HEALTHY FUTURES

NEWSLETTER No. 3

Health, environmental change and adaptive capacity: mapping, examining and anticipating future risks of water-related vector borne diseases in eastern Africa

February 2013 http://www.healthyfutures.eu

CONTENTS

Welcome to the 3rd HEALTHY FUTURES newsletter from the Scientific Coordinator of HEALTHY FUTURES

Welcome to the third (February 2013) issue of the newsletter for the HEALTHY FUTURES project. The final production of this issue is a little later than originally planned – the original intention was for a release date of December 2012. However, the slightly longer than anticipated production period has enabled the inclusion of additional articles and has allowed me to bring you news that has only just been received. Moreover, the relatively late publication date means that in addition to hoping that you are having a happy, prosperous and healthy 2013, I can also say Gōng Xǐ Fā Cái, or Happy (Chinese) New Year. Chinese New Year is the most important festival in Chinese culture, and is a time for family reunions and lots of feasting. The existing year (of the dragon) ends on February 9, with the new year (of the snake) beginning on February 10. As a European in Asia, having another new year so soon (one month) after the last means that all those problematic, unfulfilled resolutions can be reset or quietly ditched without any feelings of guilt!

Why all this talk of Chinese New Year? Well one of those pieces of recently breaking news that I am able to bring you is that the amendments to the Grant Agreement requested by HEALTHY FUTURES researchers back in September of last year have been approved by the European Commission. One of those amendments is to include the National University of Singapore (NUS) as the 16th member of the HEALTHY FUTURES consortium, and here at NUS we have been given two days off work to celebrate Chinese New Year! There are other amendments to the Grant Agreement, aimed at facilitating the relatively smooth operation of the HEALTHY FUTURES project for the remaining c. 2 years of its life (time flies – we are already more than 50% through the period of HEALTHY FUTURES research!). Identifying, making and then obtaining approval for the amendments was a hugely time-consuming process, and I would like to take this opportunity to thank all contributing members of the HEALTHY FUTURES consortium, and in particular Paul Lowen (AQUATT) and Dr. Laragh Larsen (TCD), and of course Lara Grazia Passante, the very patient and understanding desk officer for the HEALTHY FUTURES project in the European Commission, for their help.

Other news that I am able to bring you is that the European Commission appears to have received positively the First Periodic (18 months) Report, including the financial reports for the HEALTHY FUTURES project, as they have released the First Interim Payment (and would not have done this otherwise) – so thanks are also due to all HEALTHY FUTURES researchers for their efforts in putting together the reports when all had other (and often more preferable) things to do. You might also recall that in the previous issue of the newsletter I mentioned that HEALTHY FUTURES had offered to organise and run a Symposium at the forthcoming 4th Annual East African Health and Scientific Conference, scheduled for Kigali, Rwanda, in March 2013. I am pleased to be able to inform you that planning for the Symposium has moved on

National University of Singapore, Singapore: the 16th member of the HEALTHY FUTURES consortium

quickly since, and we now have WHO Africa support and a very full programme for the event. The programme, together with a brief background to the Symposium and associated developments, are provided later in this newsletter under Forthcoming Events.

The Research Reports section in this issue includes several updates of research activities that are currently underway as part of the HEALTHY FUTURES project. The number of accounts and the diversity of activities described in this newsletter provides some indication of the scope, depth and topicality of HEALTHY FUTURES research in eastern Africa, from collating and analysing information on past disease outbreaks, to modelling climate and vector-borne diseases to trying to understand social vulnerability. Much of this research is now in the process of being published in academic journals. Perhaps an even greater challenge than satisfying the demands of journal reviewers and editors, however, will be to translate the research findings into appropriate decision support tools that can be used in the effective targeting of scarce health resources in eastern Africa and beyond.

8 months when I also had to move my family and myself half-way across the world to escape the constant rain and austerity of Ireland for a new life in Singapore. These moves are never easy, so I am told, especially with school age children (I have two boys, now aged 8 and 13). I am truly grateful for all the support provided and understanding shown by colleagues in the HEALTHY FUTURES consortium and by Lara in the European Commission during this period, and apologise for any tardiness that I may have shown along the way. As far as the near future is concerned, I am looking forward to a period of not having to worry about moving offices and homes, leaving old and meeting new colleagues and friends, and assessing potential new schools. I am also greatly looking forward to seeing members of the HEALTHY FUTURES consortium at various meetings over the next few months, starting with the Symposium in Kigali, Rwanda, in March and then at the 4th Partners', 3rd External Review Panel and 2nd Early Stage Researcher (ESR) meetings, all of which are being hosted by the ICTP in Trieste, Italy.

ICTP accommodation and teaching block, Trieste, Italy

HEALTHY FUTURES continues to make my life busy, challenging and rewarding, and particularly over the last 6-

Unfortunately there is no Researcher profiles section in this issue. Hopefully in the next issue there will be,

especially as researchers at SEI (Oxford) will also have been actively contributing to HEALTHY FUTURES research by then. I can bring you some excellent news of one member of the HEALTHY FUTURES team, however. Dr. Gayle McGlynn (TCD), who is busily combining writing papers from her PhD and from her current postdoctoral research position with organising the next ESR workshop, has obtained a lectureship position in Geography at TCD and is due to take up her new appointment in September of this year. Congratulations Gayle, and richly deserved. I am sure that I am expressing the shared opinion of all colleagues in HEALTHY FUTURES in stating that I hope that you will continue to be involved in some way with HEALTHY FUTURES following your change in job.

As in previous issues of the newsletter, please let me take this opportunity to thank you for your continued interest in HEALTHY FUTURES, and to wish you well in coming months.

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RESEARCH REPORT

I. The changing distribution of malaria in Uganda

Over the years the malaria profile across Uganda has tended to change in terms of the distribution and extent of endemic, epidemic prone and free areas. The climate patterns and altitude of much of the country are favourable for malaria transmission. Much of Uganda can be classed as mid to high altitude and experiences a favourable tropical climate, with mean annual temperatures ranging from c. 16°C in the southwest, to c. 25°C in the central, east and northwest and up to c. 30°C in the northeast of the country. Uganda experiences two rainy seasons: March to June and September to December. According to the Uganda Malaria Programme Review 2001-2011, published in 2011, the two peaks of rainfall correspond with peak rates of malaria in Uganda.

