Expected Precipitation Conditions for DJF 2023/24
Issued: Oct 2023

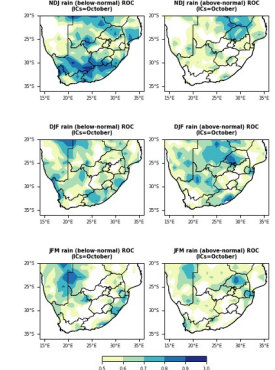


January-February-March

Expected Precipitation Conditions for JFM 2024
Issued: Oct 2023



Below-normal ROC Above-normal ROC

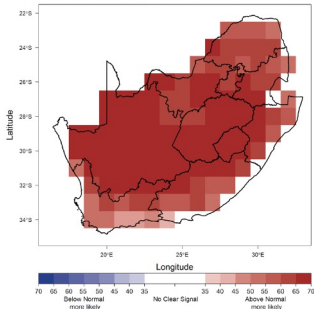


NDJ
DJF
JFM

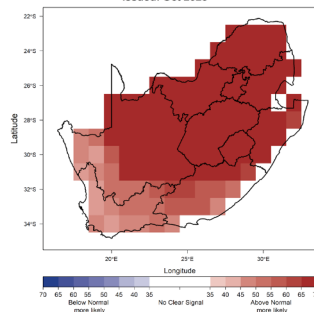
Rainfall Skill

Above-normal rainfall over the eastern parts of the country (but mostly with low-probabilities) is predicted, with below-normal rainfall predicted over the western parts of the country.

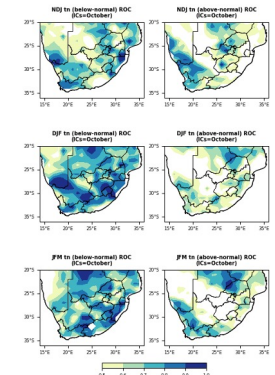
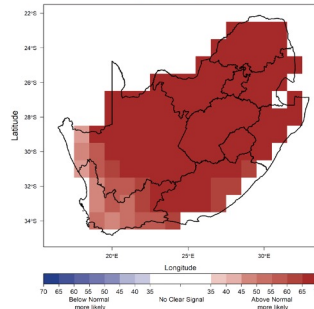
Expected Max Temp Conditions for NDJ 2023/24
Issued: Oct 2023



Expected Min Temp Conditions for DJF 2023/24
Issued: Oct 2023



Expected Min Temp Conditions for JFM 2024
Issued: Oct 2023

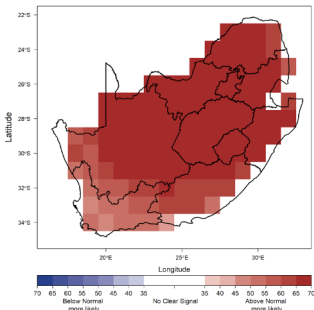


NDJ
DJF
JFM

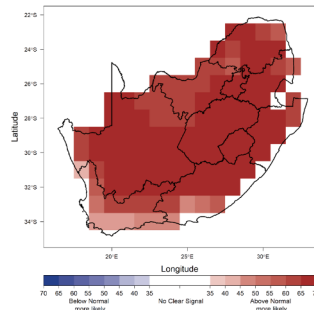
Max Temp Skill

Above-normal maximum and minimum temperatures are predicted.

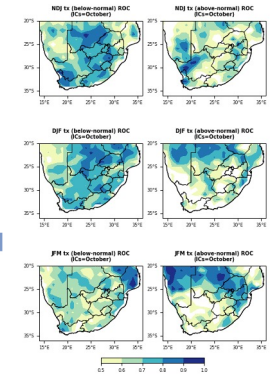
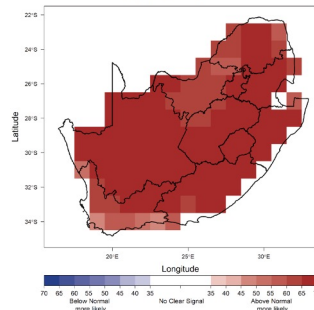
Expected Min Temp Conditions for NDJ 2023/24
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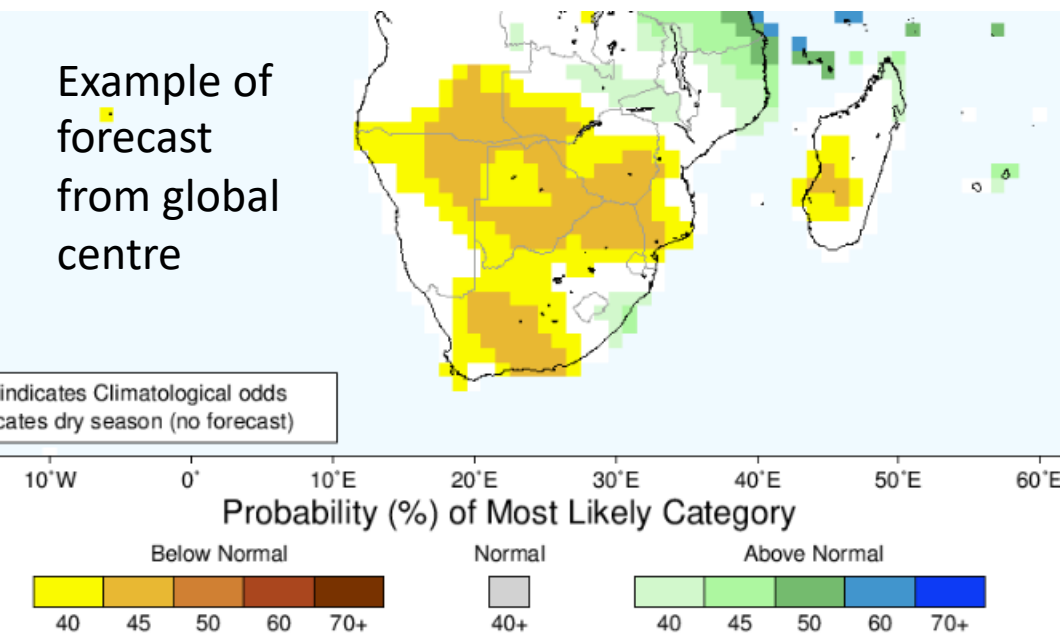
Expected Max Temp Conditions for JFM 2024
Issued: Oct 2023



NDJ
DJF
JFM

Min Temp Skill

Concluding Remarks



- Basic elements of forecasting systems – observation network and super computers
- Other planned works
 - Literature review to capture latest published work on SA climate
 - Update Climate change projections
 - Publish results on the South African Risk and Vulnerability Atlas (SARVA)

- Forecasts updated regularly as data comes in
- State of ENSO and other modulators monitored regularly
- Updates will be provided to the PCC on a quarterly basis

Thank you