Operational Practices in South African Weather Service (SAWS)

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South African Weather Service

SECOND WMO WORKSHOP ON OPERATIONAL CLIMATE PREDICTION
30 May - 1 June 2018, Barcelona, Spain

Overview

- Seasonal Forecasting System at SAWS
- How to Interpret Seasonal Forecasts
- Impact Based Seasonal Forecasts (Applications)
    - Use of seasonal Forecasts on Agricultural Decision Making
    - Drought Monitoring for Water Management & Planning
    - Infectious diseases

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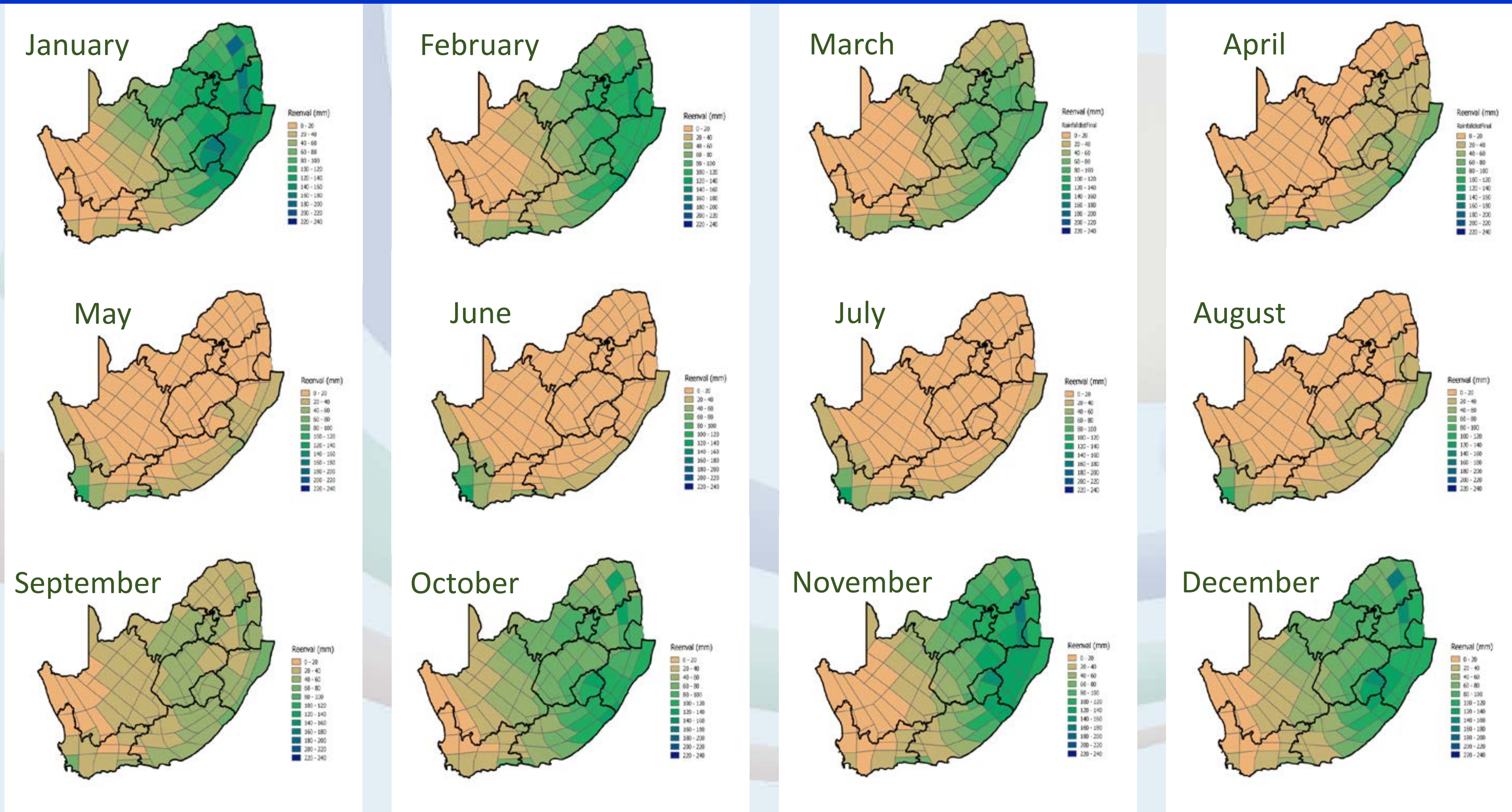
SOUTH AFRICAN DISTRICT RAINFALL (1921 – 2015)



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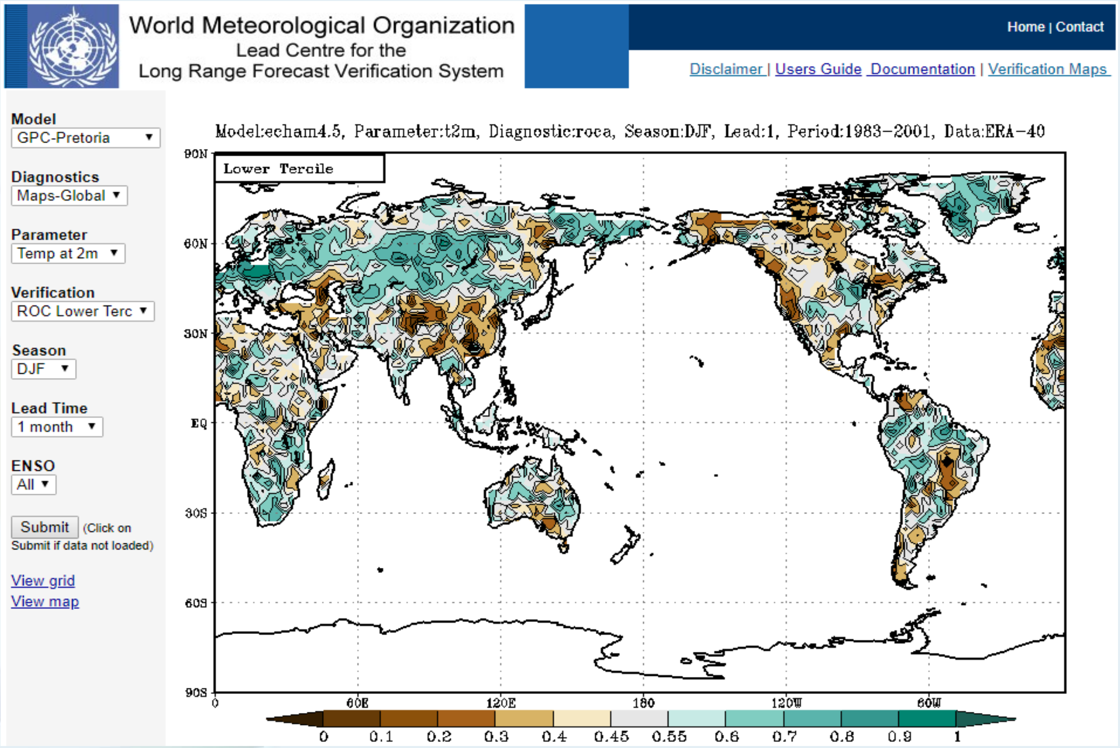
SEASONAL FORECASTING AT SAWS

