FUTURE CLIMATE FOR AFRICA

Communicating climate information and uncertainty better: Cognitive psychology insights and practical experiences

29 November, 2018

AMMA-2050

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For more information:

- Future Climate for Africa
  - www.futureclimateafrica.org
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  - Twitter: @future_climate
  - Youtube: https://goo.gl/fLzeSH
- FRACTAL
  - http://www.fractal.org.za/
    alice@csag.uct.ac.za,
  - Twitter: @FRACTALproject
- AMMA-2050
  - https://www.amma2050.org/
    twarnaars@ceh.ac.uk
  - Twitter: @amma_2050

AMMA-2050

WEBINAR PROCEEDINGS

29 November, 13:00-14:00 GMT

13:00-13:05 - Welcome, housekeeping

Mr Jean-Pierre Roux (SSN); jean-pierre@southsouthnorth.org

13:05-13:15 – Communicating changes in the west African monsoon

Ms Emma Visman (VNG Consulting); emma@vngconsulting.org.uk

Dr Tanya Warnaars (CEH); twarnaars@ceh.ac.uk

13:15-13:25 - Using climate risk narratives for city-region scale decision-making

Dr Chris Jack (University of Cape Town); cjack@csag.uct.ac.za

13:25-13:45 – Challenges and insights from psychology

Dr Jordan Harold (University of East Anglia); Jordan.Harold@uea.ac.uk

Dr Irene Lorenzoni (University of East Anglia); I.Lorenzoni@uea.ac.uk

13:45-13:58 - Attendee Q&A

13:58-14:00 - Closing remarks and poll

Mr Jean-Pierre Roux, SSN

How AMMA-2050 is communicating climatic uncertainties

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

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University of Sussex

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AMMA-2050: African Monsoon multidisciplinary Analysis

Overall objectives:

- understanding **how the monsoon will change** in future decades
- how this information can be most **effectively used to support development** in the region

Project Aims:

- Determine drivers of High Impact Weather (HIW)
- Assess trustworthiness of HIW projections
- Identify impacts and adaptation options for decision-makers
- Apply knowledge in agricultural and urban hydrological settings

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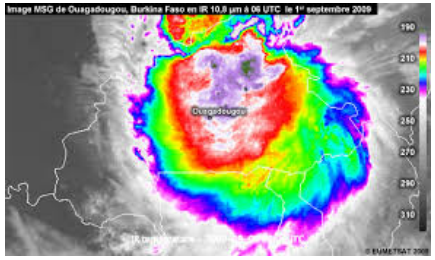
Pilot studies in resilient agriculture and urban flooding

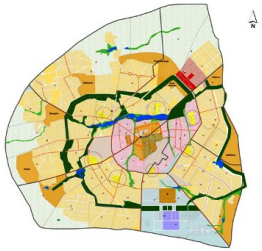
Agricultural study based in Niakhar, Senegal

- Transfer climate smart information and technologies to decision-makers to support their mid- and long-term strategies and policies
- Identify appropriate climate smart agriculture technologies and innovations for intensification

Future floods study based in Ouagadougou, Burkina Faso

- Build a comprehensive knowledge base of flood information
- Inform the urban planning process
- Evaluate the socio-economic impacts of flood predictions
- Develop tools and outputs that integrate climatic risks and socio-economic factors





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AMMA-2050 methodologies for communicating science for decision makers

- Stakeholder slides
- Plateau game
- Participatory Modelling
- Theatre Forum
- Café Scientifique

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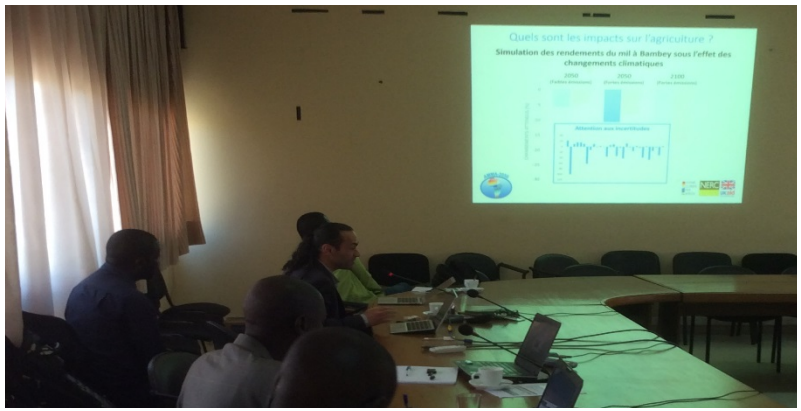
Aims of Stakeholder slides

- Baseline scientific understanding, *clarifying areas of certainty and uncertainty;*
- Build consensus amongst participating scientists and researchers on key messages for decision makers;
- Share current and emerging learning within project stakeholder meetings, for example, forum with national and local government decision makers and technical advisors, to inform National Adaptation Plan and regional decision making in Senegal in order to develop a foundational understanding from which
  - ➡ *Stakeholders can indicate areas of (additionally) required information;*
- Be revised to incorporate emerging scientific understanding.



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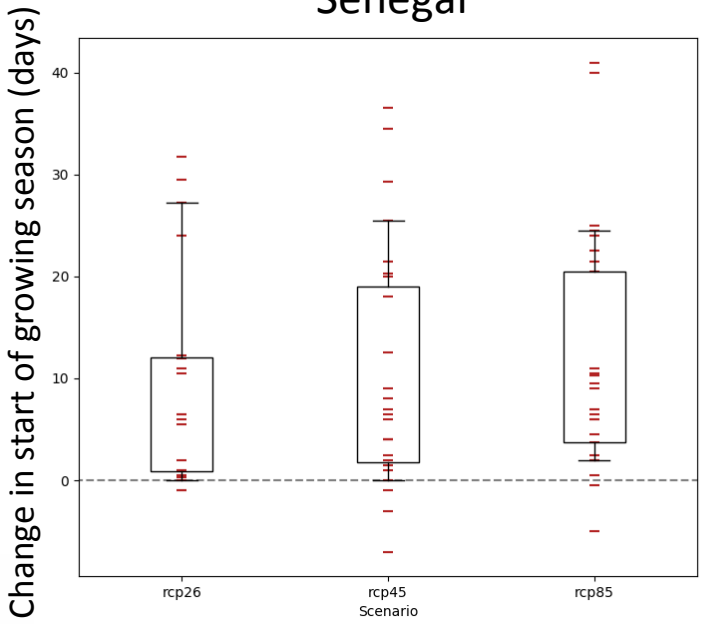
Will the wet season get longer by 2050?