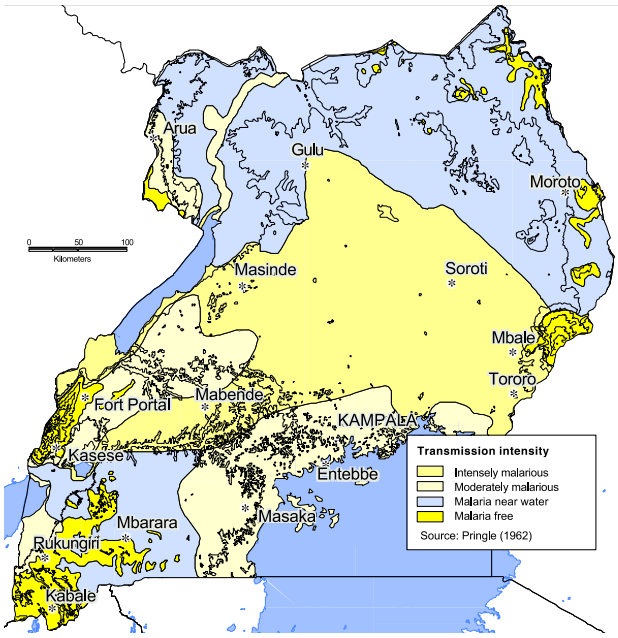

***Figure 1.1**: Malaria distribution in Uganda, 1962*

Figure 1.1 illustrates the distribution of malaria in Uganda in 1962, and highlights the intricate relationship between altitude and weather/climate. Since temperatures decrease with increasing altitude, malaria transmission was lowest in the higher altitude areas of south-western and eastern Uganda, and absent above altitudes of 1,800-2,000m (Ministry of Health Uganda, Malaria Control Programme, http://health.go.ug/mcp/distmaps.html). Humidity and rainfall were favourable for malaria transmission in most parts of Uganda and therefore altitude, as a proxy of temperature, and human factors such as population density were the key determinants of the distribution of malaria in Uganda.

With environmental, including climate, and population changes the current situation is somewhat different from the situation in 1962. Highland areas formerly malaria free are now epidemic-prone. The malaria risk map generated by the IRS Project confirms this distributional change. In fact, the Uganda Malaria Report 2001-2011 clearly indicates that:

> "Malaria is endemic in the entire country except for a few areas of low transmission that are prone to epidemics, with a mean malaria parasite prevalence rate of 45% in children under the age of 5 years [range 5% in Kampala to 63% in mid and northern Uganda]….The whole population of Uganda is at risk of malaria, with over 90% experiencing high stable all year round transmission, while the remainder, has low, unstable transmission which is epidemic prone."

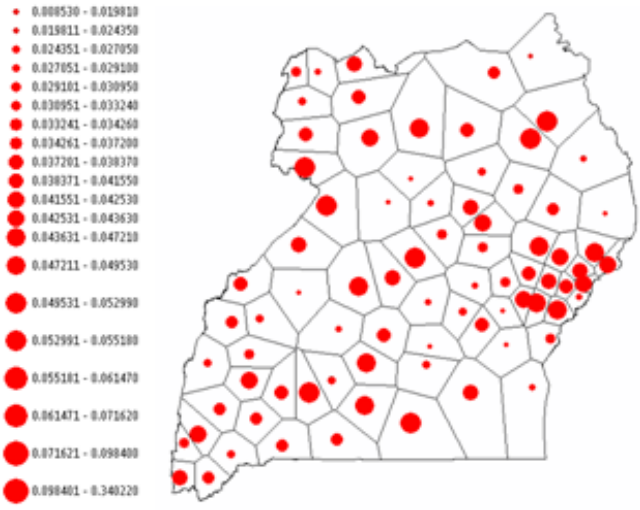

***Figure 1.2:** Model #1, Geographic distribution of malaria prevalence forecasts model*

The *Uganda Indoor Residual Spraying Project* in 2012 produced two malaria risk assessment maps. The two assessment maps, Model #1 and Model #2 (respectively figures 1.2 and 1.3), are based on the malaria data provided and analysed from 2006 through 2010 and several environmental and demographic covariates. Model

#2 also used entomological indicator data (based on species 'goodness of fit' or 'conditions conducive for' models). The two maps appear to confirm that malaria risk and transmission are now experienced across the whole country, in contrast to the situation in the early 1960s when Uganda had some malaria free zones, especially the highland areas. Warming of temperatures in highlands seems to partly account for this change. Modelling of malaria in HEALTHY FUTURES, using climate and malaria data for Uganda, will further shed light on the relationship between climatic factors and malaria risk/prevalence in this most dynamic of countries.

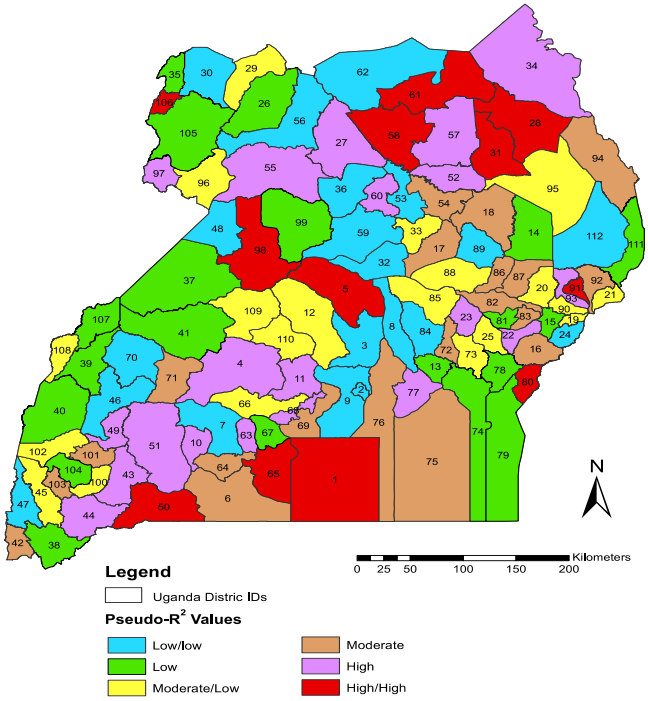

Figure 1.3: *Model #2 Assessment of risk based on random effects hierarchical linear based malaria risk model*

(From: Uganda Indoor Residual Spraying (IRS), Report on National Malaria Risk Map for Uganda, USAID, Abt Associates Uganda, July 2012)

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II. Statistical Downscaled Climate Change Projections of Rainfall and Temperature over East Africa

The Climate Systems Analysis Group (CSAG) at the University of Cape Town is tasked in HEALTHY FUTURES with the provision of statistically downscaled climate change projections for the eastern African region.

