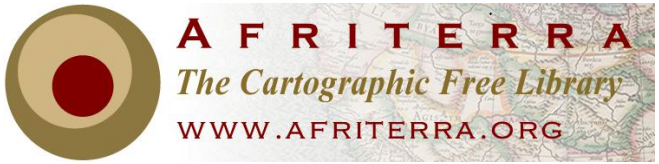

Scalability of Data, particularly Disaster Data, in Developing Countries

Dr Maryna Storie

Joint ICA-GEO Workshop: “Disaster Management, Big Data, Services and Cartographic Representation”
July 2nd 2017
Washington Marriott Wardman Park Hotel, Virginia A Room

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1. **Exciting challenges in developing countries:**
   - Respecting “old” AND “new” data;
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2. **Examples from Africa:**
   - Floodlines and flood hot spots non-scaling
   - Climate future data downscaling
   - Public health data upscaling

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Where in the world?

Setting the scene

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Image source: Reddit

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Image source: Pinterest.com

Floodlines and flood hotspots non-scaling

Image sources: Mail & Guardian / eNCA / Eye Witness News (2017)

Floodlines and flood hotspots non-scaling

Setting the scene

Image source: World Atlas / GraphicMaps.com

Floodlines and flood hotspots non-scaling

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Image source: World Atlas / GraphicMaps.com

Source: Overlapmaps.com

SA land area is slightly less than twice the size of Texas

Floodlines and flood hotspots non-scaling

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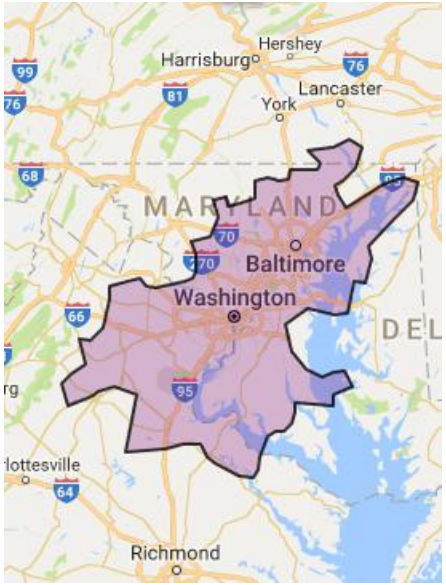
Floodlines and flood hotspots non-scaling

Image source: World Atlas / GraphicMaps.com

Gauteng Province
('Gaut' = Goud = Gold)

Floodlines and flood hotspots non-scaling



Source: Overlapmaps.com

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PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Source: GCRO

Hydrology of Gauteng, indicating rivers, wetlands, dams, flood areas and flooding hot spots

Hydrology sources: Ekurhuleni Metropolitan Municipality Corporate GIS (2012); Johannesburg Roads Agency (2012); City of Tshwane Roads and Stormwater Division (2012); West Rand District Municipality (2012); Randfontein Local Municipality Development Planning (2012); Merafong City Planning and Environmental Management (2012)

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Floodlines and flood hotspots non-scaling

Western Cape Province

Image source: World Atlas / GraphicMaps.com

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Western Cape Province

Western Cape Government
Department of the Premier

Implementing Spatial Data Governance In the Western Cape Government

A success story

Better data and information; better decision; known to all

Vision statement

Transforming into a Data and Information driven Organisation

Leadership towards coherence in data use and production

Pillars to achieve journey

- Relevant and accurate data and information
- Partner in data and information products and systems
- Accountability and transparency
- Informing Stakeholders

Journey

Four stream approach to deliver BI that is underpinned by Province-wide Data Governance

Source: Du Preez, J:
Director: Provincial Spatial Information

Opportunities…

- Driven by urgency, but also by passion

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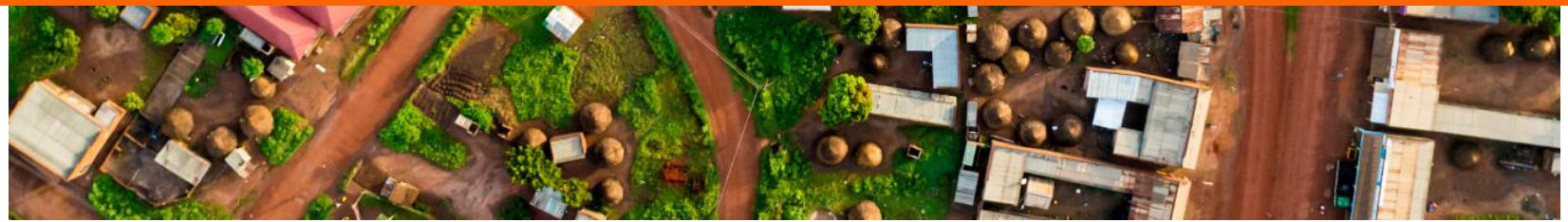
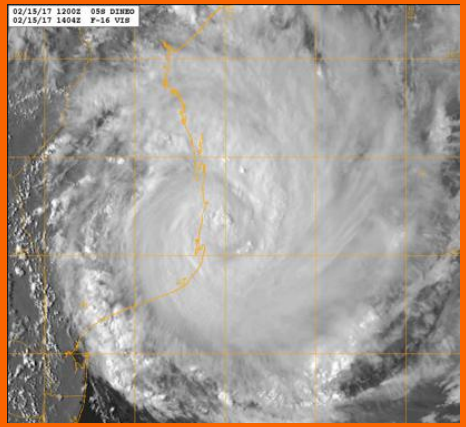
- Create awareness of the need to address the challenges
- Move from “We have good Acts but they are not being implemented” or “We do not yet have the SDI resolved to make it work” to “Implement and use what we have NOW and improve it over time”



Climate future data downscaling



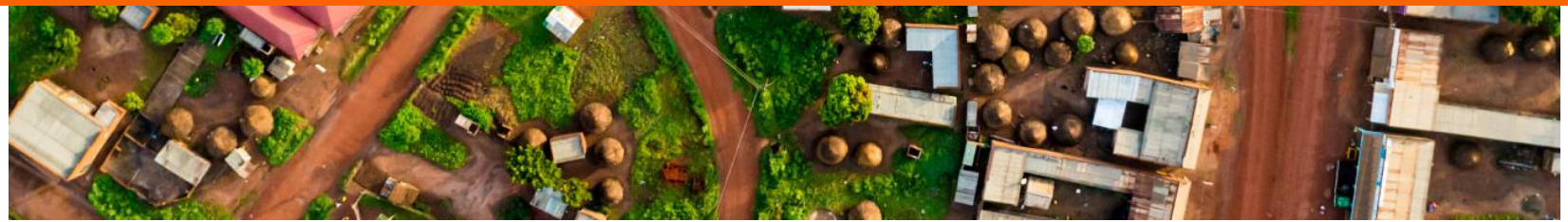


Image sources: African Leadership Magazine (2016) / eNCA (2017)

Climate future data downscaling

Setting the scene:

15 River Basins
(SADC)

Image source: Orange-Senqu River Awareness Kit
(www.orangesenqurak.com/river/Geography)

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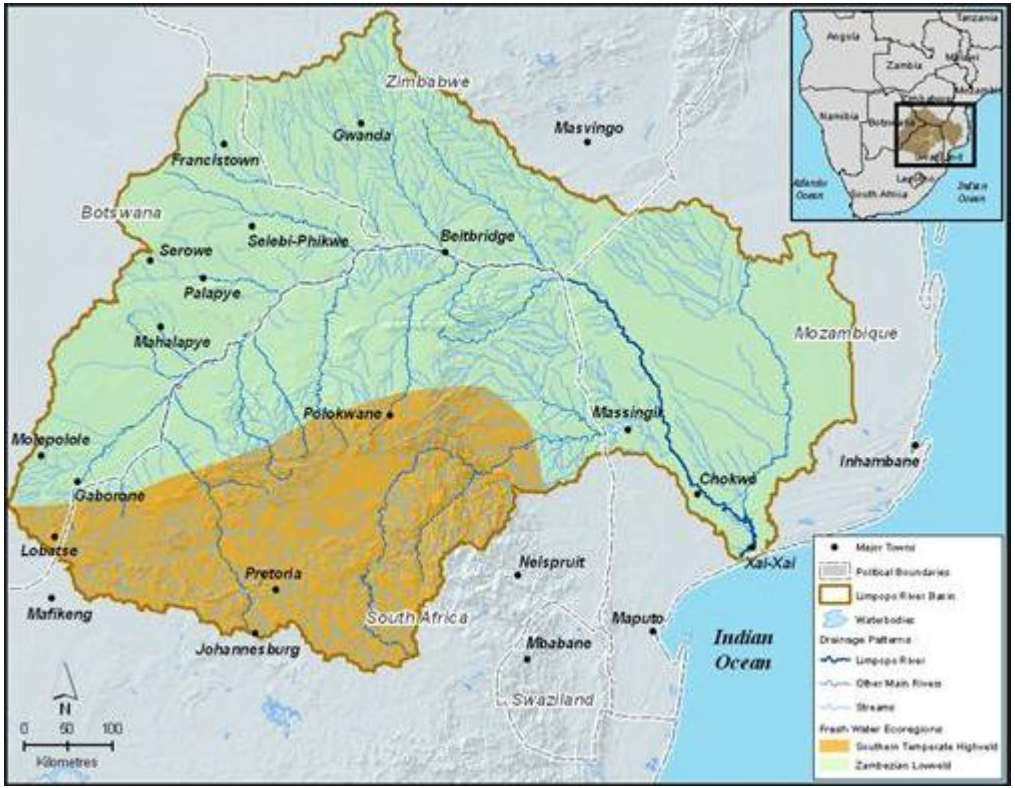

Image source: Limpopo River Awareness Kit (www.Limpopo.riverawareneskit.org)

Climate future data downscaling

Setting the scene:

“Geography leaves Mozambique vulnerable, whatever disaster reduction measures are in place.

