Application of climate forecasts to health

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Themes

- DEMETER, ENSEMBLES, ECMWF System 4 – West Africa
- Precipitation and (temperature)
- Value (macro economic)
- DMC – user interface for malaria model
- Summary - West Africa
- CMIP5 ISI-MIP malaria futures
- Conclusions

Value of seasonal forecasts over West Africa

Progress since DEMETER

We consider the seasonal hindcasts initialised in May made from DEMETER, ENSEMBLES stream 2 and ECMWF System 4.

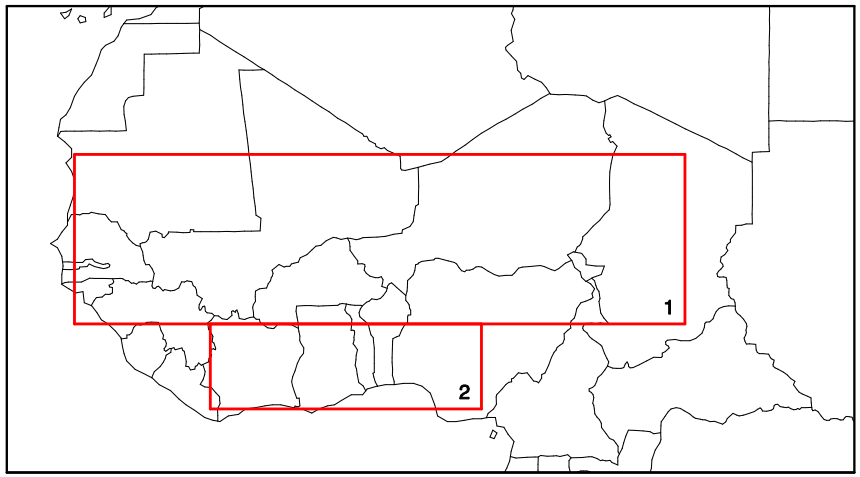
Target is JAS temperature & precipitation West Africa; considering 1981-2001 hindcast subset for each modelling system

System name	Date	Hindcast period	# models	# ensemble members
DEMETER	2004	1980-2001	7	63
ENSEMBLES	2008	1960-2005	5	45
System 4	2011	1981-2011	1	15

Value of seasonal forecasts over West Africa

Region definitions

Defining two regions and considering the forecast value of the spatially averaged hindcasts from each modelling system over the regions



1: “Sahel”

[10-20N, -16W-20E]

2: “Gulf of Guinea”

[5-10N, 8W-8E]

Value of seasonal forecasts over West Africa

Forecast value

Considering the value of upper & lower tercile temperature and precipitation forecasts (value as defined in Joliffe & Stephenson (2003))

Basic cost/loss model: A user can choose to take action at cost C to avoid a loss L. In the absence of information rational strategy is either always act or never act (depending on the ratio C/L).