Seasonal Forecasting: SAWS Coupled Model

- SAWS is recognized for its modelling efforts as a Global Producing Centre (GPC) for Long-Range Forecasts (LRF).
- And has to adhere to specific standards, including the Standardized Verification System (SVS) for LRF.



Lead Centre on LRF SVS

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Seasonal Forecasting: Multi-Model System

- As an effort to improve the local scale forecasts over Southern Africa, a Multi-Model System (MMS) was developed and is based off of three GCM's.

- The current three GCM's contributing to the MMS is the two systems run locally by SAWS (the OAGCM and AGCM) as well as the Climate Forecasting System version 2 (CFSv2) from NCEP.

- Statistical relationships are calculated between model circulation patterns and rainfall and temperature patterns (using 0.5 deg. CRU data) for a 27 year (1983-2009) hindcast period, and applied to the current GCM forecasts to obtain higher resolution downscaled forecasts for Southern Africa.
- Forecasts are produced once a month, with a forecast period of 9-months ahead.

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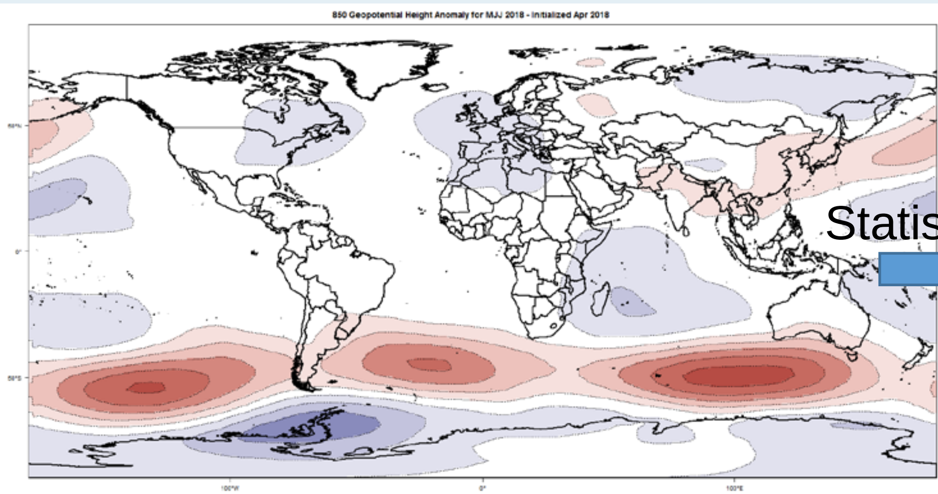
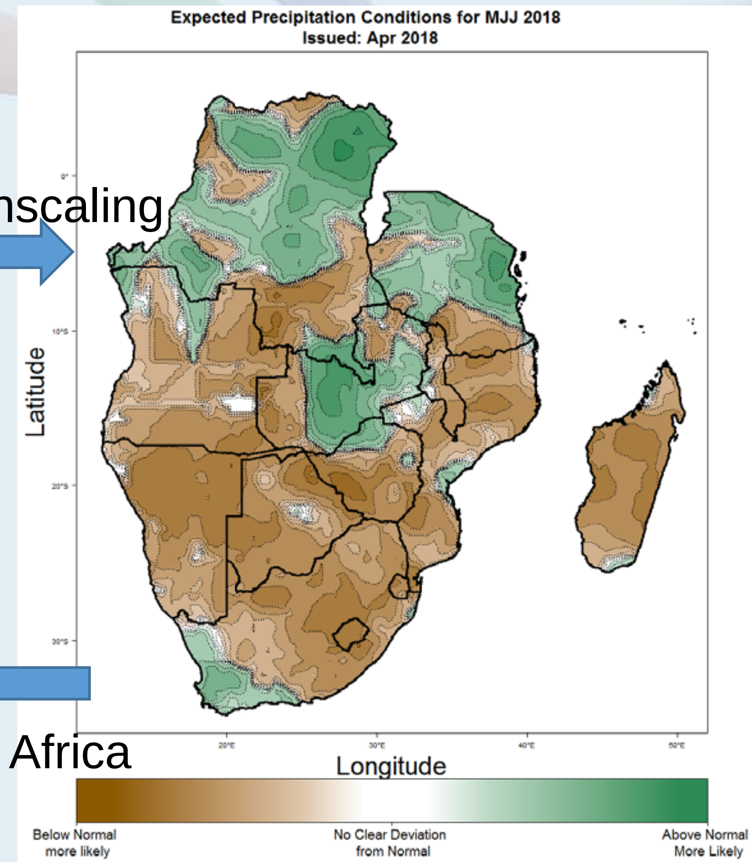
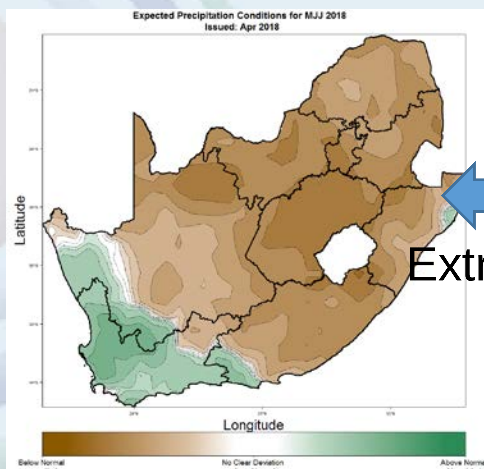
Forecasting at Seasonal Time Scales – Statistical Downscaling