We are uncertain

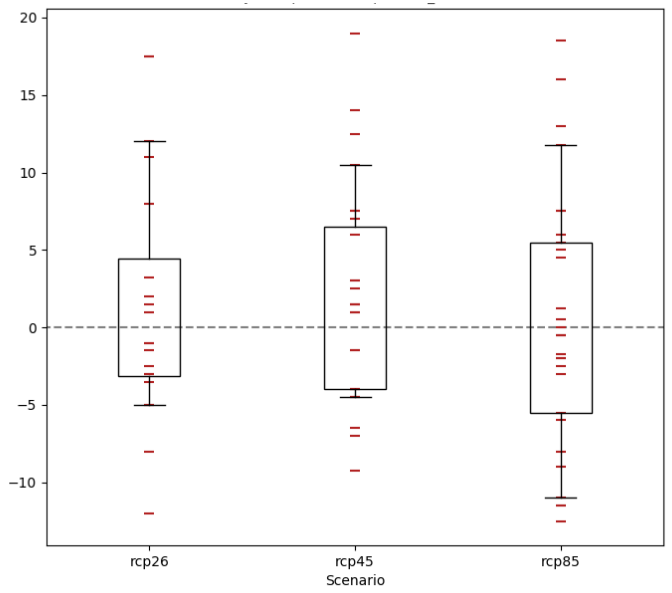
Expect delayed start of growing season in Senegal (no clear signal in Burkina Faso)

However, this may be compensated by more rain at the end of the season

Senegal



Burkina Faso



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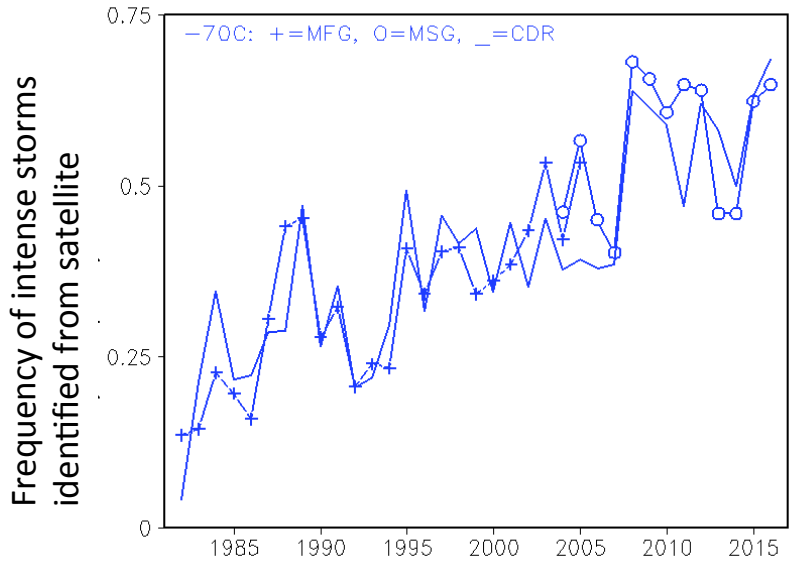
http://www.amma2050.org/content/climate-metrics

Are intense storms becoming more frequent? Yes

- The frequency of intense Sahelian storms has tripled in the last 35 years.
- Global warming is thought to be an important driver for this trend.



Taylor et al, Nature, 2017

Development of stakeholder slides

- Revised to provide scientific consensus on a series of key questions: top line question and response with accompanying scientific data;
- Non-technical commentary developed for each slide;
- Recorded presentation of slides in English and French;
- Tailored sets of slides developed for engagement in Burkina Faso and Senegal;
- Stakeholders have indicated their preference for specific forms of visualisation, *for example preferring histograms to IDF curves*… and ongoing project review to address these preferences.
- Ongoing Key Informant Scorecards to evaluate stakeholders' perceptions of the reliability and relevance of climate information.

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FUTURE RESILIENCE FOR AFRICAN CITIES AND LANDS

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FRACTAL aims to…

1. Advance **scientific knowledge** on **regional climate responses** to global change;
2. Enhance **knowledge on how to integrate this information into decision making** at the city-region scale (decision-making/ governance);
3. Responsibly **contribute to decisions for resilient development pathways** (case studies);
4. Approach through **iterative, transdisciplinary co-exploration/co-production processes** and enhance understanding of these (co-production of climate knowledge)

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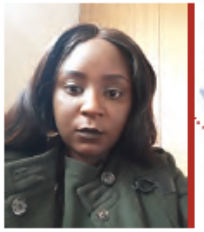
- *What are the **burning issues** in African cities?*
- *What are the **socio-economic, governance, and physical elements** of these issues?*
- *How might these issues get **worse under conditions of climate change?***
- *What (climate) knowledge can we produce that will **help make better decisions** under these conditions?*
- *How can we produce this in a way that **integrates multiple perspectives** and **supports action?***

9 Southern African Cities

LUSAKA | Zambia



Brenda Mwalukanga *Institutional partners have been engaged at the first Learning Lab resulting in joint planning and implementation for water security and resilience. We expect to see more learning and collaboration amongst stakeholders in the water and energy sectors.*

WINDHOEK | Namibia

Kornelia Iipinge *FRACTAL has enabled learning exchanges between Windhoek, Harare and Lusaka. Through city learning processes in Windhoek we have also explored what climate information is needed for resilient infrastructure design.*

GABARONE | Botswana

Lapologang Magole *Researchers from the University of Botswana, together with key individuals from the water sector and city management, have developed climate narratives for Gabarone.*

BLANTYRE | Malawi

Burnet O'Brien Mkandawire *FRAC has held an engagement workshop w multiple stakeholders and been part innovative discussion paper on a pro to turn solid waste into energy. Clima narratives have also been developed.*

HARARE | Zimbabwe

Mzime Ndebele-Murisa *GEC funding ha enabled research into climate risks, the ne between climate, water and energy, and decision-making. A successful ER model w implemented. Exchange visits to Lusaka a Windhoek highlighted common water scar*

MAPUTO | Mozambique

Genito Maure *The Maputo Water Dialog was the first event to bring multiple stakeh at the city level to the same platform to di water issues. It shed light on where the gap likely located between producers and user climate information.*

CAPE TOWN | South Africa

Amy Davison *Through FRACTAL, there has been interest shown in developing learning workshops that bring together City of Cape Town officials and academics in open discussion around climate and climate change.*

JOHANNESBURG | South Africa

Given Mbara, Lebo Molefe and Mzukisi Gwata *The Climate Change Adaptation Framework reports have been presented to section 79 and mayoral committees and a green light has been given to engage further stakeholders.*

DURBAN | South Africa

Lulu Van Rooyen *FRACTAL has investigated ways to integrate climate change information into biodiversity planning. This has sparked interest in a series of workshops to mobilize climate change knowledge within various departments in the city.*

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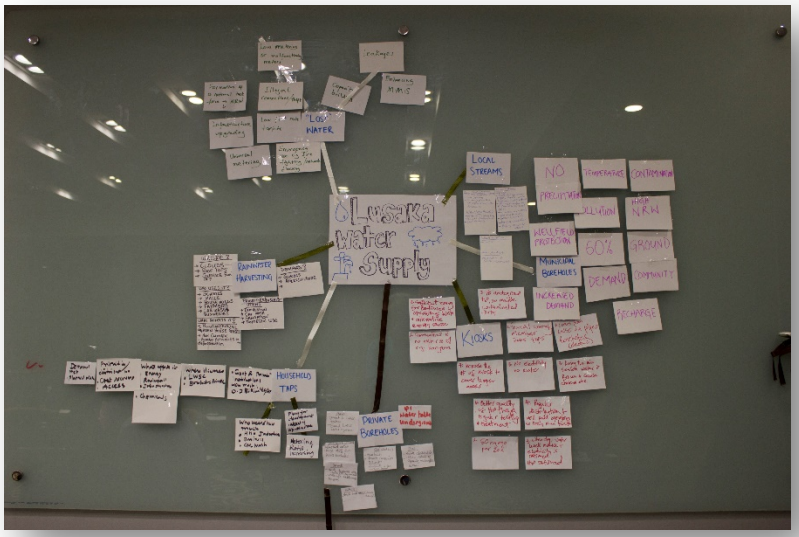
Learning Labs

Spaces for mutual learning and conversation based on principles of:

- ✓ ***Equal knowledge holders**, diversity of expertise*
- ✓ ***Trust, built on long relationships, honesty, humility and humour***
- ✓ ***Emergent pathways**, no pre-determined end point*



