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Global and regional tipping points in a changing climate

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Climate change: IPCC report is 'code red for humanity'

By Matt McGrath
Environment correspondent

12 hours ago | Comments

UK climate change protests

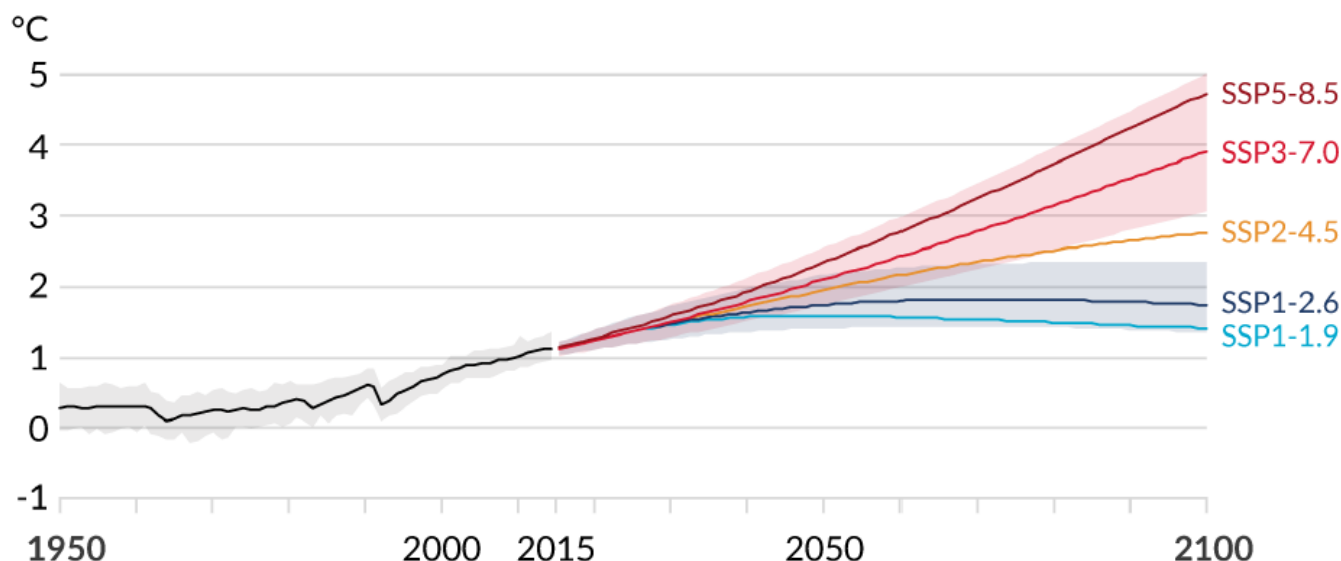


AR6 as the main science input to COP26

- IPCC report is a 'code red' for humanity.
- Earth is warming faster than previously thought, scientists say, and the window is closing to avoid catastrophic outcomes.

Human activities affect all the major climate system components, *Figure SPM.8* with some responding over decades and others over centuries

