Training Courses on the Use of Climate Information for Public Health in Madagascar

Synthesis Report

The International Research Institute for Climate and Society

MINISTERE DES TRAVAUX PUBLICS ET DE LA METEOROLOGIE
MTPM

VPMSP

World Meteorological Organisation

World Health Organization

INSTITUT PASTEUR DE MADAGASCAR

IRI is a WHO/PAHO Collaborating Center for Climate Sensitive Diseases

Climate Information for Public Health in Madagascar, 2009-2010

Synthesis Report

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[1] *Lecturers and facilitators are listed by alphabetical order of last name, with affiliations current at the time of the training.*

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About the Public Health Initiative at the IRI

The International Research Institute for Climate and Society (IRI)/Earth Institute at Columbia University is a global research and capacity building institution focused on the use of climate information in public health, agriculture and water decision-making. IRI is a collaborating center with the Pan-American Health Organization - World Health Organization (PAHO-WHO) on climate-sensitive diseases and has active international partnerships for malaria, meningococcal meningitis, Rift Valley Fever and other diseases, as well as conditions associated with flood, drought and disasters.

The mission of the IRI is to enhance society's capability to understand, anticipate and manage the impacts of climate in order to improve human welfare and the environment, especially in developing countries. The IRI conducts this mission through strategic and applied research, education, capacity building, and by providing forecasts and information products with an emphasis on practical and verifiable utility and partnership.

In particular, the public health commitment of the IRI aims to promote awareness and understanding the linkages between climate and public health, in addition to developing a set of prototypes to address and communicate these linkages. This initiative involves developing, with partners, a knowledge system based on three main components: (i) Understanding the community of practice, identifying the needs, and collaborating with Ministries of Health to work at the local to regional levels; (ii) Developing tools to monitor, survey and predict disease epidemics based on climate data, patterns and trends; and (iii) Building capacity through the education and training of public health professionals on the relationship between climate and public health in order to better manage climate risk.

The IRI is committed to converting knowledge gained into training and education products which are then communicated to expand the basis for learning about climate risks and climate risk management, and introducing concepts into a decision-making process in different sectors. As an example of this, the Summer Institute course on Climate Information for Public Health (SI) grew out of the recognition of some gaps in the knowledge, methodologies, tools, data and resources available to the public health community in their quest to better manage climate-related risks to improving public health outcomes using climate information. To meet this need, the SI team started building curricula and learning networks that can be used, refined and delivered in different communities.

Contents

Acronyms

ACMAD	African Centre of Meteorological Application for Development
AFRO-WHO	World Health Organization Regional Office for Africa
CHWG	Climate and Health Working Group
CIESIN	Center for International Earth Science Information Network
CIPH	Climate Information for Public Health
CIPHA	Climate Information for Public Health Action, newsletter
CIPHAN	Climate Information for Public Health Action Network
CPT	Climate Predictability Tool
CRM	Climate Risk Management
DGM	Direction Génerale de la Météorologie, *Stands for:* General Directorate of Meteorology at the Ministry of Public Works and Meteorology
ENSO	El Niño-Southern Oscillation
GIS	Geographic Information System
GPS	Geographic Position System
IPCC	Intergovernmental Panel on Climate Change
IPM	Institut Pasteur de Madagascar *Stands for:* Pasteur Institute of Madagascar
INSPC	National Institute for Public and Community Health *Stands for:* Institut National de Santé Publique et Communautaire
IRI	International Research Institute for Climate and Society
IT	Information Technology
MEWS	Malaria Early Warning System
MoU	Memorandum of Understanding
MSPH	Mailman School of Public Health
NCAR	The National Center for Atmospheric Research
NOAA	National Oceanic and Atmospheric Administration
NGO	Non Governmental Organization
PAHO-WHO	Pan-American Health Organization – World Health Organization
Q&A	Questions and Answers
SI	Summer Institute on Climate Information for Public Health
VPMSP	Vice Primature de Madagascar pour la Santé Publique, *Stands for:* Vice-Primature of Madagascar for Public Health
WCC-3	World Climate Conference-3
WHO	World Health Organization
WMO	World Meteorological Organization

Executive Summary

The International Research Institute for Climate and Society (IRI), the Malagasy Climate and Health Working Group (CHWG) - established in 2008 between the General Directorate of Meteorology at the Ministry of Public Works and Meteorology (DGM) and the Vice-Primature of Madagascar for Public Health (VPMSP), the World Meteorological Organization (WMO) and the Malagasy office of the World Health Organization (WHO) partnered to design and implement two training courses on the use of climate information for public health in Madagascar. Conducted in October 2009 and March 2010, these courses were implemented and funded by Public Weather Services (PWS) Program of the WMO as part of its new Learning Through Doing (LTD) approach to the delivery of climate services. The importance of such type of initiative was underlined during the World Climate Conference-3 (WCC-3) held in Geneva in September 2009, where the Global Framework for Climate Services was established to "enhance climate observations and monitoring, transform that information into sector-specific products and applications, and disseminate those products widely," said the President of the WMO, Alexander Bedritsky[2].

Through a multi-institution partnership, the two courses of one week each were designed as a comprehensive experience that provided their participants with a better understanding of the relationship between public health and climate, and of the importance and complexity of using climate information in public health decision-making, as well as new skills to help apply this knowledge.

The curriculum of these courses were based on the Summer Institute on Climate Information for Public Health organized each year by the IRI and partners from Columbia University but the courses were delivered in the local language and the materials were tailored to the local needs, using national disease surveillance data and examples relevant to the areas of work of the participants.

In total, 17 professionals from the climate and public health communities participated in the Malagasy courses on CIPH. They were all members of the CHWG of Madagascar and demonstrated impressive involvement during the courses as well as very clear vision of the short and long-term opportunities which may arise from such trainings. Six of these participants (35%) were working on climate variability, weather forecast and hydrology at the DGM. Ten (65%) had activities related to climate-sensitive disease surveillance and control, environmental health, crises and disasters management, and communication. One participant to the first

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[2] *Adapted from WMO Press Release n°86. Available from: http://www.wmo.int/pages/mediacentre/press_releases/pr_861_en.html*

workshop had expertise on veterinarian health. The participants to the courses were all professionals who played a key role at the national level in decision-making (15/17), research (1) and communication (1).

The Learning Through Doing initiative implemented in Madagascar offered new or deeper opportunities for multidisciplinary research and collaboration between climate experts and public health professionals. Further, the courses contributed to capacity building efforts through strengthening the technical capacity of the individuals and organizations involved in this initiative to identify their data needs, and improving the collection, analysis, and use of data to inform health-related decision-making. For instance, these courses triggered the implementation of a quarterly Climate and Health Bulletin, the development of new operational climate products as well as outreach and partnership development activities.

The training courses also provided an empowering environment in which members of the public health and climate communities could exchange ideas and form collaborations for forthcoming projects based on the use of climate information for public health, which resulted in the design of the CHWG Work Plan for 2010 and beyond. This "road map" aims to build the capacity of the CHWG within the frame of the Declaration of Libreville and to further the ability of its members and their peers to use targeted climate information to improve the surveillance and control of malaria, plague and RVF in Madagascar, using new channels and tools for communication and information sharing between the public health and climate communities in the country.

The structure of the full program, with an interim period between the two courses, enabled the participants to further define their expectations and to gather additional data, in addition to developing group pilot projects that paved the way for further studies. These projects offered to the members of the Malagasy CHWG the opportunity to apply their newly acquired skills and paved the way for enhanced surveillance and control of the three main climate-sensitive diseases of public health significance in Madagascar: malaria, plague and Rift Valley Fever.

In conclusion, the Training Courses on Climate Information for Public Health implemented through the Learning Through Doing Project were overall very successful initiatives which brought together high-level participants of various profiles from the Malagasy Climate and Health Working Group. It is hoped that these efforts will benefit the planning and implementation of climate-sensitive disease prevention and control programs in Madagascar. It is hoped as well that participants in these courses will be able to contribute to a network of trainers, delivering training courses for their peers in the country, in particular at the more peripheral level.

The Development of Training Courses on Climate Information for Public Health in Madagascar

History and Rationale

Training Courses on Climate Information for Public Health for Capacity Building

Public health professionals, field epidemiologists, health management workers and health policymakers are increasingly concerned about the potential impact that climate can have on public health. Climate not only determines the spatial and temporal distribution of many public health events, such as infectious diseases, but also is a key determinant of inter-annual variability in disease incidence, including epidemics and medium-term trends. However, many public health professionals are not yet aware of the ways in which climate information can help them manage the impacts of climate on their disease surveillance and control activities, as well as program implementation and evaluation.

Protecting public health from the vagaries of climate requires new working relationships between the public health sector and the providers of climate data and information. It also demands a wide variety of strategies and must occur in every location. One of these strategies is to increase the public health community's capacity to understand, use, and demand the appropriate climate information is of primary importance to efforts to mitigate the public health impacts of climate.

In order to fill the gaps existing in climate and public health knowledge and practice, the International Research Institute for Climate and Society (IRI) developed in partnership with the Center for International Earth Science Information Network (CIESIN) and the Mailman School of Public Health (MSPH), also from Columbia University, a Summer Institute on Climate Information for Public Health (SI) that offers, since 2008, public health decision makers and their partners the opportunity to learn practical methods for integrating climate knowledge into decision-making processes through expert lectures, focused discussions and practical exercises, based on real demonstrations and applications.

The Learning Through Doing Pilot Project and the Creation of a Climate and Health Working Group in Madagascar

In October 2008, a Climate and Health Working Group (CHWG) was created in Madagascar thanks to the Public Weather Services (PWS) approach to service delivery and capacity building: Learning Through Doing (LTD).

The CHWG is a functional entity that involves the Vice-Primature of Madagascar for Public Health (VPMSP), which is equivalent to the Ministry of Health, and the General Directorate of Meteorology at the Ministry of Public Works and Meteorology (DGM), which is the national meteorological office. Formalized by an agreement between the two governmental agencies and relying on specific terms of reference, the group creates a framework to reinforce and further collaboration between the climate and public health communities in Madagascar. As described in this report, the group also organizes and conducts trainings on issues at the nexus of climate and public health.

The LTD initiative supports National Meteorological Services to implement new approaches to services delivery, which, thanks to enhanced communication and collaboration with the end users, are targeted to their needs. With an initial length of two years in Madagascar, this initiative aims to support the DGM, which is the provider of the climate/weather information, and the VPMSP, which is the end user of this information, developing products to improve the surveillance and control of the three main climate-sensitive diseases of public health significance in Madagascar: malaria, plague and Rift Valley fever (RVF). The importance of such type of initiative was underlined during the World Climate Conference-3 (WCC-3) held in Geneva in September 2009, where the Global Framework for Climate Services was established to "enhance climate observations and monitoring, transform that information into sector-specific products and applications, and disseminate those products widely," said the President of the WMO, Alexander Bedritsky [3].

Following the creation of the CHWG, the WMO financed the head of the malaria surveillance and control unit at VPMSP, member of the Malagasy CHWG, to attend the 2009 Summer Institute on Climate Information for Public Health in NY, USA. This initial training experience was scaled-up by the implementation in October 2009 and March 2010 of the two courses described in this document, also financed by the WMO, to train the remaining members of the CHWG.

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[3] *Adapted from WMO Press Release n°86. Available from: http://www.wmo.int/pages/mediacentre/press_releases/pr_861_en.html*

Partnership Framework with the IRI

The IRI signed Memorandums of Understanding (MoUs) with the VPMSP and the DGM to help enable cooperative efforts between IRI and these institutions in areas connecting climate and public health. These agreements set the frame for collaboration and data protection for the two training courses on climate information for public health, and may be used as a support for potential future partnerships.

Left to Right: Nimbol Raelinera, Director General of DGM and Dr Philemon Bernard Tafangy, Director of VPMSP sign the MoU with the IRI

The MoUs were officially signed on the World Meteorological Day (March 23, 2010) by the Directors General of DGM and VPMSP. There was important press coverage and the event was covered in the news on national TV, radio and written press. The WHO and the IPM were also represented during this ceremony.

Targeted Audience and Goals

Targeted Audience

The training courses implemented under the umbrella of the WMO "Learning Through Doing Project" were primarily targeted at the members of the CHWG of Madagascar, who were all public health field epidemiologists, practitioners or researchers, or professionals working in the climate or meteorological sector. This cross-disciplinary aspect was key to foster mutual understanding of the climate and public health communities around a common set of practices.

The participants at the training courses were expected to be professionals who play a key role in public health decision-making related to the surveillance, prevention and control of climate-sensitive diseases. In particular, the participants at the CIPH training courses should demonstrate the following:

- Understanding of the central issues related to climate and public health

- Vision and strategy for applying CIPH concepts in significant public health program(s) or operational research project(s)

- Strategic opportunity for engagement with key partner organization(s)

- Potential for near and long-term impact and partnership in CIPH, including within the Malagasy CHWG and as well as with CHWGs developed elsewhere

- Willingness to train and mentor their peers and partners in the understanding and use of climate information for enhanced public health decision-making, and to further develop their expertise in Climate and Health within the growing Climate and Health Community and the network of CIPH alumni.

