Projections of future climate change in Africa – the physical science base

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bit.ly/ipcc_outreach_ghana

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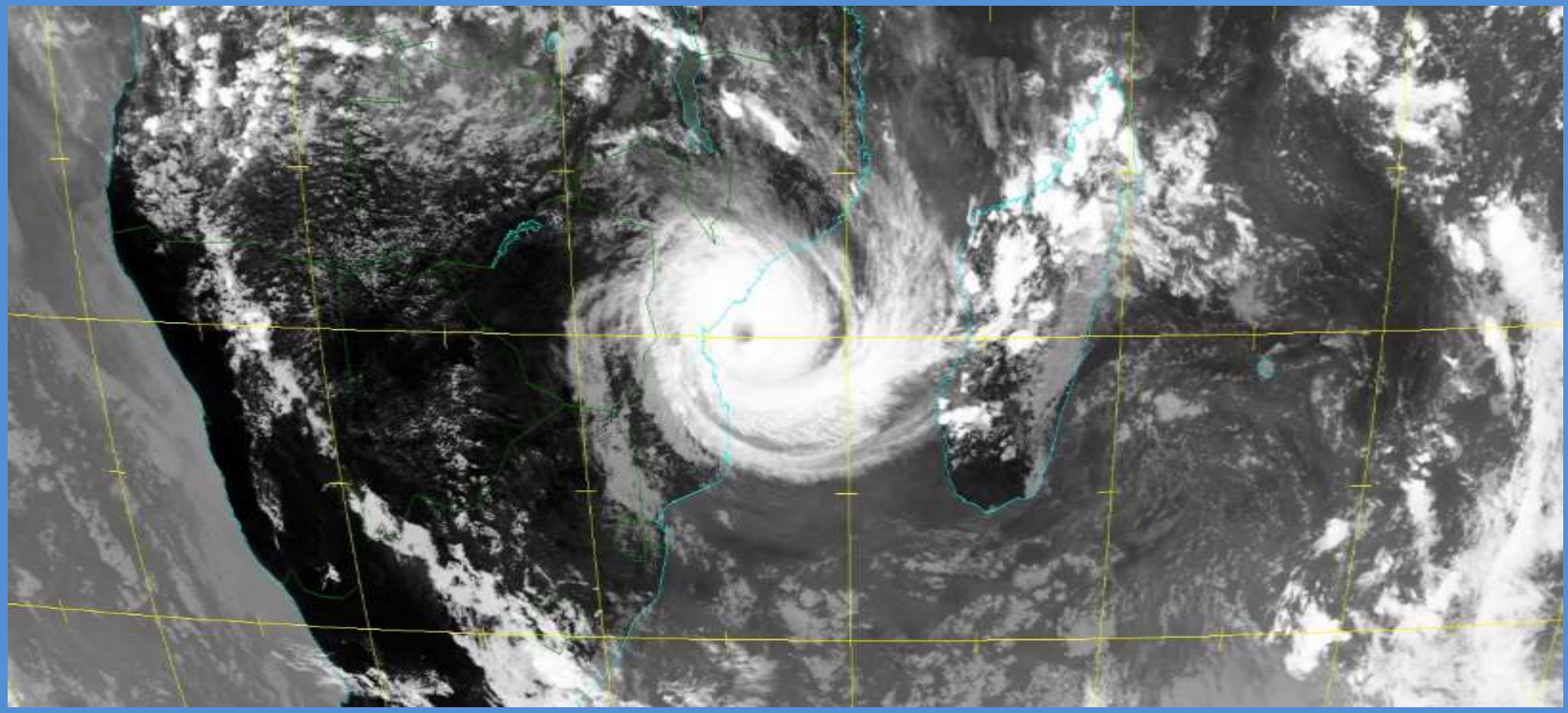
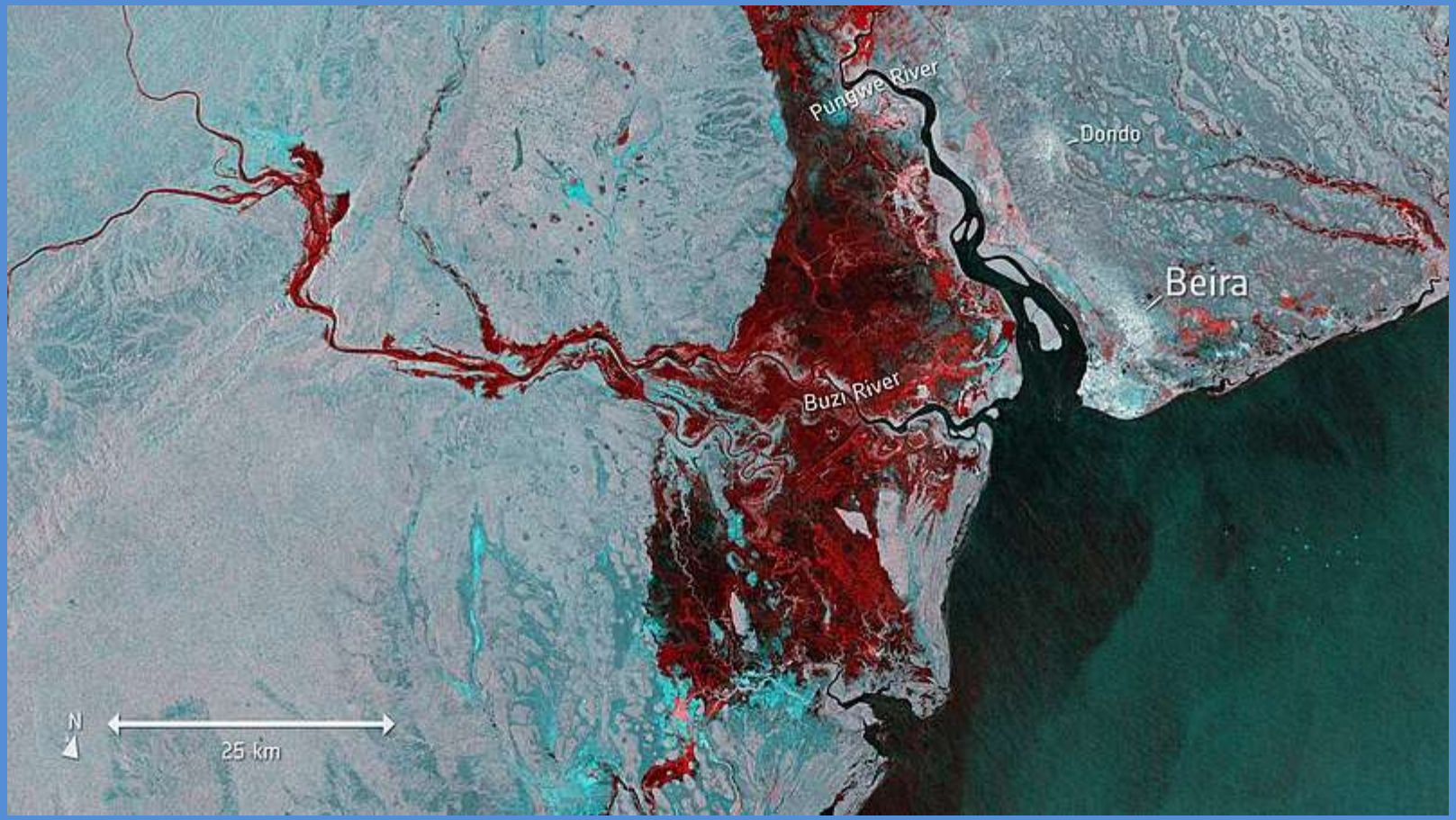
Tropical Cyclone Idai just before making landfall over Beira on 14 March 2018.



