4th AMMA International Conference

The improvement in seasonal forecasting systems for malaria prediction in Africa in the 10 years of AMMA

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Quantifying Weather and Climate Impacts on Health in Developing Countries (QWeCI)

A Seventh Framework Programme Collaborative Project (SICA)

13 partners from 9 countries

www.liv.ac.uk/QWeCI

Grant agreement 243964

Themes

- Background and scene setting
- Some brief details on the Liverpool Malaria Model (LMM)
- Results from DEMETER, ENSEMBLES
  and ECMWF System 4 for precipitation and temperature; and malaria simulation
- Summary

Introduction

- Climate variability important component determining incidence number of diseases (vector-born especially) with significant human and animal health impacts.

- Seasonal forecasting can give information to give better early warning of events opposed to using weather observations or disease surveillance

- Worked with PROVOST, DEMETER, ENSEMBLES (and AMMA), now ECMWF System 4 in QWeCI also GloSea4 (not shown). DEMETER onwards fully coupled models, System 4 (and GloSea4) is operational.

- Have we seen improvements from the prediction systems in the Sahel?

Introduction to Model Systems

DEMETER 1980-2001, May start dates – month (3-5) forecasts - (7 model, 9 members each, 63 members); 2.5° x 2.5° resolution

ENSEMBLES 1960-2005 May start dates – month (3-5) forecasts - (5 models, 9 members each, 45 members); 2.5° x 2.5° resolution

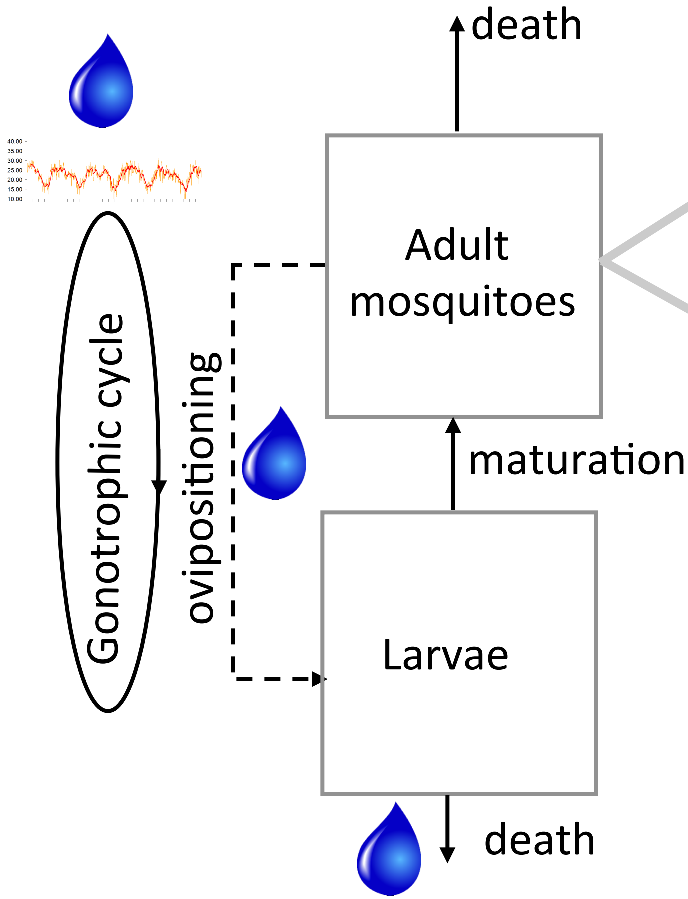
System 4 1981-2010 multiple start dates from month 1-3 to 5-7; 15 members each start, 0.7° x 0.7° resolution

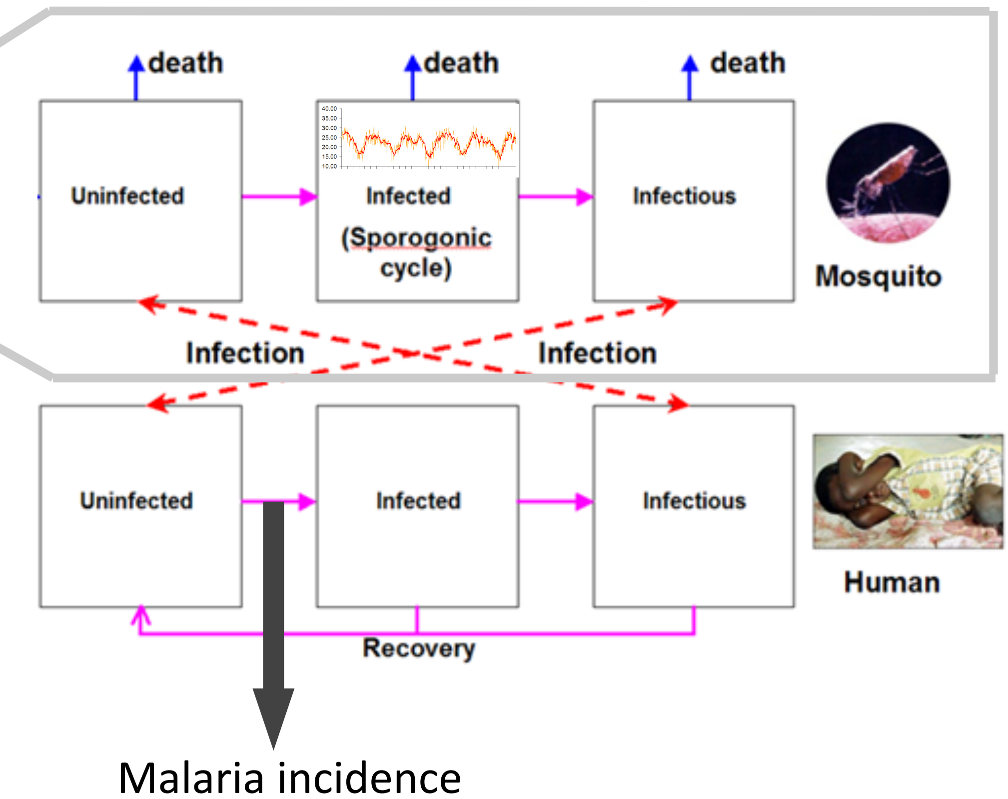
Target is JAS, validation is against NCEP for temperature and GPCP for precipitation. Data have interpolated to the lower resolution grid.