Goals

The training courses on the use of climate information for public health in Madagascar were designed to help the members of the CHWG (i) enhance their knowledge of climate-sensitive diseases and climatic threats to public health, and (ii) foster the use of climate information in the management of climate-sensitive diseases. Through a wide range of activities, participants in the "Learning Through Doing" Project gained skills to:

- Understand the fundamental concepts of climate and public health;

- Analyze the relationship between climate and public health data in space and time using basic statistics;

Leon Guy Razafindrakoto expresses his vision during a group discussion, first Malagasy CIPH course

- Use new tools for accessing, analyzing and mapping climate and epidemiological data;

- Synthesize and apply the course material to the participants' own area of interest;

- Identify the benefits that may arise from enhanced climate and public health collaboration in Madagascar; and

- Identify the means and needs to achieve this cross-discipline cooperation locally and with partner institutions.

In particular, some sessions of the training aimed to lead the CHWG towards scientific and financial autonomy, in addition to designing the CHWG work plan for 2010 and beyond.

Welcome Message

This welcoming address was delivered on behalf of Haleh Kootval, Chief of the Public Weather Services (PWS) Division at the World Meteorological Organization (WHO) by IRI Laurence Cibrelus.

"Honorable guests, Ladies and Gentlemen,

I am very pleased to communicate to you a few words of gratitude and commendation during this occasion of the opening of the Second National Training Workshop of the "Learning Through Doing" (LTD) Project that is focusing on Cross-Training on the Use of Meteorological, Climate and Health Data for the staff of Madagascar Meteorological Service and of the Ministry of Health and Family Planning". It is particularly pleasing to note that this Workshop coincides with the World Meteorological Day, whose theme is "60 years of service for your safety and well-being" – A very fitting theme for this occasion.

I am very pleased to note that in the relatively short time that has passed since October 2008 when the Protocol of Partnership between the Madagascar Meteorological Service and of the Ministry of Health and Family Planning was signed, a lot of work has been done and several milestones have been reached in the implementation of the LTD Pilot Project of Madagascar. I would therefore, like to thank the Ministers responsible for these two institutions and all the colleagues for collaborating, in an exemplary way, to implement the project. I would also like to commend the Working Group on Weather, Climate and Health for their diligence and hard work which has resulted in the completion of various activities including the organization of the first and the second training workshops. Likewise, I would like to thank the World Health Organization (WHO) Madagascar, the International Research Institute for Climate and Society (IRI) and the Institute Pasteur de Madagascar for their support, especially in training activities, which we appreciate very much.

You might be aware that the LTD Pilot Project of Madagascar was established within the framework of the "Learning Through Doing" initiative of the Public Weather Services Program of the WMO. The objective was to enhance the capability of Madagascar Meteorological Service to respond to the needs of the health sector in the area of three most important diseases in Madagascar namely Malaria, Rift Valley Fever and Plague. The eradication of major diseases such as Malaria and other endemic epidemic diseases is contained in the fifth commitment of Madagascar Action Plan that aims at ensuring that Malagasy people are healthy and can contribute productively to the development of the country, and lead long and fruitful lives. For the case of Malaria, it is worth noting that the strategy aimed at 100% coverage for Malaria prevention through the implementation of all available

services for effective control. In specific terms the strategy aimed at reducing Malaria infection from over 1.2 million people in 2005 to about 320,000 in 2012. The Pilot Project is, therefore, very important as it is designed to contribute significantly to this fight against Malaria, as well as against Rift Valley Fever and Plague which, for centuries, have caused discomfort and loss of life to the Malagasy people.

Ladies and Gentlemen,

The "Learning Through Doing" initiative was conceptualized following the WMO International Conference on Secure and Sustainable Living, which was held in Madrid, Spain in March 2007. The Conference had endorsed the Madrid Action Plan, which contained the recommendation to achieve, within five years, a major enhancement of the value of weather, climate and water services to society. That was the recommendation which inspired the "Learning Through Doing" concept. The concept was in turn endorsed by the WMO Executive Council. It was also embraced by the WMO Forum on Social and Economic Applications and Benefits of Weather, Climate, and Water Services, which is guiding its implementation.

The idea behind the "Learning Through Doing" concept is to assist NMHSs to develop and deliver an improved range of products and services which would enhance the social and economic benefits to society. I am very pleased to note that Madagascar is achieving this aim and is serving as an example to be duplicated in other countries in Africa and beyond. I would therefore encourage you to continue implementing the project with the same vigor and dedication that you have demonstrated so far, for the benefit of Malagasy people. I, on the other hand, pledge to ensure that, as much as possible, WMO accords the LTD Project of Madagascar, the support that it may require in future.

I wish you every success in this Workshop."

The training courses were honored as well by opening messages from the Director General of the DGM, Nimbol Raelinera, the Director of the VPMSP, Dr Philemon Bernard Tafangy, the interim Director of the Pasteur Institute of Madagascar Lomboahangy Andrianaja Ravaoalimalala, as well as the Meteorological and Health Coordinators of the CHWG of Madagascar, Nirivololona Raholijao and Yolande Nirina Raoelina.

Profile and Expectations of the Course Participants

Profile of the Participants

Left to Right: Yolande Nirina Raoelina, and Nirivololona Raholijao, public health and climate coordinators of the CHWG

In total, 17 professionals from the climate and public health communities participated to the Malagasy courses on CIPH. All of them were members of the CHWG of Madagascar, including the two CHWG coordinators from DGM and VPMSP, as well the focal points for the three major climate-sensitive diseases in Madagascar (Malaria, Rift Valley Fever (RVF) and Plague) and the main organizer from the Pasteur Institute of Madagascar (IPM).

Left to Right: Fanjasoa Rakotomanana from IPM, Huguette Ramiakajato, focal point for plague, SI09 Alumna Marie Clémence Rakoarivony, focal point for malaria, and Madeleine Razafindramavo Lalao, focal point for RVF.

Six of these participants (35%) were working on climate variability, weather forecast and hydrology at the DGM. Ten (65%) had activities related to climate-sensitive disease surveillance and control, environmental health, crises and disasters management, and communication, either at VPMSP (9/10) or IPM (1/10). One participant to the first workshop had expertise on veterinarian health and was working on RVF and plague surveillance.

The participants to the courses were all professionals who played a key role in decision-making (15/17), research (1) and communication (1). They were all working at the national level.

Additionally, three persons audited the training: one PhD student working on arboviroses and climate using GIS, and two public health physicians from the public health research, development and training branch of the University of Antananarivo (INSPC). The INSPC is currently considered as a new potential member of the Malagasy CHWG.

Expectations of the Participants

The expectations of the participants were captured by the coordinators of the CHWG of Madagascar and the main organizers of the course during the preparation phase of the first CIPH training course, and reflected in the development of the course curriculum. These expectations were further gathered on the first day of the training, and as the course progressed, should new elements come through.

Participants to the First Malagasy course on Climate Information for Public Health, October 2009

Prior to engaging on the training courses, the participants were hoping the following:

1. Increase their knowledge and skills in the use of climate information for public health

Through the use of data and instances relevant to Madagascar, the courses would enable the members of the CHWG of Madagascar to understand (i) how climate and weather can drive the epidemiology of the three main climate-sensitive diseases of public health significance in Madagascar: malaria, RVF and plague, and (ii) how climate and weather information may be used to improve the surveillance and control strategies for these diseases, in particular thanks to Geographic Information System (GIS)-based applications.

2. Identify the baseline expectations, needs and capacities of the climate and public health communities

After the completion of the courses each community, whether public health or climate, should be able to identify and understand the needs and capacities of the other, through a constructive interaction The participants to the courses also deemed very important to set up and define a baseline for their climate and public health activities, which would rely on relevant information, gathered and made available in an intelligible way to the rest of the community. This may include, but not be limited to:

(i) Document the availability of climate data from existing meteorological stations,

(ii) Assess where the location of the public health sentinel surveillance[4] sites for acute fever and the meteorological stations match. This would enable to collect and analyze public health and climate data that would be consistent in space and time, and

(iii) Produce updated maps of the epidemiology of malaria, plague and other climate-sensitive diseases, as well as maps of their associated relevant climate patterns, potentially the IRI Data Library.

3. Develop new channels and tools for communication and information sharing between the public health and climate communities

The participants were hoping that the courses serve as a trigger towards developing new methods for communicating and sharing information in a standard and regular way.

The members of the CHWG were hoping in particular to develop a common and comprehensive database that would support the cross-discipline activities of the group. To serve this purpose, the database should rely on three types of geo-referenced data: epidemiological, animal health and climatic.

Participants also expected to be able to develop operational climate products for informing public health decision-making and risk assessment, based for instance on the short to long term climate forecast produced by the DGM.

4. Develop sustained climate and public health activities and projects to improve the public health outcomes of Madagascar

Subsequent to the previous element, the climate and public health communities of the CHWG seek to develop joint projects and programs and to develop joint operational products, which would build on and sustain the interaction, skills and knowledge gained during the courses. Participants were hoping in particular to define together the activities of the CHWG, in terms of research and program, and to set the frame to evaluate these activities. The courses were also expected to provide the participants with the knowledge that would allow them to indentify the expertise(s) and/or partnership(s) that may enrich the capacity of the CHWG (e.g., entomologist, mammalogist).

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[4] *Sentinel surveillance is the collection and analysis of data by designated infrastructures selected based on their geographic location and ability to accurately diagnose cases and report data of good quality. Adapted from USAID.*

Course Overview

Development of the Curriculum

The curriculum for the training courses on the use of climate information for public health in Madagascar was based on the curricula of the Summer Institutes on Climate Information (SI) implemented since 2008 by the IRI, CEISIN and the Mailman School of Public Health, at Columbia University. However the course was carefully tailored to the needs, capacities, and data of Madagascar, as well as to the local language.

The signatories of the MoUs with the IRI and the participants to the second Malagasy course on Climate Information for Public Health, March 2010

This effort, which was the first attempt to transfer SI materials to an in-country training, was conducted jointly by the IRI and the CHWG as a multi-organization partnership. It built on the experience of a member of the CHWG of Madagascar who had been trained during the 2009 SI in NY.

The IRI developed part of the material and was involved in the design of the course schedule and the facilitation of the training. The CHWG of Madagascar also developed part of the material and was involved in the design of the course schedule and the facilitation of the training, in addition to being responsible for the logistics, organization and chair of the courses. The PWS Program of the WMO envisioned such training courses and the resulting climate and public health activities, in addition to providing full financial support for the courses and the CHWG activities. The WHO Office of Madagascar provided an active facilitating support during the training.

The full training program "Learning Through Doing Project: Cross-Training Workshop for the National Meteorological and Hydrological Service and Ministry of Health Staff in the Use of Meteorological, Climate and Health Data" was delivered in three parts. The first one-week course, delivered in October 2009, was followed by a second one-week course in March 2010 to deepen the skills and knowledge of the participants to the first course (totaling 80 hours of training). The intermission between the two courses allowed the trainees to assimilate the information they received, in addition to developing small CIPH group projects that guided the development of the second part of the training and enabled the courses' participants to explore their own ideas and reflect on the course lectures, seminars, exercises

and discussions they were involved in. The second training began with detailed oral presentations of the three small pilot projects conducted during the course intermission, giving the members of the CHWG of Madagascar the opportunity to share the learning experience with co-participants and facilitators.

As a result of this progressive appropriation by the members of the CHWG of the CIPH concepts, combined with their growing capacity, the IRI developed 65% of the material for the first training and 40% of the second one – with the CHWG being responsible for initially 35% and then 60% of the materials.

A Support to the Courses: The IRI Data Library

The IRI Data Library was used in support to the two CIPH training courses conducted in Madagascar. It is a powerful open-source computational engine that offers, at no cost to the user, the opportunity to:

- Access and manipulate over 400 datasets from a variety of climate-related topics, including public health;

- Analyze climate and public health data;

- Monitor present climate conditions with maps and analyses;

- Create multi-dimensional visual representations of climate and public health data, including animations;

- Customize and download plots and maps in a variety of image and data formats, including compatible with R, GIS or other software for data visualization.

The Data Library overcomes the limitations imposed by GIS platforms by being based on a much more general multi-dimensional data model. It also forms the basis for the IRI Map Room, which offers a collection of maps and analyses used to monitor current global and regional climate, as well as historical data. From the maps, it is possible to access and download the publicly available datasets being viewed, including station, atmospheric and oceanic observations and analyses, model-based analyses and forecasts, as well as land surface and vegetation information. In particular, the Health Map Room provides analyses that explore and inform users about the relationship between climate and health.

These operators can be applied to real-time datasets, creating results that are also updated in near-real time meaning that researchers and practitioners can follow environmental and climatic changes as they occur and analyze them against locally evolving health events. This infrastructure simplifies the process of analyzing spatial-temporal datasets greatly.

For more information on the IRI Data Library, see:
>>http://iridl.ldeo.columbia.edu/

Climate and Public Health Competencies

The CIPH courses implemented in Madagascar enabled the members of the CHWG to understand the distinctiveness of this field, for instance regarding the importance of spatial and temporal variations in climate for infectious diseases transmission, as well as the exciting opportunities and challenges inherent to working at the intersection of climate and public health, in an interdisciplinary context.

By the end of the courses, the participants had gained an understanding of the basic frameworks for public health analyses, the factors that drive the climate system and the range of methods used to capture public health and climate information.