The research falls within Work Package 4 'Disease risk and vulnerability mapping'. This report provides a brief summary of the latest downscaled results using ten Global Climate Models (GCMs) from the CMIP51 archive. Further information is available on request at the email address provided at the end of the article.

GCMs are numerical models that simulate the physical processes of the atmosphere, oceans, troposphere (snow and ice) and land surfaces. They represent the most advanced tools currently available for simulating the response of the global climate system to increasing greenhouse gas concentrations. GCMs are primarily skilful at reproducing large-area (small scale) circulation patterns, but cannot provide robust indictors of climate change at the finer regional or local scales. This shortcoming is especially felt in the impact and adaptation community since they usually work at a much larger spatial scales. Statistical downscaling provides one means of circumventing the problem of scale mismatch, since it derives the local response to the large-scale atmospheric state by using the more skilful attributes of the GCM.

The results presented here are created using a statistical technique called Self-Organizing Map based Downscaling (SOMD)[2] developed at the CSAG. This is a leading empirical downscaling technique for Africa and provides meteorological station level or gridded response to global climate change forcing[3]. Downscaling of a GCM is accomplished by deriving the normative local response from the atmospheric state on a given day, as defined from historical observed data. The method recognises that the regional response is both stochastic, as well as a function of the large-scale circulation. As such it generates a statistical distribution of observed responses to past large scale observed synoptic states. These distributions are then sampled based on the GCM-generated circulation in order to produce a time series of GCM downscaled daily values for the variable in question (in this case temperature and rainfall).

The observed meteorological data used in this project are from the WATCH Forcing Data 20th Century Dataset[4]. Daily rainfall and temperatures for the period 1979-2001 are used to characterise the local response to the large-scale atmospheric states over this historic period. The GCM data are then used to provide time series of projected weather patterns over the historic and future periods from which the downscaled local response can be inferred. Ten models from seven modelling centres are used, they are: BNU-ESM, CanESM2, CNRM-CM5, FOGAL-s2, GFDL-ESM2G, GFDL-ESM2M, MIROC5, MIROC-ESM, MIROC-ESM-CHEM and MRI-CGCM3. Data from the Historical (1960-2005)

[1] CMIP5 Overview: http://cmip-pcmdi.llnl.gov/cmip5/
[2] Hewitson, B.C, and Crane, R.G., 2006. Consensus between GCM climate change projections with empirical downscaling: precipitation downscaling over South Africa. Int. J. Clim., 26, 1315-1337.
[3] Wilby, R. L., S.P. Charles, E. Zorita, B. Timbal, P. Whetton and L.O. Mearns. 2004. Guidelines for use of climate scenarios developed from statistical downscaling methods, Supporting material of the Intergovernmental Panel on Climate Change, available from the DDC of IPCC TGCIA, 27. www.ipcc-data.org/guidelines/dgm_no2_v1_09_2004.pdf
[4] WATCH Forcing Data 20th Century: http://www.waterandclimatechange.eu/about/watch-forcing-data-20th-century

experiment and from two future experiments (2006-2100), employing the 4.5 and 8.5 Reference Concentration Pathways, are concatenated together to produce 140-year time series under two differing future emission pathways.

Results presented here are for the projected change in annual total rainfall and annual mean maximum temperature between a 30-year historical period (1976-2005) and future period (2041-2070) using the RCP8.5 emission scenario. Each model anomaly is presented separately along with the multi-model mean anomaly.

change, with models disagreeing on even the sign of change in many locations. Generally speaking the models projected decreasing rainfall to the south and increasing rainfall in the northwest and over more mountainous regions.

Although the results presented here are very general, they do provide insight into the range or envelope of possible future climate states given the uncertainty inherent in the models, the science and the climate system. Further work needs to be done to evaluate the results against