http://www.sat.dundee.ac.uk/geobrowse/geobrowse.php. Meteosat Second Generation (MSG) infra-red satellite image.

Cyclone Idai's flooding caused an "inland lake" to form west of Beira, as depicted on this image (red) of the European Space Agency satellite Copernicus Sentinel-1 taken on 19 March 2019



http://www.esa.int/spaceinimages/Images/2019/03/Floods_imaged_by_Copernicus_Sentinel-1

Largest flood disaster in recorded history in southern Africa

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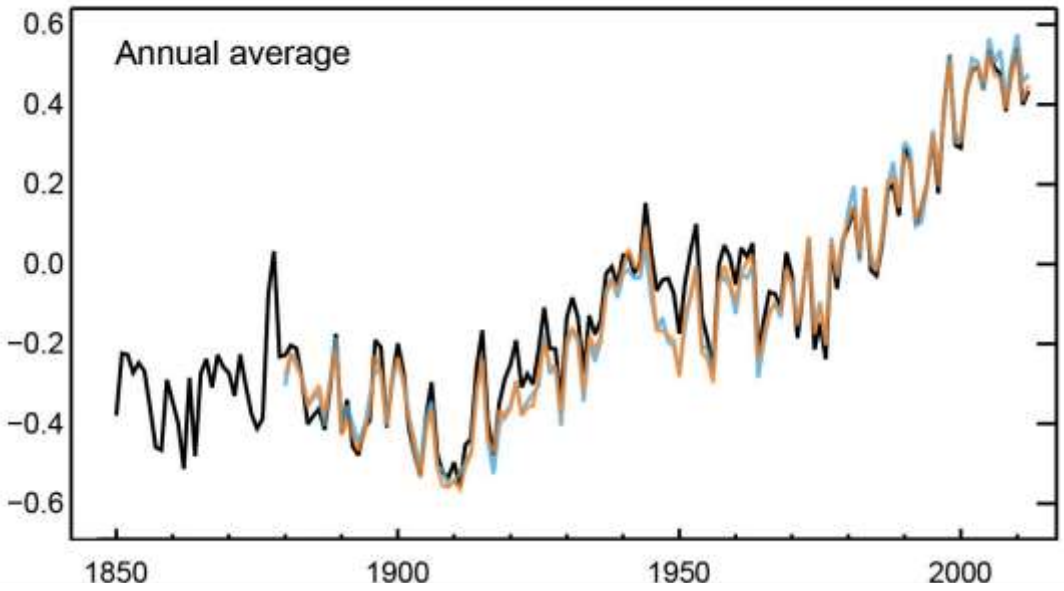
Humans are changing the climate

It is extremely likely that we are the dominant cause of warming since the mid-20th century