Liverpool Malaria Model

(Hoshen and Morse, 2004)

Dynamic, process-based model driven by daily temperature and rainfall





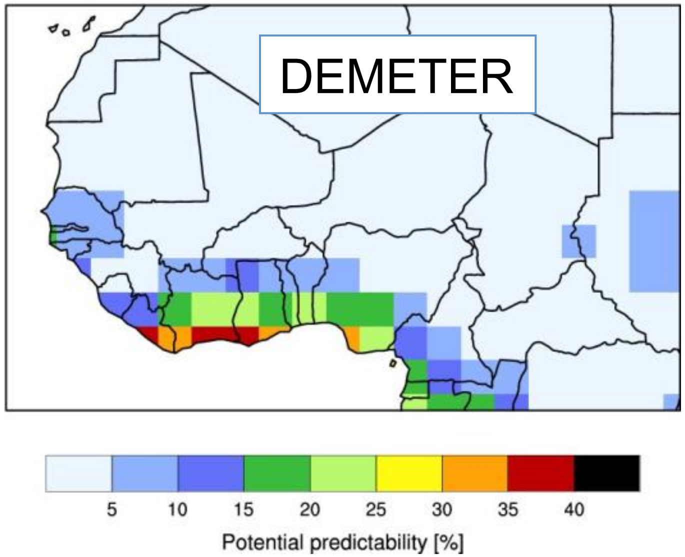
Dynamic mosquito population

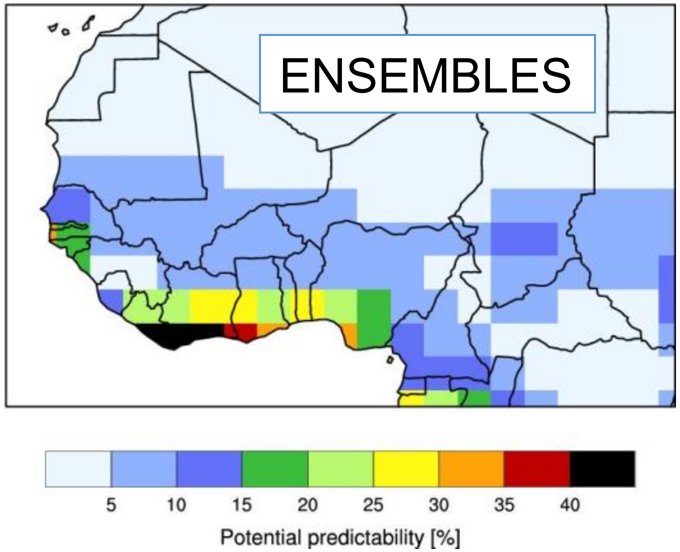
Temperature and rainfall-driven

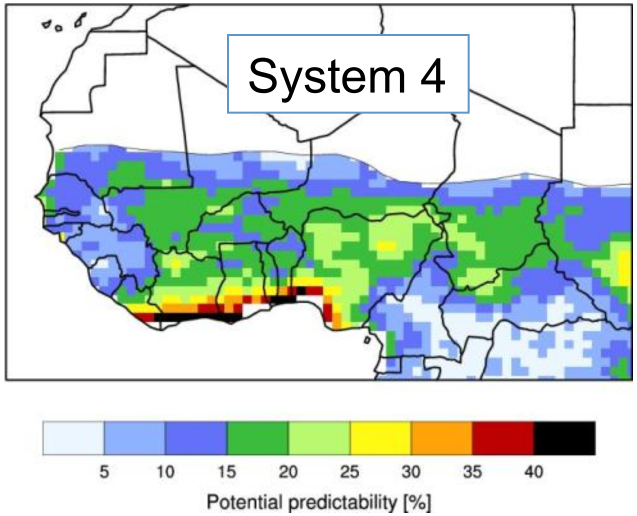
Dynamic malaria transmission

Temperature-driven

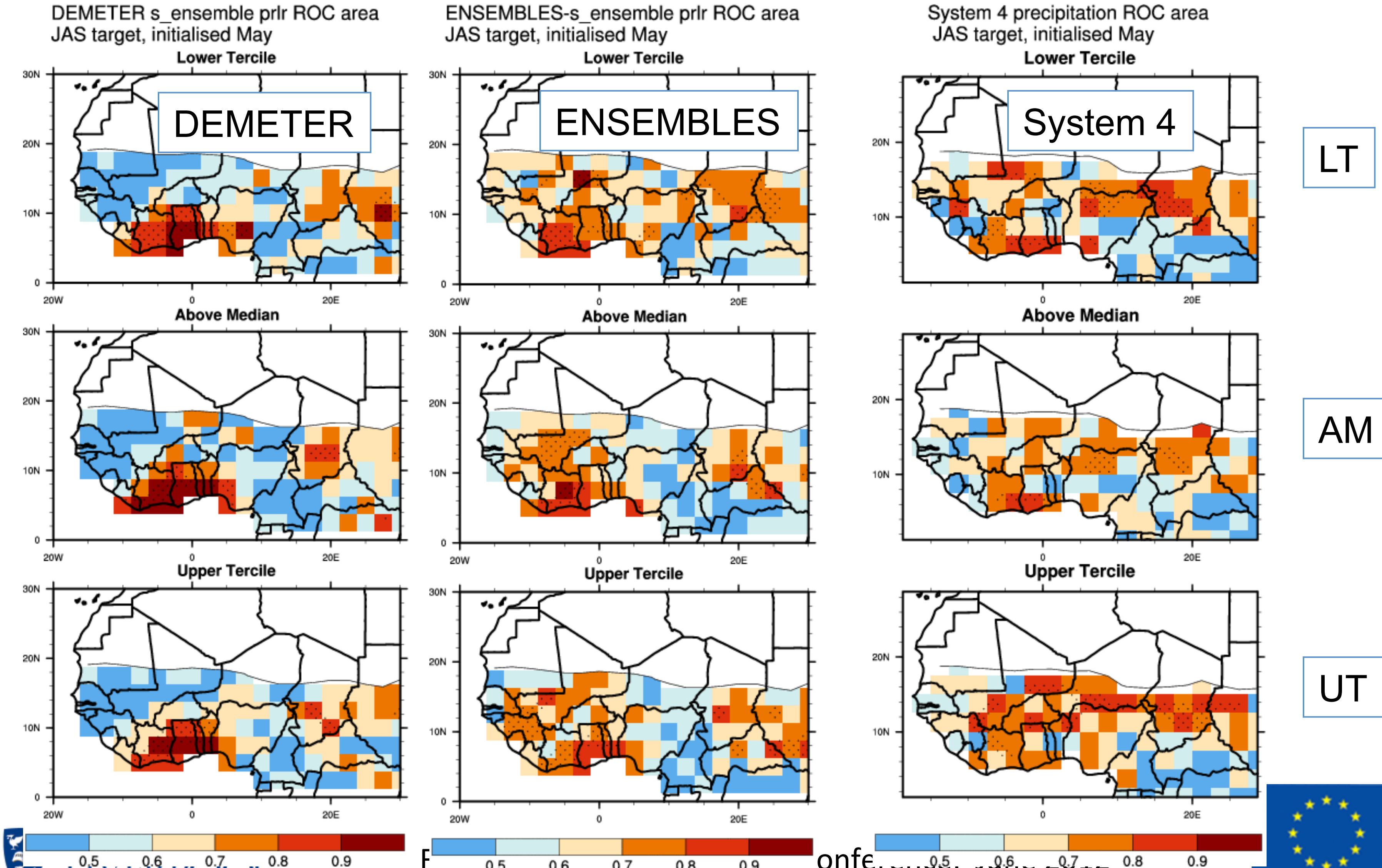
Potential Predictability Precipitation – May for JAS (3-5)