Statistical Downscaling



Extract South Africa



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How to Interpret a Seasonal Forecast

There are three stages to successfully interpret a seasonal forecast

- Identify the most likely outcome
  - Forecast maps indicate which seasonal condition (rainfall and temperature) is most likely to occur. Three conditions are possible, above-, near-, and below-normal. These categories represent the wettest/hottest (above-normal) and driest/coldest (below-normal) years in history as well as the normal years (near-normal)
- Identify whether the forecast system has sufficient skill
  - Seasonal forecasts can have various amounts of skill across the country and from season to season. SAWS attempts to communicate which areas have sufficient skill for which long-term planning can be done by masking out areas of insufficient skill
- Know your climate
  - South Africa has various climate zones, specifically rainfall can vary from season to season. For example the summer rainfall areas are predominantly the North-Eastern parts of the country and receive most of their rainfall in Dec-Jan-Feb. The winter rainfall areas are mostly in the South-West of the country and receive most of their rainfall in Jun-Jul-Aug.

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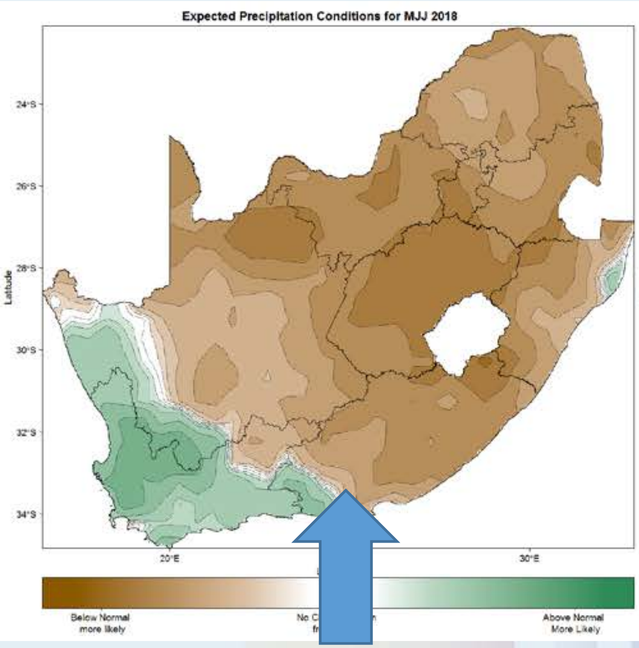
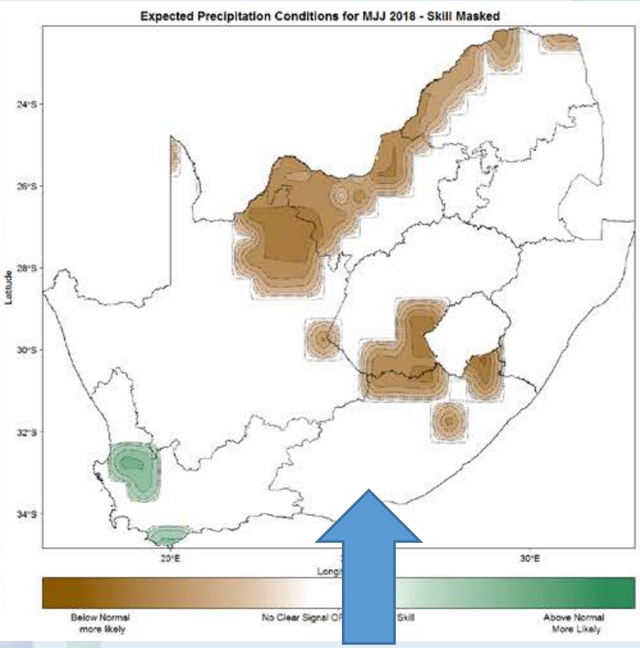
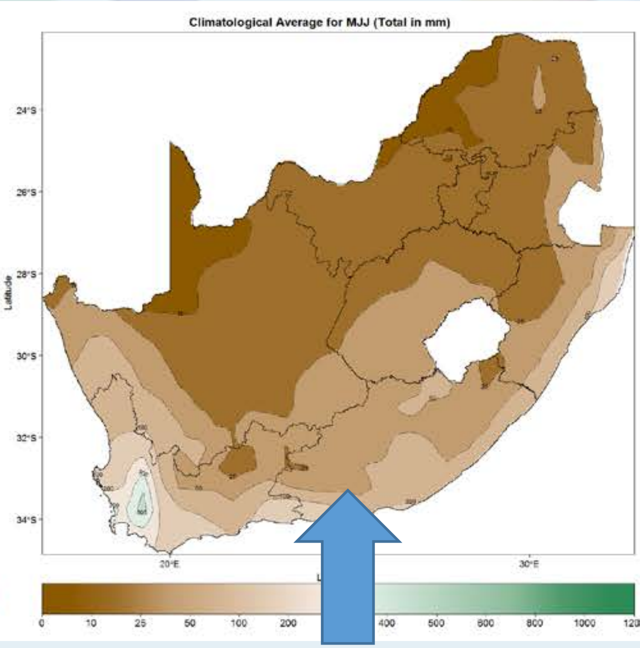
How to Interpret a Seasonal Forecast



