Decision making

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Image credits: John M Nelson
From climate data to knowledge

• What happens once we produce climate data?
• Assumptions about socio-ecological systems and settings
• The end-user concept
• The plethora of decision-makers
Interdisciplinarity and transdisciplinarity in climate services

And in practice?

'An integrating synthesis is not achieved through the accumulation of different brains.' Max-Neef, 2004

Transdisciplinary researches strive to understand the complexity of the whole problem, rather than only those parts that pertain to their main research discipline.
### Convert C to Kelvin

```r
# Convert C to Kelvin

# atl3 mod
atl3.mod <- ifelse(atl3.mod < 60, atl3.mod + 273.15, atl3.mod)

# nino3.4 mod
nino3.4.mod <- ifelse(nino3.4.mod < 60, nino3.4.mod + 273.15, nino3.4.mod)
```

### I abind the aero3 to the nmmr/euroisp

```r
# years
years <- dim(atl3.aero3)[3]

# array
atlaero3.mod <- array(NA, dim=c(1, 51, years, 10))
nino3.aero3.mod <- array(NA, dim=c(1, 51, years, 10))
nino34.aero3.mod <- array(NA, dim=c(1, 51, years, 10))

# abind
```

### PERSISTENCE

```r
# Ano_CrossValid
atlaero.anom <- Ano_CrossValid(atl3.aero3, atl3.per3obs)
nino3.aero.anom <- Ano_CrossValid(nino3.aero3, nino3.per3obs)
nino34.aero.anom <- Ano_CrossValid(nino34.aero3, nino34.per3obs)

# Ano_CrossValid
atlaero.anom <- Ano_CrossValid(atl3.obs, atl3.ano)
nino3.anom <- Ano_CrossValid(nino3.obs, nino3.ano)
nino34.anom <- Ano_CrossValid(nino34.obs, nino34.ano)
```

### corr.per.atl3 and corr.per.nino3

```r
corr.per.atl3 <- array(0, dim = 10)
corr.per.nino3 <- array(0, dim = 10)
```
The binary/fragmented view trap

- Individual vs society/ Climate service producer vs user/Natural vs social scientists
- To move beyond dualism of the natural and social (science)
- To transform society we need to shift from the “us vs them” perspective and acknowledging the entanglements and connectedness and our shared reality (O’Brien, 2021)
- The emerging knowledge networks

Image credits: John M Nelson
What is transdisciplinarity?

Transdisciplinarity
(Plerality of knowledge sources (e.g. non-scientific knowledge))

Interdisciplinarity
(Coordination from high level concept)

Pluridisciplinarity
(Cooperation without coordination)

Multidisciplinarity
(no cooperation)

Disciplinarity
(specialisation in isolation)

Adapted from Max-Neef, 2004
Transdisciplinary pyramid for climate services

**empirical level** (concerns with physical laws of nature and understanding of life and society - *what exists*)

**pragmatic level** (*what we are capable of doing*)
- Climate model.
- Data architect.
- Design
- Communic.
- User engagement

**normative level** (*what we want to do*)
- Planning
- Policy
- Coproduction
- Decision-making

**value level** (*what should we do*)
- Value
- Ethics

Coordination between these hierarchical levels

Dynamic, iterative and non-linear process

Adapted from Max-Neef, 2004
Recommendations for reaching a transdisciplinary process

❖ Achieving meaningful **interdisciplinarity**

❖ Overcoming power imposition and hierarchies

❖ Dismantling the term *user* and grasping the heterogeneity of stakeholders and the array of the knowledge they can provide

❖ Rethinking and harmonising the language, words and methorphans we chose

❖ Fitting *communication channels* and spaces to stakeholders’ circumstances

❖ Approaching *stakeholder engagement* as a lasting process through *knowledge coproduction*
Coproduction is “a complex meeting place where several different academic traditions and practices converge, overlap, affect each other, come into conflict, or cooperate” Bremer and Meisch, 2017
COPRODUCTION FRAMEWORK
for Climate Services

- Social Media
- Videos
- Websites
- User Interface Platforms
- Blogs
- Mailing lists and newsletters
- Webinars
- User forums
- Surveys
- Workshops
- Interviews
- Hackathons
- Case studies
- Operational services
- Decisionsupport tools
- Proofs of concept

STAKEHOLDERS

POTENTIAL USERS

CHAMPION USERS
Decision-making in practice
Making decision based on seasonal climate forecasts

- RCOFs
- Consensus-based decision making
  - The forecasts based on
    - atmospheric circulation models from regional and international centres
    - statistical models
    - participants’ expert interpretation

- Verification of African RCOFs: evidence of systematic errors, and the positive skill may not always be immediately apparent
  - over-forecasting of the normal category
  - “encouraging the forecasters to forecast their true beliefs rather than their safest bets”

*Position Paper: Verification of African RCOF Forecasts (Mason & Chidzambwa, 2009)*

