Calling for rain

WORKSHOP REPORT

SEASONAL CLIMATE MONITORING FOR INDOCHINA

Organized by the Indochina Global Change Network (IGCN*), with technical support from the University of East Anglia (UEA, UK) and the International Research Institute for Climate Prediction (IRI, USA)

Local organization by the National Disaster Management Office, Vientiane, Lao PDR

Sponsored by the US National Oceanic and Atmospheric Administration (NOAA) and the World Meteorological Organization (WMO)

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July 12-16th 2004

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This report was prepared by the workshop participants.

The cover photo, the Lord Buddha in the "calling for rain" pose, was taken at Wat Pha Kaew, Vientiane, Lao PDR. © 2004 Mick Kelly

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Executive summary

Climate hazards, including changes in the frequency of extreme events such as flooding, prolonged drought or heatwave and an early or late start to the rainy season, have a major impact on the nations of the Indochina region. These events affect health and welfare, may result in loss of life or livelihood, property and public infrastructure, and can damage national economies and set back development.

Can we prepare more effectively and avoid the worst impacts of climate hazards? Seasonal climate monitoring represents the first step in developing the ability to anticipate and thereby manage climate impacts more effectively.

Climate monitoring is relevant not only to hazard management, poverty alleviation and sustainable development in the short-term, but also represents a first step in improving the capacity to respond to long-term climate change resulting from human activity, a goal of the United Nations Framework Convention on Climate Change.

The workshop, "Seasonal Climate Monitoring for Indochina", was held in Vientiane, Lao PDR, in July 2004. The workshop was the latest stage in a multi-year effort to strengthen the capacity of the nations of Indochina to respond to extreme climate variability associated with El Niño and La Niña events and other processes. These activities have been organized by the Indochina Global Change Network (IGCN).

The purpose of the July 2004 workshop was:

- to share experience in the production of seasonal climate monitoring bulletins, both across the Indochina region and with other areas;
- to promote discussion between bulletin 'producers' and 'users'; and,
- to plan the resourcing of the proposed climate monitoring bulletins.

The workshop took the form of a working meeting with formal presentations mixed with informal contributions, interactive group exercises and discussion. The workshop participants consisted of country teams from Cambodia, Lao PDR and Vietnam and an international support team.

The country teams consisted of representatives from the National Meteorological and Hydrological Services or the broader meteorological community and representatives from the 'user' community (mostly representatives from relevant government ministries). The international support team consisted of individuals, experienced in climate monitoring and forecasting and in promoting user participation, from Australia, New Zealand, the United

Kingdom and the United States. The team was joined by Buruhani Nyenzi of the World Meteorological Organization.

The outcome of the workshop was the design of a monitoring scheme for the nations of Indochina, including an assessment of resource needs and funding possibilities.

The workshop participants adopted the following resolutions and recommendations.

- The workshop recognized the pressing importance of seasonal climate monitoring and the production of seasonal climate bulletins for all nations of the Indochina region to assist the management of natural disasters and longer-term climate disruption. These activities will also prepare these nations to manage the impact of long-term climate change, including trends resulting from human activity, and support the sustainable development of the region.

- The workshop recognized the excellent start in monitoring climate variability already made in all nations of Indochina through scientific work, supporting institutional structures and strong government support. It was noted though that, in all cases, the development of this work was severely limited by resource constraints, both human and financial.

- The workshop strongly recommended that bulletin production and the dissemination of information and advice should be a cooperative process between bulletin producers and users, not only in the design of the bulletin (content and style) and its distribution but in the provision of information concerning impacts and on-going feedback on the use and value of the bulletins.

- The workshop recognized that intergovernmental cooperation at the regional level was essential if each national bulletin was to take full account of the regional context and take advantage of resources available at the regional level, including the combined expertise of the regional scientific community. Cooperation with the international scientific community was also deemed essential in order to ensure the flow of information and continuing support to the region.

- Finally, the workshop participants requested that the international community recognize the pressing nature of the need for improved seasonal climate monitoring in the nations of Indochina, in the context of the existing frameworks of the World Meteorological Organization and the United Nations Framework Convention on Climate Change, and of the broader science, policy and donor communities. The provision of new and additional financial and technical resources by development partners will be vital if seasonal climate monitoring is to support present-day development goals and contribute to the long-term environmental security of the nations of Indochina.

Background

Climate hazards, including changes in the frequency of extreme events such as flooding, prolonged drought or heatwave and an early or late start to the rainy season, have a major impact on the nations of the Indochina region. These events affect health and welfare, may result in loss of life or livelihood, property and public infrastructure, and can damage national economies and set back development.

Can we prepare more effectively and avoid the worst impacts of climate hazards? Seasonal climate monitoring represents the first step in developing the ability to anticipate and thereby manage more effectively climate impacts.

Climate monitoring is relevant not only to hazard management, poverty alleviation and sustainable development in the short-term, but also represents a first step in improving the capacity to respond to long-term climate change resulting from human activity, a goal of the United Nations Framework Convention on Climate Change.

The project, "Seasonal Climate Monitoring for Indochina", is the continuation of a multi-year effort to strengthen the capacity of the nations of Indochina to respond to extreme climate variability associated with El Niño and La Niña events and other processes. These activities have been organized by the Indochina Global Change Network (IGCN) and supported by the Asia-Pacific Network (APN), National Oceanic and Atmospheric Administration (NOAA) and the Netherlands Foundation for the Advancement of Tropical Research (WOTRO). The IGCN is a non-governmental network of scientists in the region working cooperatively on global environmental change and related issues, see Appendix A. The current meeting focused on the nations of the IGCN: Cambodia, Lao PDR and Vietnam[1].

The on-going project is coordinated with regional initiatives, such as the ASEAN Specialized Meteorological Centre (ASMC), Singapore, and with international programmes such as the World Meteorological Organization (WMO) Climate Information and Prediction Services (CLIPS). The project complements and supports these programmes by providing training and developing projects tailored to the specific needs, strengths and aspirations of the Indochina nations. Participants are then able to take full advantage of the opportunities afforded by other initiatives. Activities have also been planned with the full support and cooperation of the National Meteorological and Hydrological Services and other relevant organizations in each country.

