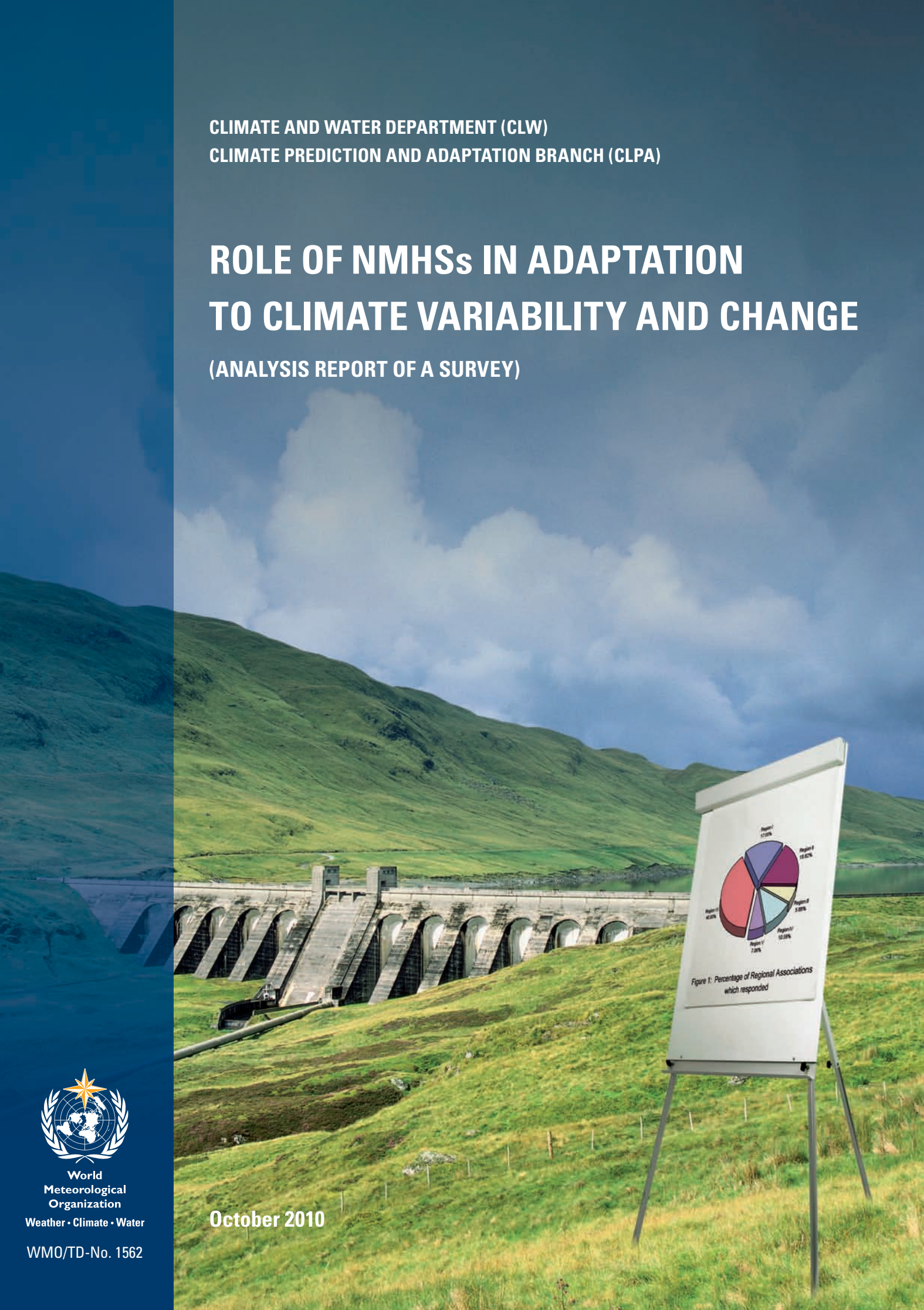
CLIMATE AND WATER DEPARTMENT (CLW)
CLIMATE PREDICTION AND ADAPTATION BRANCH (CLPA)

ROLE OF NMHSs IN ADAPTATION TO CLIMATE VARIABILITY AND CHANGE

(ANALYSIS REPORT OF A SURVEY)



World Meteorological Organization
Weather • Climate • Water

WMO/TD-No. 1562

October 2010

WORLD METEOROLOGICAL ORGANIZATION

CLIMATE AND WATER DEPARTMENT (CLW)

CLIMATE PREDICTION AND ADAPTATION BRANCH (CLPA)

ROLE OF NMHSs IN ADAPTATION TO CLIMATE VARIABILITY AND CHANGE

(ANALYSIS REPORT OF A SURVEY)

WMO-TD No. 1562

October 2010

Chairperson, Publications Board
World Meteorological Organization (WMO)
7 bis, avenue de la Paix
P.O. Box 2300
CH-1211 Geneva 2, Switzerland

Tel.: +41 (0) 22 730 84 03
Fax: +41 (0) 22 730 80 40
E-mail: Publications@wmo.int

NOTE

The designations employed in WMO publications and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of WMO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Opinions expressed in WMO publications are those of the authors and do not necessarily reflect those of WMO. The mention of specific companies or products does not imply that they are endorsed or recommended by WMO in preference to others of a similar nature which are not mentioned or advertised.

This document (or report) is not an official publication of WMO and has not been subjected to its standard editorial procedures. The views expressed herein do not necessarily have the endorsement of the Organization.

TABLE OF CONTENTS

Page

Foreword

The Earth climate system has demonstrably changed since the pre-industrial era. Thanks in particular to the WMO co-sponsored IPCC, which in 2007 received the prestigious Nobel Peace Prize, there is new and stronger evidence today that most of the warming observed over the last 50 years can be attributed to human activities. Assessed changes in the regional climate have already affected numerous physical and biological systems and there are indications that they are also altering our socioeconomic structures.

There is consensus that adaptation is indeed necessary at all scales, from global to local, to complement climate change mitigation efforts and thereby contribute to the vital objectives of sustainable development, for adaptation clearly has the potential to assuage climate change impacts and readily produce added benefits. However, neither adaptation nor mitigation alone can avert the anticipated damage.

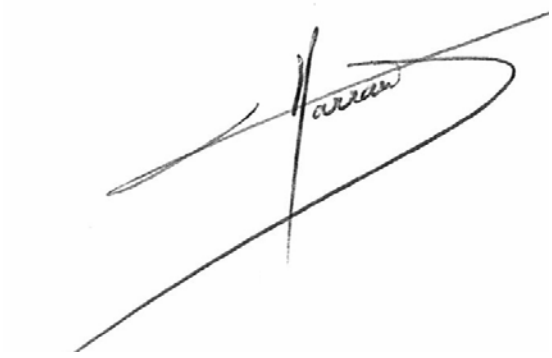
The National Meteorological and Hydrological Services (NMHSs) of WMO's 189 Members have a key responsibility in the climate variability and change adaptation strategy, in particular by facilitating a broader use of climate information, products and services, a perspective which has gained considerable recognition since the 2006 UNFCCC COP12 session, which adopted the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change (NWP). From the outset, WMO supported the NWP implementation strategy and follow-up by refocusing its climate programmes to even more optimally sustain the climate observation, data collection, prediction, research, and service provision functions of the NMHSs in support of decision-making.

These issues are part of the core mission of the WMO Executive Council Working Group on Climate and Related Weather, Water and Environmental Matters (ECWG-CWE). As a result of an ECWG-CWE proposal and with the endorsement provided by the Council at its sixtieth session (Geneva, 2008), WMO conducted the online survey *"Role of NMHSs in Adaptation to Climate Variability and Change"* to assess the present and potential future roles of NMHSs in this strategy. Survey feedback has allowed WMO to identify a number of gaps which the NMHSs may contribute to bridge, provided that sufficient resources and appropriate planning become available.

Survey outcomes were also considered at the recent *WMO Inter-Regional Workshop on Policy Aspects of Climate Change*, hosted by the Malaysian Meteorological Department in Petaling Jaya during April 2010, which considered the international science and policy processes in climate change adaptation and risk management from the perspective of the IPCC and UNFCCC programmes, as well as from more specific regional and national viewpoints.

This WMO Technical Document has also resulted from the survey analysis, in particular from the standpoint of contributing to develop the Global Framework for Climate Services (GFCS) as decided by the third World Climate Conference (Geneva, 2009), which shall enter its operational phase once the Sixteenth World Meteorological Congress (Geneva, May 2011) has adopted all the relevant implementation decisions. I would especially like to highlight that the GFCS will transcend the realm of WMO, since it will also be a key contribution to the IPCC, the UNFCCC process and the implementation of the Nairobi Work Programme.

WMO will continue to work closely with its Members and partners to develop regional and national climate adaptation strategies, as well as a fuller integration of NMHS services and deliverables in the context of socio-economic development, including the alleviation of climate-related hazard impacts. This is an objective which will demand efficient communication and sustained fundraising efforts, for which I hope that this publication may contribute to generate collaboration and partnership in adaptation and to map the road forward.



(M. Jarraud)
Secretary-General

Executive Summary

NMHSs play a vital role in providing support to weather and climate sensitive operations. Some fulfill this role through basic data management and weather forecasting; while others who have access to the necessary resources are directly involved in policy- and decision-making in government and in a variety of key economic sectors. However, in the context of both adaptation and mitigation to climate variability and change, it is not precisely clear what are the core areas that NMHSs contribute at national level.

In order to assess the current and potential future role of NMHSs in facilitating adaptation to climate variability and change in their respective countries, WMO Secretariat conducted an on-line survey on the "Role of NMHSs in Adaptation to Climate Variability and Change", to gather information on ways that NMHSs are contributing to the national climate change response both directly and indirectly, as well as potential gaps that NMHSs could fill if appropriate resources and planning are provided. The analysis and findings of the Survey is elaborated in this report.

Since 2006, WMO Secretariat with the support of NMHSs, has contributed to the UNFCCC Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change (NWP) in the areas such as; promoting development and dissemination of methodologies and tools for impact and vulnerability assessments, improving collection, management, exchange, access to and use of observational data and other relevant information on current and historical climate and its impacts, and promoting improvement of observations, including the monitoring of climate variability. WMO enjoys competency, experience and resources, among other things, to contribute to the Nairobi Work Programme at international and regional levels and closely fits into such an expected role in the present context.

To understand better the role of NMHSs in adaptation at national level, the Climate Prediction and Adaptation Branch (CLPA) has conducted, for the first time, an online survey to gather this information for the benefit of the NMHSs and the people and institutions that they serve. It is hoped that the information will allow the WMO Secretariat to acknowledge successes and address key gaps in NMHSs' efforts, both direct and collaborative, to facilitate adaptation measures and decrease the risks posed by climate variability and change across all levels and all sectors of society.

It would be worthwhile to continue monitoring changes that would update the information contained in this report and hopefully, indicate positive future trends, especially after implementation of the Global Framework for Climate Services (GFCS).

I. INTRODUCTION

Climate influences and can profoundly affect the security, health and well-being of people, their communities, their economy and the environment. Virtually all sectors are to some degree weather and climate sensitive. Societies are already experiencing impacts as a result of climate variability, extremes and changes and further impacts are inevitable. There is no option but to devise appropriate adaptation strategies and measures that include decreasing vulnerabilities and risks, and where possible increase resilience. Identifying and managing these strategies and associated measures is enhanced through access to critical climate information from the past and present, and related to the near-term and future climate.

Design of effective policies and programmes for mitigation of, and adaptation to climate change and its impacts, to manage risks related to climate variability and change, and to facilitate sustainable development fundamentally depends on understanding the risks and opportunities posed by climate variability and change. In this regard, wise and well-informed decision making at every level from households/businesses, communities, nations and regions will require access to informative climate science and information through climate services. As such, these climate services must be part of mainstreaming climate risk management into decision making at all these levels.

The Executive Council of WMO (EC-LX, June 2008) identified a number of activities that were essential to the development of the knowledge base and the internal and external linkages that underpin the WMO contribution to Members' capability to adapt to climate variability and change. The Executive Council also agreed that the development of effective strategies for adaptation required understanding of: the nature of climate variability and change; the climate sensitivity of the system or geographic area of concern; and the capacity to adapt to the projected changes.

In the context of both adaptation and mitigation to climate variability and change, it has not been clear to what extent NMHSs currently play and are capable of playing the required role at the national level. To clarify the situation, it was decided that information was needed regarding the ways NMHSs are contributing to the climate change response, as well as information on potential gaps that NMHSs could fill if appropriate resources and other support were available. To this end, the Secretary-General in October 2008 sent a survey to Permanent Representatives (or Directors of Meteorological or Hydrometeorological Services) of Members of WMO. In so doing, the intent was that the analysis and findings of the Survey would help identify existing strengths and potential weaknesses/gaps towards implementation of the WMO initiative to support climate change adaptation as approved by EX-LX, June 2008, which later evolved in Global Framework for Climate Services (GFCS) as an outcome of the World Climate Conference – 3 (WCC-3).

The responses to this Survey provided a preliminary, albeit not comprehensive, snap shot of the contribution of NMHSs to climate services in support of adaptation and of perceptions of the support they saw as needed to further support efforts in this area. For example, the analysis shows that there are already a number of NMHSs providing climate products and services (observational data, climate assessments and predictions for risk and adaptation assessments, and applications in socio-economic growth and sustainable development). NMHSs across all regions are participating in the preparation of documents and meetings on climate adaptation and/or mitigation, with slightly over half also indicated playing a role in preparing their respective national adaptation strategy. This is hint of a foundation on which to build.