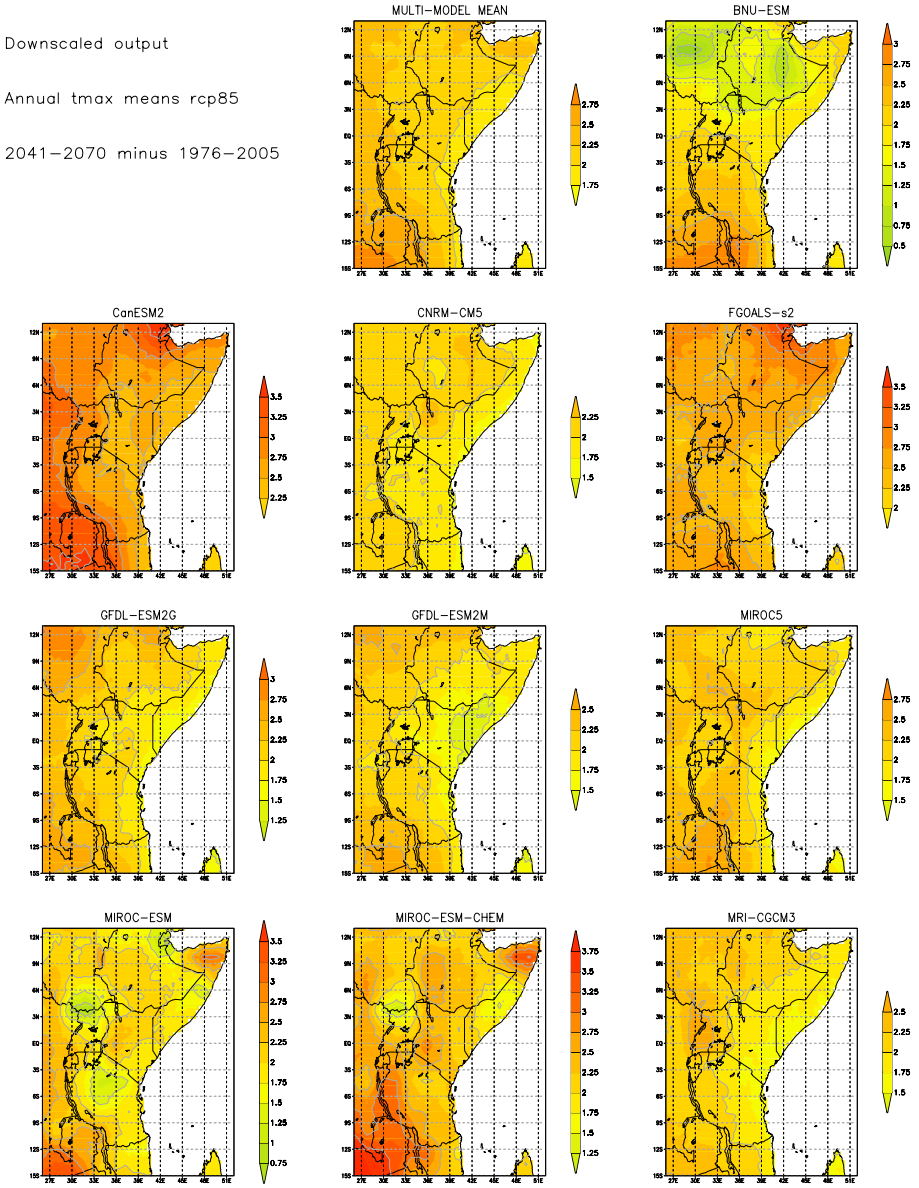

Figure 2.1: *Projected change in maximum temperature by the mid 21st Century under the RCP8.5 emission scenario*

The projected change in maximum temperature by the mid 21st Century under the RCP8.5 emission scenario (Figure 2.1) shows a general agreement in increasing temperatures over the eastern African study region. However, the amplitude and spatial distribution of the warming varies between GCMs. The projected change in annual total rainfall is for both drying and wetting over the eastern African region (Figure 2.2). Again, there are clear model differences in the spatial organisation and amplitude of

observations of current climate trends and against results from Regional Climate Models (RCMs). Once this has been completed, a multi-model ensemble of climate change information for disease-specific variables will be derived and used in the analysis of disease risk in HEALTHY FUTURES.

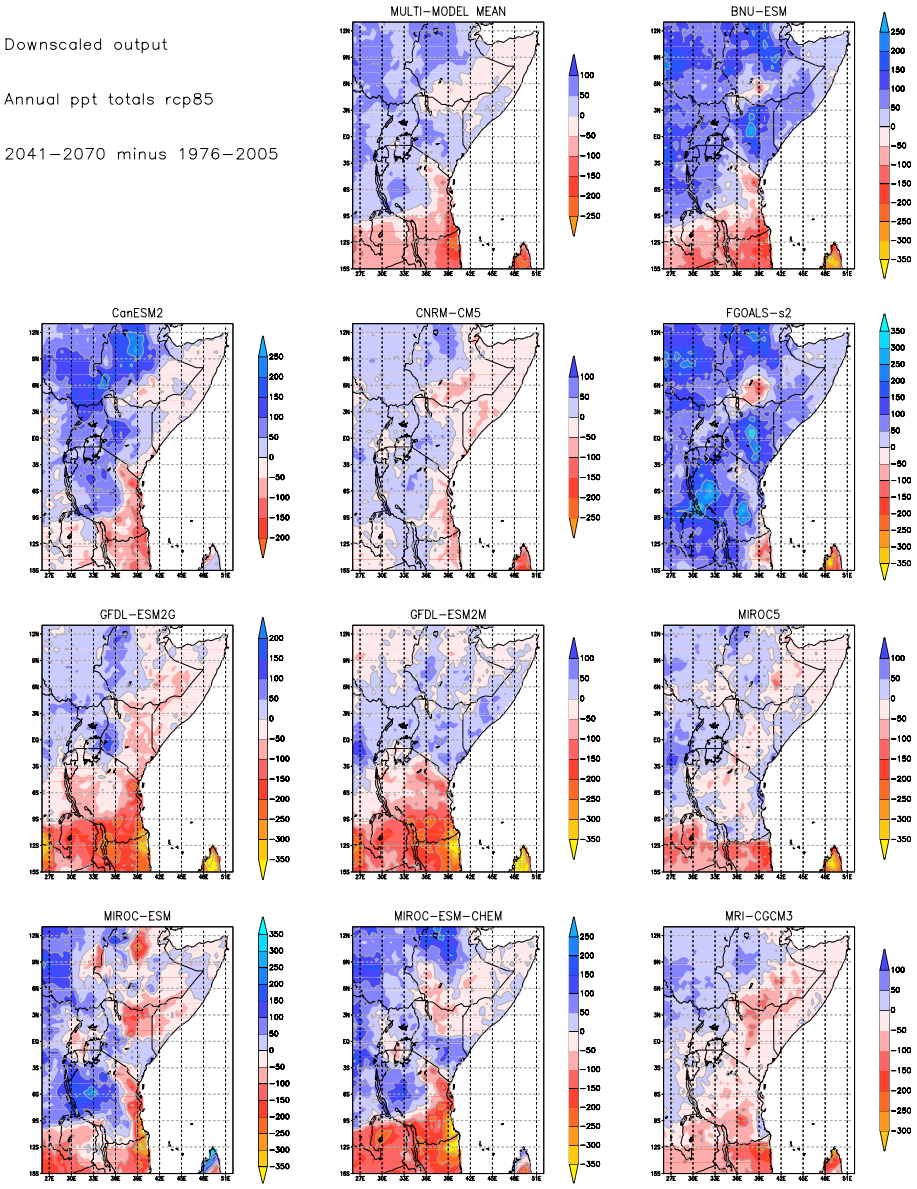

Figure 2.2: *Projected change in maximum temperature by the mid 21st Century under the RCP8.5 emission scenario*

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III. The HEALTHY FUTURES historic database

The construction of a database using historical disease and climate data from archival documentary sources continues within Work Package 2 of the HEALTHY FUTURES project. Both quantitative and qualitative data related to the study area have been, and will continue to be, collected from documents held in a number of archives in the UK and eastern Africa. The data are being coded and compiled in a searchable Access database and visually displayed in Google Earth according to data type. The Access database enables the data to be easily searched and extracted based on particular criteria. For example, conducting a query for rainfall and disease-related data for Masaka, Uganda, between 1906 and 1908 illustrates that monthly rainfall data are available between May 1906 and December 1907 and some quantitative disease data are available between May 1906 and August 1907, in the form of number of deaths from malarial fever occurring in the area. These data are plotted graphically in Figure 3.1. Such data comparisons are envisaged to be a useful method in visualising and analysing the data in order to detect and extract patterns and linkages between the available data types.