Members of the CHWG of Madagascar were also able to appropriately analyze this information in order to recognize the relationship existing between climate patterns and climate-sensitive diseases such as malaria, plague and RVF, and the resulting opportunities for enhanced public health decision-making, planning and intervention in the country.

Additionally, the participants at the "Learning Through Doing" Project gained new computer and information technology skills, in particular through the IRI Data Library, that enabled them accounting for the specificity of spatial and temporal analysis and properly applying climate information to public health activities.

Moreover, considerable efforts are required to build a sustained community of collaboration and practice in the area of public health and climate. As a result, the CIPH training courses implemented in Madagascar emphasized the need as well as some ways to develop continued mechanisms and platforms to collaborate, provide feedback, mentor and train their peers on the growing field of CIPH.

To demonstrate their newly acquired knowledge and ability to conduct CIPH activities, participants from both the public health and climate communities conducted three pilot projects, looking at the relationship between climate and the three main climate-sensitive diseases of public health importance in Madagascar: malaria, plague and RVF. The projects aimed to conduct preliminary analysis of climate and public health data and to identify the main climate patterns relevant to each of the climate-sensitive disease selected for these projects.

"The surveillance and control of the three most important climate-sensitive diseases in Madagascar will be really improved by our new ability to understand and use climate and public health data together"

CIPH Alum from Madagascar

Completion of the Courses

Typical day
Daily summary of the previous day by a rapporteur participant (15min)
Lecture and/or exercise using the IRI Data Library
Open group discussion, incl. Q&A Additional presentation by a participant
Lunch break
Lecture and/or exercise using the IRI Data Library
Open group discussion, incl. Q&A Additional presentation by a participant
Designation of the chair and the rapporteur for the next day (among participants)

A typical day of the Madagascar CIPH training courses

The CIPH training courses comprised five components:

1. Core lectures given by facilitators and courses' participants,
2. Practical sessions, such as hands-on exercises and applications,
3. Group discussions and Questions and Answers (Q&A) sessions
4. Daily summary of key messages by a participant, and
5. Participants' project presentations

These main elements were arranged as detailed in the table on the left. Each day, a participant was chairing the sessions and another one was rapporteuring.

Group discussions and other interactive activities played a key role during these training courses. In addition to demonstrating the impressive commitment and experience of the members of the CHWG, they enabled to explore ways for the CHWG to gain scientific and financial autonomy and to strategize the work plan for the CHWG in terms of activities, partners and funding opportunities. These sessions addressed, for instance, the methods and tips to write successful proposals and provided the participants with a call for proposals that fitted the activities of the CHWG related to malaria.

Nivoarimanana Andrimampianina summarizes the previous day of training

Agenda of the Courses

The CIPH trainings were conducted on 5-9 October 2009 and 22-26 March 2010. Their schedules are detailed in the tables below.

Table: Schedule of the first training course, October 5-9, 2009

	Monday October 5	Tuesday October 6	Wednesday October 7	Thursday October 8	Friday October 9
Morning Session 9:00am-12:30pm	**9:00-9:30am** Welcome *The Organization Committee* **9:30-9:45am** Official Opening *Nimbol Raelinera* **9:45-10:00am** Presentation of the Course Agenda, Goals and Participants *Marie-Clémence Rakoarivony*	**8:00-8:30am** Summary of the Previous Day by a Participant, followed by Open Discussion Selection of the Rapporteur for the Following Day **8:30-10:00am** Introduction to Remote Sensing *Laurence Cibrelus*	**8:00-8:30am** Summary of the Previous Day by a Participant, followed by Open Discussion Selection of the Rapporteur for the Following Day **9:30-10:15am** Exercises using the Map Rooms, Part II *Remi Cousin*	**8:00-8:30am** Summary of the Previous Day by a Participant, followed by Open Discussion Selection of the Rapporteur for the Following Day **8:30-10:30am** Climate Variability, Climate Change and Climate Data *Nirivololona Raholijao*	**8:00-8:30am** Summary of the Previous Day by a Participant, followed by Open Discussion Selection of the Rapporteur for the Following Day **8:30-10:30am** Epidemiology of Plague in Madagascar and Research Opportunities on Climate and Plague *Huguette Ramiakajato* *Fanja Rakotomanana*
	Coffee Break				
	10:15-10:45am Collection of the Participants' Expectations *Marie-Cl. Rakoarivony* **10:45-11:00am** Overview of the Climate and Health Project in Madagascar *Yolande Raoelina* **11:00-11:45am** Climate and Vector-borne Diseases *Marie-Cl.Rakoarivony* **11:45-12:30pm** Group Discussion	**10:30-11:45am** Malaria Mapping *Marie-Clémence Rakoarivony* **11:45-12:00pm** Overview of the Declaration of Libreville and of its Implementation in Madagascar *Luciano Tuseo* *Norohasina Rakotoarison* **12:00-12:30pm** Group Discussion	**10:30-12:00pm** Principles of Cluster Analysis *Remi Cousin* **12:00-12:30pm** Group Discussion	**10:30-12:00pm** Principles of Time Series Analysis, Part I *Remi Cousin* **12:00-12:30pm** Group Discussion	**10:30-12:00pm** Climate Suitability Mapping for Plague Transmission *Remi Cousin* **12:00-12:30pm** Group Discussion
	Lunch Break 12:30-2:00pm				
Afternoon Session 2:00-5:00pm	**2pm-3:15pm** Introduction to the IRI, the Data Library and Map Rooms *Remi Cousin* **3:15-4:00pm** Guintran Report *Luciano Tuseo* **4:00-4:30pm** Group Discussion **4:30-5:00pm** Daily Course Evaluation	**2:00-4:00pm** Exercises using the Map Rooms, Part I *Remi Cousin* **4:00-4:30pm** Group Discussion **4:30-5:00pm** Daily Course Evaluation	**2:00-4:00pm** Exercises on Cluster Analysis *Remi Cousin* **4:00-4:30pm** Group Discussion **4:30-5:00pm** Daily Course Evaluation	**2:00-4:00pm** Principles of Time Series Analysis, Part II *Remi Cousin* **4:00-4:30pm** Group Discussion **4:30-5:00pm** Daily Course Evaluation	**2:00-4:00pm** Group Discussion: Planning for the Next Training Course Developing Small Climate and Health Projects and Work Plan for the CHWG **4:00-4:30pm** Daily Course Evaluation **4:30-5:00pm** Official Closure

Table: Schedule of the second training course, March 22-26, 2010

	Monday March 22	Tuesday March 23 *World Meteorological Day*	Wednesday March 24	Thursday March 25	Friday March 26
Morning Session 9:00am-12:30pm Including a 15 min Coffee Break	**8:00-8:30am** Registration **8:30-9:00am** Pre Course Evaluation	**8:30-9:30am** Summary of the Previous Day by a Participant, followed by Open Discussion Selection of the Rapporteur for the Following Day	**8:00-8:30am** Summary of the Previous Day by a Participant, followed by Open Discussion Selection of the Rapporteur for the Following Day	**8:00-8:30am** Summary of the Previous Day by a Participant, followed by Open Discussion Selection of the Rapporteur for the Following Day	**8:00-8:30am** Summary of the Previous Day by a Participant, followed by Open Discussion Selection of the Rapporteur for the Following Day
	9:00-11:45am The Madagascar Climate and Health Small Project on Plague	**9:30-11:45am** The Madagascar Climate and Health Small Project on Rift Valley Fever (RVF)	**9:30-12:30pm** Exercises on Uploading and Downloading Data to the Data Library *Remi Cousin*	**8:30-10:30am** Exercises on Correlation using Data from Colombia *Remi Cousin*	**8:30-9:00am** Implementation of the Declaration of Libreville in Madagascar *Norohasina Rakotoarison*
	11:45-12:30pm Group Discussion	**11:45-1:00pm** Visit of the new Malaria Surveillance and Control Center	**12:00-12:30pm** Group Discussion	**10:45-12:30pm** Exercises on Correlation using Data from Madagascar *Remi Cousin*	**9:00-10:30am** Writing Climate and Health Proposals Opportunities for the CHWG of Madagascar *Luciano Tuseo* *Laurence Cibrelus* **10:30-12:30pm** Group Discussion: Review and Development of the CHWG Work Plan: Projects, partnerships, Funding and local trainings, Part I
Lunch Break 12:30-2:00pm					
Afternoon Session 2:00-5:00pm	**2:00-4:00pm** The Madagascar Climate and Health Small Project on Malaria	**2:00-3:00pm** Introduction to the CIPHAN Network and Platform *Laurence Cibrelus*	**2:00-3:00pm** Data Constraints and Limitations *Remi Cousin*	**2:00-2:30pm** Group Discussion: Limitations and Advantages of the Datasets from Colombia and Madagascar	**2:00-4:00pm** Group Discussion: Review and Development of the CHWG Work Plan: Projects, partnerships, Funding and local trainings, Part II
		3:00-4:30pm Official Signature of the MoUs between the IRI and the DGM and between the IRI and the VPMSP, followed by a Reception	**3:00-4:00pm** Correlation Analysis *Laurence Cibrelus*	**2:30-3:30pm** Group Discussion: Identification of the Main Climate Patterns Relevant to Malaria, Plague and RVF **3:00-4:00pm** The quarterly Health and Climate Bulletin by VPMSP and DGM *Sabas Rabesahala*	**4:00-4:30pm** Graduation Ceremony Official Closure *Nimbol Raelinera*
	4:00-5:00pm Group Discussion		**4:00-5:00pm** Group Discussion	**4:00-5:00pm** Current and Future Meteorological Operational Products for Public Health: How, With Which Partners and Funds? *Nirivololona Raholijao* *Voahangy Ramiandrisoa* *Luc Randriamarolaza*	**4:30-5:00pm** Overall Course Evaluation

Objectives and Summary of the Sessions

In the following chapter, "instructional guide" refers to the broad statement of intent of a formal instructional plan that describes learning outcomes, and "learning objectives" to a specific statement of what a learner will be able to accomplish on completion of a lesson or instruction activity.

The summaries of the group discussions and of the projects and activities conducted by the CHWG are captured in the chapter of this document related to the outcomes of the training courses and are therefore not provided in this section.

First Training Course

Presentation of the Course Agenda, Goals and Participants
Marie-Clémence Rakoarivony, VPMSP

Instructional Goal:
Provide an overview of the Madagascar training course on Climate Information for Public Health

Learning Objectives:
Ensure that all participants have an understanding of the overall objectives of the courses and their expected outcomes

Introduce the methodology and evaluation aspects of the courses

Summary:
The Madagascar training courses on climate information for public health are implemented to engage professionals who play a key role in the operational decision-making for climate-sensitive diseases in identifying and evaluating appropriate use of climate information through cross-discipline training. As a collaborative effort involving the IRI, the VPMSP, the DGM, the WMO and the WHO, they follow the creation in 2008, thanks to the WMO, of a Malagasy CHWG that aimed to strengthen activities and partnerships related to climate and public health in Madagascar. They also build on the curriculum of the Summer Institute on Climate information for Public Health developed by the IRI and partners and the training in the 2009 Summer Institute of one of the members of the Malagasy CHWG. These courses their participants the opportunity to learn practical methods and tools for integrating climate knowledge into decision-making processes. The courses are designed to address basic concepts of climate and public health, methods and tools to analyze climate and public health data and their applications in public health.

Recommended reading:
Cibrelus L, Mantilla G. Executive Summary. In: Summary of the Climate Information for Public Health Training Course. Palisades, NY: International Research Institute for Climate and Society at the Earth Institute, Columbia University; 2009. p. 1-5. Available from:
>>http://iri.columbia.edu/publications/id=0909

Overview of the Climate and Health Project in Madagascar
Yolande Raoelina, VPMSP

Instructional Goal:
Ensure all participants and facilitators of the training are familiar with the Climate and Health Project in Madagascar

Learning Objectives:
Describe the rationale and achievements to date of the Climate and Health Project in Madagascar

Detail the strengths and weaknesses of this project

Summary:
The Malagasy Climate and Health project arose through the WMO "Learning Through Doing" Initiative that promotes cross training and multidisciplinary activities aiming to: (i) strengthen the use of climate information for public health, and (ii) enhance the surveillance and control of climate-sensitive diseases in Madagascar. This lecture describes the key milestones of the implementation of the Malagasy Climate and Health Project, its achievements so far as well as potential room for improvement.

Climate and Vector-borne Diseases
Marie-Clémence Rakoarivony, VPMSP

Adapted from:
Climate and Vector-Borne Diseases Dynamics, by Madeleine Thomson, IRI

Instructional Goal:
Introduce the basic concepts of the dynamics of transmission of vector-borne diseases and their relationship with climatic factors in Madagascar

Learning Objectives:
Understand the means by which climate impacts on vector abundance, species distribution, physiology, synchrony and relationships with hosts and the transmission dynamics of vector-borne diseases

Understand how the climate information can be utilized in the spatial and temporal mapping of vectors and vector-borne diseases

Summary:
Vector-borne diseases present serious problems to human health and welfare around the world, especially in tropical and subtropical regions. According to recent reports of the World Health Organization nearly half of the world's human population is affected by vector-borne diseases; with malaria, schistosomiasis, onchocerciasis and leishmaniasis infecting 270, 200, 90, 18 and 12 million people, respectively. The role of climate in the transmission dynamics of vector-borne diseases in the context of replication of disease agents in their vectors and breeding, survival, distribution, abundance and longevity of vectors will be discussed. Due attention will also be given to the impact of climate change on the pattern of disease transmission and the geographical distribution of some diseases.