The first project workshop "The Impact of El Niño and La Niña on Southeast Asia" was held in February 2000 in Hanoi, Vietnam, to review understanding of the impact of the El Niño – Southern Oscillation (ENSO) phenomenon on the region. The meeting resulted in a series of recommendations for action (www.cru.uea.ac.uk/ tiempo/annex/igcn/igcn2000.htm).

[1] Myanmar, though not a formal network member, is involved informally in network activities. The IGCN contacts there will receive full details of the results of the workshop.

On the basis of one such recommendation, and following IGCN discussions in Cambodia, Lao PDR and Vietnam in January 2001, a second training workshop "Forecasting El Niño and La Niña in Indochina" was held in January 2002 in Hanoi, Vietnam. One specific aim of this workshop was to develop practical recommendations for action that would strengthen local capacity.

Since the 2002 workshop, a number of recommendations have been acted upon.

- A website has been developed that collects monitoring and forecast information from various sources (www.cru.uea.ac.uk/tiempo/annex/igcn/ircf/), updated automatically in real-time, and a copy of the website has been sent on CD ROM to each country for a trial period.
- A member of the international support team, Simon Mason, visited the region to advise scientists in the national meteorological centres on data collation and forecast techniques and to assess requirements for future support during summer 2002 (www.cru.uea.ac.uk/tiempo/newswatch/feature040609.htm).
- In addition, the workshop led to the on-going development of various activities at the national level, as discussed later in this report.

The theme of the current workshop, the production of seasonal climate bulletins, was determined during discussions at the January 2002 meeting and subsequent interaction.

It was decided that a common focus for activity across the region would be the development of national seasonal climate bulletins, in the first instance based on monitoring information (climate and impacts). Vietnam is already producing such a monthly climate bulletin, though with limited distribution. No such work is being undertaken in Cambodia or Lao PDR.

The bulletins would cover all aspects of monthly to seasonal climate variability. El Niño and La Niña effects are spatially diverse across the Indochina region and, even in the most-affected country, Vietnam, it is only in certain places and at certain times that they exert a marked influence. Varied influences on the monsoon circulations of the region play a critical role in determining the character of the seasonal climate and its impacts.

The longer-term aim would be to extend these monitoring bulletins with climate outlook information: assessment of future prospects drawn from international sources, ultimately supplemented by forecasts generated within the region. This aspect was not, however, covered in any detail at the July 2004 workshop.

The early engagement of users of this information in the process of bulletin design and production is a major goal of the exercise, ensuring that users' needs are met and that there is broad awareness of the need for preparedness.

Workshop aims, format, participants and agenda

The purpose of the July 2004 workshop was:

- to share experience in the production of seasonal climate monitoring bulletins, both across the Indochina region and with other areas;
- to promote discussion between bulletin 'producers' and 'users'; and,
- to plan the resourcing of the proposed climate monitoring bulletins.

The intended outcome of the workshop was the design of a monitoring scheme for the nations of Indochina, including an assessment of resource needs and funding possibilities.

To be successful, it was recognized that the monitoring scheme must:

- be appropriate to the circumstances of each nation of the region;
- take full advantage of local skills;
- be implemented on a local basis in a sustainable fashion, with adequate human and financial resources; and,
- take full account of user needs.

The workshop took the form of a working meeting with formal presentations mixed with informal contributions, interactive group exercises and discussion, following the successful format of the 2002 meeting. The agenda is reproduced as Appendix B of this report. All the formal presentations, along with other relevant material, were given to the participants on CD ROM.

The workshop participants consisted of country teams from Cambodia, Lao PDR and Vietnam and an international support team. They were joined on the first day by around 25 guests from ministries, NGOs and other organizations in Lao PDR.

The country teams consisted of representatives from the national meteorological services or the broader meteorological community (1-3 from each country) and representatives from the 'user' community (3-4 from each country). The representatives from the user community generally were from government ministries responsible for various user sectors (e.g. disaster management, agriculture, water resources and health).

The international support team consisted of individuals, experienced in climate monitoring and forecasting and in promoting user participation, from Australia, New Zealand, the United Kingdom and the United States. The team was joined by Buruhani Nyenzi of the World Meteorological Organization, whose invaluable contribution to the workshop is gratefully acknowledged.

The list of participants and guests is presented in Appendix C.

Phoukhieo Chanthasomboun, Head of the Cabinet of Ministry of Labour and Social Welfare, Lao PDR, opened the meeting on behalf of the host nation. During the first day, a series of presentations placed the work of the meeting in its larger context, considering the topic of seasonal climate variability (Simon Mason), user needs (Roger Stone), lessons from the 1997/98

El Niño-Southern Oscillation event (Bill Kininmonth) and the role of the World Meteorological Organization in climate monitoring and forecasting, including the ENSO Warnings (Buruhani Nyenzi). Relevant initiatives aimed at the production of monitoring bulletins and supporting activities were then presented from other parts of the world, notably the Pacific and Asia (Pene Lefale and Simon Mason).

On the following day, the participants heard of progress towards seasonal monitoring and prediction in the three nations of Cambodia (Seth Vannareth), Lao PDR (Vandy Douangmala) and Vietnam (Tran Viet Lien). The importance of user needs in the preparation of seasonal climate bulletins was then presented with examples from other parts of the world, including Africa, Asia and Australia (Simon Mason and Roger Stone). Later in the workshop, the availability on the Internet of data, forecasts and other information from the international community was defined (Simon Mason).

The remainder of the workshop consisted of group exercises and discussions, supported by informal presentations by the international support team and country delegates, all directed towards the key workshop goal, the preparation of an action plan for the development of seasonal climate bulletins in the nations of the Indochina region. The exercises were designed to draw out user needs, information needs and availability at the national, regional and international level, resource constraints and ways of organizing at the national and international level. This led to the preparation of national proposals for the development of seasonal climate bulletins and supporting activities at the regional and international level on the final day.

The exercises were undertaken as small-group activities, where the groups were made up of national teams or, on a regional basis, information providers (meteorologists and climatologists) or users (representing various sectors), as appropriate. This enabled needs to be defined, both nationally and regionally, and promoted interaction between bulletin providers and users and between nations. See the agenda in Appendix B for further details.

The following sections present the main results of the workshop.

