

Climate Predictions and Long-Term Climate Projections

05 December 2024

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South African Weather Service (SAWS) overview

- ❑ The South African Weather Service (SAWS) is an entity of the Department of Forestry, Fisheries and the Environment (DFFE)
- ❑ SAWS is the authoritative voice for weather and climate in South Africa

South African Weather Service Act (No. 8 of 2001)

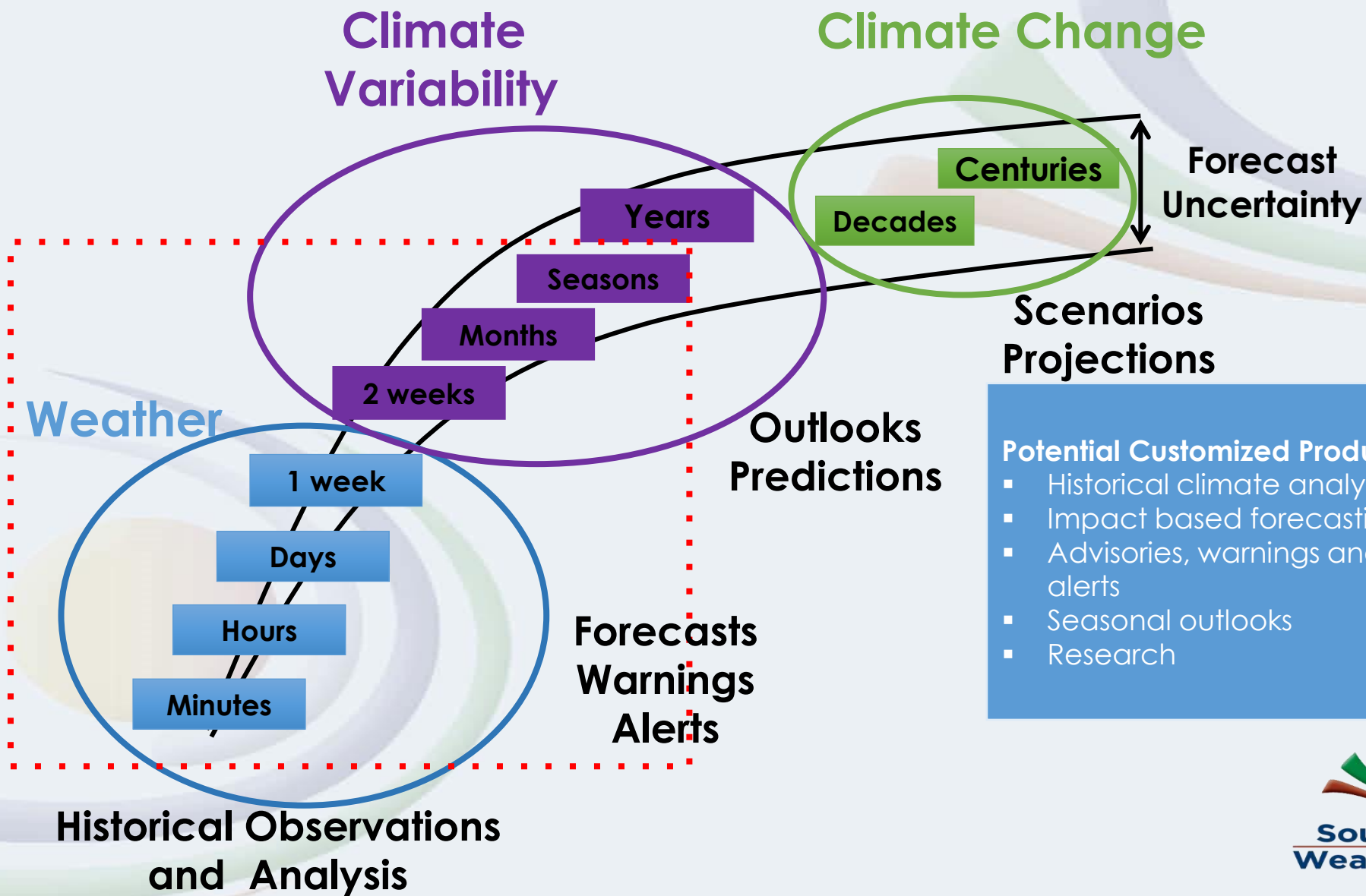
- ❑ Mandate:
 - Provide weather and climate services to all South African citizens
 - E.g., public good (weather, climate and air quality monitoring services)
 - Sector-specific (and tailor-made) solutions and services

South African Weather Service Amendment Act, 2013 (Act No. 48 of 2013)

- ❑ Mandate:
 - Maintain, extend and improve the quality of meteorological services for the benefit of all South Africans; include, among others, provisions relating to the **South African Air Quality Information System (SAAQIS)** and the **National Ambient Air Quality Monitoring Network (NAAQMN)**



Seamless Weather & Climate Services



Impact Based Weather Information

Moving from:

What the weather will **be**:
(Meteorological thresholds)

- 50mm in 24 hours
- 35 knot winds



To:

What the weather will **do**:
(Impact Warnings)

- Roads flooded
- Communities cut off



What is Impact-Based forecasting?

- Forecasting of weather hazards and the **IMPACTS** they will have on society
- Warning levels are based on the **vulnerability** of certain areas
- Communicating these warnings in plain, simple language to stakeholders and the public
- Information is available to the public through TV, radio, SAWS website, SAWS social media pages on Facebook and Twitter as well as the SAWS app.