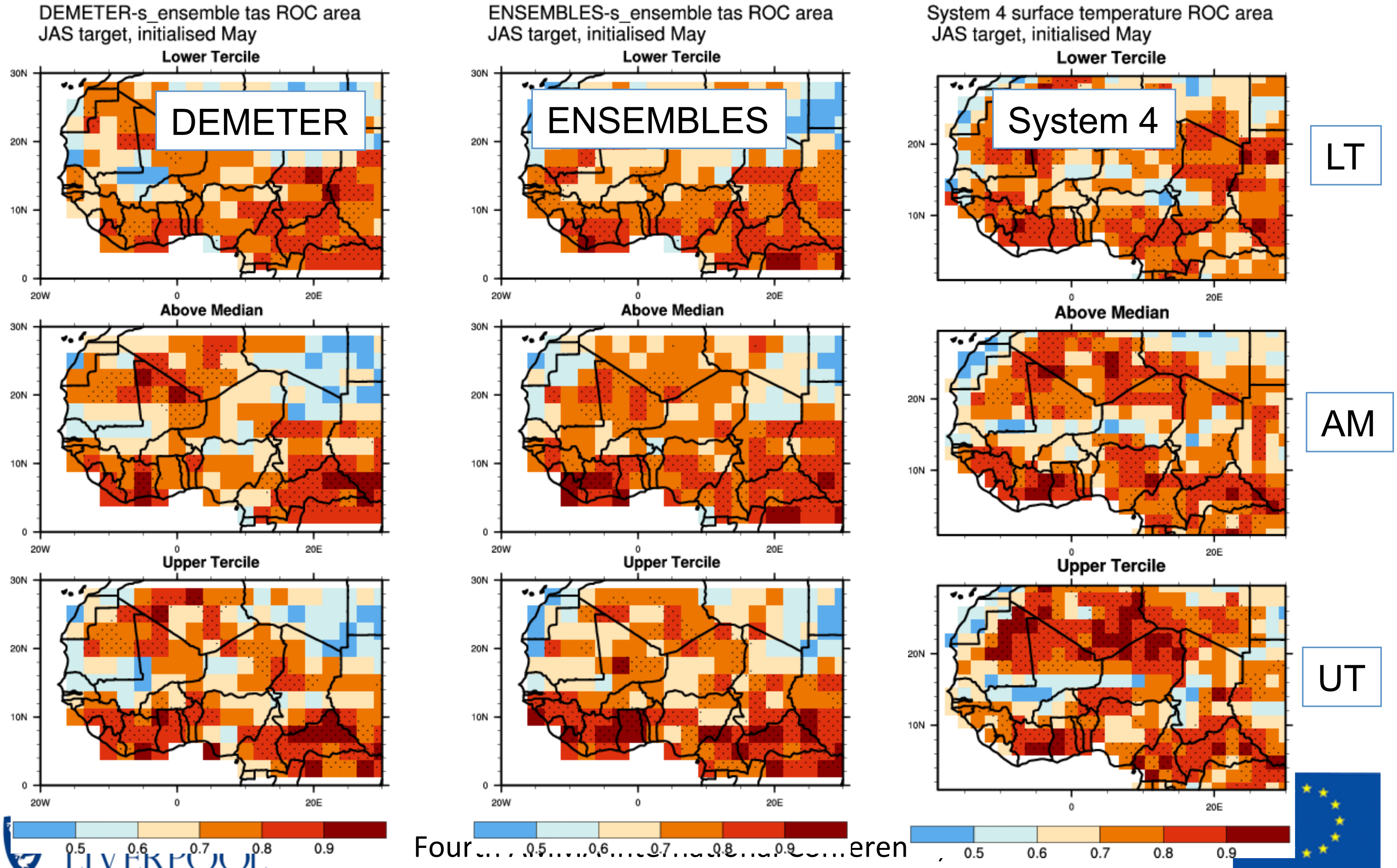




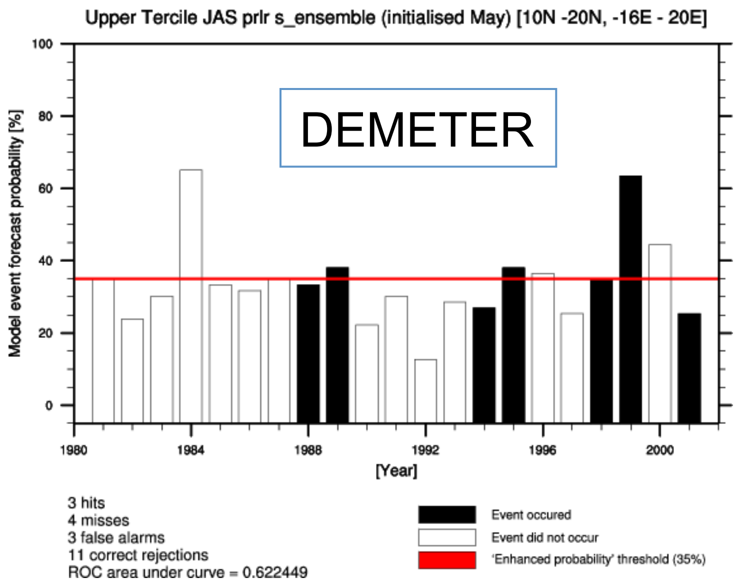
Precipitation ROC May (3-5)

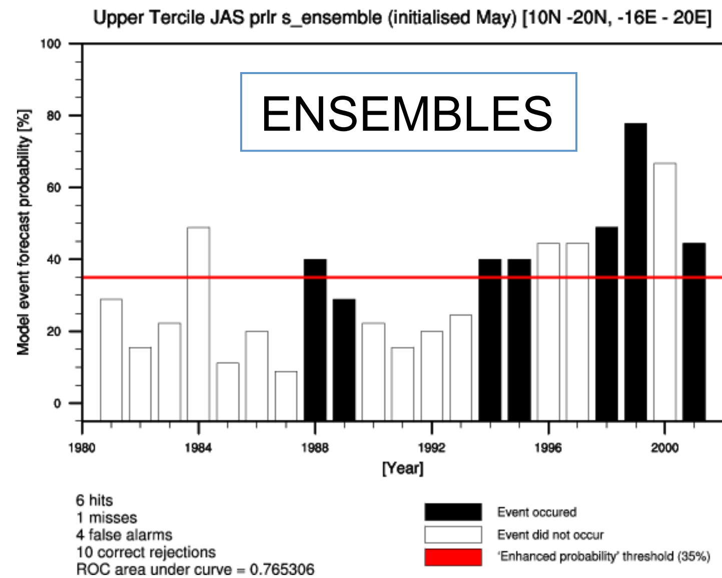


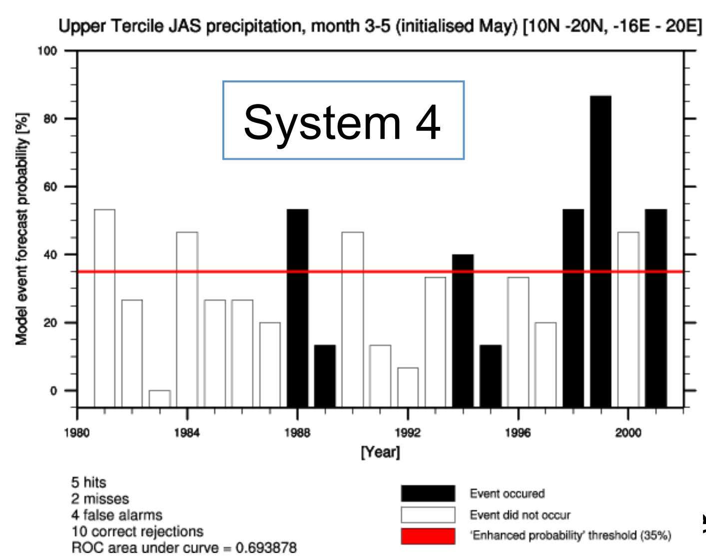
Temperature ROC May (3-5)