Identify Most Likely Outcome



Identify Sufficient Skill Areas



Know Your Climate

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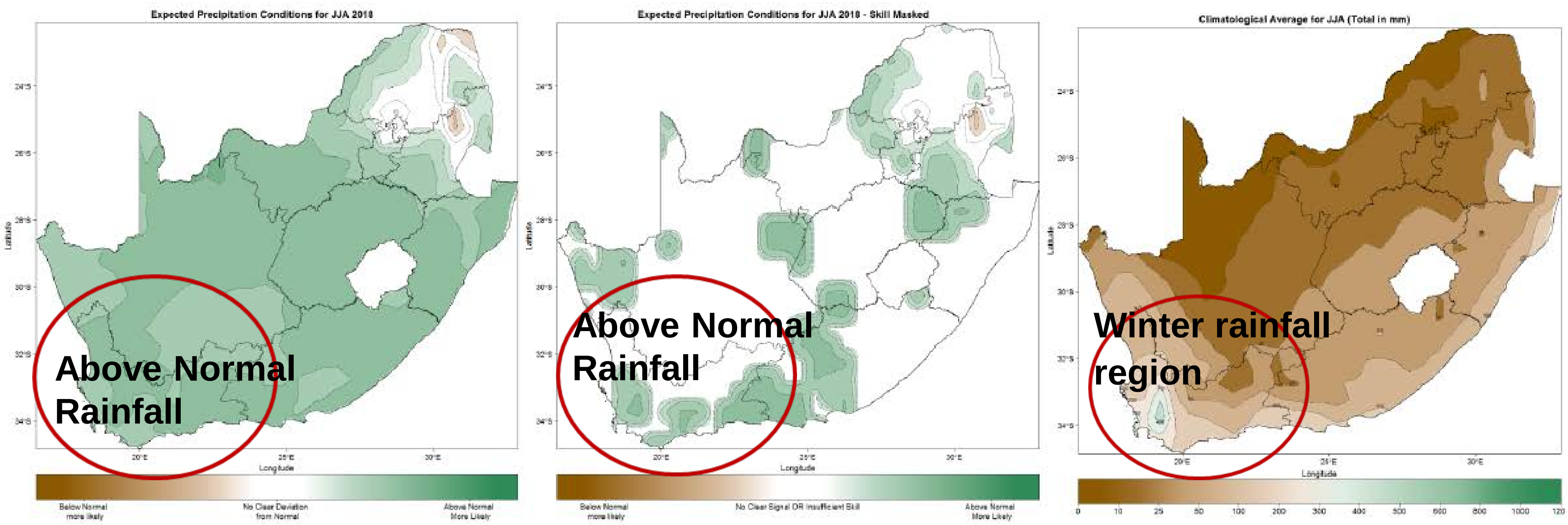
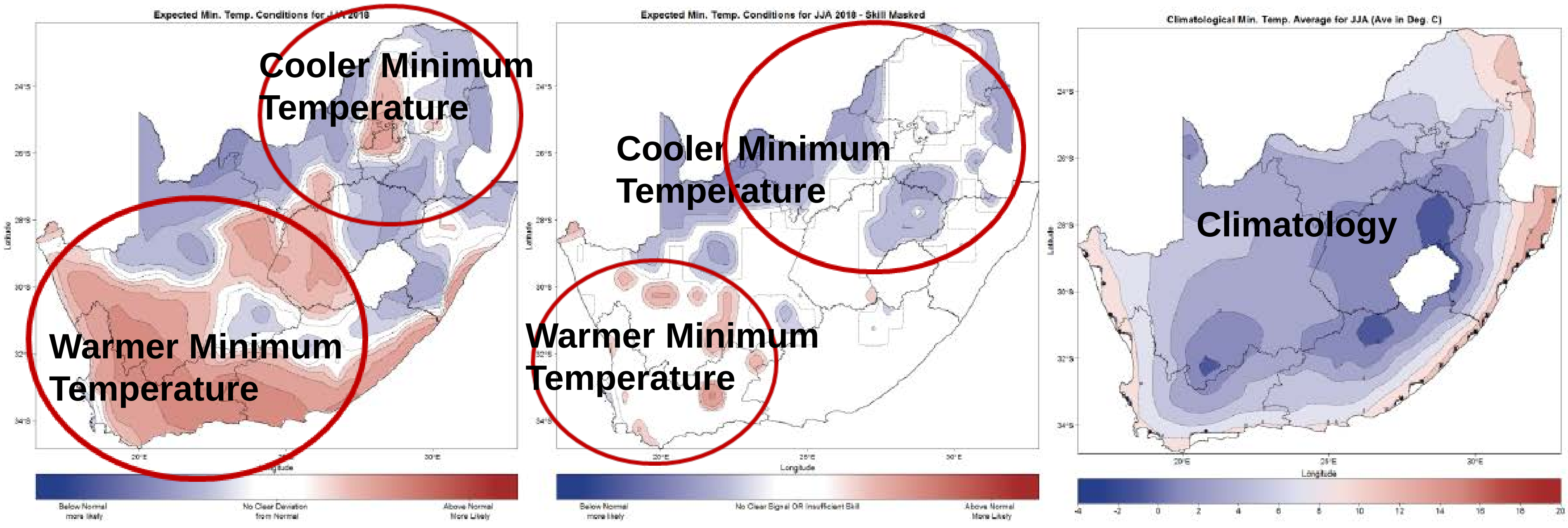
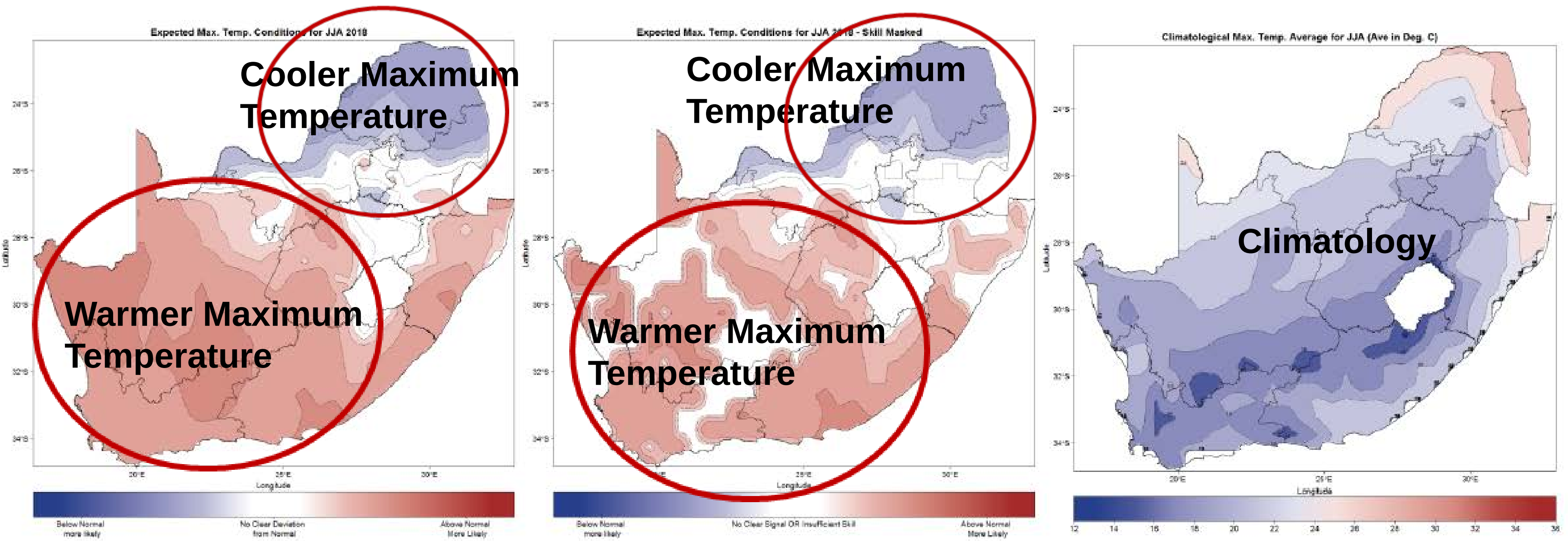
June-July-August (JJA) 2018 seasonal rainfall prediction without skill taken into account (left), as well as skill masked out (middle). Also included is the climatological average for JJA (right) calculated over the period 1979-2009.