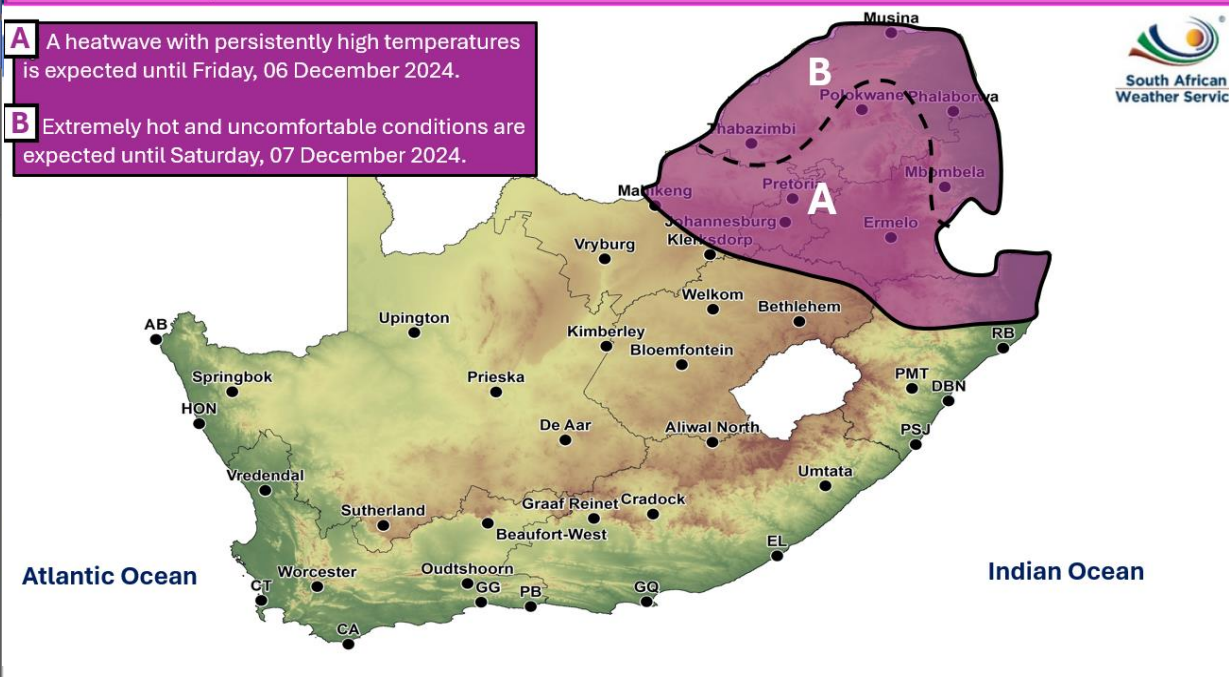
Weather Advisory: Heatwave

Issued: 05 December 2024 @ 09:00 SAST



A A heatwave with persistently high temperatures is expected until Friday, 06 December 2024.

B Extremely hot and uncomfortable conditions are expected until Saturday, 07 December 2024.

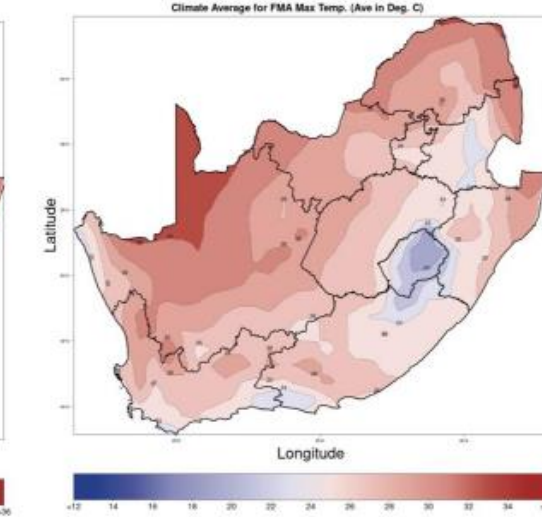
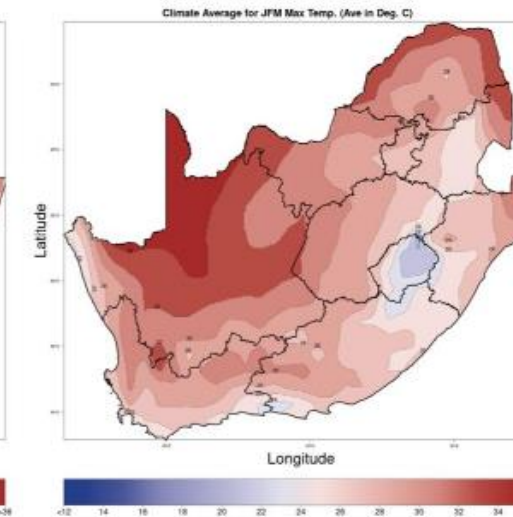
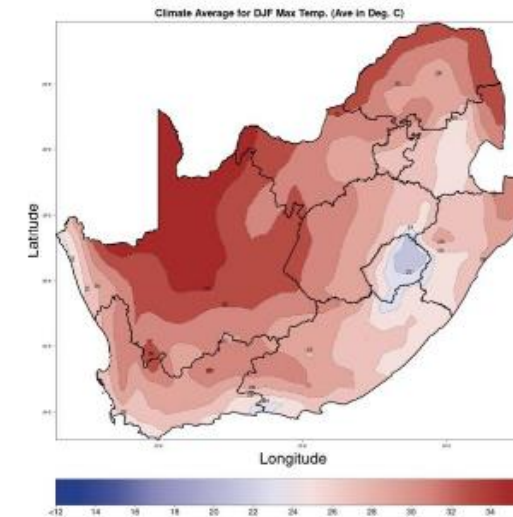
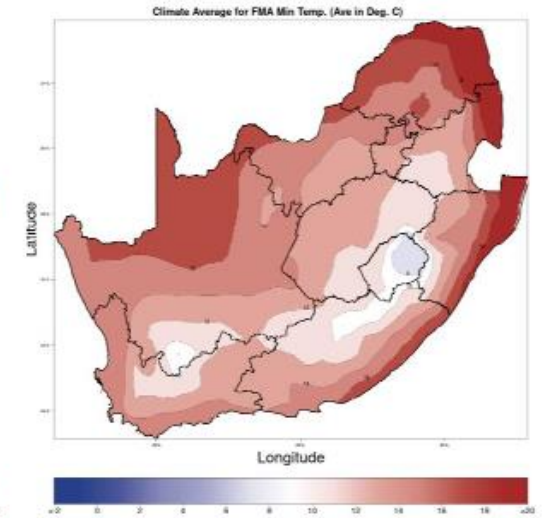
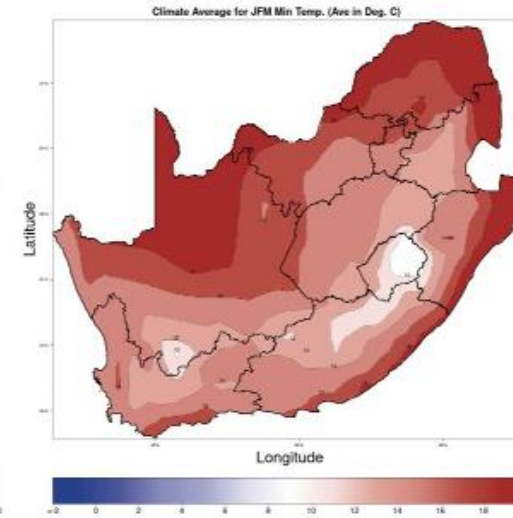
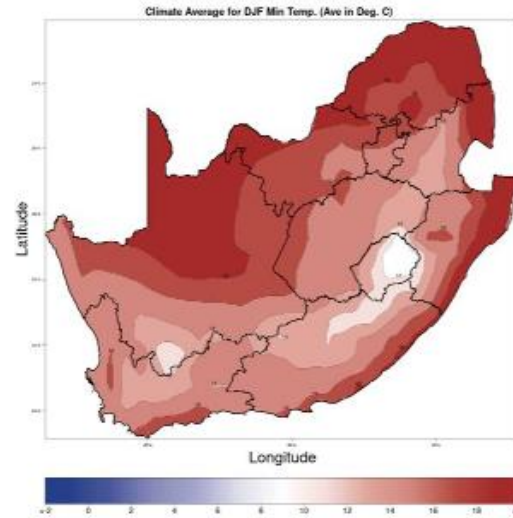


