Grant agreement no. 243964

QWeCI

Quantifying Weather and Climate Impacts on Health in Developing Countries

D5.4c – Report from end-users concerning format of information preferred

Start date of project: 1st February 2010 Duration: 42 months

Lead contractor:	ICTP
Coordinator of deliverable:	UNIMA
Evolution of deliverable	
Due date :	M3
Date of first draft :	M20
Start of review :	M20
Deliverable accepted :	M20

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)		
Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	PP
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)	

D5.4c) Report from end users concerning format of forecast preferred

1. *Introduction*

This is a report concerning consultations with end-users in Malawi about the preferred format of an eventual health early warning (HEWS) forecasting system. It is closely related to deliverable reports 5.4d and 5.4e. The nature of the report, involving the identification of local end-users and establishments of working relationships, implies complex local logistics. As a result, it was not possible to conduct the background work until the consortium visits to Malawi had been conducted in November 2010, and then the relevant stakeholders could participate in the first QWeCI workshop held at ICTP in September 2011, in which potential technological and forecast forecasts could be adequately demonstrated.

2. *Identification of end users*

During the preparation and execution of the first kick off meeting for the Malawi pilot in November 2010, local and national stakeholders were identified and meetings were arranged. These included

- The Ministry of Health (MoH) in Malawi,
- The national malaria control programme (within the MoH),
- The NGO BAOBAB Health Trust (see report 5.4e for details) active in data collection and storage in southern Malawi,
- Department of Climate Change and Meteorological Services, under the Ministry of Natural Resources, Energy and Environment,
- District health officers (DHO) responsible for health data collation, and
- Local (MoH, NGO and CHAM) clinic directors in the focus region of Mangochi.

Representatives from all six of the above stakeholder categories were visited or meetings held by the UNIMA/UNILIV/ICTP QWeCI consortium during the November 2010 visit. During the visits to the local clinics it was realized that potential usage of a forecast product would have to be discussed at a later stage and in conjunction with the MoH. Representatives from the MoH and NMA (the national meteorological service) were invited to join the first QWeCI workshop at ICTP in 2011 under the budget of ICTP in order to develop the plan for a potential operational system further. Unfortunately, administrative problems in Malawi prevented the NMA representative from travelling at the last moment, and thus this reports concentrates on the work conducted together with the Malawi MoH, (anyway the focal end-user of a health HEWS product), during this first workshop. Further development of the graphical products are shown in the resulting partner document deliverable 5.4d

3. Previous systems

Part of the difficulty of developing a new HEWS system is the relative lack of existing publically available online HEWS to act as a basis. The work on the potential development of seasonal forecasting system HEWS in Botswana was reported in the scientific literature (e.g. Jones and Morse 2010, J. Climate, pp 4202) but has so far not led to operational systems. Graphical products that aid scientific explanation are not necessarily optimal for dissemination of HEW to end-users. The international Research institute for climate and society (IRI) has a long standing programme in malaria and climate research, involving several statistical modelling systems and a successful global climate model based seasonal forecasting system, but presently their malaria "map room" consists of rainfall observational monitoring products:
http://iridl.ldeo.columbia.edu/maproom/.Health/.Regional/.Africa/.Malaria/

The interviews conducted for this report therefore started from a basic level of end-user requirements, and naturally focused on the needs and present infrastructure of the pilot region in question: Malawi.

4. Format requirements

As a result of the collaboration taking place between the MoH representative and ICTP QWeCI scientists during and after the first QWeCI workshop in September 2011 the following priorities for a forecasting system were identified:

i. Ease of access

The system should be easily accessible and simple to run. The format for the system development was envisaged to take place in a multiple stage development plan.

Stage 1: From the outset it was decided that a first level system could consist of graphical products developed and hosted by QWeCI partners ICTP and/or UoC, and made available to planner in Malawi through a website.

Stage 2: The next stage of development could be the transmission of forecast system output in a KML format for local display through the use of the Google Earth software. Limited training would be required in the use of such a system, since the software is already familiar to MoH employees. The advantage of this system is that is allows for far greater flexibility, allowing users to build up layers of health and auxiliary information, and zoom in to a region of health district of interest. Example graphical plots of a potential interface are shown in companion deliverable 5.4d

Stage 3: A third stage would envisage the local use of the malaria modeling systems (LMM and VECTRI) themselves by end-users in the MoH, allowing the user to investigate the potential impact on the upcoming season of various interventions or their delay. Such an approach relies on the continued development of the GUI model interfaces (both on and offline) as part

of WP5.1 and the reader to referred to the deliverables in this section. This third approach would require a greater level of user training, but would lead to increased capacity to plan interventions if a potential forecasting system was proved reliable.

ii. Relevance to area: the regional scale

Since the centralized data collection takes place on a health district level and collated on a monthly basis, first level predictions should also match this spatial and temporal aggregation. Climate and weather forecasts are typically made with gridded models and the users are familiar with being faced with gridded model output. However, an analogous map of parasite ratio (PR) gridded for the target region (an example is given in Fig 1) was deemed to be of limited use since the output bears little relation to the monthly, district level data the health planners are used to, while on the other hand, linking to individual health facilities is also problematic.