a) Global surface temperature change relative to 1850-1900

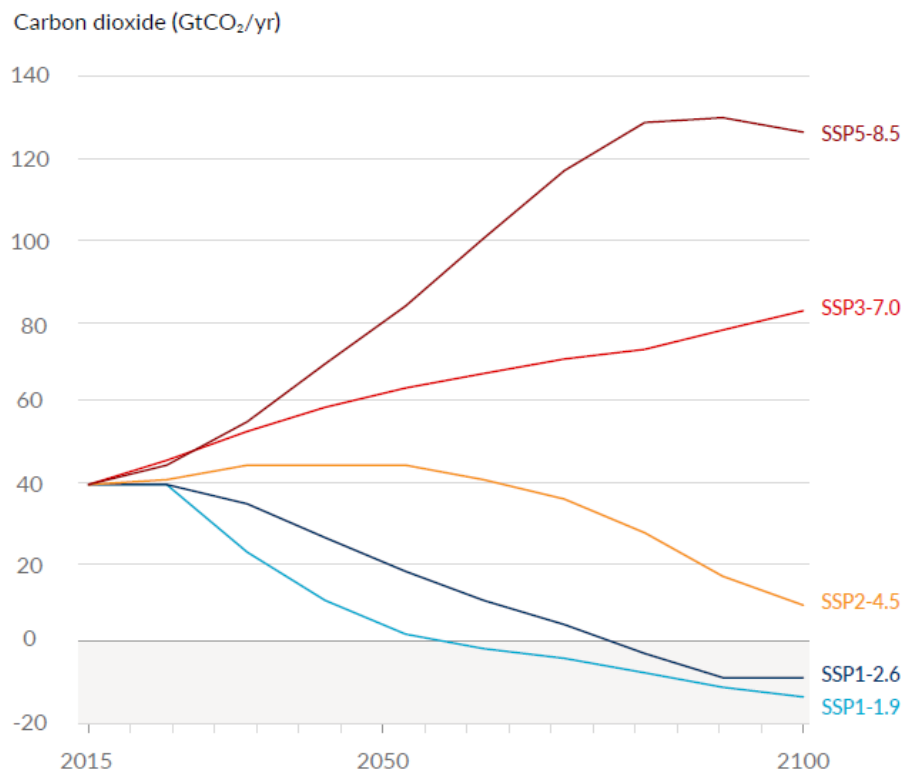


Under the five illustrative scenarios, in the near term (2021-2040), the 1.5° C global warming level is *very likely* to be exceeded under the very high GHG emissions scenario (SSP5-8.5), *likely* to be exceeded under the intermediate and high GHG emissions scenarios (SSP2-4.5 and SSP3-7.0), *more likely than not* to be exceeded under the low GHG emissions scenario (SSP1-2.6) and *more likely than not* to be reached under the very low GHG emissions scenario (SSP1-1.9).

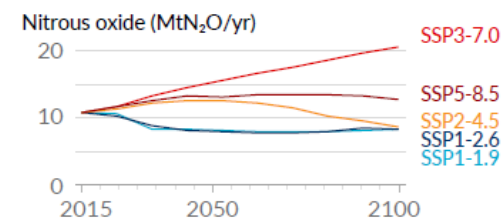
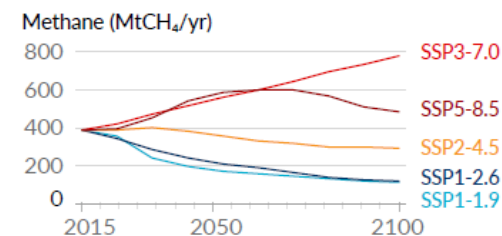


Future emissions cause future additional warming, with total warming dominated by past and future CO₂ emissions

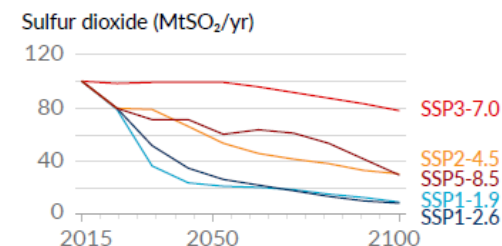
a) Future annual emissions of CO₂ (left) and of a subset of key non-CO₂ drivers (right), across five illustrative scenarios

