Climate Trends in Southern Africa and the Impact on Agriculture and Food Security

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Working group: Adaptation in Agricultural Systems

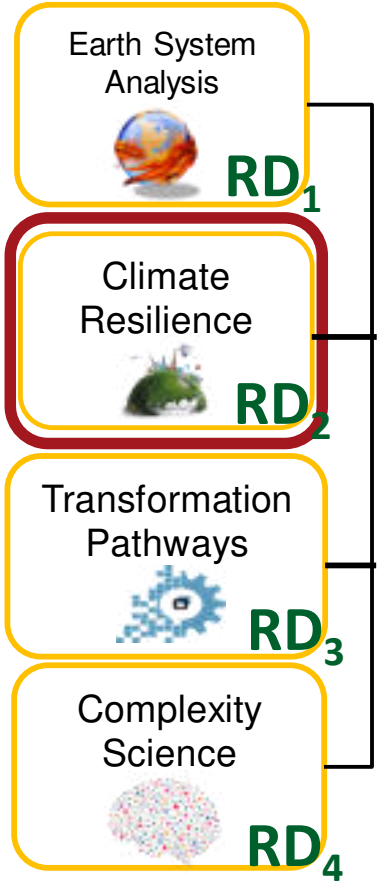


Potsdam Institute for Climate Impact Research (PIK)





- **Who we are:** **Researchers from the natural and social sciences**
- **What I do:** **Use climate data to run crop simulations.**



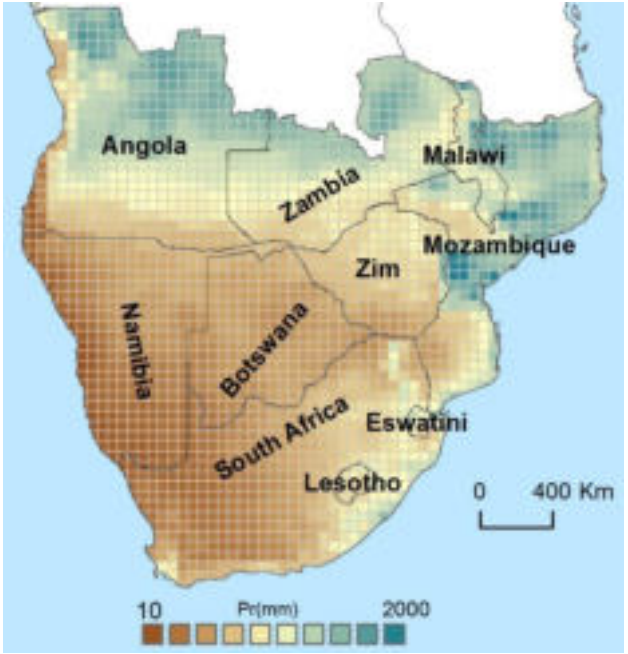
The Climate of Southern Africa



- 4 oceanic systems influence the climate of Southern Africa:
  - Seychelles-Chagos thermocline ridge
  - Agulhas Current
  - Benguela Current
  - Angola-Benguela Front
- Inter-Tropical Convergence Zone (ITCZ)

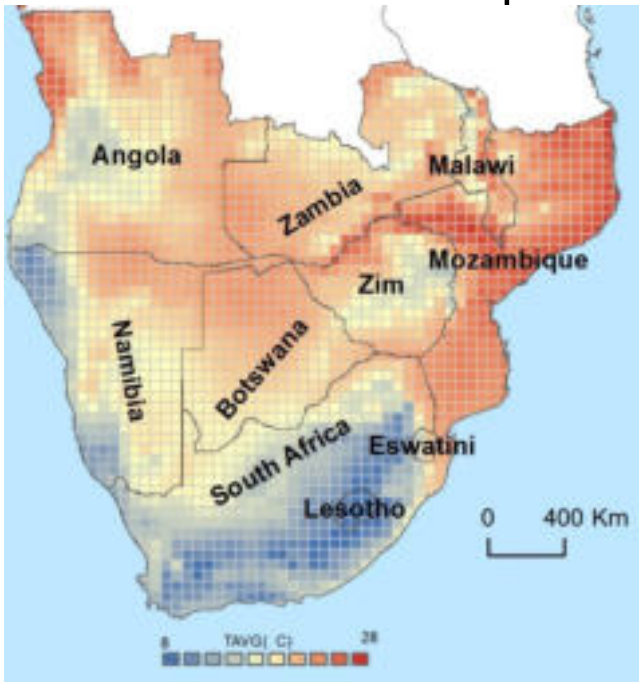
The Climate of Southern Africa

Annual Precipitation



High rainfall influenced by the oceanic system

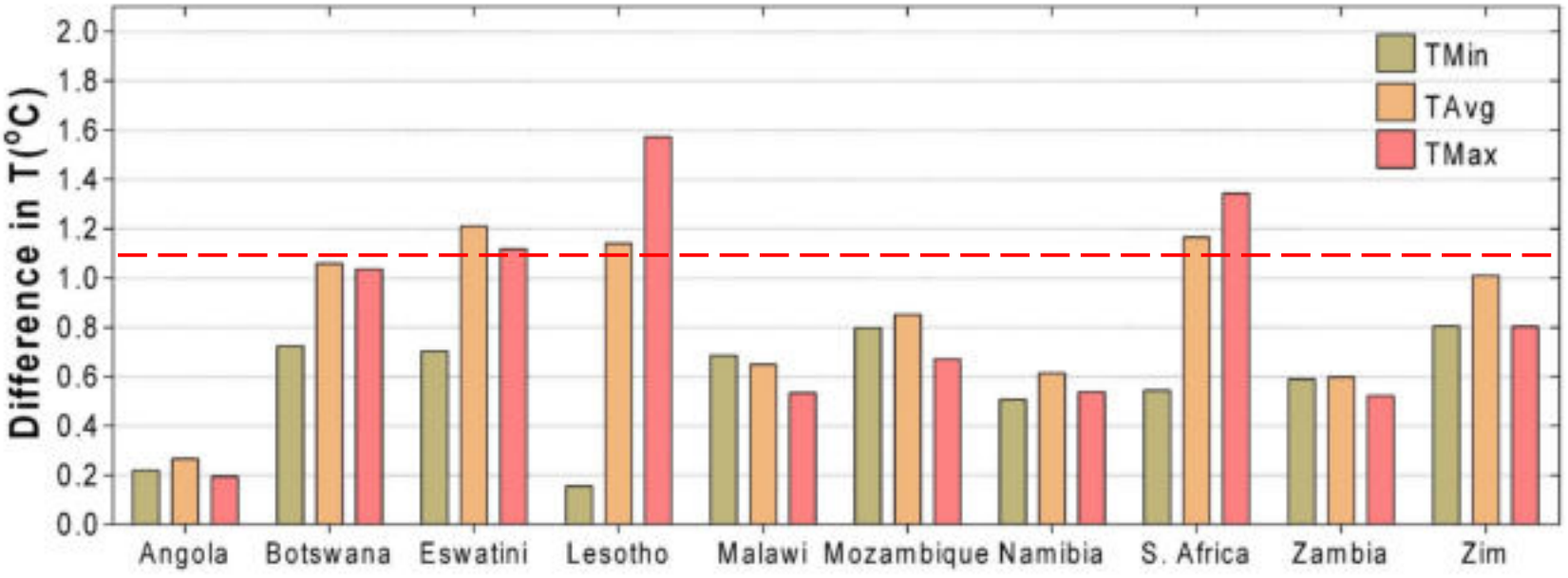
Mean annual temp.