Thirteen (13) rivers with sources in neighbouring countries empty into the Indian Ocean after traversing Mozambique, which must rely on South Africa and Swaziland to keep downstream areas in mind when managing their dams” or engage in early warning when flood events occur upstream.

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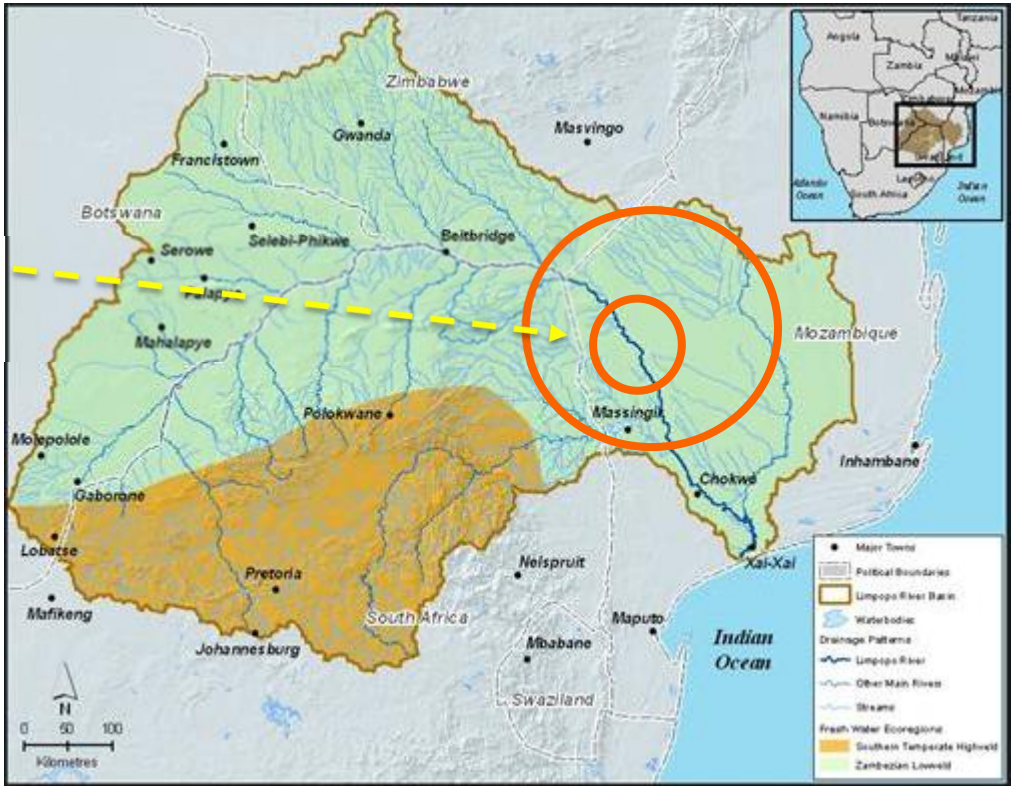
“The African continent as a whole has significant vulnerability to climate change. In particular, severity of climatic hazards and climate change impacts are relatively strong. The expected severity of climatic impacts of the hydrological regime will be relatively more severe than what would be expected elsewhere in the world”.

Source: https://phys.org/news/2013-02-mozambique-due-early.html#jCp / Engelbrecht *et al*, 2015 (CSIR)

Climate future data downscaling

Setting the scene:

Adaptation & Mitigation:
flood / drought /
food security / energy



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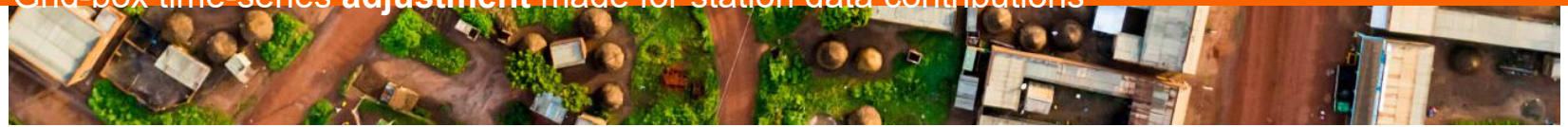
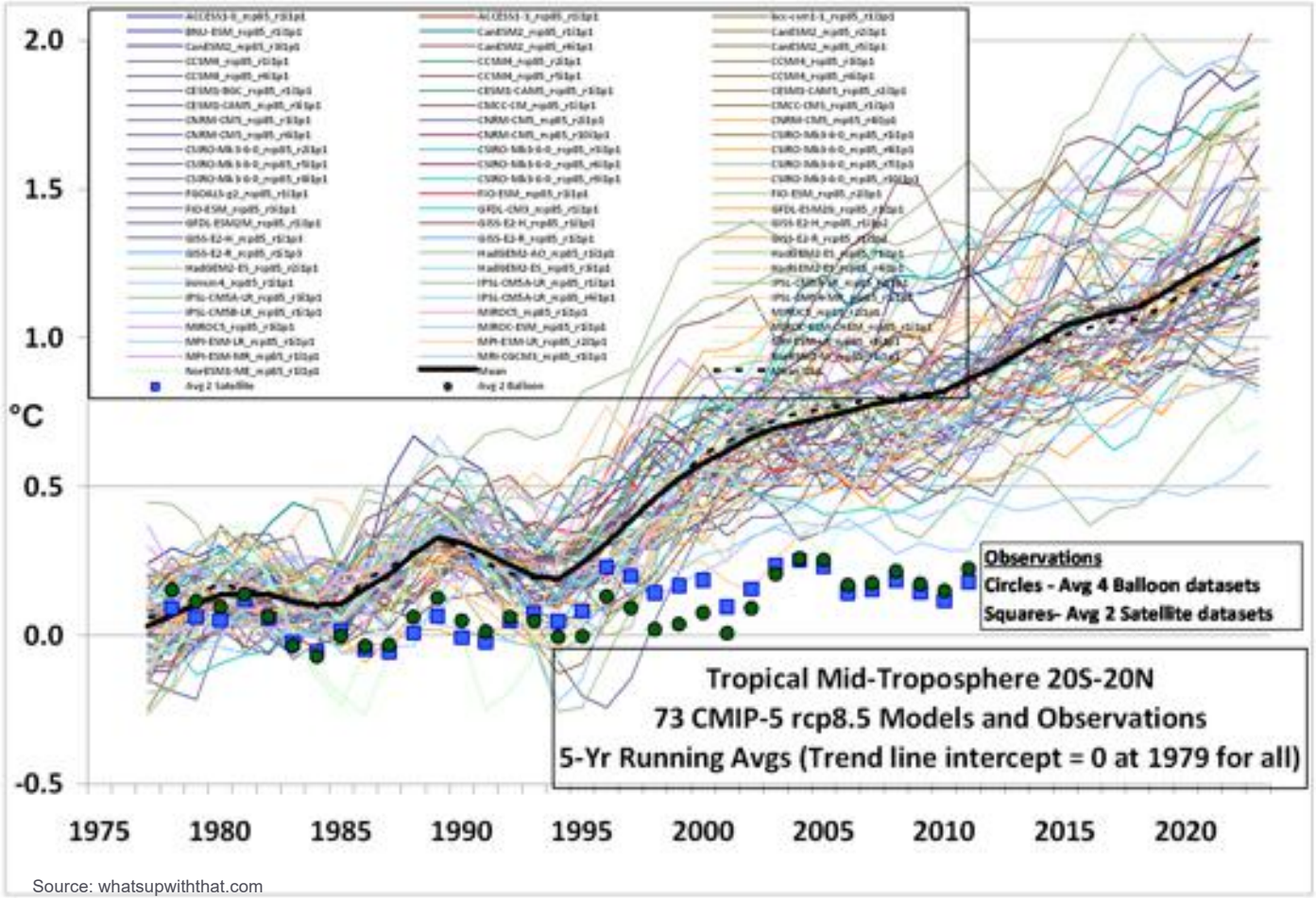


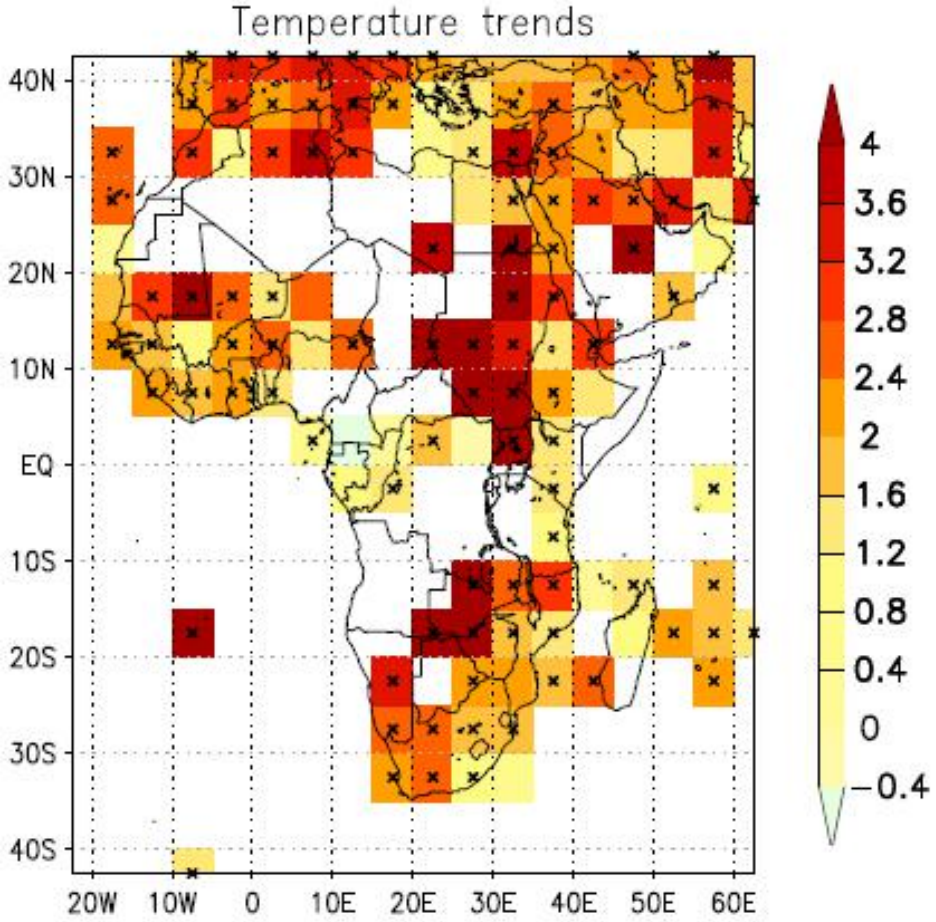


Source: whatsupwiththat.com

Parameters: e.g.

