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QWeCI

Quantifying Weather and Climate Impacts on Health in Developing Countries

Milestone 4.1a – Preliminary analysis of the existing dynamic malaria model with a seamless monthly and seasonal ensemble prediction system

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PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Milestone 4.1a – Preliminary analysis of the existing dynamic malaria model with a seamless monthly and seasonal ensemble prediction system

Dave MacLeod and Andy Morse, UNILIV

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Preliminary results are presented displaying validation of the Liverpool Malaria Model (LMM) driven by the hindcasts produced by the European Centre for Medium-Range Weather Forecasts seasonal model (System 4).

Various regions in Africa have been studied, looking at Relative Operating Characteristic (ROC) areas as a measure of prediction skill. Validation is tier-2 (Morse et al. 2005), where the LMM driven by System 4 is compared to the LMM driven by a reference dataset. In this case the reference dataset used was the ERA-Interim reanalysis (Dee et al. 2011).

System 4 hindcasts cover the period 1981-2010. The hindcasts consist of 15 members per month, with each model run integrating forward for 210 days (roughly 7 months), initialised on the first day of the month.

There is a lag in the LMM (and in reality) of roughly two months between the peak of the rainfall season and the peak of the malaria season. Therefore we consider skill in simulation of malaria incidence simulated by the LMM, averaged over a three month window centered two months after the peak of the rainy seasons. That is; where DJF is the rainy season, the incidence is averaged over FMA, for JAS; SON, and so on.

The metric to measure the skill is the ROC area. The ROC area gives an optimistic indication of model performance in forecasting events, and the events used here are upper tercile and lower tercile incidence. More details on ROC areas can be found in Jolliffe & Stephenson (2003).

In order to run the LMM it must be driven first with at least a year of climatology, in order that the mosquito population levels reach realistic starting values. To achieve this 366 day smoothed temperature and precipitation climatologies were created for both System 4 and ERA-I, and subsequently every run of the LMM was preceded by this climatology starting at the appropriate day of the year.

Results are shown here for Senegal, Ghana & South Africa. The rainy seasons considered to correspond to these regions are JAS and AMJ for Senegal and Ghana and DJF for South Africa.

Since only regions for which malaria is present are relevant, annual malaria climatology was calculated and grid points for which the simulated incidence (driven by ERA-Interim) were nominally low were masked (in this case where incidence is less than 0.2 cases per 1000 people).

ROC areas are shown for upper and lower tercile malaria incidence ‘events’. A score above 0.5 indicates a forecast system better than using climatology, with a score of 1 indicating a perfect forecast system. A score between 0.5 - 0.7 might be considered to be too close to noise to be useful (ROC areas are generally an upper bound on potential skill), whilst scores above 0.8 are generally significant, and scores over 0.9 indicate a well performing forecast system.