The analysis of these responses also shows that this participation and the

capabilities to provide these climate products and services vary considerably within and across the Regions. It also indicates that there is much more needed to provide the required products and services and to do so will require technical, capacity and financial support. For example, there are a number of NMHSs who see climate services to support adaptation as being of low priority or not considered in their overall goals. This would naturally limit their abilities in supporting adaptation. In terms of factors limiting their ability to contribute, the lack or limited nature of financial support was specifically recognised by many NMHSs. Other limiting factors and therefore areas where further support was identified as being important related to the visibility and recognition of the NMHSs within their respective governments, including lack of understanding of the value of services provided. To address this shortcoming, respondents indicated support was need for promoting the importance of climate products and services, including that directed at being able to clearly demonstrate the benefits derived from including these as inputs into policy and decision making.

Additional limiting factors identified were the availability of professional staff and applications software. In addressing these, respondents indicated a need for technical transfer, capacity building, technical guidance and technical training, along with the provision of advice and specifications, and education, training and public outreach. These latter points may be the result of many respondents recognising the limited level and scope of activity related to engaging end-users. Towards addressing this and the other limiting factors, the analysis suggests that there may be a potential for knowledge sharing with roles for the Technical Commissions and Regional Associations.

It is suggested that this initial snap shot should be treated as such with other NMHSs being encouraged to respond to specific components of the current Survey; improving the basis for using the responses to the Survey. In addition, this Survey, possibly with some modification, should be resent to NMHs in 5 years time (2013). This would provide a second snap shot; an opportunity to gauge progress and seek views on the effectiveness of existing initiatives and on the need for additional efforts.

II. The 2008 Survey

The Survey on the Role of NMHSs in Adaptation to Climate Variability and Change (hereafter referred to as the Survey) was distributed on-line to the Permanent Representatives of Members of WMO by the Secretariat on 14 October 2008. Members were asked to complete the Survey on line no later than 14 November 2008. A copy of the Survey is attached as Annex 1.

The Survey sought information on the scope, including capacity to deliver, of the contributions by NMHSs to adaptation at the national level; information about the nature of the relevant activities in which the NMHSs are involved; and information on gaps and needs. This information was sought by dividing the Survey into three parts – Policy role of NMHSs, NMHSs role in adaptation activities, and Gaps and Needs. The first of these parts solicited information on the nature of the role of NMHSs in working with and supporting policy makers on adaptation. Specifics asked were related to their roles in preparing documents, participating in meetings, working directly with policy makers/government to integrate climate variability and change into policies, and whether they had a designated in-house liaison.

The second part sought information on the nature of the NMHSs role in adaptation from an organisational perspective, relative to national adaptation efforts, and on those with whom they worked. This included requesting information on: priority given to adaptation, whether or not staff members were designated to deliver this role, whether their country had a national strategy for adaptation and the nature of their roles in the development and implementation of that strategy, who they collaborated with in delivering the various roles; contributions to relevant technical

areas including those under the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change, and whether or not they had an established system for end-user feedback.

The third part sought information that could be used to explore factors that the NMHSs believed were limiting and could enhance the opportunities for their involvement in national adaptation and mitigation. On the factors limiting their potential for involvement, NMHSs' views were sought on the relative importance of barriers to their participation in these national and international activities such as scope for involvement, organisational, connectivity and capacity. Views were also sought on how WMO's global and regional coordinated efforts could enhance their overall contributions to adaptation and mitigation activities.

NMHSs were also provided with an opportunity to provide examples of past successes and failures when providing advisory services regarding adaptation activities, contributions to technical areas in adaptation relative to the areas of the Nairobi Work Programme not included in the Survey categories and additional adaptation projects with a specific focus on evaluating end-user benefits. These issues were extensively discussed in the WMO Inter-Regional Workshop on Policy Aspects of Climate Change (Petaling, Jaya, Malaysia, 19-21 April 2010). The report of the Workshop is attached as Annex 2.

Eighty-six on-line responses were received by the deadline (see Figures 1 and 2). This represents a return rate of 45.2% across the WMO Members and these responses will be the basis of the following analysis. It is worth noting when interpreting this analysis the relative response rate by WMO Regional Associations. Of the responses received, forty percent came from NMHSs in Region VI (68% of the Region VI Members responded). Although comprised of a similar number of Members, 17.7% of the response received came from Region I (28.9% of the Region I Members responded). From the other regions, responses were received from 31.6% to 45.7% of the Members which represent 5.9% to 18.8% of the responses to be analysed.

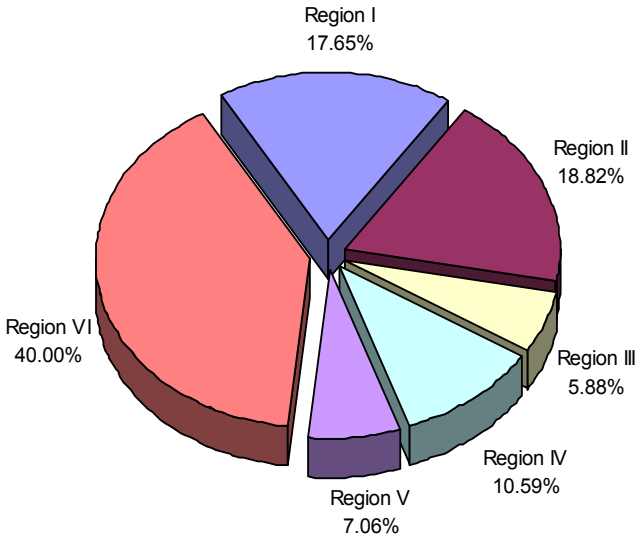


Figure 1: Percentage of Regional Associations which responded

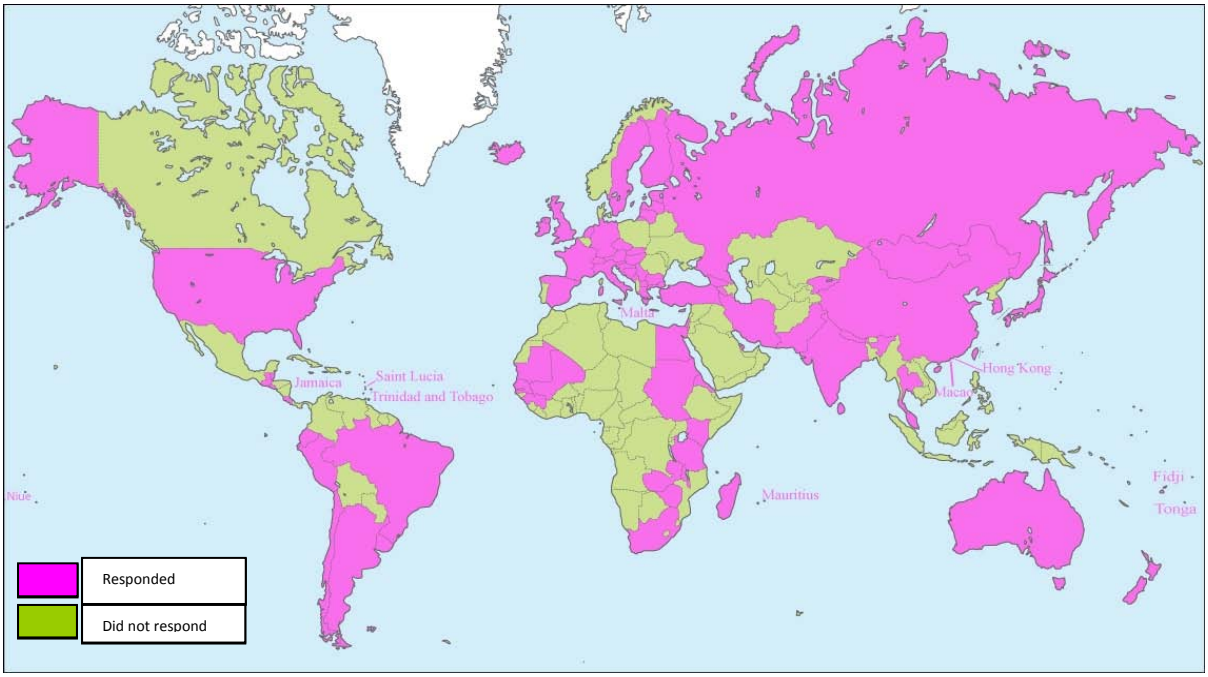


Figure 2: Map highlighting the countries that responded to the Survey

Although a return rate of 45.2% can be considered sufficient for analysis, the limited number of responses from some of the regions is somewhat of concern and may not allow for a comprehensive understanding of the existing strengths, gaps and potential solutions. Although likely to be no more than speculative, it would be helpful to understand why responses were not received. Was non-response linked to: limited capacity (in the broad sense or specifically related to the understanding of adaptation); non-recognition of the climate services as an important issue for their respective NMHS; or some other reason (e.g., availability to access the on-line version or availability to respond in the time available)?

It is interesting to look at this response rate and its geographic distribution in the context of especially affected systems, sectors and regions as identified by the IPCC in its Fourth Assessment Report (IPCC AR4, WGII, 2007). Although none of the research on vulnerability to date has resulted in a systematic and agreed way of assessing, measuring, expressing and comparing the vulnerability of countries to climate change, there is some evidence that points to regions of the globe for which climate change will be of particular concern. Specifically noted within the IPCC Fourth Assessment Report (AR4) are the Arctic, Africa (especially the sub-Saharan region), areas with low-lying coasts or that are especially susceptible to flooding (e.g., small islands and Asian mega deltas) and low-latitude regions (water resources, including implications for agriculture). In addition, the UN Framework Convention on Climate Change (UNFCCC), Article 4.8 lists several groups of countries with "specific needs and concerns". This listing reiterates those reflected in the IPCC AR4 and adds countries with: areas prone to natural disasters; areas liable to drought and desertification; areas of high urban atmospheric pollution; and fragile ecosystems, including mountainous ecosystems.

As such, it could be argued that countries within these regions or with these characteristics will require particular adaptation attention, including access to the information (e.g., climate information and predictions) necessary to support assessments and adaptation management. This suggests that the demand for climate services and the capacity to deliver those services should be high in these areas. In terms of the

regions of the WMO, most, if not all, of the regions have countries and areas with some of the above highlighted characteristics. Thus climate services and the capacity to deliver should be strong within all NMHSs. However, based on the above considerations, Region I (Africa), parts of Region II (Asia), Region III (South America), and Region V (South-West Pacific) may need particular attention in this regard.

What is the level of response from these latter-mentioned Regions? Region I, II and III also had the lowest response rates thus adding to the difficulty of drawing comprehensive conclusions from the Survey. This begs the question; would the analysis and conclusions differ significantly with a higher level of participation?

III. Policy Role of NMHSs

Seventy-six (89.4%) of the responding NMHSs are preparing documents regarding climate change or climate-related activities for policy makers and/or government officials. There is a high level of participation indicated across most regions. Responding NMHSs in Region I, III and V all indicated that they were preparing such documents and 31 of the 34 responding NMHSs in Region VI (91.2%) also responded positively. Although still relatively high, 13 of the 16 responding NMHSs in Region II, 6 of the 9 in Region IV and 6 of 9 NMHSs in Region IV reported this type of involvement.

In terms of which type of climate-related activities these documents addressed (see Figure 3), the majority of responding NMHSs (50%) indicated that they were targeted at both mitigation and adaptation, with a significant number (34%) addressing adaptation alone. Only 3 respondents (4%) indicated that documents produced were addressing mitigation alone.

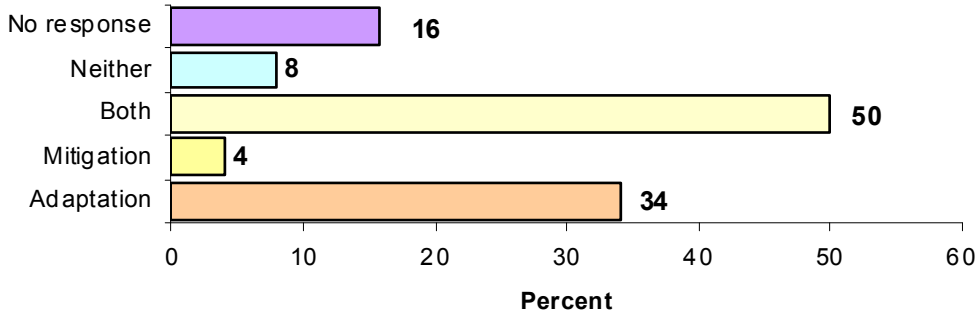


Figure 3: Subjects of climate-related documents produced by NMHSs

Similar relative scope and levels of participation were indicated for meetings with policy makers/government officials both globally across all responding NMHSs and as a regional breakdown. Seventy-three of responding NMHSs indicated that they regularly meet with policy makers/government officials to update them on the most recent climate information and activities. In terms of the scope of these meetings, 56% of respondents indicated that the meetings address both adaptation and mitigation and 29% indicated that only adaptation was addressed. As in the case of NMHSs preparing documents, few (3 NMHSs or 4%) indicated that the meetings addressed mitigation only. It is worth noting that slightly more NMHSs are preparing documents than are participating in regular meetings (76 compared to 73) with the difference resulting from reduced participation in meetings by NMHSs from Region II and Region VI.

When indicating the frequency of these meetings with policy makers/government officials, 30 of the 71 NMHSs responding to this question indicated that they met more than three times per year and an additional 20 that they met 1-3 times per year. Six NMHSs indicated that meetings were ad hoc or less than annual, with 17 NMHSs indicating that they meet with policy makers/government officials but did not indicate a frequency of those meetings.