Seasonal Climate Watch

December 2024 to April 2025

Date issued: 04 December 2024

- SAWS is recognised by the World Meteorological Organisation (WMO) as a Global Producing Centre (GPC) for Long-Range Forecasts
- This is owing to its local numerical modelling efforts, which involved coupling of both the atmosphere and ocean components to form a fully interactive coupled modelling system – named: SAWS Coupled Model (SCM)
- SCM is the first of its kind in both South Africa and the region.
- The El Niño-Southern Oscillation (ENSO) is currently in Neutral state and is predicted to weaken – current prediction indicate the development of a weak La Nina
- Current predictions indicate above normal rainfall for parts of the north-eastern central and coastal areas (summer rainfall areas)
- Minimum and Maximum temperatures are expected to be mostly above normal countrywide for the forecast period



**HOW WILL THE
CLIMATE CHANGE
BY 2050 IN
SOUTH AFRICA?**

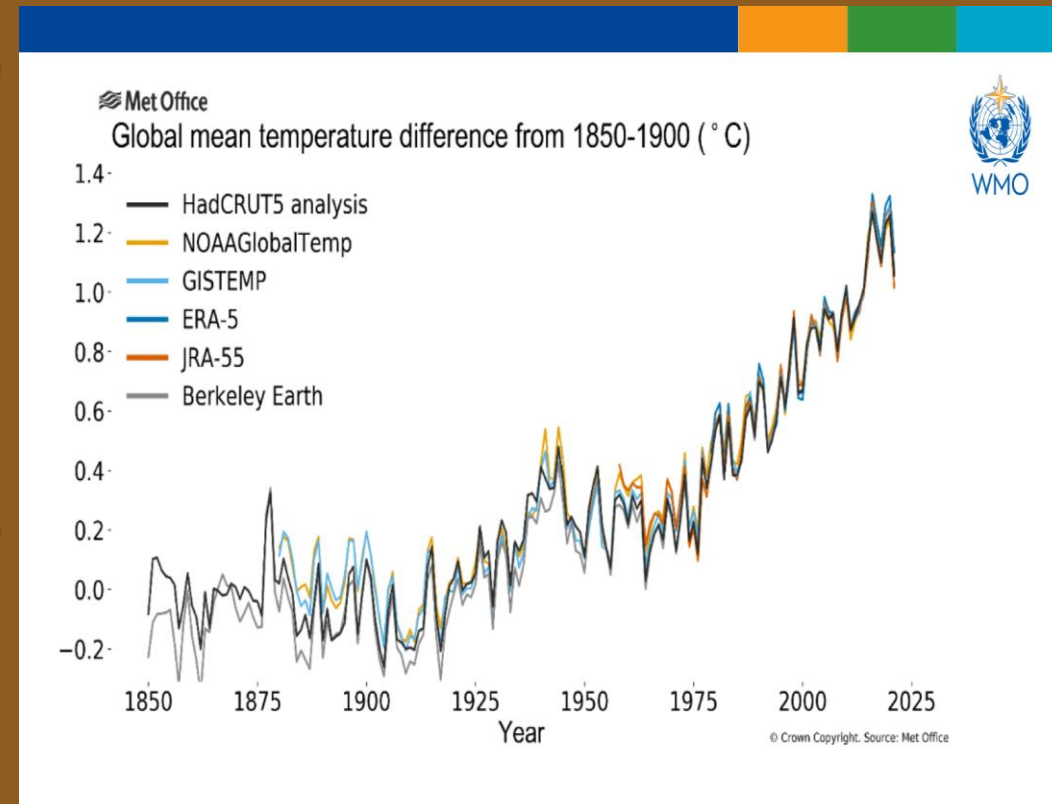


South African

Weather Service

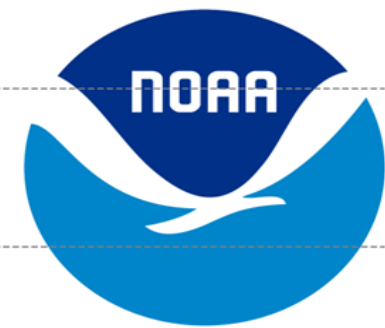