Current climate monitoring activities

Vietnam

There has been a long history of climate monitoring in Vietnam. The Indochina Climate Monitoring Bulletin was initiated in 1927 and published monthly in French. An annual review of the climate was also published in French. The bulletins contained reports on meteorological data for up to 40 stations, and rainfall for up to 60 stations. The reports contained information on temperatures, humidity, wind speed and direction, and comments on any special phenomena such as tropical cyclones. The annual bulletin contained information from Vietnam, Lao PDR, and Cambodia, and contained data for air pressure, temperature, humidity, rainfall, sunshine, cloudiness, and information on phenomena such as fog and storm occurrence. After 1954, the bulletins contained information only for Vietnam and Lao PDR until 1975. During this period, upper air data were added.

From 1975 to 1998, the bulletin changed its name to the Climate Bulletin of Vietnam. This was an annual summary report of climate, tropical cyclone activity, and the winter monsoon. The bulletin was published in Vietnamese only. Monthly records were generated, but were not distributed.

Since 1999, with the commencement of the project "Experimental Study on Climate Forecast in Vietnam" bulletins have been issued by the Institute of Meteorology and Hydrology on a quarterly basis, together with an annual review. The bulletins provide the latest information on the climate of Vietnam using 140 stations throughout the country, together with a description of climatic conditions beyond, including the ENSO phenomenon, tropical cyclone activity in the north-western Pacific and South China Sea, and monsoon activity (mainly the winter monsoon) and low-latitude trade winds. The quarterly bulletin reviews the climate anomalies of the previous season (rainfall, temperature, sunshine, evaporation and humidity, extreme events), and provides an outlook for Vietnam for the coming three months based on information from the Climate Prediction Centre (CPC), the European Centre for Medium-Range Weather Forecasts (ECMWF), and the International Research Institute for Climate Prediction (IRI).

The quarterly bulletin is published on the website of the National Centre for Hydro-Meteorological Forecast (www.nchmf.gov.vn/khihau/TBKH.htm) because the Institute of Meteorology and Hydrology does not yet have its own site. The bulletin is published only in Vietnamese. Given the target audience (there are currently about 40 users of the bulletin, most of whom are policy makers), the language of the bulletin is appropriate, although the value of having an English version for the international community is appreciated.

Cambodia

Climate monitoring in Cambodia is severely hampered by data problems. Data for currently operational stations are available only since 1981, and only for 5 stations located in the southern half of the country. Nine automatic weather stations (AWS) were implemented in 1992; measurements are primarily of temperature and precipitation because of a lack of instrumentation for other parameters.

There are serious problems in obtaining the data from the provinces. Although daily reports are received via Single SideBand (SSB), there are numerous mistakes and data quality problems, and so these cannot be used to generate monthly summaries. Instead, the data records have to be collected manually by visits to the stations, which occur only once per year. As a result, there is no way of assessing the current state of the seasonal climate in Cambodia on a real-time basis.

There is a pressing need for data rescue. In many cases, earlier data from archives destroyed during the 1970s could be replaced from foreign sources, though gaps in station records during this period will remain.

The data currently available are insufficient for seasonal climate forecasting, though good progress has been made in investigating the predictability of climate for Cambodia. Accordingly, seasonal climate forecasts are not currently generated on a routine basis, but some information is made available to other government departments upon special request. This information is not released to the general public.

Lao PDR

Lao PDR has 17 synoptic stations, and 33 secondary stations. Only 7 of these have been upgraded. There are an additional 113 rain gauges. Communication links between the stations and the headquarters in Vientiane are adequate, and there are additional links for data exchange with Bangkok and Vietnam. There is, however, some concern about the ability to maintain these communication links with funding for the Global Telecommunications System (GTS) connections, for example, due to end shortly. There is also a need to upgrade the software of the meteorological service in order to manage the climatological data better.

Weather forecasts are released routinely via the media in both English and Lao (and there are plans to release the forecasts in French), and forecasts are provided directly to the National Disaster Management Office which is responsible for liaison with other ministries. Experimental seasonal forecasts are being produced, but further training is required to improve these, and these seasonal forecasts are not widely accepted; there is a much stronger reliance at the community level on traditional methods of weather and climate monitoring and forecasting.

Identification of user needs in climate monitoring

Participants at the workshop first discussed user needs at the national level, considering which sectors were most important, the desired spatial and temporal scale of monitoring information, and what derived data (crop yields, for example) were required. A number of common themes emerged and provided the basis for regional group discussion on a sector-by-sector basis.

On the basis of these discussions, priority sectors that would benefit significantly from additional support through climate monitoring were identified. Though presented here on a sectoral basis, the workshop participants strongly endorsed the recommendation that an integrated system is needed to manage the flow of information both to and between the various sectors to ensure that all user needs are met.

Water resource management

Water resource management included aspects associated with hydroelectricity power generation, irrigation management/scheduling, and groundwater recharge (especially for urban water needs). Additionally, aspects related to water transport operation were highlighted where, for instance, water transport systems could be severely disrupted due to flood events. There was a strong call from the participants for major interactive programmes and activities where major water authorities (for example, the Mekong River Commission, now based in Vientiane) are concerned. Flooding crises are major issues for the region and improved climate monitoring and

reporting were identified that would potentially provide enormous improvements in management and protection during floods and associated natural disasters. Additionally, there are major irrigation management systems and allocation processes in place in Indochina which would benefit greatly from an integrated monitoring and outlook service that could, in part, be tailored for their particular needs.

Agricultural management needs

Issues identified in the agricultural sector included improved drought management plans and management plans for other extreme climatic events for key industries in the region such as coffee, pepper, sugar cane, rice (glutinous and non glutinous), tobacco, maize, soybean, rubber, peanut, and cacao. It was stressed that these improved management requirements could extend beyond farmer needs to harvesting, milling, and key import and export aspects that can affect the entire region's food security and economic development to a major extent. Additionally, climatic variation and change has and will have major impacts on fishing industries in both river systems and in major offshore fisheries. It was stressed that better monitoring and understanding of the key climatic drivers on these industries would have major benefits in terms of improved risk management and also the ability to capitalize on the potentially better seasons when they occur.