In interpreting the above results it may help to consider them in the context of whether the NMHSs indicated that they are working directly with and have a designated in-house liaison to support their working with policy makers/ government officials. Sixty-six percent of those responding indicated that they were working directly with policy makers/government officials and 80% have a designated in-house liaison with whom the policy makers/government officials could consult directly. The major difference is identified for Region II and Region VI where, although there are NMHSs who have designated in-house liaison (75% and 67%, respectively), some of them have reported that they are not working directly with policy makers/government officials (50% and 53%, respectively). It is also worth noting that for the most part, that the responses show that participation in regular meetings with, and preparing documents for, policy makers/government officials is predominately more prevalent in those NMHSs where there is a designated in-house liaison. Few (1 NMHS in Region I and 7 NMHSs in Region VI) indicated they have regular meetings with policy makers/government officials yet do not have a designated in-house liaison.

IV. Role of NMHS in Adaptation Activities

Of the eighty-six NMHSs that responded to the Survey, seventy-nine (representing 41% of all WMO Members) provided further details on their role in adaptation activities. These responses will form the basis of the following analysis.

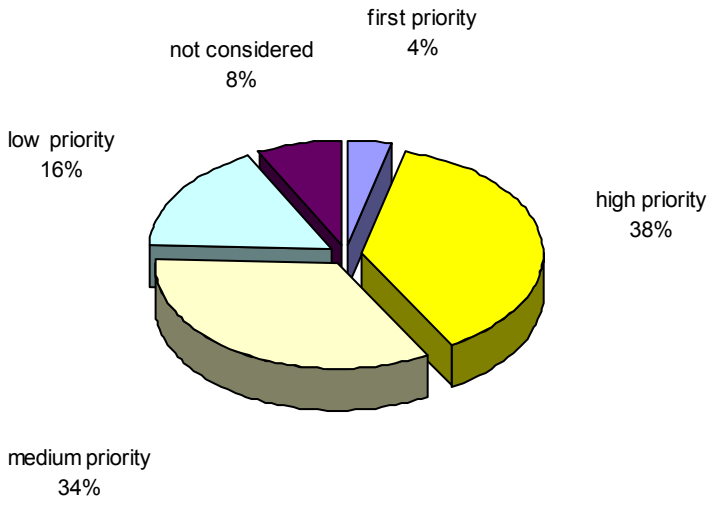


Figure 4: Priority of adaptation activities among the overall goals of the NMHSs

i. Organizational issues

Thirty-three (42%) of the responding NMHSs (see Figure 4) indicated that adaptation activities are either a high or the first priority (76% medium, high or first priority) with only nineteen (24%) identifying these activities as low priority or not considered in the overall goals of their NMHS. Those that identified adaptation activities as their first priority (4%) were located in Regions I and II (1 and 2 NMHSs respectively). It is interesting to note that those NMHSs indicating that adaptation activities are either of low or no priority were also in Region I and II (3 NMHSs in each), but either low or no priority for adaptation was also identified by some NMHSs in all responding regions but Region V.

Despite the priority given to adaptation activities, few (32%) NMHSs indicated that they had staff devoted primarily to adaptation activities. On a regional basis, some of the responding NMHSs in all but Region IV indicated they had staff devoted primarily to adaptation activities.

These two latter sets of results may need to be interpreted with some caution as adaptation activities may be seen differently by the different NMHSs. Depending on how adaptation is interpreted, adaptation activities may be seen as part of everyone's activities or as a separate set of activities. As such, it is possible that differences in the NMHSs' perceptions of what constitutes adaptation activities could bias and lead to misinterpretation of the responses here.

ii. Role in National Adaptation Strategy

Information was sought on the role of NMHSs in their national adaptation strategy for adaptation. Forty (51%) of the responding NMHSs indicated that they did play a role and as such the following analysis of the extent and nature of these roles are based on their responses.

The responses provided included the official title of the national strategy on adaptation, the years each of these cover and how often the strategy is revised/updated. On the later, 53% identified that in their countries adaptation strategy is to be revised/updated with 23% and 46% respectively indicating that this was required up to every 3 to 5 years.

The majority of the responding NMHSs (38 of 40) indicated that they are a contributing agency in the creation or implementation of their country's national strategy on adaptation. Most responded that they played a minor role in its creation (50%) and its implementation (61%). One

NMHS (Region II) indicated that it was the sole authority in creating and implementing its national adaptation strategy, and 34% and 21% of the respondents respectively indicated they had lead responsibility for creation and implementation.

Information provided on the nature of their roles, provides some further insights. Responsibilities identified included primarily provision of information and scientific advice (national and international) on climate variability, trends and change. These responsibilities included provision of policy relevant advice and data on historical, current and projected climate change, and in some cases undertaking and reporting on research or analyses (e.g., baseline studies). In a few cases, NMHSs indicated that their responsibilities included acting as a focal point or member of an inter-ministerial committee and being involved in approval and adoptions of the national strategy.

As the above analysis suggests, collaboration on both creation and implementation of a national adaptation strategy are seen by most responding NMHSs as an important (and essential) role.

With whom are the NMHSs collaborating (see Figure 5)? Most respondents indicated collaboration with government ministries. Of these, all respondents indicated that they were collaborating with their respective environment ministries with a high percentage also indicating collaboration with agriculture ministries, especially in those regions where agriculture is of high economic and political significance. Science, transportation and industry ministries were also identified. Additional collaborating government ministries identified reflected particular national interests (e.g., tourism and fisheries) or the particular ministerial structure (interior, and economy and sustainable development), but also reflected key ministries such as health and education that were not included in the supplied listing but were specified under the 'other' category of collaborating ministries.

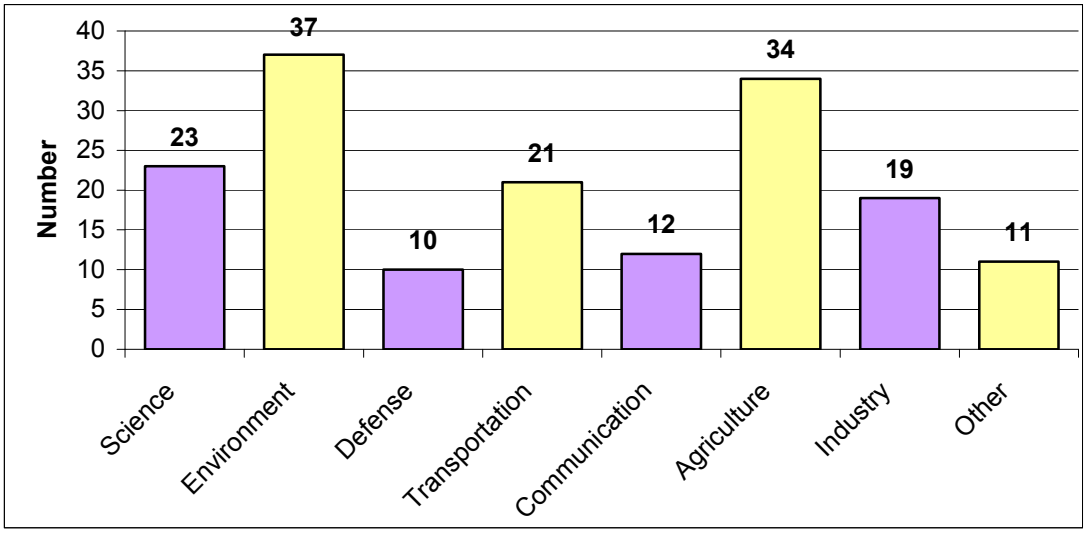


Figure 5: Government ministries with whom NMHSs indicated they were collaborating regarding implementation of national strategies for adaptation

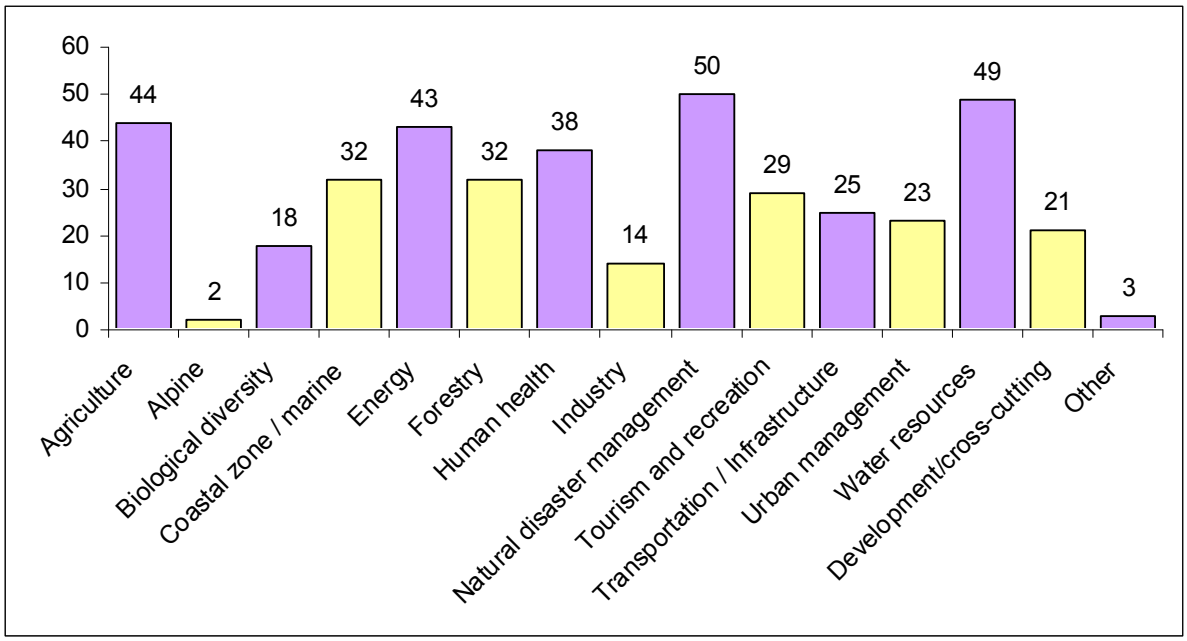


Figure 6: Sectors which NMHSs are providing sector-specific advisory services regarding adaptation activities

In terms of other collaborators listed in the Survey, a small number (17 NMHSs) of the respondents (half of which were NMHSs in Region I) indicated that they were collaborating with NGOs. A similar level of positive responses was indicated for NMHSs collaborating with businesses and the private sector (and again half of these in Region I). As one would expect, the specific collaborators primarily reflected the priority issues of each country, but also those operating within the country (water, disaster relief, agriculture, ecology) and country specific structures (e.g., private companies involvement in utilities).

iii. Provision of Sector-Specific Adaptation Services

Fifty-seven NMHSs indicated that they did provide sector-specific advisory services on adaptation (see Figure 6).

The sectors to which they provided those services, once again reflect particular economic, social and environmental interests of their respective country (included as part of the NMHSs' mandated responsibilities). Sectors of prime interest (see Figure 6) are natural disaster management, water resources, agriculture and energy. Other sectors noted are human health, coastal zone/marine and forestry.

Examples of recent successes in providing sector specific adaptation services included:

- Development and provisions of forecasts to support effective management of extreme events such as droughts, floods and malaria outbreaks;
- Provision of information to support farmers' decision making (irrigation and crop vulnerability and potential) and fire management – Inline with contributing to addressing concerns related to current climate variability and change;
- Provision of climate scenarios and projections and in supporting specific adaptation projects, including through the provision of tools and guidance in such areas as agriculture, coastal zone/marine and fisheries in line with contributing to addressing concerns related to projected climate change;
- Preparations of national communications under the UNFCCC;

- Raising awareness of politicians and journalists regarding climate change through targeted workshops and through identifying and making available information on climate conditions of concern.

A few NMHSs mentioned recent failures in providing sector-specific services with most of these linked to the inadequacy of the climatological information available (more local information needed than is available due to lack of equipment or insufficient spatial or temporal coverage) or the inadequacy of the human resources available. Also identified as contributing to failures are limited dissemination of climate change information to rural communities, and the difficulty the general public has with interpreting probabilistic forecasts.

iv. Contributions to Technical Areas in Adaptation

Under this sub-section of the Survey, information was sought on the contributions of NMHSs to technical areas in adaptation, particularly with respect to categories of work within the Nairobi Work Programme (NWP). Those NWP categories are: methods and tools; climate data and observations; climate modelling, scenarios and downscaling; climate-related risks and extreme events; socio-economic information; adaptation planning and practices; and research. For each of these, specific adaptation activities were identified and respondents were asked to indicate whether their country implements or participates, the nature of the specific role of their NMHS and who were the partnering agencies or ministries.
Of the eighty-six respondents, six did not include responses to this sub-section of the Survey. As such the following analysis will be based on 79 responses.

a. Methods and Tools

This NWP category includes activities under Climate watches, the Climate Information and Predictions Services (CLIPS) and the Regional Climate Outlook Forums (RCOFs). Figure 7 summarises the degree to which the responding NMHSs indicated implementing or participating in each of these. In terms of their specific roles within Climate watches and CLIPS, fifty-eight and fifty-five respectively, of the responding NMHSs indicated that they had either sole authority or lead responsibility.

