

The importance of and findings from integrated climate-health projects in Africa: towards the establishment of 'epiclimatology'?

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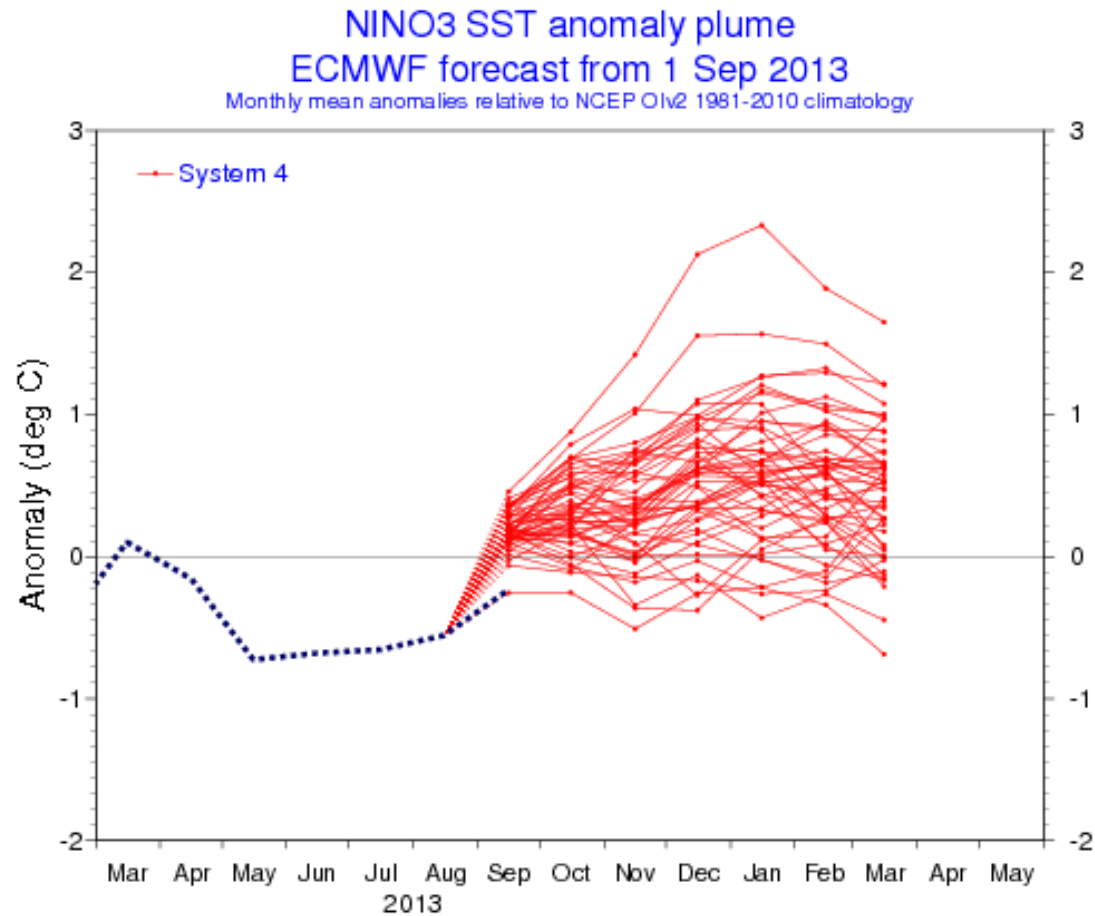
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Cyril Caminade, Anne Jones, Andy Heath, Dave MacLeod