Recommended reading:
Gage KL, Burkot TR, Eisen RJ, Hayes EB. Climate and vector borne diseases. American journal of preventive medicine 2008;35(5):436-450.

Introduction to the IRI, the Data Library and Map Rooms
Remi Cousin, IRI

Adapted from:
Climate Risk Management and Development, by Walter E. Baethgen, IRI, and Overview of the Data Library, by Michael Bell, IRI

Instructional Goal:
Introduce the IRI Data Library and gain an understanding of its contents, structure, and capabilities, and applications as a useful tool for analyzing climate and health data.

Learning Objectives:
Introduce the IRI and to describe its evolution throughout its first 15 years of existence

Become familiar with the organization of the Data Library and its data sets

Learn how to perform simple arithmetic analyses in the Data Library, to create customized maps and graphs and to download data and images

Learn how the Data Library is related to the IRI Map Rooms

Summary:
The IRI Data Library is a powerful online resource for accessing, analyzing, visualizing, and downloading climate-related data sets. It is capable of relating different types of data sets (e.g. gridded data, station data, geographic shapes) in a common data model such that relationships between gridded climate data and health data collected by geographic region, for example, can be analyzed. Specialized map and analysis tools in the IRI Map Rooms have been developed using Data Library functionality to meet specific needs in the health community and other sectors. This session provides an introduction to the IRI Data Library.

Recommended reading:
The IRI Data Library: A Tutorial. Available from:
>>http://iridl.ldeo.columbia.edu/dochelp/Tutorial/

Guintran Report
Luciano Tuseo, WHO

Adapted from:
Technical support to the early detection of malaria epidemics in Madagascar. A report by Jean-Olivier Guintran for the WHO, August 2004

Instructional Goal:
To describe the first attempts to use climate information in support to malaria surveillance and control activities in Madagascar

Learning Objectives:
Understand which variables may be used to predict the occurrence of malaria outbreaks

Understand which indicators may be used for malaria early warning and detection in Madagascar

Summary:
This presentation describes and analyses the environmental characteristics of Madagascar and the epidemiological patterns of malaria in the country, in order to assess which information may be available, useful and useable to enhance the surveillance and control of malaria in the country. Case studies are provided to support the conclusions of this study.

Introduction to Remote Sensing
Laurence Cibrelus, IRI

Adapted from:
Remote Sensing as a Tool to Manage Environmental Data, by Pietro Ceccato, IRI

Instructional Goal:
Introduce the concepts of remote sensing and provide information on how to retrieve environmental factors using remotely sensed products

Learning Objectives:
Understand remote sensing as a tool to monitor environmental data

Know the remote sensing products available to monitor the environment

Summary:
Remote sensing is the science of obtaining information about an object through the analysis of data acquired by a device (sensor) that is not in contact with the object (remote). As you read these words, you are employing remote sensing. Your eyes are acting as sensors that analyze the electromagnetic waves (visible light) reflected from this page. The light your eyes acquire is analyzed in your mental computer to enable you to explain the words. Apart from the eyes, more sophisticated sensors have been developed to measure the electromagnetic waves in domains outside the visible. By measuring the electromagnetic waves in domains from Gamma rays to Microwaves, we can retrieve information on objects we want to study.

Recommended readings:
Ceccato P, Dinku T. Introduction to Remote Sensing for Monitoring Rainfall, Temperature, Vegetation and Water Bodies. IRI Technical Report. Available from:
>>http://iri.columbia.edu/publications/id=986

Ceccato P, Connor SJ, Jeanne I, Thomson MC. Application of Geographical Information Systems and Remote Sensing technologies for assessing and monitoring malaria risk. Parassitologia 2005;47(1):81-96.

Malaria Mapping
Marie-Clémence Rakoarivony, VPMSP

Adapted from:
Climate and Malaria Mapping, by Judy Omumbo, IRI

Instructional Goal:
Understand the utility of climate information for dynamic disease mapping.

Learning Objectives:
Understand where, when and for how long the combination of climatic conditions (rainfall, temperature and humidity) may be suitable for malaria transmission in Africa.

Discuss the importance of considering climate variability and unusual climate events when selecting a baseline year for assessing the impact of interventions against plague.

Summary:
Malaria transmission occurs under defined conditions of precipitation, humidity and temperature. This knowledge has been applied to the cartography of malaria for almost a century. Historical malaria maps have used climate information in combination with expert opinion to define the geographical limits of malaria transmission. The widening range of applications for disease maps and need for improved estimates of disease burden as has fuelled an increasing interest in using maps as a key tool for decision-making in disease control.

Today's disease control programs need dynamic maps that track the variability of disease transmission in space and in time. Today's maps are also potentially powerful analysis tools for charting the effects of interventions, policy changes, societal influences on disease and trends. Cartographers over the years have recognized that to understand disease transmission, one must understand the climate. This lecture describes, using examples, the evolution of malaria maps for sub-Saharan Africa from historical times to present day initiatives and the role of climate information in the development of malaria maps.

Recommended Readings:
Craig MH, Snow RW, le Sueur D. (1999). A Climate-based Distribution Model of Malaria Transmission in Sub-Saharan Africa. Parasitology Today, 15: 105-111.

Omumbo JA, Hay SI, Snow RW, Rogers DJ. (2005). Modelling malaria risk in East Africa at high spatial resolution. Tropical Medicine and International Health, 10: 557-566.

Feachem, R.G.A., with A.A. Phillips and G.A. Targett (eds) (2009). Shrinking the Malaria Map: A Prospectus on Malaria Elimination. Chapter 1 and 6. San Francisco: The Global Health Group, Global Health Sciences, University of California, San Francisco.

Overview of the Declaration of Libreville and of its Implementation in Madagascar
Luciano Tuseo, WHO
Norohasina Rakotoarison, VPMSP

VPMSP Norohasina Rakotoarison and WHO Luciano Tuseo present the Declaration of Libreville

Instructional Goal:
Provide an overview of the political frame supporting climate and public health activities in the African region

Learning Objectives:
Describe the Libreville Declaration from August 2008 on Health and Environment in Africa
Describe the Windhoek Declaration on the implementation of the Libreville Declaration and its implementation in Madagascar

Summary:
The Declaration of Libreville was signed in August 2008 by African Ministers responsible for health and environment issues to reaffirm their commitment to implement all the existing policies "that bear on health and environment linkages" and to develop "health-and-environment strategic alliance, as the basis for plans of joint action". The Windhoek Declaration addresses how this initiative may be implemented at the national level, prompting the countries to implement baseline resource assessments and to develop strategic plans accordingly by 2010. This presentation details the achievements of Madagascar so far to implement the Declaration of Libreville.

Recommended reading:
Libreville Declaration on Health and Environment in Africa. World Health Organization, Regional Office for Africa. August 2008. ISBN: 978 929 023 1080. Available from:

>>http://www.afro.who.int/en/tanzania/tanzania-publications/doc_download/2223-libreville-declaration-on-health-and-environment-in-africa-libreville.html

Exercises using the Map Rooms
Remi Cousin, IRI

Adapted from:
Summarizing Climate and Health Data Using Descriptive Statistics and Map Tools, by Michael Bell, IRI.

Instructional Goal:
Learn the fundamentals of the use of Expert Mode in the IRI Data Library and the Map Room to calculate and visualize exploratory and descriptive statistics of climate and public health data of Madagascar.

Learning Objectives:
Learn how to work with multiple items in Data Library Expert Mode, to apply filters and functions

Learn how to display time series of epidemiological and climate data in the Data Library, to construct histograms and to calculate various statistical measures of epidemiological and climate data

Summary:
As a first step to understanding or summarizing a data set of observations, whether of climate or health information, it is often useful to calculate exploratory or descriptive statistics of the data. The IRI Data Library includes functions and options useful for calculating and displaying such statistics. This session presents fundamentals of using Expert Mode in the Data Library and practical exercises to calculate measures of central tendency and spread and spatial averages of gridded data.

Recommended reading:
Statistical Techniques in the Data Library: A Tutorial. Available from:
>>http://iridl.ldeo.columbia.edu/dochelp/StatTutorial/

Principles of Cluster Analysis
Remi Cousin, IRI

Lecture
Adapted from:
Introduction to Cluster Analysis, by Andrew Robertson, IRI

Instructional Goal:
Learn how cluster analysis works as a method to identify patterns in multivariate data.

Learning Objectives:
Understand what cluster analysis is.

Learn how the K-means method works.

Learn how to implement K-means, including how to choose the appropriate number of clusters, and how to interpret the results.
Summary:
In multivariate data analysis, identifying any shared behavior between locations or variables is a key simplifying step. This lecture will teach how such data can be stratified into groups using cluster analysis, in order to identify patterns, and to facilitate the identification of associations between climate and health data. We will learn how the K-means method partitions a set of observations into sub-groups, based on their similarity according to a measure of the "distance" between them, and so as to minimize the scatter within each cluster. Examples will include July temperatures at US cities, and malaria data gathered for Eritrea. We will try to answer the following questions: Do the patterns identified by cluster analysis always correspond to "real" underlying processes, or could they result from random data? When is cluster analysis a good choice for analyzing health and climate data?

Recommended readings:
Ceccato P, Ghebremeskel T, Jaiteh M, Graves PM, Levy M, Ghebreselassie S, et al. Malaria stratification, climate, and epidemic early warning in Eritrea. The American journal of tropical medicine and hygiene 2007;77(6 Suppl):61.

Wikipedia on K-means and clustering. Available from:
>>http://en.wikipedia.org/wiki/K-means_clustering

Exercises on K-means and Cluster Analysis
Adapted from:
Exercises on K-means and Cluster Analysis: Malaria Seasonality, by Pietro Ceccato, IRI

Instructional Goal:
Apply the concepts of clustering using two case studies (Eritrea and Madagascar) to understand clustering analysis and its implication for decision-making.

Learning Objectives:
Analyze malaria patterns in Eritrea and Madagascar.

Cluster malaria data collected at district levels over a long time period.

Understand the spatial and temporal distribution of malaria in Eritrea and Madagascar in order to: 1) take decisions about control strategies and 2) understand the relationship between malaria and environmental factors.

Summary:
Cluster analysis or clustering is the assignment of objects into groups (called clusters) so that objects from the same cluster are more similar to each other than objects from different clusters. Often similarity is assessed according to a distance measure. Clustering is a common technique for statistical data analysis, which is used in many fields, including machine learning, data mining, pattern recognition, image analysis and bioinformatics.

Climate Variability, Climate Change and Climate Data
Nirivololona Raholijao, DGM

Instructional Goal:
Provide fundamental concepts on climate variability, climate change and climate data, as well as their characteristics in Madagascar

Learning Objectives:
Define and provide instances of weather, climate, climate variability and climate change

Describe how these elements may be forecasted and with which confidence

Detail which climate/weather information is available in Madagascar

Summary:
In order to conduct fruitful multi-disciplinary initiatives, it is important that both the climate and public health communities are familiar with the basic concepts of the other discipline. This presentation describes the fundamental concepts in weather and climate, as well as the way to forecast them and their availability in Madagascar.

Principles of Time Series Analysis
Remi Cousin, IRI

Adapted from:
Exploratory Time Series Analysis, by Andrew W. Robertson, IRI

Instructional Goal:
Learn simple techniques for exploratory analysis of univariate time series of climate and health data.

Learning Objectives:
Understand the nature of climate variability on daily to interannual time scales in terms of rainfall and temperature at a particular location.

Learn how simple averaging and time-series plots can be used to separate different time scales of variability, namely weather variability, seasonal cycle, interannual variability, interdecadal variability and long-term trends.

Learn how to identify the direction and strength of a long-term trend in a time series, evaluate the probability that a trend in a data set occurred only by chance, and learn two methods to remove a trend in a data set.

Learn how several time series can be used in conjunction to identify and quantify associations between them.

Summary:
Climate and epidemiological data are often recorded as time series of a measurement at some location. Historical records of weather data have lead to much of our understanding of weather and climate, in terms of daily weather fluctuations, seasonality, interannual "climate" variations, and longer term trends. Epidemiological time-series data may show similar and contrasting features, and exploratory analysis of (univariate) time series forms the starting point for more complex statistical analysis, to identify associations between health and climate data, for example. The lecture will illustrate simple exploratory analyses of univariate time series, including how time averaging can be used to separate different aspects of a climate time series, such as weather, the seasonal cycle, interannual variability, and longer-term variability and trends. We will illustrate the differing characteristics of temperature, rainfall, and malaria count data using an example from Colombia, and consider the implications for defining "normal" and "unusual" features in time series, and identification of associations between climate and epidemiological data.

Recommended readings:
Tian L, Bi Y, Ho SC, Liu W, Liang S, Goggins WB, et al. One-year delayed effect of fog on malaria transmission: a time-series analysis in the rain forest area of Mengla County, south-west China. Malaria Journal 2008;7(1):110.

Briët OJT, Vounatsou P, Gunawardena DM, Galappaththy GNL, Amerasinghe PH. Temporal correlation between malaria and rainfall in Sri Lanka. Malaria Journal 2008;7(1):77.