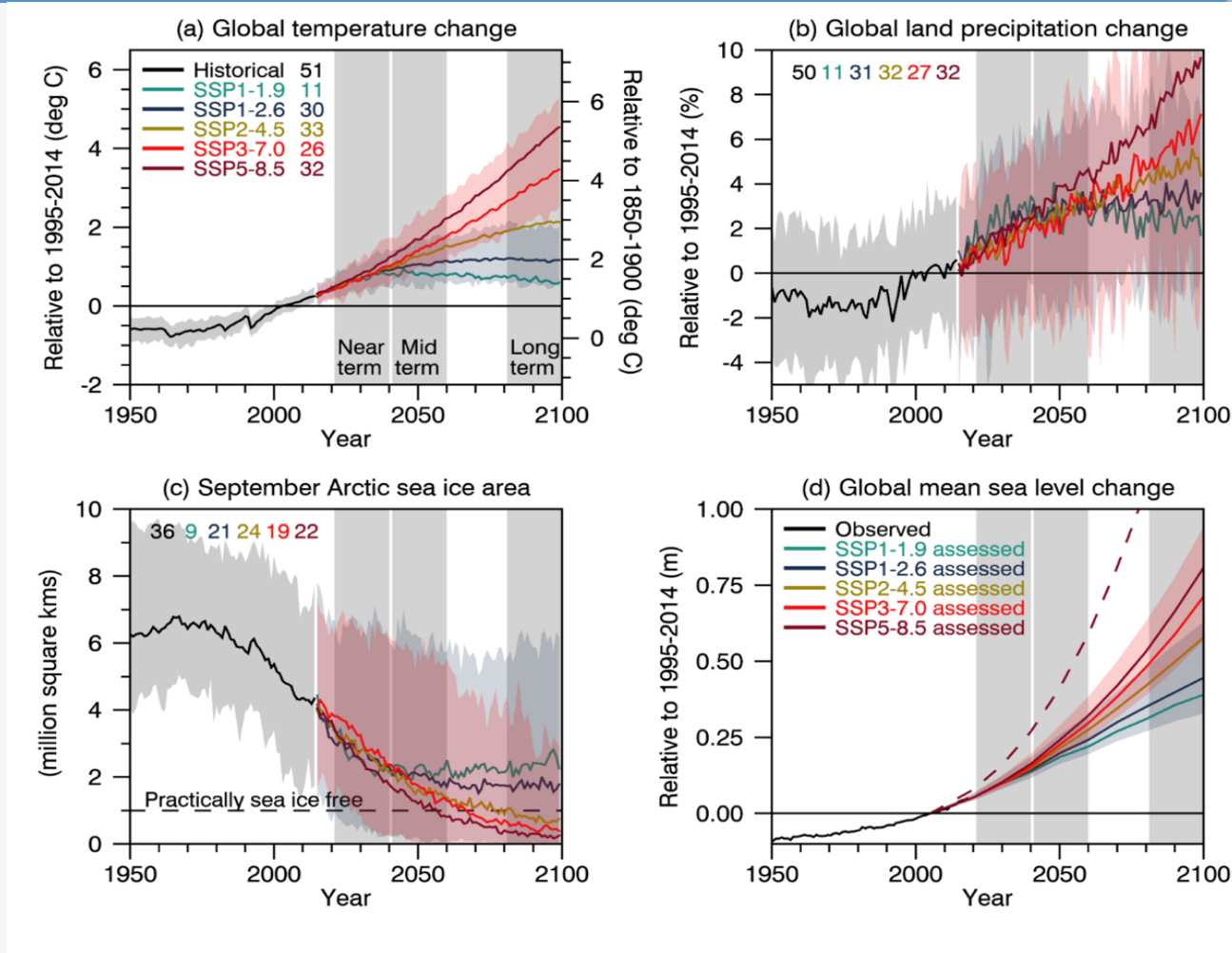


Selected contributors to non-CO₂ GHGs



One air pollutant and contributor to aerosols

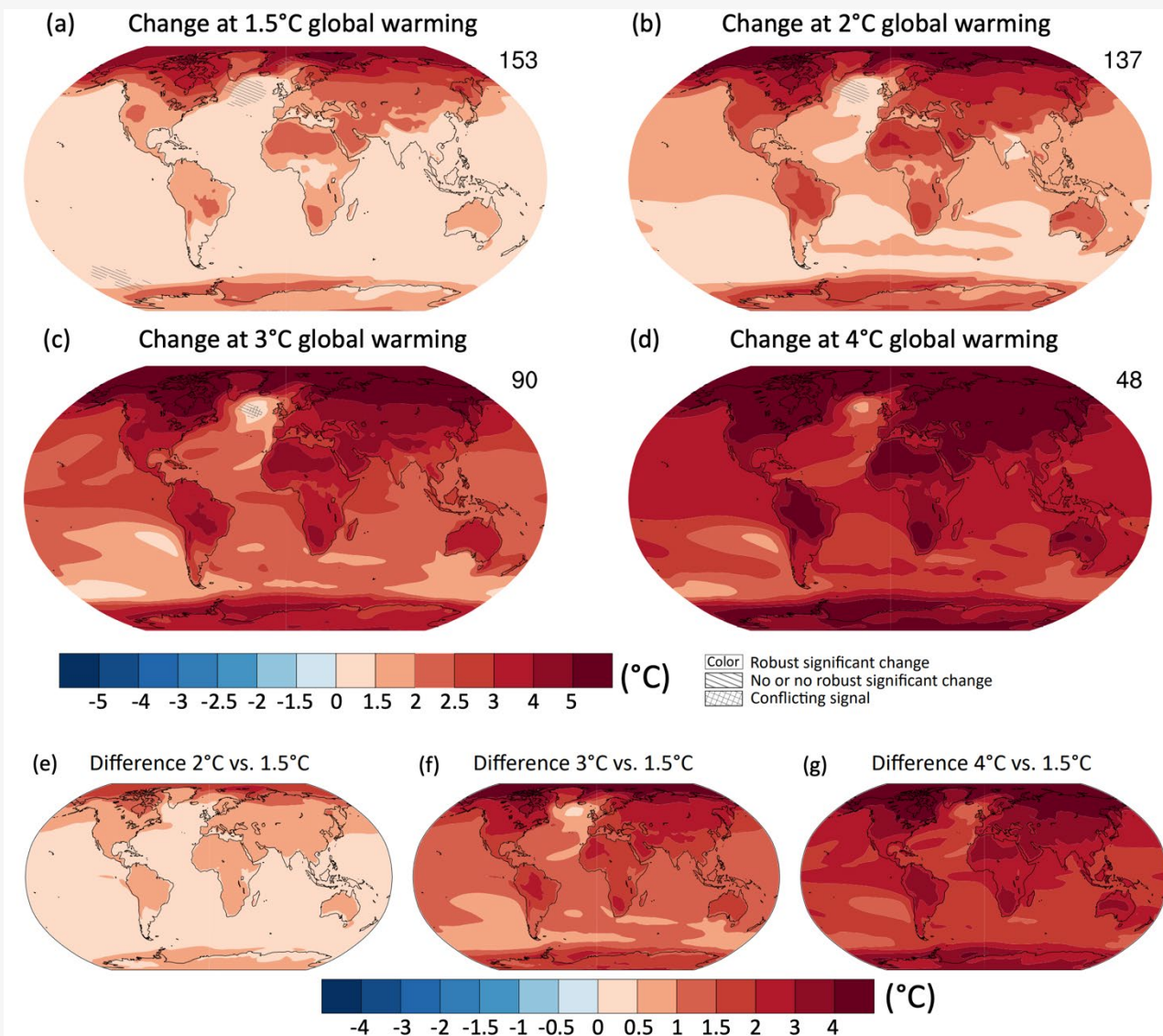




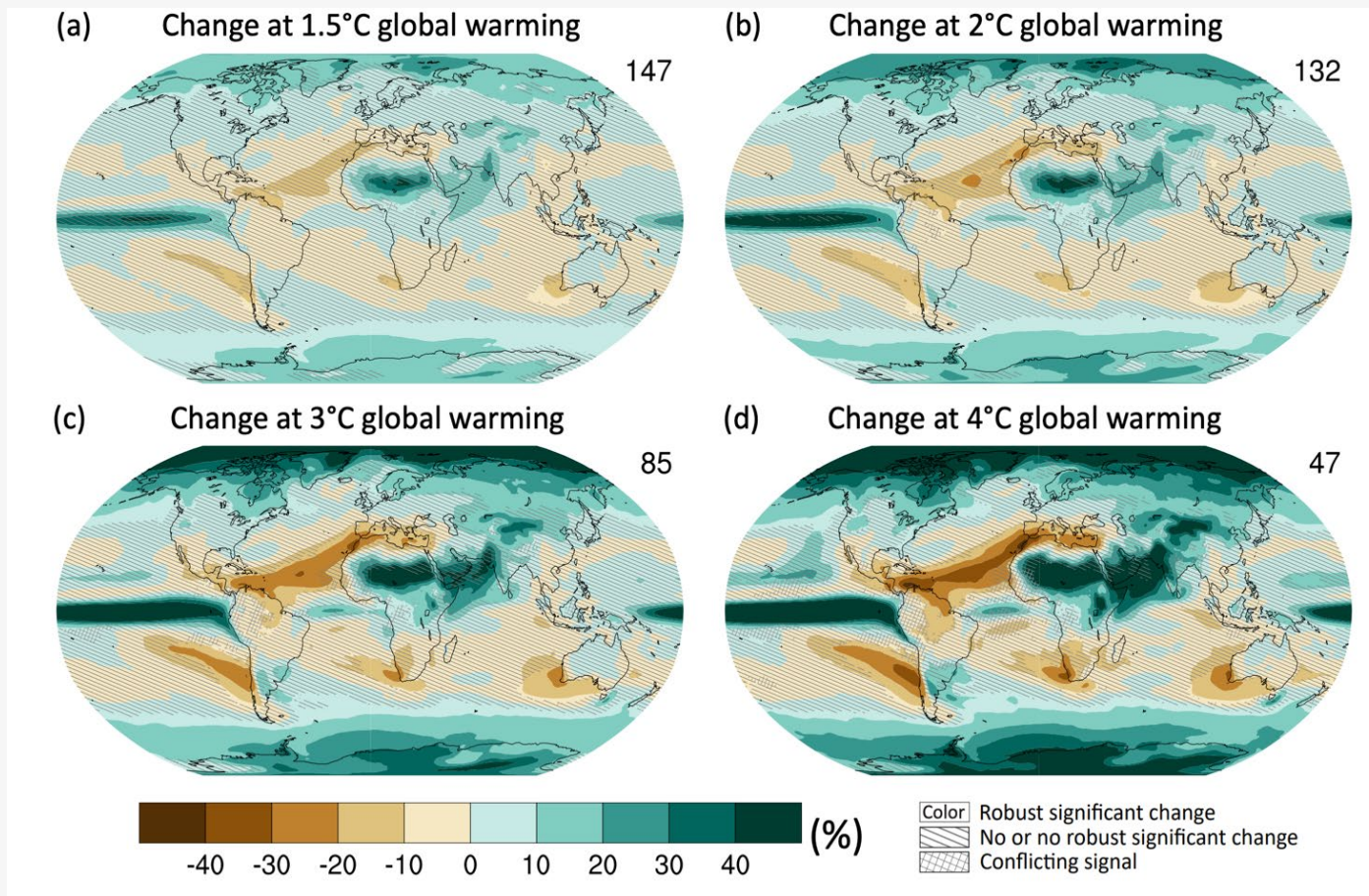
Selected indicators of global climate change from CMIP6 historical and scenario simulations (Figure 4.2, Chapter 4, AR6).

Global tipping points and irreversible change

- The following global tipping points can not be ruled out:
 - Greenland ice-sheet collapse
 - West-Antarctic ice-sheet collapse
 - Amazon forest die back
 - Abrupt change in ocean circulation – collapse of the Atlantic Meridional Overturning Current (AMOC)
- Sea-level rise is fundamentally irreversible
 - may reach 6 m over the next 2000 years under 2 ° C of global warming
 - completely altering today's coastline.



Projected spatial patterns of change in annual average near-surface temperature (°C) at different levels of global warming (Figure 4.31, Chapter 4, AR6).