June-July-August (JJA) 2018 seasonal minimum temperature prediction without skill taken into account (left), as well as skill masked out (middle). Also included is the climatological average for JJA (right) calculated over the period 1979-2009.



June-July-August (JJA) 2018 seasonal maximum temperature prediction without skill taken into account (left), as well as skill masked out (middle). Also included is the climatological average for JJA (right) calculated over the period 1979-2009.



CLIMATE CHANGE PROJECTIONS

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EXPERIMENTAL DESIGN

COoRdinated Downscaling EXperiment (CORDEX) Grid resolution of 44º x 0.44º (≈50km x 50km).

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)
NorESMI-M	Norway	1.9° x 2.5°	Tjiputra et al., (2013)
GFDL-ESM2M	USA	2.0° x 2.5°	Dunne et al., (2012)

Dynamical downscaling: Nine ocean-atmosphere CGCMs provided lateral boundary input to the Rossby Centre regional model (RCA4)

Variables:
Temperature
Rainfall
(ensemble means)

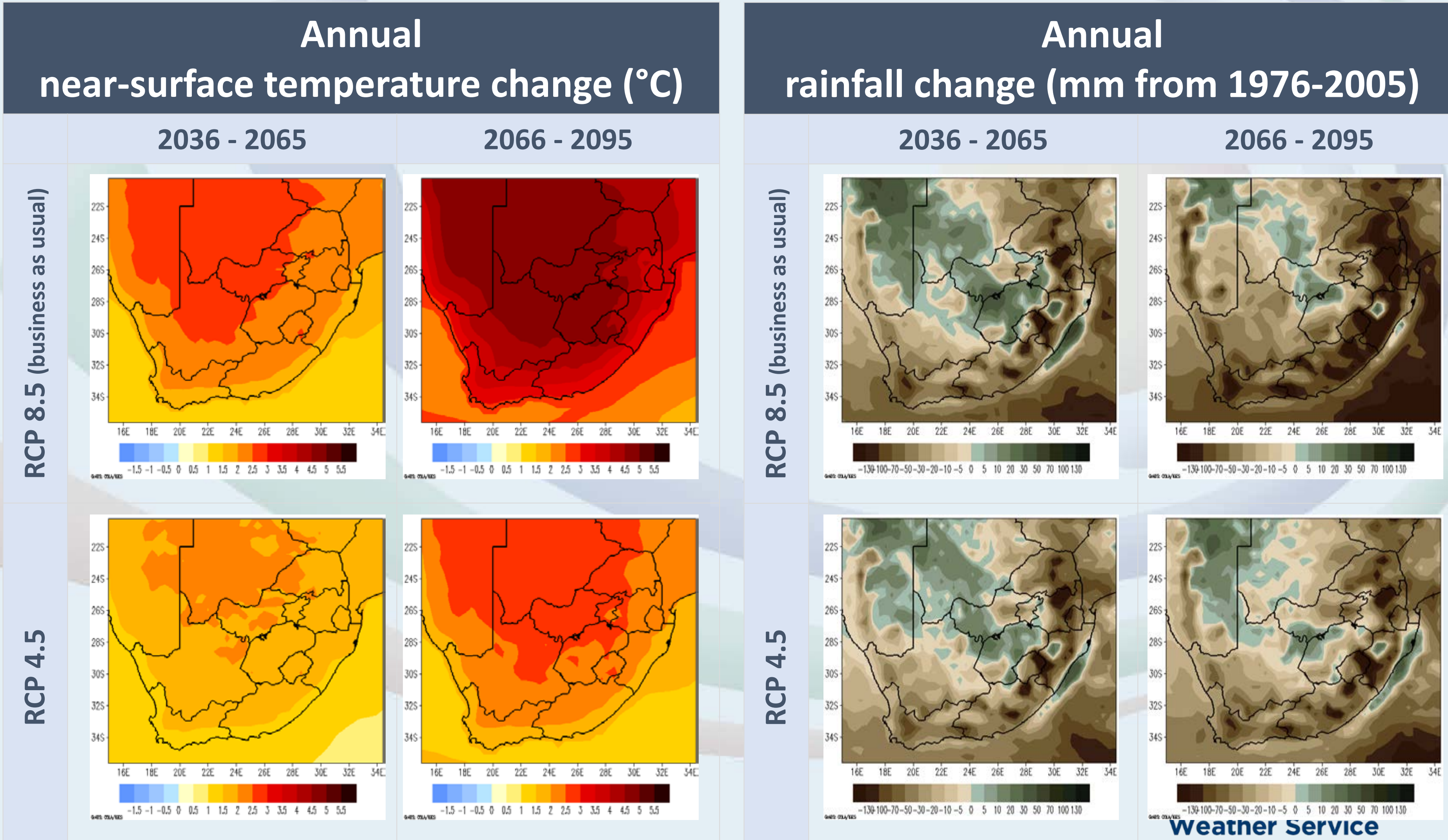
30-year periods:
1976-2005: history
2036-2065
2066-2095