Globally averaged combined land and ocean surface temperatures

AR5 WGI SPM

- Under low mitigation we will reach 1.5˚C between 2030 and 2052

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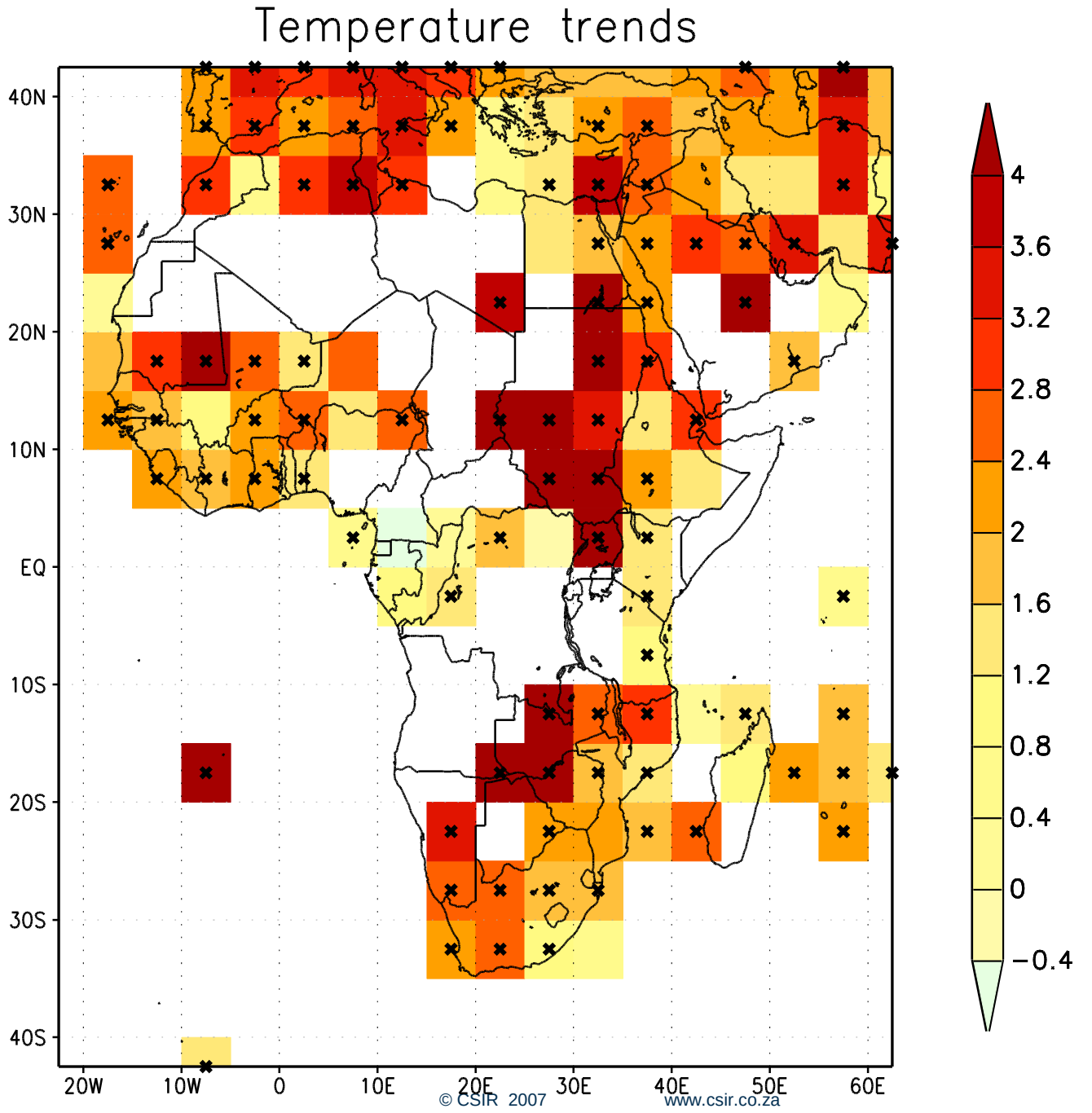
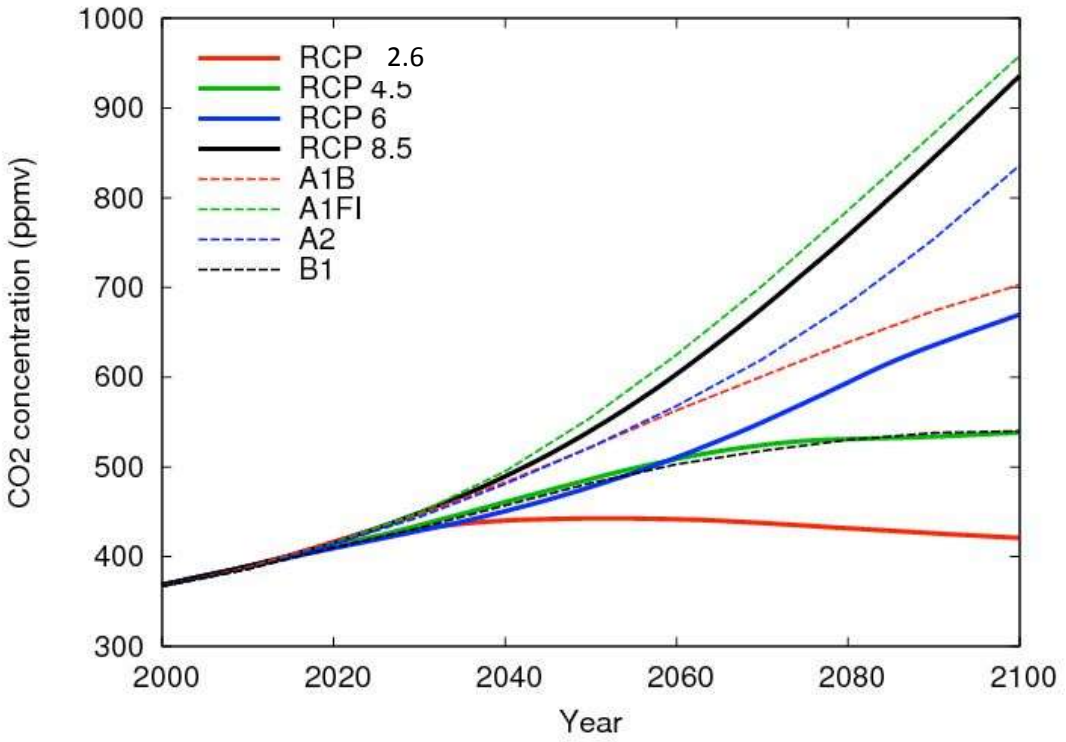


Observed trends in annual-average temperatures over Africa 1961-2010

(Engelbrect et al., 2015; *ERL 10: 085004*)