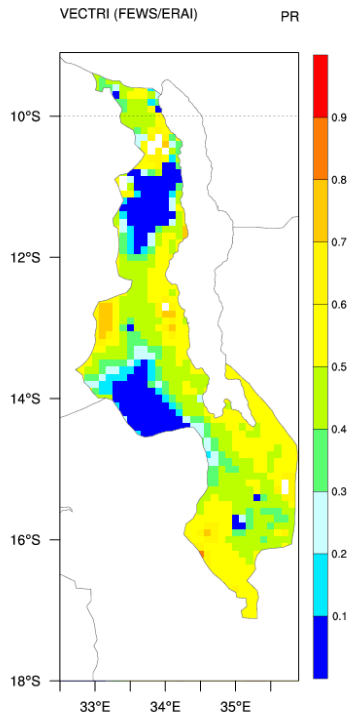

Figure 1: Example gridded integration of the VECTRI dynamical malaria model. the Malawi MoH found such gridded products to be of limited use since they neither supply information on an aggregated district level, nor allow focus on individual health facilities

A second aspect of the system is that a plot such as figure 1 is purely deterministic and displays no information concerning forecast uncertainty. This is returned to in section (iv). Likewise it was considered important to include an easy to access and interpret guide to the eventual products developed for the district level with a clear assessment of past performance. It was

noted, however, that with less than a decade of data, validation efforts would be necessarily limited. Thus a system should show

- Maps of disease anomaly indices
- Time series of disease progression through the seasonal on a district level
- Information concerning the district malaria long term mean on a month-by-month basis
- Information on the forecast uncertainty in an ensemble prediction system
- Information on the forecast systems previous skill.

Parameters that were considered important for a system to show were

- Ratio of cases to expected cases (standardised morbidity ratio)
- Total cases
- Advanced users: Entomological Immunization Rate (EIR) to compare to field studies and assess the system

iii. Local/regional scales

In addition to district level/monthly forecasts, the Malawi MoH requested that an eventual system facilitate the display of data on a clinic by clinic basis to help more localized district level planning. It is felt that although climate drivers of disease usually undergo seasonal anomalies (e.g. drought, floods, heatwaves) on the meso to regional scale, and that seasonal forecast systems also usually only have skill over large spatial scales in the tropics beyond the deterministic (few days) leadtimes, information from the forecast system could still be usefully disaggregated to the individual clinic level. This is because the relative case number of individual clinics depends on known local socio-economic and environment factors such as land-surface types, and especially on the mean temperature in the catchment area, which is itself a function of the (known) mapped topography. Thus district scale forecasts are likely to be scalable to the clinic level using either statistical post processing techniques of statistical/dynamical model output, or even statistically downscaling temperature used as an input to the dynamical disease models.

iv. Understanding uncertainty

Understanding and communicating forecast uncertainty effectively is a crucial element of an operation forecasting system. This involves two components

1) Effective display of past forecast validation. This is commonly the case for seasonal forecast system for the climate. For example, users of the IRI or European Centre for

Medium Range Weather Forecasts (ECMWF) seasonal forecast system are able to browse various graphical products of skill for a wide range of previous forecasts (known as hindcasts) compared to observations or a model analysis system's assessment of the atmospheric state. Any HEWS system would preferably include such an assessment. However, it is acknowledged by the MoH that such efforts are necessarily curtailed in the field of health by the lack of appropriate data with which to validate the system. Moreover, many validation and development exercises for dynamical modeling systems are accomplished in terms of parameters such as EIR that are derived from research field studies. These are not generally available, nor necessarily well understood by a non-expert.

2) The second aspect that should be conveyed in the element of uncertainty is associated with **uncertain initial conditions** and **model error**. The HEWS system will tackle this in an analogous manner to the atmospheric sciences, integrating a coupled ensemble of models. The driving atmospheric forecasts that provided the upcoming seasonal temperature and rainfall information are already integrated in an ensemble framework with perturbations made to the initial conditions of 41 ECMWF seasonal forecast members. The dynamical disease models can then also be integrated with parameter perturbations to encompass their uncertainty, while the statistical models can also account for uncertainty. Ensemble information is a clear way to demonstrate uncertainty. The key will be to find a quick and clear method to communicate this ensemble uncertainty to the end-user, which is discussed in report 5.4d.

5. Summary

Extensive interaction discussion and collaborative work was conducted with the ministry of health of Malawi for a three week period including the first annual workshop of QWeCI at ICTP in September 2011. These sessions enabled QWeCI partners from outside Malawi to better understand the data collection and planning procedures already in place in Malawi, a process that had already started in the project planning stage and during an extended visit of QWeCI scientists to Malawi at the end of 2010. These sessions outlined in more detail the type of system output that the tools developed in the QWeCI project would potential provide and then discussed the desired products, formats and interactive tools that would best aid the MoH in their planning actions. A number of recommendations were made which are summarised in this report. An outline of the associated graphical product prototypes and planned tool is summarized in the associated report 5.4d.