- Solar radiation
- Land and ocean water distribution
- Land ice distribution
- Sea surface temperatures and sea ice
- Soil temperature
- Soil moisture
- Cloud distribution
- Cumulus cloud convection
- Greenhouse gas constituents: CO_2, Sulphate and Ozone

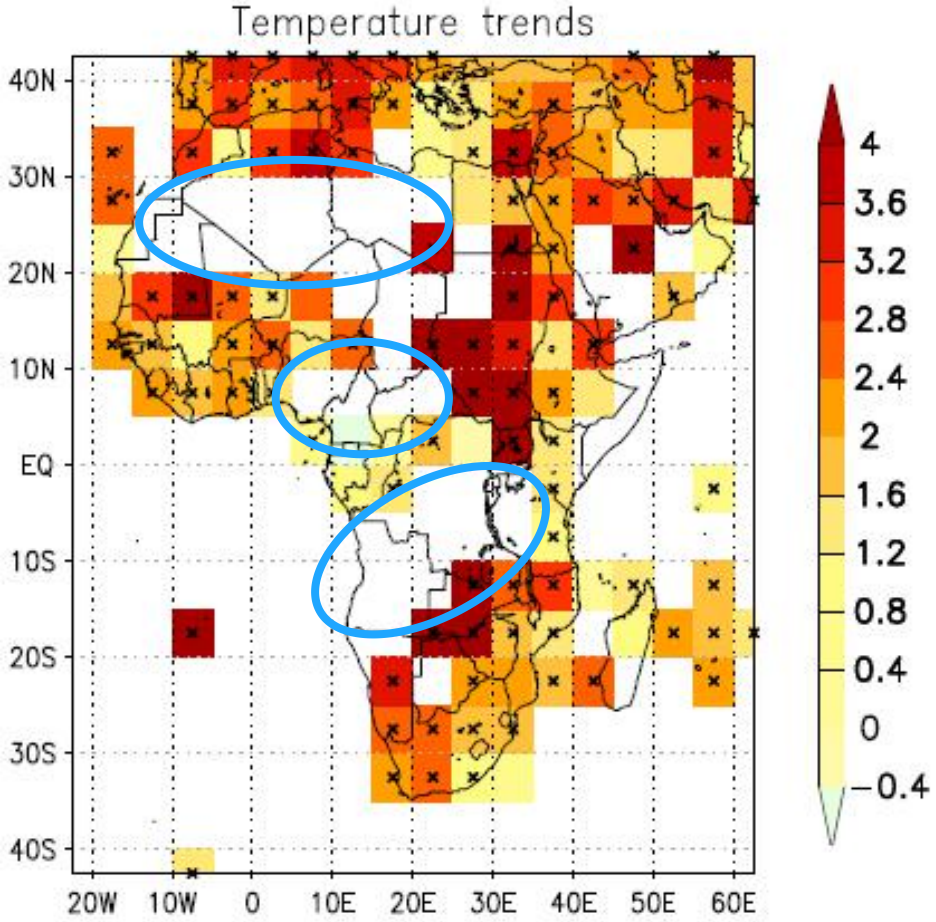
- Fire occurrences/vegetation types/fuel biomass not included



Observed trends in annual-average near-surface temperatures (°C/century) over Africa for the period 1961–2010,

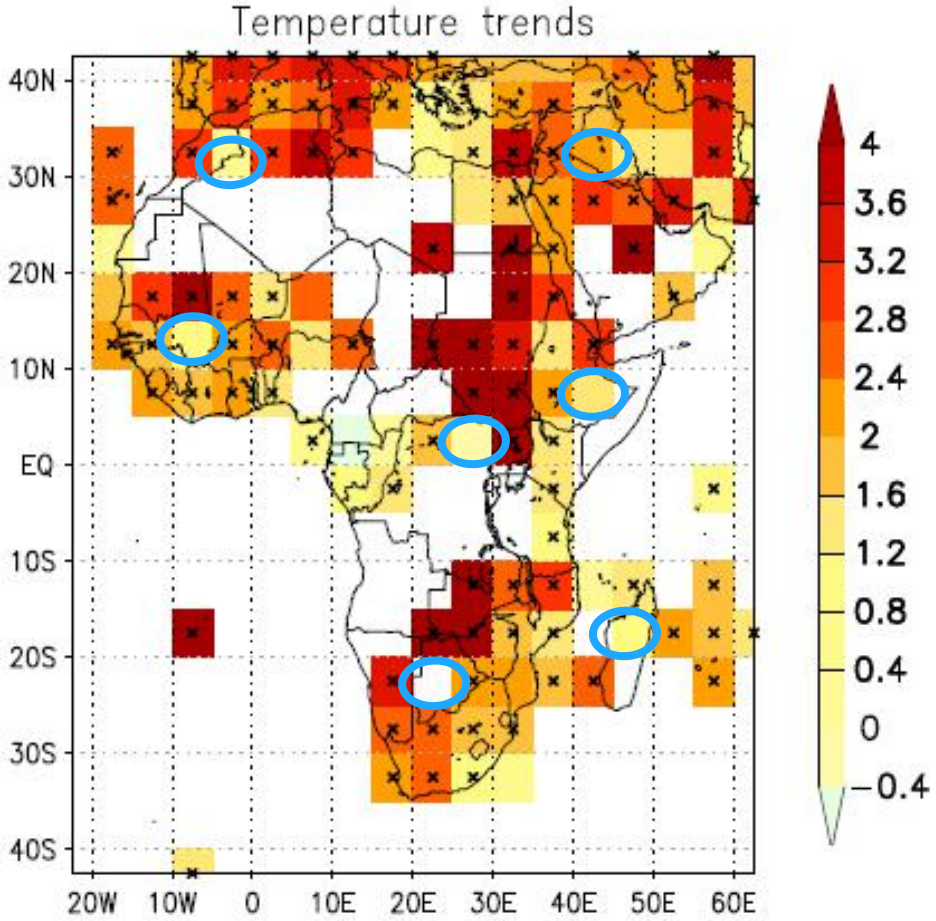
calculated using the method of pairwise-slopes applied to the 5° longitude × 5° latitude gridded CRUTEM4v data of CRU. The grid boxes where the trends are statistically significant according to the Spearman rank correlation test are indicated by crosses.

Source: Engelbrecht, F, Adegoke, J., Bopape, M-J., Naidoo, M., Garland, R., Thatcher, M., McGregor, J., Katzfey, J., Werner, M., Ichoku, C., Gateb, C. (2015)