Precipitation bar charts 'ROClike' upper tercile May (3-5)







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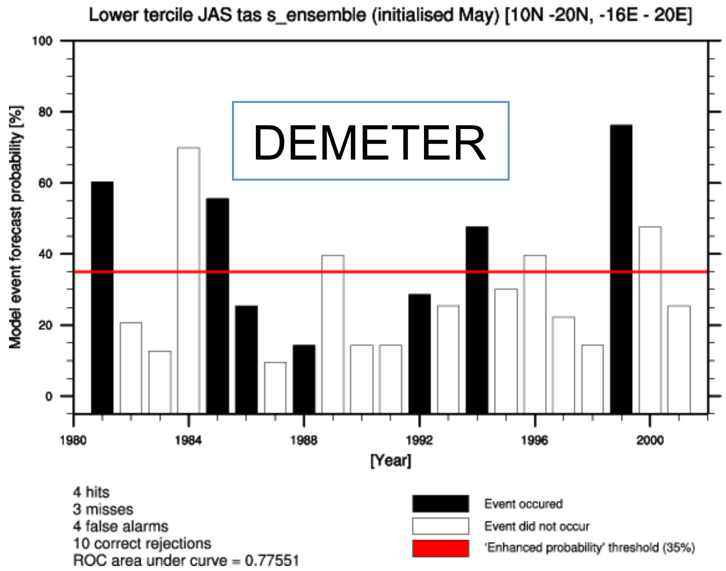
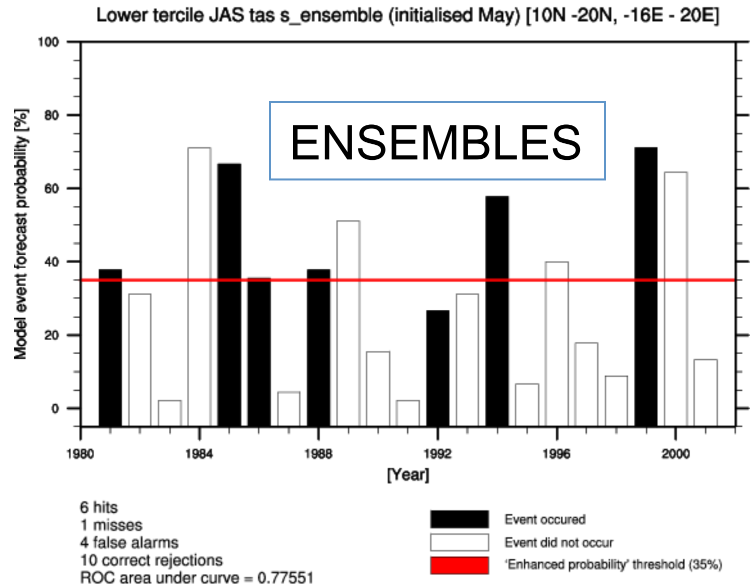
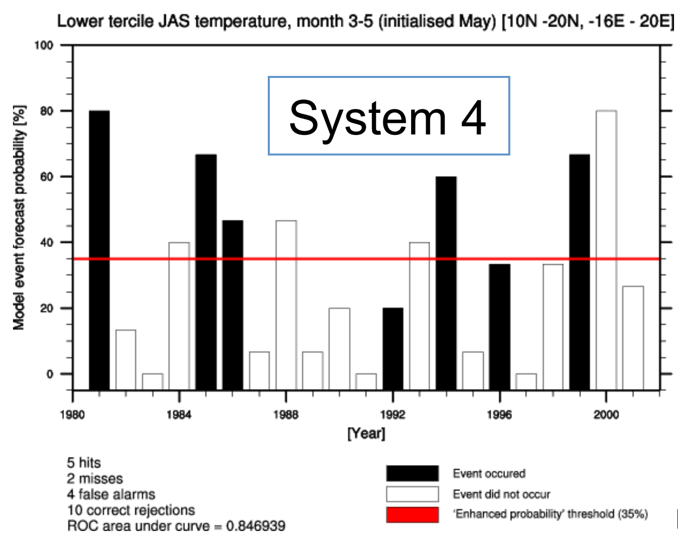
Tempertaure bar charts ‘ROClike’ lower tercile May (3-5)