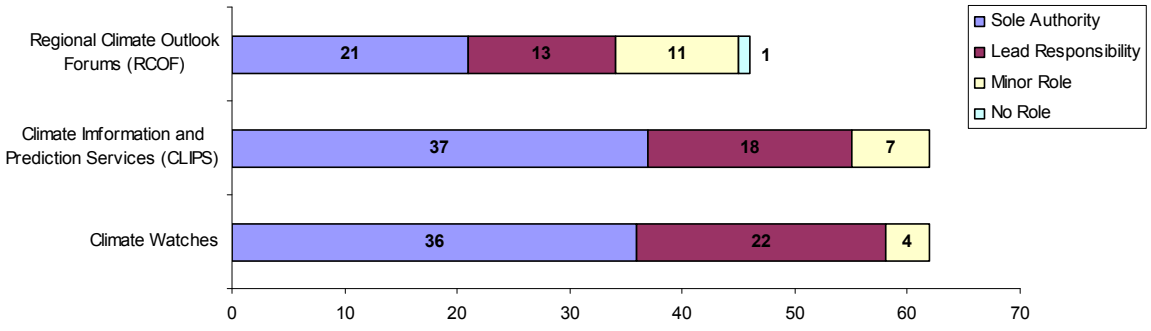


Figure 7: NMHSs indicating that they did contribute to adaptation activities under Methods and Tools

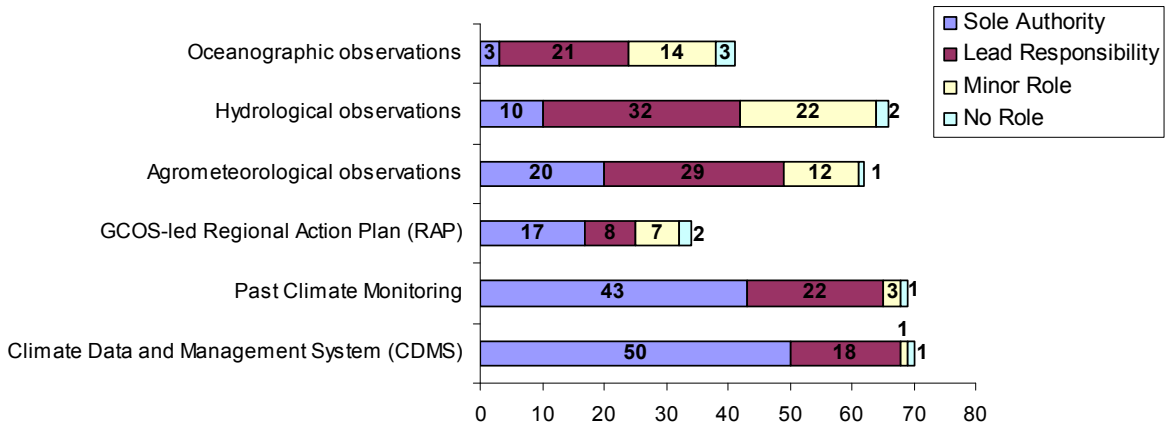


Figure 8: NMHSs indicating a role contributing to adaptation activities under Climate Data and Observations

Within the RCOF activity, thirty-four NMHSs indicated having either sole authority or lead responsibility, eleven indicated a minor role and forty indicated either no role or did not respond (23 of which were in Region VI).

b. Climate Data and Observations

This NWP category includes activities under the Climate Data Management System (CDMS), past climate monitoring (e.g., monthly climate reviews), GCOS-led Regional Action Plan (RAP), agrometeorological observations, hydrological observations and oceanographic observations. Figure 8 summarises the degree to which the responding NMHSs indicated implementing or participating in each of these. In terms of their specific role in each of these, sixty-eight of seventy and sixty-five of sixty-nine NMHSs, respectively indicated they had either the sole authority or lead responsibility under the Climate Data Management Systems (CDMS) and past climate monitoring.

In terms of contributions in the other areas, sole authority or lead responsibility was identified by the NMHSs to a slightly lesser degree for agrometeorological and hydrological observations activities (49 and 42 number of the responding NMHSs, respectively). Under contributing to oceanographic observations and the GCOS-led Regional Action Plans, even fewer NMHSs (25 and 24 number of NMHSs, respectively) indicated that they have sole authority or lead responsibility and more indicated that they played a minor role or played no role (or did not provide a response). This latter result is not surprising considering the number of NMHSs which have responsibility for oceanographic observations and are involved in the GCOS-led Regional Action Plans.

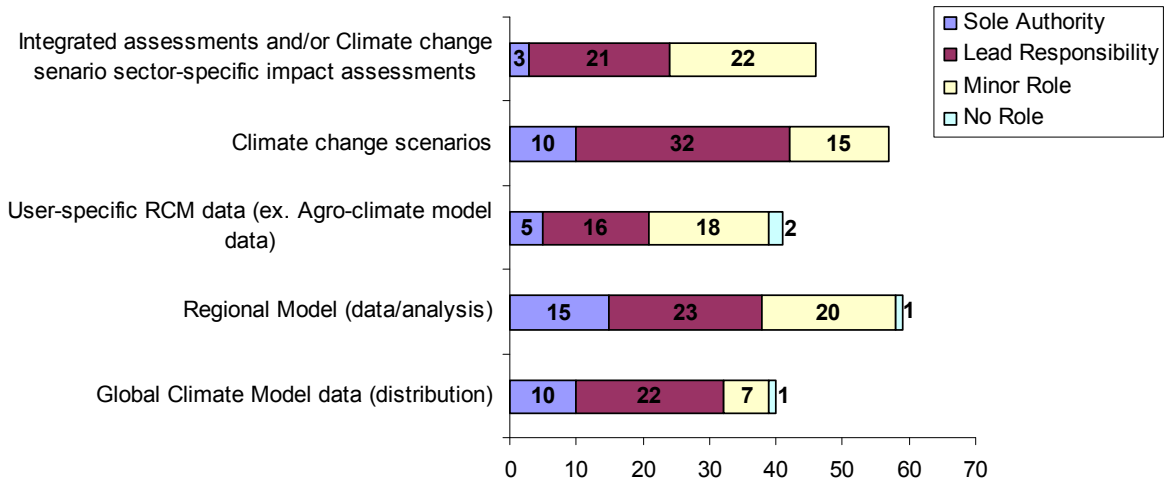


Figure 9: NMHSs indicating a role contributing to adaptation activities under Climate Modelling, Scenarios and Downscaling

c. *Climate Modelling, Scenarios and Downscaling*

This Nairobi Work Programme category includes potential contributions of NMHSs related to distribution of global climate model data, regional climate model data/analysis, user-specific RCM data (e.g., agro-climate model data), climate change scenarios, and integrated assessments and/or climate change scenario sector-specific impacts assessments. Figure 9 summarises the degree to which the responding NMHSs indicated implementing or participating in each of these. Relative to other NWP categories of activities, a large number of NMHSs across all regions indicated that they did not have a role or did not indicate a role in the identified categories.

Of those indicating that they have a role in the distribution of Global Climate Model data (39 NMHSs) and Climate Change Scenarios (57 NMHSs), the majority identified that role as having sole authority or lead responsibility. All Regions had responding NMHSs that indicated sole authority or lead responsibility for these two activities and conversely, there are NMHSs in all regions that indicated that they play no role or that did not indicate a specific role under these two activities.

On the other hand, forty-six NMHSs indicated that they either did not have a role or did not indicate a role related to user-specific RCM data. Twenty-one NMHSs across all Regions indicated their role in this activity as sole authority or lead responsibility. The other activity in this category that is providing 'user-specific' information – integrated assessments and/or climate change scenario sector-specific impact assessments – has associated with it a similar level of activity. Thirty-nine respondents did not indicate a role (with twenty-two indicating a minor role), and twenty-four indicated either having the sole authority or lead responsibility. It is worth noting that it is within these two 'user-specific' activities in this category where NMHSs contributions are indicated as being generally less.

d. *Climate-related Risks and Extreme Events*

This NWP category includes potential NMHSs contributions related to medium-term (1-4 weeks) temperature and precipitation forecasts, long-term (>1 month) temperature and precipitation forecasts, climate hazard outlooks (e.g., fire), and national weather/climate disaster risk reduction programme. Figure 10 summarises the degree to which the responding NMHSs indicated implementing or participating in each of these.

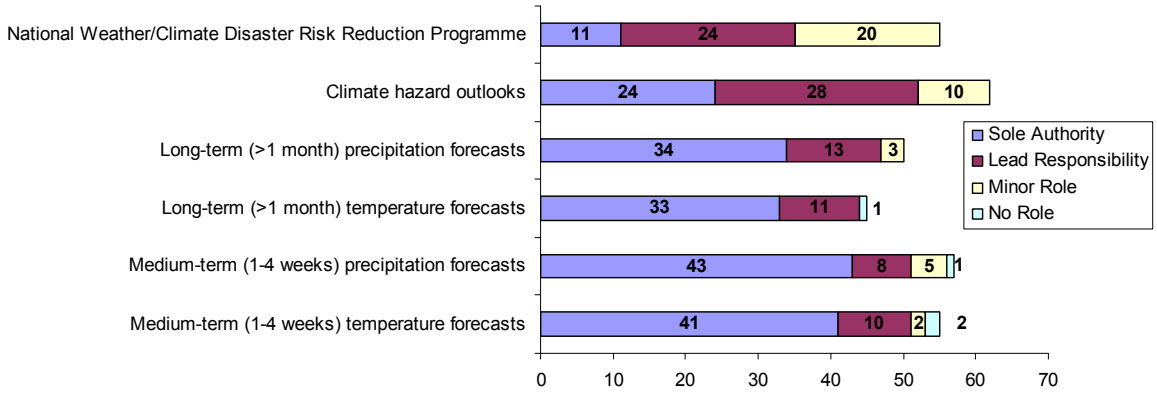


Figure 10: NMHSs indicating that they did play a role in contributing to adaptation activities under Climate-related risks and extreme events

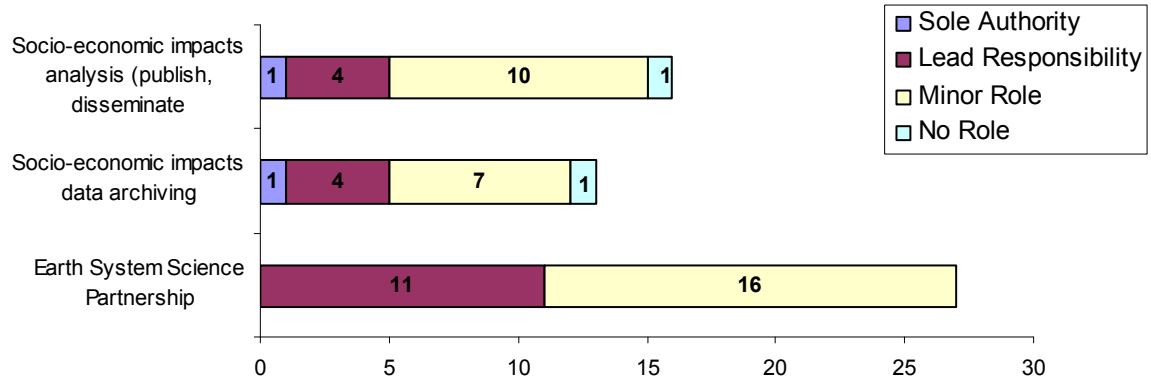


Figure 11: Percentage of NMHSs indicating a role contributing to adaptation activities under socio-economic information

Across all these activities, fifty to fifty-five NMHSs indicated that they did contribute (see Figure 10) with the exception of long-term temperature forecasts for which forty-five indicated contributing. Of those indicating a role, the majority of responding NMHSs indicated that they had sole responsibility for the medium-term and long-term temperature (41 and 33 NMHSs, respectively) and precipitation (43 and 34 NMHSs, respectively). Responding NMHSs indicated a similar level of participation in climate hazard outlooks and their national weather/climate disaster risk reduction programme (35 NMHSs indicating either having sole authority or lead responsibility). Of those responding the majority had sole authority (24 NMHSs) or a lead responsibility (18 NMHSs) for climate hazard outlooks, but a lead responsibility (24 NMHSs) or minor role (20 NMHSs) in their respective national weather/climate disaster risk reduction programme (11 NMHSs indicating sole authority).

e. Socio-economic Information

This NWP category includes activities related to Earth System Science Partnerships (ESSP), socio-economic impacts data archiving, and socio-economic impacts analysis (publish and disseminate). Figure 11 summarises the degree to which the responding NMHSs indicated a role in implementing or participating in each of these. Few of the reporting NMHSs indicated a role in contributing socio-economic information and those that did predominately indicated that that role was minor. No role or no identified role was indicated for fifty-eight NMHSs under Earth System Science Partnership, seventy-three NMHSs under socio-economic impacts data archiving, and seventy NMHSs under publishing and dissemination of socio-economic impacts analyses.

Of the three identified activities, twenty-seven NMHSs did indicate a minor (11 NMHSs) or lead role (16 NMHSs) in contributing to Earth System Science Partnership. Twelve NMHSs indicated that they contribute to archiving socio-economic impacts data (7 NMHSs play a minor role) and fifteen NMHSs indicated that they contribute to publishing and dissemination of socio-economic impacts analyses (10 NMHSs distributed across the Regions indicated playing a minor role).

f. Adaptation Planning and Practices

This Nairobi Work Programme category includes activities related to regional climate centres (RCCs) and climate risk assessment mapping. Figure 12 summarises the degree to which the responding NMHSs indicated having a role in implementing or participating in each of these. Forty-five NMHSs indicated that they contribute to regional climate centres with the nature of that role being predominately either as sole authority (14 NMHSs) or lead responsibility (13 NMHSs), with twelve NHMSs indicating that they had but a minor role.

The responses related to the roles of NMHSs in RCCs show that NMHSs in all regions do not see themselves as contributing in this manner. In fact, a high proportion of the responding NMHSs in each region did not indicate a role or indicated that they did not have a role in RCCs in terms of adaptation activities.