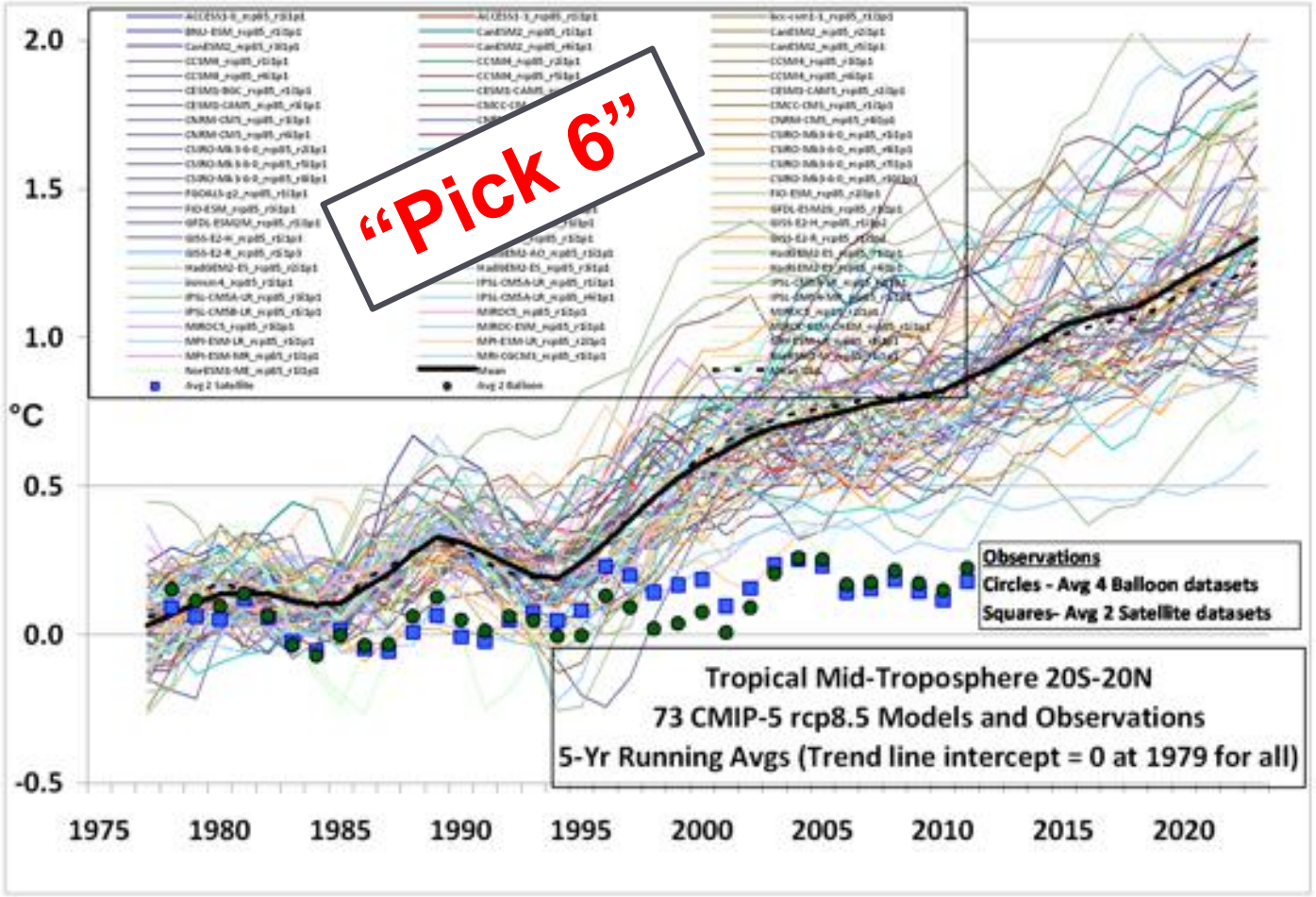
Lack of observed data

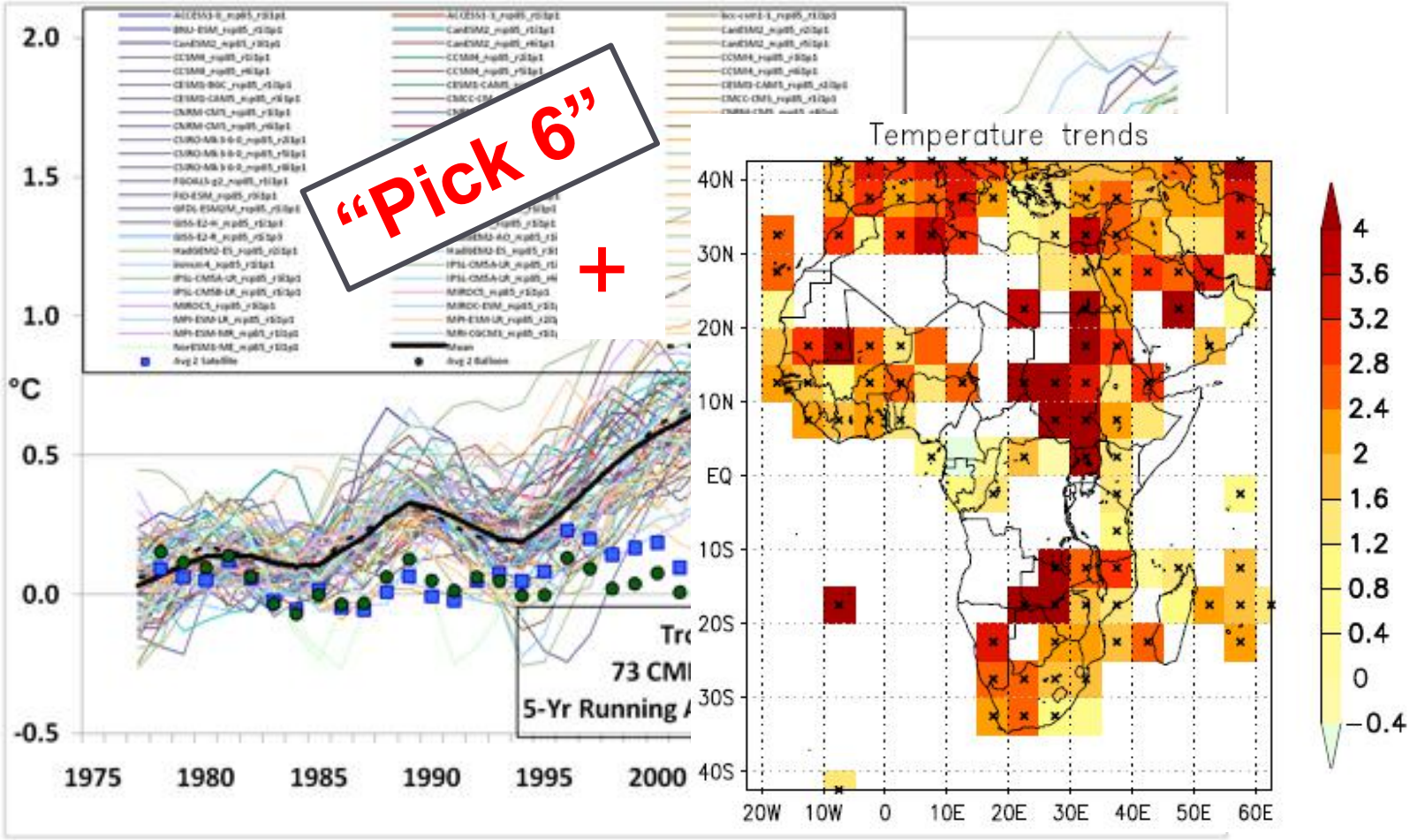
Source: Engelbrecht, F, Adegoke, J., Bopape, M-J., Naidoo, M., Garland, R., Thatcher, M., McGregor, J., Katzfey, J., Werner, M., Ichoku, C., Gateb, C. (2015)



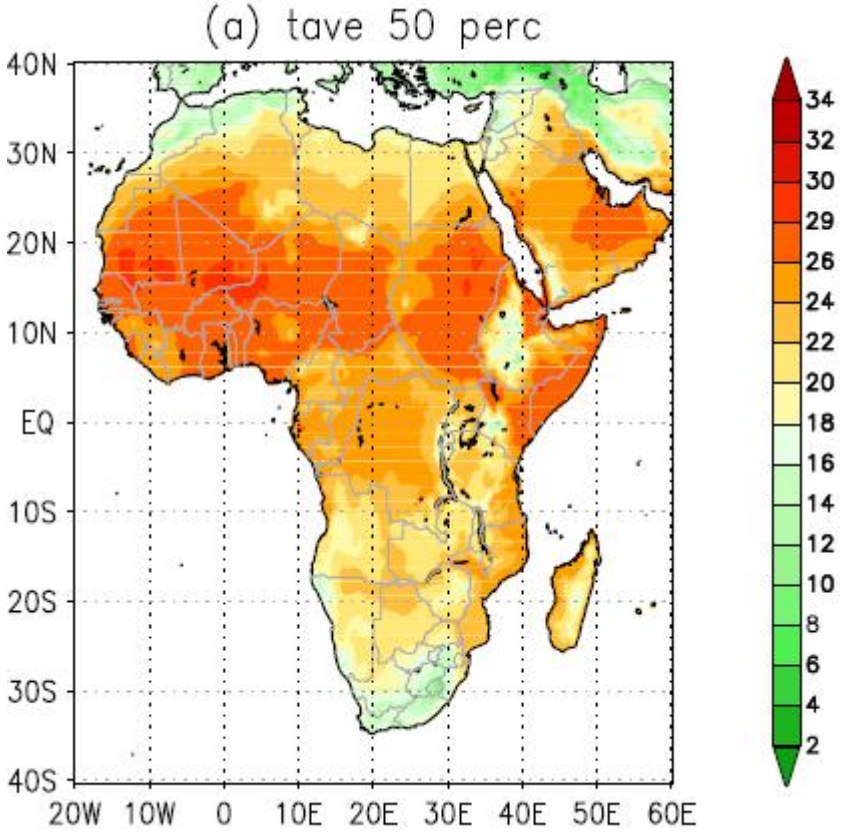
Statistical significance uncertain in some locations

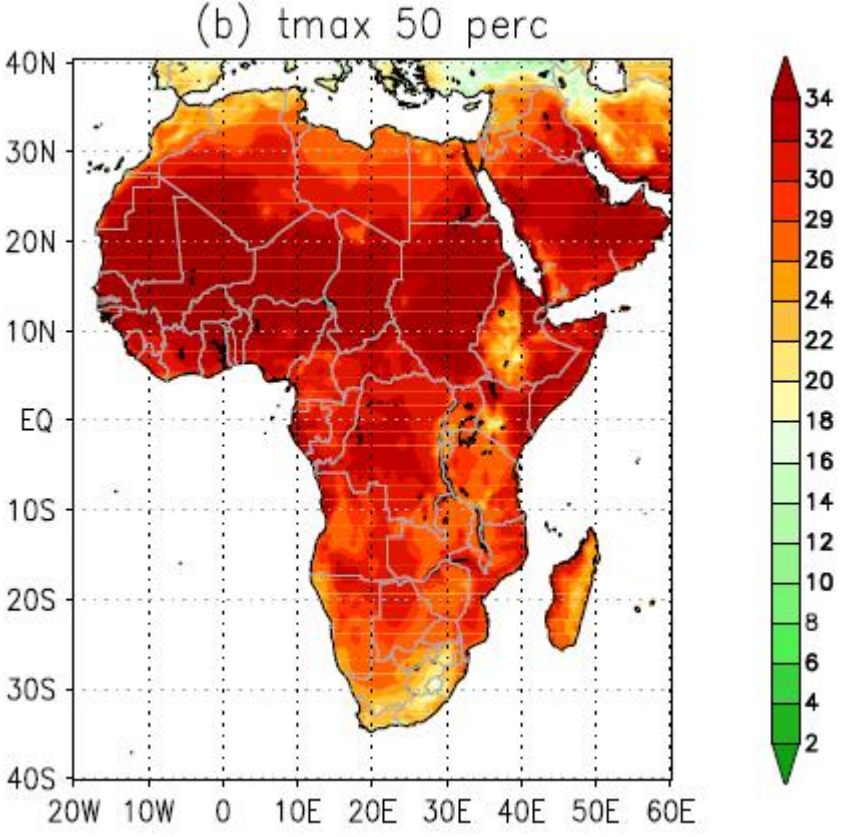
Source: Engelbrecht, F, Adegoke, J., Bopape, M-J., Naidoo, M., Garland, R., Thatcher, M., McGregor, J., Katzfey, J., Werner, M., Ichoku, C., Gateb, C. (2015)