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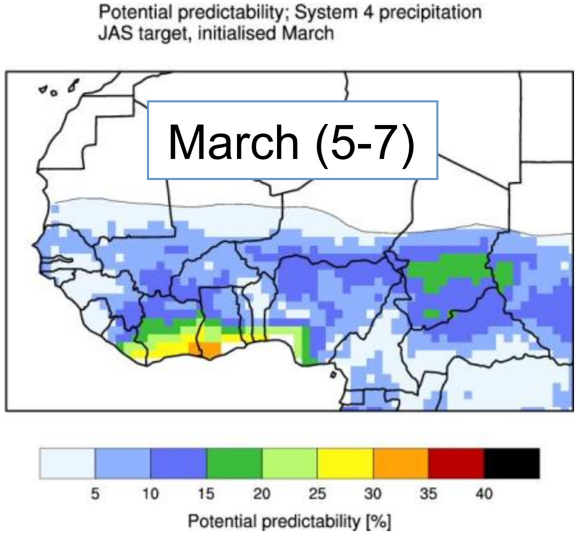
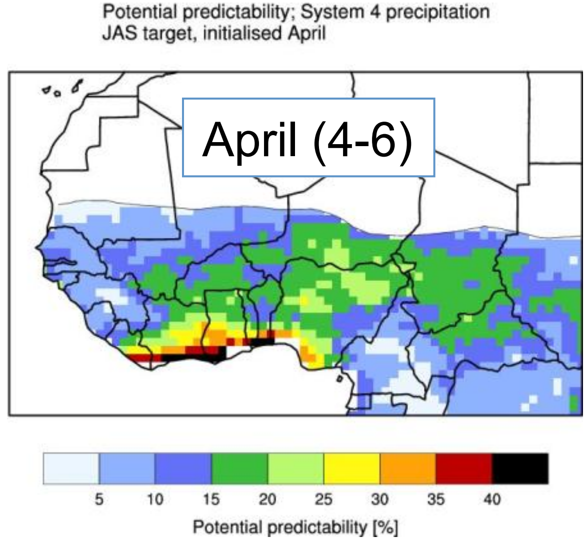
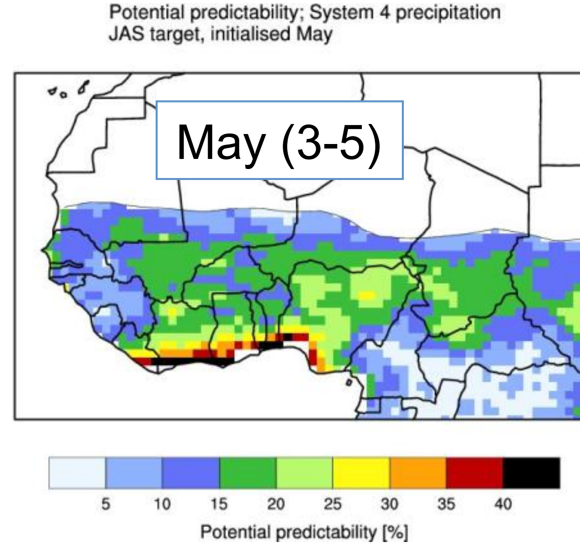
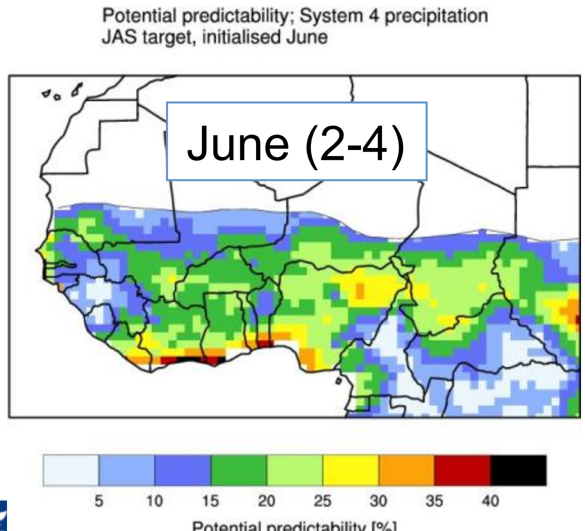
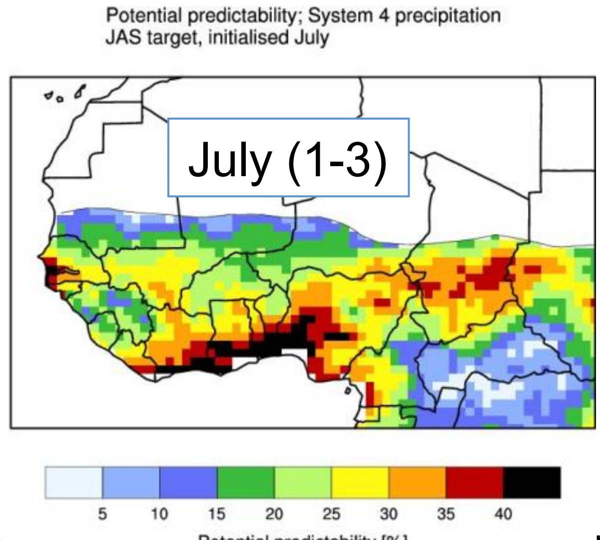
System 4 - Potential Predictability Precipitation - JAS target