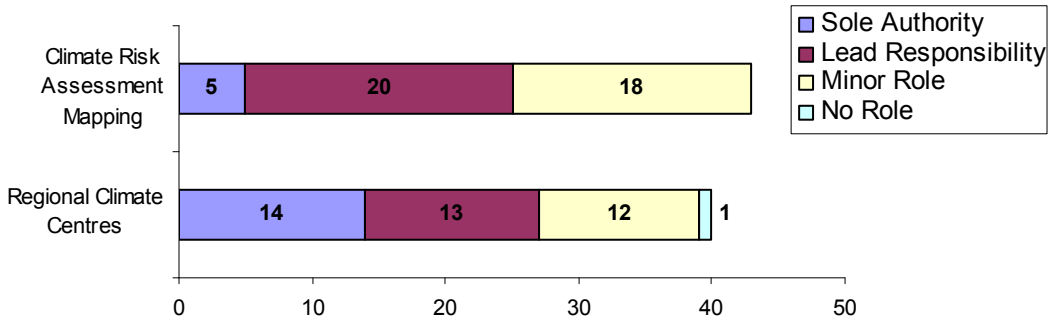


Figure 12: NMHSs indicating a role contributing to adaptation activities under Adaptation Planning and Practices

The responses under this question should be looked at in light of the response related to the potential role of WMO's global and regional coordinated efforts related to promotion and development of the RCCs (see Section VI). Although among those areas which was not seen as highly important by a large number of NMHSs, there were some NMHSs, particularly in Region II and Region VI that did see WMO efforts in this area as highly important (ranked as either first, second or third in terms of importance).

Under climate risk assessment mapping, forty-three NMHSs identified that they did play a role with twenty NMHSs identifying that they had lead responsibility and eighteen identifying that they had a minor role. Forty-two NMHSs did not indicate a role under this activity.

Examining this level of contribution under adaptation planning and practices along with gaps/needs regarding NMHS involvement in national adaptation efforts (see Section VI) can provide further background to the priority and importance given to the identified gaps/needs. For example, the identification of professional staff and application software as limiting factors, as well as the high level of importance given to the need for WMO global and regional coordinated efforts to be directed at technology transfer, capacity building, technical guidelines and technical training could be interpreted as being consistent with the lower level of contributions to adaptation planning and practices indicated.

g. Research

This Nairobi Work Programme category includes activities related to improvement of climate prediction models, output analysis, national vulnerability assessment reports, and national climate change impact assessment reports. Figure 13 summarises the degree to which the responding NMHSs indicated having a role in implementing or participating in each of these activities.

Thirty-one of the 55 NMHSs who indicated they have a role in contributing to improving climate prediction models output and analysis (see Figure 13) identified that they have lead responsibility with thirteen indicating that they have sole authority. Thirty NMHSs did not indicate their roles under this adaptation activity, including no reports from Region IV (6 of 9 NMHSs) and Region II (7 of 16 NMHSs).

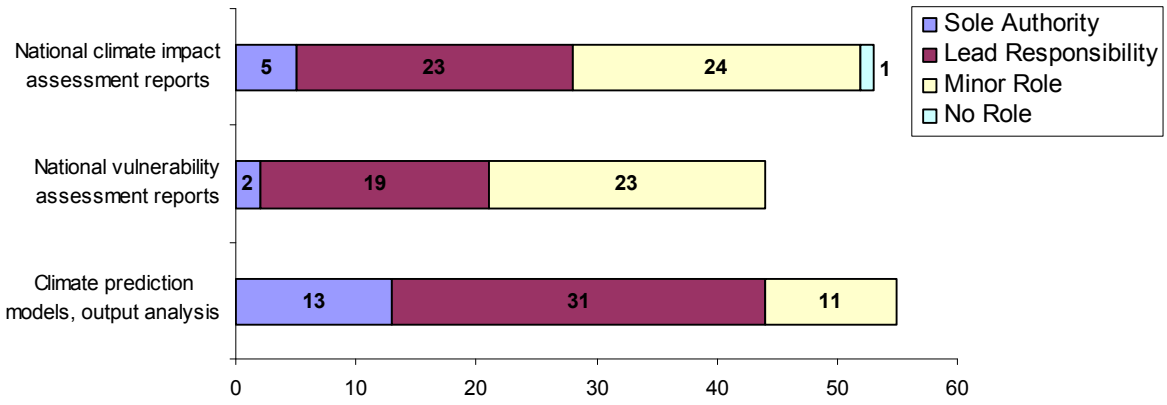


Figure 13: NMHSs indicating a role contributing to adaptation activities under Research

Forty-four NMHSs, spread across all the Regions indicated a role under contributing to national vulnerability assessments reports (thus forty-one did not indicate a role under this activity). As to the nature of the roles, twenty-three NMHSs indicated playing a minor role and nineteen indicated having lead responsibility. Lower levels of contributions were indicated in Region III (only one NMHS indicating having a role which is minor) and in Regions II, IV and VI in which those not indicating a role were as many or more than those indicating a role.

h. Partnering agencies/ministries

Not all respondents indicated with whom they partnered in delivery of the identified technical areas in adaptation. Of those that did, the identified partners for the most part reflected national priorities and structures, as well as the presences of regional institutions. Predominant among the identified partners were central government agencies/ministries (Environment, Agriculture, Water Resources, Disaster Management, Tourism, Physical Planning, Industry and Commerce), with only one country indicating that they partnered with the Prime Minister's Office. National and regional scientific and academic institutions were also identified and although not always the case, these were predominantly natural or physical sciences based. Some of the identified partners could be interpreted as reflecting the evolving adaptation-development nexus. Specific reference to natural resources management, industry, commerce and physical planning could reflect this linkage, but this may be over interpretation of the provided information.

A small number of countries identified the WMO, Regional Associations and Regional Meteorological/Climate Centres as partners in delivering technical areas in adaptation. This low result may reflect the current capacity and relationships of NMHSs to these organisations in the context of adaptation. As such, they may also suggest the need for further information in the context of better understanding of where and how WMO's global and regional coordination efforts on adaptation should be best placed.

V. End-User Feedback

Thirty-seven percent (21) of the 57 NMHSs who responded to this question indicated that they have an established system for acquiring input from end-users on specific product/service needs on adaptation. The limited level of activity in establishing and operating such systems is reflected in the NMHSs responses across all regions with less than 50% in any region indicating that they had such a system (see Figure 14 for regional analysis).

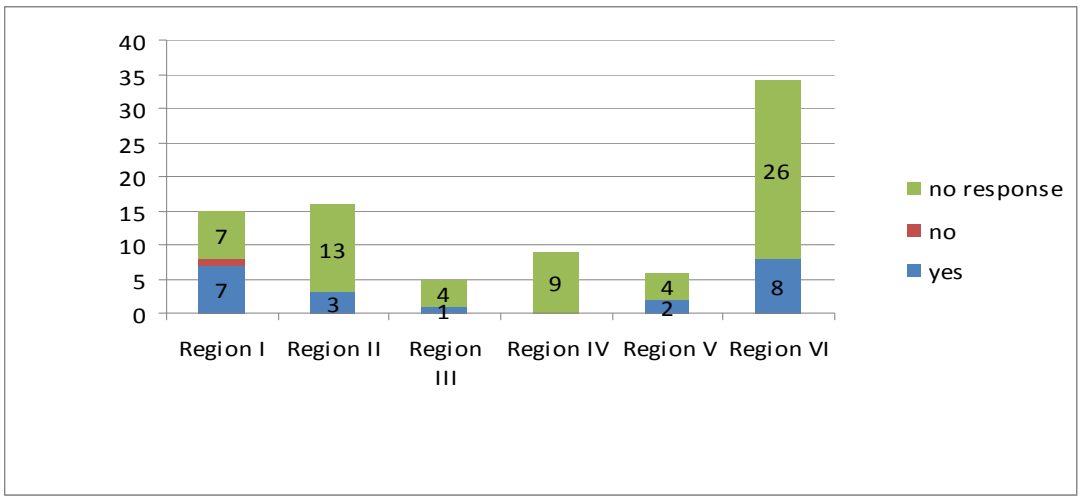


Figure 14: NMHSs with a system for acquiring input from end-users on specific product/service needs for adaptation

Respondents that had such systems identified a number of mechanisms being used to obtain feedback from users: targeted consultations (e.g., with representatives from specific sectors), formal evaluation procedures, and feedback solicitation mechanisms. The feedback solicitation mechanism identified varied and included:

- Soliciting feedback: through surveys; during lectures, conferences, field days; and when meeting with working and reference groups involving end-users; and
- Offering users the opportunity to provide feedback through an existing NMHSs website (homepage).

Views were sought on factors limiting NMHSs contributions to adaptation and mitigation and on what they believed should be WMO's role in enhancing their involvement in these areas. To establish a baseline, the NMHSs were asked to indicate if they were a major climate information and service provider in support of adaptation and of mitigation. Eighty-three percent (62) of the 75 responding NMHSs indicated that they were such a provider in support of adaptation efforts (see Figure 15), and fifty-one percent (38) in support of mitigation (see Figure 16), with 13% (10) and 35% (26), respectively, indicating that they were somewhat involved in supporting these efforts.

VI. Gaps and Needs

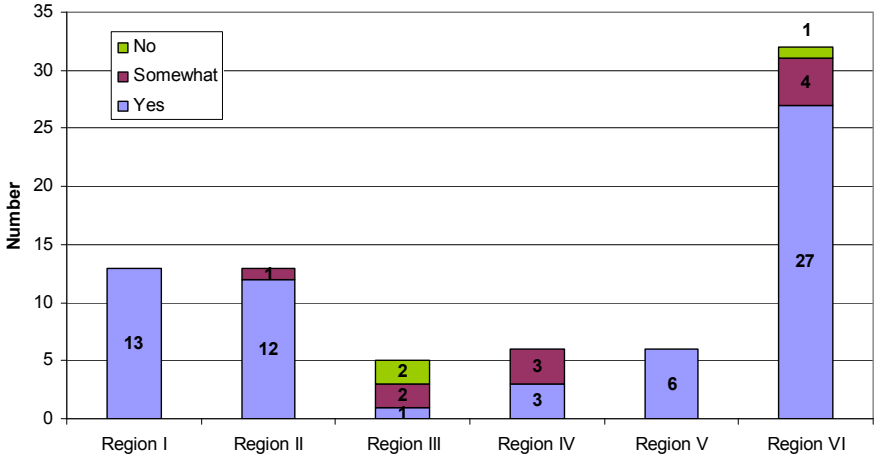


Figure 15: NMHSs as a major climate information and service provider - Adaptation

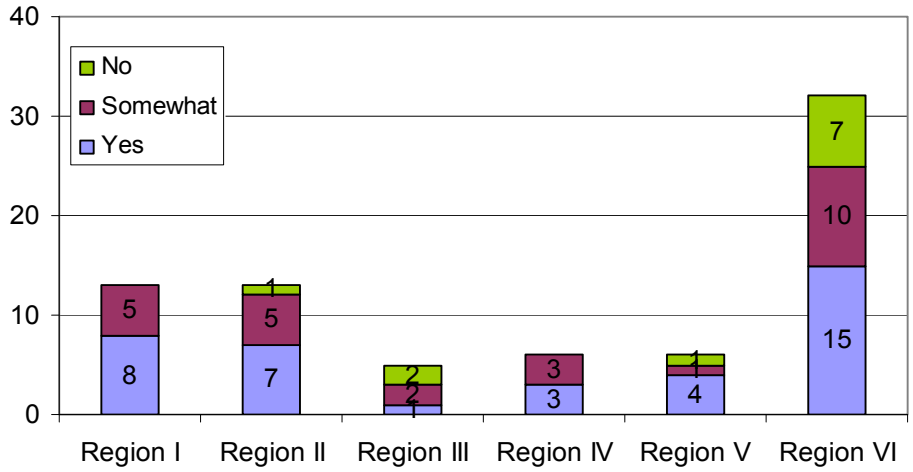


Figure 16: NMHSs as a major climate information and service provider - Mitigation

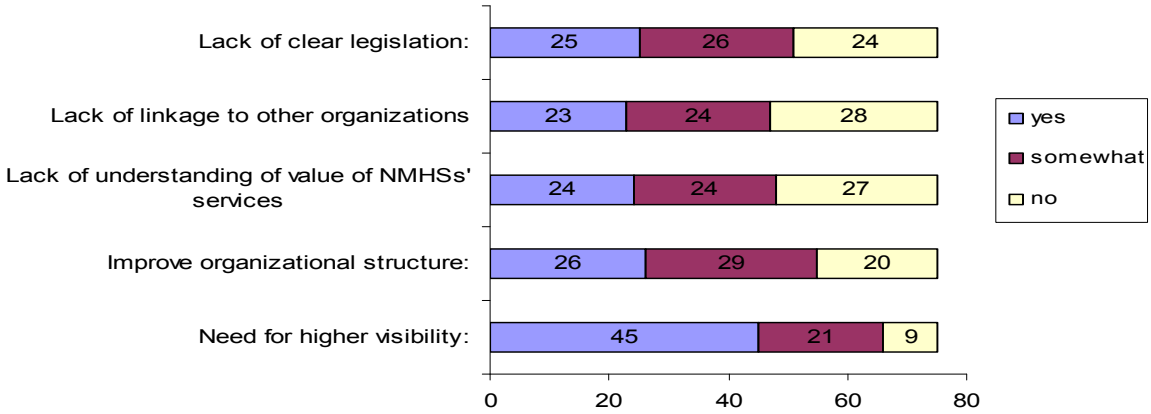


Figure 17: Identified needs that would enhance contribution of NMHSs to adaptation activities

i. Factors Limiting Contributions

Under limiting factors, the NMHSs were provided with the opportunity to identify gaps and needs that they believe limit their potential contribution to their country's adaptation (see Figure 17) and mitigation (see Figure 18) efforts and ability to provide climate products to interested stakeholders. The factors supplied for respondents to consider were: need for higher visibility and recognition within Government, organisational structure of national efforts limiting potential contribution, lack of understanding of the value of NMHSs' services provided, lack of linkages with other organisations involved, and lack of clear legislation or policies regarding the role of the NMHSs.