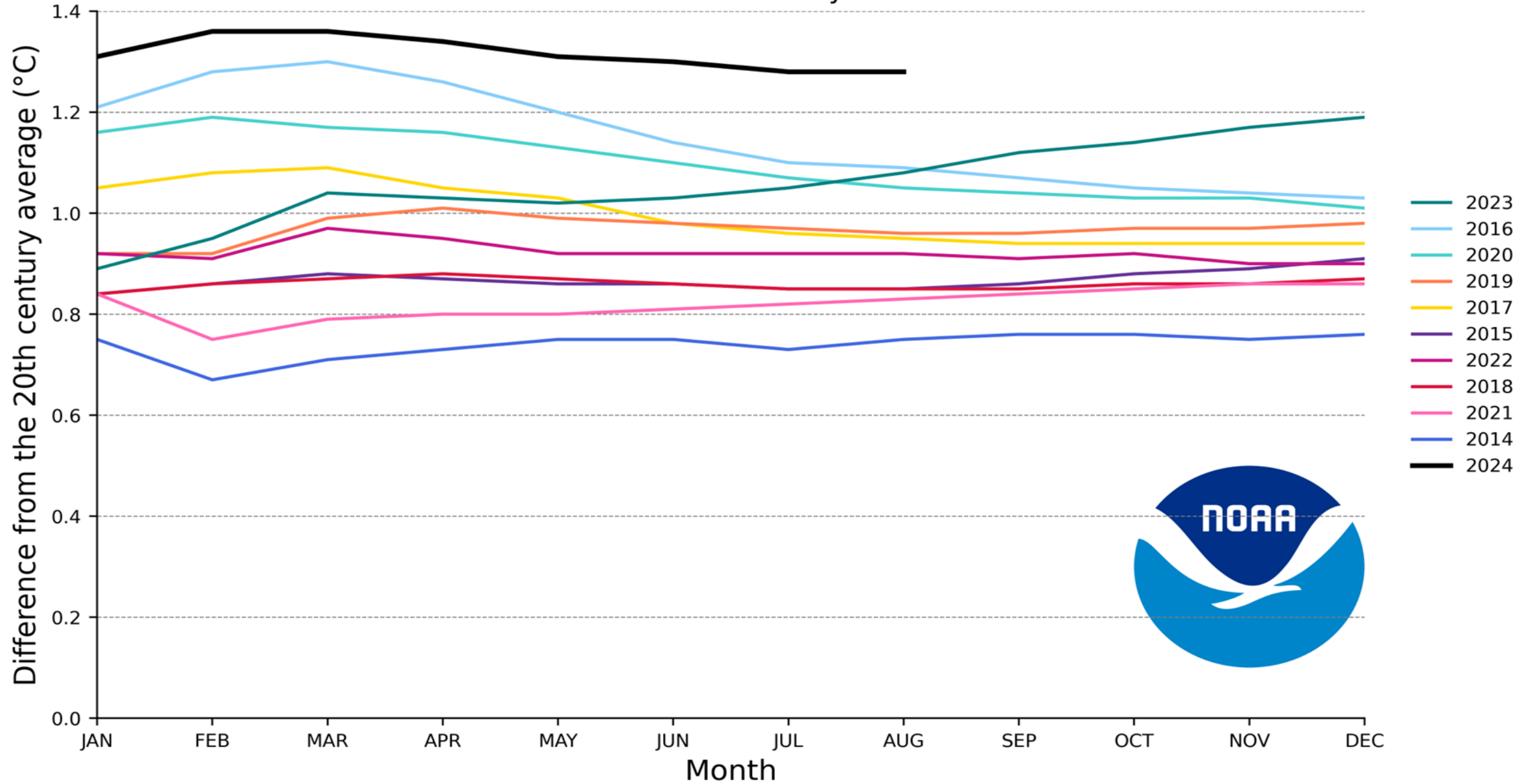
Background

- **Global Temperature Increase:** 1°C rise from 2001–2020 compared to pre-industrial levels; accelerated warming since (IPCC AR6, 2021).
- **2050 Climate Milestone:** The year 2050 is a key milestone in climate predictions, as scientists expect to see significant changes in our climate, based on how much we reduce greenhouse gas emissions by then (IPCC AR6, 2021).
- **Extreme Weather Intensification:** Linked to more frequent heatwaves, veld fires, and droughts (Mbokodo *et al.*, 2020).
- **Impact of Heatwaves:** Several news outlets reported that January 2023 heatwave in Northern Cape reached 41°C, causing heatstroke-related deaths.
- **Variable Rainfall Patterns:** Increased variability and intensity of rainfall, leading to severe storms and flooding (Tarmizi, 2019).
- **Security Threats:** Significant risks to food and water security, human health, the economy, and social stability (Kwame *et al.*, 2022) .



Global Year-to-Date Temperature Anomalies

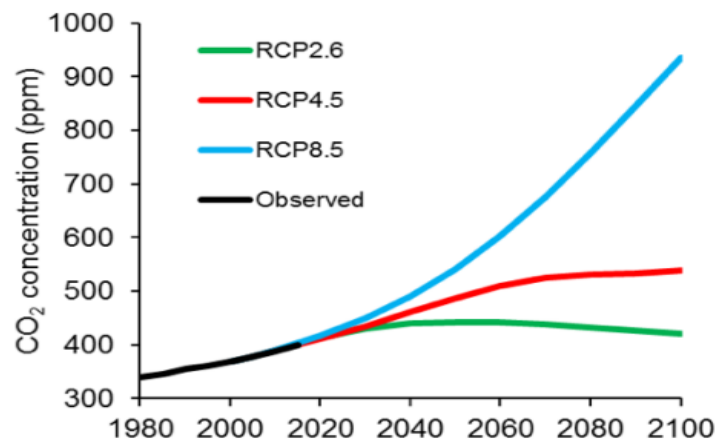
for 2024 and the 10-warmest years on record