"Pick 6"
2.0
1.5
1.0
°C
0.5
0.0
-0.5
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Observations
Circles - Avg 4 Balloon datasets
Squares- Avg 2 Satellite datasets
Tropical Mid-Troposphere 20S-20N
73 CMIP-5 rcp8.5 Models and Observations
5-Yr Running Avgs (Trend line intercept = 0 at 1979 for all)


"Pick 6"
+
Temperature trends
°C
2.0
1.5
1.0
0.5
0.0
-0.5
1975
1980
1985
1990
1995
2000
5-Yr Running
73 CMI
40N
30N
20N
10N
EQ
10S
20S
30S
40S
20W
10W
0
10E
20E
30E
40E
50E
60E
4
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0
−0.4

Expected average & maximum temperatures (°C)





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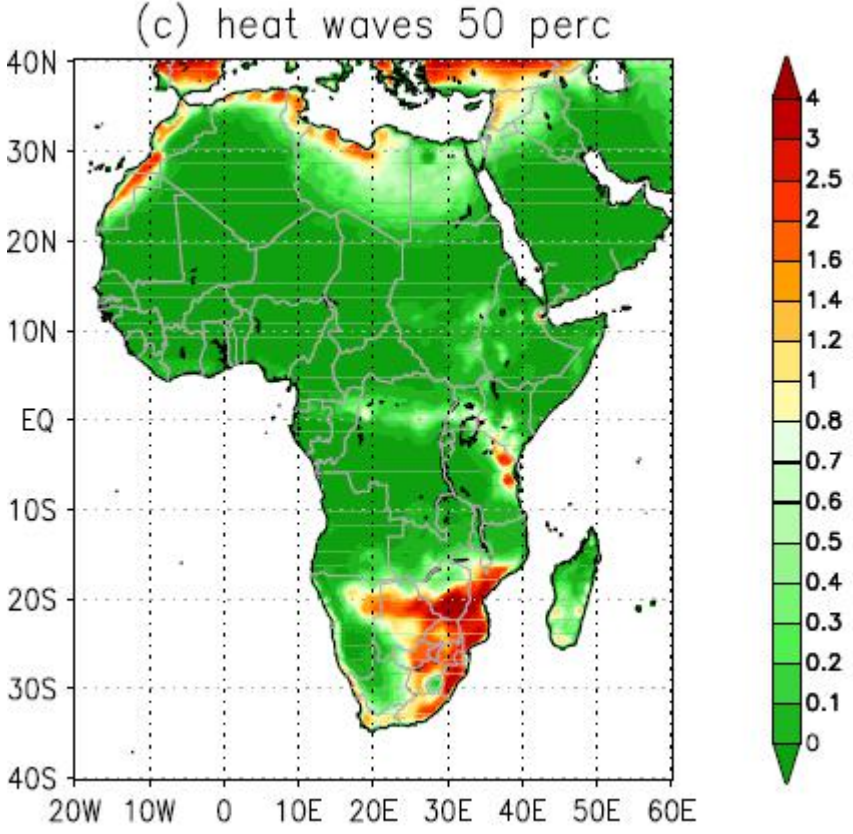
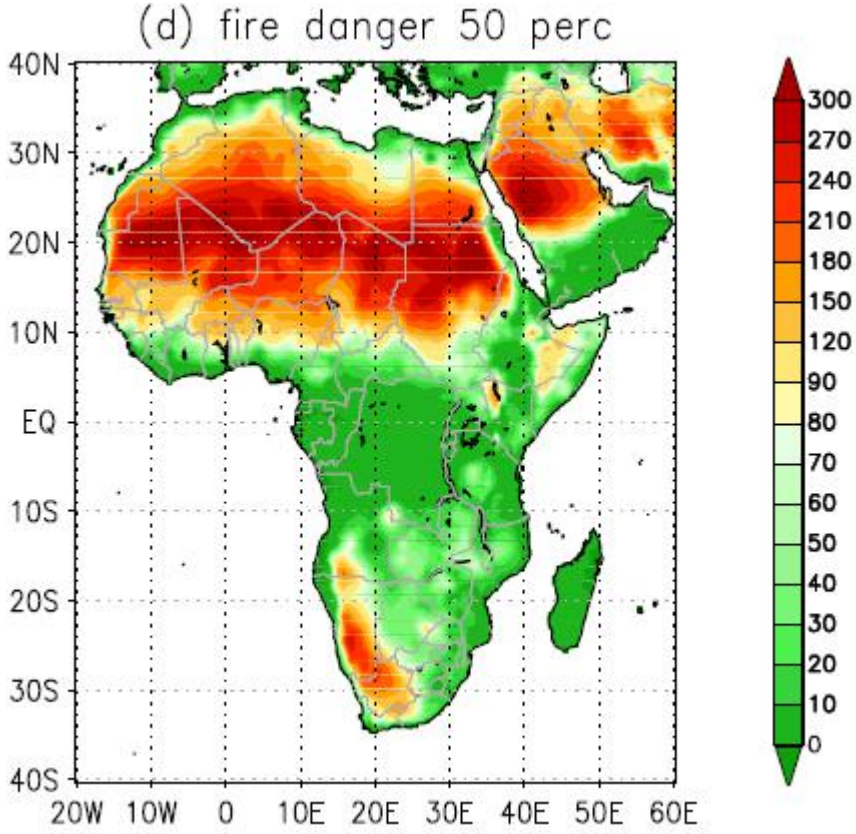
Heat waves & Fire index indications





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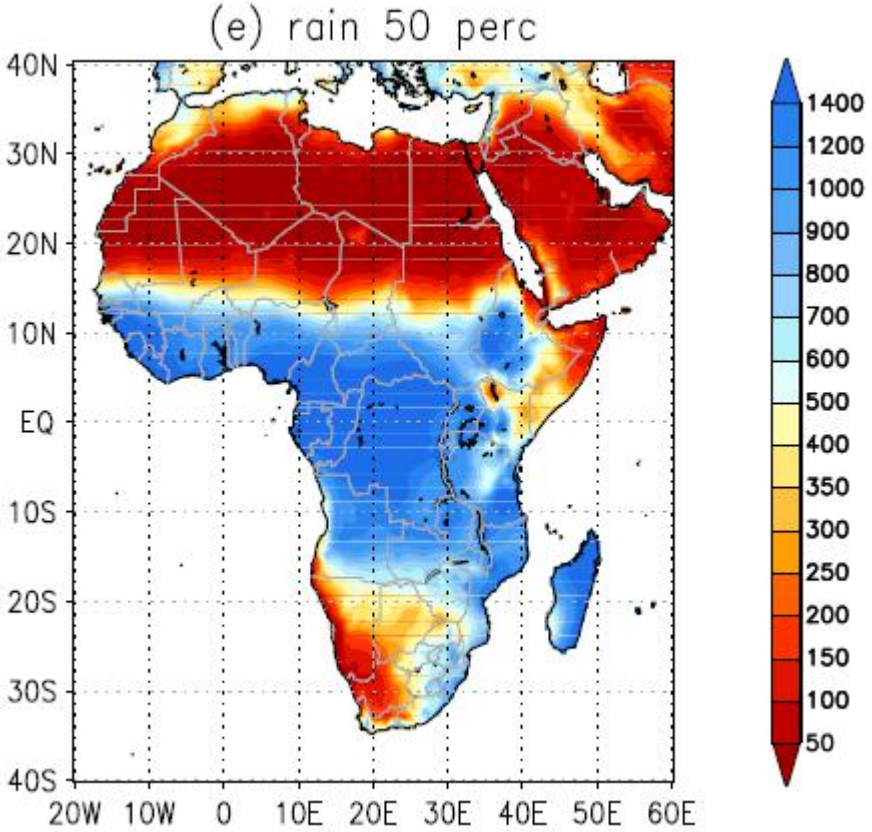
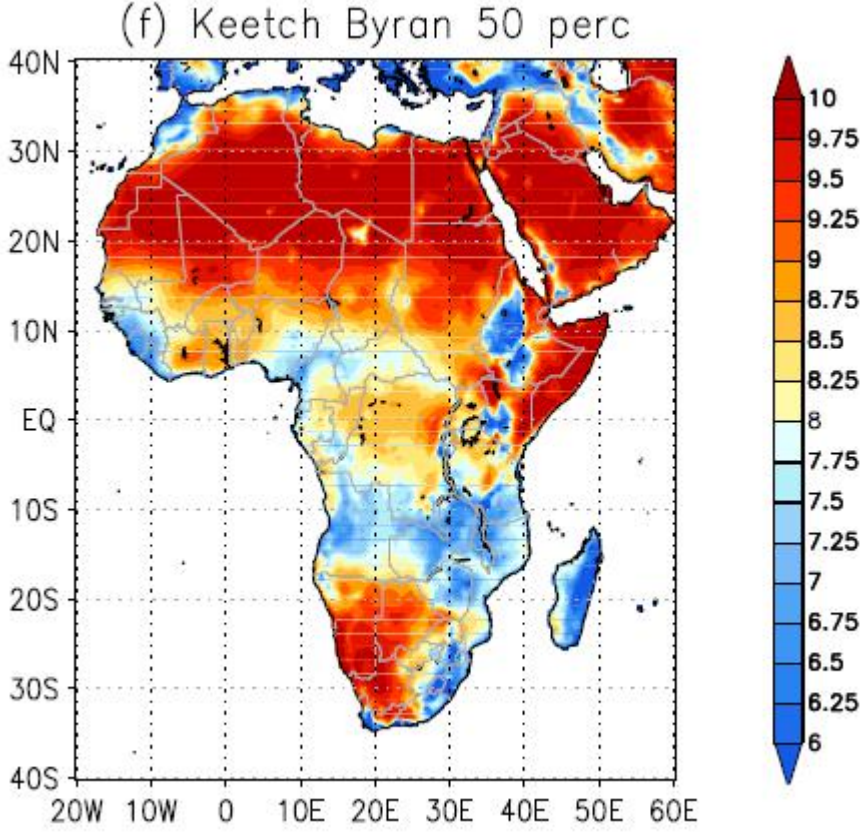
Rainfall & Drought indications