Epidemiology of Plague in Madagascar and Research Opportunities on Climate and Plague

Huguette Ramiakajato, VPMSP
Fanja Rakotomanana, IPM

Instructional Goal:
Understand the epidemiology of plague in Madagascar and how climate may impact the epidemiology of the disease

Learning Objectives:
Understand the relation between the vector and host of plague and humans.

Understand the means by which climate impacts the behavior of the host and the transmission dynamics of plague

Discuss which areas of research and intervention could be subsequently implemented

Summary:
Plague is a bacterial infection caused by the bacterium *Yersinia pestis*. It is transmitted by fleas and infects, mainly rodents, that can invade areas with human settlements and cause human epidemics. Plague was virtually eliminated from Madagascar in the 1930s but resurfaced in 1990. Today, more than 200 human cases are diagnosed each year. There are two main species of host rats in Madagascar: Rattus norvegicus, which lives in urban household, and the most common species, Rattus rattus, which can be found in any ecosystem of the country. The eradication of plague has been difficult because rodents can live both in domestic and wild environments. When food resources are abundant in the countryside, rodents remain in isolated settings, where very few human live, while during the dry seasons, rats infected by plague seek food in human habitations or in areas where grain is harvested and stored, i.e. very close to human settlements.

Plague is endemic in two main areas in Madagascar: areas beyond 800 meters above sea level, and some urban areas as in the coastal port of Mahajanga and Antananarivo. In urban areas, the disease is most active in the port of Mahajanga. In the central highlands, plague transmission mostly occurs during the rainy season (from October to April), while the transmission on the west coast is more related to the cold and dry season that spans from July to November.

The national surveillance system for plague relies on case detection and treatment and on the prevention of contact between humans and chips, through good sanitation and through the elimination of rats in residential areas.

Recommended reading:
The Atlas of Plague in Madagascar. The Study Group for Plague at the Pasteur Institute of Madagascar. Available from:
>>http://www.pasteur.mg/Atlas-Peste/

Climate Suitability Mapping for Plague Transmission
Remi Cousin, IRI

Adapted from:
Malaria Mapping and the Climate Suitability for Malaria Transmission Tool in the Health Map Room, by Judy Omumbo, IRI

Instructional Goal:
Understand the utility of climate information for dynamic disease mapping.

Learning Objectives:
To be able to navigate the climate suitability for plague transmission tool, a clickable map interface that describes where, when and for how long the combination of climatic conditions may be suitable for plague transmission in Madagascar.

Understand and be able to review the tool's graph, table and map outputs, including for intervention targeting (when and where to administer interventions) and impact evaluation.

Summary:
A good understanding of climatic and environmental conditions suitable for plague transmission would enhance the mapping and prediction of the seasonal distribution of the disease. In rural areas of the highlands, of Madagascar for instance, plague is positively correlated with spring rainfall. The optimum humidity conditions for plague transmission are 85-95% and cases peak when the vegetation is abundant. In this exercise, participants will use their knowledge of the epidemiology of plague and its relationship to the climate to develop maps of the seasonal climatic conditions suitable for plague transmission.

Recommended readings:
Migliani R, Chanteau S, RahalisonL, Ratsitorahina M, Boutin J-P, Ratsifasoamanana L, Roux J. (2006). Epidemiological trends for human plague in Madagascar during the second half of the 20th century: a survey of 20 900 notified cases. Tropical Medicine and International Health, 11: 1228-1237.

Chanteau S, Ratsitorahina M, Rahalison L, Rasoamanana B, Chan F, Boisier P, Rabeson D, Roux J. (2000). Current epidemiology of human plague in Madagascar. Microbes and infection, 2: 25-31.

Second Training Course

Introduction to the CIPHAN Network and Platform
Laurence Cibrelus, IRI

Instructional Goal:
Introduce the participants to the courses with the concept of climate and public health platforms for interaction and networking

Learning Objectives:
Understand the rationale for climate and public health platforms for interaction

Describe the structure and contents of the Climate Information for Public Health Action Network (CIPHAN) Web page and of the Climate Information for Public Health Action (CIPHA) newsletter

Understand the benefits and opportunities that may arise from engaging in these networking channels

Summary:
The CIPHAN interface was created in 2010 to provide public health professionals with knowledge, methodologies, tools, and data to better manage climate sensitive diseases toward improving health outcomes. It acts as a web portal to guide the learner towards other sources of information, as well as a source of learning resources, such as educational modules and exercises. This site's library also contains a directory of published material to give the reader opportunity for further investigation. For the first time, this interface was used as a support to a CIPH training course for the 2010 SI. It enables as well as to disseminate paper or electronic-based advocacy and networking supports.

Recommended reading:
Visit the Web page of the Climate Information for Public Health Action Network at:
>>http://ciphan.iri.columbia.edu/

Exercises on Uploading and Downloading Data to the Data Library
Remi Cousin, IRI

Adapted from:
Data Upload into the IRI Data Library, and Extracting Data from the IRI Data Library, by John del Corral, IRI

Instructional Goal:
Upload and download public health and other datasets between one's computer and the IRI Data Library in order to analyze these datasets against other databases existing in the Data Library

Learning Objectives:
Ensure the data set has the appropriate spatial and temporal format

Ensure the data is characterized by metadata, which has the appropriate format

Upload the data and the metadata

Select a subset of a particular dataset of the IRI Data Library based on time and location, or other independent variables

Learn how to average the data over time using the Data Library Expert Mode when needed

Save the dataset to the desktop in appropriate format (e.g., compatible with Microsoft Excel, GIS)

Summary:
Many users of the Data Library from public sector professions (health, agriculture, and water management) have sector-related data from their own region or country. They would like to correlate this data with the climate and environmental data available in the IRI Data Library. An Internet accessible data upload facility is used to bring user data into the IRI Data Library. As long as this data contains spatial and temporal reference information, it can be correlated with the datasets in the Data Library. Similarly, it is possible in the Data Library to extract a subset of a particular dataset, based on time and location, or other independent variables. There can be a number of reasons to do this. One may wish to use his/her own analytical software on the subset or may only have intermittent access to the Internet. The extracted data can be delivered in several formats.

Recommended reading:
Manipulating, Visualizing, and Downloading Data in the IRI Data Library: A Tutorial. Available from:
>>http://iridl.ldeo.columbia.edu/dochelp/Tutorial/MVD/

Data Constraints and Limitations
Remi Cousin, IRI

Adapted from:
Data Constraints and Limitations: the Instance of the Temperature Trends in the Highlands of Kenya, by Bradfield Lyon, IRI

Instructional Goal:
Understand the limitations of climatological datasets before performing data analysis

Learning Objectives:
Understand the source and intended use of climate data in order to avoid placing an excessive burden on these data when conducting analyses

Provide examples of regional variations in climate variability and trends

Understand the importance of data quality control
Gain an appreciation of some of the challenges in assessing temporal trends

Summary:
Several studies have considered the impact of climate change, and temperature in particular, on the distribution and incidence of malaria in the highland regions of East Africa. The results, however, often led to different conclusions. This was in part related to the fact that they typically used different climate datasets, which were either interpolated analyses based on station observations or an insufficient set of station observations, or length of record, for the specific areas of interest. It is indeed a critical issue to understand the climate (or health) data being used in any study, including limitations in using such data before conducting any analysis. This includes the issue of data quality but also using the appropriate time scale of information (e.g., daily versus monthly rainfall data) for the health question being considered. One needs to take into account the caveats to using gridded data derived from point observations, for example, to avoid drawing potentially inappropriate conclusions from the analysis. Indeed, any analysis should begin with a simple, exploratory step that can subsequently be followed by more sophisticated methods. It is recommended that when undertaking interdisciplinary studies, experts from across disciplines are involved to help minimize misinterpretation of the datasets being used. This lecture illustrates these points through considering the analysis of the relation between malaria and temperature in the highlands of Kenya.

Recommended readings:
Hay SI, Cox J, Rogers DJ, Randolph SE, Stern DI, Shanks GD, et al. Climate change and the resurgence of malaria in the East African highlands. Nature 2002;415(6874):905-909.

Patz JA, Hulme M, Rosenzweig C, Mitchell TD, Goldberg RA, Githeko AK, et al. Climate change (Communication arising) Regional warming and malaria resurgence. Nature 2002;420(6916):627-628.

Correlation Analysis
Laurence Cibrelus, IRI

Adapted from:
Making Sense of Associations, by Tony Barnston, IRI

Instructional Goal:
Understand and apply the concepts of correlation and lagged correlation to climate and public health issues

Learning Objectives:
Understand the rationale and methods for performing correlation analysis using the instance of malaria and rainfall.

Assess the strength and significance of a correlation

Understand how correlation can be used to make predictions

Summary:
"Association" refers to relationship between two variables, such as rainfall and malaria incidence. Once we identify the two variables of interest, we may want to introduce a lag time between them. For rainfall and malaria in Botswana, for example, due to the dynamics of the mosquito life cycle and malaria transmission, we find that the peak of the rainfall season precedes the peak of malaria incidence by about 2 to 3 months. Therefore, in studying the association between rainfall and malaria we consistently use rainfall data occurring 2 to 3 months earlier than the malaria incidence data, building a data set covering many years.

The next step is to evaluate the strength of the association; i.e. to determine how closely related the malaria incidence is to the rainfall. While there are several methods to quantify the strength of the association, here we focus mainly on the linear correlation coefficient. Once the correlation coefficient is obtained, consideration is given to its statistical significance – i.e., the likelihood that the coefficient could have occurred only by chance, given the size of the data sample analyzed. We also discuss the implication of a strong (or statistically significant) correlation regarding a causal relationship between the two variables.

Finally, we show how the association can be used to make predictions for one of the variables when the value of the other variable is available. For example, when the

amount of rainfall has been observed (or forecast), the correlation coefficient can be used to predict the malaria incidence in advance of its occurrence. Common complicating issues in the use of correlation to describe the strength of association and for prediction are discussed, such as skewness in one or both variables, the presence of outliers, and non-linear relationships between the variables.

Recommended Readings:
Wilks DS, 2006: Statistical Methods in the Atmospheric Sciences. Second Edition. Edition. Academic Press, 648 pp.

Wonnacott TH and Wonnacott RJ, 1990: Introductory Statistics. Fifth Edition. Chapters 15, 17. John Wiley & Sons, 711 pp.

Exercises on Correlation using Data from Colombia, and Exercises on Correlation using Data from Madagascar
Remi Cousin, IRI

Adapted from:
Lagged correlation of Rainfall with Malaria Incidence, by Michael Bell, IRI

Instructional Goal:
Map and correlate climate and public health data in the Data Library using two datasets with very distinct characteristics

Learning Objectives:
Use the Data Library to calculate anomalies of epidemiological and climate data
Review the calculation of district-average values of gridded climate data

Create a map of epidemiological values by district in the Data Library

Use the Data Library to calculate the Pearson Product Moment Correlation between two variables

Lag two data sets and calculate the lagged correlation

Summary:
One challenge of relating climate conditions to epidemiological conditions is to re-express these data in the same spatial and temporal framework. For example, while epidemiological data may be collected by health district, climate data are often available by station or in a gridded format. This session shows how to use the Data Library to put climate and health data into a common spatial and temporal framework, map data by district, and calculate correlations and lagged correlations by district. It will rely on two very distinct datasets: one set of weekly data spanning

over seven years (Colombia) and one set of monthly data spanning over three years (Madagascar).

Recommended reading:
Statistical Techniques in the Data Library: A Tutorial:
>>http://iridl.ldeo.columbia.edu/dochelp/StatTutorial/

Implementation of the Declaration of Libreville in Madagascar
Norohasina Rakotoarison, VPMSP

Summary:
Following the Overview of the Declaration of Libreville and of its implementation in Madagascar as provided by Luciano Tuseo, WHO, and Norohasina Rakotoarison, VPMSP, in October 2009, this presentation details the achievements in implementing the Declaration of Libreville in Madagascar and the resulting opportunities.

Writing Climate and Health Proposals
Opportunities for the CHWG of Madagascar
Luciano Tuseo, WHO
Laurence Cibrelus, IRI

Instructional Goal:
Implement joint climate and public health interventions or operational research projects

Learning Objectives:
Understand the advantages and constraints of implementing multi-disciplinary joint projects

Be familiar with the range of potential partners in the area of climate and health (e.g., stakeholders, donors)

Understand the principles of writing and submitting a proposal, in particular in the area of climate and health

Summary:
A lot of knowledge and experience remain to be built in the area of climate and public health. It is therefore critical that the climate and public health/field epidemiology communities, involved in government or international agencies, Non-Governmental Organizations (NGOs), research institutions etc. collaborate to jointly fill this gap, with the common goal of improving public health outcomes across the

globe. This collaboration may take the form of climate and public health integrated interventions or operational research projects. Despite the challenges associated with the development of connecting proposals, these projects must be developed with clear and realistic objectives, quality indicators measuring the projects long-term benefits, as well as consistency with and contribution to broader climate and public health policy principles.

Recommended reading:

European Commission. Aid Delivery Methods. Project Cycle Management Guidelines. March 2004. Available from:

>>http://www.europa.eu.int/comm/europeaid/qsm/index_en.htm.