Figure 1 (a): June to September 2022 rainfall forecast
WMO (2020): “Guidance on Operational Practices for Objective Seasonal Forecasting”

- Use a procedure that is traceable, reproducible, well-documented – with forecasts amenable to verification
- Use dynamical climate models as the primary basis
OND 2019 - bold probabilities

- 55% predicted probability of above normal
- Strong positive Indian Ocean Dipole was developing - favouring widespread wet
- But not all models were in line with this
- Subjective intervention would likely have led to weakening of probabilities
- In the event, objective output encouraged better decision making
MAM 2021 - confronting uncertainty

- For MAM 2021, much spread in models resulted in wide areas with “equal chances”
- Low predictability for the MAM season is well known to climate producers...
- Opportunity to emphasise that $33/33/33/$ does not mean “average” - it means there is, e.g. “a 33% chance of worst case”
- The objective discipline forces/fosters confrontation of uncertainty
- At the GHACOF user response planning, consideration of pre-existing vulnerabilities come to the fore
New, more user-relevant products

- Probability of rainfall exceeding user-relevant thresholds
- Virtually impossible to generate with consensus approach
¡BUT!

Climate services promise better decisions but mainly focus on better data (Findlater et al. 2021)

1. **Process vs products**

   “Does this process exclude the role of NHMS?” (a SADC NHMS representative)
   - Established practice
   - Downstream products
   - Believes and trust

2. **Demand-driven vs demand-relevant**

   “many climate services would more accurately be described as relevant to assumed demand rather than driven by actual demand” (Finslater et al. 2021)

3. **Evaluation vs valuation**
   - Valuation ignores process and addresses only quantifiable outcomes
   - It precludes learning because as it uses prior assumptions
   - It blurs distinction between better data and better service
Decision-support: techniques for decision analysis

• Cost-Benefit Analysis (CBA) - when the various dimensions of the problem can be converted into monetary units

“What we do now creates damage that hits decades later, so we don’t charge ourselves for it, and the standard approach has been that future generations will be richer and stronger than us, and they’ll find solutions to their problem. But by the time they get here, these problems will have become too big to solve.” (Robinson: The Ministry for the Future, 2020)

• Robust decision-making approach - explores how options perform in a multitude of possible future scenarios

• CCA decision problems are multidimensional and expected performances of options are measured according to multiple indicators - Multi-criteria analysis (MCA)
Multi-criteria analysis

- MCA methods provide a wide set of techniques for elicitation and aggregation of decision preferences

- Involving stakeholders for discussing and deciding on criteria and their weightings for the prioritisation and selection of adaptation options

- Criteria examples: effectiveness, efficiency, robustness, flexibility, acceptability, enhancement of adaptive capacity, conflict resolution...

- MCA aggregates partial preferences describing individual criteria into a global preference and rank the alternatives

- **Group decision-making** is a final phase that facilitates the identification of a compromise solution, combining all individual rankings
Multi-criteria analysis for assessment of CCA measures in the Alps
Multi-criteria analysis for assessment of CCA measures in the Alps

- The Alps - 1,200 kilometres across eight countries
- Spatial element of climate change and adaptation needs
- mDSSweb tool combined with the C3-Alps Web Map Viewer
- Involvement of experts in assessment of measures
- Exercise available in different Alpine languages
Results of the assessment of CCA measures in the Alps

**Individual Results**

Evaluation of adaptation measures

**Criteria weights**

Sustainability performance of the options

**Overall Results**

The overall preliminary results reveal highest score for the last measure – Improving planning instruments for water saving, while the most importance is given to effectiveness and efficiency.

**Group Results**

Determined by geographical location, the aggregated preferences by sub-groups can refer to a country or smaller NUTS regions.
Missing assessment of adaptation options

- Absence of assessment can result in reduced incentive to adapt and lack of acceptability of proposed measures

Social network of actors involved in water and flood management in Kenya (Bojovic and Giupponi, 2019)
Missing assessment of adaptation options

• Nzoia river basin in Western Kenya - intensive floods and frequent droughts
• Local knowledge, entrenched habits, informal institutions - Indigenous early warning committee

• Proposed measures:
  • Early warning system - radio broadcasting for flood warning communication, but there is lack of trust in conventional weather forecast
  • Sorghum seed - resilient to droughts and floods, but inadequate for the local staple food and paying school fees

➢ Decision support can help structuring the adaptation problem and decision-making processes and selecting cost-effective, multiple-benefits and no-regret adaptation options
Thank you for your attention!

“One of the most profound aspects of climate change, and environmental change in general, is that more people are beginning to consciously perceive themselves to be part of a larger system. When we perceive of ourselves as entangled quantum systems and recognize consciousness and free will as inherent within our being, we can choose to relate differently to ourselves, each other, the environment, and the future. Yet an equitable and thriving world will not just “happen”...we may need a different way of “being in action”, including a different understanding of individual and collective agency.” (Karen O’Brien, You matter more than you think, p. 86)