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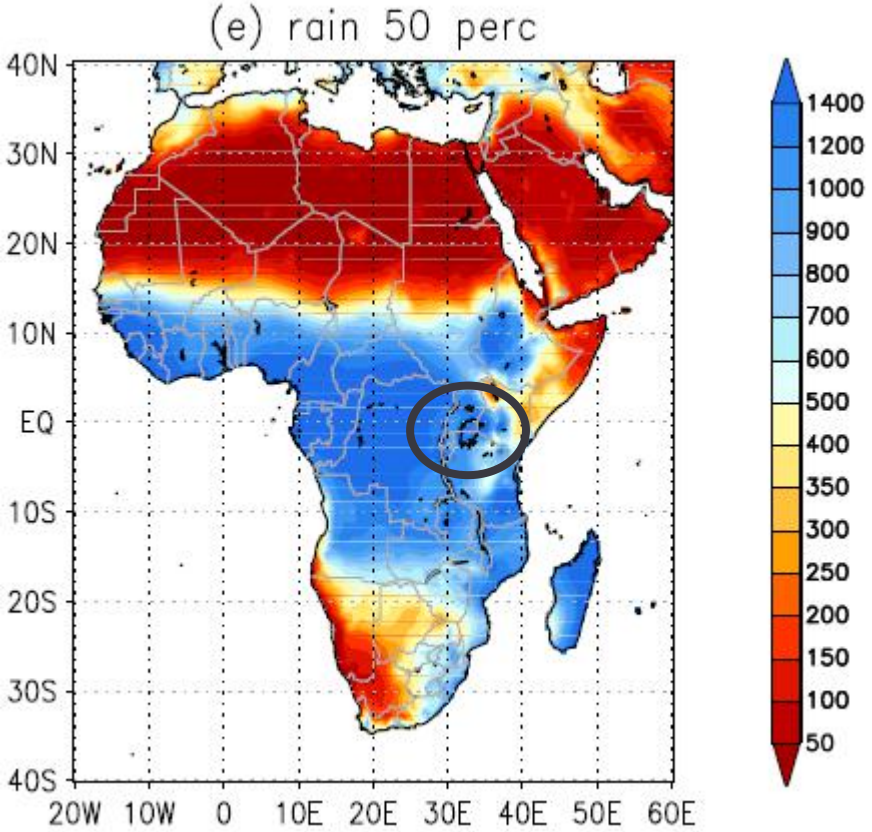
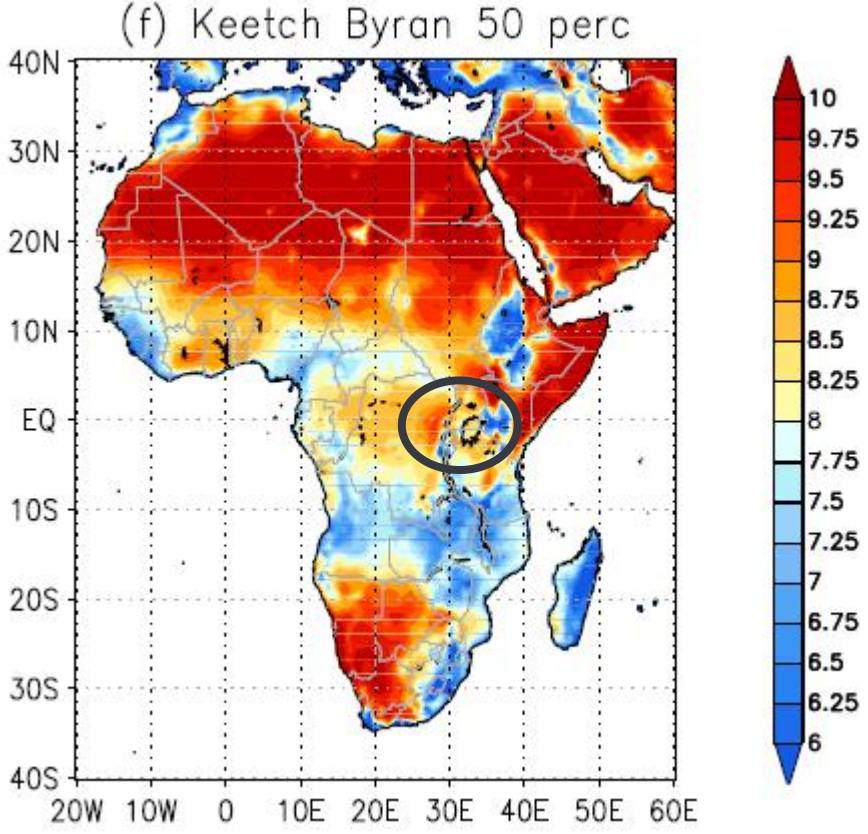
Rainfall & Drought indications





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Now to apply the results to basin-level programmes… e.g. considering rainfall

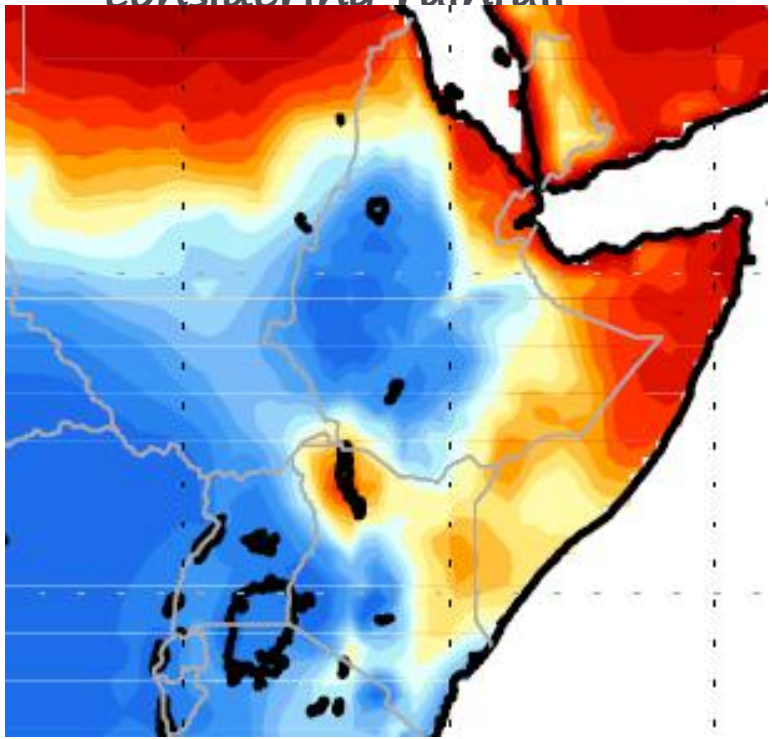
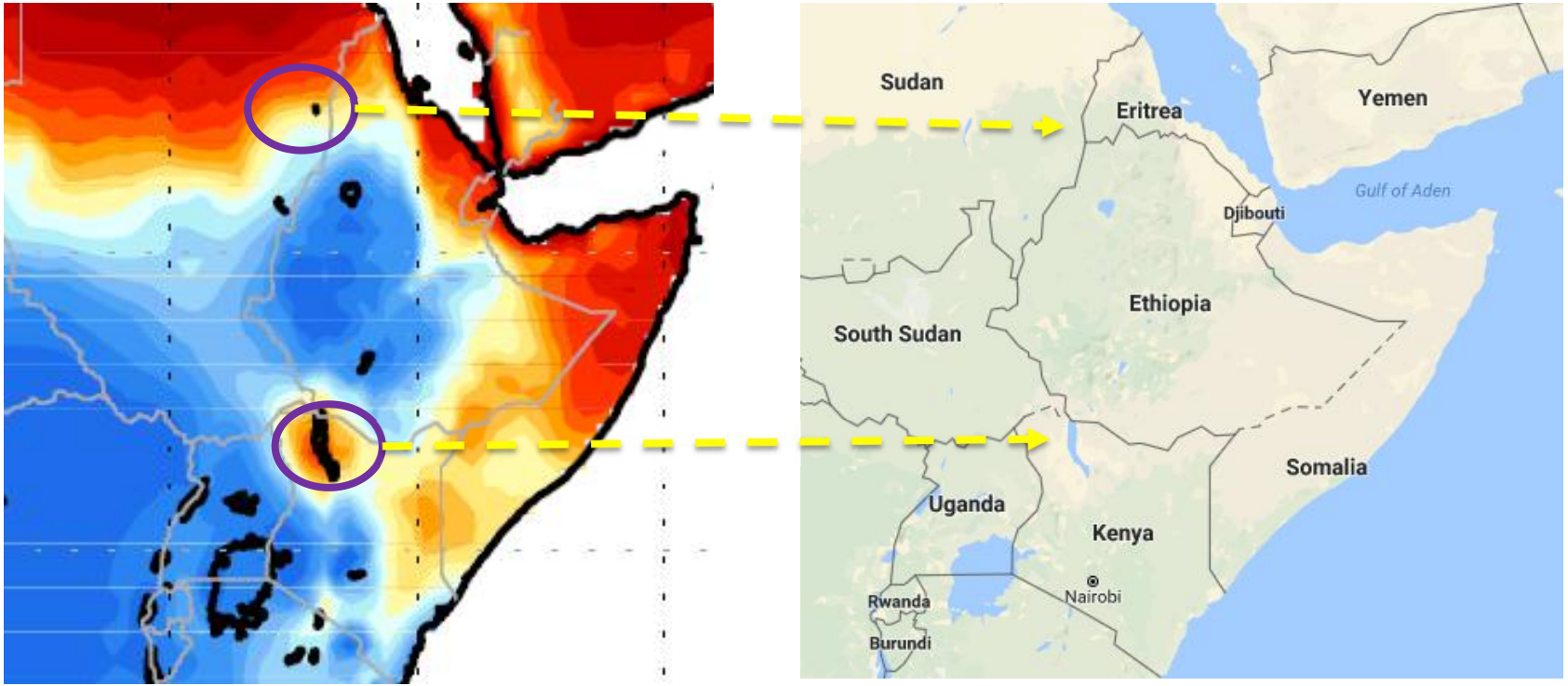


