

Adapting to climate change in Africa

The role of geographical research

Dr Rachel James

Senior Lecturer in Climate Science





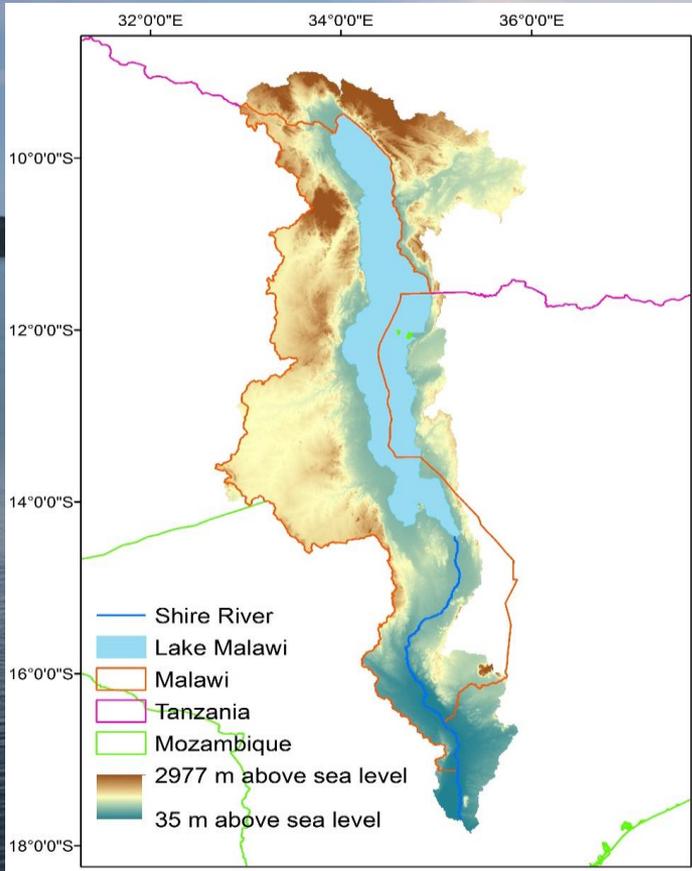


Figure: Ajay Bhave
UMFULA project



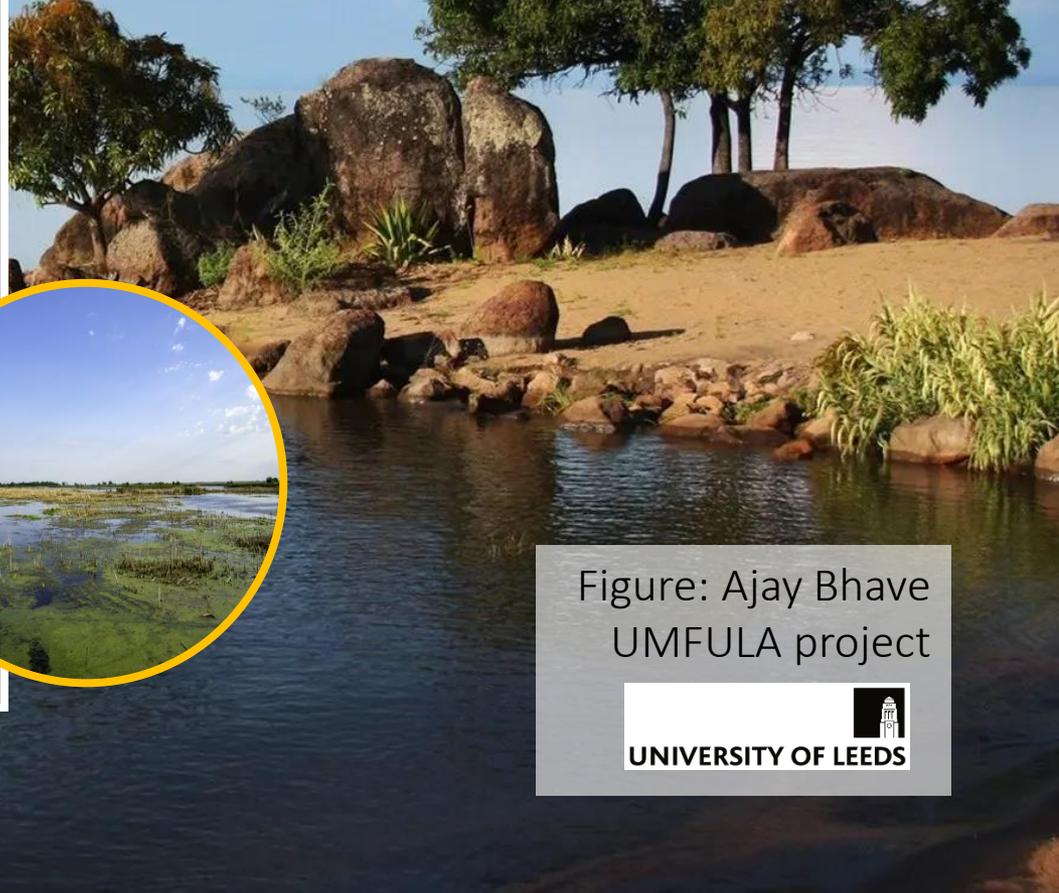
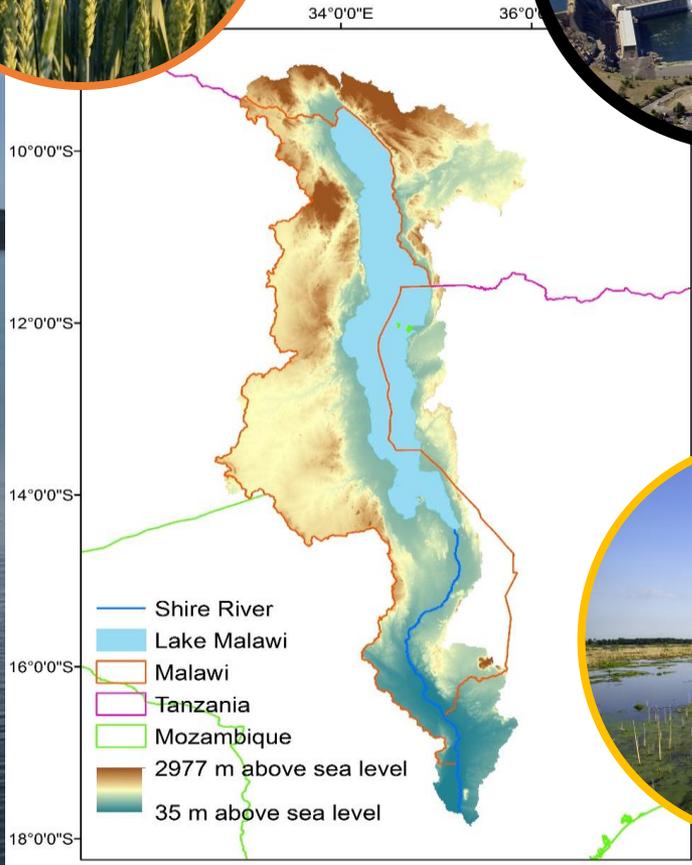
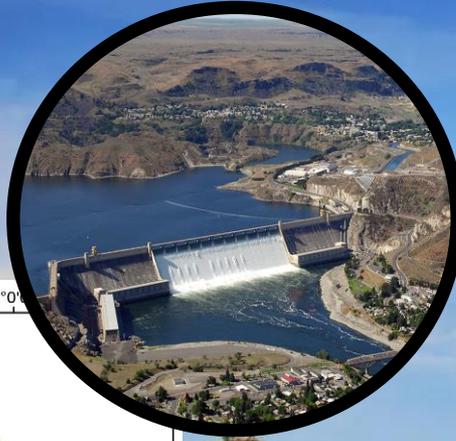
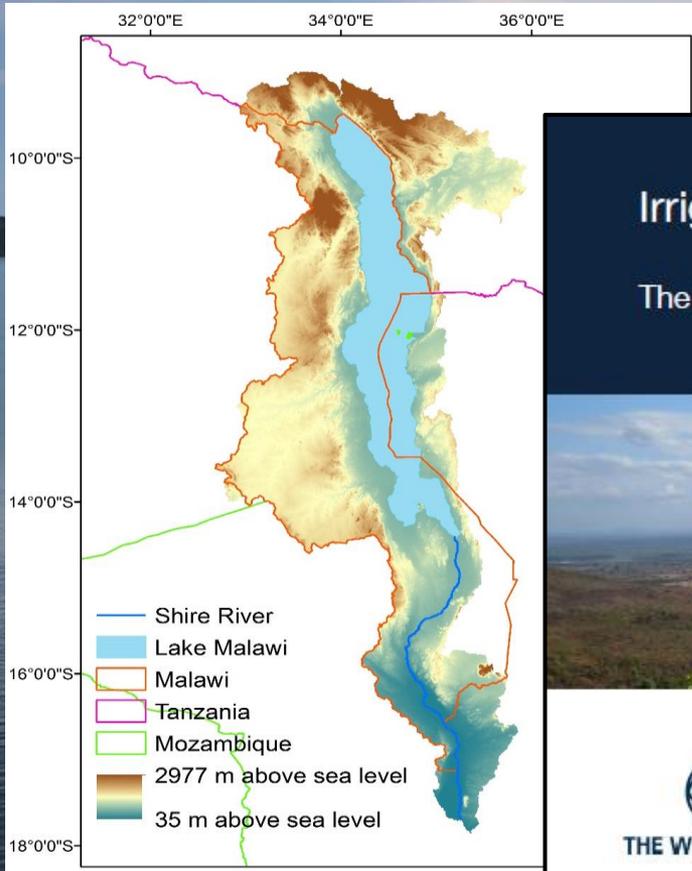