Higher temp. in the east & northern parts of SADC.

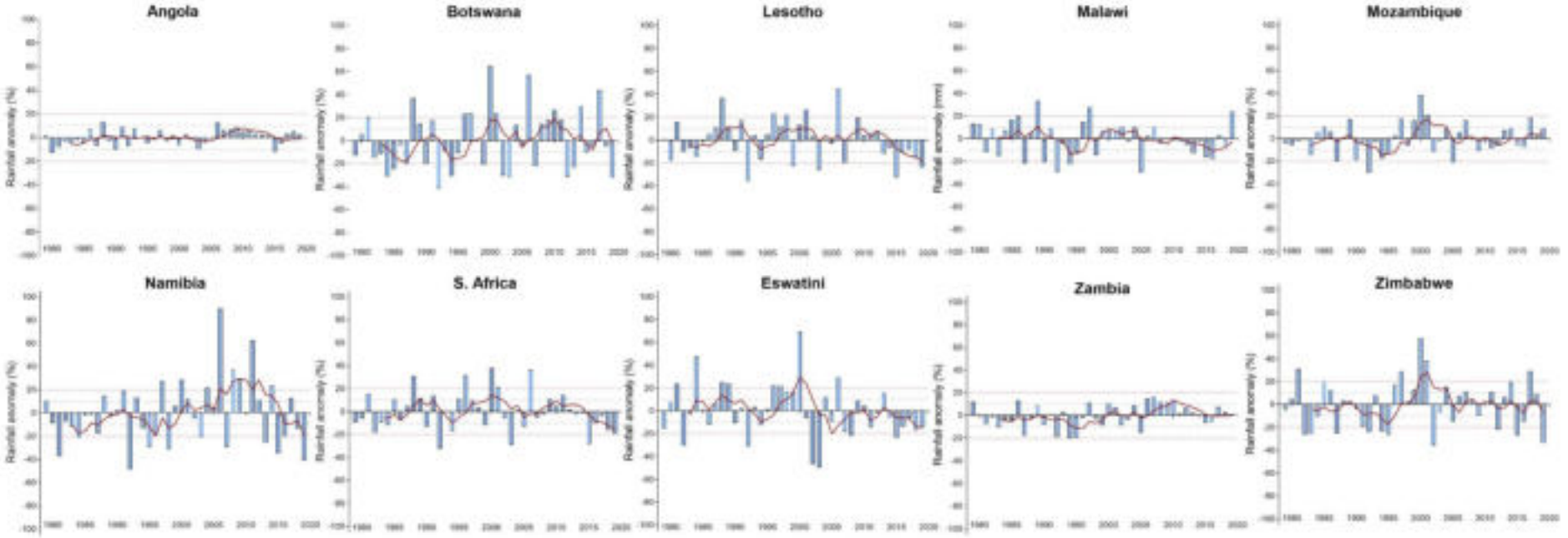
Historical temperature change

Difference in temp. values between means of 1979-1983 & 2015-2019



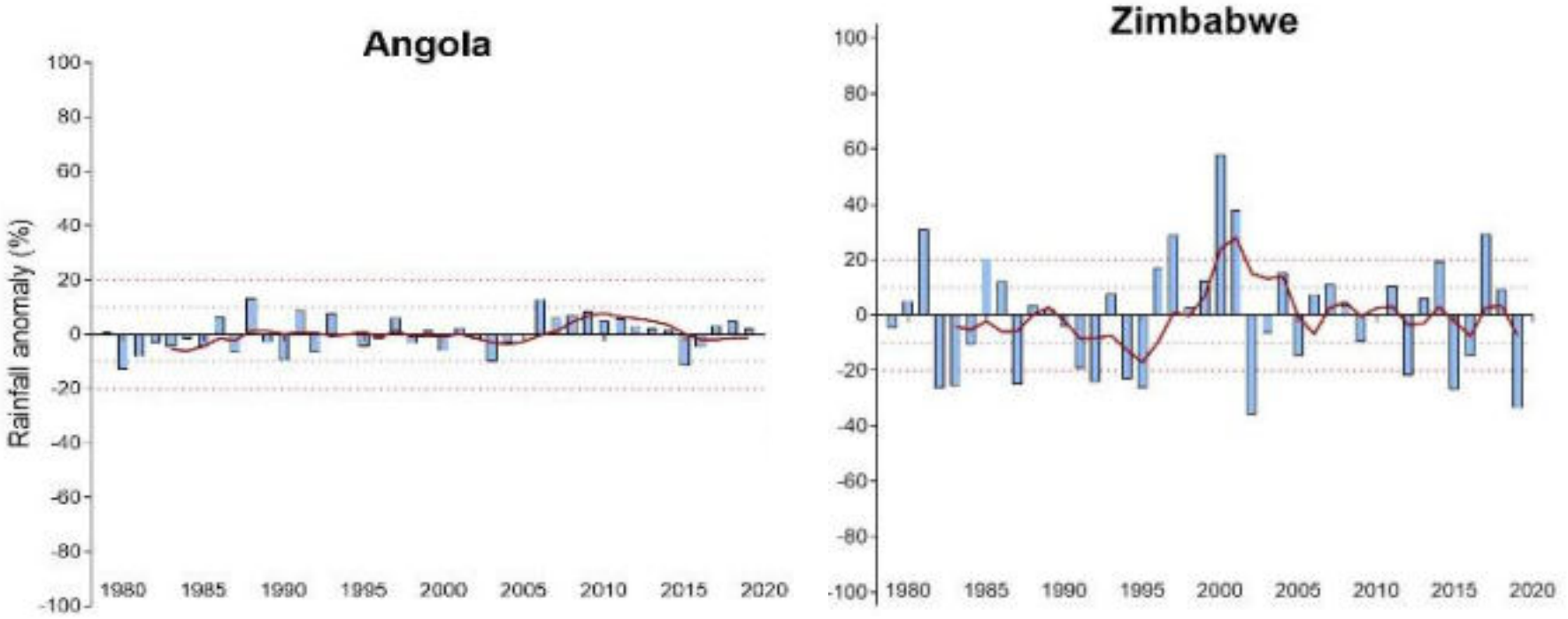
Half the countries already experienced over 1°C in the past 40 years