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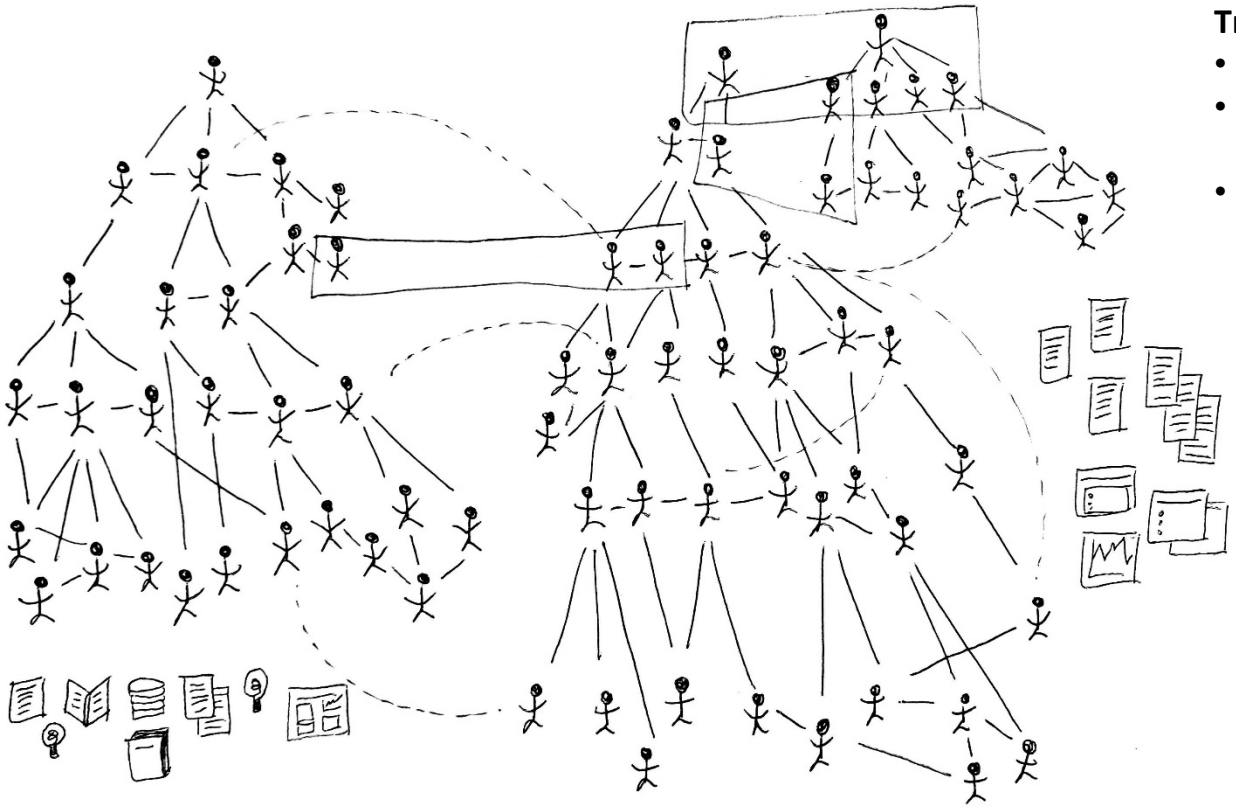

Traditional hierarchies

- Knowledge flow is limited
- Few (formal and informal) connections across groups
- Information is produced outside of context for 'uptake'

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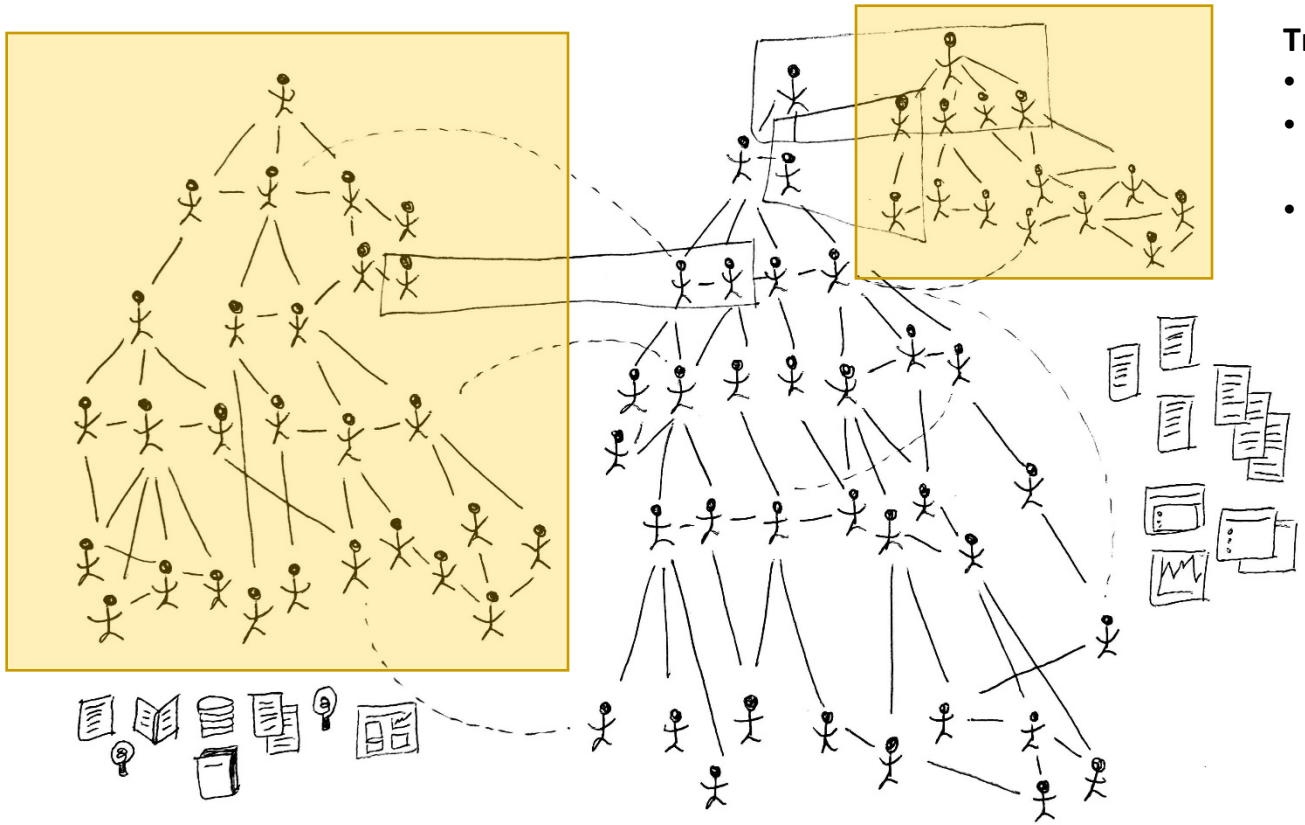