Background

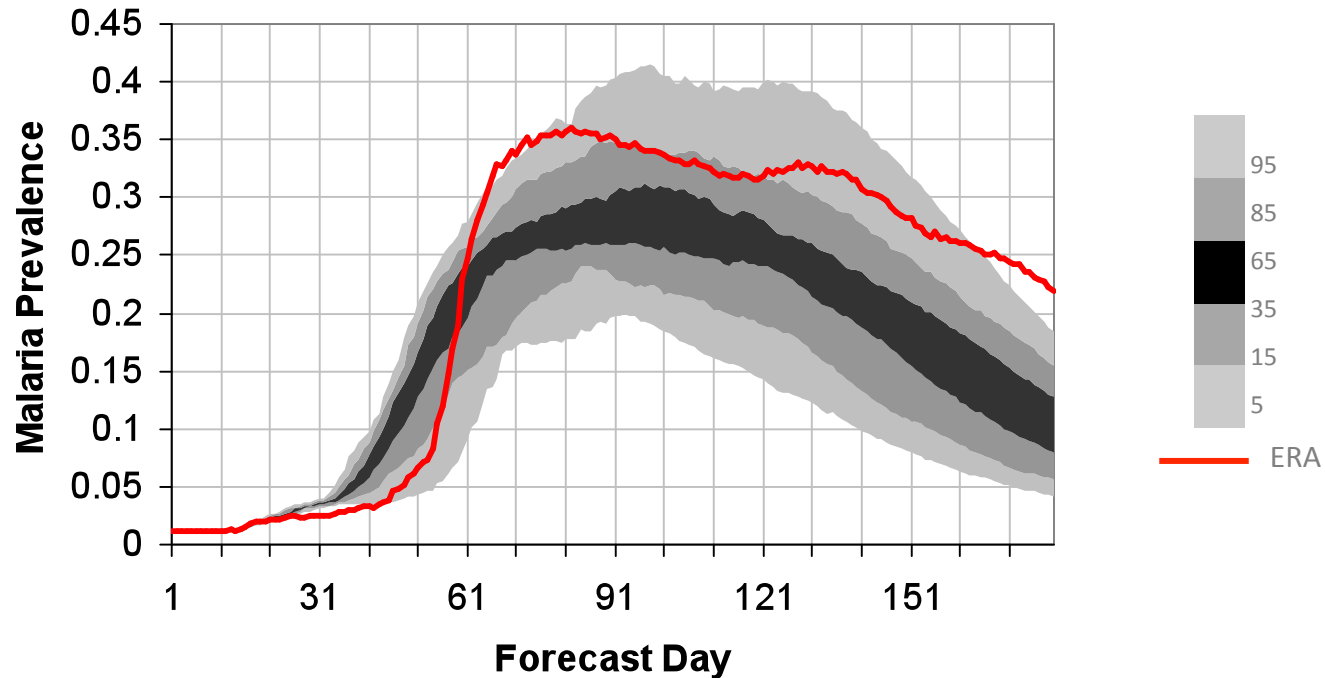
- Infectious disease models
- Climate model driven
- Climate model analysis
- Early warning development
- Big data (big and multiple sources)
- **One Health**

Background – seasonal forecast data



ECMWF

Research Examples – seasonal malaria prediction



Botswana malaria forecast for February 1989

LMM (Liverpool Malaria Model) (Hoshen and Morse, 2004)

driven by DEMETER multi-model 63 members

(ERA-driven control model shown in red)