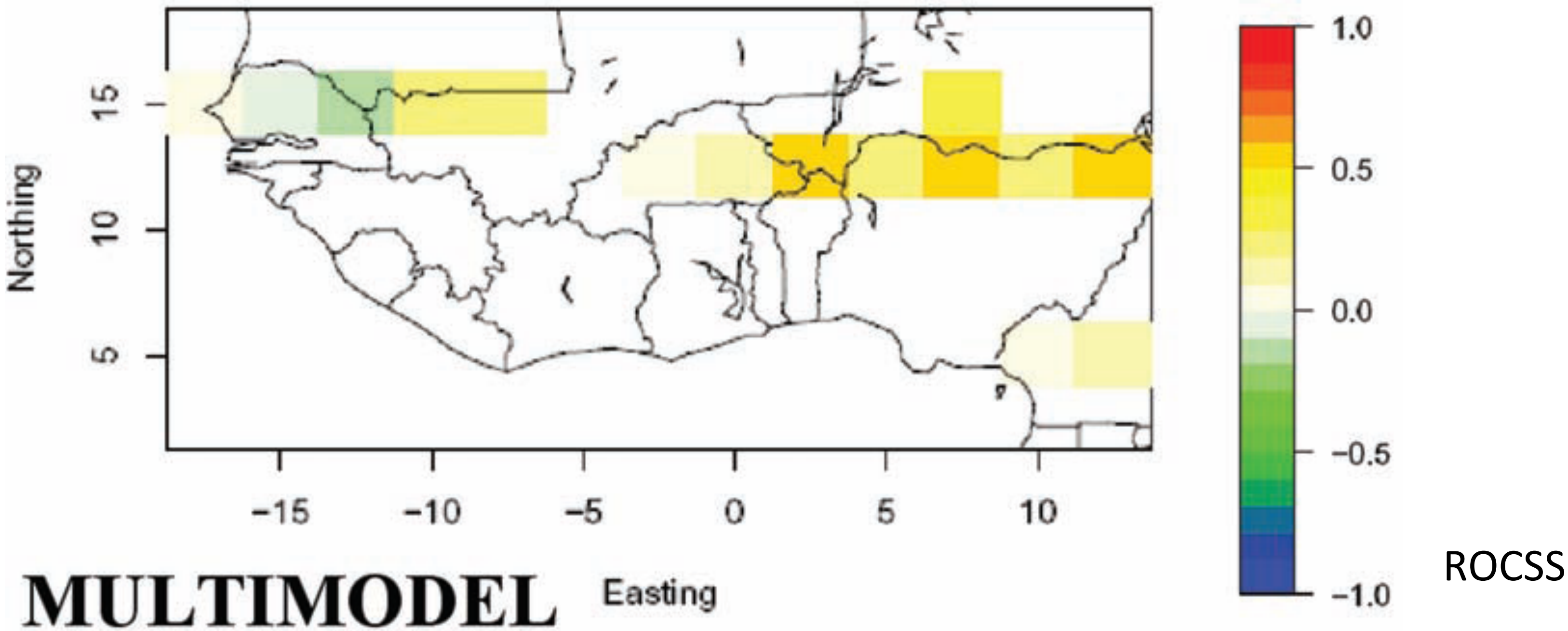








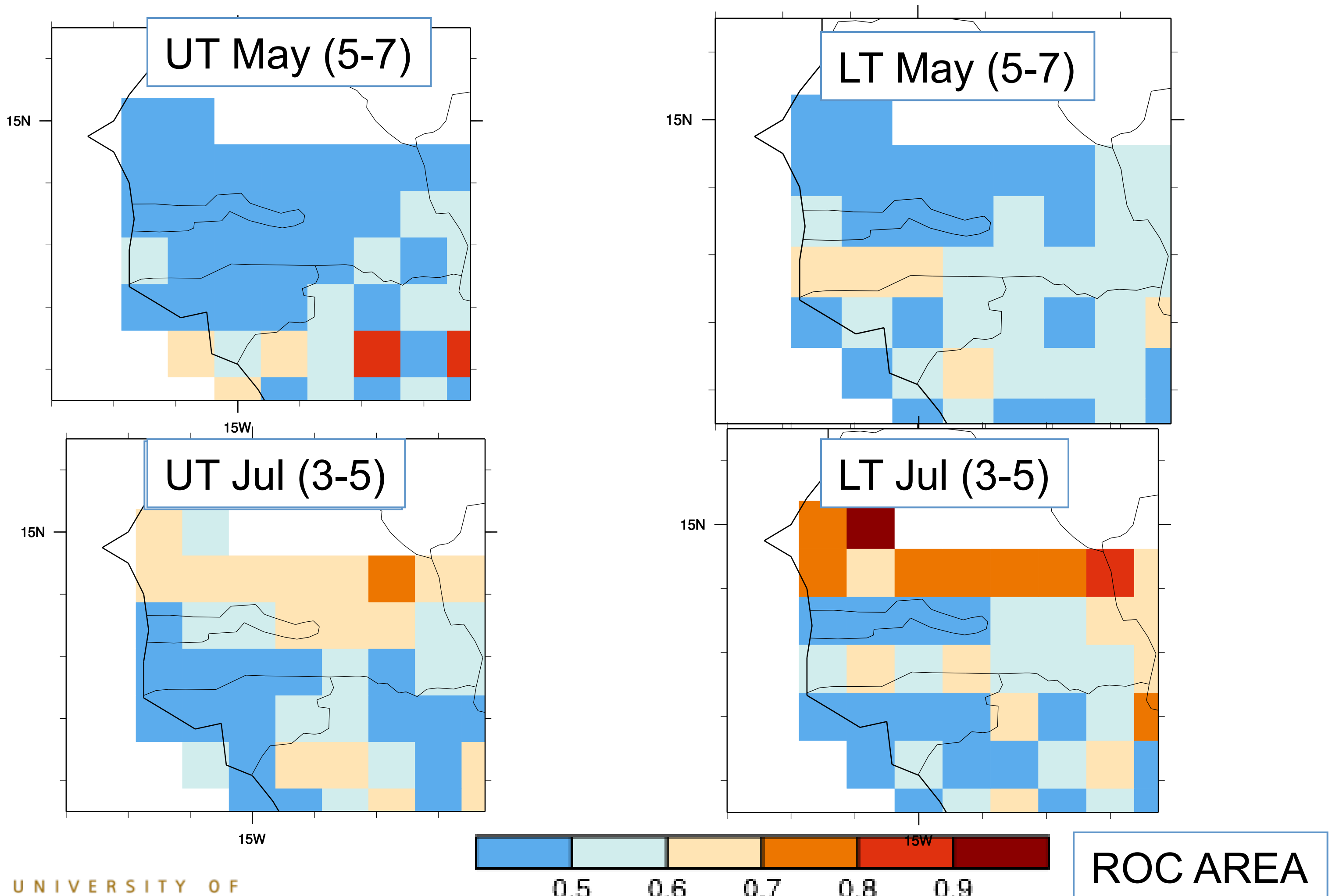
Potential Seasonal Skill in Epidemic Zones for Malaria



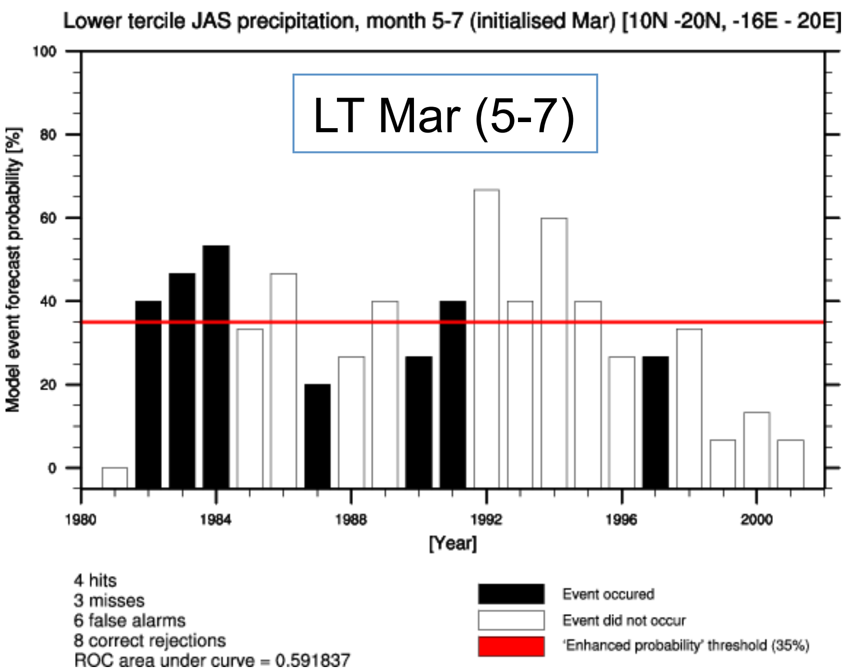
Based on the Liverpool Malaria Model simulations driven by seasonal ensemble multi-model outputs (Rainfall and Temperature)

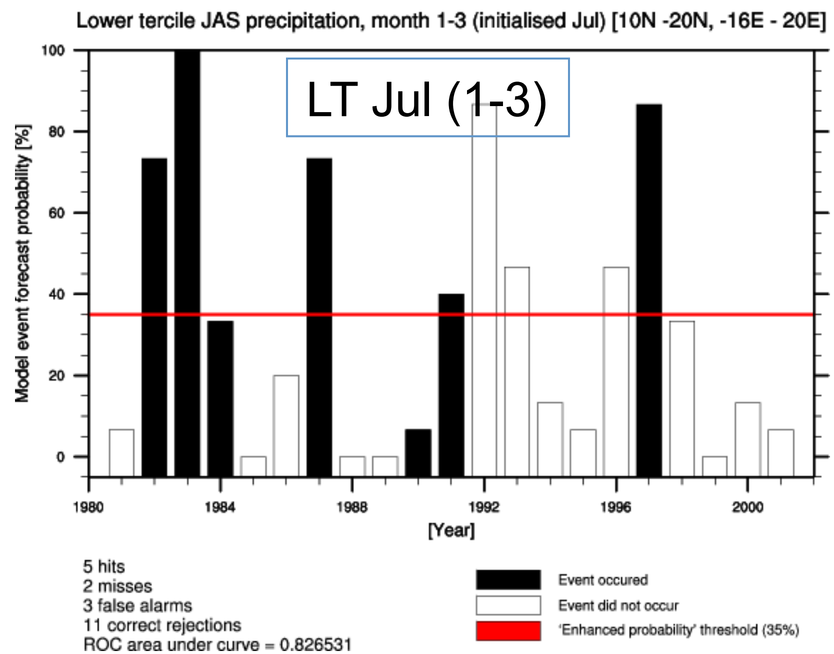
ENSEMBLES Seasonal EPS May 4-6 (ASO) upper tercile
epidemic transmission zone ROCSS
Jones and Morse (2012) in revision
NOT TO BE DISTRIBUTED