Historical rainfall variability



Rainfall variability is a natural phenomena in climate.

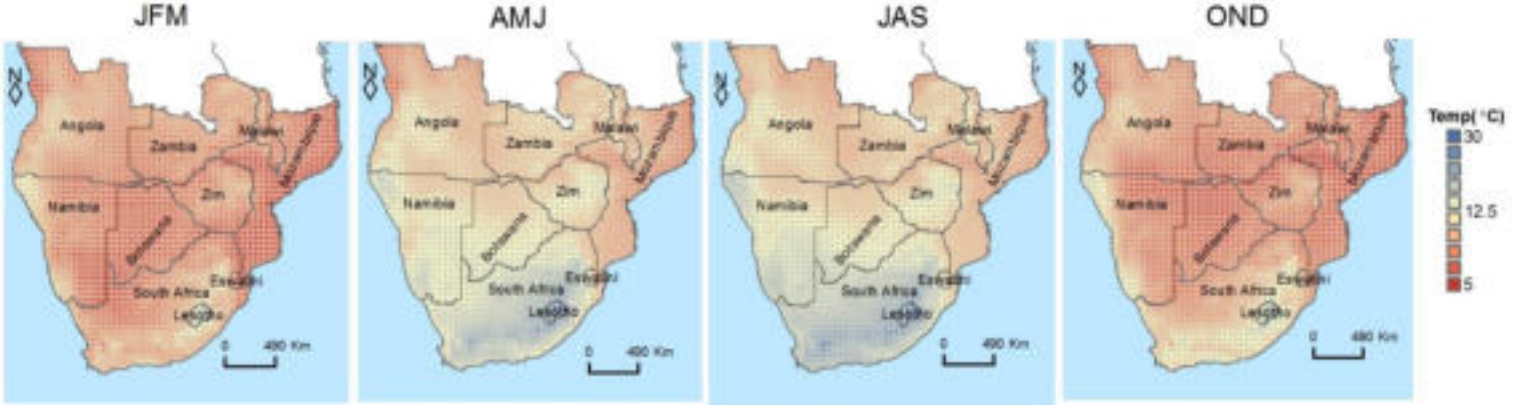
Historical rainfall variability



Variability differs between countries and cells.

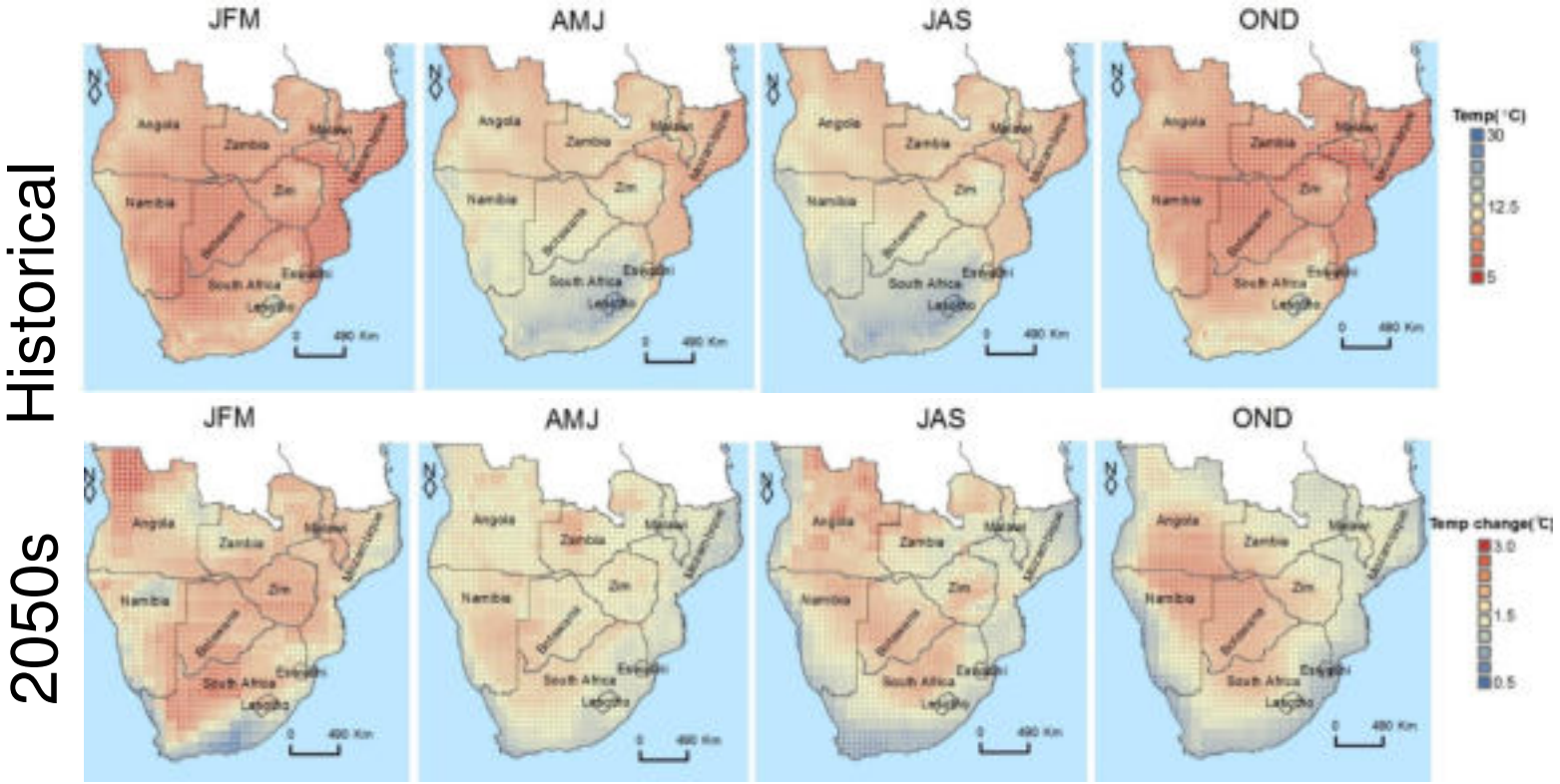
Climatology: Temperature

Historical



Warmest periods at OND & JFM, and cool periods in AMJ & JAS, South Africa/Lesotho.