Need for higher visibility and recognition of the NMHSs within their respective Government was predominantly identified as a limiting factor among the responding NMHSs for their involvement in both adaptation and mitigation. Regarding adaptation and mitigation, sixty-six and sixty-two of the 75 responding NMHSs; respectively, indicated that this was a limiting factor. Lack of understanding of the value of services provided was also identified as limiting the contribution of NMHSs to adaptation (forty-eight) and mitigation (fifty-four), of the 75 responding NMHSs respectively. However, among the same number of responding NMHSs, twenty-seven and twenty-two respectively, indicated that this was not a factor limiting their contribution).

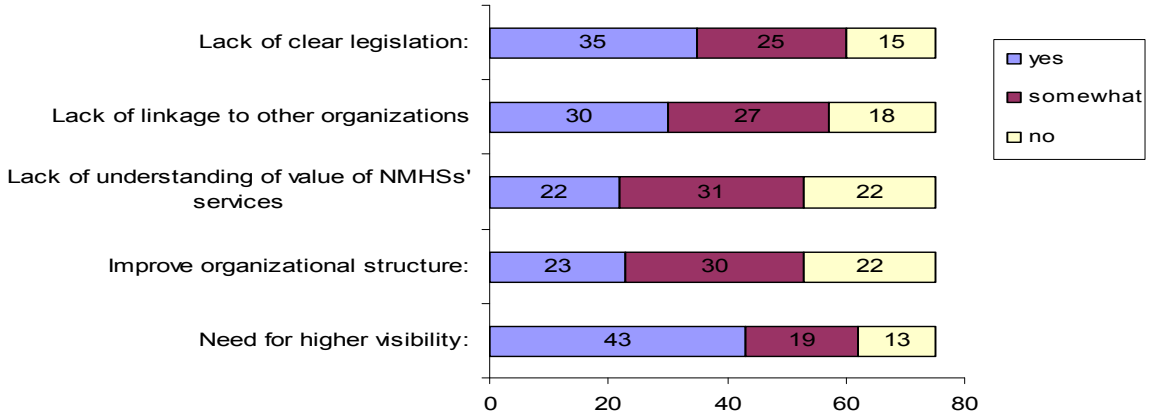


Figure 18: Identified needs that would enhance contribution of NMHSs to mitigation activities

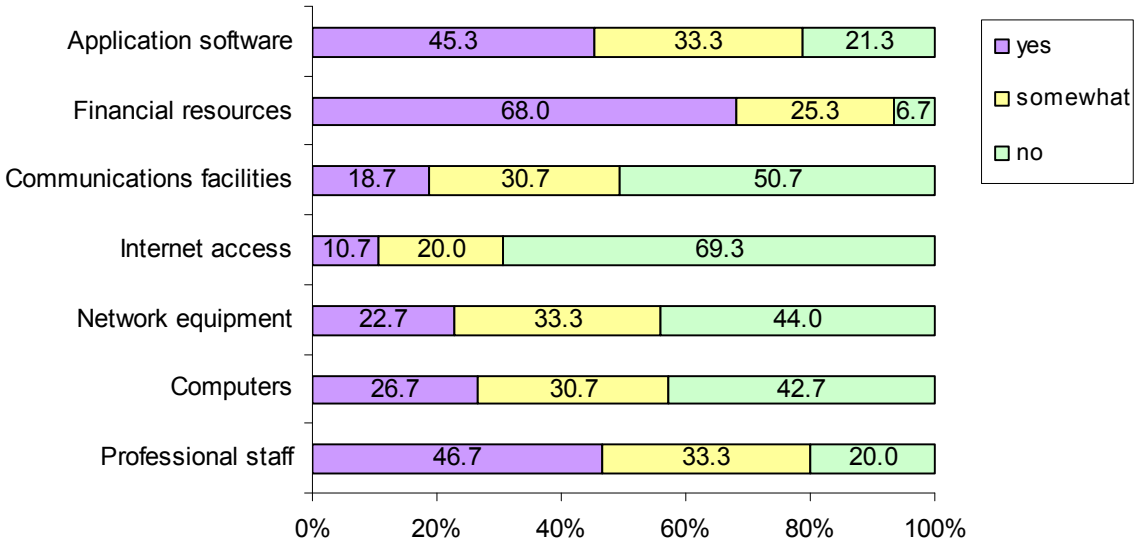


Figure 19: Identified factors that limit ability of NMHSs to provide climate-related products to interested stakeholder

ii.. Resource Limiting Contributions

In terms of available resources limiting the NMHSs' ability to provide climate-related products to interested stakeholders, respondents were asked to indicate to what degree each of the following are a factor: professional staff, computers, network equipment, internet access, communications facilities, financial resources and application software (see Figure 19). Of the seventy-five NMHSs that responded to this question, fifty-one (68%) indicated that financial resources were a limiting factor. In contrast, five countries or 7% of them indicated that it was not a factor. Other limiting factors of note pointed out are; the availability of

professional staff and applications software which 80% and 78% of the responding NMHSs, respectively, identified as being either limiting or somewhat limiting their ability to contribute.

Internet access was not seen as a limiting factor by fifty-two (69%) of the responding NMHSs, however at the regional level some NMHSs in Region I and Region II (as well as Region III and IV) identified access to the internet as limiting their ability to contribute.

A regional analysis does provide some further insight into the relative roles of these limiting factors. Factors other than financial resources predominantly identified as limiting NMHSs in each of the regions are:

Region I – professional staff, communication facilities and applications software

Region II – application software and professional staff

Region III – application software and professional staff

Region IV – application software, network equipment, computers and professional staff

Region V – professional staff and application software

Region VI – professional staff and application software

iii. Focus for WMO's Global and Regional Coordinated Efforts

In seeking the views of the NMHSs on where WMO's global and regional coordinated efforts could be best placed to enhance their NMHS's contributions to adaptation and mitigation efforts, the following areas were provided and NMHSs were asked to rank the importance of each: advocacy for enhanced visibility; cost-benefit analysis for hydro-meteorological services; strengthening strategic partnerships with stakeholders; education, training and public outreach; and resource mobilisation.

In addition, for adaptation views were also sought on NMHSs' ranking of the importance of WMO's global and regional coordinated efforts being directed in the following areas: assisting members in the development of a national adaptation strategy; provision of technical advice and specifications; technology transfer, capacity building and technical guidance and training; strengthening strategic partnerships with other technical organisations and agencies; and promotion and development of Regional Climate Centres.

a. Enhancing NMHSs' Contributions to Adaptation Activities

Among the 75 respondents to this section of the Survey, areas predominately ranked as highly important are technology transfer, capacity building, technical guidance and technical training (40% ranked as being at their highest priority level); cost-benefit analysis of hydro-meteorological services (33% ranked as being at their highest priority level) and advocacy for enhanced visibility of NMHSs (24% ranked as being at their highest priority level). More specifically, areas identified by respondents as being predominately of higher importance (those ranked as either first, second or third) are: technical transfer, capacity building, technical guidance and technical training (65%), provision of technical advice and specifications (53%), cost-benefit analysis of hydro-meteorological services (51%); and education, training and public outreach (50%).

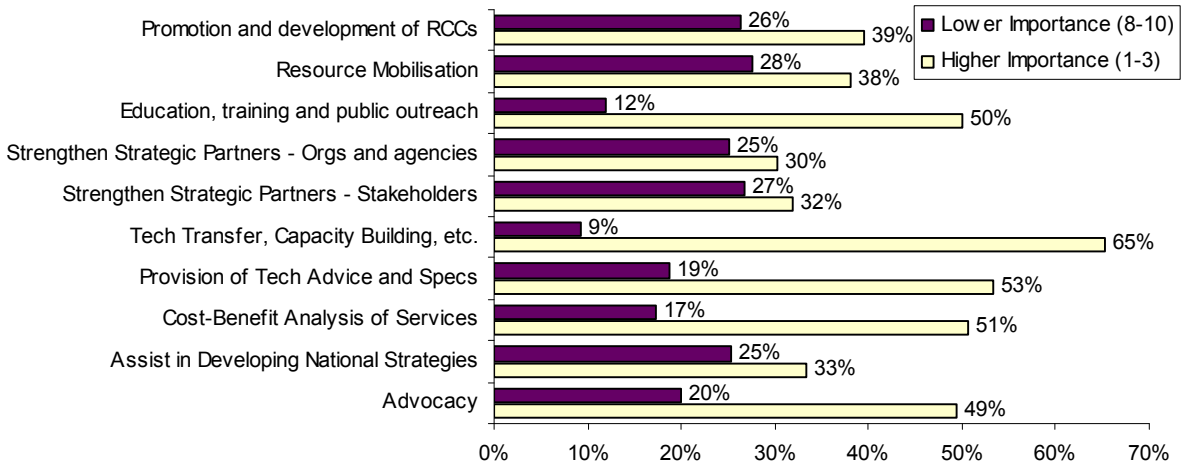


Figure 20: Predominant Ranking of higher and lower importance of areas where WMO's coordinated efforts should be directed - Adaptation

Ranked as being among the lowest of importance (see Figure 20) for a number of NMHSs (either ranked as being 8th, 9th or 10th in importance) of the identified areas where WMO's global and regional coordinated efforts could enhance their overall contributions to adaptation activities are: resource mobilisation (28%), strengthening strategic partnerships with stakeholders (27%), promotion and development of Regional Climate Centres (26%), and assist members in the development of a national adaptation strategy (25%).

It is worth noting the bi-polar nature of the rankings for some of these areas; similar number of NMHSs ranking an area as being of higher importance to those ranking it as being of lower importance. This is the case for three of the areas which were ranked as being of lower importance – assisting members in the development of a national adaptation strategy, strengthening strategic partnerships with stakeholders, and strengthening strategic partnerships with other technical organisations and agencies. This bi-polar nature for these areas of potential efforts by WMO is also reflected at the regional level.

b. Enhancing NMHSs' Contributions to Mitigation Activities

Among the seventy-six respondents to this sub-section of the Survey, highly important areas for WMO's global and regional coordinated efforts identified by the NMHSs (those areas ranked as either one or two out of five) are: education, training and public outreach programmes (forty four NMHSs); and advocacy for enhanced visibility of NMHSs (thirty-one NMHSs). Ranked as being of lower importance for a number of responding NMHSs (either ranked as being fourth or fifth in importance) was WMO's global and regional coordinated efforts being directed at resource mobilisation (35 NMHSs indicated efforts in this area as being of lower importance). In terms of interpreting this result, it should be noted that a number of the responding NMHSs in Region I (eight), Region IV (three) and Region V (four) did identify WMO directing its efforts at resource mobilisation as highly important.

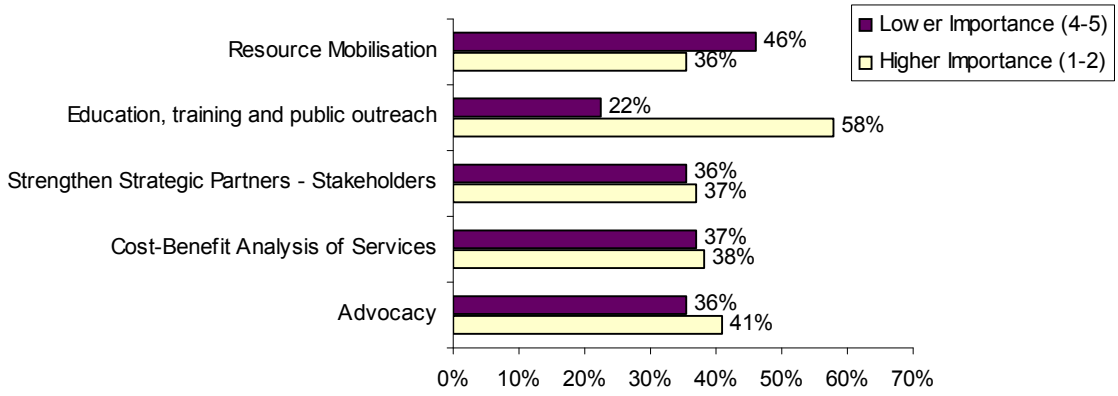


Figure 21: Predominant Ranking of areas of higher and lower importance, where WMO's coordinated efforts should be directed -Mitigation

As is the case for areas important for enhancing NMHSs' overall contributions to adaptation activities, some of the rankings to enhance contributions to mitigation activities are also bi-polar in nature, (see Figure 21); similar number of NMHSs ranking an area as being of higher importance to those ranking it as being of lower importance. In fact, this is the case for all the identified areas except for education, training and public outreach programmes (more ranked this as being highly important) and resource mobilisation (more ranked this as being of lower importance).

At the regional level, this bi-polar nature of the response is also reflected with the exception of two areas of coordinated efforts. Under cost-benefit analysis, more NMHSs in Region I, II and IV ranked efforts in this area by WMO as being of lower importance, and more NMHSs in Region V and VI ranked this as being of higher importance than did those NMHSs ranking it otherwise in these respective regions. For the area of resource mobilisation, more NMHSs in Region I, IV and V ranked WMO efforts in this area as being of higher importance than lower and in Region II and VI, more ranked this area as being of lower importance than higher.

VII. Linking the Survey to Subsequent Developments – GFCS and EC-LXI

The Heads of States and Governments, Ministers and Heads Delegations present at the World Climate Conference-3 (WCC-3), held from 31st August to 04th September 2009 in Geneva, through the WCC-3 High-level Declaration decided to establish a Global Framework for Climate Service (GFCS). This Framework is expected to help the global community to be better equipped to meet the challenges of climate variability and change and to bridge the gap between the climate information being developed by the climate science and service providers' communities on one hand and the practical needs of information users on the other. The Expert Segment of WCC-3 reviewed the various challenges facing the climate service provider and user communities; considered the needs and capabilities for applying climate information in key climate-sensitive sectors, as well as for social and economic benefits; examined the scientific bases for climate information and prediction services; and concluded that:

- There is already existing firm scientific bases for the delivery of a wide range of climate services;

- Present capabilities to provide effective climate services fall far short of meeting present and future needs and of delivering the full potential benefits, particularly in developing countries;
- The most urgent need is for much closer partnerships between the providers and users of climate services; and
- Major new and strengthened research efforts are required to increase the time-range and skill of climate prediction through new research and modelling initiatives; to improve the observational basis for climate prediction and services; and to improve the availability and quality control of climate data.