The Google Earth database spatially and temporally maps the data according to category. Disease-related data are divided according to the three target diseases of the project (malaria, Rift Valley fever and schistosomiasis) and are further distinguished according to whether they relate to: an incident, outbreak or quantitative measurement of the relevant disease; intervention or control of the disease; a qualitative report or description related to the disease; or to official policy concerning the disease in question. For example, Figure 3.2 displays the location points of the historic data collected and input thus far.

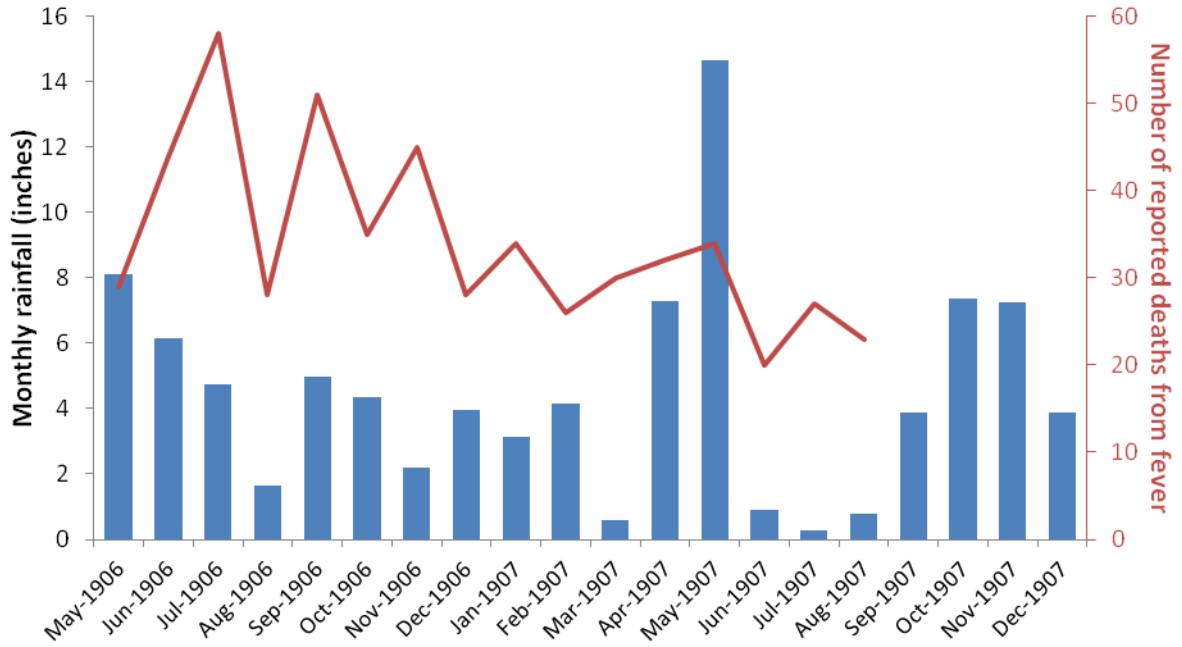

Figure 3.1: *Comparison of quantitative rainfall and disease-related data for Masaka between 1906 and 1908.*

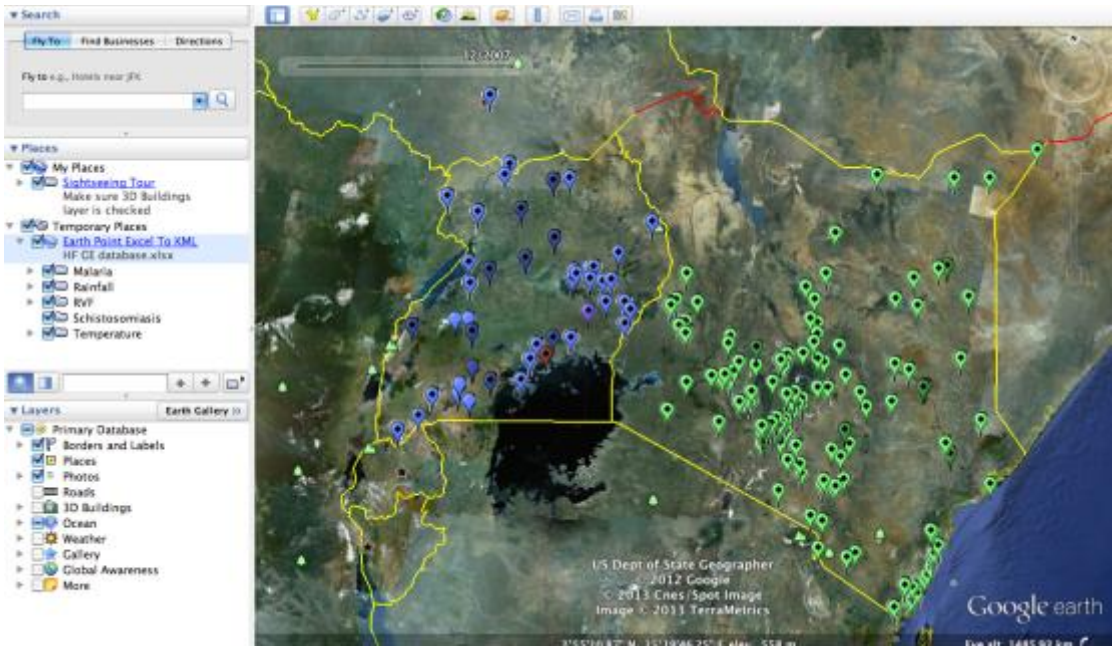

Figure 3.2: *Data visualised in Google Earth*

In relation to malaria, Gething *et al.* claim that 'non-climatic factors, primarily direct disease control and the indirect effects of a century of urbanisation and economic development … have exerted a substantially greater influence on the geographic extent and intensity of malaria worldwide during the twentieth century than have climatic factors.'[5] Through an initial investigation, it is evident that the links between environment and disease in eastern Africa – particularly malaria – have been known for over a century, and have played a major role in past efforts to control the disease in the region. The historic database of the HEALTHY FUTURES project hopes to contribute to such debates and to build a clearer picture of the environment-disease relationship. The historic database also aims to provide a historical context for the examination of the impact of environmental change on health, and thus a basis for comparing and assessing future risks.