Modelling Approach

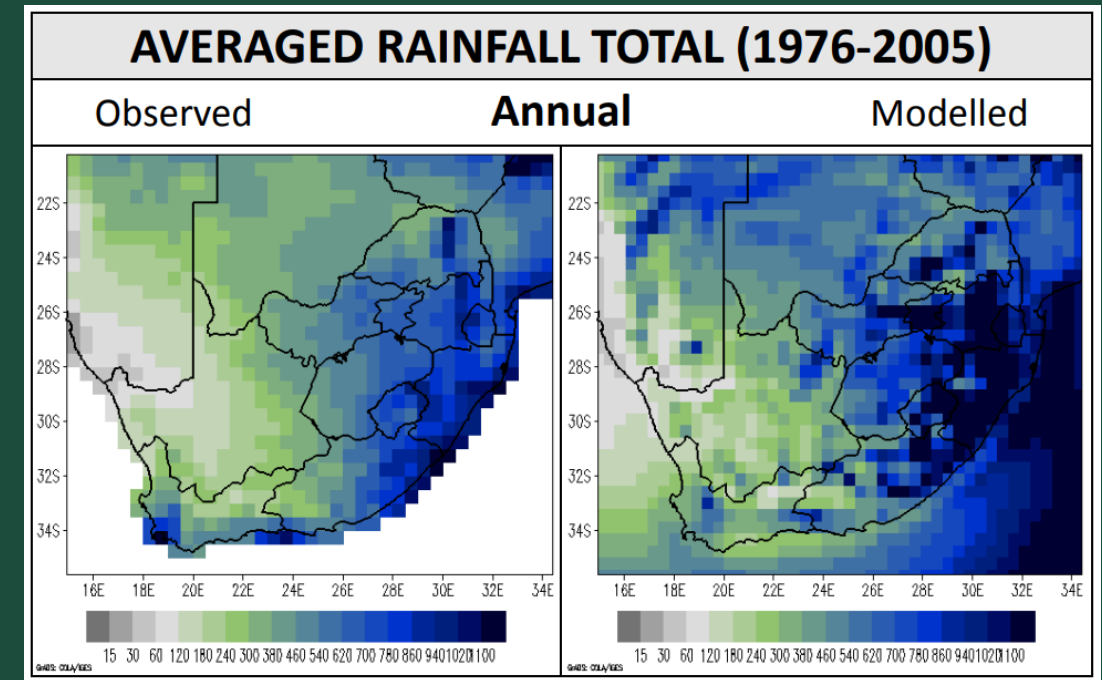
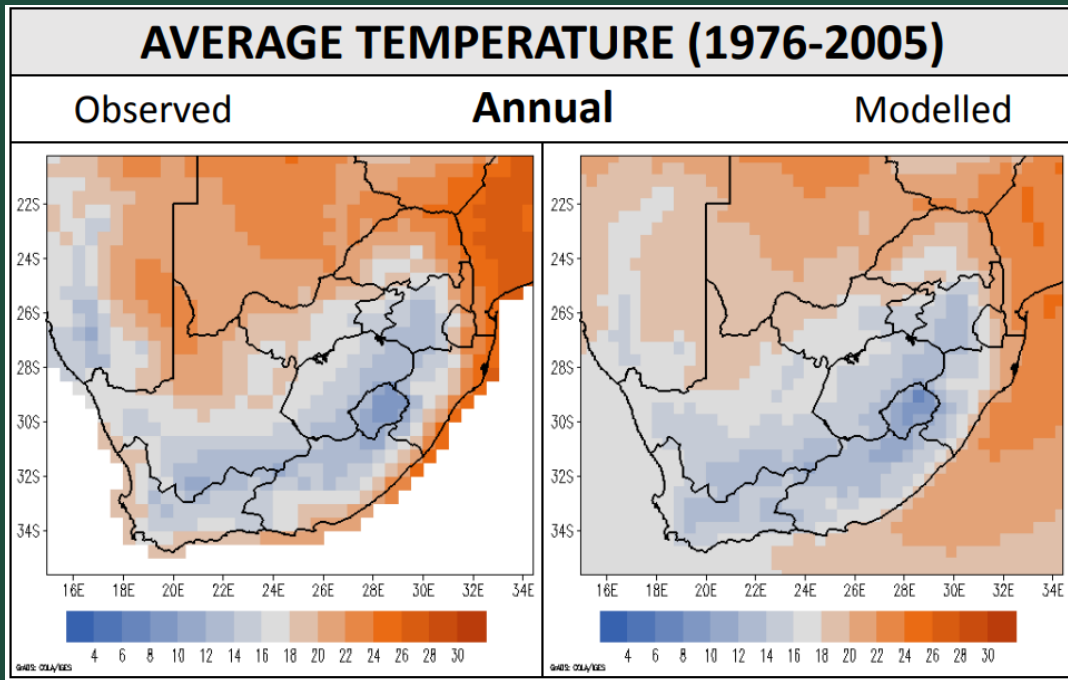
Model name	Country	Resolution	Literature
CanESM2m	Canada	2.8° x 2.8°	Arora et al., (2011)
CNRM-CM5	France	1.4° x 1.4°	Voldoire et al., (2013)
CSIRO-Mk3	Australia	1.9° x 1.9°	Rotstayn et al., (2013)
IPSL-CM5A-MR	France	1.9° x 3.8°	Hourdin et al., (2013)
MICRO5	Japan	1.4° x 1.4°	Watanabe et al., (2011)
HadGEM2-ES	UK	1.8° x 1.2°	Collins et al., (2011)
MPI-ESM-LR	Germany	1.9° x 1.9°	Ilyina et al., (2013)
NorESM1-M	Norway	1.9° x 2.5°	Tjiputra et al., (2013)
GFDL-ESM2M	USA	2.0° x 2.5°	Dunne et al., (2012)

- **Model Basis:** The temperature and rainfall predictions are based on climate models from the CMIP5 project, which are also used in SAWS Climate Change Atlas https://www.weathersa.co.za/Documents/Climate/SAWS_CC_REFERENCE_ATLAS_PAGES.pdf.
- **Greenhouse Gas Scenarios:** The study looks at two scenarios for greenhouse gas emissions: one where emissions are reduced (RCP 4.5) and one where emissions continue to rise without major changes (RCP 8.5).
- **Climate Model Analysis:** The research uses data from nine different climate models to look at past and future climate conditions, though these models initially provide data that is not very detailed.
- **Improved Detail:** To get more accurate and detailed predictions, the data from these models is refined using a technique called dynamical downscaling, resulting in a clearer view of changes at a smaller scale (about 50 km).



Carbon dioxide concentrations associated with the Representative Concentration Pathways.

Model Verification Against Observations



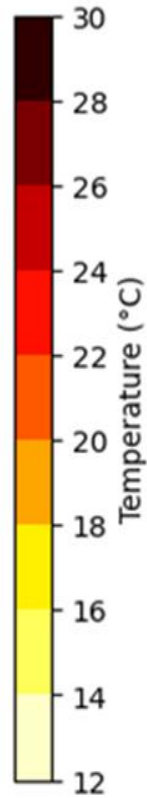
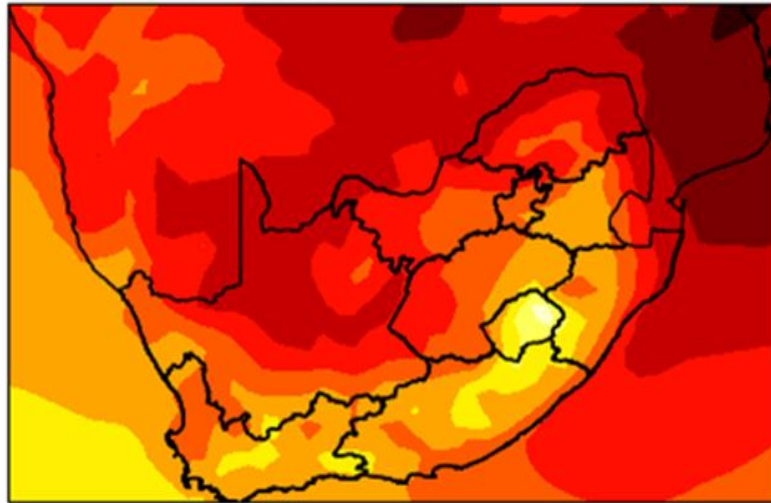
Model Verification: The climate projections for temperature and rainfall were rigorously generated by assessing the model's performance against historical data from 1979 to 2005, ensuring reliability through comparison with top-tier observational datasets.

Accurate Representation: The model demonstrated exceptional capability in capturing the spatial patterns of temperature. The simulated rainfall is, however, slightly overestimated in most part of the country, including for Botswana and Namibia.