WMO Programmes and infrastructure created over the years for observations, predictions and advisories, developed and maintained by the NMHSs, as well as international research coordinated by WMO, form the foundation of the GFCS. WMO, in partnership with other international organisations, has been active in developing specialised knowledge and guides for the generation of climate information (analysis, prediction, products and services, etc.) and their use in various sectors and regions, including for adaptation to both climate variability and change. The WCC-3 participants urged WMO to continue to build on this foundation, but also to go further, to develop more relevant and meaningful climate products and services that people and economies require, especially under a changing climate.

WMO climate activities also include the enhancement of the capacity of Members, particularly in developing and least developed countries; and close partnerships with many organisations. On the matter of partnerships, it is recognised that most of the components of the World Climate Programme and GCOS are reflected within the GFCS thus embracing the existing partnerships in its delivery. In addition, the Executive Council (EC-LXI, 2009) agreed to use the UN 'Delivering as One' initiative (a system-wide coherent approach to climate change activities) to coordinate climate issues at the UN level rather than attempting to revitalise the Inter-Agency Committee on the Climate Agenda (IACCA). Working in partnerships as described in the EC-endorsed 'WMO initiative to support climate change adaptation' also includes WMO's commitment to the Nairobi Work Programme in support of adaptation to climate change.

A number of the above directions and calls for action from WCC-3 and WMO Executive Council ring true in the context of the responses to the Survey. It is first worth noting that despite this call to arms to address adaptation, 24% of the respondents indicated that adaptation is either of low or no priority within their NMHS and 32% indicated that they had staff devoted primarily to adaptation activities. The regional distribution of the relative priority given adaptation activities is also a reason for concern as in Regions where many would suggest there is a need for specific attention to adaptation, there are NMHSs which see adaptation as being of low or no priority.

In terms of factors limiting contributions by the NMHSs, limited visibility and recognition within their respective governments as one of the main contributing factors was identified by 60% of the respondents. In terms of the ranking of WMO's global and regional coordinated efforts being directed at advocacy for enhanced visibility of NMHSs in adaptation activities, approximately half of the respondents saw this as a highly important role.

From a resources perspective, in addition to the availability of financial resources (70 of the 75 respondents identified this as a limiting factor), the availability of professional staff and application software were predominately identified across all Regions as limiting respondents ability to provide climate-related products to interested stakeholders. The availability of computers and associated hardware and connectivity remains an issue for some NMHSs in all Regions, but previous efforts to address these problems appear to be making some progress. The

responses, however suggest continued efforts are needed, especially under an enhanced effort in provision of climate services.

On the role of partnerships at the NMHS level, responses in the Survey related to identifying the agencies/ministries with whom they partner when delivering adaptation activities reflect national and regional concerns and priorities, long-standing and existing relationships and institution structures. As such, partners identified include agencies/ministries such as Environment, Agriculture, Water Resources, Disaster Management, Tourism, Physical Planning, Industry and Commerce). Where scientific and academic partners were identified, these were predominately natural or physical science based. It is interesting to note that a small number of respondents identified the WMO, Regional Associations and Regional Meteorological/Climate Centres as partners.

This latter result could be interpreted as further evidence of the need and suggested directions for WMO's global and regional coordinated efforts relating to enhancing NMHSs' contributions to adaptation activities. The responses ranked highly WMO's efforts being directed towards technology transfer, capacity building, technical guidance and technical training; cost-benefit analysis of hydrometeorological services; and advocacy for enhanced visibility of NMHSs. As noted in the analysis, when interpreting the responses, ranking importance of different areas to which WMO's efforts could be directed can be potentially misleading. It is suggested that this is the case for the importance placed in WMO's efforts being directed at strengthening NMHSs' strategic partnerships with stakeholders. The responses have a bipolar distribution with similar number of responding NMHSs ranking this area of effort as being of high importance as those ranking it as being of low importance. Greater clarity in the scope, nature and need for targeting such efforts may be required.

Climate activities for which WMO has responsibility are guided by a number of WMO constituent bodies and co-sponsored entities with the Executive Council (EC-LXI, 2009) urging for enhanced interaction and coordination among these bodies and with relevant associated bodies at the regional and national levels.

Within the Commission for Climatology, priorities for work during the period 2010-2014 include:

- Climate data and observations and climate system monitoring and analysis of climate variability and change;
- Climate research application, and practices in transfer of research results to operations and user needs to the research community;
- Climate products and services;
- Climate applications for adaptation and risk management;
- Regional Climate Centres;
- User interface mechanism;
- Capacity building and training activities; and
- Interagency partnerships and collaborations.

For 2015-2018 and beyond (continuing to further support the GFCS), CCl priorities will focus increasingly on building capacity at national levels to apply the basic set of tools and knowledge supporting the GFCS and on further developing the global, regional and national scale portal to this information for use by decision makers.

Based on the evolving nature of risk and adaptation assessments and the underlying knowledge, building capacity to apply the tools may be insufficient. This would particularly be the case if capacity to apply does not also include capacity to recognise their strengths and limitations, where and how they can and cannot be applied, and how to adapt them to meet the requirements of the particular situation. It will also be necessary to build the capacity to recognise where and when the existing tools and supportive guidance are no longer fit-for-purpose and therefore need further development or replacement.

The responses within the Survey are enlightening in terms of where the respondents suggest WMO's global and regional coordinated efforts could be directed to enhance NMHSs' overall contribution to adaptation activities. From an overall perspective, respondents predominantly highly ranked technology transfer, capacity building, technical guidance and technical training. This area for WMO's efforts was followed by provision of technical advice and specifications, cost-benefit analysis of hydrometeorological services in adaptation activities and then education, training and public outreach programmes in adaptation targeted at NMHSs and their stakeholders. This overall ranking is consistent with the identification of factors limiting involvement in national adaptation efforts – need for higher visibility, and the lack of professional staff and applications software.

It is worth noting, however, that there are significant differences even within Regions as to the importance of different areas which the respondents believe WMO efforts should be directed to. This result is not surprising considering the differences within the Regions in terms of the importance given to adaptation by the different NMHSs; capacity within each NMHS to deliver climate services directed at adaptation; and the scope and nature of adaptation interests within each country. This does suggest the need for a better understanding of the nature and scope of the needs of individual NMHSs, as well as at the regional level. The results suggest that there is no single model for the provision of climate services that should be applied across all NMHSs or Regions. It should be fit-for-purpose and able to adapt as the context and demand for the services and their delivery changes. They also suggest greater involvement of the Regional Associations in defining and coordinating development and delivery of the required supportive efforts.

Established systems for acquiring input from end-users on specific products/services needs for adaptation exist within 21 of the responding NMHSs. This result needs to be looked at in the context of the number providing sector-specific advisory services on adaptation (fifty-seven of 79 NMHSs indicated that they were providing such services) and in the context of NMHSs that had staff devoted primarily to adaptation activities (twenty-five of 79 NMHSs had such staff). These results suggest that partnerships between the providers and users of climate services towards developing more relevant and meaningful climate products and services that people and economies require in support of adaptation will need greater attention (moving from a culture of service delivery that is primarily supply driven to one that is end-user demand informed). These results also suggest the need for capacity building and other technical support in the area of engaging end-users and service/product development to meet user needs.

A question that this raises is who are the users that NMHSs are targeting and that will need to be targeted towards developing, delivering and evaluating progress on providing climate information and predictions that contribute to nations and regions adapting well. What is an effective engagement strategy? Targeting individuals, professional groups, organisations, and/or government ministries/agencies at various levels (local, national and where appropriate regional) will have implications (resources) and can each be more or less effective depending on the particular circumstances. There is no single appropriate set of users, but the users to be engaged should reflect the needs and capabilities of those needing to promote, develop, deliver and evaluate adaptation measures and strategies. As such, part of the process of gaining the required feedback, will need to be directed at identifying and engaging the required user communities. This may require enhancing the capacity of NMHSs in the area of effectively engaging users.

Learning from and Taking the Survey Forward

As the above analysis has shown, this Survey has provided an opportunity to understand the existing roles and

relationships of NMHSs in national adaptation activities, and to seek the views of NMHSs on factors limiting their involvement in adaptation and mitigation activities, as well as where WMO's efforts could enhance that involvement. It is suggested that this Survey should be seen as a providing a snapshot or baseline against which progress can be monitored and the effectiveness of efforts evaluated. To this end, it is suggested that it would be constructive to seek information from other NMHSs in Regions where participation was particularly low and adaptation is indicated to be of particular concern (e.g., Region I, Region III and Region V). Attention in getting responses from other NMHSs should be initially placed on seeking responses to questions under Part A and Part C.

It is also suggested that this Survey, potentially with some modification, should be sent out to NMHSs again in 5 years (2013). This would provide an opportunity to gauge progress and seek views of the effectiveness of existing efforts and where further efforts are needed. Doing so would also provide an opportunity to identify and confirm directions of WMO constituent bodies and co-sponsored entities that are seen as playing a major role in delivering the GFCS.

ANNEX 1

WORLD METEOROLOGICAL ORGANIZATION
==========

Sample of the Survey

ROLE OF NMHSs IN ADAPTATION TO CLIMATE VARIABILITY AND CHANGE

SURVEY

Last Name: .....

First Name: .....

Title: .....

Country: .....

WMO Region: .....

Organization: .....

E-mail address: .....

Telephone number: .....

Date: .....

PART A: POLICY ROLE OF NMHS

I. NMHS and Policymakers	
1) Does your NMHS prepare documents regarding climate change or climate-related activities for policymakers and/or government officials? If "Yes", please answer the following question: Which climate-related activities do these documents address? *Check <u>one</u>* ☐Adaptation ☐Mitigation ☐Both ☐Neither	☐ Yes ☐ No
2) Does your NMHS participate in regular meetings with policymakers and/or government officials in order to update them on the most recent available information related to climate variability and change or climate-related activities? If "Yes", please answer questions a) – b) below:	☐ Yes ☐ No
a) Which climate-related activities do these meetings address? *Check <u>one</u>* ☐Adaptation ☐Mitigation ☐Both ☐Neither	
b) How often do these meetings take place?	
3) Does your NMHS work <u>directly</u> with policymakers/government officials to integrate climate variability and change into policy decisions?	☐ Yes ☐ No
4) Does your NMHS have a designated in-house liaison with whom policymakers/government officials can consult directly for climate-related matters?	☐ Yes ☐ No

PART B: NMHS ROLE IN ADAPTATION ACTIVITIES

I. Organizational	
1) What priority is given to **adaptation activities** in the overall goals of your NMHS?	*Check one* ☐ First Priority ☐ High Priority ☐ Medium Priority ☐ Low Priority ☐ Not Considered
2) Does your NMHS have any staff members devoted primarily to adaptation activities?	☐ Yes ☐ No

II. Adaptation	
1) Does your country's government have a national strategy for adaptation? (e.g. National Adaptation Plan of Action (NAPA) for LDCs) Please refer to the following link for additional information: http://unfccc.int/adaptation/napas/items/2679.php *This includes if a sub-strategy for adaptation exists within a broader national climate change strategy.* If "No", please skip the question. If "Yes", please answer questions a) - d) below:	☐ Yes ☐ No
a) What is the official title?	
b) What years does it cover (*yyyy - yyyy*)? -	
c) How often is it revised/updated? Every years	
*Note for question d): If your country does not have a distinct strategy for adaptation, please answer the following questions solely with respect to **adaptation activities** within the overall national strategy.*	
d) Is your NMHS a contributing agency to its creation or implementation? If "Yes", please answer questions i) - iv) below:	☐ Yes ☐ No
i) What was the leadership position of your NMHS in creation of the strategy?	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role
ii) What was the leadership position of your NMHS in implementation of the strategy?	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role

iii) With whom does your NMHS collaborate regarding implementation:	
1. Government If "Yes", please answer the following question:	☐ Yes ☐ No
General scope of collaborating ministries?	*Check <u>all that apply</u>* ☐ Science ☐ Environment ☐ Defense ☐ Transportation ☐ Communications ☐ Agriculture ☐ Industry ☐ Other (specify):
2. Non-Governmental Organization (NGO) If "Yes", specify titles:	☐ Yes ☐ No
3. Business and private sector If "Yes", specify titles:	☐ Yes ☐ No
4. Other If "Yes", specify:	☐ Yes ☐ No
iv) What are the responsibilities (completed, current, and/or planned) of your NMHS in the creation and/or implementation of the strategy?	
2) Does your NMHS provide sector-specific advising services regarding adaptation activities? If "Yes", please answer questions a) – b) below:	☐ Yes ☐ No
a) Which sectors?	*Check <u>all that apply</u>* ☐ Agriculture and food production ☐ Alpine zone (Europe) ☐ Biological diversity ☐ Coastal zone / Marine ☐ Energy ☐ Forestry ☐ Human health ☐ Industry (if not listed) ☐ Natural disaster management ☐ Tourism and recreation ☐ Transportation / Infrastructure ☐ Urban management ☐ Water resources ☐ Development/Cross-cutting ☐ Other (specify):
b) Please detail some specific examples of past successes and/or failures. <u>Please include means and available results of evaluation of end-user benefits</u>:	

III. Contribution to technical areas in adaptation, particularly within the Nairobi Work Programme (NWP) on Impacts, Vulnerability and Adaptation to Climate Change

Please refer to the following link:
http://unfccc.int/adaptation_agenda_item_adaptation/items/3633.php

1) Please assess the contribution of your NMHS to each of the following ongoing adaptation activities, which are categorized according to official NWP adaptation areas of work.
If the item listed is a multi-national Programme, please address the degree to which your NMHS contributes significantly to your country's representation in that Programme.