Pathways:
RCP 4.5
RCP 8.5

Seasons:
Annual
December-January-February : DJF
March-April-May : MAM
June-July-August : JJA
September-October-November : SON

SOUTH AFRICAN CC PROJECTIONS

Climate Change Reference Atlas:
A Water Research Commission Supported Product



RCA4 Regional Climate Model simulations forced by 9 CMIP5 Global Models – 9 member ensemble mean

IMPACT BASED SEASONAL FORECASTING

Use of Seasonal Forecasting on Agricultural Decision Making

❑ Farm Level

- Change crop variety (short or long duration)
- Change crop species or mix of species
- Implement soil and water conservation techniques
- Increase or decrease area planted
- Adjust timing of land preparation
- Increase or decrease borrowing for inputs
- Sell or purchase livestock depending on anticipated cost and availability of feed

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Use of Seasonal Forecasting on Agricultural Decision Making

❑ Provincial and National Level

- Water resources management - water budgeting to prioritize water use and allocate water resources among various competitive users
- Provide agricultural input support - credit arrangements and contingency plans
- Policy decisions - identify potential impact areas and target resources for mitigation measures
- Policy measures - export and import of agricultural commodities

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Use of Seasonal Forecasting on Agricultural Decision Making

❑ Crop production

Above-Normal Rainfall	Below-Normal Rainfall
Clear and prepare land for planting	Implement agricultural water conservation techniques
Orient furrows should it be necessary	Orient furrows or planting row across the slope
Plant flood tolerant crop	Plant drought tolerant crops/varieties
Plant longer duration cultivars/varieties	Apply less fertilizer
Increase planted area if necessary	
Increase planting density	Minimize planting density
Control weeds frequently	Supplementary irrigation

Use of Seasonal Forecasting on Agricultural Decision Making

❑ Animal production

Above-Normal Rainfall	Below-Normal Rainfall
Locate animals in dry and well drained camps	Sell older livestock
Provide shelter	Provide shelter and shade
Vaccinate animals at a recommended time and age	Buy and store sufficient feed ahead of time
Practice proper grazing rotation	
Clean water and shade	

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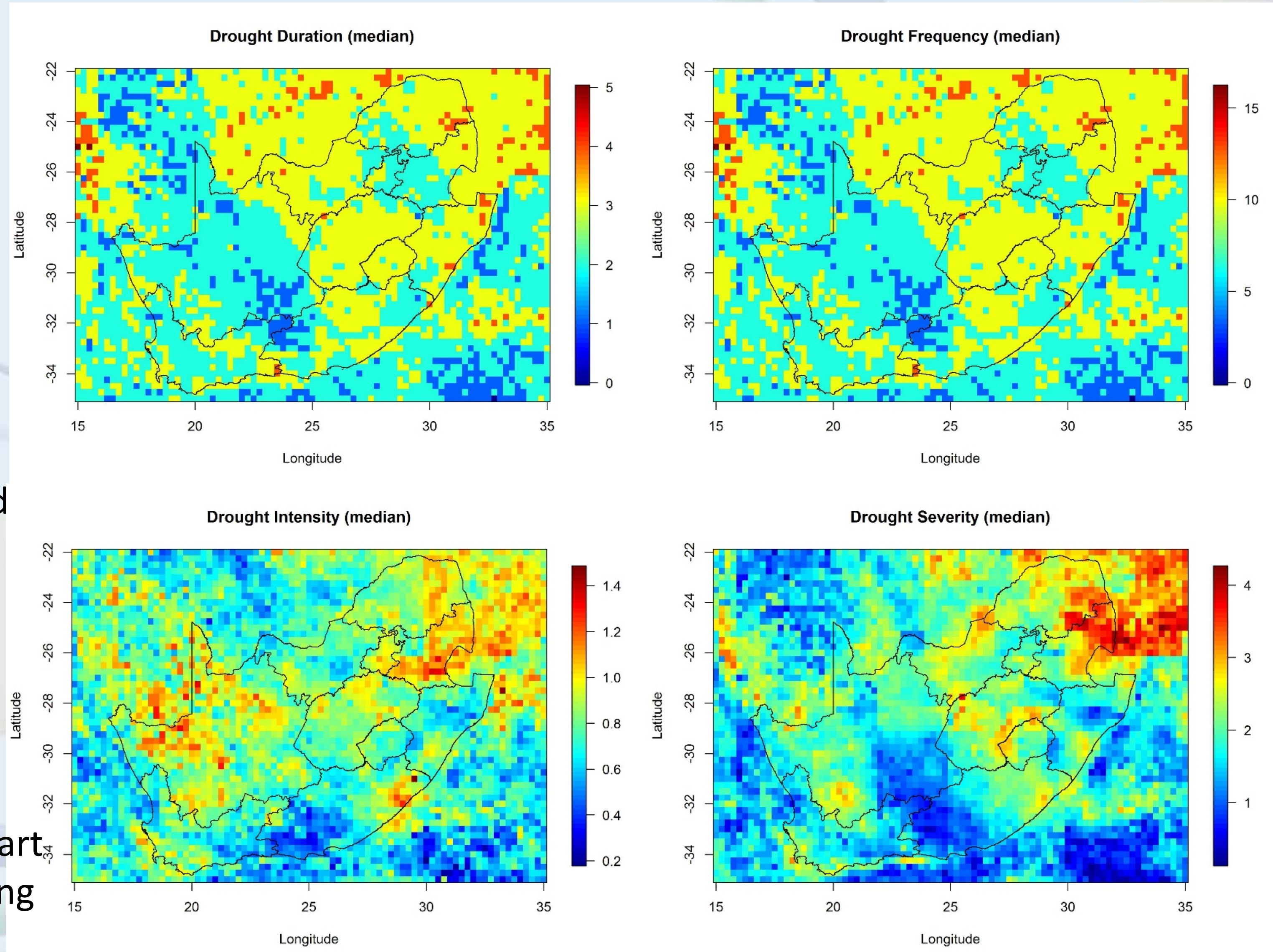
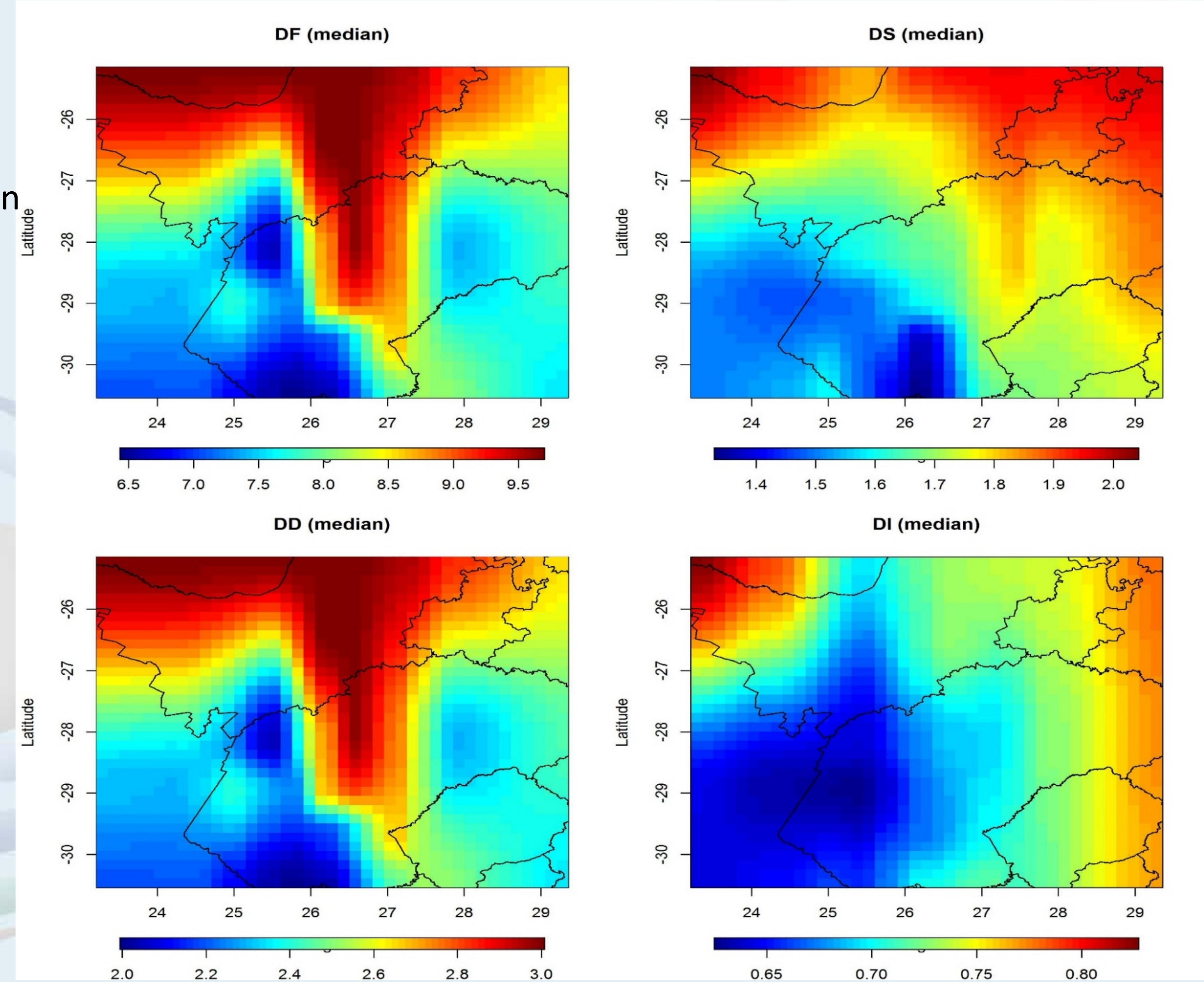
Drought monitoring for water management & planning: National level