Traditional hierarchies

- Knowledge flow is limited
- Few (formal and informal) connections across groups
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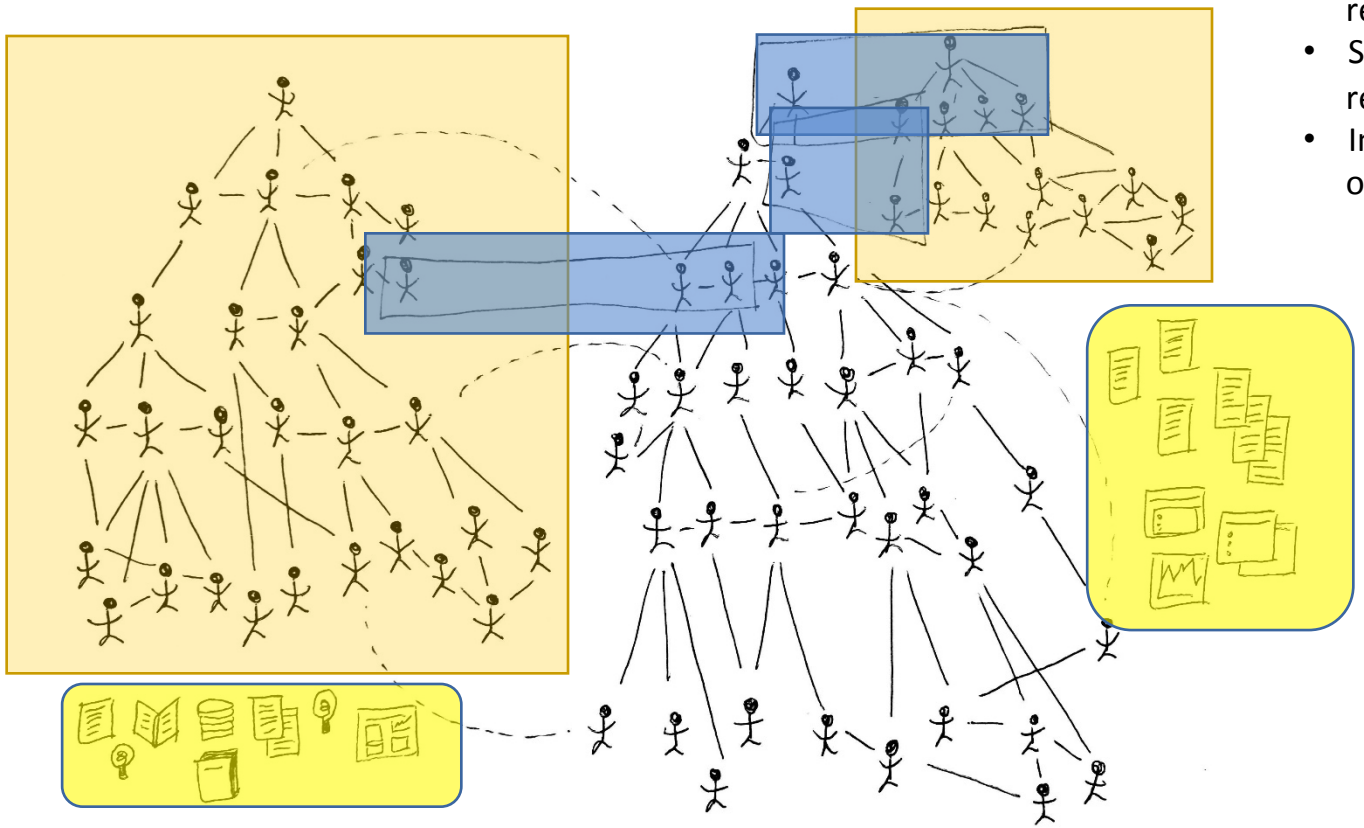
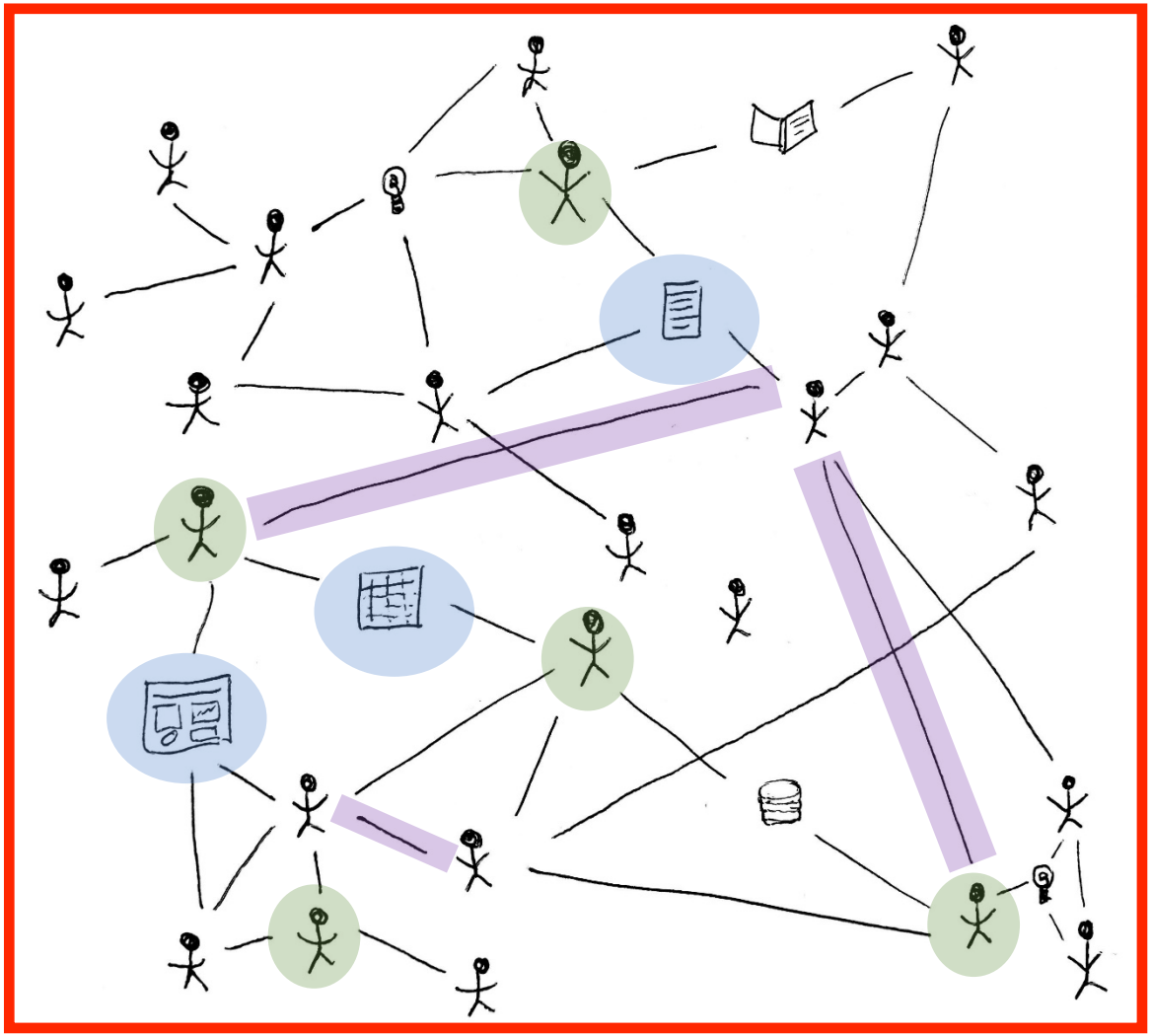
Traditional hierarchies

- Knowledge flow is limited
- Some formal connections/ relationships
- Some information connections/ relationships
- Information is produced outside of context for 'uptake'





FRACTAL Praxis

- Expand and (semi) formalize spaces of connection and **co-production spaces** to be more inclusive, diverse and consequential
- Develop **capacity** to engage, ask questions and analyse problems in a holistic way
- Develop **receptivity** to different world views (support capacity) and to exercise agency in co-production processes
- **Distilling information** through bringing it to bear on particular decisions