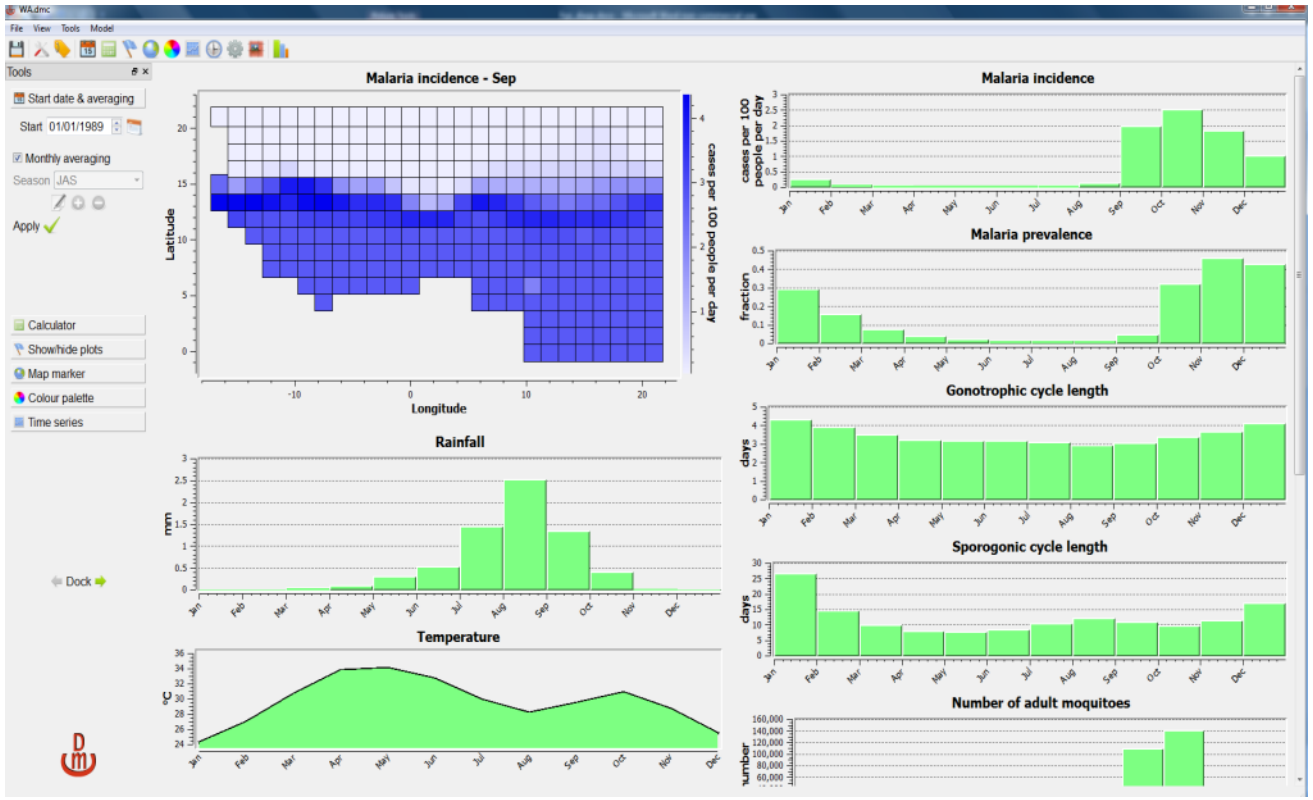
Value is defined as the reduction in expense a forecast system provides, relative to a perfect forecast, i.e;

$$V = \frac{E_{climate} - E_{forecast}}{E_{climate} - E_{perfect}}$$

Can be plotted for a range of 'decision thresholds'

Joliffe & Stephenson, Forecast Verification: A Practitioner's Guide in Atmospheric Science (2003), Wiley & Sons

DMC front end with LMM



Model and Tutorial available from

http://www.liv.ac.uk/qweci/project_outputs/#d.en.241691

Summary

Value of precipitation forecasts over the Sahel has improved over the past decade.

Precipitation forecasts over the Gulf of Guinea region have value, though this has not significantly increased since DEMETER.

Upper tercile temperature forecasts have value and have increased in value from DEMETER to System 4. Lower tercile temperature forecast value has remained constant.

Results are robust when considering each system's complete hindcast set.

N.B. System 4 is a single model – would value increase further if it were combined in a super-ensemble with other quality state-of-the-art models? EuroSIP, NCEP CFS etc.?

CMIP5 Malaria Model Projections : ISI-MIP

Inter-Sectoral Impact Model Intercomparison Project

http://www.pik-potsdam.de/research/climate-impacts-and-vulnerabilities/projects/Externally_RD2/isi-mip

Climate datasets:

GCM1= hadgem2 (UKMO, UK)

GCM2=ipsl-cm5a-lr (IPSL, France)

Monthly mean rainfall and temperature have been bias corrected before running the impact model using the WATCH dataset as a reference.