Image source: Clipped from Engelbrecht, F, Adegoke, J., Bopape, M-J., Naidoo, M., Garland, R., Thatcher, M., McGregor, J., Katzfey, J., Werner, M., Ichoku, C., Gateb, C. (2015)

Now to apply the results to basin-level programmes…



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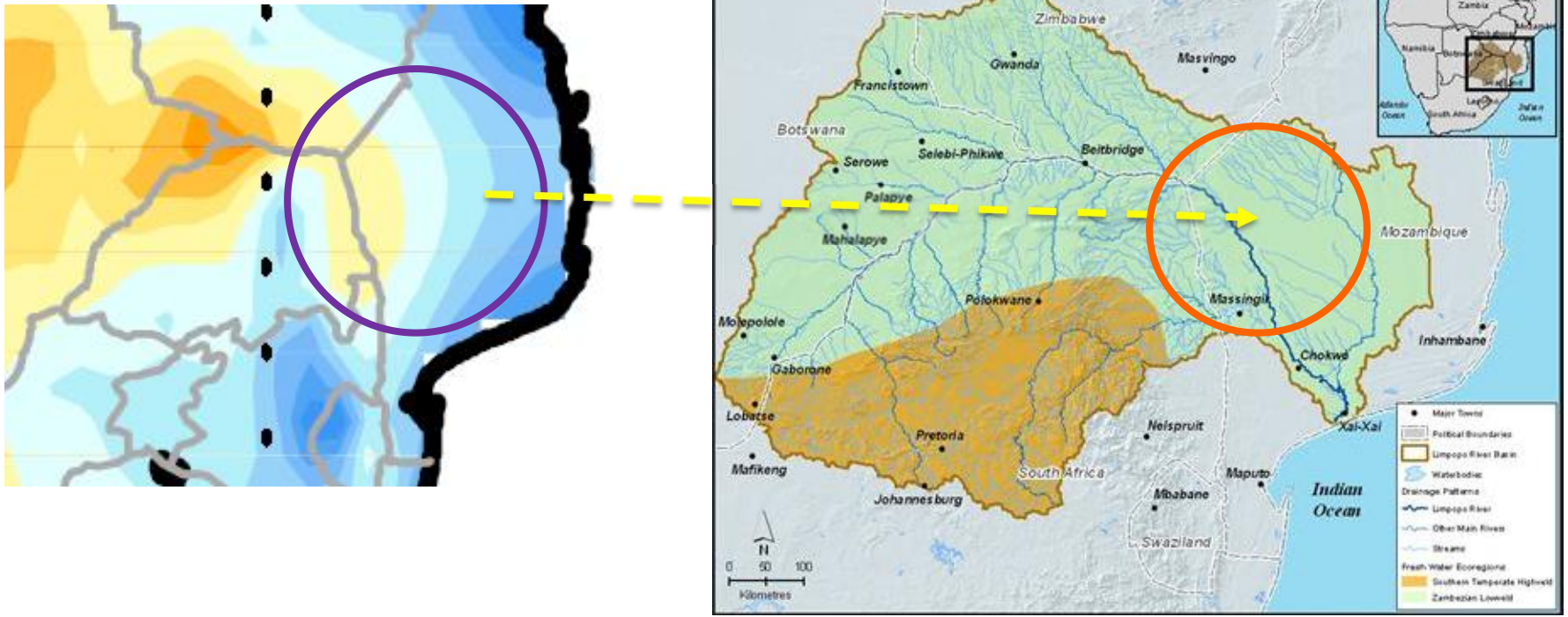
Now to apply the results to basin-level programmes…



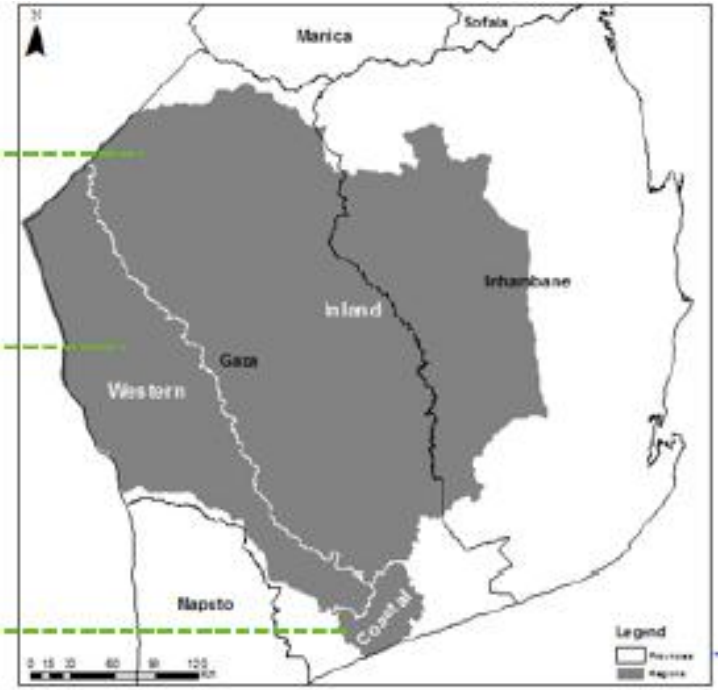
Downscaling may not be perfect, but opportunities exist:

- It provide much-needed insight into the future climate that Africa faces.
- At most locations the signatures are **statistically significant**.
- Enable **real impacts** in terms of infrastructure investment, early warning systems, agricultural practices, human health intervention & natural resource management.

Inland Region	Current Vulnerability	Future Vulnerability
Climatic Factors	High	High
Water Availability	High	High
Flood Events	High	High
Drought Periods	High	High

Western Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Medium	Medium
Water Availability	Medium	High
Flood Events	High	High
Drought Periods	High	High

Coastal Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Low	Low
Water Availability	Medium	High
Flood Events	High	High
Drought Periods	Medium	Medium



Sector Vulnerability for each of the Three Regions of the Lower Limpopo Basin:

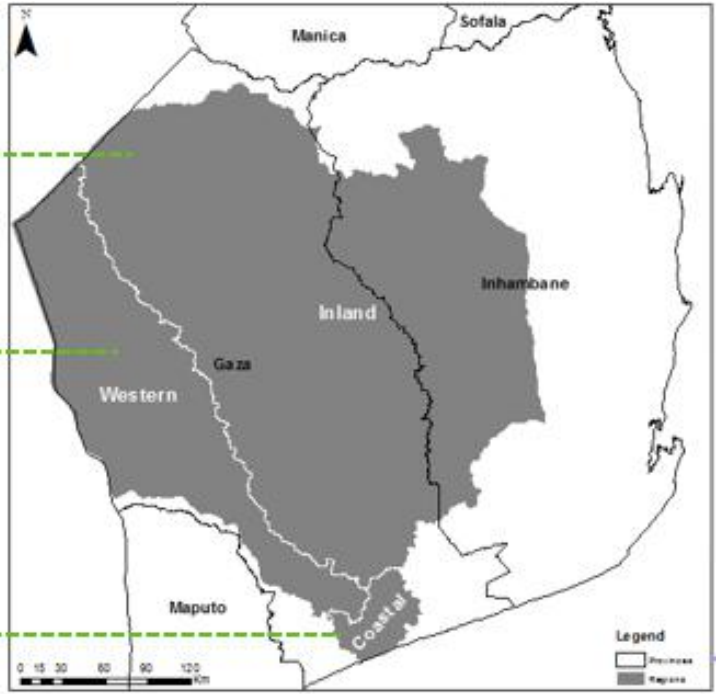
Agriculture

Source: PEGASYS / Climate & Development Knowledge Network (CDKN) / ARA-Sul

Inland Region	Current Vulnerability	Future Vulnerability
Climatic Factors	High	High
Water Availability	High	High
Flood Events	High	High
Drought Periods	High	High

Western Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Medium	Medium
Water Availability	High	High
Flood Events	High	High
Drought Periods	High	High

Coastal Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Low	Low
Water Availability	High	Medium
Flood Events	High	High
Drought Periods	Medium	High



Sector Vulnerability for each of the Three Regions of the Lower Limpopo Basin:

Agriculture

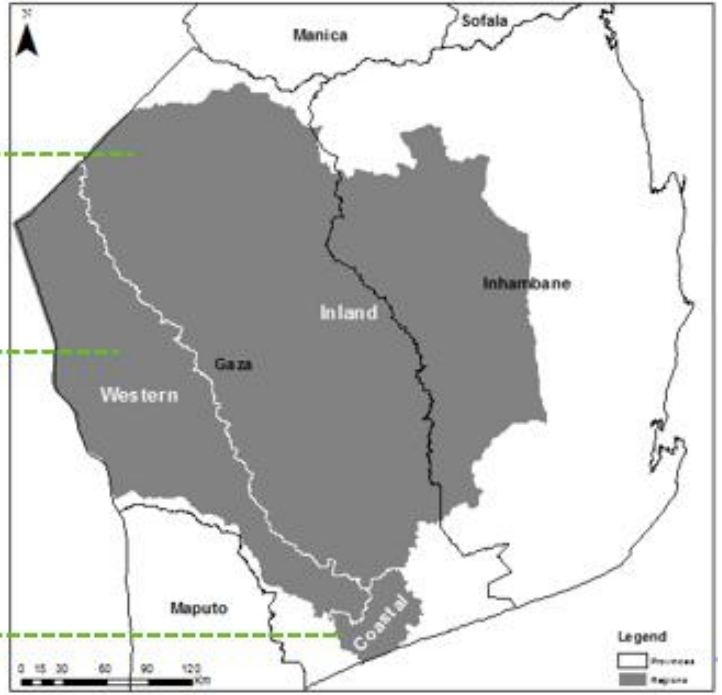
Human Safety & Health

Source: PEGASYS / Climate & Development Knowledge Network (CDKN) / ARA-Sul

Inland Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Low	Medium
Water Availability	High	High
Flood Events	High	High
Drought Periods	High	High