Results

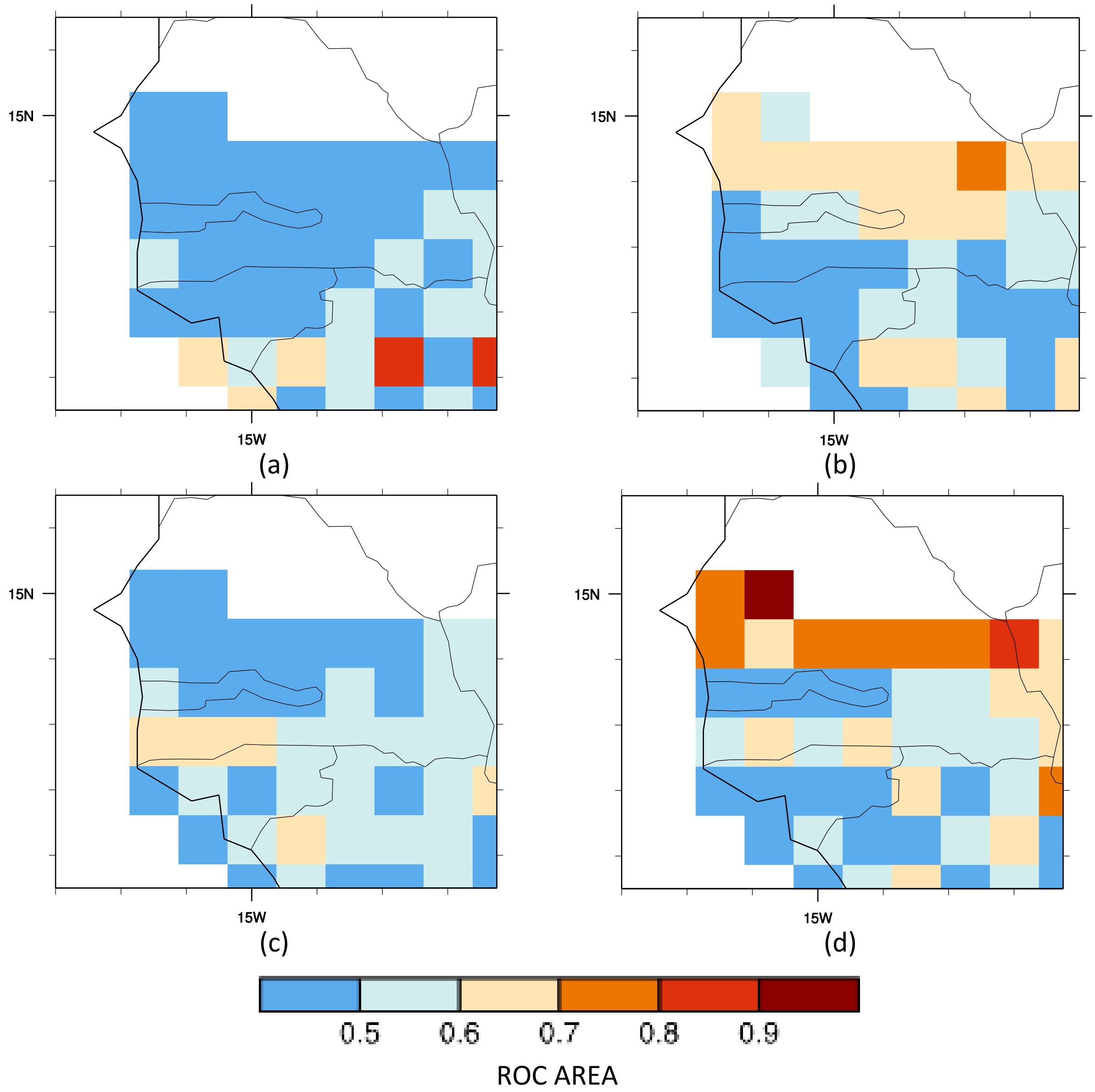

Figure 1: ROC area for SON malaria incidence from System 4-driven LMM over Senegal, showing (a) Upper tercile, forecast issued May, (b) Upper tercile, forecast issued July, (a) Lower tercile, forecast issued May and (d) Lower tercile, forecast issued July.