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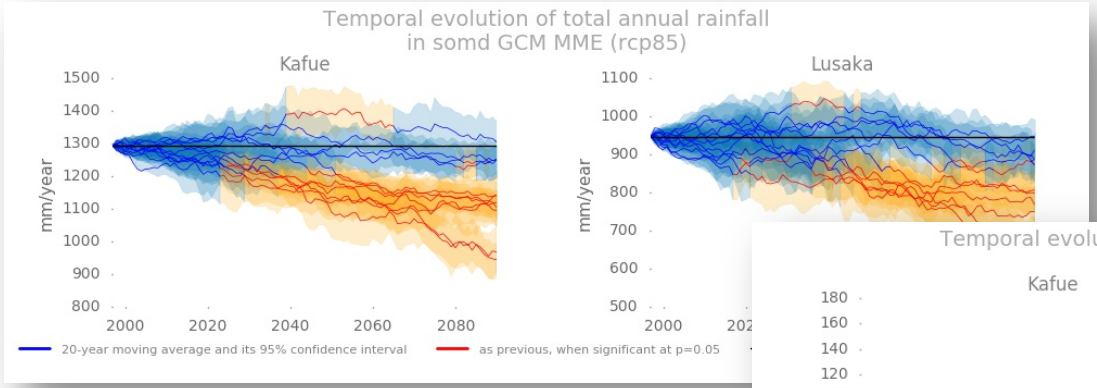
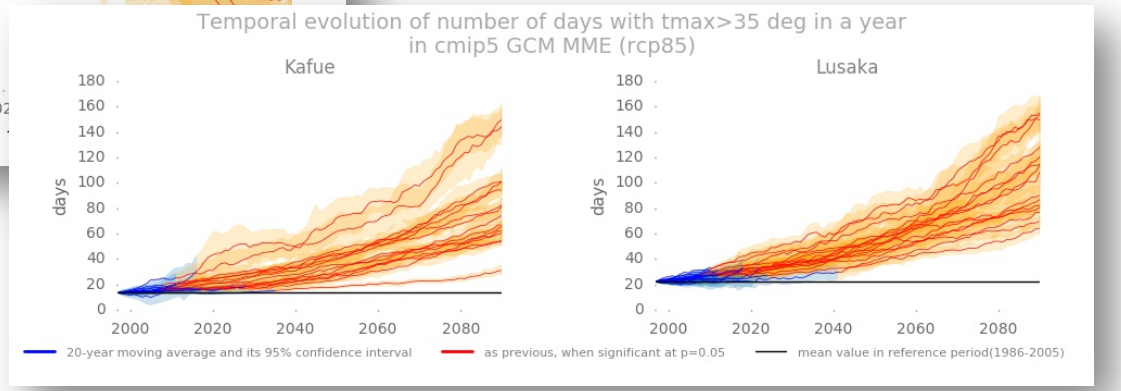
Climate risk narratives

The premise:

- ✓ *People have **pre-existing "narratives"** about climate change*
- ✓ ***Narratives can be powerful**, both positively and negatively*
- ✓ *It is hard to translate science outputs into **"things that matter"***
- ✓ ***Distilling** multiple, contradicting, lines of evidence is*
- ✓ *Directly constructing narratives about things that matter, rather than presenting "raw" evidence **might be more effective and "accurate"***





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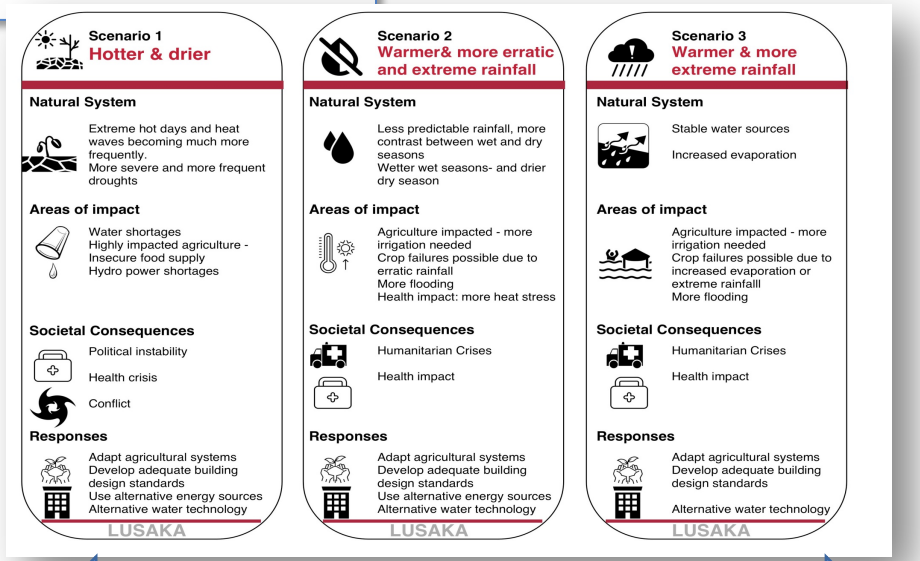
Climate risk narratives

"It is the middle of the 21st century, Windhoek and the region of Khomas experience temperatures which are much hotter than they used to be. The hottest years which were experienced by the region at the start of the century are now normal…

… Lower rainfall, lower runoff and higher evaporation rates have seen water sources become more polluted by blue-green algae and contain higher concentrations of salts….

… However some benefits from the hotter and drier climate have been felt by the city of Windhoek and region of Khomas. Flooding, and its associated damage, is [illegible] warmer temperatures in the dry season allow a great range of crops to [illegible] can afford irrigation. … "

Multiple stories ~ Uncertainty



Common impacts and responses

Which story is more likely?

Arguably impossible to ascribe formal probabilities

Narratives don't replace other decision making under uncertainty (DMU) methods such as decision scaling

If a particular narrative causes concern we can further explore the strength of the evidence behind it

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Climate risk narratives

The reality?

- ✓ *Good for **starting conversations** and **breaking down barriers** about climate change in a context*
- ✓ *Useful for **integrating different types of knowledge** in a cohesive way*
- ✓ *Effective at **translating climate science into things that matter***
- ✓ *Co-produced and so **co-owned, understood, and trusted***

But need to consider:

- ✓ *Unusual and **unexpected***
- ✓ *Not always considered "scientific enough"*
- ✓ *Need to keep **anchored in evidence***
- ✓ *"Safe" within the learning space, need to be careful when they **break free…***

Prefer climate narratives to climate graphs

The narrative is useful for planners and policy-making. Useful in any decision-making.

Need to have in depth knowledge of local context to translate climate science into an accurate narrative

The climate risk narratives and our way of working with scenarios is powerful

the breakdown of the scenarios into narratives was a very ingenious way of communicating.

Challenges and insights from psychology

University of East Anglia

Tyndall Centre for Climate Change Research

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Communicating uncertainty in the context of decision-making

Intuitive	Analytical
Type 1 processing	Type 2 processing
automatic	*controlled*
fast	*slow*
experience-based	*simulation of consequences*

Our everyday decision-making tends to be *experience-based*

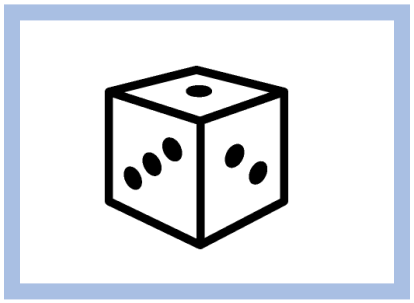
However, scientific endeavour typically characterised as being *analytical*

Changes in future climate will not necessarily match prior experiences

Evans, J. S. B., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science*, *8*(3), 223-241.

How to develop shared understanding of uncertainty?

Shared understandings



Things we know and fully understand
can precisely quantify…
but can't reduce

(aleatoric uncertainty)

Things we know but don't fully understand
Can estimate…
and can reduce with greater knowledge

(epistemic uncertainty)

Things we are ignorant of
Outside of our experience…
but that we may become aware of

(ontological uncertainty)

Spiegelhalter, D. (2017). Risk and uncertainty communication. *Annual Review of Statistics and Its Application*, *4*, 31-60.

How to enhance understanding of visual representations of uncertainty?