Figure: Ajay Bhave
UMFULA project



Irrigation and Cash Crops for a Better Life

The Shire Valley Irrigation Project (SVIP)

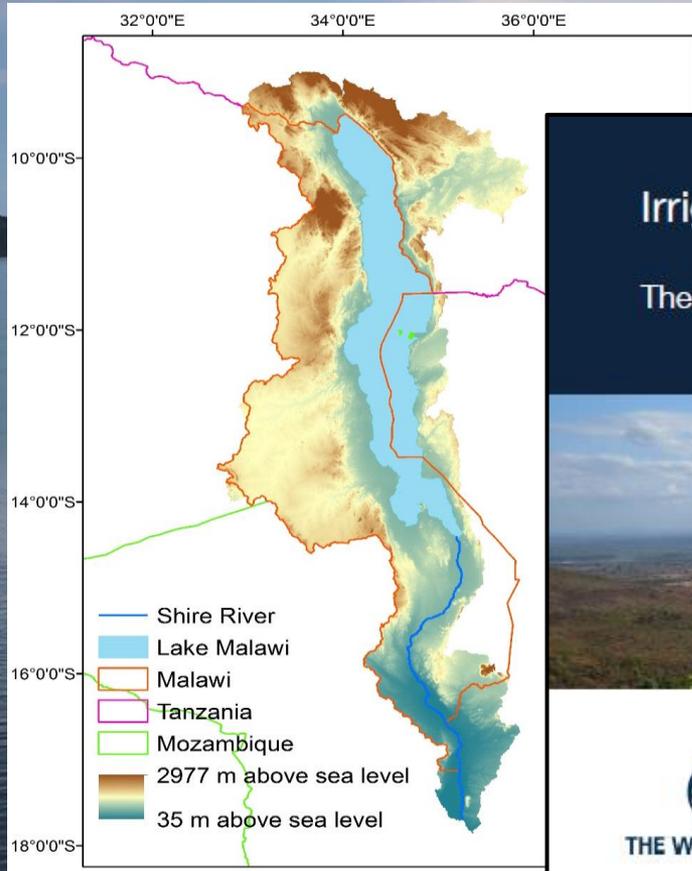


THE WORLD BANK



African Water Facility
Facilité africaine de l'eau
Mobilising Resources for Water in Africa

How might climate change influence water availability?



Irrigation and Cash Crops for a Better Life

The Shire Valley Irrigation Project (SVIP)



THE WORLD BANK



African Water Facility
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Overview:

Adapting to climate change in Africa

1. Why is this important?
2. Why is it challenging?
3. Our approach: geographical research!
4. My part: climate science
5. Summary

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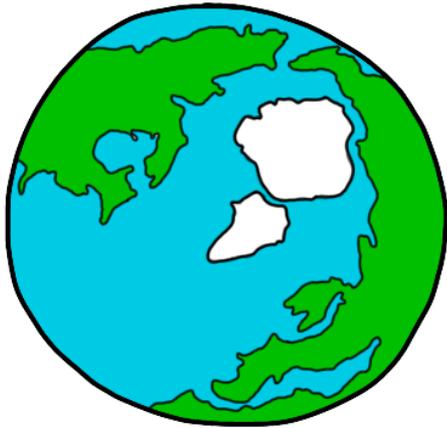
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future loading...

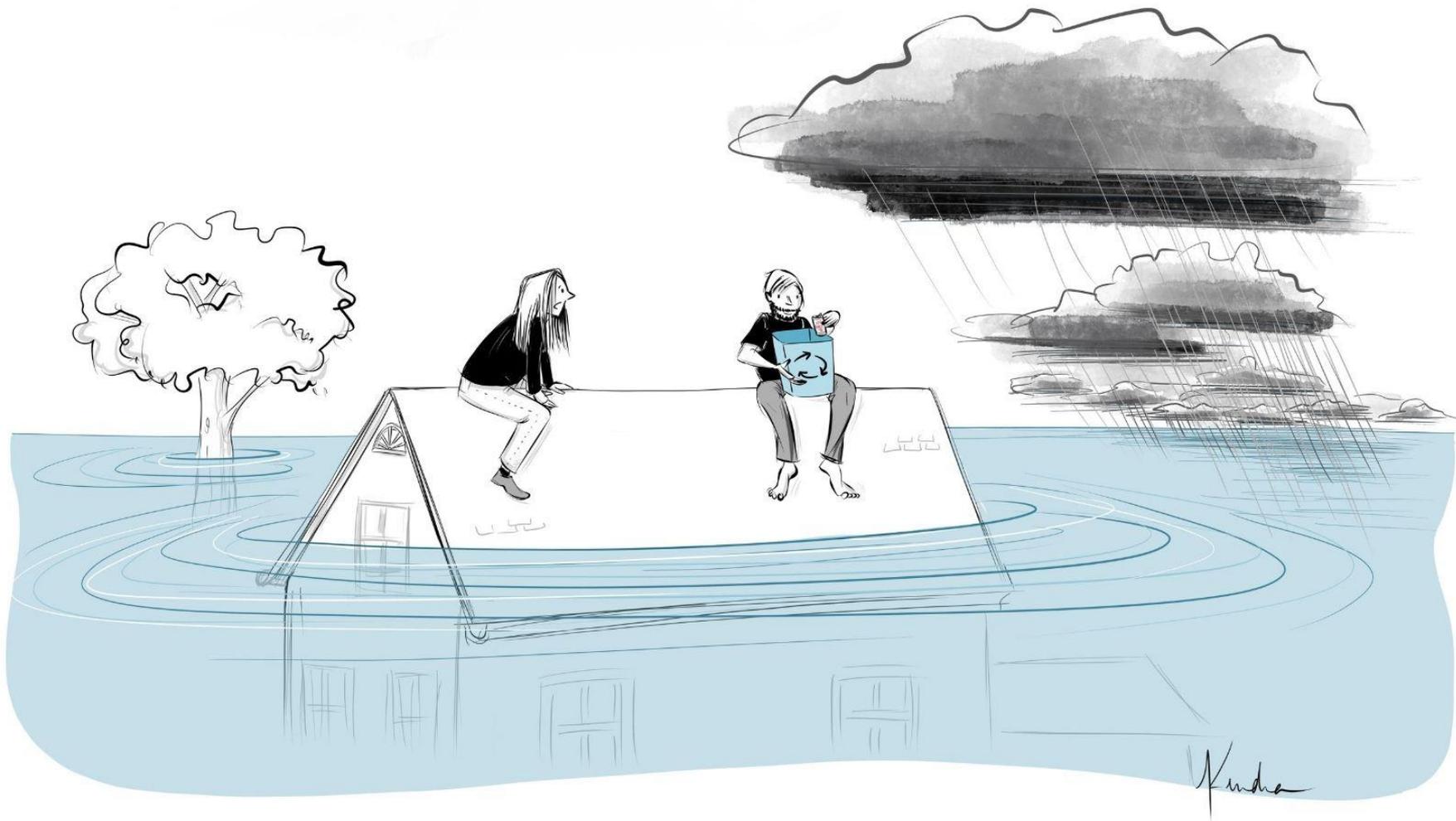




Source: New York Times

What actions can we take to address climate change?