Health issues

Major issues associated with health management aspects were identified at the workshop. Climatic variation is known to have major impacts on diseases common to the region such as malaria, dengue fever, 'bird flu', SARS, skin diseases, and eye diseases. Such health issues were highlighted by all nations represented at the workshop as requiring urgent attention, especially as their increased prevalence in certain seasons is understood to be strongly related to climatic variability. Improved monitoring, reporting, and understanding of key climate patterns affecting the region is believed to offer the potential for much improved management and mitigation of the associated large and serious health problems in Indochina. Issues associated with water resource management have direct relationships with health issues where flooding or drought can have a major impact on water quality with subsequent increased risk of disease.

Industrial needs

Needs for secondary industry included aspects related to security of energy supply, often also related to hydroelectric power generation. Hydroelectric power generation as a source of energy in industry and urban needs, as well as for export and import, fluctuates with climate variation, especially rainfall timing and spatial distribution. It was believed improved knowledge and closer monitoring of climate variation and change over the region could greatly improve capabilities in energy generation, storage, and supply. (This aspect also attracts considerable interest from industry in other countries and regions.) Additionally, growing urban development in the region means considerable benefit would be obtained from increased integration of relevant climate information and services with the construction industry. In this instance, improved planning for wet weather disruption would be just one example where better monitoring of seasonal climate patterns could greatly assist the construction industry in the region. Similarly, for the offshore oil industry, improved monitoring of seasonal climate patterns

would significantly assist management and scheduling of oilrig operations, particularly in typhoon affected areas. Finally, the tourist industry, including health and welfare, was identified as a major concern and must be considered when developing seasonal monitoring programmes.

Monitoring issues

Emerging from the user needs exercise was the definition of the spatial and temporal scales on which climate monitoring information was needed and this assessment was fed back to the climate group for review.

As far as spatial scale was concerned, it was concluded that information was needed at a minimum resolution of the provincial level and upwards. This assessment took account of both the nature of the spatial climate variability in each nation and the manner in which monitoring information would be used.

The temporal resolution of the monitoring should be monthly, that is a seasonal assessment updated at monthly intervals. It was recognized, though, that certain user activities would benefit greatly from a higher frequency of updates of specific information at critical times of the year (such as the planting season). Interaction between the climate monitoring process and synoptic and medium-term weather forecasting and flood prediction efforts would be necessary in these cases.

Workshop proposals

On the basis of the preceding assessment of the current monitoring situation and user needs, workshop participants then prepared concrete proposals for bulletin production and related activities. Two main proposals emerged. The first proposal concerned the production of national climate bulletins. The second proposal concerned the application of the monitoring information: research on traditional methods of climate monitoring and forecasting. Both proposals were developed during the final stages of the meeting by the workshop participants from the Indochina region, with assistance from the international support team.

Proposal: The production of national seasonal climate bulletins

Information flow

The workshop participants found that an information flow schematic produced by the climate group was a useful way of conceptualizing the structure of the activities supporting bulletin production and identifying priorities (see Figure 1 on page 19).

Producing seasonal climate bulletins requires, first, that the data and information on which the bulletins are based is available to the bulletin producers and, second, that the resulting bulletins should be produced in close cooperation with, and widely distributed to, the user community. Adequate communications and information flow are, therefore, critical. Yet even the requirement

that in-country data are available to the bulletin producers presents a serious challenge in some cases, as discussed below.

The schematic shows, in the lower half, the main sources of information (data, forecasts and other relevant information) at the international level that would be needed in preparing a national monitoring bulletin. There is a need for a regional 'node' that would provide easy access to this information for the Indochina nations. The workshop participants concluded that the regional node should be a 'virtual' communication centre for the project in the first instance, based around a website. At a later stage, this node could be considered by WMO Regional Association II as a formal regional climate centre for the region.

At the national level, existing structures developed for, for example, natural hazards management (coping with individual floods, storms, etc) would provide a good basis for the dissemination of seasonal climate monitoring information and the development of a capacity to respond to warnings regarding climate hazards on monthly and longer timescales (such as the likelihood of a higher frequency of flooding or the build-up of drought).

The National Meteorological and Hydrological Services would have the major responsibility for bulletin production and issuance of any related advisories or warnings. A coordinator would be necessary to involve the user community fully in the process of bulletin production and dissemination. The location of this coordinator within each national structure would be dependent on national circumstances.

The workshop participants recognized that, ultimately, information flow in both directions between all the stakeholders represented in the schematic would be necessary and/or desirable, but focused on priority flows that could be implemented in the foreseeable future.

Two 'tracks' were identified through which the priority information flows could be implemented on a timescale of months to a few years (see Figure 1 on page 19; the thickest arrows refer to the fast-track priorities and the thinner arrows refer to the slow track).

The 'fast track' is based on activities that can be implemented in the immediate future with a relatively low level of financial support and that would provide a sound foundation for further development. Implementing these activities can be undertaken at the national level, with informal support from outside the region through the project website discussed above and without a need for formal approval of intergovernmental cooperation within the region. In terms of organizational structure, then, the fast track consists of a) formal activities at the national level and b) informal project activities, largely undertaken by the international support team, to enable the effective flow of information from the international level to the regional level where it will be available to each nation. At the national level, the workshop participants resolved to act immediately and set in motion the development of national structures as a first step in the fast-track activities.

The 'slow track' is equally important but will take longer to develop. This track involves the extension of the fast-track structure with intergovernmental cooperation in the region, under the auspices of the World Meteorological Organization (WMO). Through this process, the creation

of a formal regional climate monitoring centre for Indochina could be considered. Such a centre could take over the interim, informal activities aimed at effective communication of information from the international to the regional level.

The National Meteorological and Hydrological Services (NMHSs) of the region, as well as relevant regional and international initiatives, have been directly involved in the project since its inception. It was noted that the continued support of the NMHSs, especially the Directors Generals, for the project and their full involvement in slow-track activities would be essential for the success of this process. Plans for follow-up activities to facilitate the development of formal intergovernmental cooperation in the area of seasonal climate monitoring will be discussed later in this report. The Director Generals of the NMHSs from the region will meet for the Thirteenth Session of Regional Association II in Hong Kong in December 2004.

Consideration of the existing flow of information at each level identified serious constraints, communications problems, which must be addressed if the national bulletins are to be feasible and effective.