Garland et al., 2015; *Int J of Env Res and Public Health*

Emission Scenarios and Representative Concentration Pathways



From CSIRO: Martin Dix

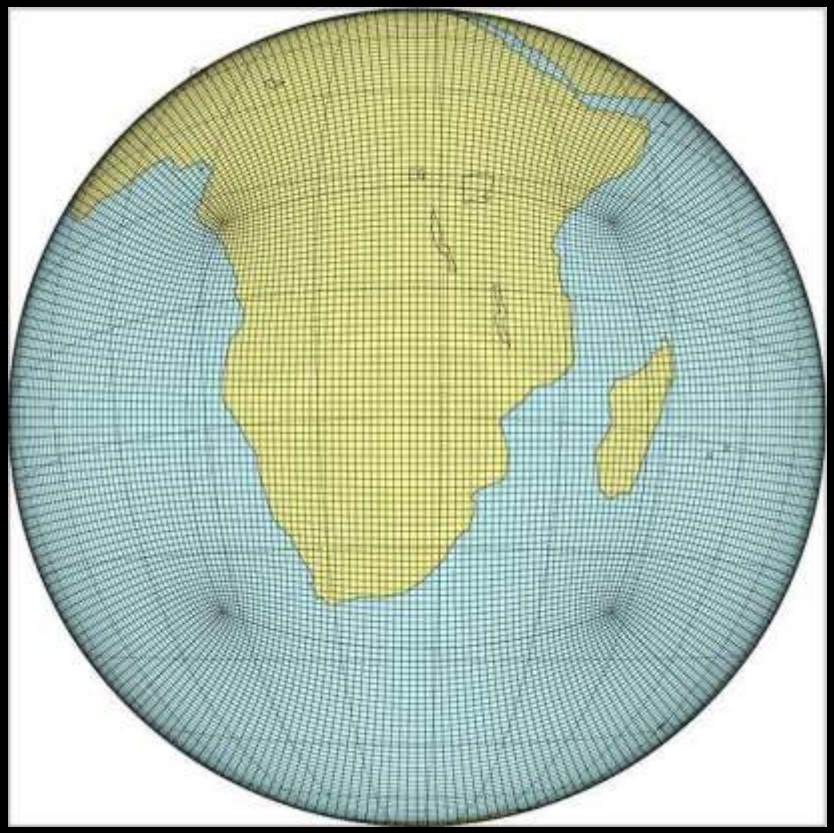
Projected temp anomalies for 2081-2100 relative to pre-industrial conditions (0-degree world)

AR5 WG1 estimations relative to 1986-2005 were adjusted with a 0.6 °C factor

Only RCP 2.6 can safely keep us well below the Cancun agreed 2 °C (Long Term Global Goal), whilst the world is currently between A2 and RCP8.5

Scenario	Temp anomalies relative to pre-industrial (adapted from AR5)
RCP 2.6	0.9 to 2.3
RCP 4.5	1.7 to 3.2
RCP 6	2.0 to 3.7
RCP 8.5	3.2 to 5.4

Global and Regional Climate Models are the main tools to project future climate change



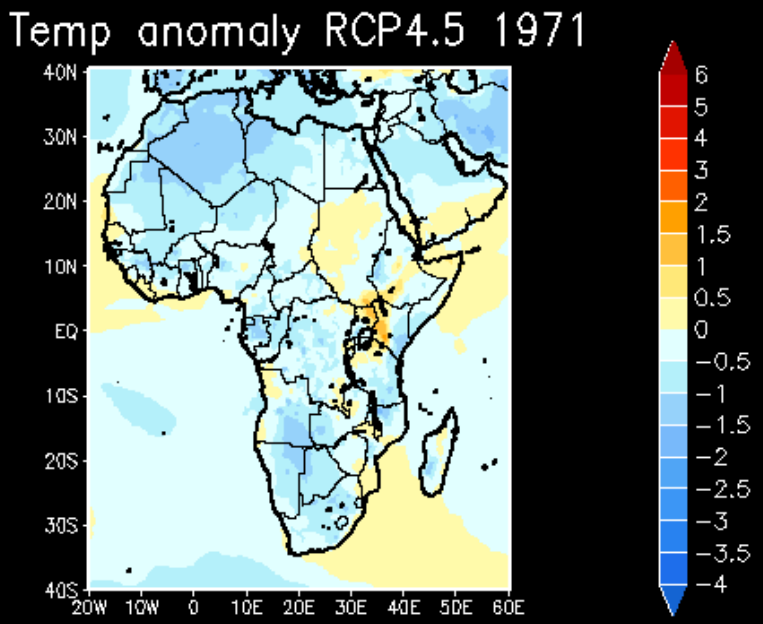
A regional model's stretched-grid over Africa