Mentimeter...



“It’s not that I don’t appreciate your recycling, Leo, I’m just suggesting it’s not the only thing we should be doing right now.”

We need **Mitigation AND Adaptation**

Mitigation (of climate change): A human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs)

Adaptation: The process of adjustment to actual or expected climate and its effects.

The High 5 for transforming Africa Le Top 5 pour transformer l'Afrique



1

Light up & power Africa
Eclairer & électrifier l'Afrique



2

Feed Africa
Nourrir l'Afrique



3

Industrialise Africa
Industrialiser l'Afrique



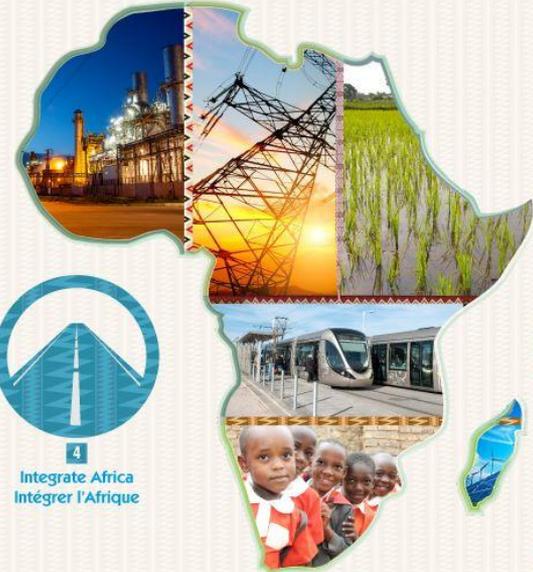
4

Integrate Africa
Intégrer l'Afrique



5

Improve the
quality of life for
the people of Africa
Améliorer la qualité
de vie des populations
en Afrique

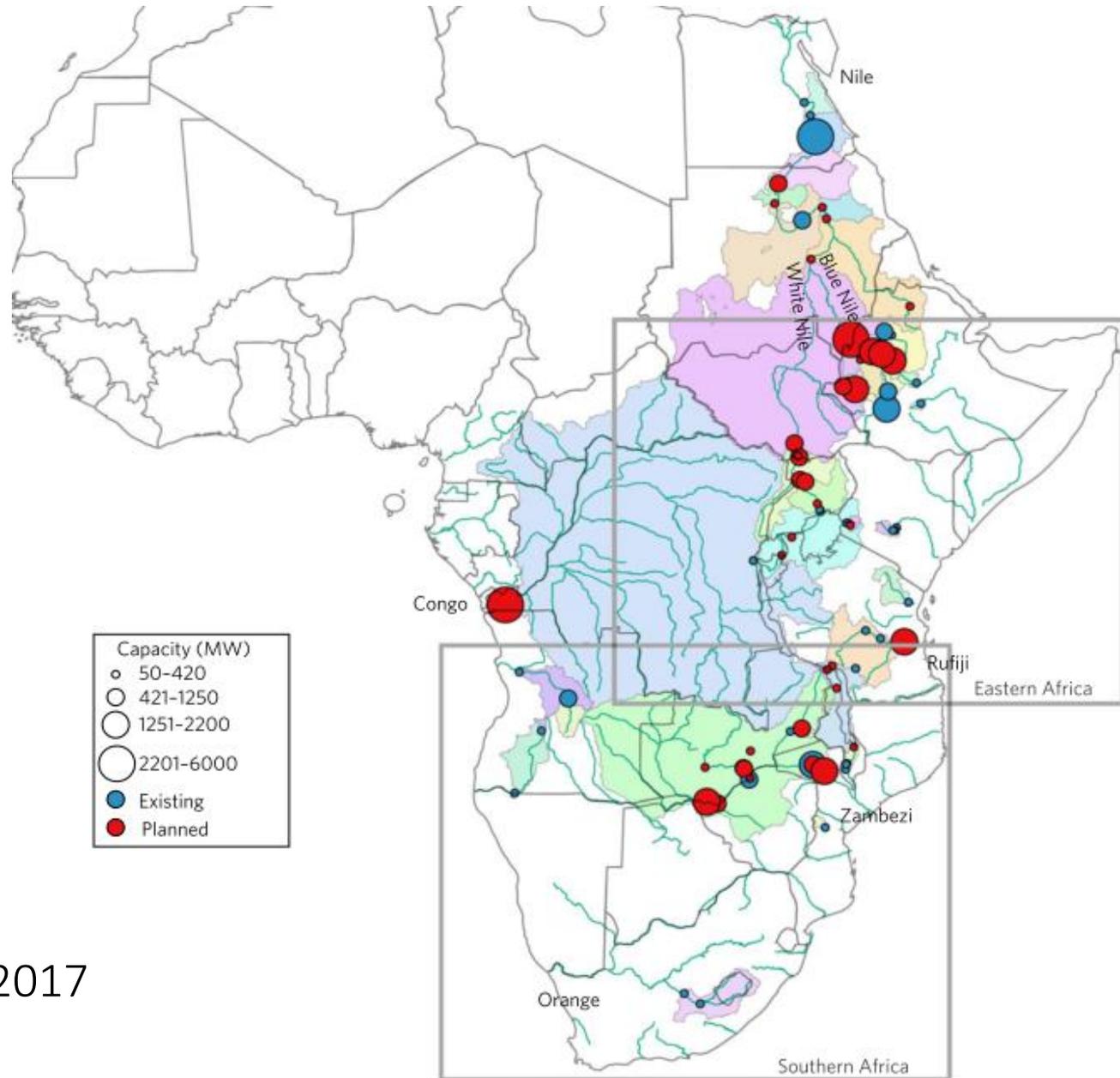


AFRICA'S RISING CITIES

How Africa will become the center of the world's urban future



A hydropower boom?



Conway et al. 2017



How can hydropower and irrigation development in the Shire Valley be robust to climate change?



How can growing cities like Cape Town plan sustainable urban water supply in a changing climate?



How can urban planners improve conditions for those living in informal settlements?

Why is this important?

- Climate systems are changing
- We need to reduce emissions to limit climate change: “mitigation”
- We also need to adjust our way of life for a new climate: “adaptation”
- African countries already changing rapidly: growth, urbanization, large investments in infrastructure
- How can this development be climate-resilient?

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Interview

Stop talking, start acting, says Africa's first extreme heat official

Saeed Kamali Dehghan

Rising temperatures are already killing people in Sierra Leone's Freetown, says Eugenia Kargbo, who is planning how best to protect the hundreds of thousands living in informal settlements



Sierra Leone's capital, Freetown. Migration to the city after years of civil war and poor harvests has led to deforestation as shantytowns spread. Photograph: Random Institute on Unsplash



📍 Eugenia Kargbo: 'We need people to understand that extreme heat is a climate hazard.' Photograph: Arsht-Rockefeller Resilience Center

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African rainfall: difficult to predict future change

High variability



Nanyuki, Kenya, 2009



Nairobi flooding, March 2018



Vinny Radak
@radakv

Follow

How Arsenal fans are watching the game pale
Ngara @JohnNdavi #nairobiproblems
#NairobiFloods