System 4: Liverpool Malaria simulated incidence
Model ROC area **SON** target



System 4 Precipitation bar charts 'ROClike' – JAS target





Summary

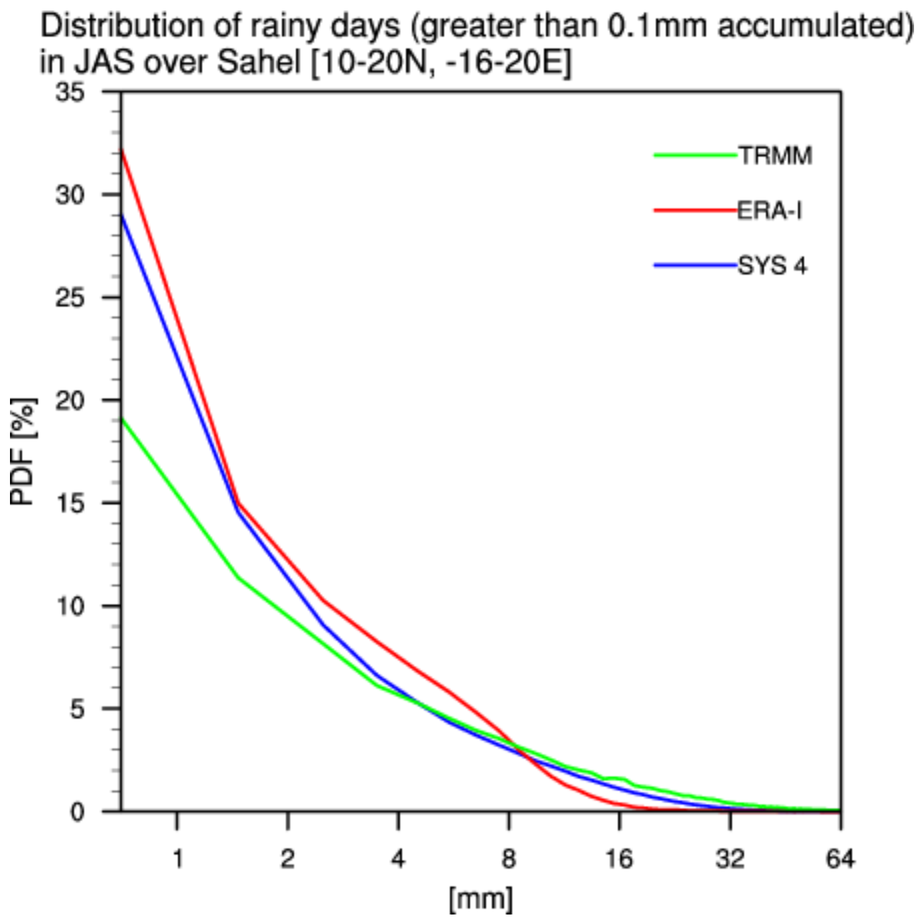
- Show improvement through last 10 years in season forecasts
- Forecasts skill still low at long lead times
- Skill sharpens near target and improvement is seen in malaria simulations
- Work on seasonal and sub-seasonal forecasts (seamless system)
- Can we make sufficiently skilful seasonal scale predictions of malaria for the region? Working within Climate Services Framework.
- Need more spatially consistent skill in seasonal forecasts and at longer lead times
- Issues of forecast biases, target data biases, interpolation
- Short hindcast sets in operational systems

Thank you.
Any questions?

Sahel Area

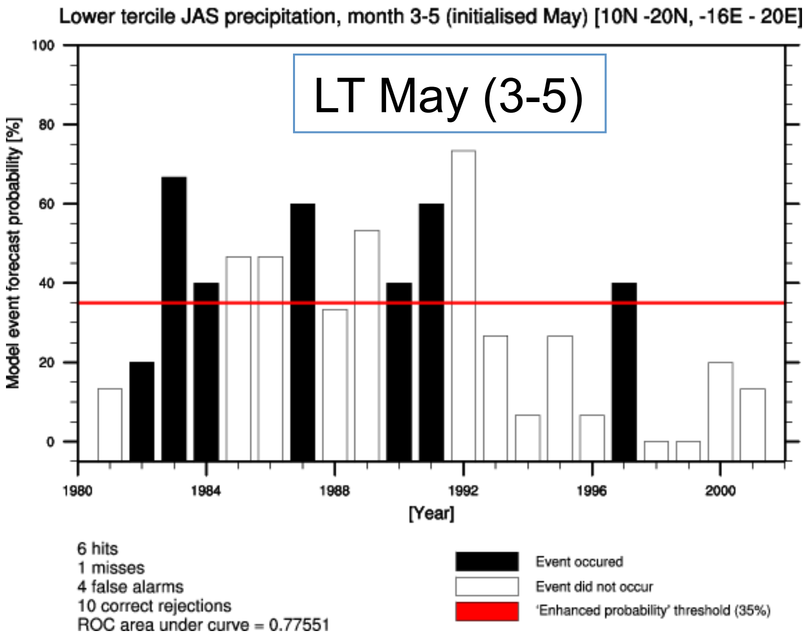
Target region, 'Sahel': 10N - 20N, -16E - 20E

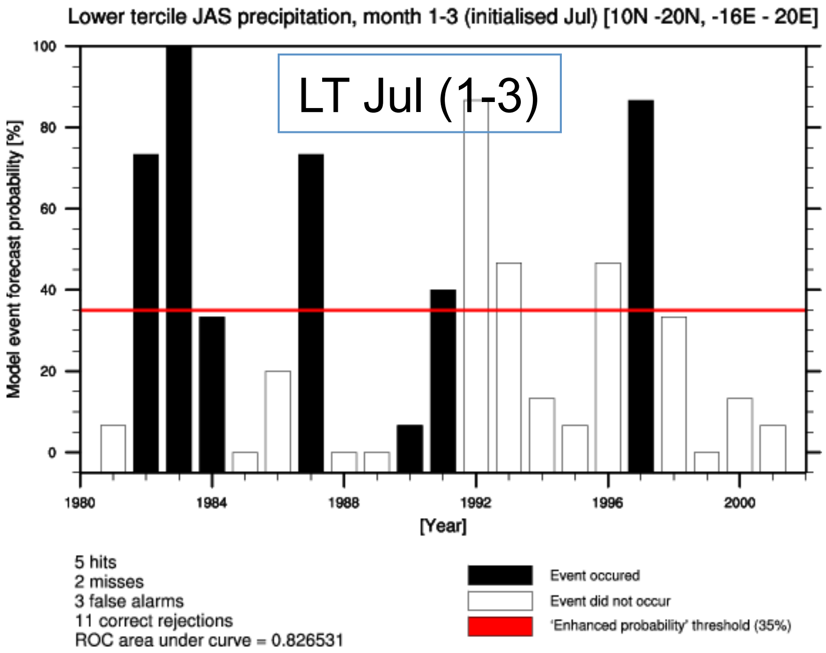
Sahel Area



Distribution of rainy days in JAS over Sahel, vs TRMM and ERA-Interim (note the logarithmic axis)