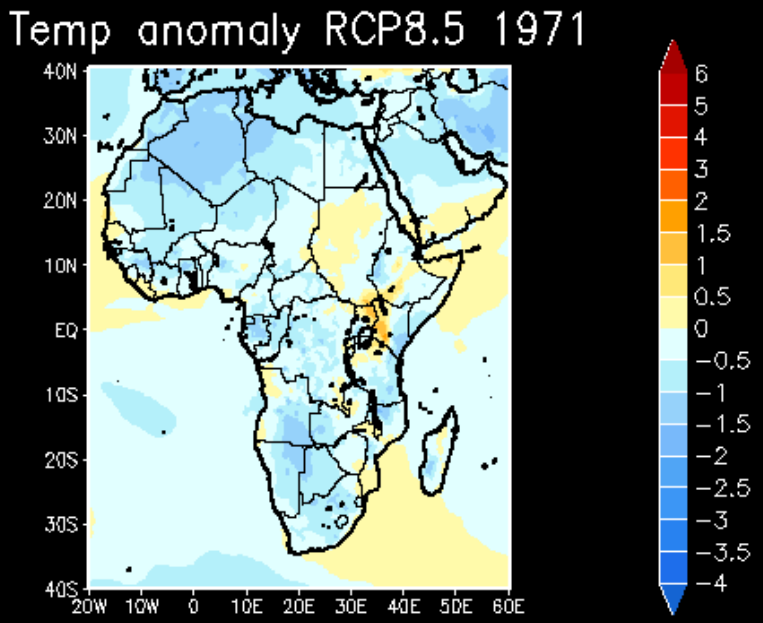
Based on the Laws of Physics

Simulates the coupled ocean-atmosphere-land processes of the Earth System

Parameterisation of processes that can't be resolved at a given grid resolution

IPCC Assessments make use of multi-model ensembles to describe uncertainty range associated with the projections for a number of emission scenarios

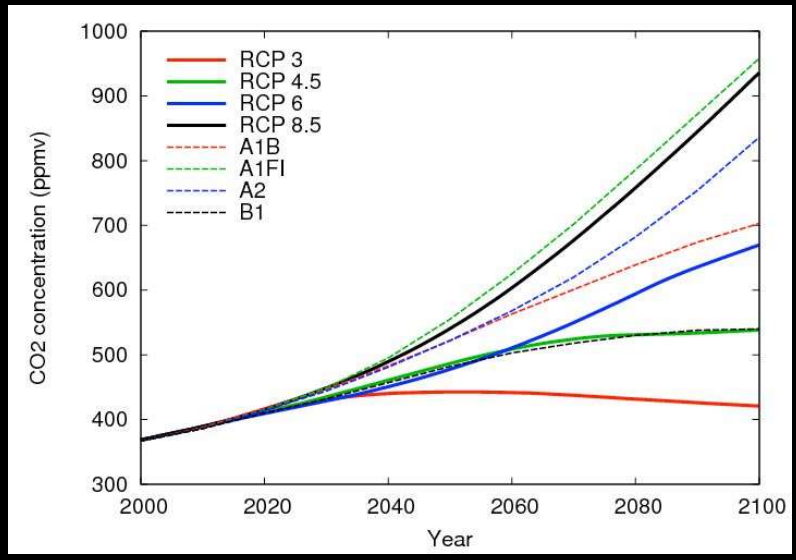




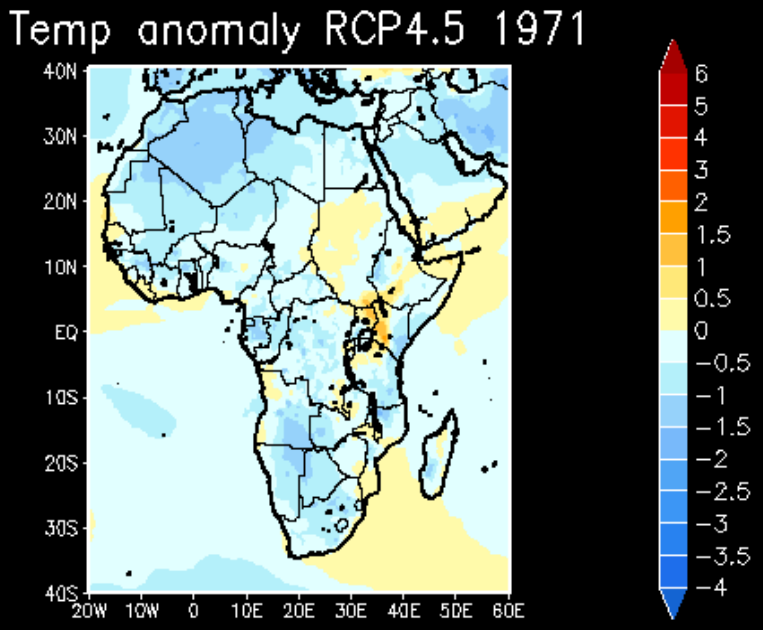
Simulations of African climate change using a regional climate model