Research Examples – malaria forecasts Botswana past performance

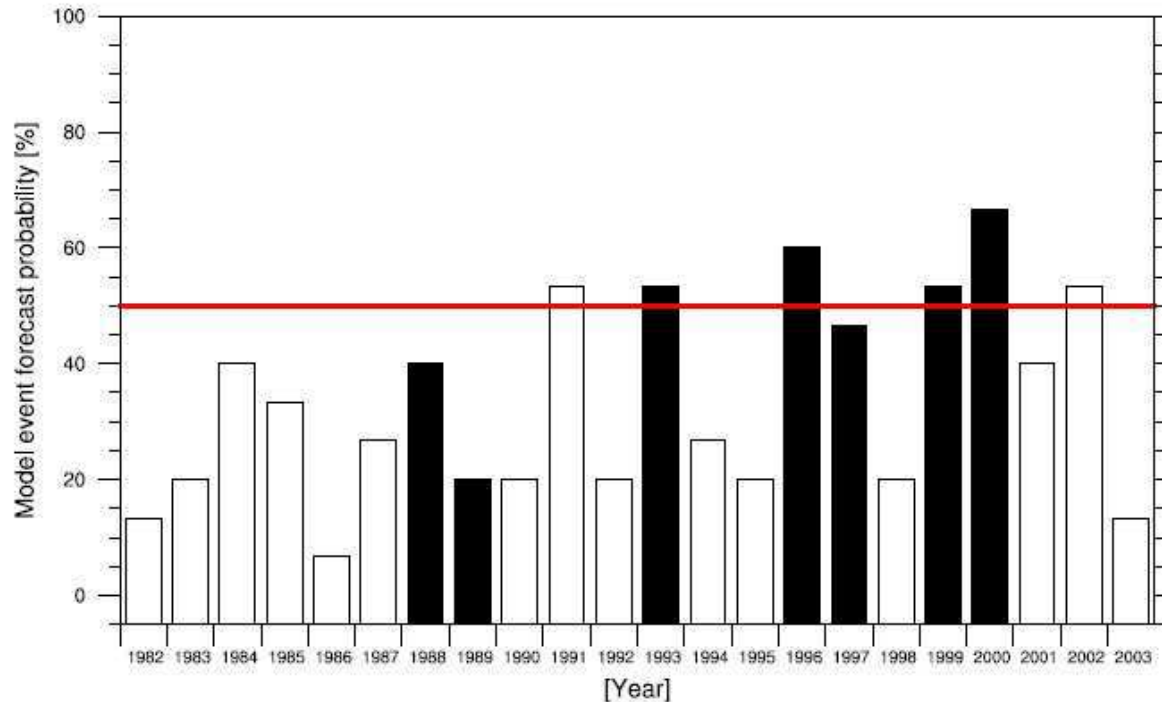


Figure concept highlighted in BIS (UK Dept Business, Innovation and Skills) Foresight Disaster Risk Reduction report 2012

4 hits
3 misses
2 false alarms
13 correct rejections
ROC area under curve =

System 4 driven LMM incidence forecasts of above upper tercile events issued in **November** for MAM (5-7).

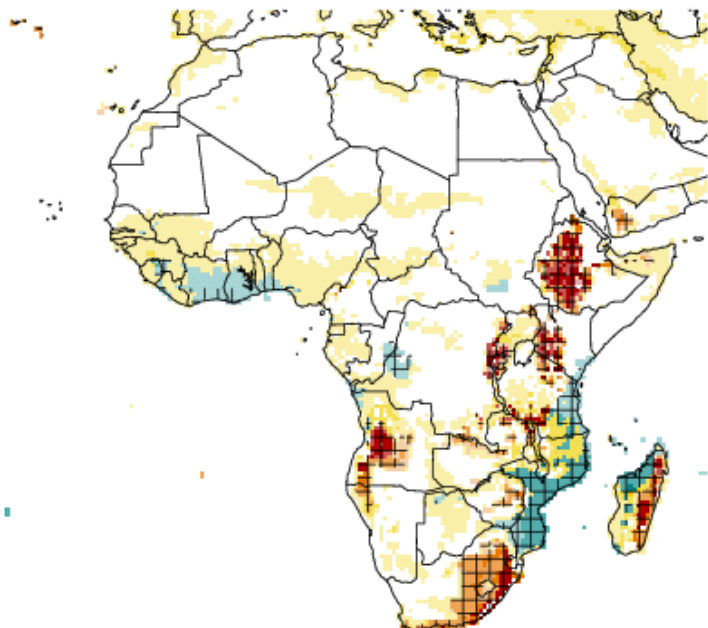
Black (white) bars indicate years where observed incidence is above (below) the upper tercile.
22 years correct 17 times. 77%.



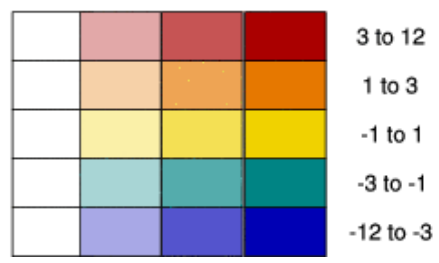
CMIP5 Malaria Model Projections: ISI-MIP

Future changes: length of the malaria transmission season rcp8.5 2069-99 vs 1980-2010

rcp8p5 2080s



signal to noise
0 0.5 1 2 5
change (months)



5 GCMs 3 malaria models.
The different saturations represent signal-to-noise (μ/σ).

Matrix after Kaye, Hartley and Hemming 2012

See poster Cyril Caminade et al.