Temperature Projections for year 2050 - Average Temperature : Annual

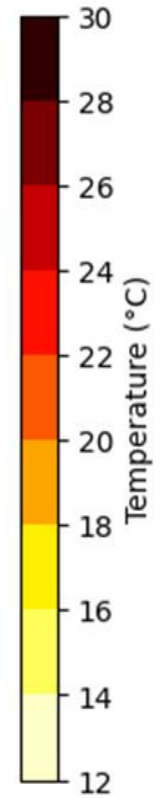
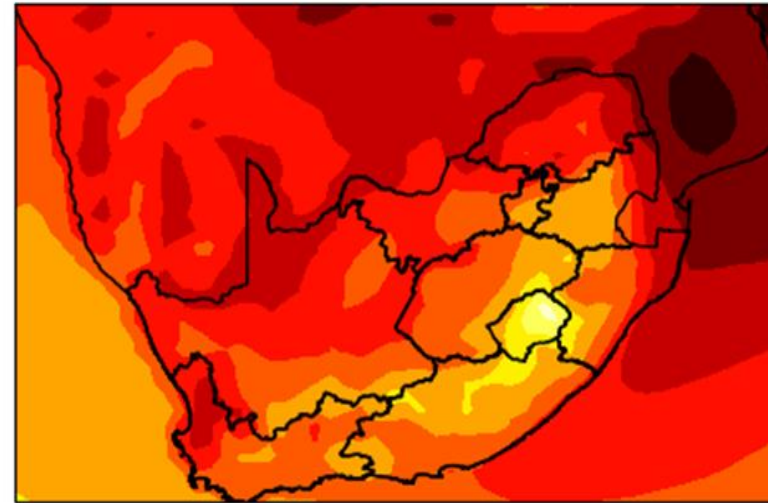
RCP4.5 - SCENARIO A

SA TAS ENSEMBLE RCP 4.5 2050



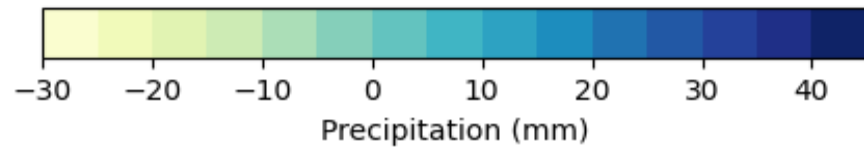
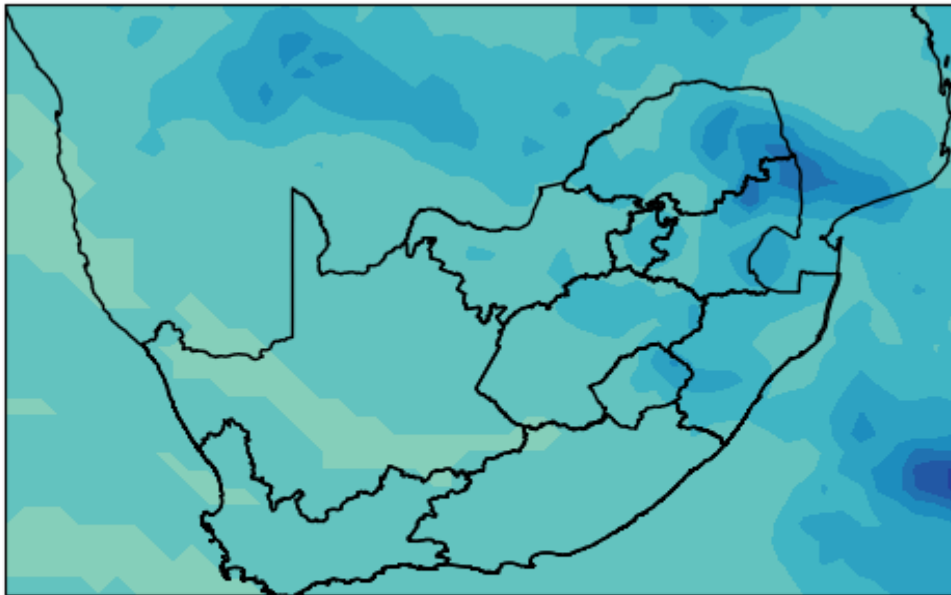
RCP8.5 - SCENARIO B

SA TAS ENSEMBLE RCP 8.5 2050

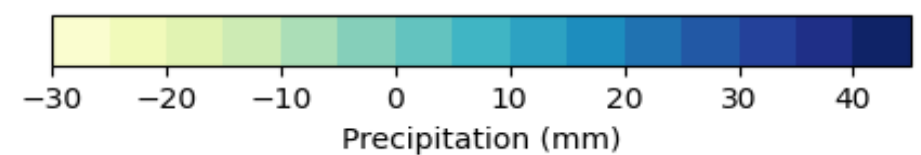
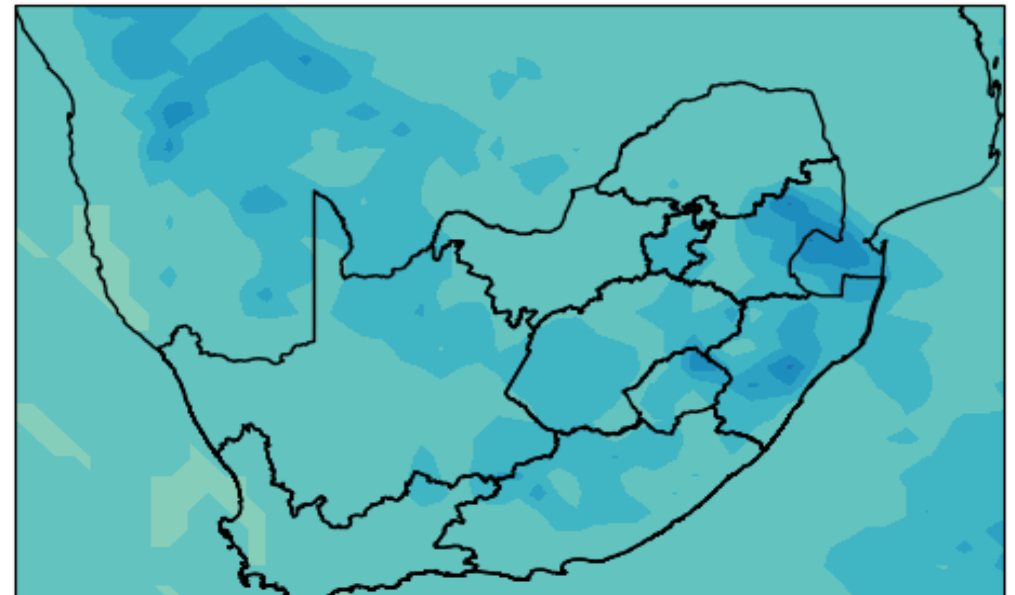