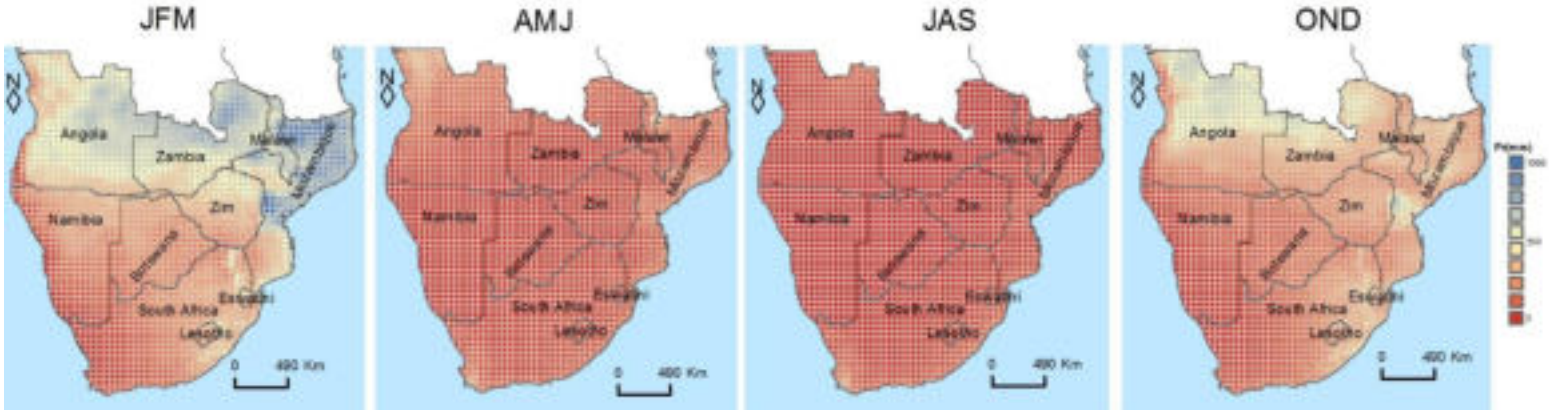
Climatology: Temperature



Warming projected in all areas, but mostly for the JFM.

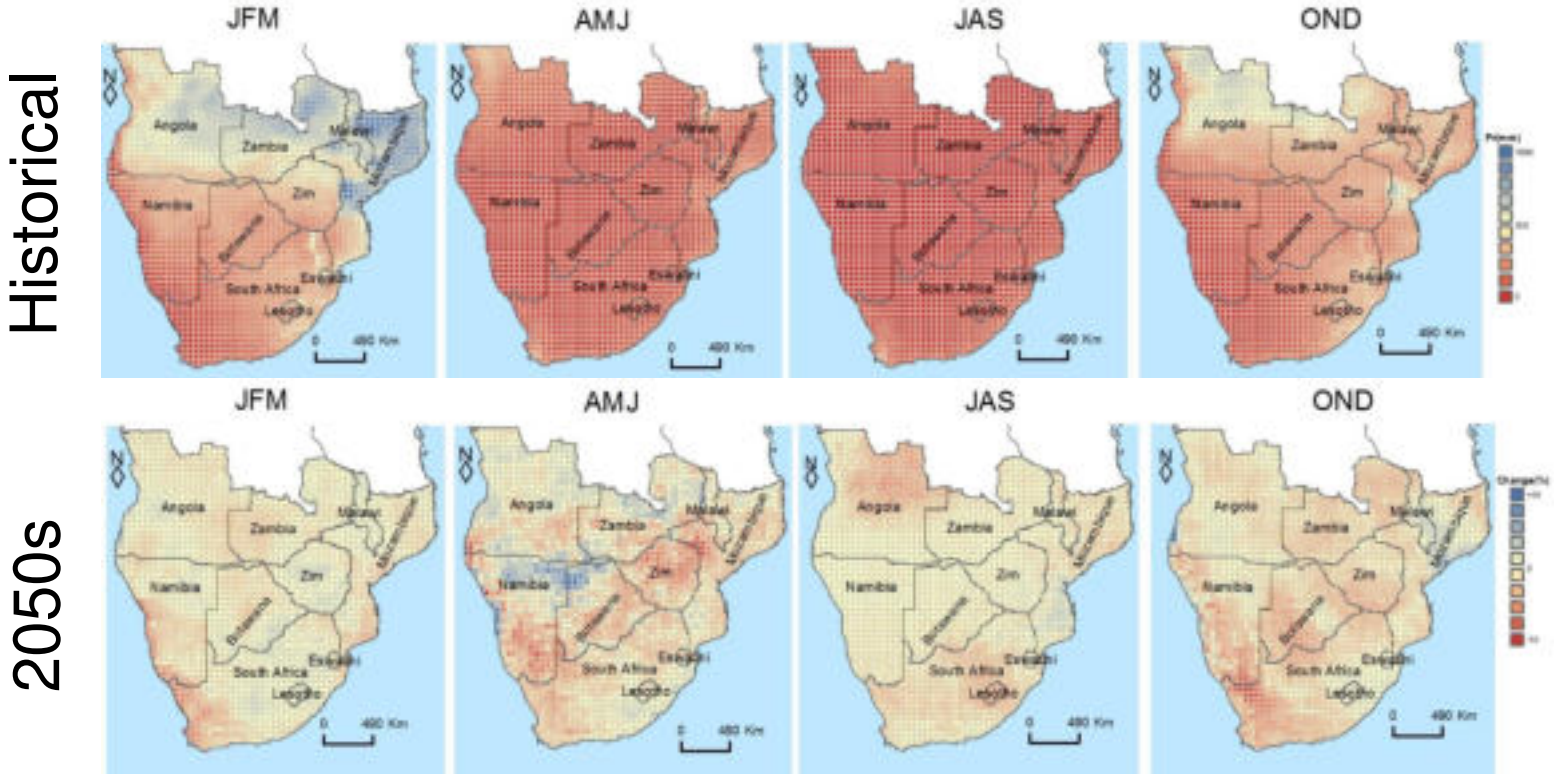
Climatology: Rainfall

Historical



Most rainfall in OND & JFM, crop production season.