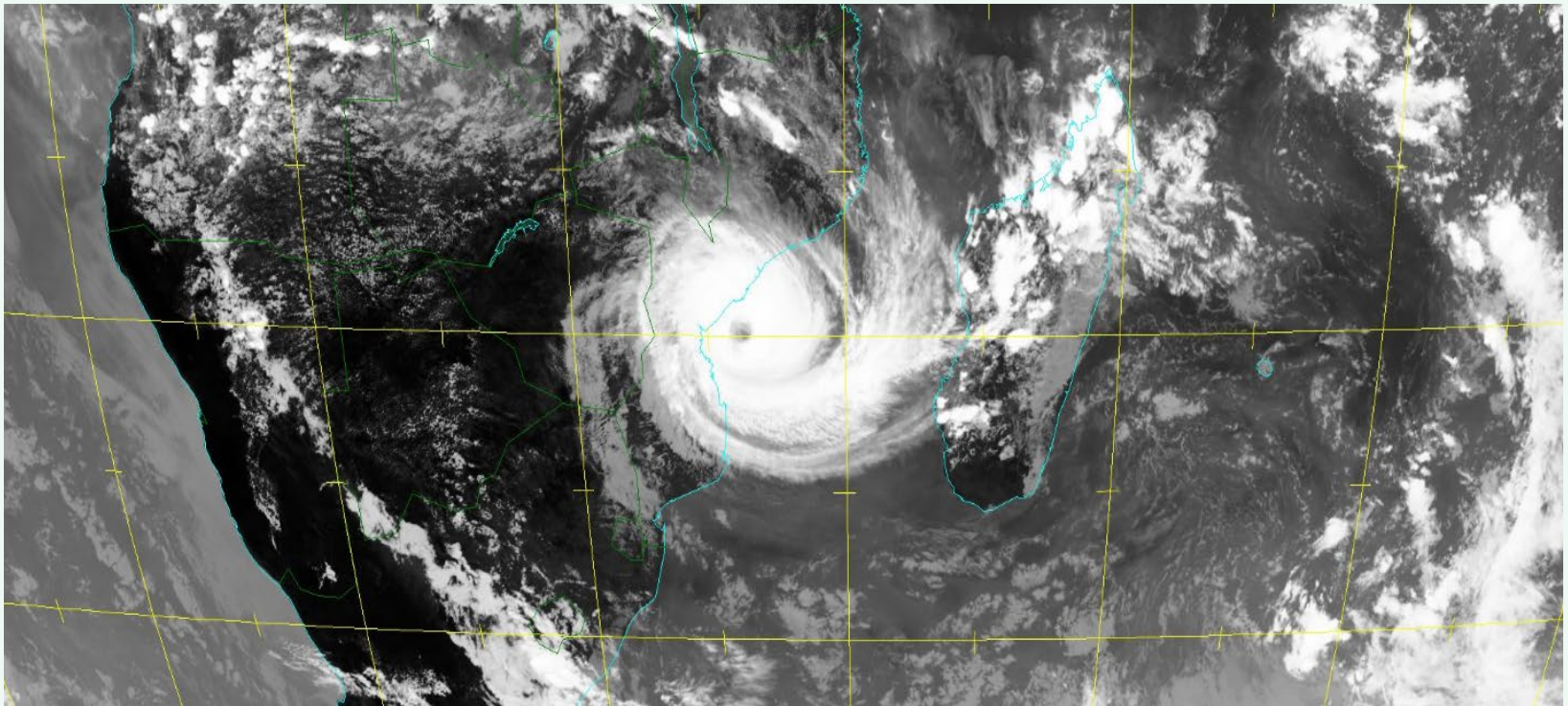
Projected spatial patterns of change in annual average precipitation (expressed as a percentage change) at different levels of global warming (Figure 4.32. Chapter 4, AR6 WGI report.

Regional tipping points in Africa – do they exist, and where and when will they be reached?

- Energy-transition related tipping points... fossil fuel assets becoming 'stranded assets' in a short space of time.
- Can an intense tropical cyclone (category 4/5 hurricane) reach Maputo in Mozambique, Richardsbay in South Africa, or Dar es Salaam in Tanzania?
- Day-zero droughts in some of the growing African cities – perhaps our biggest climate change risk in the near-term?
- More frequent and intense multi-year droughts and heat-waves impacting on the maize crop and cattle industry – is there a point of collapse?
- More frequent and intense heat-waves impacting on human health and mortality.

Landfalling intense tropical cyclone at Maputo, Richardsbay or Dar es Salaam

Tropical Cyclone Idai just before making landfall over Beira on 14 March 2019.



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

‘Day zero’ droughts in Africa’s growing cities



A dust storm rolls over the plains of the Free State, South Africa, in December 2015.

The 2015/16 El Niño drought was the culmination of four years of drought in southern Africa’s summer rainfall region.

The level of the Vaal dam fell to below 25% in September 2016.

50% of the water supply of South Africa’s Gauteng Province is via the Vaaldam.