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[5] Gething, P.W., Smith, D.L., Patil, A.P., Tatem, A.J., Snow, R.W. and Hay, S.I. (2010) Climate change and the global malaria recession. *Nature* 465: 342-346, p.343

IV. Research stay in the Department of Geoinformatics (Z_GIS) at the University of Salzburg, Austria

Jean Pierre Bizimana, PhD Student from the National University of Rwanda, spent his first secondment at the Department of Geoinformatics – Z_GIS at University of Salzburg in Austria from 29th June to 12th August 2012 (Plate 4.1). The city of Salzburg is a highly dynamic city in the Province of Salzburg, Austria. Bisected by the Salzach River, the city is a tourist hot spot, not only because of its historical and cultural richness, but also because of its location, being bordered by the Alps in the south and by rolling plains to the north. Salzburg is also the birthplace of Mozart and the setting for the musical and film "*The Sound of Music*".

The main objectives of this research stay were to finalise the research proposal on "Climate Change and Vulnerability to Malaria in Rwanda", to be trained on advanced methods in spatial assessment of vulnerability to malaria using the object-Based Image Analysis (OBIA) methods, to participate in Young Researcher Forum: 2-3 July 2012 and to attend the GI_Forum 2012 International Conference. Jean Pierre Bizimana attended the first "*Young Researchers' Forum*" in the context of Spatial Analysis of the Climate Change and Vulnerability for Disaster Risk Reduction and Adaptation Planning. This forum offered him an opportunity to present and discuss his research plans. Students received feedback, comments and views on their proposal as part of an inspiring academic community. Comments were provided by PhD students themselves, experienced researchers – including keynote speakers from the GI Forum, faculty members of GIScience Doctoral College at University of Salzburg, the European Marie-Curie ITN CHANGES, and the Doctorate School in Global Change Science and Policy (ChangeS), Italy.

Plate 4.1: *Jean Pierre drawing inspiration in Austria for his own research in Rwanda*

From July 3-6, 2012, Jean Pierre was able to participate in the 6th Geoinformatics Forum conference on Applied Geoinformatics (GI_Forum). This conference was organised by the Department of Geoinformatics (Z_GIS) at the University of Salzburg, Institute of GIScience at the Austrian Academy of Sciences, and the German University of Technology in Oman. It offered full-fledged, intertwined tracks on GIScience and Technology and Learning with highlights that contributed to the success of GI_Forum focus on Geovisualization, Society and Learning, and their inter-relationships. Inspiring keynote speakers, excellent presentations and stimulating social events were just a few 2012. With over 1000 participants from 41 countries, the conference organisers of GI_Forum and AGIT received an overwhelming positive response from its growing, vibrant GI community.

During the conference, Jean-Pierre was also introduced to the Geographic Information Summer Schools, where he presented a brief overview of HEALTHY FUTURES, followed by a description and explanation of the objectives guiding his PhD research. This summer school was organised by Z_GIS and aimed at assuring top quality short intensive training courses and the internationalisation of geoinformation study programmes. Participants were students of the UNIGIS network, international universities, interested members of the geo-information science community and public and private companies from all over the world. Lectures by distinguished scholars and researchers were complemented by workshops, lab sessions and excursions that give students the opportunity to prepare for an international work force, obtain qualifications and experiences in GIScience, and build strong inter-personal and team skills.

This first research stay in Salzburg was very constructive and fruitful and helped Jean Pierre to better understand the HEALTHY FUTURES Project, to exchange knowledge and skills with University of Salzburg staff in Integrated Vulnerability Assessment and to take a major step forward in his PhD training process.

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V. A spatially-explicit individual-based model for simulating RVF transmission dynamics

Remarkable progress has been made in the development of a dynamical model for simulating RVF transmission dynamics in Kenya. The model predicts vector and livestock population dynamics and RVF virus transmission processes in a spatially-explicit environment that is subdivided into grid cells of 500 x 500 m to capture some of the spatial heterogeneities that are thought to influence the transmission of RVF. At the moment, spatial heterogeneities being considered are: the location of vector breeding sites; and seasonal grazing sites. In addition, only 2 vector species (*Aedes* spp. and *Culex* spp) and 2 host species (cattle and sheep) are included in the model. Vector population dynamics are driven by daily rainfall values obtained from Tropical Rainfall Measuring Mission (TRMM). Simulations are updated on a daily basis and analysis currently focuses on the period 1st July 2006 to 30th June 2007 in order to capture the time when the recent RVF outbreak occurred in Kenya. Focusing on this period helps in establishing the rainfall thresholds that promote RVF emergence and spread. Figure 5.1 illustrates the distribution of estimated rainfall values for the study period.

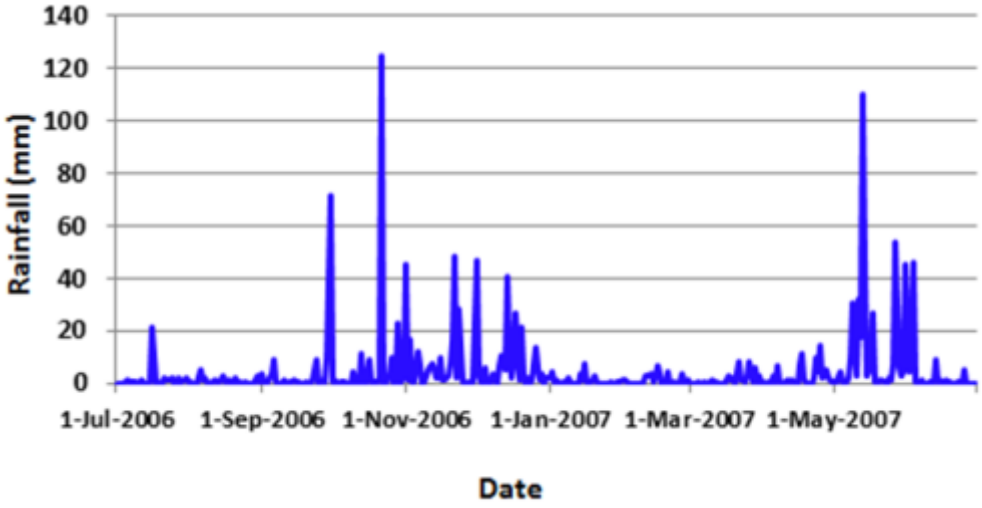

Figure 5.1: *Distribution of rainfall values obtained from TRMM for selected sites in Ijara district for the period 1st July 2006 to 30th June 2007*