Rainfall Projections for year 2050 - Average Rainfall Total : Annual

SA PR ENSEMBLE RCP 4.5 2050



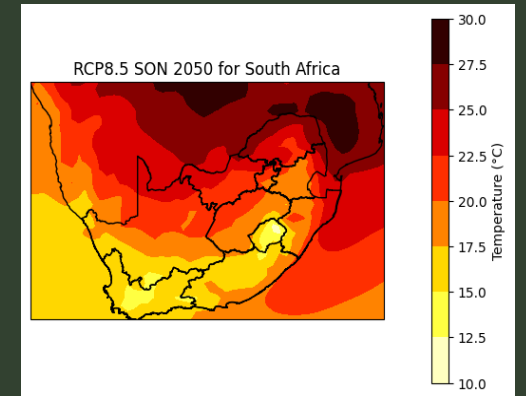
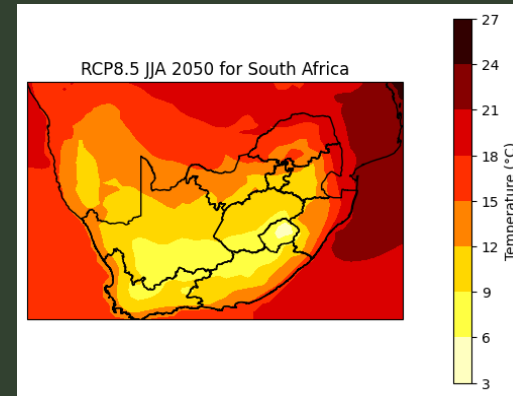
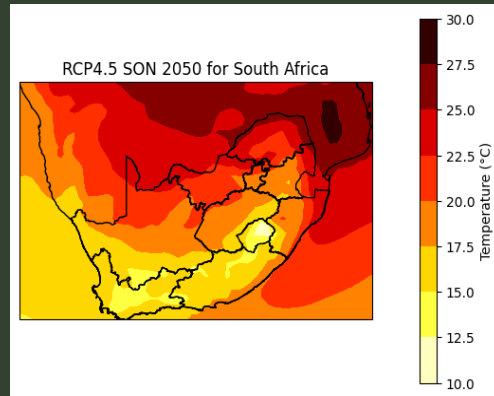
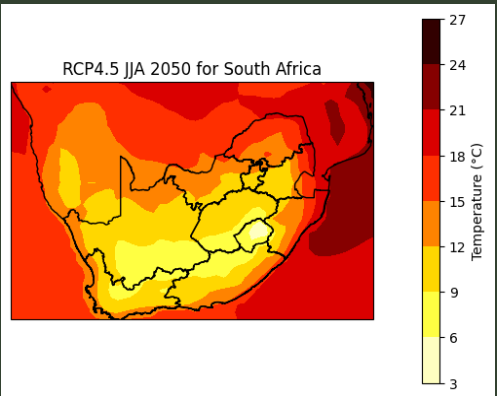
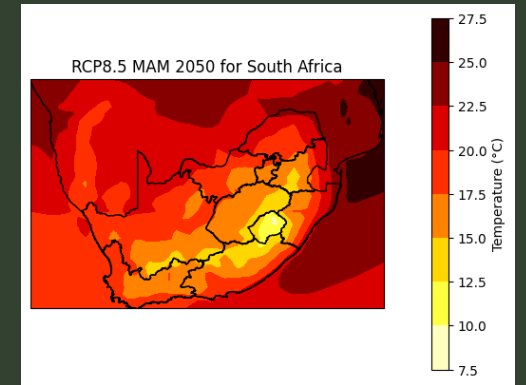
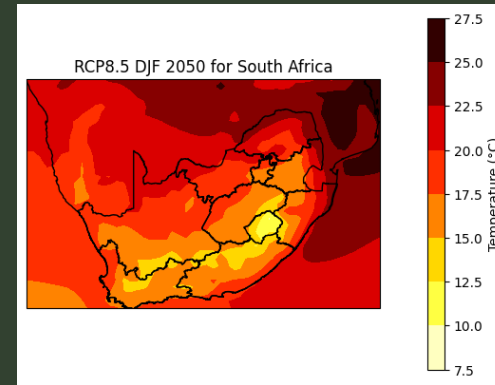
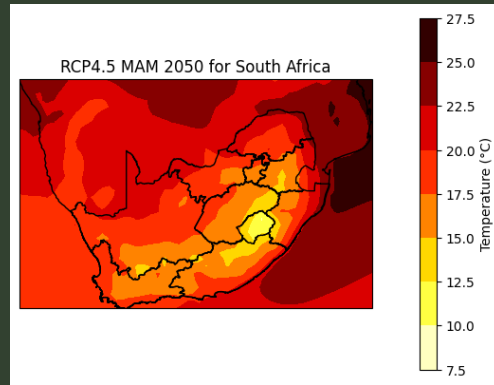
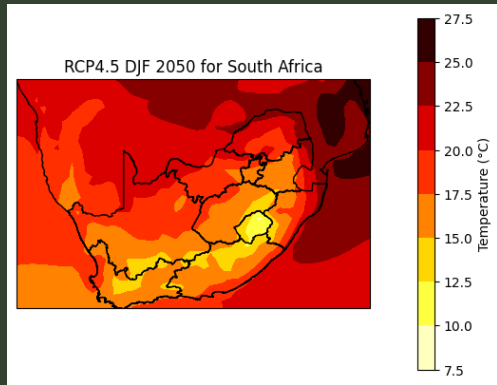
SA PR ENSEMBLE RCP 8.5 2050