Research Examples 'Operational' - ECMWF Monthly to Seasonal Forecasts portal - QWeCI project

The screenshot displays the ECMWF QWeCI project website. The top navigation bar includes links for Home, Your Room, Login, Contact, and Feed. The main content area is divided into several sections:

- QWeCI project**: A central heading for the project.
- Seamless Forecast - Predicted Anomalies**: Features three maps showing forecasted anomalies from the monthly-varEPS and the seasonal concatenated in a seamless stream. Plots offered here show quantification and prediction of climate and weather on a hemispheric scale.
- Seamless Forecast - Predicted Fields**: Features four maps showing forecast fields from the monthly-varEPS and the seasonal concatenated in a seamless stream. Plots offered here show quantification and prediction of climate and weather on a hemispheric scale.
- Seamless Forecast - Historical Record**: Features three maps showing historical records of anomalies from the monthly-varEPS and the seasonal forecasting system.
- Climatic Malaria Transmission Conditions - Mean transmission and Interannual variability**: Includes a map and text explaining that statistics of mean malaria conditions are derived using the previous 18 years of the present day forecast. Products in this folder are presented in terms of hindcast of the Entomological Inoculation Rate (EIR; in infectious mosquito bites per person per unit time), which is a measure of the malaria transmission intensity. Displayed are the mean EIR values from the hindcast period (e.g. 1995-2012) as a reference for the EIR forecasts. Most observations from endemic malaria regions reveal transmission values between about 1 and 300 infectious bites per person per year. Annual EIR values above 500 are rarely observed in Africa and stand for a very high transmission intensity. Areas with very low mean annual EIR values (e.g. below 1 or even lower) might be epidemic malaria areas.
- Forecast of malaria transmission**: Includes a map and text explaining that malaria forecast information is given in terms of probability for any of the 51 ensemble simulations to be in one of the lower or upper tercile of the distribution of transmission values shown in the folder "Climatic Malaria Transmission Conditions".

On the left side, there are navigation menus for "Other charts" (Era, Demeter, Eraclim, Physics, Predictability, Model climate, QWeCI project) and "Chart catalogue" (Page overview, Find charts).

The case for epiclimatology

The subject areas of **hydrometeorology** and **agrometeorology** are well established.

Agrometeorology branch of meteorology - **impacts of weather and climate on agriculture.**

WMO AgMP and support through **UN Food and Agriculture Organisation.**

Established as far back **150 years ago.**

Crop models driven by weather data

Organised impacts community - **AgMIP** The Agricultural Model Intercomparison and Improvement Project.

Crop models driven with Seasonal EPS and Global/Regional **Climate Models**

The case for epiclimateology

Hydrometeorology branch of **meteorology and hydrology** - transfer of water and energy - **atmosphere & land surface**.

Droughts and flooding, **evaporation processes**.

Integral understanding **energy transfer** in **coupled climate models**.

Hydrological models driven by knowledge of forecasts of rain across a catchment.

Strong connections to agrometeorology

The case for epiclimatology

Epiclimatology use of **climate and weather information** for the **prediction** of **disease outbreaks** and risks including **impacting** on **chronic conditions**.

Should this be seen as a **Grand Challenge**.

Chronic conditions: **Heat waves** (2003 European Heat Wave), **cold spells** (winters e.g. UK 2010/11) , air pollution and pollen levels –**part established**.

Establish use of **climate and weather information** for **infectious diseases** especially **vector borne disease** for humans and animals – under a **One Health** framework.

Non-infectious diseases already integrated **Climate Services Agenda**

The case for epiclimatology

Emphasis on infectious diseases especially operational early warning.

Also future emerging disease risk.

Use of climate observations, monthly-seasonal to decadal prediction, and climate projections.

Need socio-economic data, disease surveillance, social science.

Build links through NMHS to MoHs, role for NGOs

Epiclimatology need emerging Future Earth agenda support and recognition within international organisations.

Summary

Epiclimatology is a **Grand Challenge**.

Now established as a **successful user** of **seasonal predictions** and **climate projections**.

Feeds back on **value** of forecasting the projection systems to **climate science community**.

Malaria modeling is on the **operational cusp**.

Models for **other diseases** and vectors **well advanced**.

Very important for **improving well being** of people in **Africa**.

Need **support** within **emerging** African and Global **research agendas**.

Questions?

Thank you for listening.

Thanks to our funders and project partners.



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www.healthyfutures.eu



www.equip.leeds.ac.uk



www.liv.ac.uk/enhance