- Drought is monitored using multi-drought indices.
- Also characterized in terms of its duration, intensity, frequency and severity.
- Further characterized in terms mild, moderate or severe.
- All can form part of early warning systems



Drought monitoring for water management & planning: the North-West & Free State situation

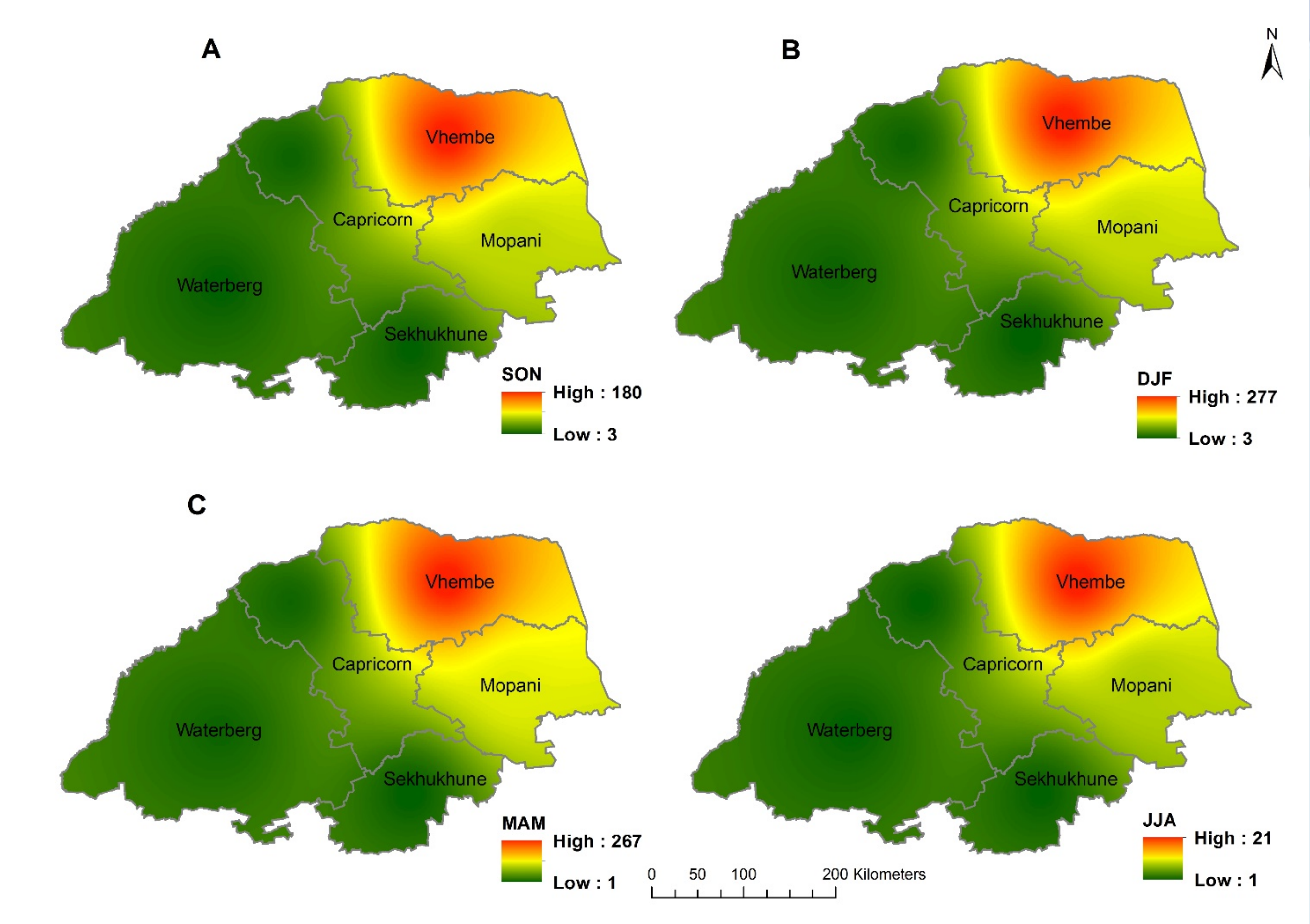
- Drought frequency, severity, duration and intensity in the North-West and Free State provinces
- Weak negative trends towards the south-eastern parts of the province.
- Positive trends towards the south-western parts of the province.