Temperature Projections for year 2050 - Average Temperature : Seasonal

RCP4.5 - SCENARIO A

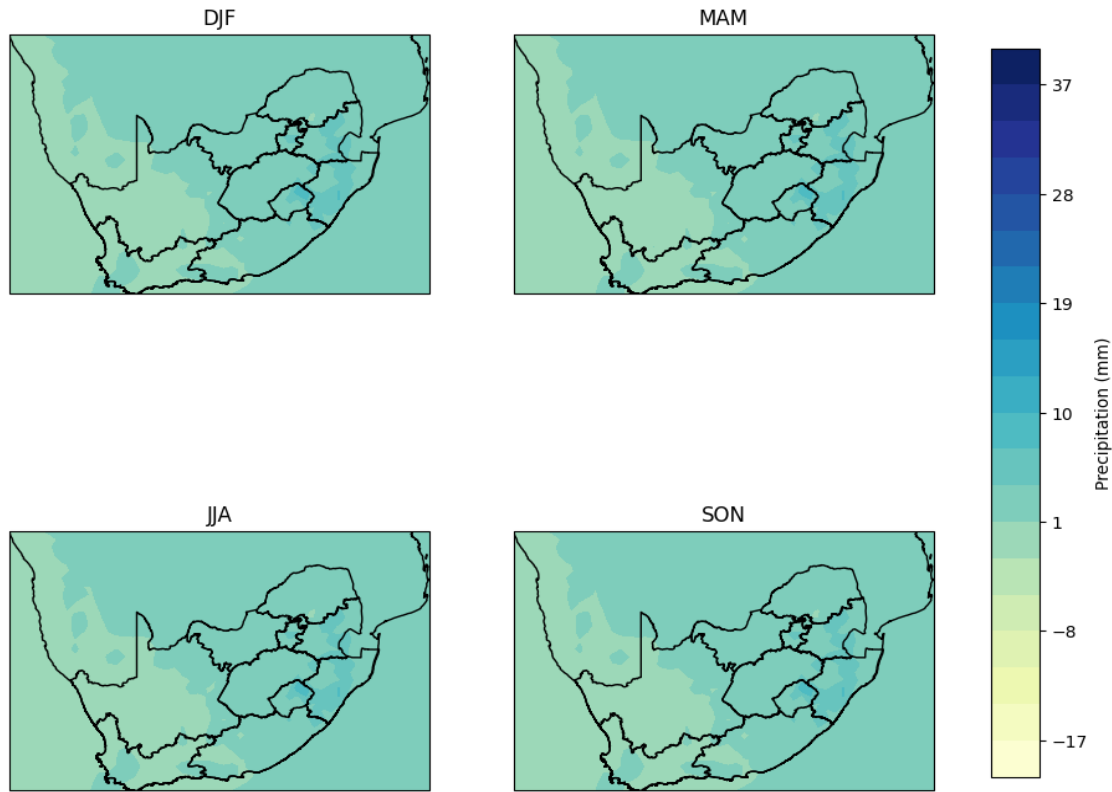
RCP8.5 - SCENARIO B



Rainfall Projections for year 2050 - Average Rainfall Total : Seasonal

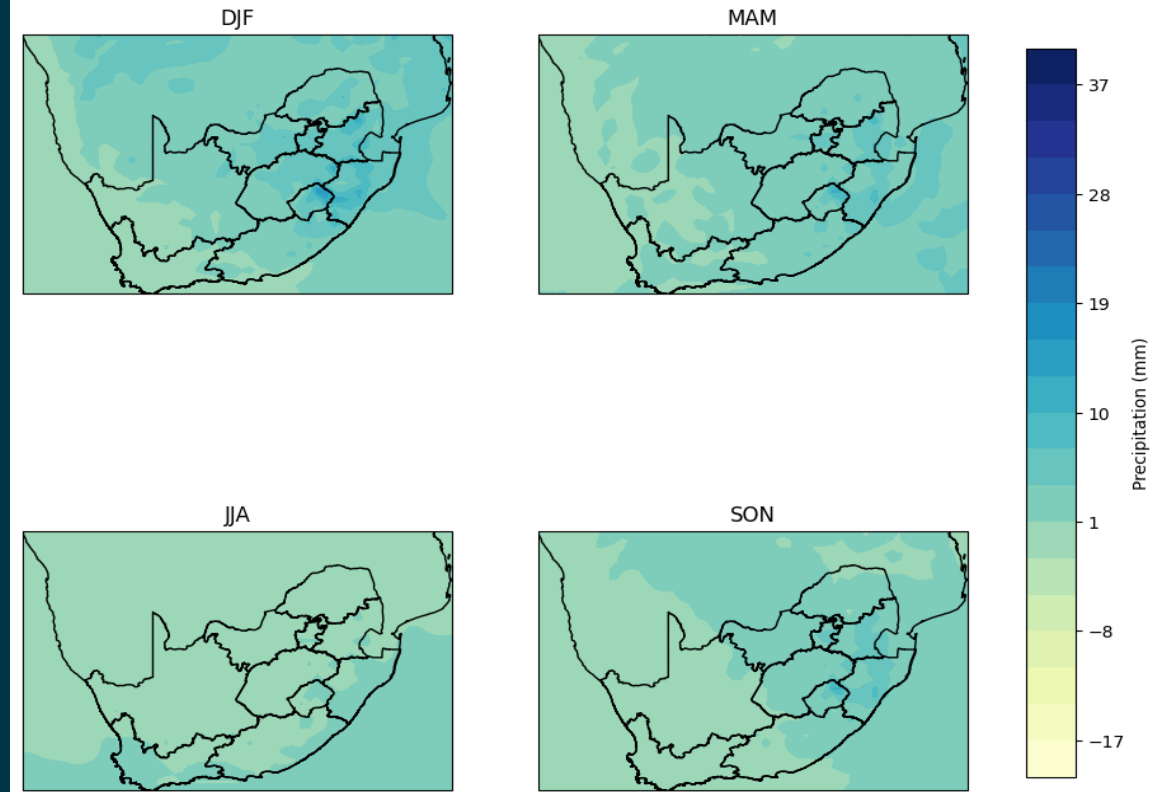
RCP4.5 - SCENARIO A

Seasonal Precipitation (mm) for SA 2050 RCP4.5



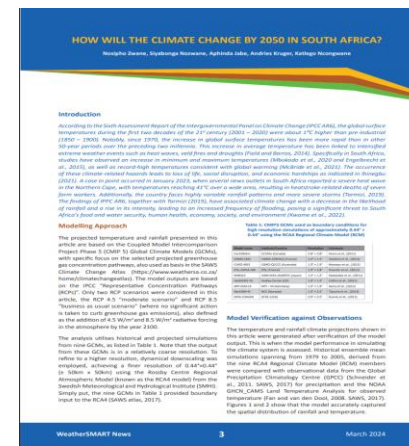
RCP8.5 - SCENARIO B

Seasonal Precipitation (mm) for SA 2050 RCP8.5



CONCLUSION.

- Greenhouse Gas Emissions: Both RCP 4.5 and RCP 8.5 scenarios predict rising emissions until mid-century, after which RCP 4.5 stabilizes, and RCP 8.5 continues high emissions.
- Drier Conditions: South Africa is likely to become drier, with more intense rainfall during periods of precipitation, especially in the eastern region.
- Susceptibility to Extremes: The country will face both extreme droughts and flooding.
- Economic and Social Impact: Climate changes will affect South Africa's economy, water security, food security, and health.





THANK YOU