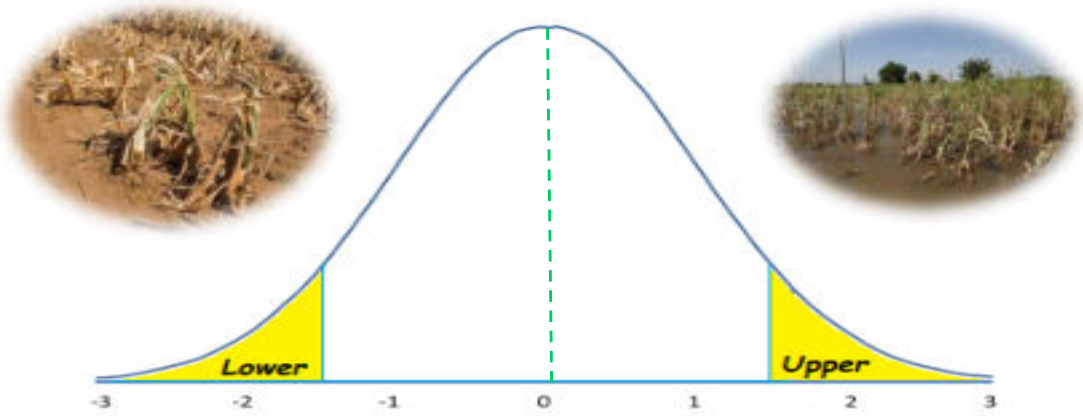
Climatology: Rainfall



Decreases over Zambia, Angola & Mozambique especially for the JFM & OND.

Extreme climate events

Extreme weather or extreme climate events are unexpected, unusual, severe, or unseasonal weather that is at the tails of the **historical distribution**.

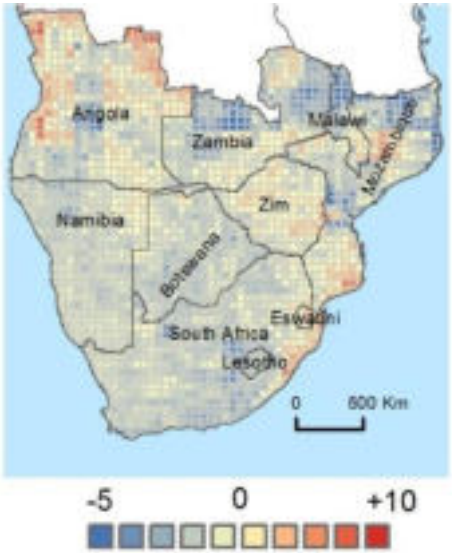


Temperature extremes
- Warmest daily Tmin
- Days above 30/35 degrees

Rainfall extremes
- Wettest consecutive five days
- Rainfall events above 20mm

Changes in extreme weather variables : 2050 (RCP7.0)

Heavy rainfall events



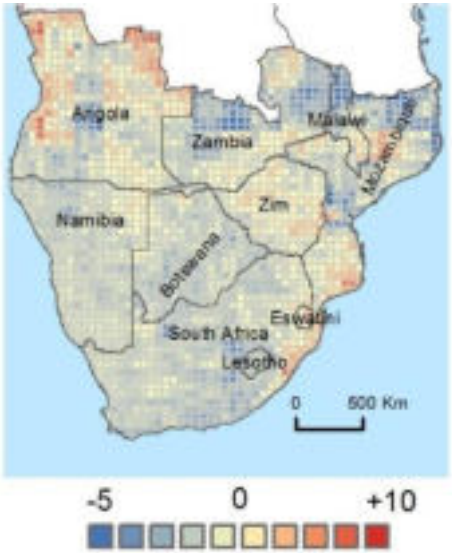
Decreases in heavy rainfall events over Angola & Zim but increases over Zambia

Fewer but heavier rainfall events.

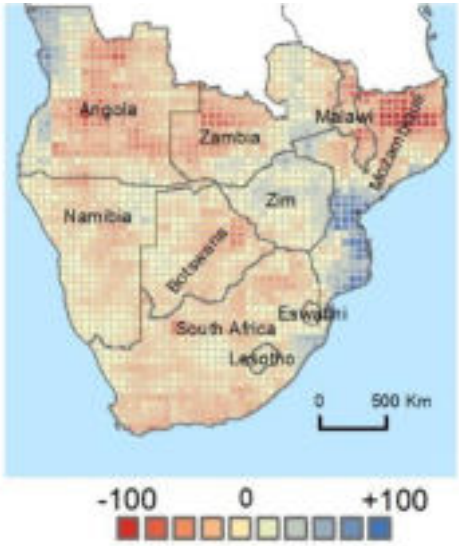
High risk of flooding, erosion and soil water logging

Changes in extreme weather variables : 2050 (RCP7.0)

Heavy rainfall events



Prolonged rainfall

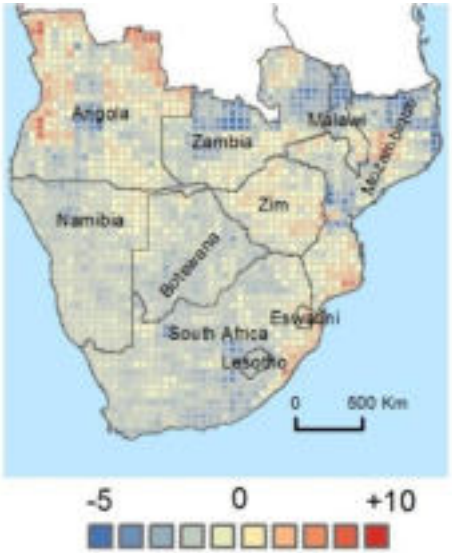


Most areas projected to have less prolonged rainfall:

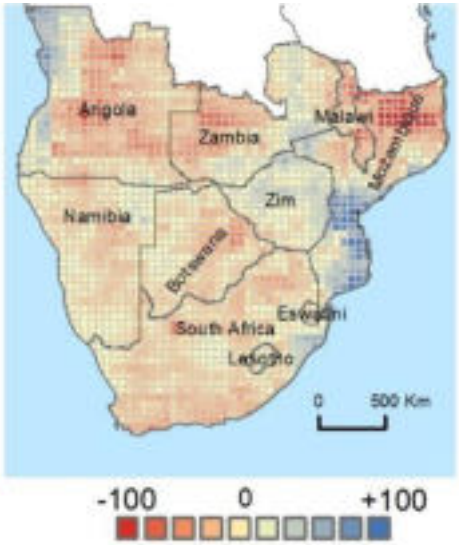
- reduced infiltration potential

Changes in extreme weather variables : 2050 (RCP7.0)

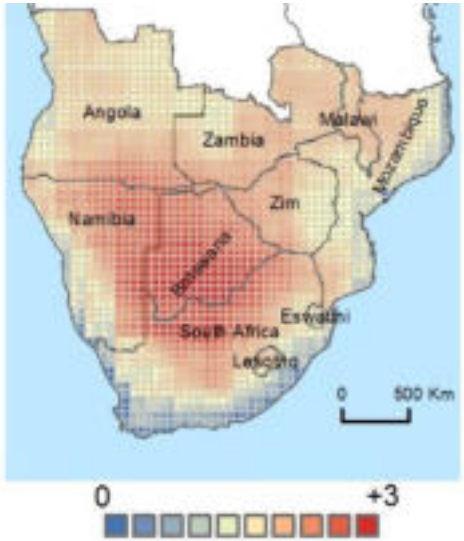
Heavy rainfall events



Prolonged rainfall



Warm Nights

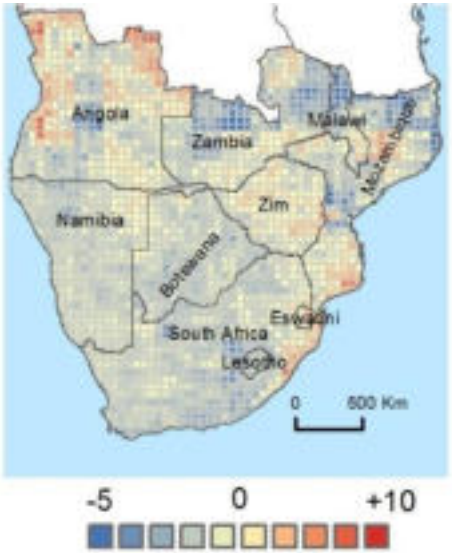




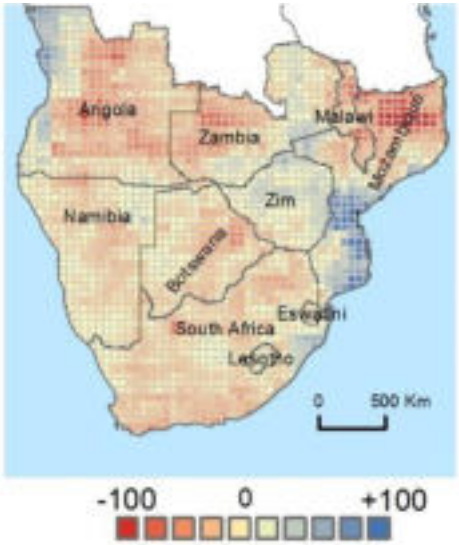
Wasteful respiration and a lower dry matter accumulation in crops

Changes in extreme weather variables : 2050 (RCP7.0)

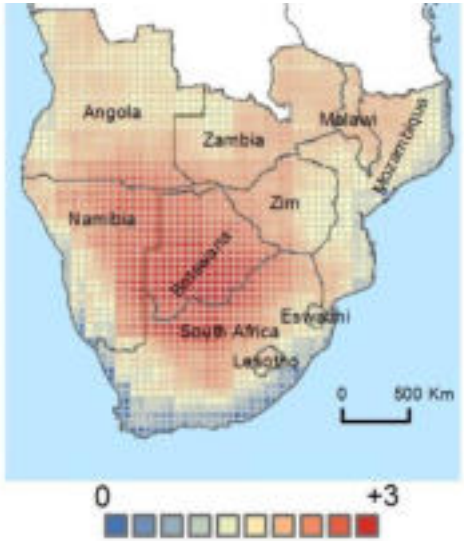
Heavy rainfall events



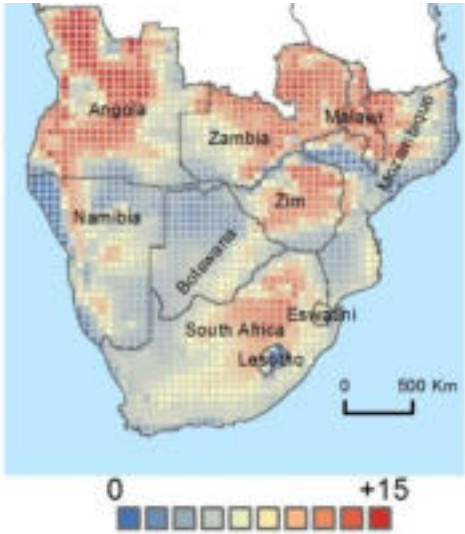
Prolonged rainfall



Warm Nights



Hot days



Changes in extreme more enhanced & variable than in weather parameters

CC and Food Security in Southern Africa

↑ Temp

Crop temperature stress:

- pollen abortion or lost viability
- reduced shoot & root growth

Increased evaporative demand:

- reduced effective rainfall
- less irrigation efficiency

Reduced nutrient uptake and metabolism



Heat stress effects on maize

CC and Food Security in Southern Africa

Rainfall



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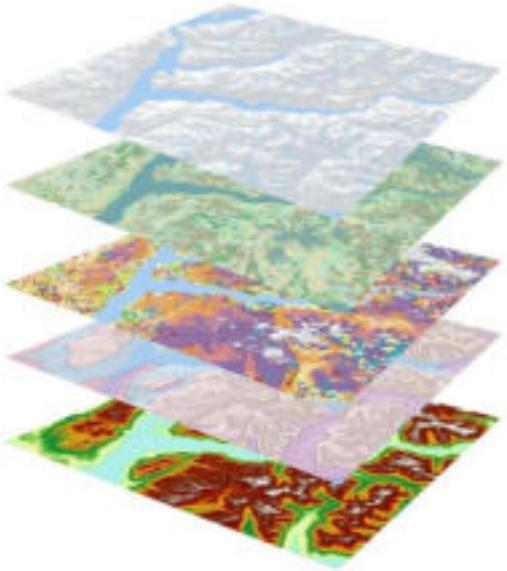
More important than temperature effects :