Visual representations

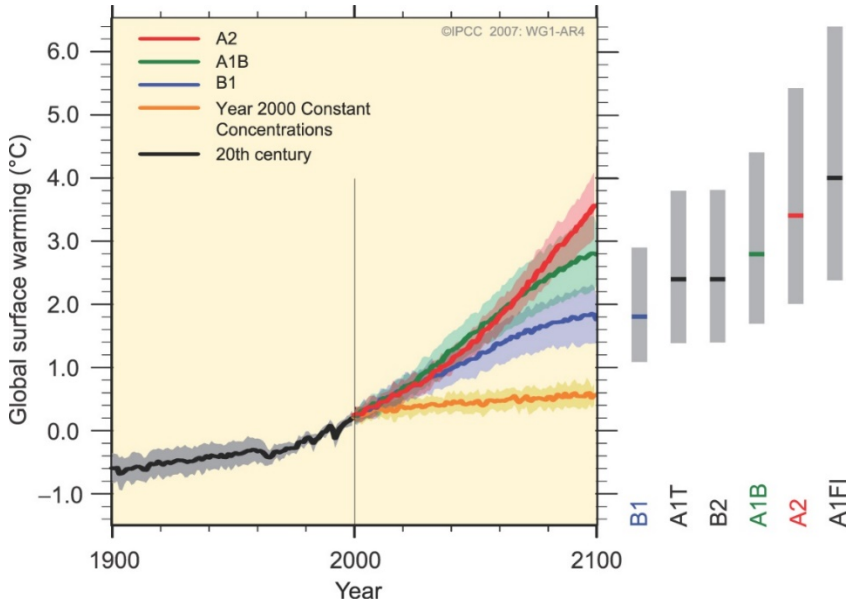


Figure: IPCC (2007) AR4 WG1 Figure SPM.5

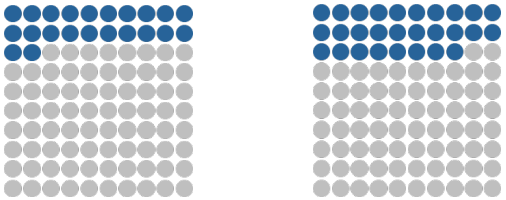
Among non-specialists:
Scenario uncertainty falsely attributed to model uncertainty

McMahon, R., Stauffacher, M., & Knutti, R. (2015). The unseen uncertainties in climate change: reviewing comprehension of an IPCC scenario graph. *Climatic Change, 133*(2), 141-154.

How best to communicate deep uncertainties?

Deep uncertainties

Probabilistic uncertainty: example

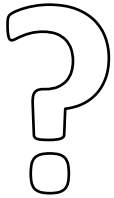


22 out of 100
22%

28 out of 100
28%

Probabilistic uncertainty may be best communicated by using a variety of formats, and combining visual arrays with text.

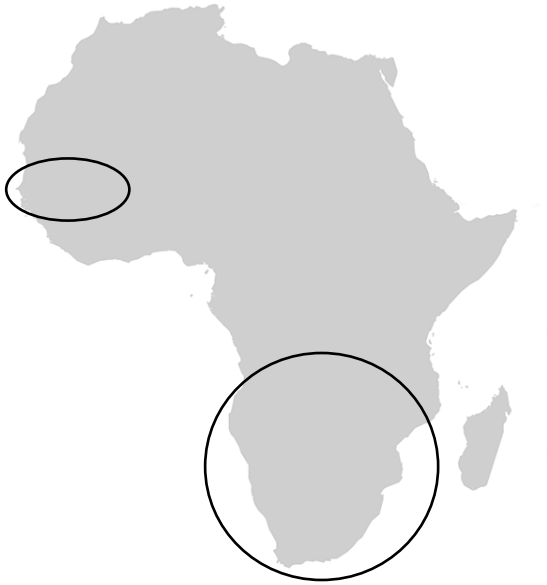
Deep uncertainty…



But what formats can be used to communicate deep uncertainties, for which there may be a variety of views and beliefs, and where we may be ignorant of relevant information?

Spiegelhalter, D., Pearson, M., & Short, I. (2011). Visualizing uncertainty about the future. S*cience*, *333*(6048), 1393-1400.

Project interviews



Senegal

Farmers and women's groups; local/ national gov; NGOs

Blantyre, Malawi
Gaborone, Botswana
Windhoek, Namibia

City regions; local/ national government; NGOs; researchers

Stakeholders

What is relevant to decision-making?

Researchers

What is important to communicate?

Cognitive challenges

How can decision-makers be supported?

Trust

Shared understandings

Deep uncertainties

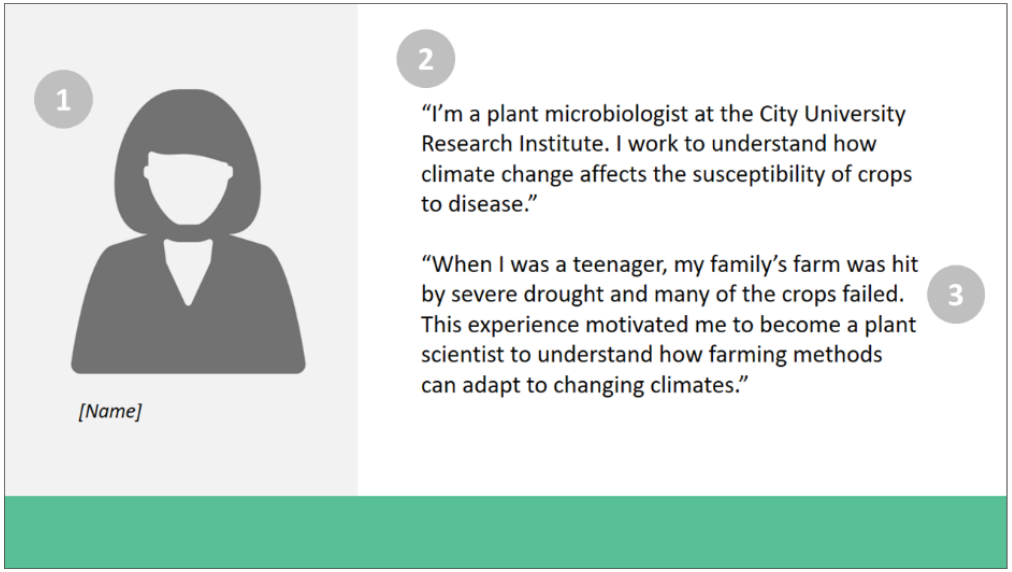
Project finding:
Stakeholders may interpret 'uncertainty' as 'not knowing', or a 'lack of accuracy'

- **Develop shared understandings and mutual trust to support use of climate information in decision-making.**

Trust in information and sources can be affected by assessments and communication of uncertainty (e.g. Otto et al., 2016).

Otto, J., Brown, C., Buontempo, C., Doblas-Reyes, F., Jacob, D., Juckes, M., Keup-Thiel, E., Kurnik, B., Schulz, J., Taylor, A. and Verhoelst, T. (2016). Uncertainty: Lessons learned for climate services. *Bulletin of the American Meteorological Society* , *97* (12), ES265-ES269.

Building trust



1. **Identifiability**: Photograph and text in first person
2. **Credibility:** Personal credentials and affiliations
3. **Empathy:** relevant personal experience

Trust

Trust may be affected by format of information provision: visual formats designed to be more accessible may lower trust in information if they do not meet expectations (e.g. may not look scientific) (McMahon, Stauffacher, & Knutti, 2016).

Communication of uncertainty may be facilitated by responsive forms of engagement.

McMahon, R., Stauffacher, M., & Knutti, R. (2016). The scientific veneer of IPCC visuals. *Climatic Change, 138*, 369-381.