Malaria Models:

LMM simplified (Malaria model 1):

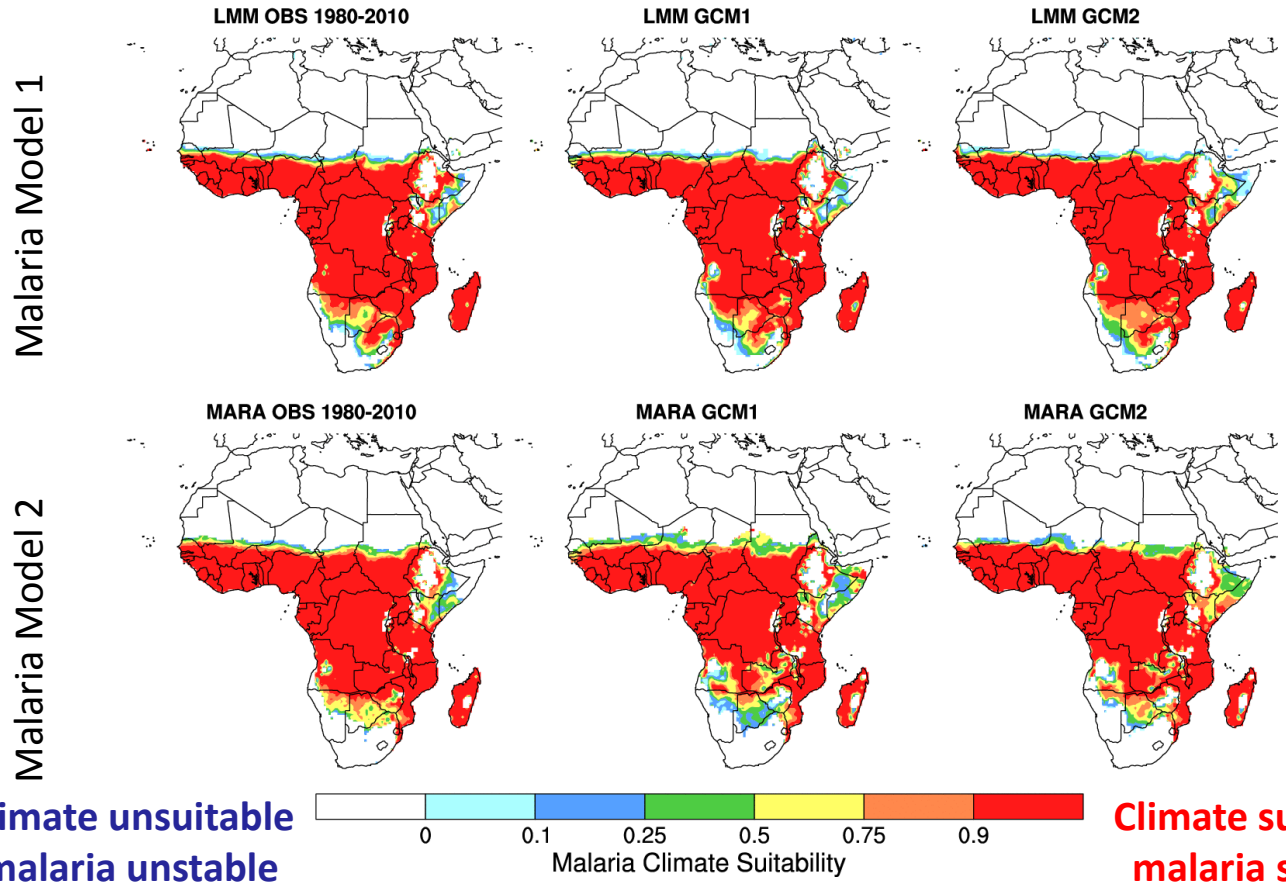
is a simplified version of the Vector Transmission Potential model formulated by A. Jones

MARA (Malaria model 2)

The Climate Suitability = 1 simulated length of the malaria transmission season > three months for a given year.