International Development Research Centre, Canada. Integrated Research Partnerships for Malaria Control in Africa - Request for Concept Notes. Available from:

>>http://www.idrc.ca/en/ev-151439-201-1-DO_TOPIC.html

"This training course was very eye-opening for me and changed the way I think about my work. I think that it gave me a more scientific approach"

CIPH Alum from Madagascar

Outcomes of the Training Courses

Pilot Projects on Malaria, Plague and Rift Valley Fever

Three exploratory projects were developed between the two courses, building on the knowledge and skills gained on the relationship between public health and climate and on the tools existing to comprehend this relationship. Building on the outcomes and new skills gained during the first training, the CIPH trainees developed their projects using the results and figures obtained with their own data during the practical sessions of the first training and afterwards, while working on their own with the IRI Data Library.

Through preliminary analyses, these group projects aimed to formulate the first hypotheses on the association between climate and malaria, plague and RVF in Madagascar, which would, in turn, improve the surveillance and control of these climate-sensitive diseases. This is now more important than ever as, said Yolande Nirina Raoelina during her presentation at the First Conference of Ministers of Meteorology in Africa held in April 2010, "the African region has seen the emergence of several new diseases in the past decade, all of which have the capacity to become epidemics. She also noted that with erratic rainfall patterns and the emerging threat of climate change, both of which affect human health, there is a need for the public health sector to work more closely with meteorologists, hydrologists, and climatologists"[5].

[5] *From: CIPHA Newsletter, May 2010, Vol.2 Issue 3. International Research Institute for Climate and Society, The Earth Institute at Columbia University, Palisades, NY. Available from: http://iri.columbia.edu/education/ciphnews*

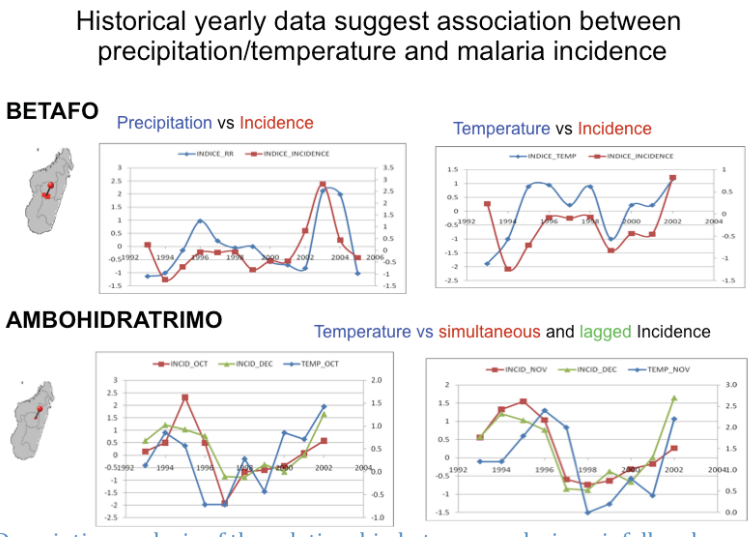
The Madagascar Climate and Health Small Project on Malaria

Rabesahala Lalao Sabas, VPMSP, Rakotomanana Fanjasoa, IPM, Rakotoarivony Marie Clémence, VPMSP, and Ramiandrisoa Voahanginirina, DGM.

Summary:
The Malaria and Climate sub-group of the CHWG conducted a pilot study on the relationship between malaria and temperature and rainfall between 1997 and 2009 in the districts of Betafo and Ambohidratrimo, where malaria is endemo-epidemic, as well as in Maevatanana where malaria transmission is stable.

The study described the current patterns and trends of malaria, rainfall and temperature in these areas, using contemporary as well as lagged data. It then used correlation analysis to assess the relationship between the incidence of malaria and rainfall and temperature, at a given point in time and following a time lag – therefore paving the way for malaria forecasting using climate information.

The study also highlighted the challenges associated with the joint analysis of climate and public health data, which are available at different temporal and spatial scales, and the resulting difficulties in interpreting the results of such analysis.



Descriptive analysis of the relationship between malaria, rainfall and temperature in Betafoa and Ambohidratrimo, from the presentation by the Malaria and Climate sub-group.

The Madagascar Climate and Health Small Project on Plague

Ramiakajato Huguette, VPMSP, Rakotoarison Norohasina, VPMSP, Andriamampianina Nivo, VPMSP, Ralaiarinoro Herinjanahary, DGM, Ranivoarisoa Sahondra, DGM and Rakotomanana Fanjasoa, IPM.

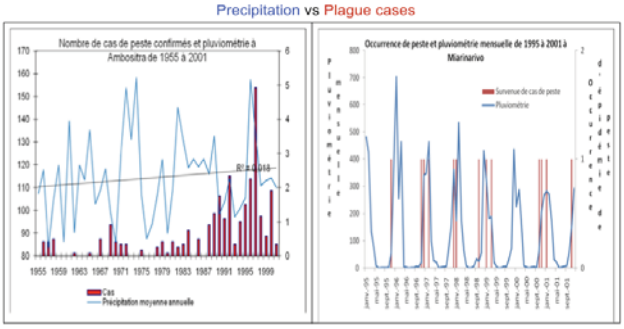
Summary:
This project looked at the relationship between plague and some climatic and environmental factors over time in the High Lands of Madagascar, between 1955

and 2001. Following a descriptive analysis of the epidemiological and climatic patterns of plague in this area, the team performed a correlation analysis. The results indicated that occurrence of plague was positively correlated with the minimal temperature as well as with rainfall.

Graph on the left suggests that long term precipitation trend could be responsible for plague cases increase over 50 years.

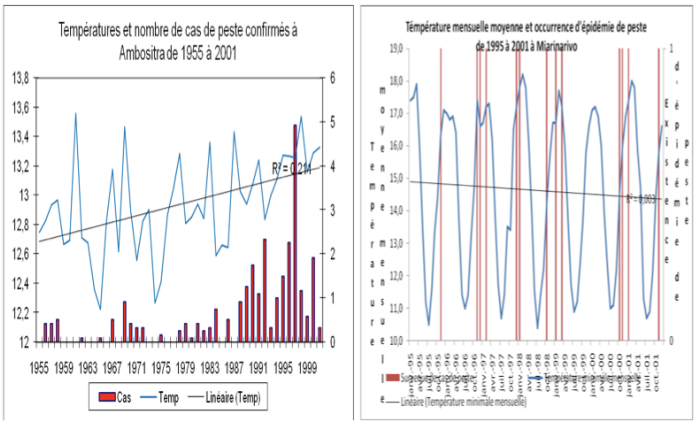
Graph on the right suggest that plague cases can only occur after rain has fallen.

Precipitation vs Plague cases



Graph on the left suggests that long term temperature trend could be responsible for plague cases increase over 50 years. Graph on the right suggests that plague cases can only occur above 14°C

Temperature vs Plague cases



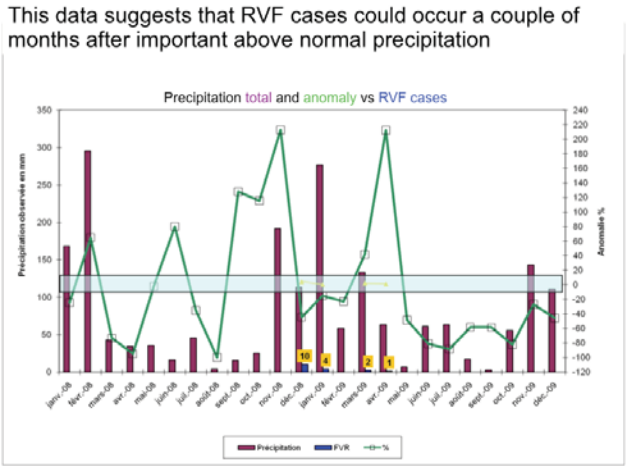
Descriptive analysis of the relationship between plague, rainfall and temperature in Ambositra, 1955-2001, from the presentation by the Plague and Climate sub-group.

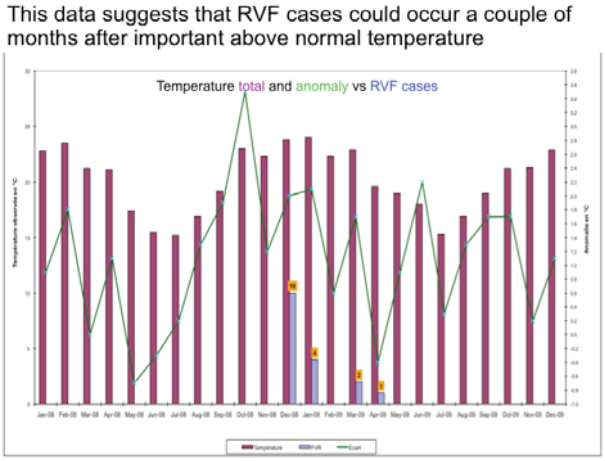
Beyond the results of the analysis, the group discussed the challenges they encountered to conduct the study – including in relation to the development of a multi-disciplinary project

The Madagascar Climate and Health Small Project on Rift Valley Fever (RVF)

Vololoniaina Manuela Christophère, VPMSP, Razafindramavo Lalao Madeleine, VPMSP, Razafindrakoto Léon Guy, DGM, and Andriabjafinirina Solonomenjanahary, DGM.

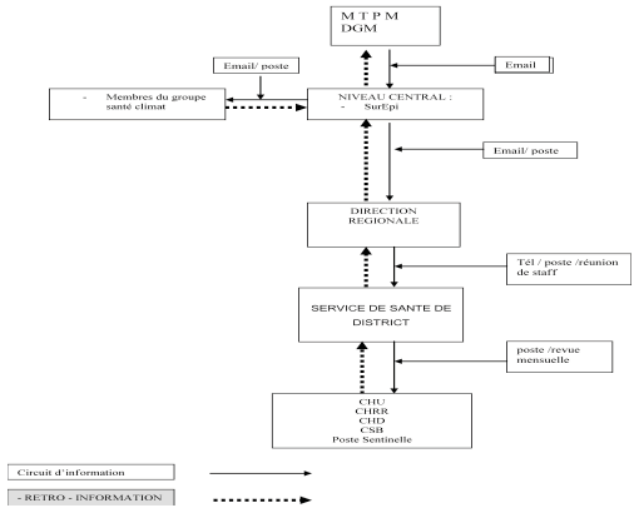
Summary:
This project focused on the regions of Analamanga, Haute Matsiatra, Alaotra Mangoro, Diana and Anosy to better understand the potential relationship existing between the occurrence of Rift Valley Fever (RVF) and climatic factors over two main periods of time: 1990-91 and 2008-09. The choice of these periods was dictated by the occurrence of confirmed cases of RVF, which do not occur every year; fourteen cases total were identified across this time period, all occurring between December and May. A descriptive analysis of the incidence of the disease and the patterns of temperature and rainfall was performed. No information was available on the occurrence of RVF among the cattle, which is the main source of infection for humans. The small sample size of the study prompted the team to interpret the results with caution.





Descriptive analysis of the relationship between RVF, rainfall and temperature in Madagascar, from the presentation by the RVF and Climate sub-group.

Implementation of a Climate and Health Bulletin



Information flows within the climate and public communities in Madagascar. Source: Presentation by Lalao Sabas Rabesahala.

Building on the interaction between the Malagasy public health and climate communities during the first CIPH training, the VPMSP and DGM developed a quarterly Climate and Public Health Bulletin aiming to improve the early detection and response of outbreak-prone diseases in Madagascar. As published by the VPMSP, using input from the DGM, this bulletin summarizes the quarterly predictions of rainfall and temperature over the 22 regions of Madagascar and their expected qualitative impact on diseases' incidence (i.e., risk of recrudescence). Relying on the information flows detailed in the figure above, it is distributed to relevant stakeholders working both at the peripheral and central levels, regional centers for diseases prevention and control, Pasteur Institute and WHO, among others. For instance, public health officers responsible for diseases epidemiological surveillance in Madagascar could compare weather forecast information for January-February-March 2010 with the statistical, microbiological and entomological bio-climatic

characteristics of the country; they used this information to call for enhanced surveillance, preparedness and response to certain diseases and/or ongoing outbreaks in the regions and districts of Madagascar.

Development of New Operational Products

The DGM is developing operational tools that could be used in routine by the public health community in Madagascar to improve operational perspectives for field public health decision-making in the country. The training courses and the regular meetings of the CHWG enabled the meteorological community to understand which climate products are useful and useable by the public health community, the end user. These tools would rely on short-term, seasonal and intra-seasonal forecasts – the latest being released as an experiment.

The DGM provides the public health community with easily understandable information on the status of El Nino, the seasonal trend, the risk of cyclones, and the forecast for temperature and rainfall (6, 3 and 1 month ahead); and the group is currently developing a forecast of daily rainfall per millimeter over 14 days, using models from the National Centers for Environmental Prediction and a high resolution regional model, in addition to a forecast for minimum and maximum temperatures.

Outreach and Development of Partnerships

The training courses were an opportunity to discuss the vision of the members of the Malagasy CHWG on the future of the field of climate and public health in their country and with their partners. Some of their initiatives, achievements and ideas were published in the quarterly Climate Information for Public Health Action (CIPHA) newsletter6. This newsletter provides updates on the latest developments within the CIPH network, including activities of alumni and facilitators, brief meeting reports, news from the health and climate community, and opportunities for collaboration. The CIPHA newsletter was also spontaneously used during the training to seek potential international partner researchers on climate and public health.