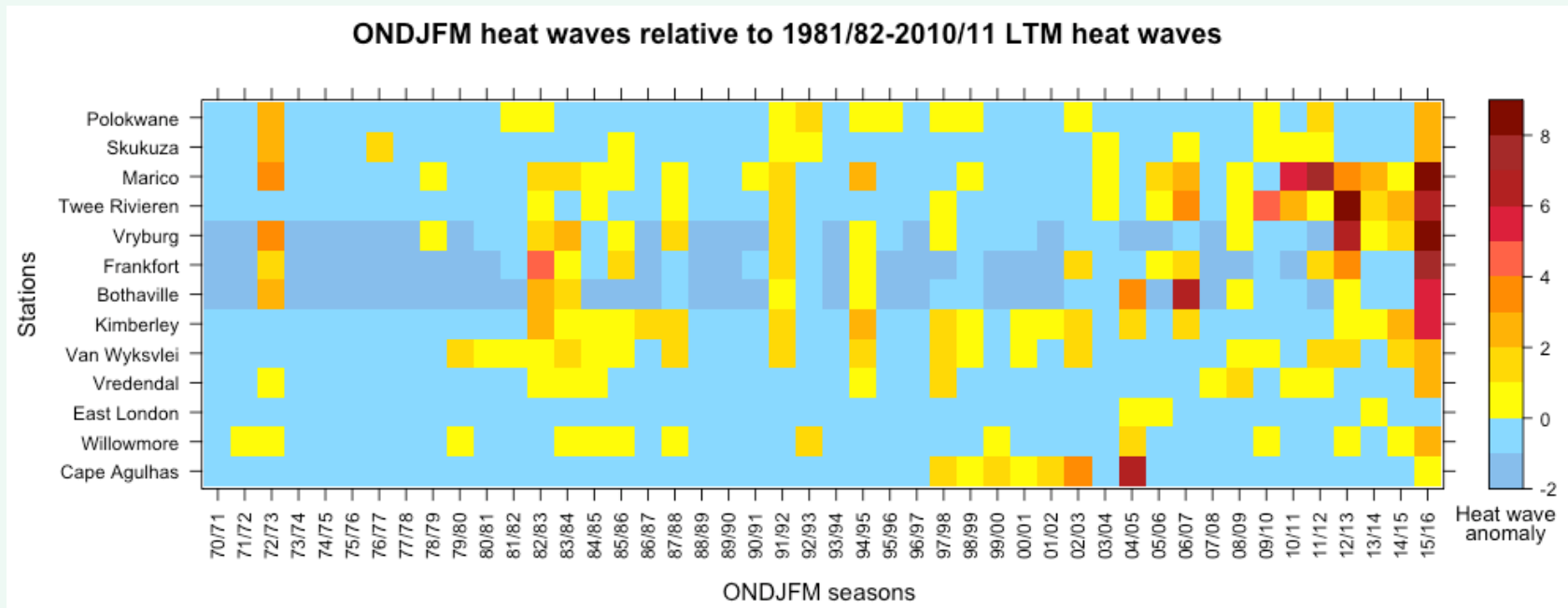
This risk likely extends to many of Africa’s growing cities.

Collapse of the maize crop and cattle industry

- IPCC SR1.5 assessed that this risk exists at 3 °C of global warming.
- It is a biophysical risk, related to heat-stress and heat-tolerance.
- In 2015/16: Botswana lost 40% of its cattle.
- In 2015/16: maize crop 40% lower in South Africa than the previous year.
- When taking into account socio-economic factors however, will limits to economic sustainability perhaps imply system collapse at even lower levels of global warming?
- Subsistence farmers – Sahel, Mozambique, Zimbabwe, Madagascar... droughts in recent years brought food scarcity, famine in some communities and displaced people to cities.

Prolonged, unprecedented heat-waves

- Human comfort, also human mortality.
- Extreme heat is life threatening when living in informal housing without cooling or access to cool water.
- Hundreds of people died in late-June heat-wave in the Pacific Northwest.



HEAT WAVES ARE CONSIDERED AS ONE OF THE WEATHER EVENT TYPES WITH THE LARGEST NEGATIVE IMPACTS From Engelbrecht C et al. (2021); In preparation

Every bit of warming matters: we need immediate action in both climate change mitigation and adaptation