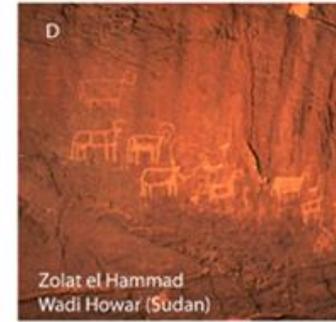


Uganda 2016/2017 drought

African rainfall: difficult to predict future change

Potential for surprises

Green Sahara

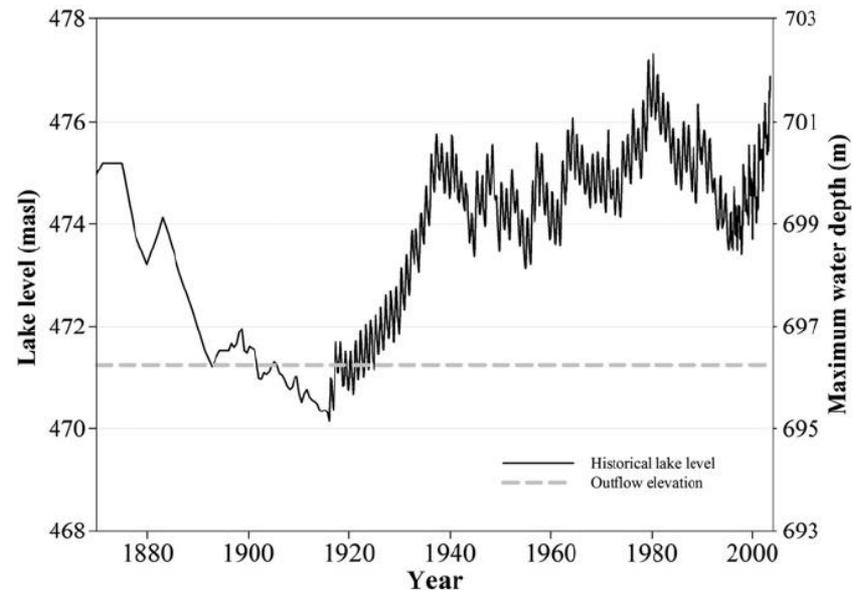


Drought and famine



How might climate change influence rainfall?

In early 20th century lake levels fell below average for two decades



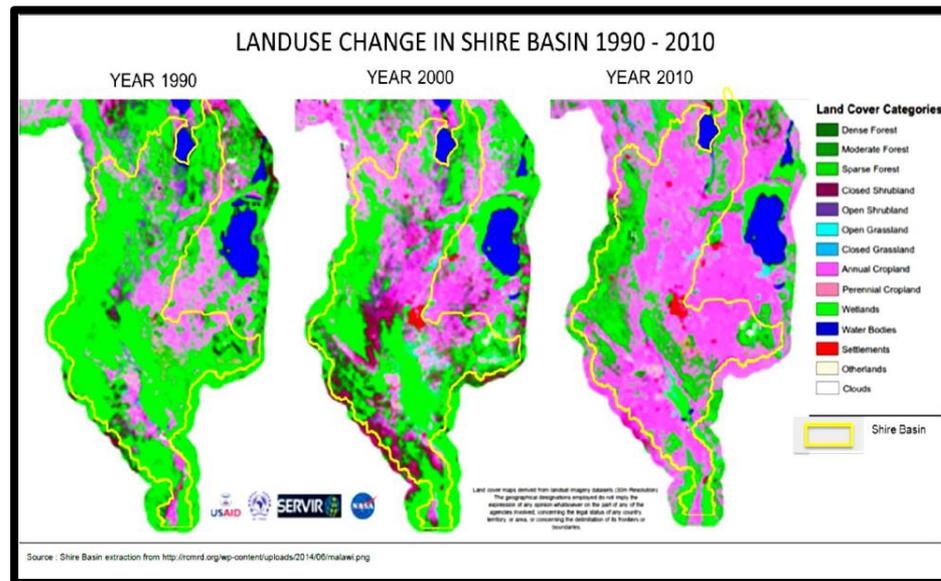
Ajay Bhave
UMFULA project



Source: Lyons et al. 2011

How might climate change influence water availability?

Shire Valley is experiencing dramatic rates of deforestation



Likoya (2018)

Understanding the physical geography is just the beginning!

- Who makes decisions about whether to build a dam? How to manage it? Where to irrigate?
- What other factors – political, social, economic, personal – influence their decision?
- How do people living in the river basin manage water?
- On what timescales can each stakeholder plan?
- What is the policy landscape for climate change?
- How to communicate across disciplines, outside of academia, and across cultures?

IT'S



COMPLICATED

Why is it challenging?

- The impact of climate change on local and regional rainfall is hard to predict
- Other factors influence water availability e.g. deforestation
- MANY other factors influence adaptation-relevant decisions
 - A “wicked problem”?

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An example: the UMFULA project



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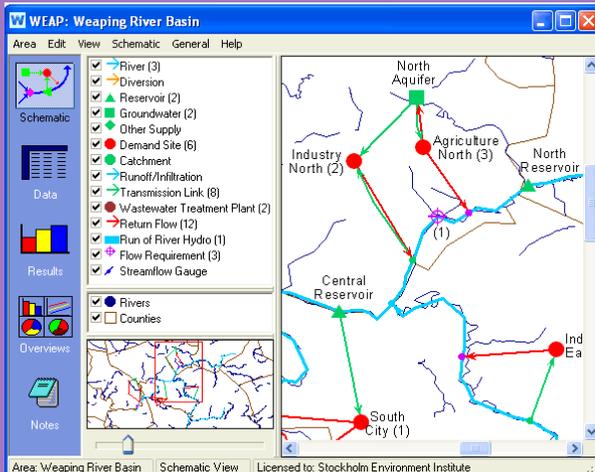
Workshops with water managers



Interviews with farmers



Water resource modelling



Analysis of policy documents



Analysis of climate model experiments



An example: the UMFULA project

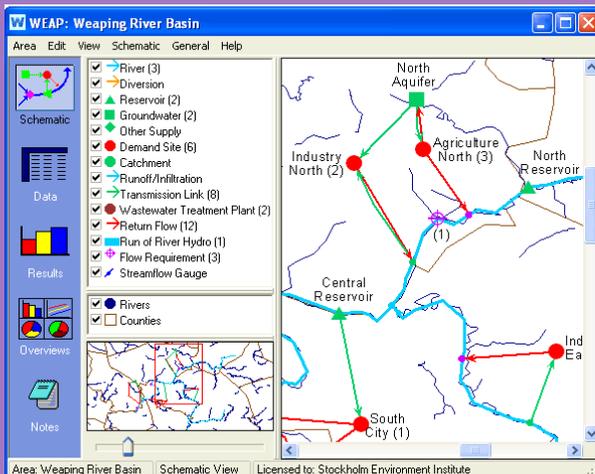
Transdisciplinary research



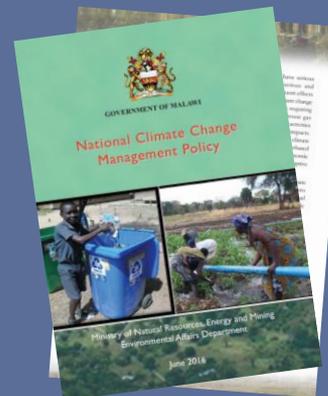
Social science



Engineering & hydrology



Political science



Climate science/physics



Geographical research!