In Cambodia, for example, monthly climate data for the country are only collated once each year, largely because there is no timely means of communications between the provincial stations and the central department for routinely collecting and collating error-free data on a more frequent basis. As a result, there is currently no means of assessing the current state of the national climate on a timely monthly or seasonal basis. In Lao PDR, the national meteorological service has limited access to the Internet which creates serious problems in obtaining regular information (such as updates of larger data sets or even complex graphics) from the international community.

In developing seasonal climate monitoring, workshop participants concluded that these, and other infrastructure problems, mostly related to local and regional communications issues, must be addressed as a matter of urgency.

Fast-track proposal: the production of national climate monitoring bulletins

The ultimate outcome of these activities is that the National Meteorological and Hydrological Service (NMHS) of each country will prepare a regular climate monitoring bulletin (CMB) directed to meeting user needs in the main sectors. The national proposals are summarized in the following paragraphs.

Cambodia

Extreme climate events (floods, droughts) cause hundreds of millions of dollars worth of damage to the economy of Cambodia and significant loss of life each year. Despite this, Cambodia does not have a seasonal climate monitoring programme. This project proposal seeks to establish the required infrastructure support to fast track the establishment of such a programme.

The main goals of this proposal are as follows.

- To establish a seasonal climate monitoring programme for Cambodia as the basis for a national centre for climate research, knowledge, technology, information, services and products.
- To work in close partnership with stakeholders at all levels (local, national, regional and international) to produce and distribute specifically-tailored and locally-relevant monitoring products for Cambodia to mitigate the impacts of climate-related disasters on climate-sensitive sectors and create new business opportunities that optimize the use of Cambodia's climate-dependent natural resources.

The main objectives are:

1. to re-align Cambodia's Department of Meteorology's services to establish the required infrastructure support for this programme, including internal data collection and Internet access, by the end of 2004;
2. to produce and distribute seasonal climate bulletins for Cambodia;
3. to strengthen links, including communications infrastructure, with stakeholders, including end users of climate information, services and products at all levels – local, national, regional and international; and,
4. to enhance the scientific and technical capacity of staff of the Department of Meteorology assigned to the programme.

Implementation of the programme will require the following actions and infrastructure support.

- As a priority, obtain resources to ensure timely (monthly) transfer of climate data from the provinces to the national office.
- Recruit and/or re-assign current climate scientists and other staff from the Department of Meteorology, in close consultation with other government departments and end users, to fast track the establishment of the required infrastructure support.
- Secure funding to purchase and install a computer network (minimum 3 computers), with Internet access, appropriate software programmes and back-up services specifically assigned for the programme.
- Engage a computer expert to assist programme staff install and run the computer network.
- Undertake in-country consultations with appropriate stakeholders, in particular government departments and local communities to identify specific climate information, services and products' needs at all levels.
- Produce and distribute a seasonal CMB, in Khmer language with a summary in English for Cambodia by June 2005.

<u>Lao PDR</u>

There are infrastructure needs to enable the Department of Meteorology and Hydrology to collect and process national data in a timely manner and to access international information. The national and international information will be integrated, initially at three-month intervals but later monthly. The national CMB will ensure that decision-makers have access to appropriate information related to seasonal rainfall, temperature etc, and the broad-scale controls over any

persisting anomalies. This is a new initiative in Lao PDR and will require initial training of staff, including with staff of other NMHS from Indochina.

Initially, the CMB will be focused on five user groups: agriculture; water resources; transport; health; and tourism.

The Department of Meteorology and Hydrology has a need for:

1. appropriate Internet connection to the Department of Meteorology and Hydrology in order to access regional and global products relevant to climate monitoring;
2. computer software for the preparation of the CMB;
3. training of personnel in the techniques of CMB production, including the integration of national and international data;
4. computer equipment for maintaining the climate database, handling graphics, analysis of data and CMB production; and
5. a website to provide broad national access to the CMB.

Vietnam

The Institute of Meteorology and Hydrology (the component of the NMHS responsible for climate) has commenced production of a CMB on an experimental basis. The objective is to improve the CMB and make it operational. The national proposal, therefore, consists of the following goals.

- To increase the quality of the CMB and make it more relevant to user needs. The focus of the CMB will be on tropical cyclones and the variability of the summer monsoon including the impacts of drought, both of particular concern to Vietnam. This will include expanding information content in order to meet a wider range of users' basic needs. In addition to the published monthly manuscript it is intended to translate the CMB to English and publish it on the Internet.
- To hold workshops with users in the main climate sensitive sectors, both to inform users of the benefits of the CMB and to identify climatological events that are specific to different sector needs.
- Investigate the establishment of activities to support and link the NMHSs of the Indochina countries for the coordinated provision of climate monitoring information in the region. This will include the holding of intra-regional workshops and staff training activities supported by international experts.

Infrastructure requirements

As noted earlier, communications constraints, in Cambodia and Lao PDR in particular, must be addressed if bulletin production is to be successful. In Cambodia, the transfer of climate data from the provinces to the central office at timely intervals (seasonal in the first instance if not monthly) is essential. In both countries, sustained and expanded Internet access to improve electronic communications must be a priority.

User communities

In each country, meetings will be held with representatives of the user communities to brief them on plans for the national bulletins and to discuss methods of organization at the local and national level. This will ensure the full cooperation between the bulletin producers and bulletin users in the design of the bulletins, the preparation of each issue (which will contain impact information as well as climate assessment), distribution and use, and feedback on the value of the bulletins. A user training workshop for each nation will form part of the country proposals.

Funding proposals

Each national team produced a list of requirements for training, equipment, labour and other resources required to undertake the programme activities. These are not documented here but will provide the basis for detailed funding proposals. The international support team and the Indochina Global Change Network will discuss possibilities for financial support with donors as a matter of urgency.

Virtual project centre

All three countries strongly support the need for a website that would serve primarily as a single locus of monitoring and outlook information designed to supply the NMHSs of the respective countries with information at the global and regional scales.