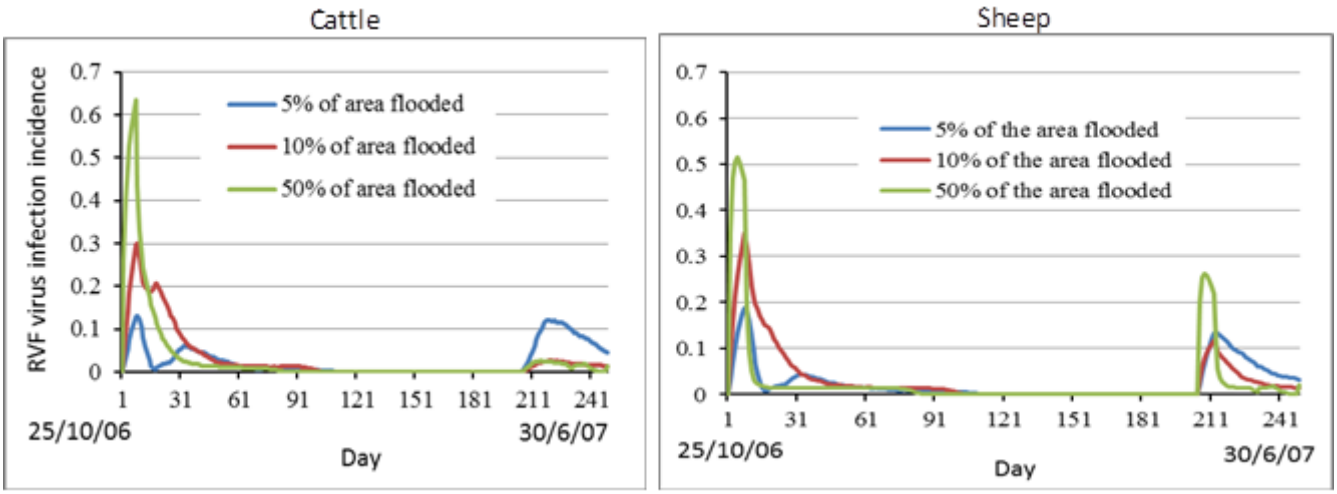

Figure 5.2: *The expected effect of varying the size of the area under floods (and hence mosquito breeding sites) on the size and duration of an RVF outbreak in cattle and sheep*

Numerous simulations have been generated in the course of the model evaluation and refinement. An example of these predictions is provided in Figure 5.2, which summarises the expected relationship between varying the area affected by flooding (and therefore the distribution of vector breeding sites) and the size and the duration of an RVF outbreak. Increasing the relative proportion of the area under floods from 5 to 50% (hence expanding the surface area that can be used by vectors for breeding) increases the peak of an epidemic. Interestingly, a further increase in the size of the flooded area to 80% does not increase the peak of the outbreak further from the patterns predicted for 50% flooding level (results not shown), presumably in part because vectors are unable to use all of the even more enlarged water bodies for breeding.

Predictions given in Figure 5.2 also suggest that immunity could be important in regulating the size of RVF epidemics, and that is particularly the case in cattle when compared with sheep. This is because these predictions reveal that the heavy rains observed from May 2007 did not result in appreciable levels of RVF virus infection because the proportion of animals that were in the removed/immune class was greater than those classed as susceptible. Published work indicates that innate immunity contributes to the early clearance of RVF virus in infected animals. However, there are no reports on the duration of protective immunity, although group immunity in small ruminants is known to decline much faster than in cattle or camels because of their high population turn-over rates. More work is being done to understand these dynamics and it is expected that the model will be used to identify interventions that can be used to manage the disease more effectively than has been the case to date.

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CLUSTER UPDATE

I. AFROMAISON

The EU FP7-funded project AfroMaison aims to integrate the main components of natural resource management into a coherent and adaptive management process at meso-

scale (defined as that level (sub-national) to which power has shifted after decentralisation) in Africa.

http://www.afromaison.net/

Due to the relative youth of meso-scale authorities and institutions in Africa, their capacity for integrated natural resources management (INRM) often requires strengthening. From a natural resources perspective, the meso-scale corresponds to a landscape, ecosystems or a river (sub)basin. The challenge of AFROMAISON is to provide a holistic toolbox and operational framework for INRM that can be applied in a variety of environmental and socio-economic conditions in Africa. At the same time, following a participatory analysis of opportunities and challenges, AFROMAISON provides participatory management options for operational INRM, which are both embedded in local traditions and culture, and are scientifically sound.

To date the project has developed an operational framework to improve adaptive and integrated management of natural resources that is currently being tested in five case study areas in Africa: Tunisia, Mali, Ethiopia, Uganda and South Africa. The framework is a stepwise approach that assists the natural resource manager to analyse the context, identify issues, develop scenarios, identify options and integrate these into strategies. Subsequently the resulting integrated strategies are tested for acceptance and suitability.

A rapid assessment was undertaken in all case studies, using a variety of methods. Stakeholders have participated in a visioning exercise and the formulation of scenarios. A focal issue was defined for all case studies and conceptual maps were developed in order to understand, discuss and structure case study-specific problems. A comprehensive climate report was delivered for all case studies using the WATCH forcing data. A statistical regional climate model was applied to all cases and the dynamical regional climate models REMO and CCLM were applied for the Rwenzori, Fogera, and Drakensberg case studies. For the purpose of quantitative assessments of vulnerability, the eco-hydrological model SWIM is being set up in case studies to quantify the impacts of changes of land use management and climate change on water balance and crop production. A Spatial Data Infrastructure (SDI) has been put in place in order to provide a basis for geospatial data discovery, evaluation and application.

The main deliverables from the project will be guidelines for natural resource managers and facilitators explaining the stepwise process of context analysis, option assessment, strategy building and testing, as well as how this process can be customised to fit local circumstances, and a toolbox allowing the users to choose between a number of tools that best fits their needs. The process has to be flexible so that it can be applied in a wide range of differing contexts, and can be embedded in existing planning and management processes. At each step the natural resource manager or process facilitator is offered a number of tools that may assist him or her in achieving particular goals. Tools are presented with varying degrees of complexity, resource or capacity needs.

The guidelines and toolbox will be complemented with case studies, demonstrating how the framework can be customized and how different tools can be applied.