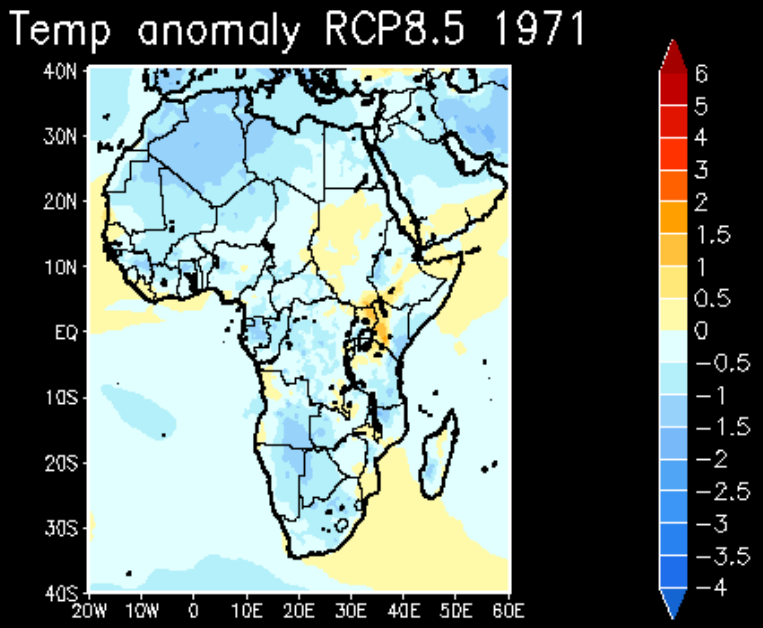
Downscaling various CMIP5/AR5 CGCMs for different RCPs

Wits CSIR-CSIRO collaboration towards CMIP6, CORDEX



Martin Dix, CSIRO





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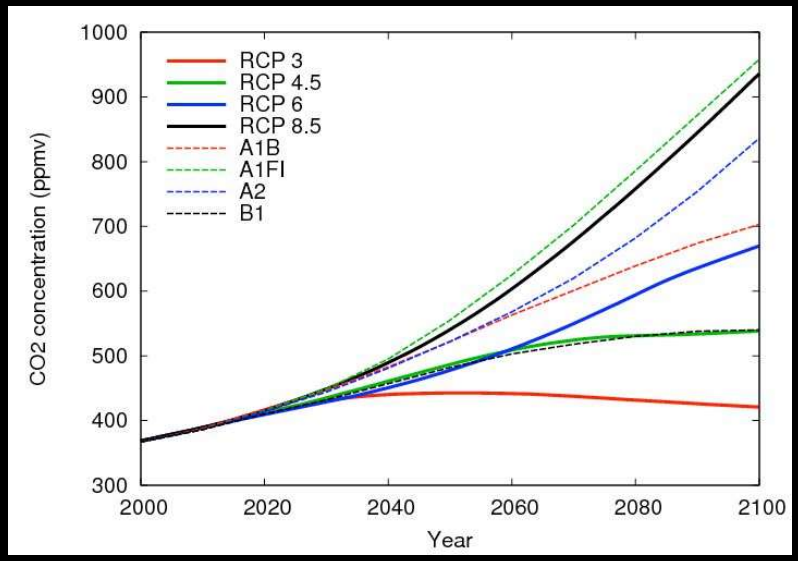

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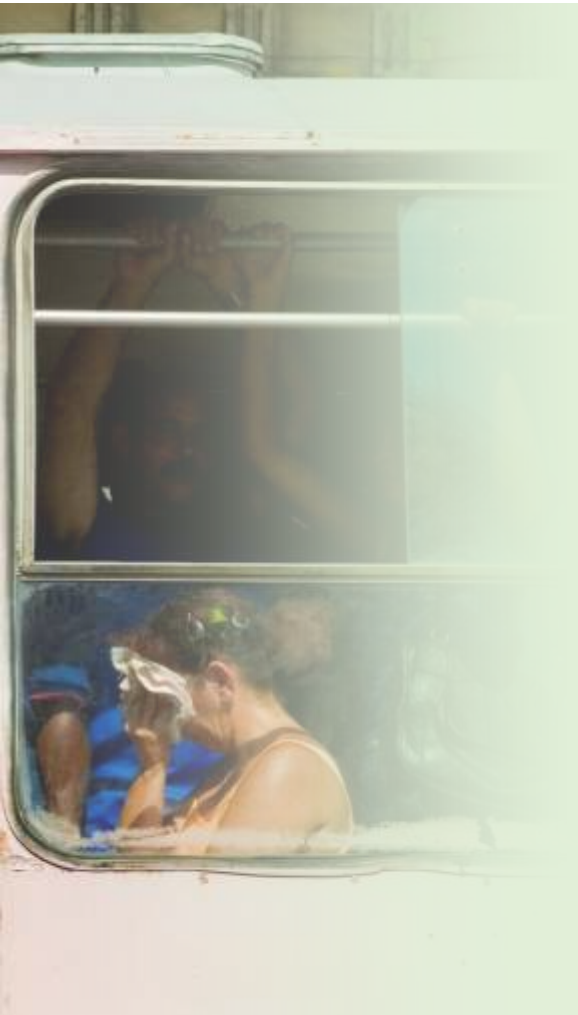