INFECTIOUS DISEASES

Others include

- Infectious diseases e.g. malaria cases outlook



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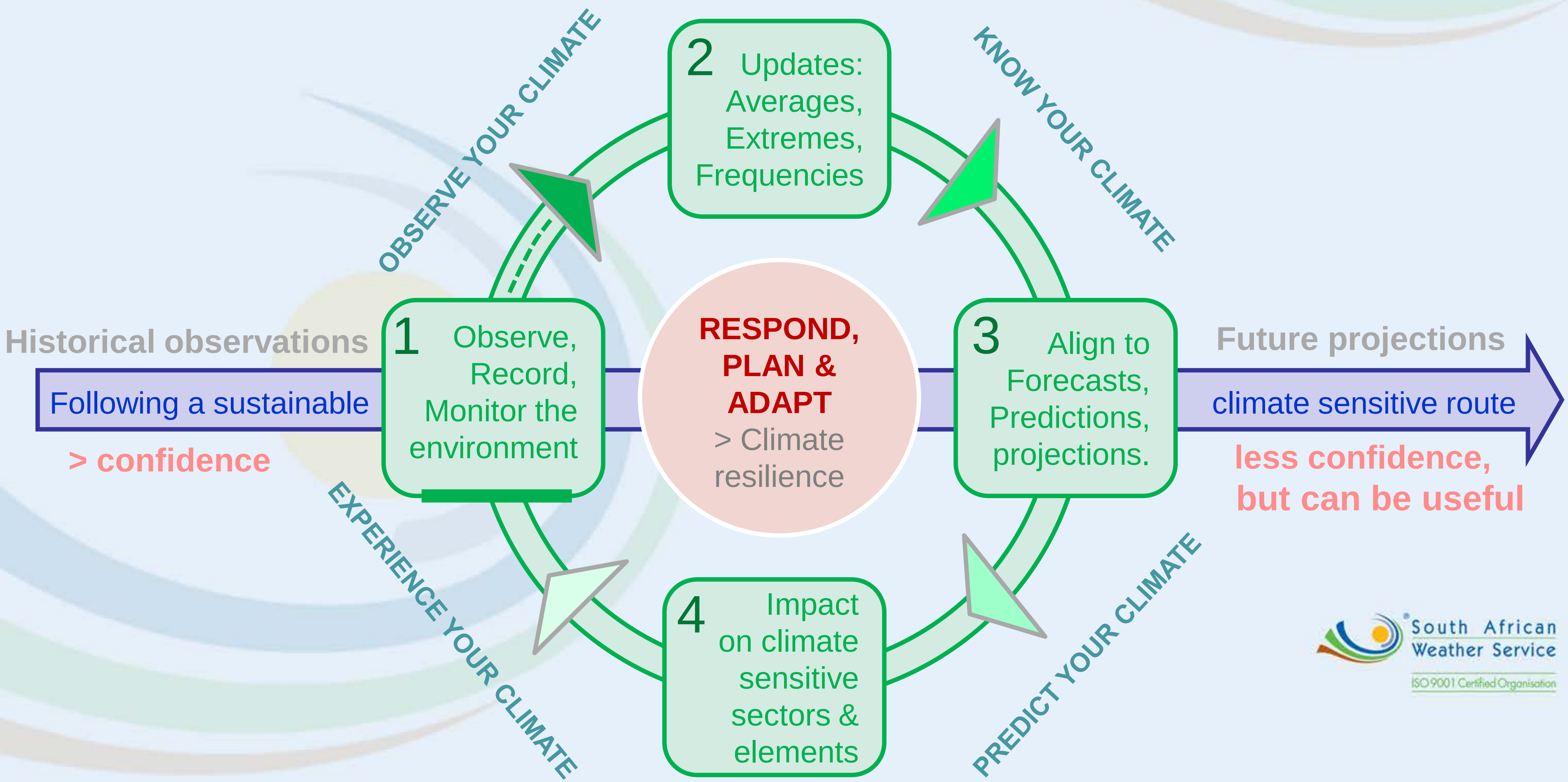
FOLLOWING A “ROTATING CLIMATE SENSITIVE ROUTE”

Climate change adaptation can be achieved by following a sustainable ROTATING CLIMATE SENSITIVE ROUTE, based on good observations, regular updates and risk assessment and response planning according to observed weather and climate events, while aligning these to weather forecasts, seasonal predictions and climate change projections, as they happen at the location of interest.



Thank you

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