System 4 Precipitation bar charts 'ROClike' – JAS target

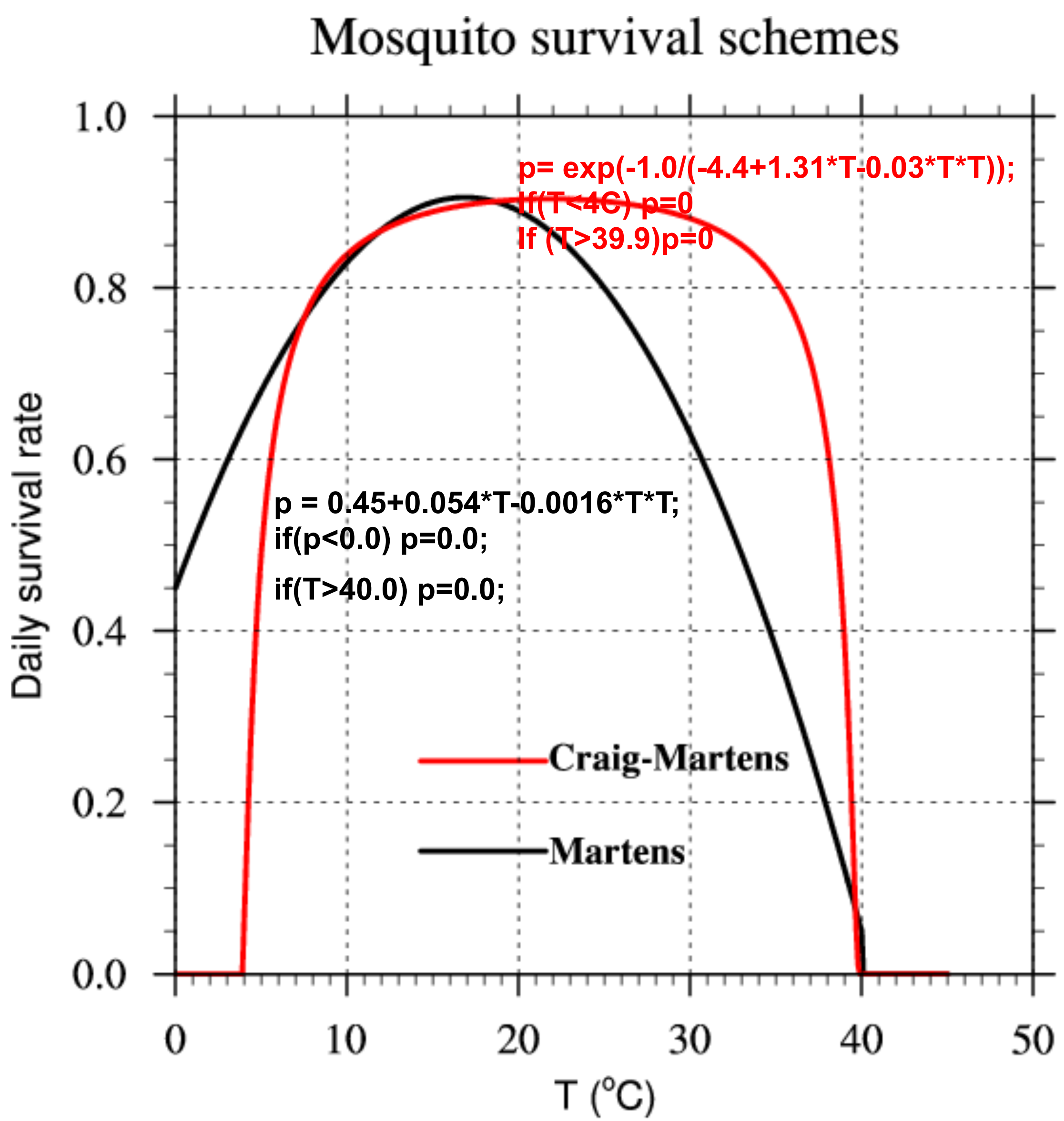




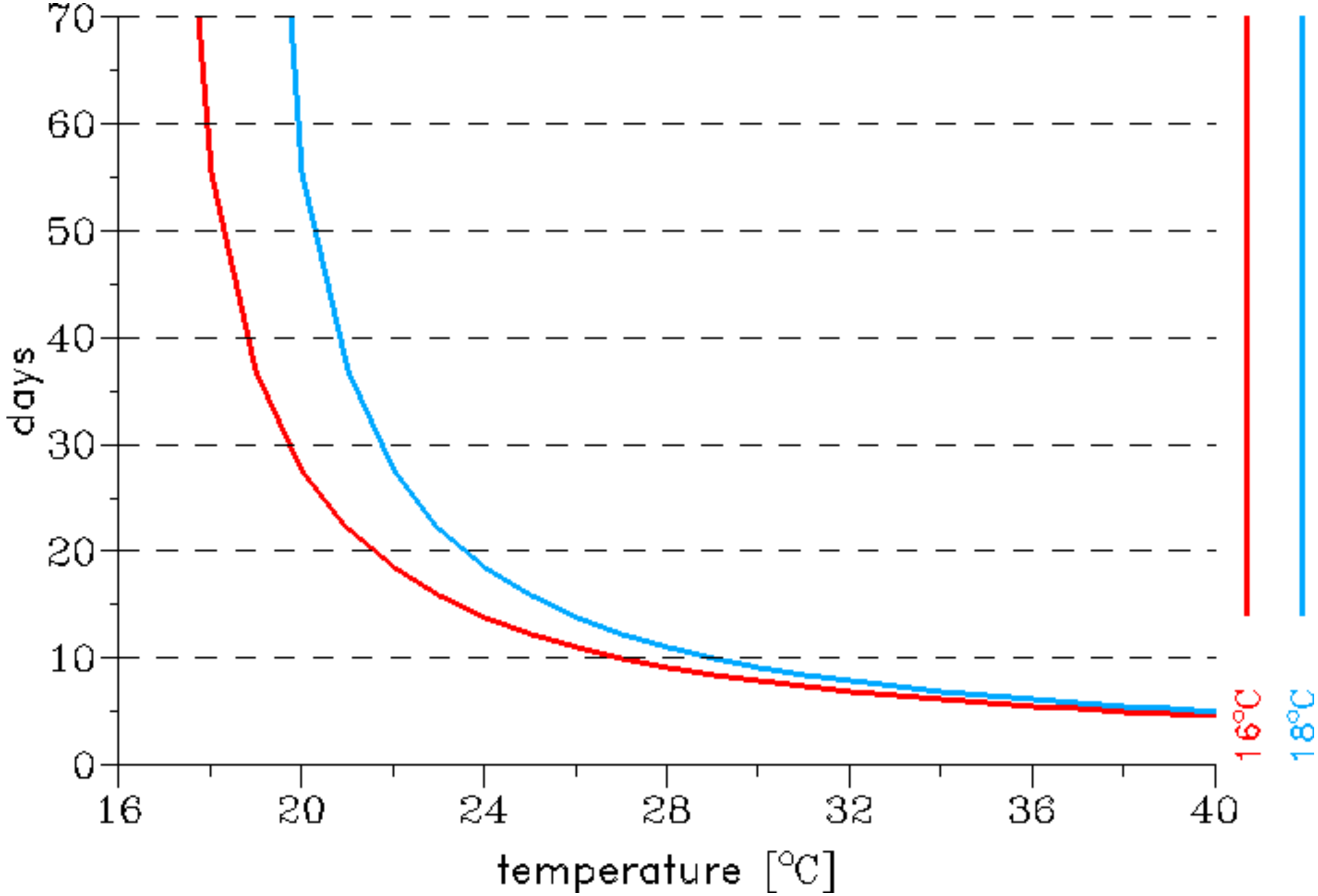
Comparison
Between
Martens and
Craig-Martens

Adult mosquito
Survival schemes

Craig: More survivors
at high temperatures



Sporogonic cycle



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Survival probability scheme