The website would contain information and maps of sea-surface temperatures, descriptions and diagrams of the state of the El Niño Southern Oscillation phenomenon (ENSO), gridded estimates of one- and three-month rainfall and precipitation anomalies, and other such features of the climate. Summaries of outlook information provided by international centres would be included, and would cover ENSO and climate outlooks. Publicly available information on climate impacts in the Indochina region could be included on the website in addition to the climate data and diagrams.

Having a single location from which all the relevant monitoring information can be downloaded by the NMHSs for input into their own national reports would greatly reduce the amount of time required to search and download information. It would also be possible to host compressed versions of the data on the website for faster download. It is not intended to make the web site public, at least initially, since its function is to serve as a data and information repository for the NMHSs.

Initially, at least, the website would be hosted by the International Research Insitute for Climate Prediction, and could be generated easily using automated techniques developed at UEA under the previous stage of the project for generating the ENSO summaries that were sent out by CD ROM. The website can be generated using in-house resources at the IRI and UEA, and with the input of relevant regional products and information routinely generated by institutions such as the Bureau of Meteorology (BOM, Australia), the National Institute of Water and Atmospheric Research (NIWA, New Zealand), and the Queensland Department of Natural Resources (QDNR, Australia). The site will not incorporate data from the NMHSs at this stage.

Ideally, the page should have descriptive content with the diagrams, but realistically the project team members do not have the time or expertise to provide descriptions of the state of the climate in the region. Instead, there was unanimous agreement that an email discussion group be established to act as a forum for asking questions about and discussing recent climate events, most notably the evolution of the southeast Asian monsoon. Experts from the ASEAN Specialized Meteorological Centre, Hong Kong Observatory and other centres in the region will be sought to contribute to the email discussions. The University of East Anglia will develop the technology for this aspect of the website.

The interactive nature of the discussion forum, as opposed to a static description on a web page, is likely to prove the more beneficial option. It could serve training purposes as well as providing a forum for general communication between project participants across the region and with the international support team and other contributors.

At a later date, given approval from the NMHSs for data exchange, the climate component of the web page could be evolved into something like Monsoon On Line (www.tropmet.res.in/~kolli/MOL/). The availability of data for neighbouring countries would allow more effective analyses, but intergovernmental agreement would be required. This would be part of the slow-track activities, discussed below.

The international support team concluded that the website could be developed without the need for funding and is an immediate priority. Financial support will only become necessary as the website is transferred to the region during the course of the slow-track process.

Slow-track proposal

To facilitate the development of regional intergovernmental cooperation, workshop participants agreed to brief the heads of their organizations and other relevant parties on the outcome of the meeting through the preparation of workshop summaries, based on the summary of this report, in their own language and, as appropriate, discussion meetings.

The Director Generals of the NMHSs and the Permanent Representatives of the WMO in each country will be fully briefed during this process. The continuing support of the Director Generals of the NMHSs of the region will provide a strong basis for intergovernmental cooperation.

Coordination will also be beneficial with the National Adaptations Plans of Action programme of the United Nations Framework Convention on Climate Change which is active in the region. Strengthening local capacity to respond to seasonal climate disruption is an important component of any long-term action plan on climate change.

Proposal: Traditional indigenous knowledge of weather and climate monitoring in Indochina

Goals

- To establish a research programme on traditional indigenous knowledge of climate and weather for the Indochina region.
- To document, analyze and integrate traditional indigenous knowledge of climate and weather into seasonal climate monitoring and forecasting in the Indochina region.
- To work in close partnership with stakeholders at all levels (local, national, regional and international) involved in traditional indigenous knowledge research programmes.

Scope of the challenge

Long before the advent of climate models, indigenous communities used traditional ecological knowledge of their environments to monitor changes in climate and weather. This information was used as a basis for routine decision-making regarding weather- and climate-related activities. This knowledge, passed on from generation to generation, enabled, and continues to enable, indigenous communities to manage effectively activities within the annual climate cycle and to reduce, if not eliminate, the impact of climate-related events (seasonal monsoons, interannual variability, floods, droughts, etc).

In recent years, there is increasing recognition that modern scientific tools and techniques alone cannot provide all the answers to complex, non-linear relationships associated with understanding climate-related events. Local knowledge, including traditional indigenous knowledge, is now widely recognized as an important means of improving our understanding of the complex climate system and the effects of climate variability, particularly at the local level.

There is a clear need to integrate modern scientific approaches to monitoring and the management of weather- and climate-related activities with traditional forms of decision-making and thereby reduce the impact of adverse events and take greater advantage of beneficial outcomes. A number of research programmes are now underway to document and explore the application of this wealth of unique knowledge. This proposal is part of this rapidly expanding work.

The work proposed here will not only provide the foundation and baseline data and information on traditional indigenous knowledge for the Indochina region but it will also act as a 'bridging mechanism' between providers and users of climate information and services at all levels. It is of direct relevance to the objectives of the United Nations Framework Convention on Climate Change. In linking climate and sustainable development, this work will also contribute to the fulfillment of national obligations under other international agreements and conventions on the environment, such as the Biodiversity Convention, and development, for example, Agenda 21 and the Millennium Development Goals.

Objectives

1. Establish a traditional indigenous knowledge of weather and climate research programme for the Indochina region to document and explore the application of this cultural heritage.
2. Strengthen links between the meteorological science communities in Indochina and the user communities, in particular, social scientists and planners currently working in local communities to identify and formulate appropriate coping and adaptation response measures and policies to climate-related events and change.
3. Explore the application of, and integrate where appropriate, traditional indigenous knowledge of climate and weather to support preparation of seasonal climate monitoring products, outlooks and decision-making in the Indochina region.

Required actions

- Organize a workshop to review existing information on traditional indigenous knowledge, both regionally and internationally, and use this information to develop a research programme for the Indochina region.
- Establish a traditional indigenous knowledge country focal point in each nation.
- Country focal points to undertake in-country consultations with all stakeholders at all levels (local, national, regional and international) to identify research needs for each country, taking into account lessons and experiences from other similar research programmes elsewhere (USA, Canada, Finland, Australia, New Zealand, Pacific Islands, Africa, India, etc.). This will involve discussion and collaboration with country representatives involved in the formulation and implementation of national enabling activities (such as preparation of National Communications and the National Adaptations Plans of Action) in fulfillment of obligations under the United Nations Framework Convention on Climate Change.