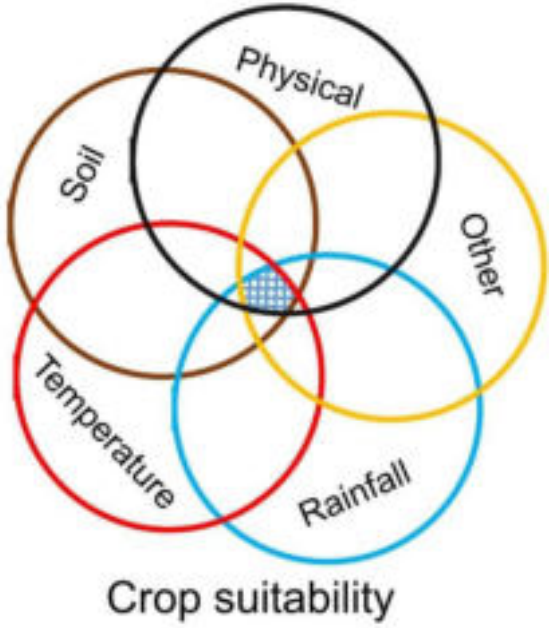
- Most limiting for food security

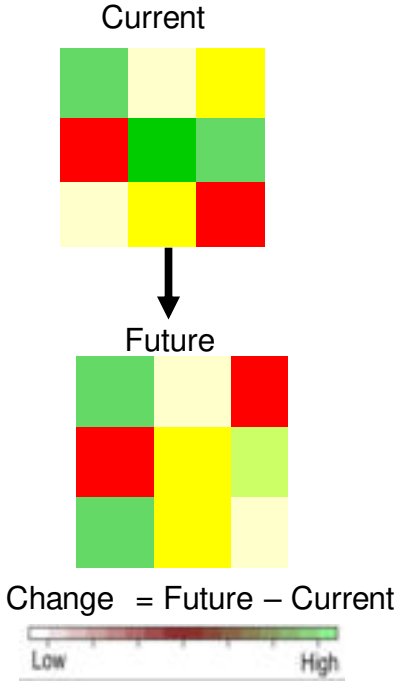
Regulates plant growth and nutrient assimilation

Directly influences biomass and grain yield components

Crop suitability

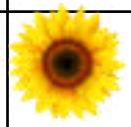






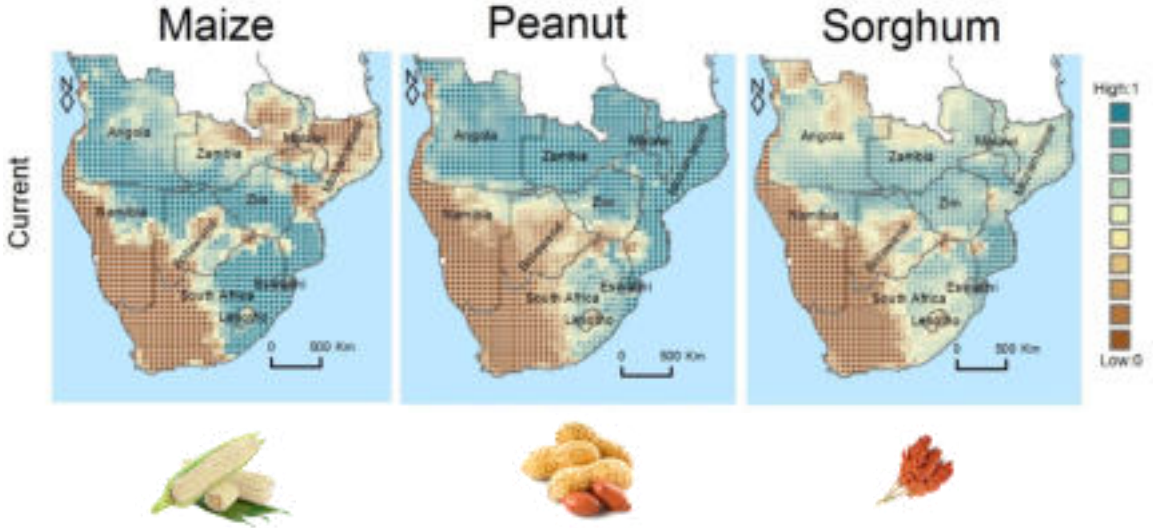
Crop suitability is a measure of the climatic and other biophysical characteristics of an area to sustain a crop production cycle (Beck, 2013; Srinivasan et al., 2019)

Importance of food crops by area (top 5)

