How well can climate information support efforts to strengthen community resilience?

Andy Morse

with Cyril Caminade, Anne Jones, Dave MacLeod and Andy Heath

Issues of predictability and reliability across timescales and regions, and learning from experience on engagement with humanitarian/development and community users.
Data, data everywhere.

The Ancient Mariner:
In a sea of data

Original engraving by Gustave Doré
C.1878,
The Matrix inspired data rain/fog
by Andy Heath

The Ancient Mariner: 1798,
Samuel Taylor Coleridge
User Questions and Needs?

How important is the role of climate?

Rank impacts of climate.

Specifically – (examples of questions from the tropics)
• Onset and cessation of rainy season
• Quality of rainy season e.g. frequency of long break cycles
• Trends in drier* than, average years or ’seasons’
  * wetter, hotter, colder
• Onset of drought

• Sector focused? Concentrate on sector common questions.
Data and models

Decided climate is important.

What data are needed to address questions and strengthen resilience?

**Climates**: Define current climates (prior 30 years or beyond) – gridded data – reanalysis, satellite, observations; station data (access and quality issues)

**Predictions**: Seasonal Forecasts (forthcoming rains, seasonal temperatures)

**Projections**: Climate Projections (for near future +20 years (and beyond), changes in seasonal or annual means and distributions)
Monsoon onset climate in Senegal. Mean onset of the rainy season (per decades or 10 days) based on the Hachigonta criterion:
First decade with 25mm followed by two decades of 20mm. Based on the TRMM satellite data for the period 1998-2008. Analysis Cyril Caminade.
Temperature ‘PDF” type figure for Kaffrine in Senegal for the dry season based on the SRESA1B ensemble. Future climate (2030-50) is compared to the recent climatic context (1990-2010).

An average of four grid points around the region was retained for the eight ENSEMBLES Regional Climate Models. The envelope depicts the spread in the multi-model ensemble (two standard deviations of the model ensemble).

Analysis: Cyril Caminade
DEMETER multi-model malaria forecasts for upper tercile malaria, Botswana, November forecast months 4-6 (FMA), compared to observed anomalies from published index.

After Jones and Morse, 2010, J Climate.

6 hits, 1 miss 4 false alarms and 9 correct rejections.
Thoughts from groups in EQUIP

Extrapolating past performance is rarely justified since future predictions are typically dissimilar to past cases.

We can collect a diversity of past cases, some similar to the future predictions, to help sharpen our judgments.

Should impacts model requirements inform climate model ensemble design?

External forcing (CO$_2$ increase etc.) is more important than initial conditions for providing ‘skilful’ forecasts on the decadal scale.

In global models- The scales where we find useful ‘skill’ is over the whole of Europe, and over large sub regions (Central Europe, Southern Europe etc).

The global simulations are generally too coarse for a direct application ... adequate downscaling methods need to be applied.
Thoughts from groups in EQUIP

Decadal GCMs seem to add little value to (in fact, to detract from) statistical methods at even global scales.

"uncertainty in the data": the model runs are exact, the observed uncertainty is folded into the kernel dressing

Question of choice of variable: should we be looking at surface temperatures or heat content?

The given advice has been highly appreciated on a policy level, providing policy relevant information from scientific model output.
Are things improving?

We must show value or utility!
Seasonal forecast performance for Botswana

ROC Skill Score for **November forecast** incidence above UT modelled malaria incidence against obs malaria index. Whiskers show 95% confidence intervals.

System 4: West Africa precipitation JAS forecast skill

March forecasts  
May forecasts  
July forecasts

ROC AUC for System 4 forecasts of JAS precipitation vs GPCP. Stippled area indicates where AUC is above 95% significance.

slide Dave MacLeod
System 4: Sahel precipitation value – upper tercile

Value curves for System 4 forecasts of upper tercile JAS precipitation vs GPCP over the Sahel. 30/50/70% decision thresholds defined by blue/green/orange lines. Dashed lines indicate 95% significance level.

slide Dave MacLeod
Future changes
rcp8.5 2069-99 vs 1980-2010

Rainfall
rcp8p5 2080s

Temperature
rcp8p5 2080s

Climate models agree on:
1) Pronounced warming over the Sahara and southern Africa
2) Wetter conditions over the high altitude regions over eastern Africa
3) Drying signal over southern Africa

Matrix after Kayle et al., 2012

ISI-MIP climate malaria slides from Cyril Caminade after Kovats et al (2013) Modelling the impact of climate change on malaria: a comparison of global malaria models, PNAS (in review)
Future changes: length of the malaria transmission season rcp8.5 2069-99 vs 1980-2010

Climate & Malaria models agreement:

1) **Increase of the length of the transmission season over the high altitude regions** in East Africa, Madagascar, South Africa & Angola. For most of these regions climate becomes suitable in the future (strong temperature effect). Feature consistent across scenarios.

2) Slight decrease of the malaria season south of Sahara, in north-western Madagascar, eastern coasts of Tanzania and Mozambique and northern Botswana (high temperature effect for physically-based models).
Key Challenges

Stronger science base and science use by user including humanitarian agencies (Perhaps through mutual body or honest broker?).

Questions of climate science research – of interest to climate scientists that also benefit humanitarian agencies i.e. a dual question.

Key User and Humanitarian Challenge for Climate Scientists –

Develop sustained community use of seasonal forecast products (rainfall) by demonstrating real world economic value
We can train ourselves to be better judges of relative performance, and especially to avoid over-confidence.
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