Follow-up activities

Workshop participants adopted the following action points to be implemented immediately following the meeting.

- Brief their own institutions and other relevant parties on the outcome of the workshop.

- Organize a national meeting to discuss the proposed climate monitoring programme and a structure for cooperation with the user community and information dissemination.

- Develop the website to act as a regional communications centre for the project and a link between the national and international levels.

- Ensure coordination with relevant international programmes under the auspices of the World Meteorological Organization and the United Nations Framework Convention on Climate Change.

- Investigate funding possibilities.

Resolutions and recommendations

The workshop participants adopted the following resolutions and recommendations.

- The workshop recognized the pressing importance of seasonal climate monitoring and the production of seasonal climate bulletins for all nations of the Indochina region to assist the management of natural disasters and longer-term climate disruption. These activities will also prepare these nations to manage the impact of long-term climate change, including trends resulting from human activity, and support the sustainable development of the region.

- The workshop recognized the excellent start in monitoring climate variability already made in all nations of Indochina through scientific work, supporting institutional structures and strong government support. It was noted though that, in all cases, the development of this work was severely limited by resource constraints, both human and financial.

- The workshop strongly recommended that bulletin production and the dissemination of information and advice should be a cooperative process between bulletin producers and users, not only in the design of the bulletin (content and style) and its distribution but in the provision of information concerning impacts and on-going feedback on the use and value of the bulletins.

- The workshop recognized that intergovernmental cooperation at the regional level was essential if each national bulletin was to take full account of the regional context and take advantage of resources available at the regional level, including the combined expertise of the regional scientific community. Cooperation with the international scientific community was also deemed essential in order to ensure the flow of information and continuing support to the region.

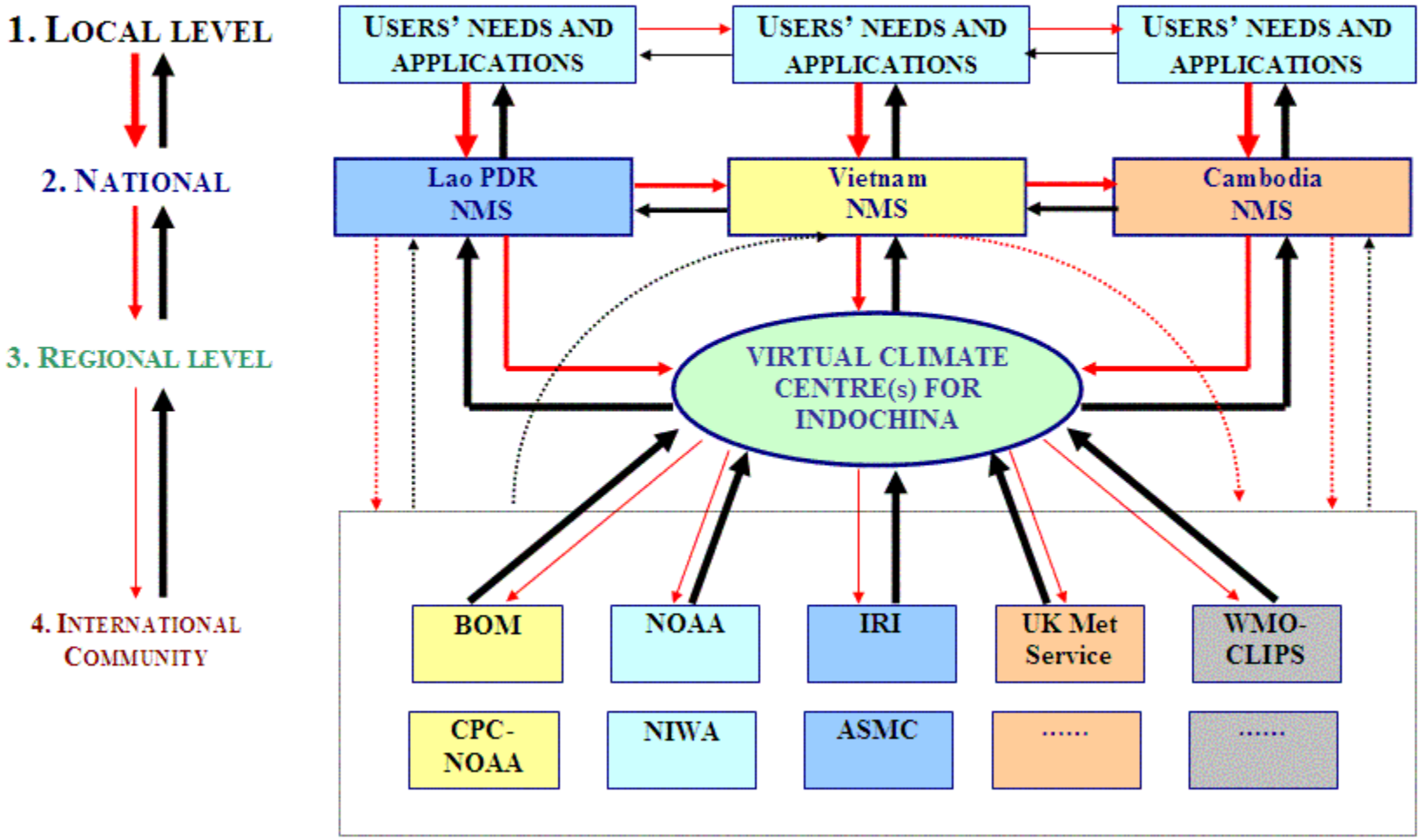
- Finally, the workshop participants requested that the international community recognize the pressing nature of the need for improved seasonal climate monitoring in the nations of Indochina, in the context of the existing frameworks of the World Meteorological Organization and the United Nations Framework Convention on Climate Change, and of the broader science, policy and donor communities. The provision of new and additional financial and technical resources by development partners will be vital if seasonal climate monitoring is to support present-day development goals and contribute to the long-term environmental security of the nations of Indochina.

In conclusion

The workshop organizers, on behalf of the Indochina Global Change Network, would like to thank the sponsors of the workshop, NOAA and WMO, for their support and all who attended the workshop for their enthusiastic involvement. The excellent work of the staff of the National Disaster Management Office in the organization of the workshop is gratefully acknowledged, as is the warmth and hospitality of the staff of the Novotel and of the Lao people.