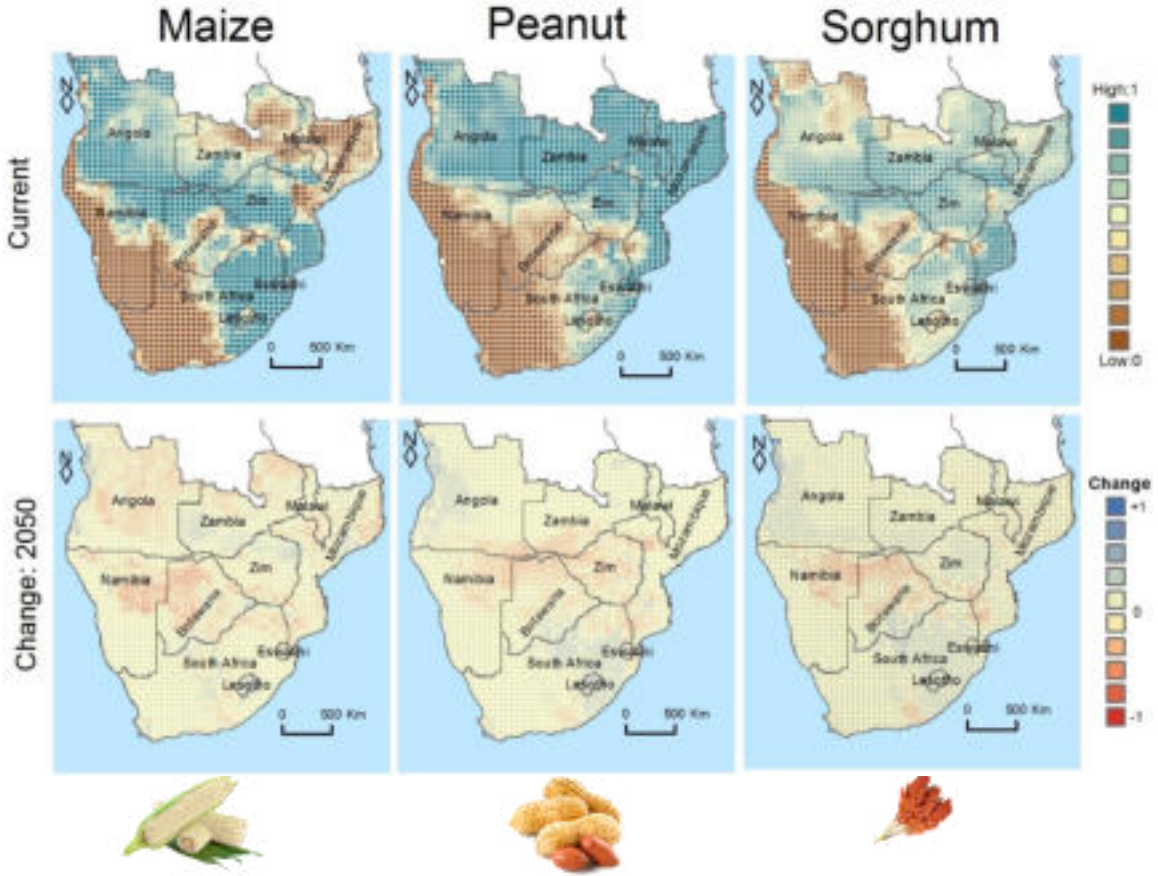
Rank	Angola	Botswana	Eswatini	Lesotho	Malawi	Mozambique	Namibia	S. Africa	Zambia	Zimbabwe	Count
1											
2											
3											
4											
5											

CC and crop suitability in Southern Africa

- Peanut more possible to the climate & soils in SADC.
- Eastern & northern parts more suited for crop production.

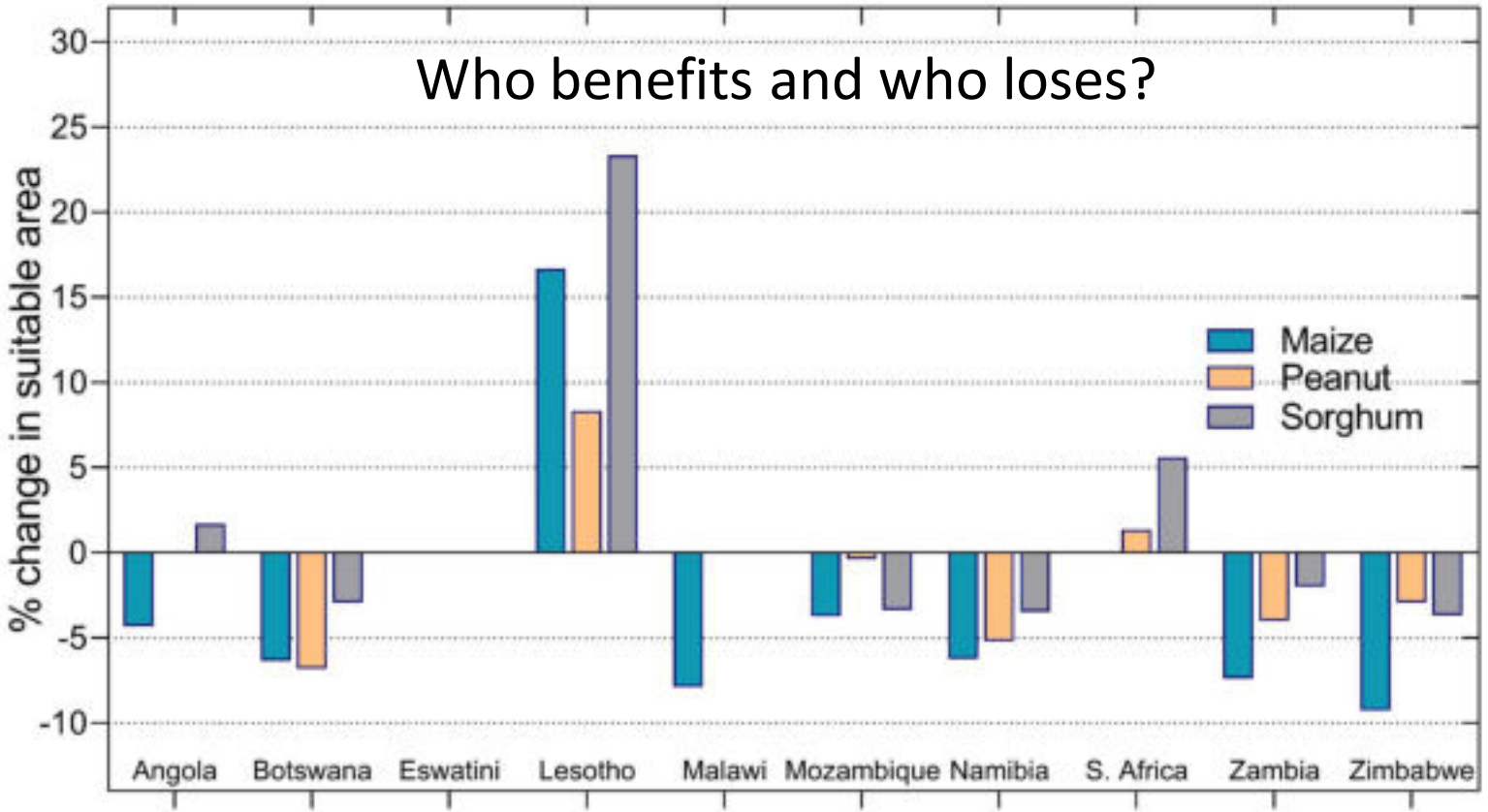


CC and crop suitability in Southern Africa



- Changes in maize & peanut more pronounced than those for sorghum.
- Parts of Angola, North Zambia & Mozambique to loose suitability for maize.

Change in suitability



Summary & conclusions

- Changes in climate are already being experienced over Southern Africa: Temp and rainfall changes
- Extreme weather events more significant in trend than weather variables.
- Crop suitability will be affected by climate change over many areas (current low productivity).
- Investments into adaptation strategies urgently required especially for maize cropping.



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Thank you.