Impacts of global warming in Africa beyond 2 °C of global warming

- Unprecedented heat-waves in tropical and southern Africa with direct impacts on human comfort, health and mortality
- Tipping point in maize production at ~ 3 °C of global warming: large crop losses/collapse of maize crop; tipping point in cattle production in subtropical southern and North Africa at ~ 3 °C of global warming: cattle industry no longer sustainable
- Unprecedented droughts may occur in southern Africa, leading to “day zero” events

Jason Florio / Aurora Photos

Greenhouse gas emissions pathways

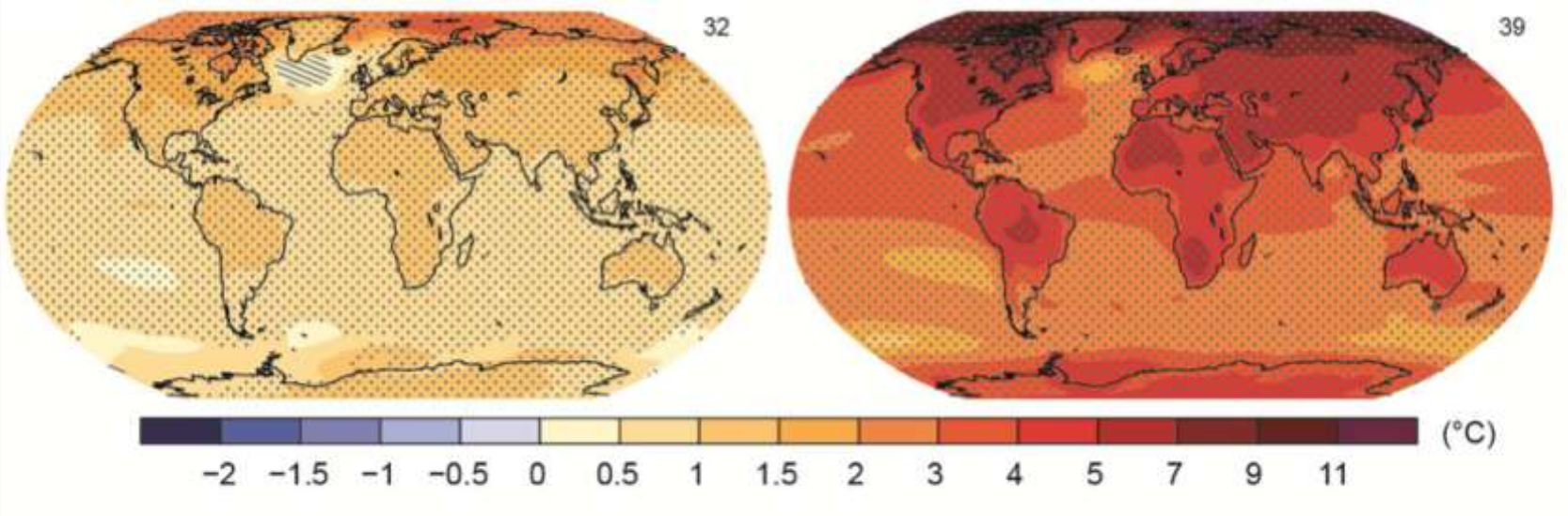
- To limit warming to 1.5˚C, CO_2 emissions fall by about 45% by 2030 (from 2010 levels)
  - Compared to 25% for 2˚C
- To limit warming to 1.5˚C, CO_2 emissions would need to reach 'net zero' around 2050
  - Compared to around 2070 for 2˚C
- Reducing non-CO_2 emissions would have direct and immediate health benefits

Robert van Waarden / Aurora Photos

The Choices We Make Will Create Different Outcomes

With substantial mitigation

Without additional



Change in average surface temperature (1986–2005 to 2081–2100)

AR5 WGI SPM

Substantial benefits in terms of reduced impacts if global warming can be restricted to 1.5 °C (SR1.5)

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What actions can we take?

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THANK YOU FOR YOUR ATTENTION!

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