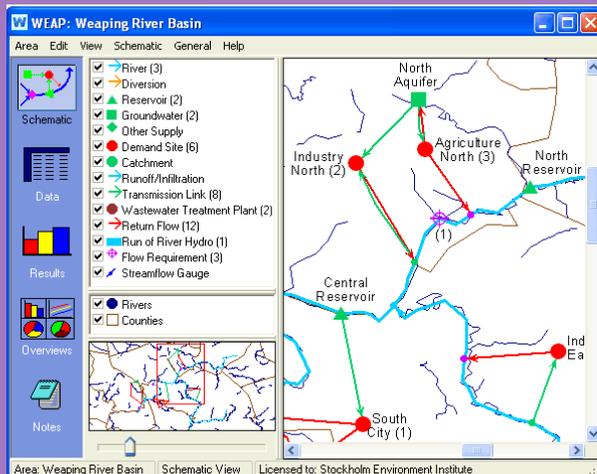
Transdisciplinary research



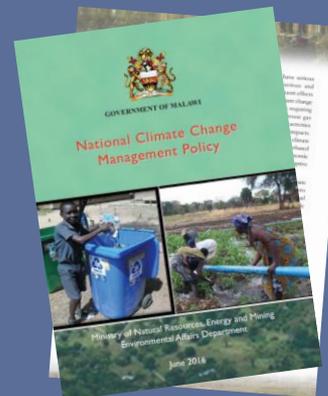
Social science



Engineering & hydrology



Political science



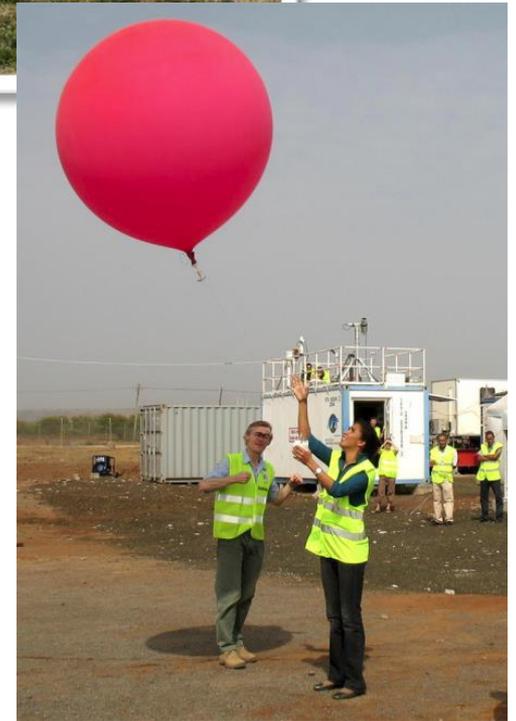
Climate science/physics



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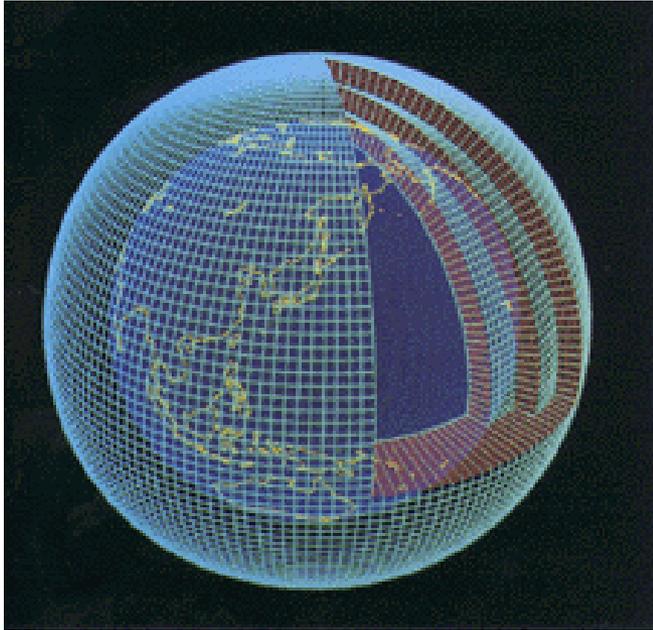




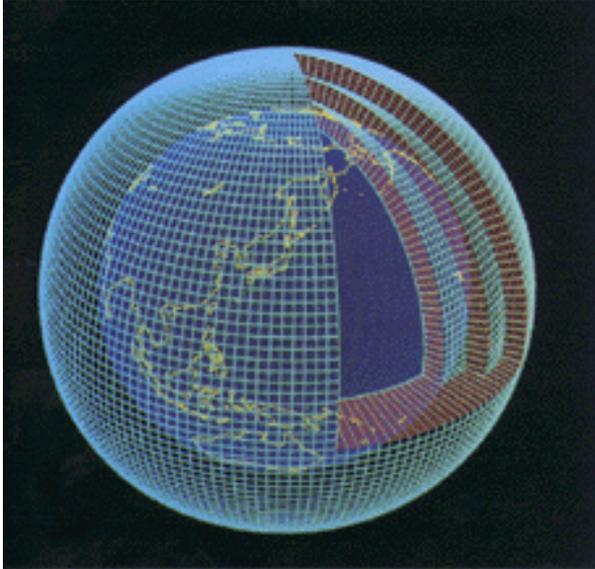
POLICE PUBLIC CALL BOX

PLEASE OBSERVE
THE TIME AND
PLACE OF THIS
BOX. DO NOT
OPEN IT UNLESS
YOU ARE CALLED
TO IT. PLEASE
DO NOT OPEN
IT UNLESS YOU
ARE CALLED TO
IT.

Climate models!

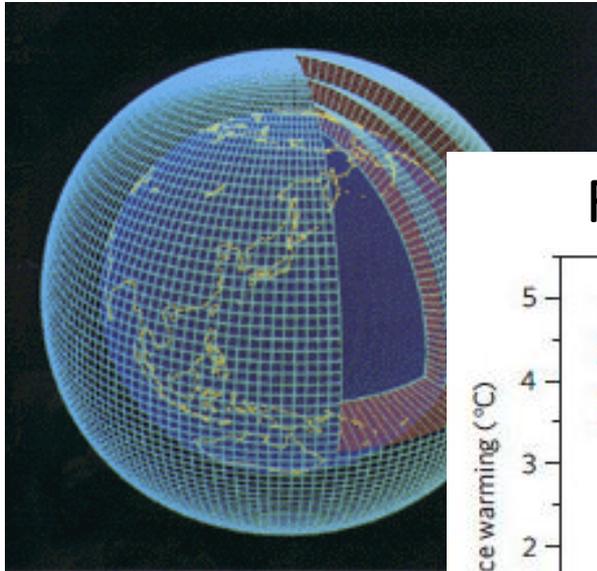


How do we find out what might happen to climate in the coming decades?



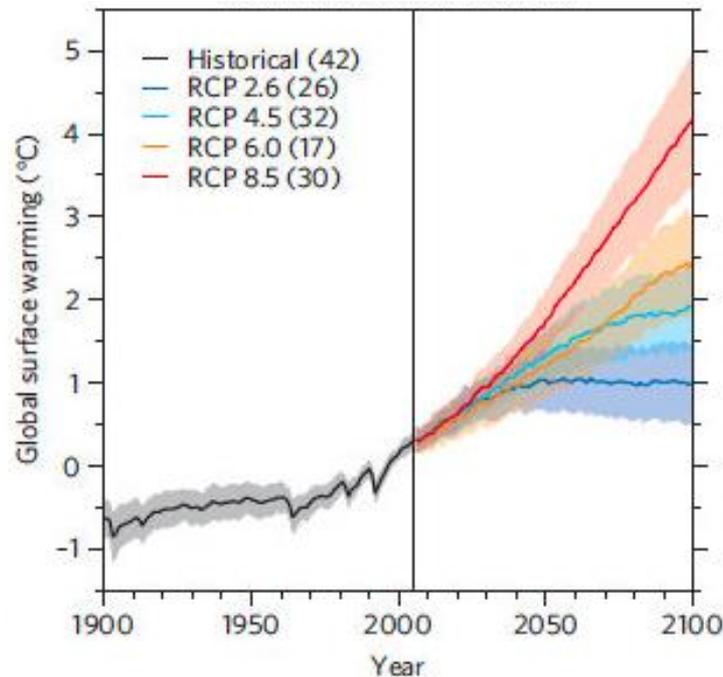
Climate model

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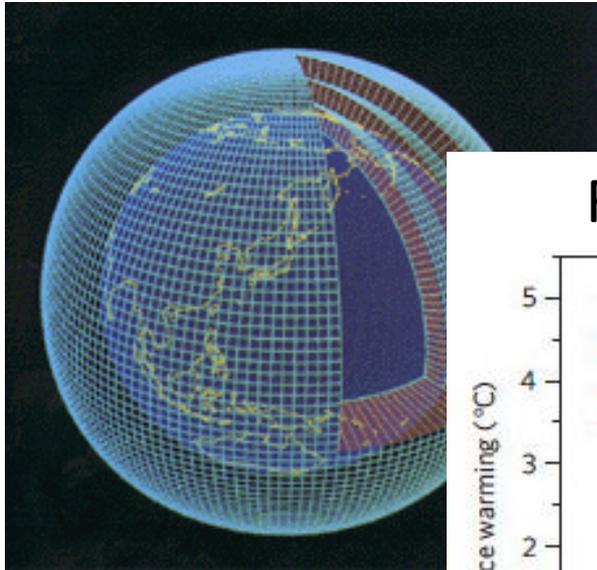