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MEETING REPORTS

I. HEALTHY FUTURES Stakeholder Workshop, Nairobi, Kenya, November 6th 2012

Researchers associated with HEALTHY FUTURES, in collaboration with the CGIAR program on Climate Change, Agriculture and Food Security (CCAFS), held a stakeholder workshop on 6th November 2012 at the International Livestock Research Institute (ILRI) campus in Nairobi, Kenya. The purpose of the workshop was to engage with regional experts from a range of disciplines and organisations with the specific aim of examining potential future scenarios of vector-borne diseases in eastern Africa. Participants at the workshop discussed future scenarios of socio-economic development in the region and their implications for the spread and control of malaria, schistosomiasis and Rift Valley fever. The outcomes of the workshop included the development of an inventory of interventions to tackle the target diseases and decisions on the next steps forward to ensure that vulnerability assessments and decision support systems are based upon high quality qualitative and quantitative information.

FORTHCOMING EVENTS

I. Environment and health in Africa (Climate and vector-borne diseases) Symposium March 29 2013

A symposium at the 4th Annual East African Community Health & Scientific Conference, *Serena Hotel, Kigali, Rwanda* March 27-29 2013 (www.rbc.gov.rw)

The 4th Annual Health & Scientific Conference in Kigali, Rwanda, in March 2013, targets eastern African health priorities and opportunities in a changing world. Spread over three days, the Conference programme comprises four sub-themes (Maternal and Child Health, Non Communicable Diseases and Trauma, Health Systems Quailty of Health Care) and four symposia (HIV and AIDS, Integrated disease surveillance and disaster preparedness, Environment and health in Africa, and Tobacco control).

The Environment and heath in Africa Symposium is being jointly coordinated by members of the **HEALTHY FUTURES** and **QWeCI** (http://www.liv.ac.uk/qweci) research projects and brings together researchers at the cutting edge of efforts to understand the relationships between health and environment, and in particular links between climate and vector-borne diseases, in Africa.

The Symposium organising committee has managed to secure WHO Africa support and is currently in the process of negotiating an agreement with the Bulletin of the WHO through which a selection of papers based on talks presented at the meeting could be packaged with a single, thematic issue of the Bulletin. The Symposium organising committee, which has recently drafted a programme for the one-day Symposium (see below), comprises representatives from both HEALTHY FUTURES and QWeCI:

Theophile Niyonzima (NUR)
David Taylor (NUS)
Andy Morse (Liverpool)
Colin Jones (SMHI)
Rachel Lowe (IC3)
Adrian Tompkins (ICTP)
Mark Booth (Durham)

Symposium Programme

Serena Hotel, Kigali, Rwanda March 29 2013
(Only the presenter's name is listed below)

08.00 - 08.45	**Registration**
08.45 - 09.00	**Welcome** QWeCI Coordinator: Andy Morse, University of Liverpool, and HEALTHY FUTURES Coordinator: David Taylor, National University of Singapore
09.00 - 09.30	**Plenary speech** Dr Magaran Bagayoko, Protection of Human Environment Programme, World Health Organization – Regional office for Africa, Brazzaville, Congo Republic
09.30 - 09.50	**Climate change and the discourse of environmental health in eastern Africa** David Taylor, Department of Geography, National University of Singapore, Singapore
09:50 - 10.10	**Community Perceptions of Health Risk Management in Changing Climate in Tanzania** Sheila Chemjor, Eastern Africa Regional International Federation of Red Cross and Red Crescent, Nairobi, Kenya
10.10 - 10:30	**Uses of seasonal forecasts in Africa for malaria prediction** Andy Morse, University of Liverpool, Liverpool, UK
10:30 - 11:00	**COFFEE**
11.00 - 11.20	**Rainfall and RVF emergence in Senegal: beyond twenty years of investigation, lessons learned and perspectives** Jacques Andre Ndione, Centre de Suivi Ecologique, Dakar, Senegal
11.20 - 11.40	**Mapping the distribution of potential Rift Valley Fever hotspots in East Africa** Bernard Bett, International Livestock Research Institute, Nairobi, Kenya
11:40 - 12.00	**Identification of Malaria Transmission Hotspots for Targeting Malaria Control in Kigali City** Jean Pierre Bizimana, National University of Rwanda, Butare, Rwanda
12.00 - 12.20	**Mapping the underlying causes of vector-borne diseases in East Africa** Stefan Kienberger, University of Salzburg, Salzburg, Austria
12.20 - 12.40	**Climatic and socioeconomic determinants of malaria in Rwanda and Uganda** Felipe de Jesús Colón-González, The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
12.40 - 14.00	**LUNCH**
14.00 - 14.20	**Geostatistical modelling and analysis of under five malaria risk in Malawi** James Chirombo, Malawi Ministry of Health, Lilongwe, Malawi
14.20 - 14.40	**A spatially-explicit simulation model for Rift Valley fever transmission** John Gachohi, International Livestock Research Institute, Nairobi, Kenya
14.40 - 15.00	**VECTRI - a new high resolution regional model for malaria that accounts for population density and surface hydrology** Adrian Tompkins, The Abdus Salam International Centre for Theoretical Physic, Trieste, Italy
15.00 - 15.20	**21st century projections of *Anopheles gambiae* sensu stricto population dynamics in Africa** Nils Hempelmann, Climate Service Centre, Hamburg, Germany

15.20 - 15.40	**EUPORIAS dynamical downscaling of global seasonal forecasts for East Africa** Grigory Nikulin, Swedish Meteorological and Hydrological Institute, Norrköping, Sweden
15.40 - 16.00	**Comparative Study of the Impact of Climate Variability on Prevalence of Urinary Schistosomiasis** Sammy Crowther Kofi Tay, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
16.00 - 16.20	**COFFEE**
16.20 - 16.40	**Providing regional climate change information for East Africa: CORDEX and HEALTHY FUTURES** Grigory Nikulin, Swedish Meteorological and Hydrological Institute, Norrköping, Sweden
16.40 - 17.00	**The prototype Malaria Early Warning System of ECMWF and ICTP (MEWS)** Francesca Di Giuseppe, European Centre for Medium-Range Weather Forecasts, Reading, UK
17.00 - 17.20	**Conclusion of the day and acknowledgments** Theophile Niyonzima, National University of Rwanda, HEALTHY FUTURES
18.00 - 20.00	**Reception (with posters)**

NEXT ISSUE OF THE NEWSLETTER

The next (fourth) issue of the HEALTHY FUTURES project newsletter is scheduled for release during June/July 2013. Please send contributions for the fourth issue to: David Taylor (david.taylor@nus.edu.sg) or Paul Lowen (paul@aquatt.ie). Please send your contributions as soon as possible, rather than waiting for the deadline for submissions to become imminent. As we are always keen to improve, please also send to Paul and David any suggestions as to how the newsletter might be improved in the future.