Co-production

Shared understandings

Visual representations

Deep uncertainties

Collaboration and involvement among decision-makers, scientists and practitioners (in partnership, resulting in joint outcomes).

Project finding:
Scientific formats are difficult to understand and use in decision-making

- **Incorporate decision-makers' needs and contexts in the design of communications containing uncertainty (i.e. co-production)**

Some **researcher interviewees**

- Emphasised importance of the contexts and values in which scientists and stakeholders work.
- Indicated need for providing spaces for shared understanding and relationships to be developed.
- Use of co-produced narratives to start conversations on climate and uncertainty.
- Acknowledged processes necessary for development of narratives.

Some **stakeholder interviewees**

- Proposed dialogues with the information producers, so that information may be conveyed in a more useful format to users.

Co-production requires willingness, commitment, time and resources

Accessible data visualisations

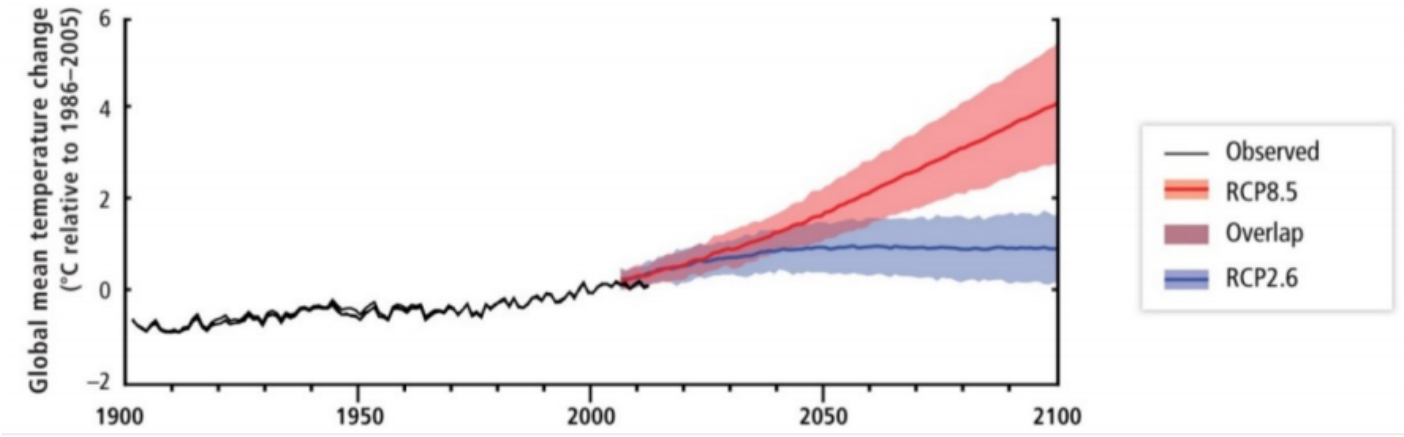
Visual representations

Message	Does the visual communicate a clear message?
Audience	Is the visual appropriate for the intended audience(s)?
Design	Does the visual use evidence-based design principles?
Evaluation	Has the visual been tested with the audience(s)?

Harold, J., Lorenzoni, I., Coventry, K. R., & Minns, A. (2017*). Enhancing the accessibility of climate change data visuals: Recommendations to the IPCC and guidance for researchers.* Report published by the Tyndall Centre for Climate Change Research, Norwich, UK

Example of cognitive visual design principles

Original figure:

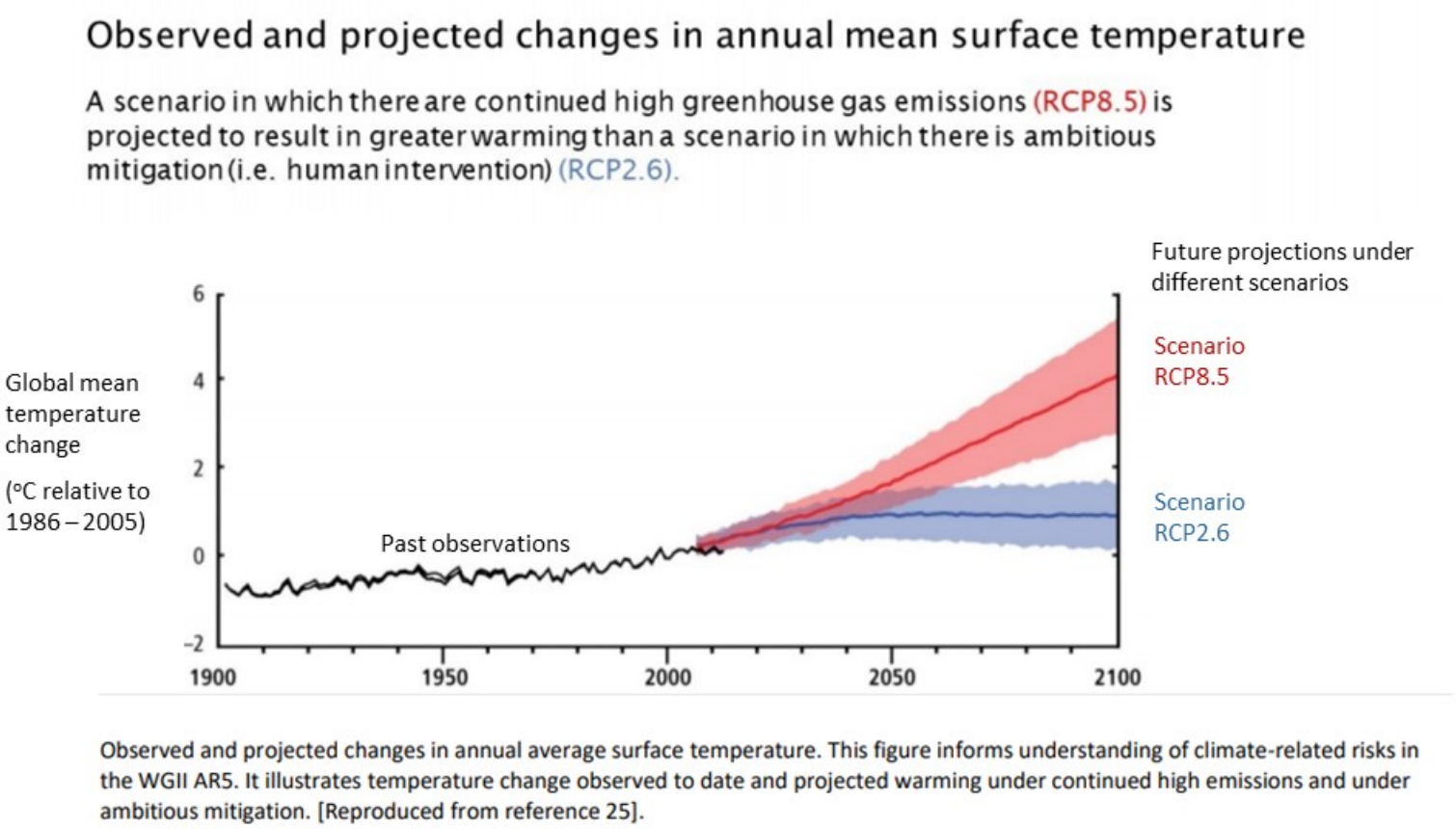


Observed and projected changes in annual average surface temperature. This figure informs understanding of climate-related risks in the WGII AR5. It illustrates temperature change observed to date and projected warming under continued high emissions and under ambitious mitigation. [Reproduced from reference 25].