Climate model

Future scenarios

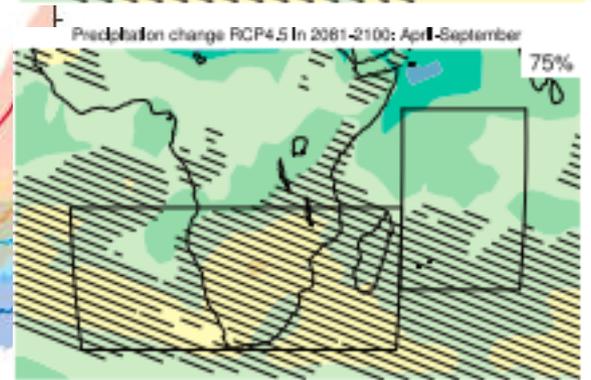
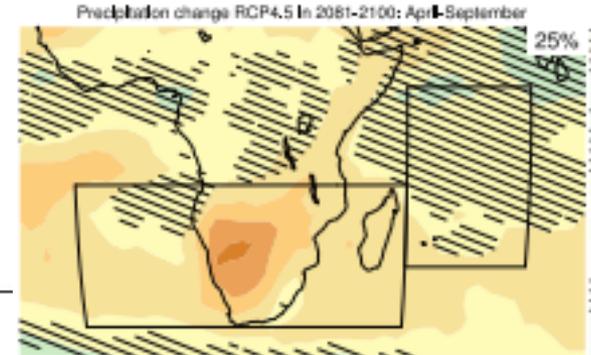
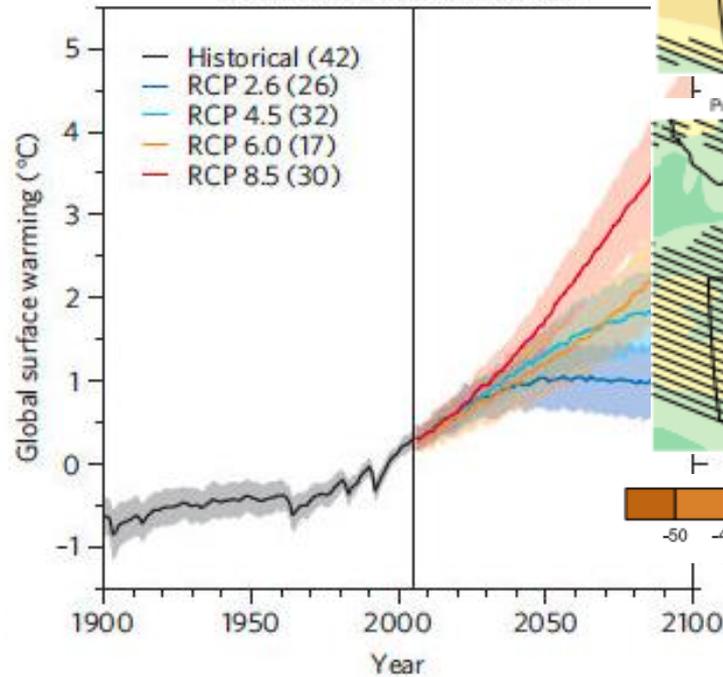


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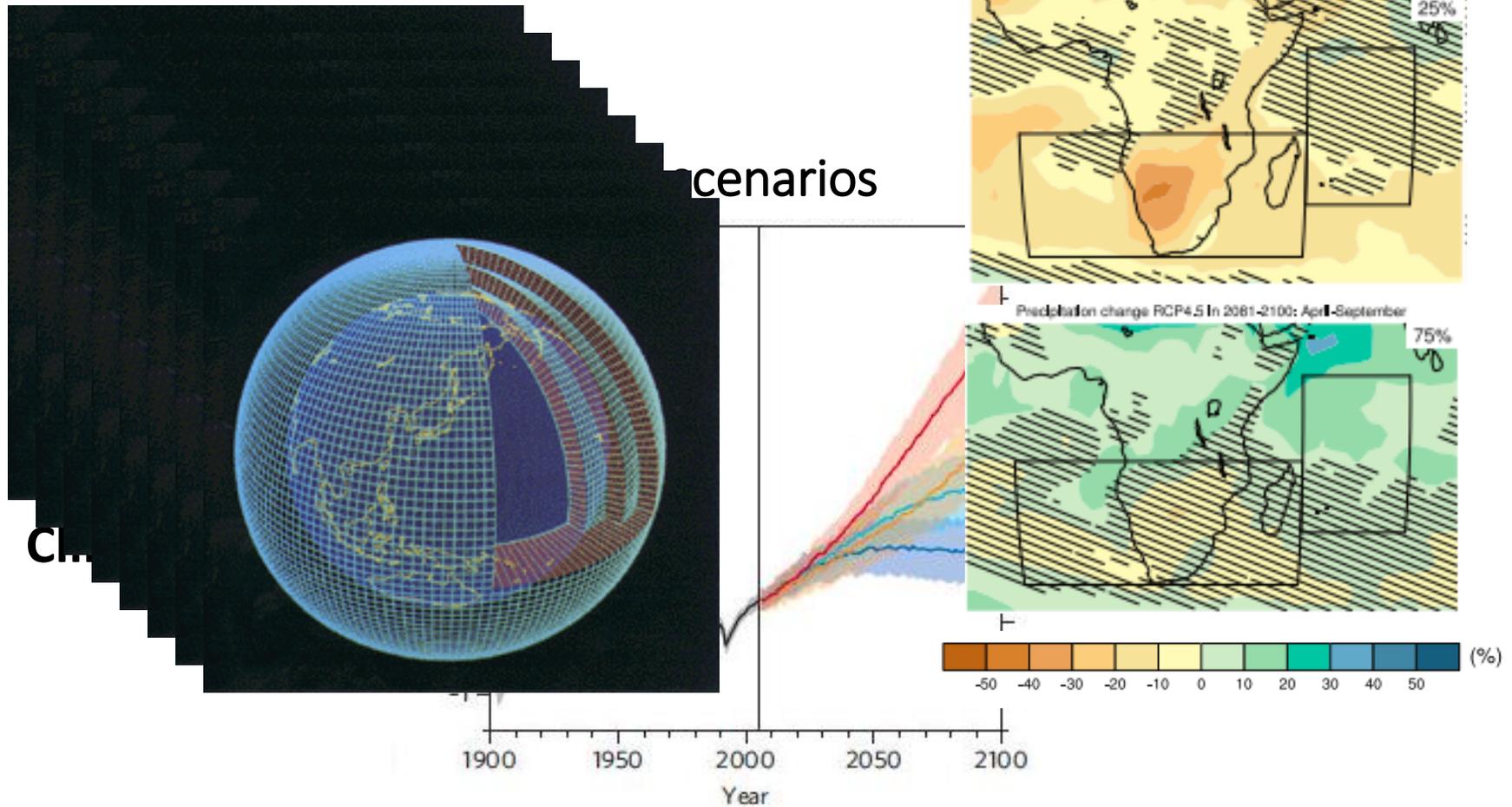