Figure 1: Information Flow for Seasonal Climate Monitoring for the Indochina Region

Thick arrows: Fast track Thinner arrows: Slow track Thin arrows: Other desirable flows



APPENDIX A

THE INDOCHINA GLOBAL CHANGE NETWORK

The overall goal of the Indochina Global Change Network is to strengthen the scientific capacity of Cambodia, Lao PDR and Vietnam and hence the ability of these nations to respond to the threat posed by global environmental change and related hazards. Network activities include policy-relevant information provision, training and research on global change issues.

The Network has three main aims:

- to foster and provide support for focused capacity-strengthening projects, directed at specific regional needs;
- to provide training in global change studies through workshops, studentships and fellowships and to promote the development of relevant educational materials for the scientific community, policy makers and the general public; and,
- to foster and, where appropriate, coordinate regional research on global environmental change, providing high-level expertise in support of policy development.

The Network is pledged to interdisciplinary research and, in particular, the fusion of biophysical and socio-economic methods. The Network is also committed to a long-term perspective since the problems of global change have characteristic timescales of decades to centuries. The Network recognizes that an effective precautionary response to long-term environmental change must be based on action to reduce present-day vulnerability and that this is, in many cases, a more immediate development priority. Finally, the Network is dedicated to the ideal of sustainable development, meeting present-day needs while ensuring environmental security across both space and time, through the fostering and coordination of regional activities on global environmental change and related hazards.

Past Network activities have been supported by the Netherlands Foundation for the Advancement of Tropical Research (WOTRO), the Asia-Pacific Network for Global Change Research, the National Oceanic and Atmospheric Administration and the World Meteorological Organization.

The Indochina Global Change Network is coordinated by Dr Nguyen Huu Ninh of the Center for Environment Research Education and Development, Hanoi, Vietnam, with technical support from Dr Mick Kelly and Sarah Granich.

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APPENDIX B

WORKSHOP AGENDA

The aim of this workshop is to provide training in the production of seasonal monitoring bulletins, learning from experience in other parts of the world, and to plan the development of national bulletins in the Indochina region.

The meeting will consider the broad range of seasonal climate variability. It will pay particular attention to the El Niño-Southern Oscillation phenomenon that brings seasonal climate disruption to many parts of the tropics, including the Indochina region.

Day 1, Monday, July 12th

Session 1: Opening session Chair: Mick Kelly and Phetsavang Sounnalath

09h00-09h15 Welcoming addresses
On behalf of Lao PDR host, Phoukhieo Chanthasomboun, Head of the Cabinet of Ministry of Labour and Social Welfare
On behalf of IGCN, Nguyen Huu Ninh
On behalf of sponsors, Buruhani Nyenzi

09h15-09h30 Purpose of workshop, Mick Kelly

09h30-10h00 Overview of seasonal climate variability, focusing on the El Niño-Southern Oscillation phenomenon, Simon Mason

10h00-10h30 Meeting user needs, Roger Stone

Break

11h00-11h30 Lessons from the 1998 El Niño-Southern Oscillation event and predictability of impacts over SE Asia, Bill Kininmonth

11h30-12h00 The role of the WMO in climate monitoring and forecasting, including the WMO ENSO Warnings, Buruhani Nyenzi

12h00-12h30 Statements from Cambodia, Lao PDR and Vietnam delegations

12h45 *Lunch for workshop participants and guests*

Session 2: Learning from experience #1 Chair: Buruhani Nyenzi

14h00-14h30 Pacific Island Climate Update/Climate Information for Pacific Communities, Pene Lefale

14h30-15h00 The ASEAN Specialized Meteorological Centre (ASMC), Simon Mason

15h00-15h30 The Pacific ENSO Applications Center (PEAC), Pene Lefale

Break

16h00-17h00 Discussion

19h30 *Workshop dinner*

Day 2, Tuesday, July 13th

Session 3: Learning from experience #2 **Chair: Bill Kininmonth**

09h00-09h30 Current seasonal climate monitoring: Vietnam, Tran Viet Lien
09h30-10h00 Current seasonal climate monitoring: Cambodia, Seth Vannareth
10h00-10h30 Current seasonal climate monitoring: Lao PDR, Vandy Douangmala

Break

Session 4: What do users need? #1 **Chair: Roger Stone**

11h00-11h30 Examples from Sri Lanka, Africa and elsewhere, Simon Mason
11h30-12h00 Examples from Australia, Roger Stone

12h45 Lunch

14h00-14h30 User needs from Vietnam, Lao PDR and Cambodia
14h30-15h30 Exercise – the definition of monitoring needs from participants who are potential users of monitoring bulletins and the response from the bulletin producers, led by Mick Kelly

Break

16h00-17h00 Exercise (continued) – the definition of monitoring needs

Day 3, Wednesday July 14th

Session 4: What do users need? #2 **Chair: Roger Stone**

09h00-10h30 Exercise (continued) – the definition of monitoring needs

Break

11h00-12h00 Conclusions – the definition of monitoring needs

12.15 Lunch

Excursion for overseas participants

Day 4, Thursday July 15th

Session 5: Data availability **Chair: Simon Mason**

09h00-10h30 Sources of data and information – global, Simon Mason

Break

11h00-12h00 Exercise – Definition of local and regional sources by workshop participants, led by Bill Kininmonth
12h00-12h30 Discussion – Organisation at different levels, led by Mick Kelly

12h45 *Lunch*

Session 6: Putting it together Chair: Mick Kelly

14h00-14h15 Outline of options for producing seasonal climate monitoring bulletins for the Indochina region
14h15-15h30 Discussion and decision making – Which option(s) are best suited to user needs and the circumstances of each nation?

Break

16h00-17h00 Meeting of international support team

Farewell dinner

Day 5, Friday July 16th

Session 7: Resourcing Chair: Simon Mason and Phetsavang Sounnalath

09h00-10h30 Proposal development, country teams

Break

11h00-12h00 Action plan, including funding opportunities
12h00-12h30 Follow-up activities and next meeting

12h30 Close of workshop

12h45 *Lunch*

APPENDIX C

WORKSHOP PARTICIPANTS AND GUESTS

P = participant G = Guest at opening session

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