Western Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Low	Low
Water Availability	High	High
Flood Events	High	High
Drought Periods	High	High

Coastal Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Low	Low
Water Availability	High	High
Flood Events	High	High
Drought Periods	Medium	Medium



Sector Vulnerability for each of the Three Regions of the Lower Limpopo Basin:

Agriculture

Human Safety & Health

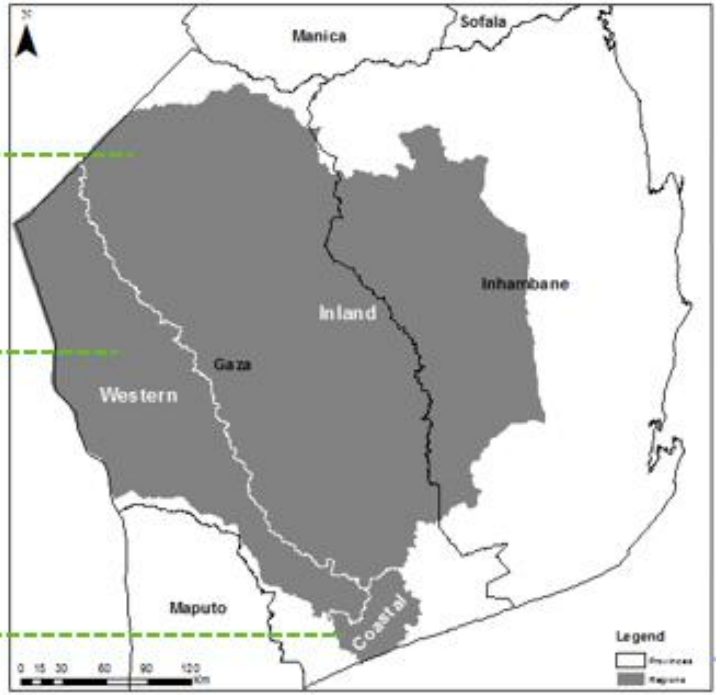
Water supply and Sanitation

Source: PEGASYS / Climate & Development Knowledge Network (CDKN) / ARA-Sul

Inland Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Low	Medium
Water Availability	Low	Medium
Flood Events	High	High
Drought Periods	Low	Medium

Western Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Low	Low
Water Availability	Medium	High
Flood Events	High	High
Drought Periods	Low	Medium

Coastal Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Low	Low
Water Availability	Low	Medium
Flood Events	High	High
Drought Periods	Low	Low



Sector Vulnerability for each of the Three Regions of the Lower Limpopo Basin:

Agriculture

Human Safety & Health

Water supply and Sanitation

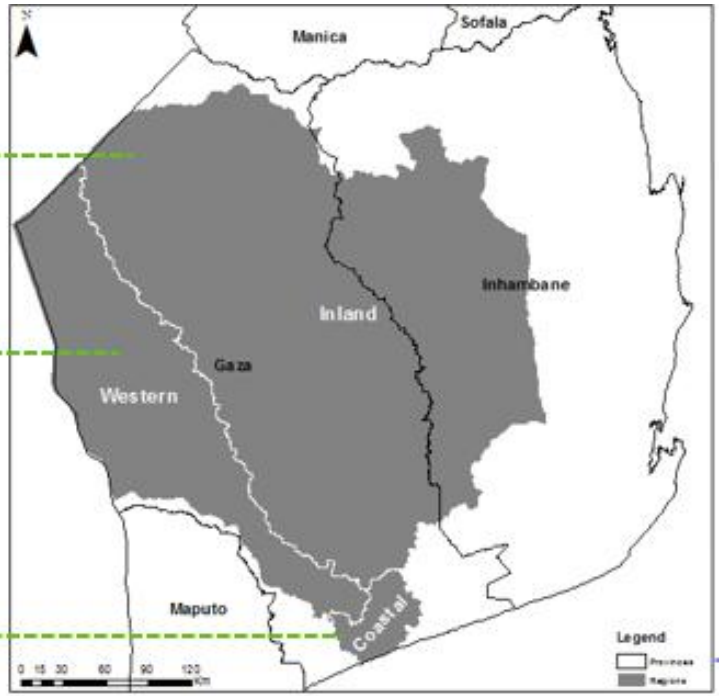
Economic Infrastructure

Source: PEGASYS / Climate & Development Knowledge Network (CDKN) / ARA-Sul

Inland Region	Current Vulnerability	Future Vulnerability
Climatic Factors	High	High
Water Availability	High	High
Flood Events	High	High
Drought Periods	High	High

Western Region	Current Vulnerability	Future Vulnerability
Climatic Factors	High	High
Water Availability	High	High
Flood Events	High	High
Drought Periods	High	High

Coastal Region	Current Vulnerability	Future Vulnerability
Climatic Factors	Medium	Medium
Water Availability	High	High
Flood Events	High	High
Drought Periods	High	High



Source: PEGASYS / Climate & Development Knowledge Network (CDKN) / ARA-Sul

Sector Vulnerability for each of the Three Regions of the Lower Limpopo Basin:

Agriculture

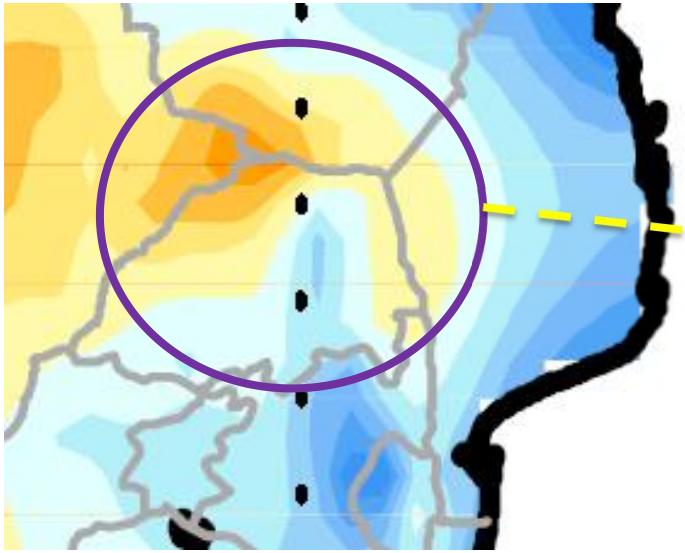
Human Safety & Health

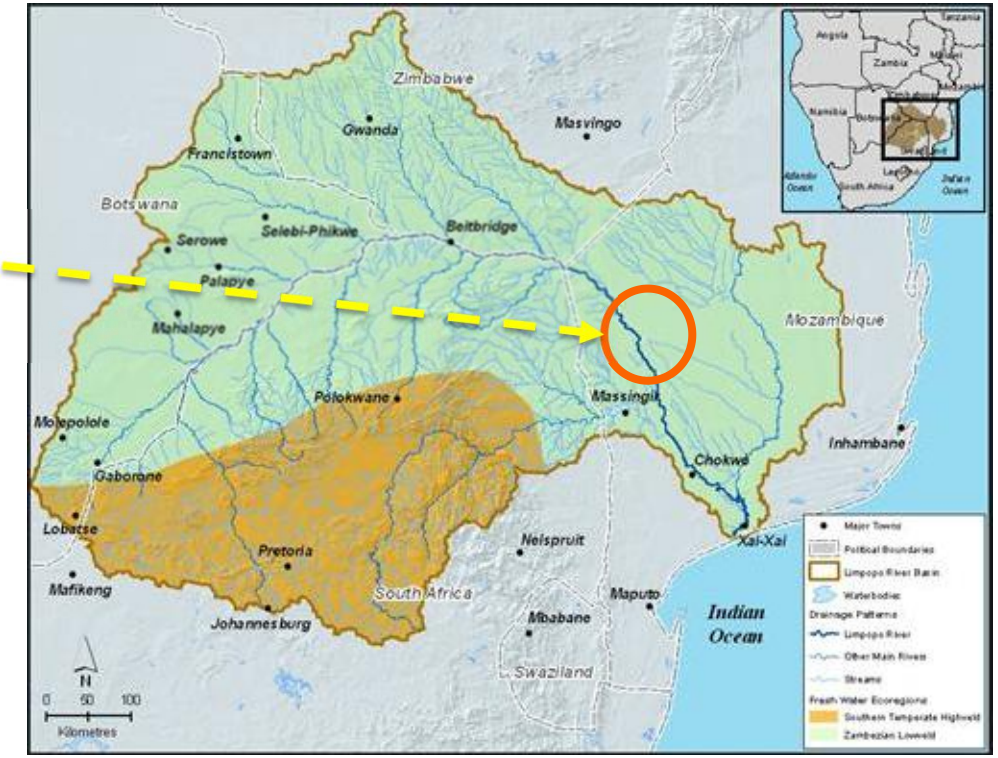
Water supply and Sanitation

Economic Infrastructure

Conservation & Ecosystems

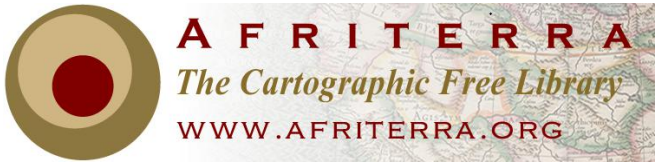
And to specific infrastructure decision making and design parameters…





Tangible and positively implementable results

Image sources: World Bank Group / Power Online



Thank you!

Dr Maryna Storie

Scalability of Data, particularly Disaster Data, in Developing Countries