Climate model

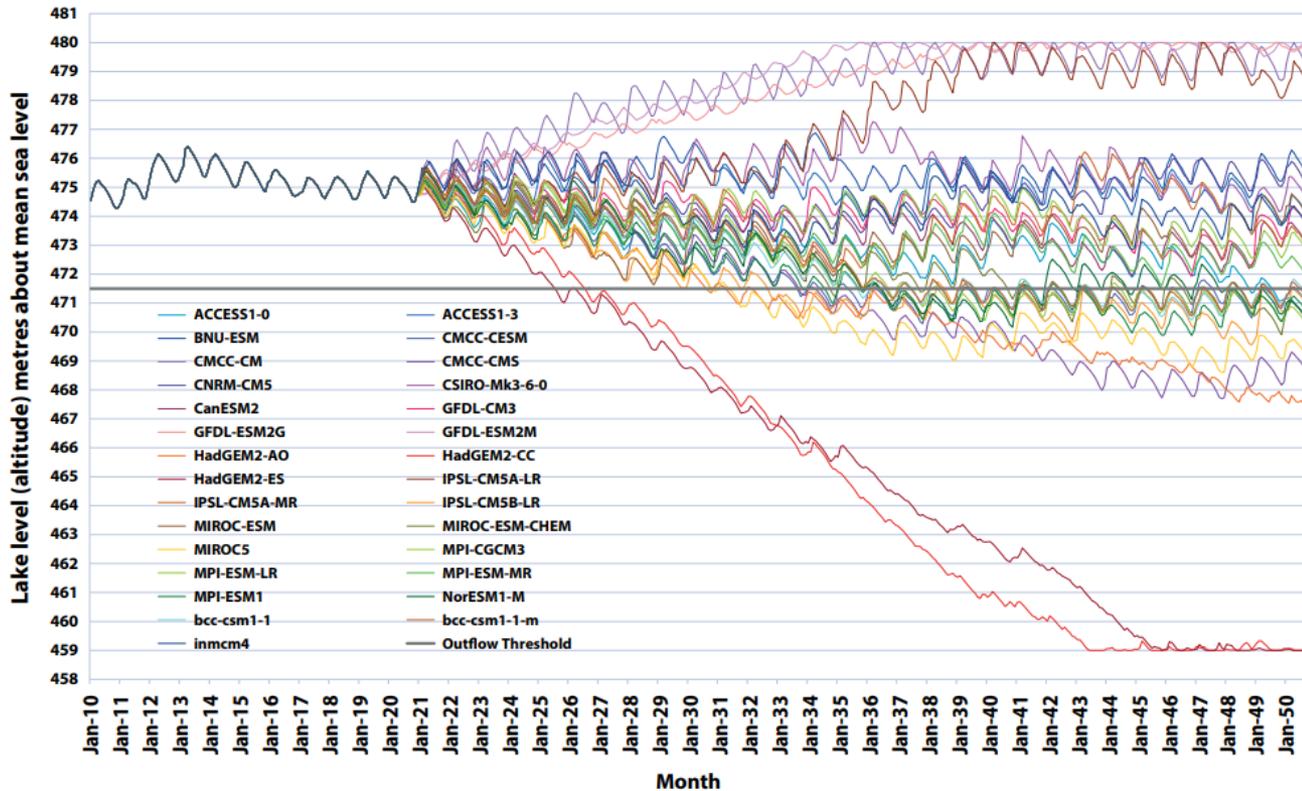
Future scenarios



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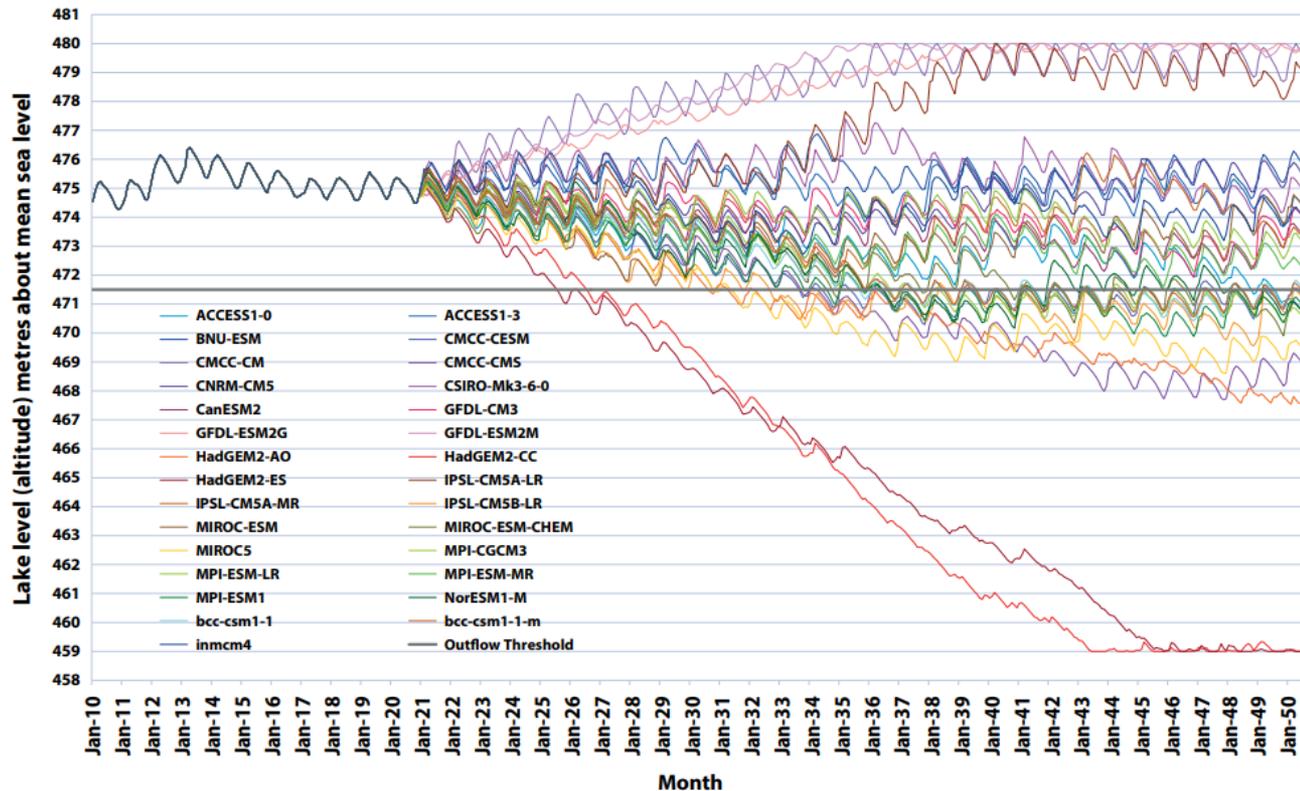


Some models say it'll get wetter, some say it'll get drier



Climate change impacts on Lake Malawi levels based on 29 climate models (Bhave et al. 2019)

Should water managers in the Shire Valley prepare for wetter or drier futures?

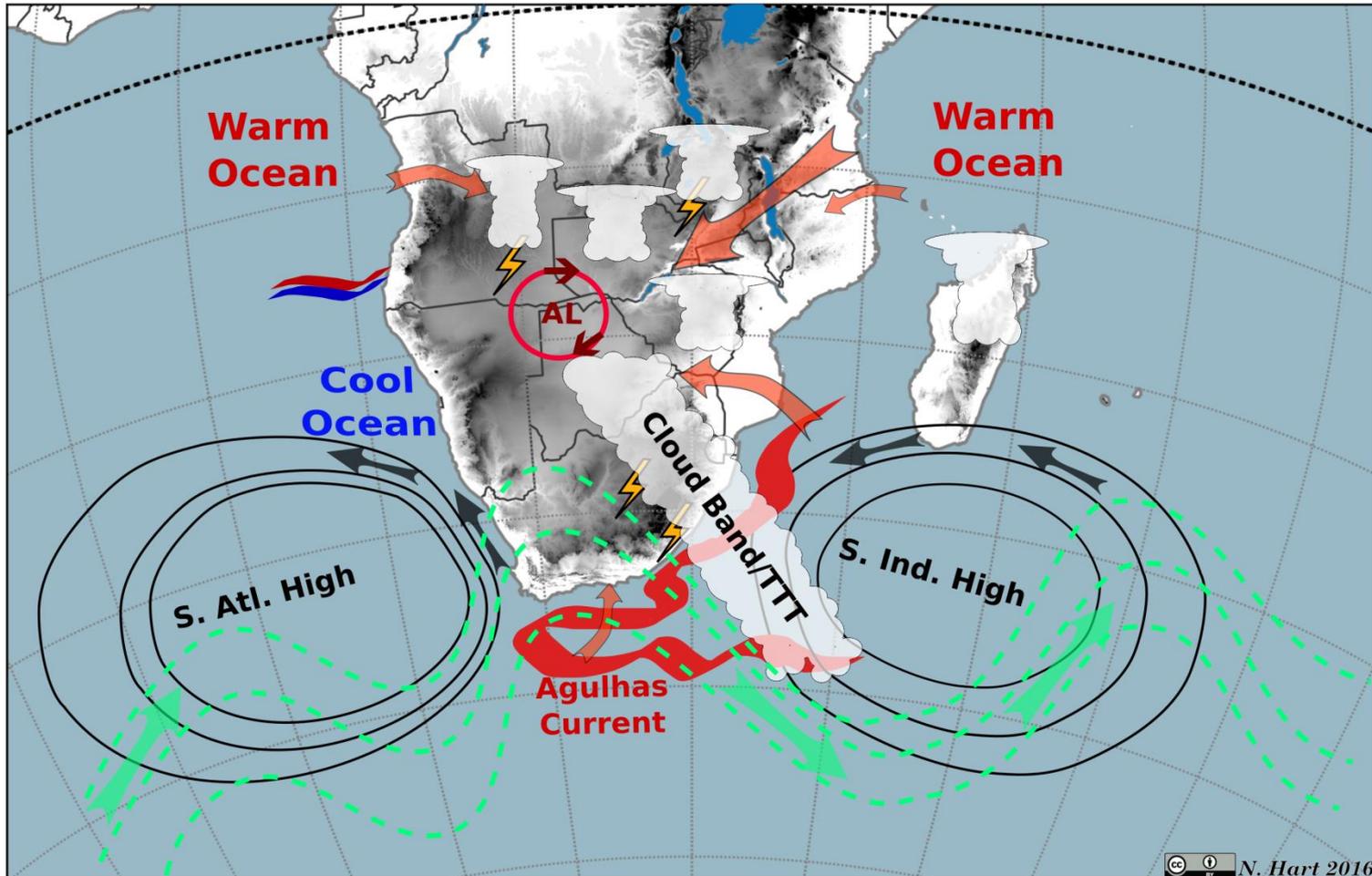


Climate change impacts on Lake Malawi levels based on 29 climate models (Bhave et al. 2019)

*Should water managers in the Shire Valley
prepare for wetter or drier futures?*

mentimeter

What shall we do now? More climate science!