The training also enabled further discussions about the activities that the Malagasy CHWG could conduct with similar groups implemented in Ethiopia and Kenya. Between the two training courses, all three CHWGs held their first joint working

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[6] *Available from: http://iri.columbia.edu/education/ciphnews*

session in early November 2009 at the fifth annual meeting of the Multidisciplinary Initiative for Malaria (MIM) in Nairobi, Kenya. One output of the session was a joint presentation on their achievements and planned activities which was delivered to the MIM Research Capacity Strengthening Symposium: "Building Capacity to Use Climate and Environmental Information for Improving Health Outcomes." Joint activities also included a meeting at the Inter Governmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC) and the Kenyan Ministry of Public Health & Sanitation, Division of Malaria Control.

IRI Laurence Cibrelus and Remi Cousin visited the newly built national center for malaria, funded by the WHO and the MonacoAID. Along with SI09 Alumna Marie-Clémence and WHO Luciano Tuseo, they provided the new center with IRI French and English publications related to climate and public health. They also met Celine Seigon-Kandissounon, the WHO representative in Madagascar, to whom they gave a report from the 2009 Summer Institute on Climate Information for Public Health. She expressed interest in further climate and health collaboration in the country. She was pleased to see that, once again, Madagascar was a leading country in pilot projects in health-related sectors.

WHO Luciano Tuseo, VPMSP Marie Clémence Rakoarivony and IRI Laurence Cibrelus in the library of the new national center for malaria in Madagascar

Work Plan for the Climate and Health Working Group

The outcomes of the training courses contributed to designing the road map for the forthcoming activities of the CHWG of Madagascar. For 2010 and beyond, the CHWG seeks to build its capacity within the frame of the Declaration of Libreville and to further the ability of its members and their peers to use targeted climate information to improve the surveillance and control of malaria, plague and RVF in Madagascar, through the development of new channels and tools for communication and information sharing between the public health and climate communities. Members of the Malagasy CHWG also underlined the need to improve the availability of the climate and public health data available in routine.

Although the detailed work plan of the CHWG is not provided in this synthesis report of the training courses conducted in Madagascar, the CHWG of Madagascar hopes, for instance, to: be able to update the Madagascar Atlas for Plague and

Malaria using climate data, identify the climate and temperature trends in Madagascar (e.g., more frequent extreme rainfall events, positive temperature trend), assess the impact of ENSO in Madagascar, validate the temperature data obtained by remote sensing with observation data from the meteorological stations, and describe where meteorological stations exist, have been closed, could be re-opened and at which cost.

Because these tremendously important initiatives shall be conducted by the entire climate and public health communities of the country, the Malagasy CHWG also plans to perform more CIPH training courses, inspired by those described in this document, to support capacity building efforts in Madagascar.

"Now that we have a clearer understanding of the links between public health and climate, it is important to develop, beside the training, concrete applications and collaborations for our country"

CIPH Alum from Madagascar

Evaluation of the Courses

Methods

The participants were offered three opportunities to evaluate and give their feedback on the full CIPH training program "Learning Through Doing".

The evaluation process was anonymous and addressed the performance and satisfaction associated with the design and delivery of the courses, as well as the opportunities that could arise from them, using open-ended, yes/no, or multiple choice questions. Some aspects of the course were rated on nominal scales from 1 to 5, where 5, which was the highest score, represented the most positive response - for instance, level of agreement from Strongly Disagree (1) to Strongly Agree (5). The evaluation surveys were filled on questionnaires' printouts, available from the appendix section of this report.

The ***initial evaluation***, completed at the end of the first week of training in October 2009, enabled to identify the key points and challenges associated with the processes of adaptation to the course and knowledge assimilation. The CHWG of Madagascar designed this survey.

The ***intermediate evaluation*** was completed on the first day of the second week of training in March 2010. It was designed to help the participants assess their gain in knowledge and understanding of the key concepts taught during the first week of training, and to reinforce learning by providing the participants with an idea of what topics they should further concentrate on. It also helped the course organizers understand how successfully the materials had been delivered and presented.

The ***overall evaluation*** of the course was completed on the last day of the second training. This survey assessed whether the goals of the course were met, as well as the value of the course content, its transferability, design and delivery. It was designed by the IRI.

Additionally, the strengths of the courses and the opportunities for improvement were discussed between the participants and the facilitators.

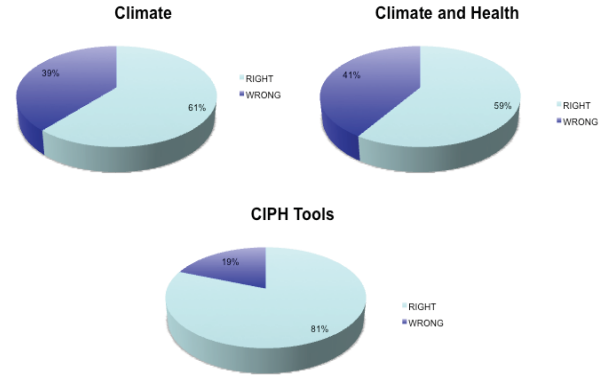
A distance evaluation of the "Learning Through Doing" project should be performed locally to assess the impact and usefulness of the training courses regarding the activities of the members of the CHWG of Madagascar. This survey should be conducted twelve to eighteen months after the completion of the training. It will explore if the participants have learned, if they are able to apply what they learned, if these new knowledge and skills enhanced their capacity or this of their institutions, and if the members of the CHWG trained and mentored their peers.

Initial Evaluation

Overall, the initial evaluation indicated that the materials were easy to understand, the instructions easy to follow and that the course was useful for the practice of its participants. However, the members of the CHWG indicated seeking more practice and case studies, including based on GIS, and more on interpretation of the data. The members of the CHWG expressed keeping the same team of trainees and facilitators for the second training.

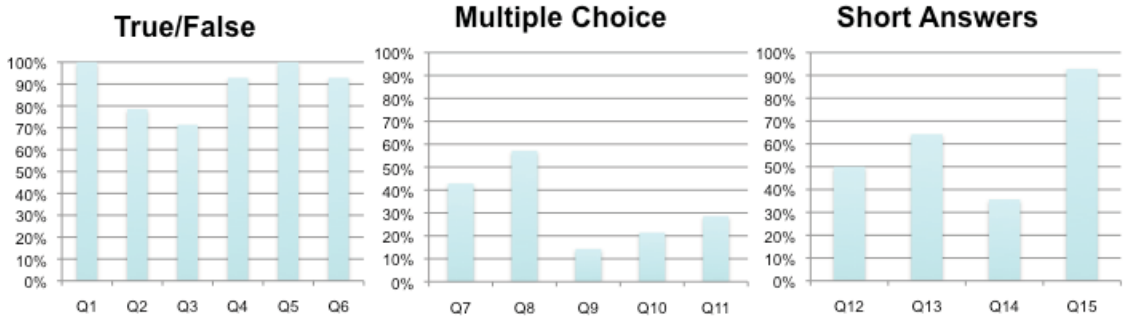
Intermediate Evaluation

With a response rate of 100%, the intermediate evaluation indicated that the concepts addressed during the first week of training were overall assimilated by the members of the CHWG of Madagascar and that the materials were successfully delivered. The results by topics (Climate, Climate and Health, and CIPH Tools) and by types of questions (True/False, Multiple Choice, and Short Answer) are provided in the figures below.



Results by topic of the intermediate evaluation of the CIPH courses

However, special attention is required while looking at the questions that were answered incorrectly (mostly multiple choice questions). These questions were actually set up to stimulate the members of the CHWG thinking beyond the usual boundaries of their discipline, and opening to the possibility of tailoring their methods and tools to the needs of their colleagues from the other community. One question, for instance, was asking how rainfall might be measured: millimeters per day, every six days, per decade, all of the above. One participant from the health sector, and one participant from the climate sector got the correct answer ("all of the above"), while all the others stated that rainfall may only be measured in millimeters per day.



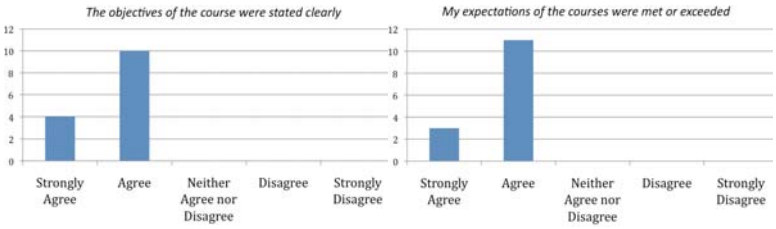
Results by type of question of the intermediate evaluation of the CIPH course

Overall Evaluation

With a response rate of 93%, the overall survey indicated that the goals of the course were met, with the answers from the participants reflecting homogeneously the quality of the course content, and of its transferability, design and delivery.

Course Objectives:

All the participants acknowledged that the objectives of the course were stated clearly and matched their expectations.

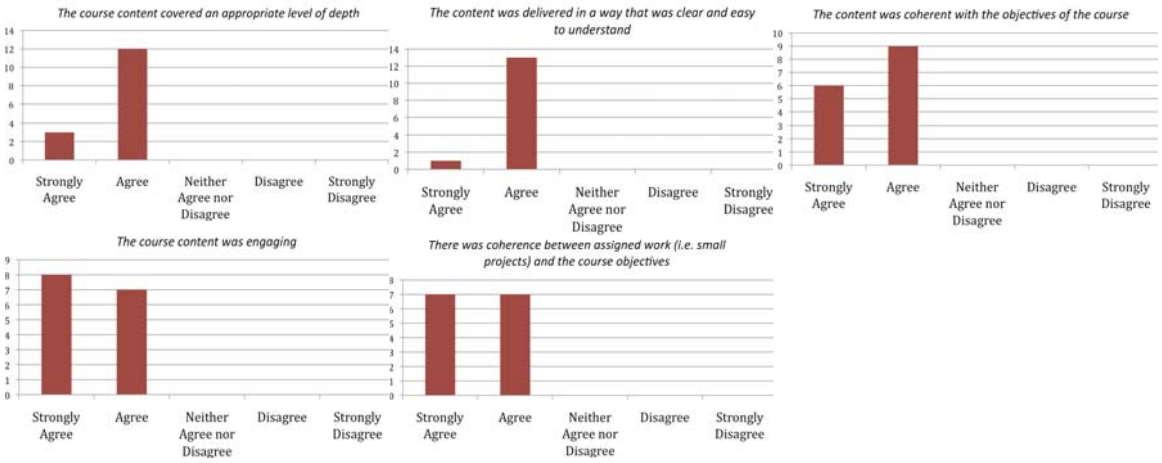


Results of the questions related to the course objectives, overall evaluation of the CIPH course

Course Content:

The members of the CHWG consistently agreed that the course content covered an appropriate level of depth in an intelligible and engaging way, which aligned with the objectives of the course. They deemed that the work assigned, in particular regarding the small projects, was coherent with the course. When asked to specify which topics were the most instructive to them, the vast majority of the respondents (86%) designated the lecture and exercises on correlation analysis. The development and management of projects on climate and health (9%) and the importance of temporal and spatial scales (5%) were also acknowledged as very enlightening.

Further, the participants were offered the opportunity to comment openly on the course content. Some of the members of the CHWG of Madagascar suggested the content, although overall very good and well adapted to their needs and expectations, could be improved if more time was dedicated to practical sessions and hands-on exercises in general, and to correlation analysis as well as to the manipulation of the Data Library in particular.



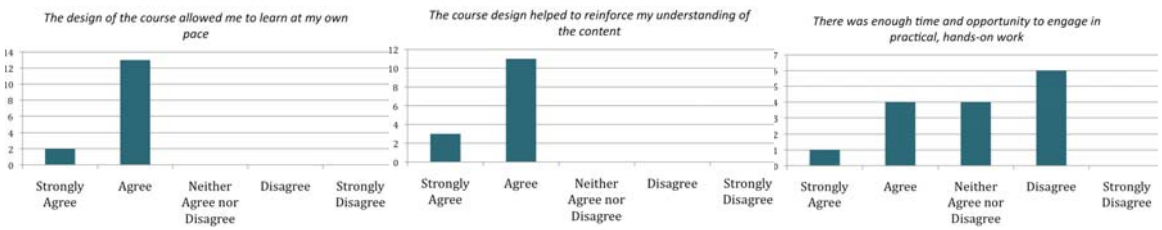
Results of the questions related to the course content, overall evaluation of the CIPH course

Global Transferability of the Course Content:

This section relied in three open-ended questions assessing how useful the course content was with respect to the work of the members of the CHWG of Madagascar. Fourteen of the 15 respondents found that the content of the course was relevant to their geographic region and organization. Participants frequently listed more than one topic as the most relevant to their work. Although two of respondents commented that all the topics were equally pertinent to them, two areas were deemed as very particularly important: correlation analysis (mentioned 8/15 times), and upload and download data from the Data Library (mentioned 5/15). The notion of different temporal scales, the completion and presentation of the small projects as well as the identification of the climatic patterns relevant to the main climate-sensitive of public health significance in Madagascar were also mentioned (once) as most relevant to the work of the members of the CHWG of Madagascar. The item related to the topic least relevant to the participants' work was left blank by all but one respondent, who indicated low interest in doing an exercise based on data from Colombia (see page 41 of this document).