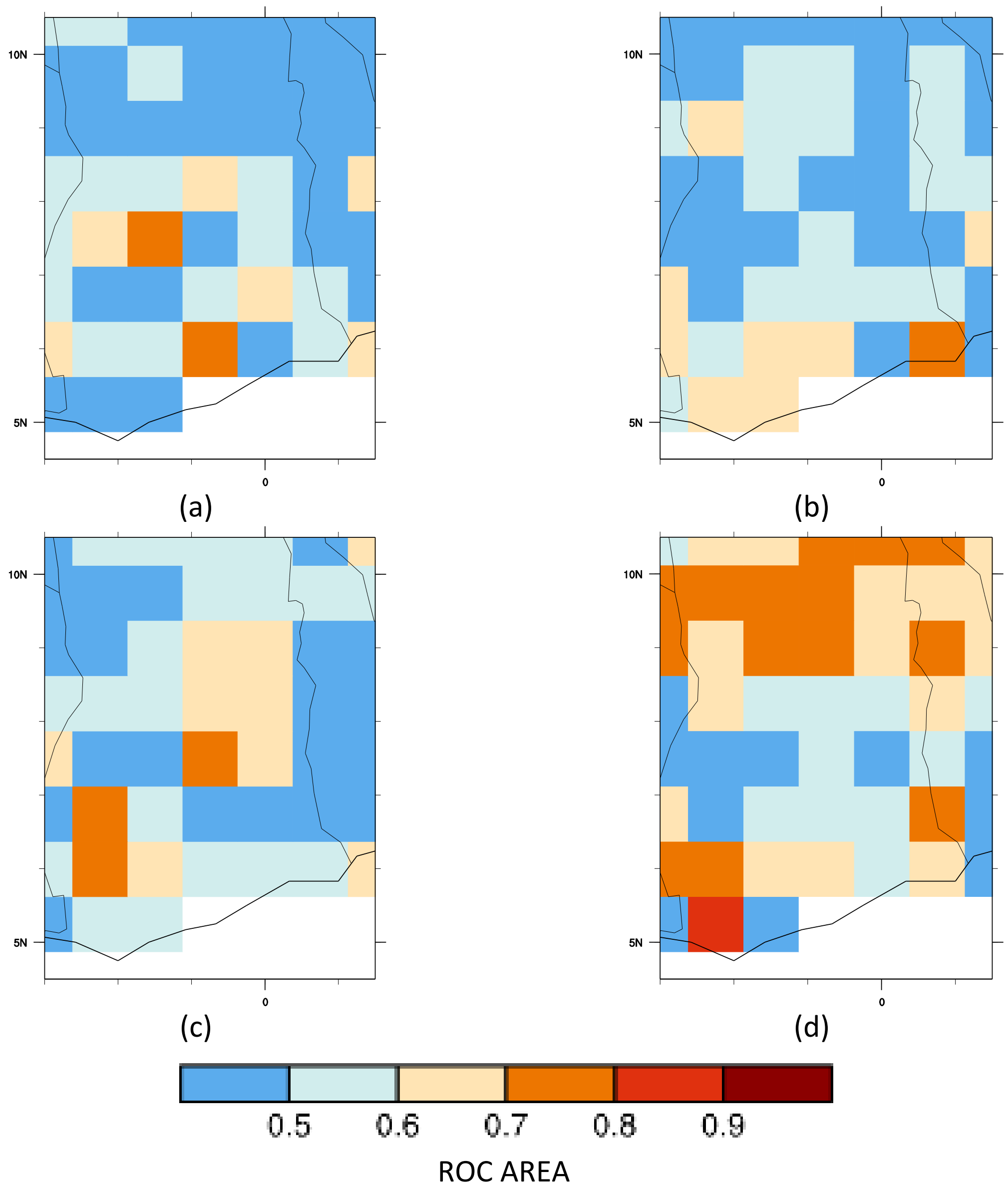

Figure 2: ROC area for JJA malaria incidence from System 4-driven LMM over Ghana, showing (a) Upper tercile, forecast issued March, (b) Upper tercile, forecast issued May, (a) Lower tercile, forecast issued March and (d) Lower tercile, forecast issued May.

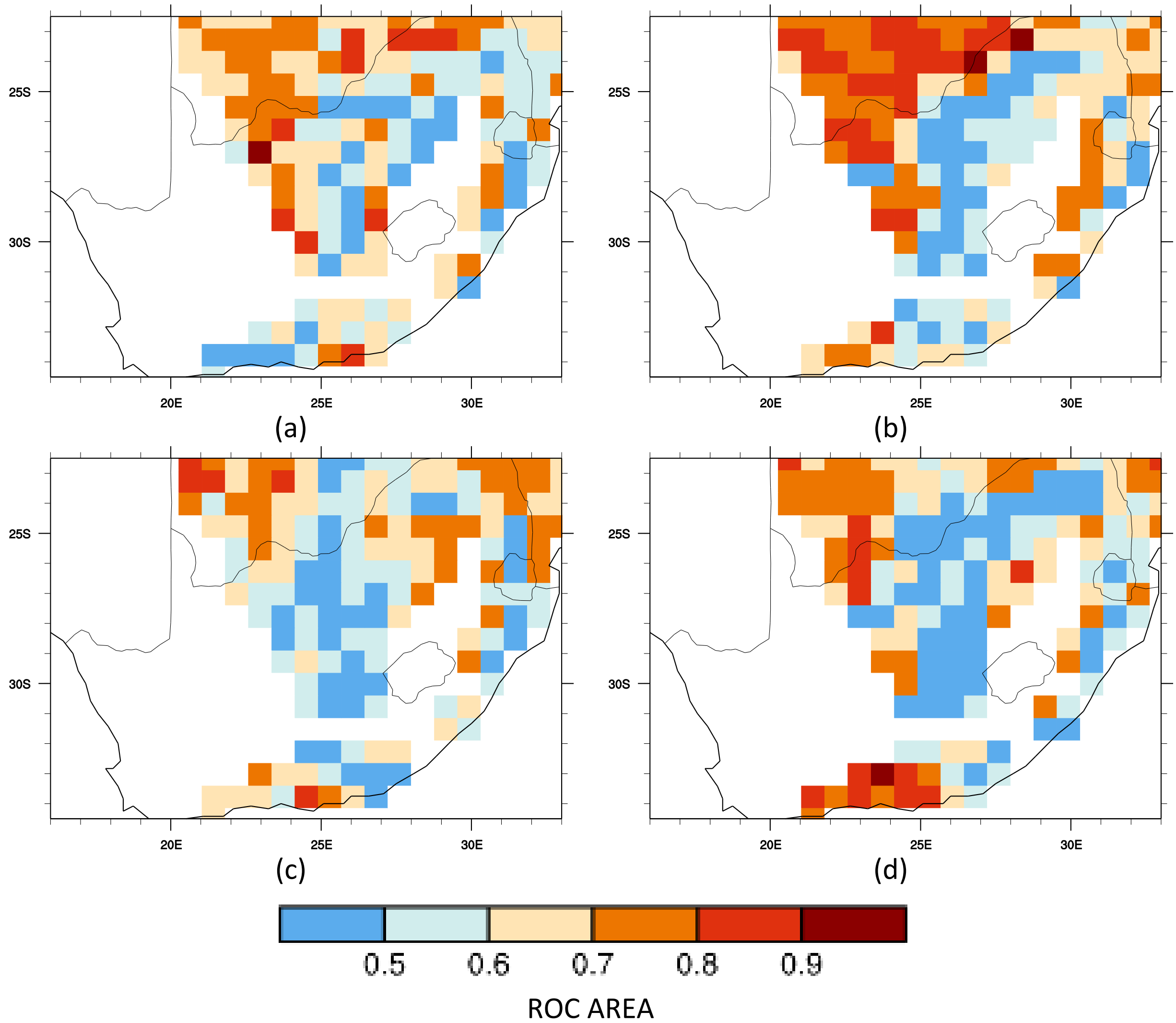

Figure 3: ROC area for FMA malaria incidence from System 4-driven LMM over South Africa, showing (a) Upper tercile, forecast issued October, (b) Upper tercile, forecast issued December, (a) Lower tercile, forecast issued October and (d) Lower tercile, forecast issued December.

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