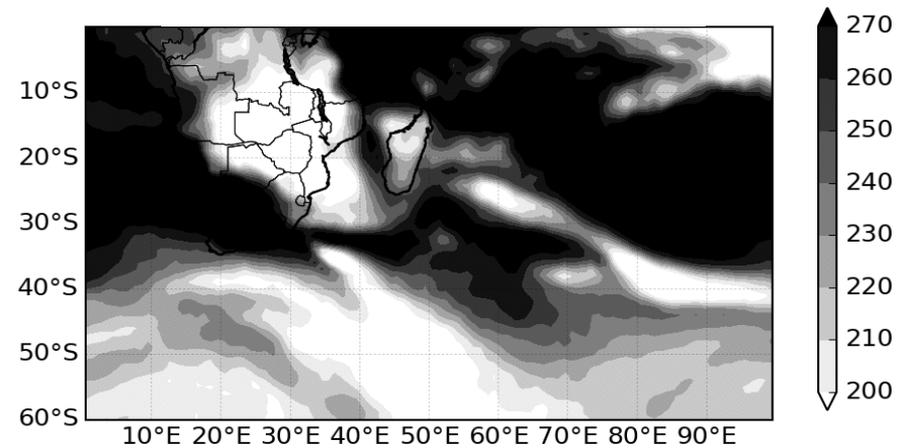
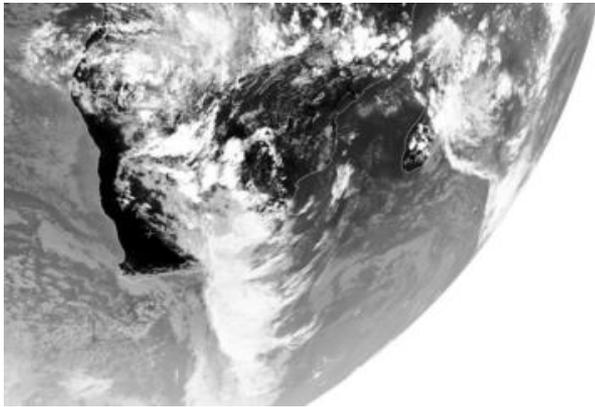
AL Angola Low
⚡ Thunderstorms

➡ Low-level Moisture Transport
➡ Upper-level Flow

Schematic by Neil Hart

Tropical Temperature Troughs (TTTs)

as a lens to explore rainfall change



daily satellite Outgoing Longwave Radiation (OLR) (W m^{-2})

How might rainfall change in southern Africa
in future?



How might TTTs change in future ?



What changes in TTTs are projected by
climate models, and can we trust them?



How well do climate models represent
TTTs?

LaunchPAD: Analysing processes in climate models across the continent



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Summary

- Adaptation to climate change is unavoidable
- In African countries, great opportunities for climate-resilient development & investment
- Adaptation is not easy, especially for rainfall change, which is uncertain
- Informing adaptation is a transdisciplinary challenge, geographers have potential to be very useful!
- Climate science is one part of this research: important to support science across the continent to help inform adaptation decisions

Thank you! Any questions?

Thanks to UMFULA and LaunchPAD teams

<https://launchpad6.home.blog/>

<https://climatebristol.org>

Dr Rachel James

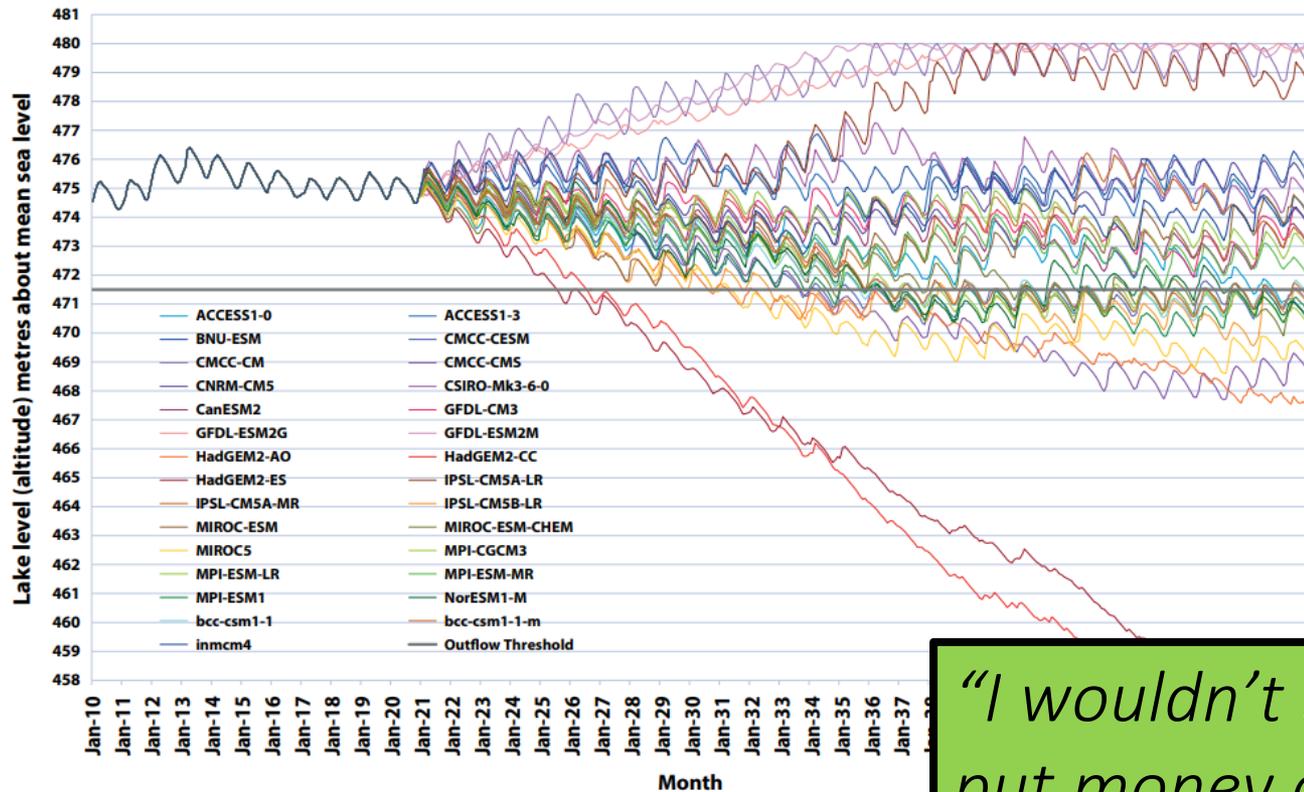
Senior Lecturer in Climate Science



What can we do to adapt to climate change in Bristol?



Should water managers in the Shire Valley prepare for wetter or drier futures?



"I wouldn't like to put money on it"

Climate change impacts on Lake Malawi levels based on 29 climate models (Bhave et al. 2019)



Kate Marvel

@DrKateMarvel

Following



I feel like most people think
uncertainty = $\sqrt{(\text{ツ})}$
but it's actually more like 🙄

Peter Jacobs @past_is_future

This follows on work by @DrKateMarvel and others
agupubs.onlinelibrary.wiley.com/doi/full/10.10...
[twitter.com/Tim_AndrewsUK/...](https://twitter.com/Tim_AndrewsUK/)