From: IPCC (2014). Summary for Policymakers. In C. B. Field, V. R. Barros, D. J. Dokken, et al. (Eds.*), Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge, UK and New York, USA, Cambridge University Press.

Example of cognitive visual design principles

Adapted figure with cognitive design principles applied:

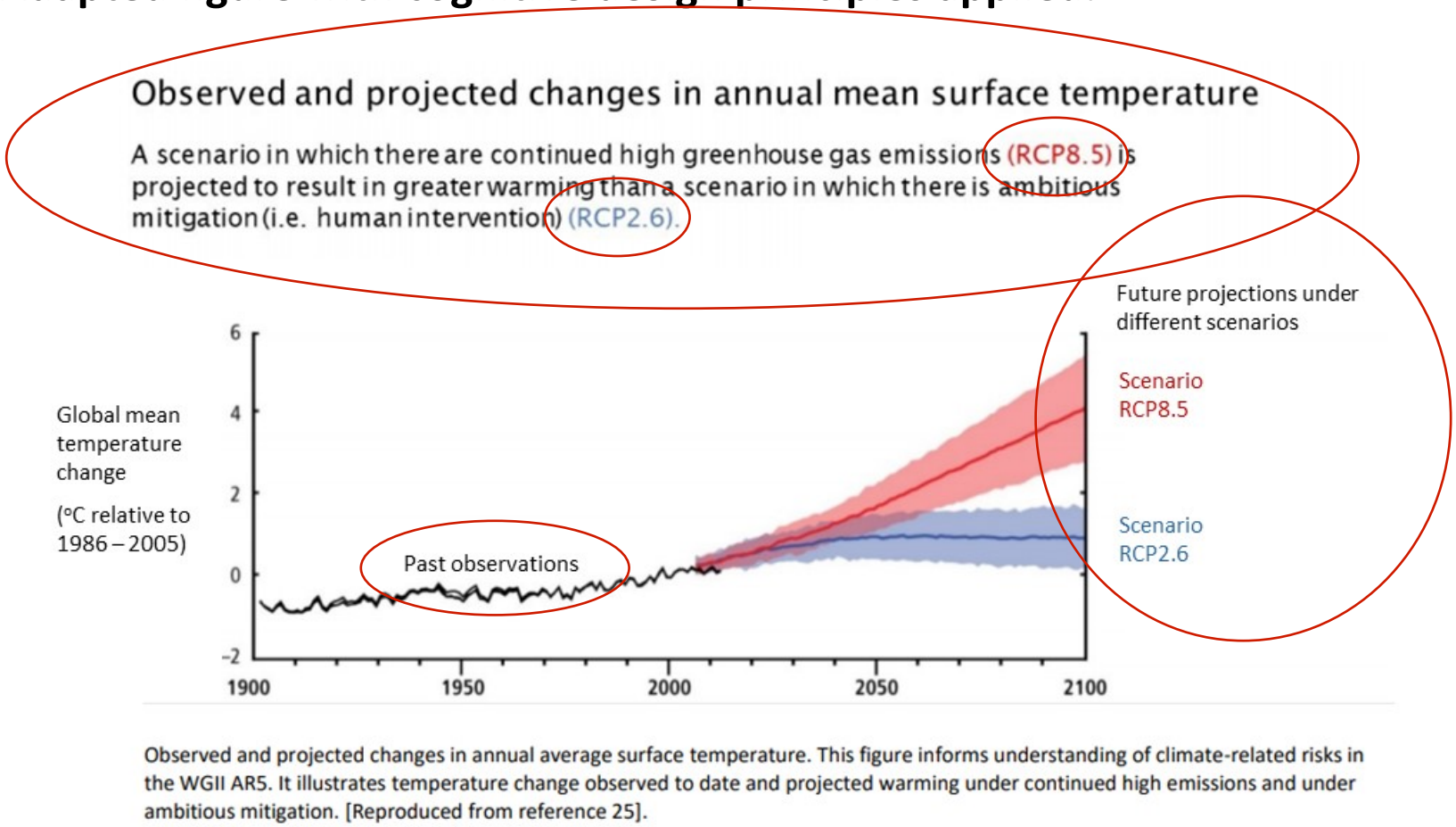


Observed and projected changes in annual average surface temperature. This figure informs understanding of climate-related risks in the WGII AR5. It illustrates temperature change observed to date and projected warming under continued high emissions and under ambitious mitigation. [Reproduced from reference 25].

Harold, J., Lorenzoni, I., Coventry, K. R., & Minns, A. (2017). Enhancing the accessibility of climate change data visuals: Recommendations to the IPCC and guidance for researchers. Report published by the Tyndall Centre for Climate Change Research, Norwich, UK,

Example of cognitive visual design principles

Adapted figure with cognitive design principles applied:



Observed and projected changes in annual average surface temperature. This figure informs understanding of climate-related risks in the WGII AR5. It illustrates temperature change observed to date and projected warming under continued high emissions and under ambitious mitigation. [Reproduced from reference 25].

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Recommendations

1. Layer information (balance between conveying gist and specifics)
2. Develop shared understandings
3. Evaluate trust in materials throughout development
4. Co-production – model of good practice
   - Time/resource constraints – combine multiple approaches
5. Build in evaluation of understandings of uncertainty
   - Understanding → information needs → relevance → decision-making

Resources and further reading

COMMUNICATION

The Climate Communication Project: https://theclimatecommsproject.org

Harold, J., Lorenzoni, I., Coventry, K. R., & Minns, A. (2017). Enhancing the accessibility of climate change data visuals: Recommendations to the IPCC and guidance for researchers. Report published by the Tyndall Centre for Climate Change Research, Norwich, UK, http://guidance.climatesciencecognition.com

UNCERTAINTY

Corner, A., Lewandowsky, S., Philips, M. and Roberts, O. (2015) guide: communicating climate change uncertainty. Climate Outreach.
https://climateoutreach.org/resources/guide-communicating-climate-change-uncertainty/

Shepherd, T. G., Boyd, E., Calel, et al (2018). Storylines: an alternative approach to representing uncertainty in physical aspects of climate change. *Climatic Change*, [online first]
https://link.springer.com/article/10.1007%2Fs10584-018-2317-9

CO-PRODUCTION

Willyard, C., Scudellari, M. and Nordling, L. (2018) How three research groups are tearing down the ivory tower. The people who should benefit from research are increasingly shaping how it's done. *Nature*, 3 October 2018, https://www.nature.com/articles/d41586-018-06858-4

Resources and further reading

AMMA-2050 NARRATED SLIDESET

Stakeholder Slides - This recording summarises our current knowledge of the projected changes, uncertainties, and recent trends of West African climate. These slides were first presented to stakeholders in Senegal (April 2016) and Burkina Faso (July 2016); they also document the baseline of climate knowledge from which AMMA-2050 would build. The first version of these slides have been updated using recent information generated by AMMA-2050 and were used at the stakeholder meetings in May 2018 in Senegal and Burkina. These slides focus on key questions of interest to our stakeholders such as: is it getting warmer? Is it getting wetter or drier? Etc.

https://www.youtube.com/watch?v=vQ9OTpQE1ho

FRACTAL CLIMATE NARRATIVES

Climate Home News, article by Alice McClure (2018). How do we tell stories of climate risk?
http://www.climatechangenews.com/2018/08/22/fractal-project-narrating-climate-risk/

FRACTAL Blog (2018) A newcomer's reflections on the fourth Lusaka Learning Lab.
http://www.fractal.org.za/2018/06/23/learning-lab-4-lusaka-a-newcomers-perspective/

FRACTAL Blog (2018) Growing climate knowledge through narratives of the future.
http://www.fractal.org.za/2018/07/31/growing-climate-knowledge-through-narratives-of-the-future/