CMIP5 Malaria Model Projections: ISI-MIP

Climate suitability for Malaria 1980-2010



Climate unsuitable malaria unstable or absent

Climate suitable malaria stable

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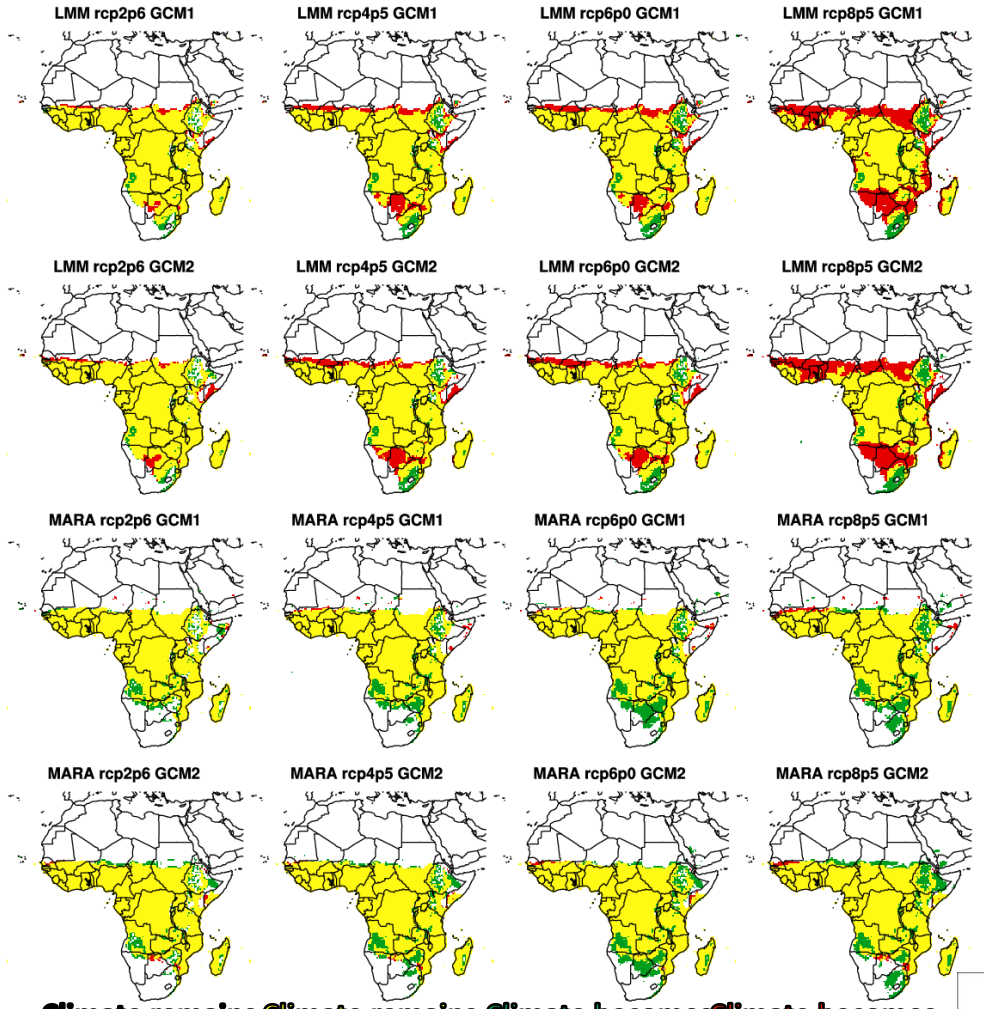
CMIP5 Malaria Model Projections : ISI-MIP

Simulated Changes in Malaria 2069-2099 vs 1980-2010

Low emission scenario ⟷ High emission scenario

Malaria Model 1

Malaria Model 2



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CMIP5 Malaria Model Projections: ISI-MIP

Summary

Uncertainties related to the impact models are large!

Southern shift of the malaria epidemic belt over West Africa (drier and warmer conditions).

Climate more suitable over the Ethiopian highlands and south Africa (temperature driven).

Larger ensemble in progress (5GCMs and 4 malaria models), plus socio-economic factors (demography, migration…) to be considered soon….

Conclusions

• See an ongoing improvement in seasonal EPS for regions that have specific forecasting challenges e.g. Sahel

• Forecasts now have potential macroeconomic value

• Seamless slider of a impacts model developed at initial prediction seasonal scales and verified, to its use at multi-decadal projection scales.

• Use of multiple single sector single impact, impacts models

• Questions: Super-ensembles? Limitations of operational hindcasts? Operationlising the system? What can we say about future climate projection timescales and impacts? Quality/usefulness of daily data in climate projections? Multi-models of impacts models?

Thank you and Current Projects and Funders

Thank you for listening.

Thanks to our funders and project partners.

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