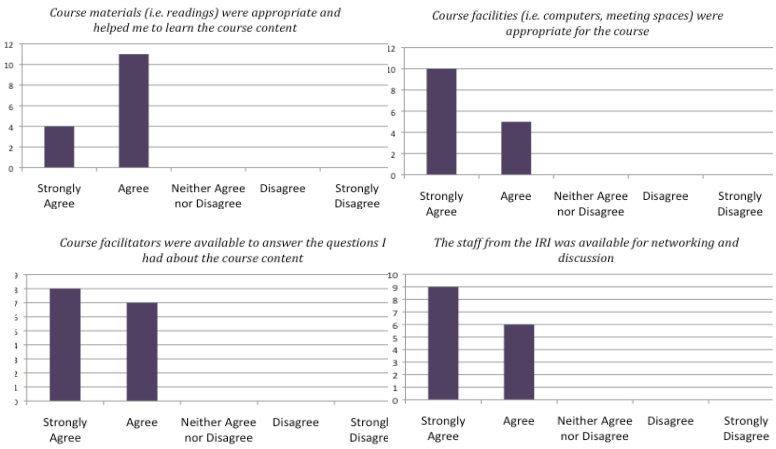
Course Design:

Although all the participants agreed that the design of the course helped reinforcing their understanding of the course content at their own pace, most of them (67%) were neutral or disagreed when commenting on the statement that there was enough time to engage in practical sessions.



Results of the questions related to the course design, overall evaluation of the CIPH course

Course Delivery:



Results of the questions related to the course delivery, overall evaluation of the CIPH course

The participants to the training course deemed both the course materials and the course facilities were appropriate for the training and helped them learning. The course facilitators were also perceived as available to answer questions and to network or discuss.

When asked to express themselves on the delivery of the courses, participants to the training gave high praise on it. However, they also regretted the technical issues experienced while manipulating the Data Library on-line.

"I can think of new applications for my work and for the group projects based on what we learned"

CIPH Alum from Madagascar

"The materials were very well tailored and enabled our understanding of the concepts of the course"

CIPH Alum from Madagascar

Conclusions

The Training Courses on Climate Information for Public Health implemented through the Learning Through Doing Project were overall very successful initiatives which brought together seventeen high-level participants of various profiles from the Climate and Health Working Group of Madagascar.

Through a multi-institution partnership, the courses were designed as a comprehensive experience that provided a better understanding of the relationship between public health and climate, and of the importance and complexity of using climate information in public health decision-making, as well as new skills to help apply this knowledge. This initiative offered new or deeper opportunities for multidisciplinary research and collaboration between climate experts and public health professionals, in addition to capacity building.

The training courses also provided an empowering environment in which members of the public health and climate communities could exchange ideas and form collaborations for forthcoming projects based on the use of climate information for public health.

The courses were well planned and effectively fulfilled the participants' expectations. The members of the Malagasy CHWG acknowledged that the materials, as tailored from these of the Summer Institute on Climate Information for Public Health and translated in French, provided them with new skills that should be useful for their own work and institutions. The daily review sessions ensured the main messages had been successfully understood and were well appropriated by the course's participants. It was recommended, however, that more time be allocated to practical sessions in order to increase the participants' proficiency in manipulating climate and public data and the Data Library.

The group pilot projects offered to the members of the Malagasy CHWG the opportunity to apply their newly acquired skills and paved the way for enhanced surveillance and control of the three main climate-sensitive diseases of public health significance in Madagascar: malaria, plague and RVF.

It is hoped that these efforts will benefit the planning and implementation of climate-sensitive disease prevention and control programs in Madagascar. It is hoped as well that participants to these courses will be able to contribute to a network of trainers, delivering training courses for their peers in the country, in particular at the more peripheral level. This progress will be followed up in the Climate Information for Public Health Action newsletter.

Appendix

Appendix 1: Evaluation Questionnaires

Initial Evaluation

1/The presentations were easy to understand.
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree
If you disagree, which improvements would you suggest?

2/Which session did you find most difficult?

3/The guidelines to complete the exercises were easy to follow.
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree
If you disagree, which improvements would you suggest?

4/Do you feel that the knowledge and skills you gained during this course will be useful for your work? Please, comment further.

5/The topics addressed during this training course matched your expectations.
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree
If you disagree, please explain.

6/Do you have any suggestions for the next training course (topics, duration, organization)?

Intermediate Evaluation

Thank you very much for participating to the second training on climate information for public health in Madagascar.

Please take a few minutes to answer the questions below, which relate to the knowledge you gained during the first training. We would very much appreciate you share your thoughts and suggestions with us. This questionnaire is anonymous and only aims to improve the quality of training courses to come.

The questions you'll need to answer are divided into three parts: true / false, multiple choice, and definition/short answer questions. Each part has its own instructions, please read them carefully.

The total duration of this test is 45 minutes. GOOD LUCK!

PART I. TRUE OR FALSE QUESTIONS

For each of the statements below, please indicate T for true or F for False.

1. Climate is conditions averaged over long periods, generally at least 30–50 years.

2. Weather is an average condition of the atmosphere near the earth's surface over 10 year's period

3. Climate is what we expect and weather is what we get.

4. Cluster analysis is a particularly useful method when you are classifying multiple attributes.

5. Advancement in GIS technology assisted the development of malaria risk map and seasonal predictions using satellite-derived environmental data.

6. The inter-annual variability of malaria is not related to climate variables.

PART II. MULTIPLE CHOICE QUESTIONS

Circle the correct answer and put the mark "X" if you finally change your answer.

8. Which of the following variables are climate-related?

a. Rainfall
b. Cloudiness
c. Sea Surface Temperature
d. Only a and c are correct
e. Humidity
f. All of above

9. Which of the following are sources of climate data?
a. Meteorological stations
b. Ocean observation
c. Satellite
d. Only a and c
e. All of above

10. Climate data is described using a variety of units of measure. How is rainfall measured?
a. Millimeters / day
b. Millimeters / every six days
c. Millimeters / ten days
d. All of the above
e. None of the above

11. Which one of the following is/are temperature dependent stages in malaria transmission?
a. Sporogonic cycle (duration of parasite development)
b. Gonotrophic cycle (duration of larval development)
c. Daily vector survival
d. Vector survival after period required for sporogony

e. All of the above
f. A and b are answers

13. The major advantage of seasonal climate forecasting over case surveillance in malaria early warning system is due to its:
a. Timeliness
b. Accuracy
c. Cost effectiveness
d. None of the above

PART III. BRIEF RESPONSE QUESTIONS

Answer the following questions.

14. Define the following geographic terms used to describe climate information:

a. Latitude_____
b. Longitude _____
c. Geographic coordinate systems_____
d. Spatial scale_____
e. Grid _____

16. Describe the following climatic terms:
a. Climate variability _____
b. Climatology_____
c. Forecast _____
d. Anomaly_____

17. Describe the following epidemiological concepts:
a. Incidence _____
b. Prevalence _____
c. Risk ratio_____
d. Odds ratio_____

19. Cite three uses of the climate information to improve health outcomes.

Thank you for your time and answers!

Overall Evaluation

Thank you for participating in the Second Training on Climate Information for Public Health, 2010.

Your input regarding this full course will greatly improve future planning and course implementation. Please let us know your feelings about the overall course content, design, and delivery. Your answers are anonymous.

We greatly appreciate your time and input!

Objectives

1. The objectives of the course were stated clearly.
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

2. My expectations of the course were met or exceeded (please explain your answer below)
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree
Please, comment further.

Course Content

3. The course content covered an appropriate level of depth
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

4. The content was delivered in way that was clear and easy to understand
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

5. The content was coherent with the objectives of the course
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

6. The course content was engaging
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

7. There was coherence between assigned work (i.e. small projects) and the course objectives
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

8. What topics of the course were most instructive to you? What did you learn that was most valuable?

Global Transferability of Course Content

9. Was the content of the course relevant to you geographical region and organization?
Please provide details about what or was not relevant.

10. What part of the course was the MOST relevant to your work?

11. What part of the course was the LEAST relevant to your work?

Course Design

12. The design of the course allowed me to learn at my own pace
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

13. The course design helped to reinforce my understanding of the content
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

14. There was enough time and opportunity to engage in practical, hands-on work
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

15. Please provide us with any other comments you have on the course design

Course Delivery

16. Course materials (i.e. readings) were appropriate and helped me to learn the course content
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

17. Course facilities (i.e. computers, meeting spaces) were appropriate for the course
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

18. Course facilitators were available to answer the questions I had about the course content
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

19. The staff from the IRI was available for networking and discussion
Strongly agree / Agree / Neither Agree nor Disagree / Disagree / Strongly Disagree

20. Please provide us with any other comments you have on the course.

21 Did you experience any significant problems during the courses? For example, was language a problem? Or were the materials too technical or too challenging? Not challenging enough? Please describe below.

Thank you for your answers and participation to the training courses on Climate Information for Public Health!

Appendix 2: Profile of the Facilitators and Participants

Name	Organization and Area of Interest
Partners involved in the preparation and facilitation of the training[7]:	
Dr Yolande Nirina RAOELINA	Public Health Coordinator of the CHWG of Madagascar Head of the Applied Research on Climate and Meteorology department,, DULM, VPMSP
Nirivololona RAHOLIJAO	Climate/Meteorology Coordinator of the CHWG of Madagascar Director-manager of the Public Health Emergencies and Control of Neglected Diseases Department,, DGM
Dr Marie Clémence RAKOARIVONY	SI09 Alumna Focal Point for Malaria in the Madagascar CHWG Head, Malaria Surveillance and Control Unit, DGAS/PTS, VPMSP Member of the Malaria Small Project Team
Dr Mavoarisoa Huguette RAMIAKAJATO	Focal Point for Plague in the Madagascar CHWG Head, Plague Surveillance and Control Unit, SLMER/DURLM, VPMSP Member of the Plague Small Project Team
Dr Lalao Madeleine RAZAFINDRAMAVO	Focal Point for RVF in the Madagascar CHWG Head, RVF Surveillance and Control Unit, SLMER/DURLM, VPMSP Member of the RVF Small Project Team
Dr Fanjasoa RAKOTOMANANA	Main organizer on the Pasteur Institute side GIS and plague research specialist Member of the Plague and Malaria Small Project Teams
Dr Luciano TUSEO	Head, Malaria Control and Emergencies World Health Organization (WHO) Madagascar Office

[7] *Were also involved in the workshops as participants, except for IRI and WHO staff members*

Dr Pietro CECCATO	SI 08-10 Facilitator Associate Research Scientist, IRI Remote Sensing
Dr Laurence CIBRELUS	SI08 Alumna, SI 09-10 Facilitator Staff Associate, IRI Public Health
Remi COUSIN	SI08-09 Facilitator Staff Associate, IRI Data Library
Dr Gilma MANTILLA	SI08-10 Facilitator Senior Staff Associate, IRI Public Health
Dr Judy OMUMBO	SI 08-10 Facilitator Associate Research Scientist, IRI Epidemiology of Malaria

Participants to the training:

Health Sector

Dr Lalao Sabas RABESAHALA	Disease Epidemiological Surveillance, Prevention and Control SUREPI/DULM, VPMSP Member of the Malaria Small Project Team
Dr Norohasina RAKOTOARISON	Environmental Health SSEnv/MSPF, VPMSP Member of the Plague Small Project Team
Dr Nivoarimanana ANDRIAMAMPIANINA	Communication SCM, VPMSP Member of the Plague Small Project Team
Dr Manuela Christophère VOLOLONIAINA NIVOARISOA	Health Emergencies and Disasters Management SURECA/DULM, VPMSP Member of the RVF Small Project Team

Veterinary Sector

Dr Emilie VOAHANGINIRINAHARIVONY[8]	Focal Point for RVF in the Veterinary sector SLMA/DSV

[8] *Only attended the first workshop*

Climate Sector

Leon Guy RAZAFINDRAKOTO[9]	Head, Weather Forecast (former) DGM Member of the FVR Small Project Team
Solonomenjanahary ANDRIANJAFINIRINA[10]	Head, Weather Forecast (current) DGM Member of the FVR Small Project Team
Herinjanahary RALAIARINORO	Head, Hydrology DGM Member of the Plague Small Project Team
Sahondra Vololoniaina RANIVOARISOA	Head, Climate and Climatology DGM Member of the Plague Small Project Team
Voahanginirina Anne Marie Pierrette RAMIANDRISOA	Head, Climate Variability and Applications DGM Member of the Malaria Small Project Team

Auditors

Hanta ANDRIANAVALONA	PhD candidate GIS and Health
Dr Herizo RAJAONARY[11]	Disease Surveillance and Control National Institute of Public and Community Health, University of Antananarivo
Dr Alain RAKOTOARISOA[12]	Disease Surveillance and Control National Institute of Public and Community Health, University of Antananarivo

[9] *Only attended the first workshop*

[10] *Only attended the second workshop*

[11] *Only attended the second workshop*

[12] *Only attended the second workshop*

Appendix 3: Contact information

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Misaotra Tompoko!