Adaptation Activity	**Country implements / participates?**	**Role of your NMHS**	**Who are your partner agencies/ministries?**
Methods and Tools			
Climate watches	☐ Yes ☐ No If "No": next item	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Climate Information and Prediction System (CLIPS)	☐ Yes ☐ No If "No": next item	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Regional Climate Outlook Forum (RCOF)	☐ Yes ☐ No If "No": next item	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Climate Data and Observations			
Climate Data Management System (CDMS)	☐ Yes ☐ No If "No": next item	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Past climate monitoring (*ex: monthly climate reviews*)	☐ Yes ☐ No If "No": next item	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
GCOS-led Regional Action Plan (RAP)	☐ Yes ☐ No If "No": next item	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Agrometeorological observations	☐ Yes ☐ No If "No": next item	*Check one* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	

Hydrological observations	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Oceanographic observations	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Climate Modeling, Scenarios and Downscaling			
Global Climate Model data (distribution)	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Regional Climate Model (RCM) data/analysis	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
User-specific RCM data (*ex: agro-climate model data*)	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Climate change scenarios	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Integrated Assessments (IA) and/or climate change scenario sector-specific impact assessments	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Climate Related Risks and Extreme Events			
Medium-term (1-4 weeks) temperature forecasts	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Medium-term (1-4 weeks) precipitation forecasts	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Long-term (>1 month) temperature forecasts	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	

Long-term (>1 month) precipitation forecasts	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Climate hazards outlook (*ex: fire*)	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
National Weather/Climate Disaster Risk Reduction Programme	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Socio-Economic Information			
Earth System Science Partnership	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Socio-economic impacts data archiving	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	If "Yes", which data?
Socio-economic impacts analysis (publish, disseminate)	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Adaptation Planning and Practices			
Regional Climate Centres (RCCs)	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Climate Risk Assessment / Mapping	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
Research			
Improvement of climate prediction models, output analysis	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	
National vulnerability assessment reports	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	

National climate change impact assessment reports	☐ Yes ☐ No If "No": next item	*Check <u>one</u>* ☐ Sole Authority ☐ Lead Responsibility ☐ Minor Role ☐ No Role	

Please list any other relevant ongoing adaptation activities <u>to which your NMHS has contributed significantly</u> and categorize each according to official NWP adaptation areas of work (see Introduction).

Note 1:
If the item listed is a multi-national Programme, please address the degree to which your NMHS <u>contributes significantly to your country's representation</u> in that Programme and contributes to achieving its goals.

Note 2:
Specific adaptation projects (i.e. goal-oriented, with an end date) to which your NMHS contributes will be addressed in a later section. For example, building a coastal barrier against sea level would be considered a "project" and should <u>not</u> be listed below.

IV. Additional Adaptation Projects

1) Please select the **three** projects in which <u>your NMHS was most involved</u>:

<u>Project #1</u>
1. Project title:
2. How does it facilitate adaptation?
3. Means of evaluating end-user benefits (*ex: survey, quantitative indicators etc.*)?
4. Results of evaluation (*ex: improvement in crop yield, positive/negative user feedback etc.*)?

<u>Project #2</u>
1. Project title:
2. How does it facilitate adaptation?
3. Means of evaluating end-user benefits (*ex: survey, quantitative indicators etc.*)?
4. Results of evaluation (*ex: improvement in crop yield, positive/negative user feedback etc.*)?

<u>Project #3</u>
1. Project title:
2. How does it facilitate adaptation?
3. Means of evaluating end-user benefits (*ex: survey, quantitative indicators etc.*)?
4. Results of evaluation (*ex: improvement in crop yield, positive/negative user feedback etc.*)?

V. End-User Feedback

1) Does your NMHS have an established system for acquiring input from end-users on specific product/service needs for adaptation? If "Yes", how?	☐ Yes ☐ No

PART C: GAPS AND NEEDS

Gaps/Needs regarding NMHS involvement in your country's adaptation/mitigation efforts	**Adaptation** *Check one*	**Mitigation** *Check one*
1) Is your NMHS a major climate information and service provider?	☐ Yes ☐ Somewhat ☐ No	☐ Yes ☐ Somewhat ☐ No
2) Does your NMHS need higher visibility and recognition within the Government as one of the main contributing agencies to adaptation/mitigation efforts in your country?	☐ Yes ☐ Somewhat ☐ No	☐ Yes ☐ Somewhat ☐ No
3) Does the organizational structure involved in national adaptation/mitigation efforts (*ex: involvement of different ministries, sectors, stakeholders, etc.*) limit potential contributions of your NMHS to such activities in your country?	☐ Yes ☐ Somewhat ☐ No	☐ Yes ☐ Somewhat ☐ No
4) Does the lack of understanding by governmental authorities of the value of service that your NMHS provides limit your contribution to adaptation/mitigation efforts?	☐ Yes ☐ Somewhat ☐ No	☐ Yes ☐ Somewhat ☐ No
5) Does a lack of linkages between your NMHS and other organizations involved in adaptation/mitigation efforts (*ex: other ministries, sectors, stakeholders, etc.*) limit the contributions of your NMHS to such activities in your country?	☐ Yes ☐ Somewhat ☐ No	☐ Yes ☐ Somewhat ☐ No
6) Does a lack of clear legislation or policies regarding the role of the NMHS in adaptation/mitigation efforts (*ex: socio-economic impacts assessment*) limit the effectiveness of your contribution to such efforts in your country?	☐ Yes ☐ Somewhat ☐ No	☐ Yes ☐ Somewhat ☐ No

7) Please indicate if any of the following factors limit your ability to provide climate-related products to interested stakeholders:

a)	Professional staff	☐Yes	☐Somewhat	☐No
b)	Computers	☐Yes	☐Somewhat	☐No
c)	Network equipment	☐Yes	☐Somewhat	☐No
d)	Internet access	☐Yes	☐Somewhat	☐No
e)	Communications facilities	☐Yes	☐Somewhat	☐No
f)	Financial resources	☐Yes	☐Somewhat	☐No
g)	Application software	☐Yes	☐Somewhat	☐No

8) In which of the following areas would WMO's global and regional coordinated efforts enhance your NMHS' overall contributions to **adaptation** activities?	Please rank the following ten areas in order of importance according to the priorities of your organization (***1 being the most important and 10 being the least important***).
a) Advocacy for enhanced visibility of NMHS in adaptation activities	Rank:

b) Assist members in the development of a national adaptation strategy	Rank:
c) Cost benefit analysis of hydro-meteorological services in adaptation activities	Rank:
d) Provision of technical advice and specifications (*ex: to enhance observing networks, operational infrastructures, relevant products and services for adaptation applications*)	Rank:
e) Technology transfer, capacity building, technical guidelines and technical trainings (*ex: regional climate model tools and methodologies, climate change risk mapping, data management*)	Rank:
f) Strengthening strategic partnerships with stakeholders (*ex: various sectors, media etc.*)	Rank:
g) Strengthening strategic partnerships with other technical organizations and agencies (*ex: meteorology, hydrology, ocean services, etc.*)	Rank:
h) Education, training and public outreach programs in adaptation (*ex: targeted at NMHSs and their stakeholders*)	Rank:
i) Resource mobilization	Rank:
j) Promotion and development of Regional Climate Centres	Rank:
9) In which of the following areas would WMO's global and regional coordinated efforts enhance your NMHS' overall contributions to **mitigation** activities?	Please rank the following five areas in order of importance according to the priorities of your organization (*1 being the most important and 5 being the least important*).
a) Advocacy for enhanced visibility of NMHS in mitigation activities	Rank:
b) Cost benefit analysis of hydro-meteorological services in mitigation activities	Rank:
c) Strengthening strategic partnerships with stakeholders (*ex: various sectors, media etc.*)	Rank:
d) Education, training and public outreach programs in mitigation (*ex: targeted at NMHSs and their stakeholders*)	Rank:
e) Resource mobilization	Rank:

General comments

ANNEX 2

WORLD METEOROLOGICAL ORGANIZATION

CLIMATE AND WATER DEPARTMENT

WMO INTER-REGIONAL WORKSHOP ON POLICY ASPECTS OF CLIMATE CHANGE

PETALING JAYA, MALAYSIA

19-21 April 2010

REPORT

EXECUTIVE SUMMARY

The Inter-Regional Workshop on Policy Aspects of Climate Change, hosted by the Malaysian Meteorological Department, was held from 19 to 21 April 2010, in Petaling Jaya, Malaysia. Participants included representatives of Malaysian and international partner organizations, Permanent Representatives with WMO, National Meteorological Services (NMSs), and the WMO Secretariat.

The workshop provided an opportunity to bring together representatives from NMSs, Regional Associations, the Commission for Climatology (CCl), regional climate service providers and independent scientists to address the challenge as how to encompass a core set of longstanding capabilities in climate research, observations, modelling, predictions and assessments generated by NMSs along with other scientific institutions. Furthermore, the workshop aimed at an improved understanding of the required transition towards a solid scientific foundation for extensive on-the-ground climate services that respond to requests of governments on public policy decision making, UN Agencies, climate sensitive sectors, in an integrated way.

The specific objectives of the workshop were as follows:

- Identify: opportunities and challenges ahead for NMSs for establishment of National Climate Services;
- Review: How NMSs to varying degrees should develop an effective mechanism to deliver climate products to all sections of society at various levels and to assist the users in various sectors in their respective decision making processes;
- Explore: Areas that NMSs can carry comparative advantage to enhance their profile at the national level through science- policy advice;
- Explore: In depth, the role of scientific bodies such as Commission for Climatology as how to they can assist Regional Associations to increase synergies in addressing climate change issues;
- Discuss: The ways NMSs can provide substantive input at national level on climate change policy issues including the IPCC process, the UNFCCC process and provision of climate services for adaptation (particularly within the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change) as well as mitigation;
- Review: The manner in which climate information is presently utilised (with its inherent uncertainties) in policy and decision-making processes in different regions around the world;
- Review: The existing national institutional set up for providing climate services in different regions and make recommendations on the possible models;

A panel of experts summarized the international science and policy processes through the perspective of IPCC and UNFCCC programmes.

Panels of experts from each WMO Region presented regional and national perspectives on climate services for climate change adaptation and risk management in their respective Regions.

The workshop concluded that two principles should guide the developing of climate services within the NMSs – their contribution in the National Climate Services of their countries and territories:

- It is critical that all NMSs focus on consolidating and where possible expanding their existing capabilities. They should aim to be the authoritative, national voice in delivering the critical climate data, information and services needed by their

respective communities of stakeholders to manage and live with climate variability and change;

- NMSs have a particular capacity to contribute to *adaptation* actions that will address the consequences of climate variability and trends on time scales that matter to decision makers, although there was some concern expressed about unintended consequences that might accompany a National Meteorological Service increasing its role into the respective national negotiation procedures.

Noting that the WCC3 through the Conference declaration had decided to establish the GFCS, and, endorsing the concept of the National Climate Services proposed within the concept of the GFCS, and in particular the concept of the NMS playing a key role within the programme of the NCS, the workshop made the following recommendations:

- Build on the assets that underpin the comparative advantages of NMSs that are linked within the operational WMO structure;
- Capitalize on, and enhance the climate information and services focus;
- The political will of the national government should ensure the ability of the NMS to provide effectively its uniquely significant information and services in its National Climate Service;
- Structural capacities of NMSs should be leveraged, and enhanced.

WMO INTER-REGIONAL WORKSHOP ON POLICY ASPECTS OF CLIMATE CHANGE
Petaling Jaya, Malaysia, 19-21 April 2010

REPORT

1. SESSION I: OPENING OF THE WORKSHOP

1.1 The Inter-Regional Workshop on Policy Aspects of Climate Change opened on 19 April 2010, at 0930 hours at the Headquarters of the Malaysian Meteorological Department in Petaling Jaya, Malaysia. Program for the workshop is shown in Annex 1. Welcoming remarks were given by Yap Kok Seng, Director General of the Malaysian Meteorological Department and Permanent Representative (PR) of Malaysia with WMO. M.V.K. Sivakumar, representative of the Secretary-General of WMO also made welcoming remarks. The opening address was provided by Y. Bhg. Dato' Madinah Mohamad, Secretary General of Science, Technology and Innovation.

1.2 Yap Kok Seng extended a warm welcome to all Permanent Representatives, sincere gratitude to Y. Bhg. Dato, and thanks to WMO. Yap Kok Seng noted that, in this time of strong indications of climatic change, the World Climate Conference-3 (WCC3) and the Global Framework for Climate Services (GFCS) had come in a timely manner. He noted the promise of the GFCS to contribute to beneficial multilateral agreements. He recognized that GFCS implementation requires NMSs to provide more effective climate services in all aspects, including negotiations at the inter-governmental level. Yap Kok Seng noted the common need for adaptation to climate trends, and the role of NMSs to provide climate change information in adapting to them.

1.3 M.V.K. Sivakumar expressed appreciation to Yap Kok Seng for his welcoming remarks, for agreeing to host the workshop, and for the kind hospitality extended by the Malaysian Meteorological Department staff. Citing the unfortunate volcanic ash problem that caused a number of participants to delay or cancel their travel to the Workshop, he noted the impact of natural disasters on our connected world. He further noted that 14 Malaysian Institutions were participating, together with eleven Permanent Representatives and ten departmental level managers which show the importance of this issue to the WMO. M.V.K. Sivakumar explained that the analysis and projections of climate change and their impacts is a daunting task for scientists, economists and policy makers that require a policy framework. He related that the work of the WCC3 to establish the GFCS had brought a new momentum to help governments and their citizens to understand the local impacts and to develop adaptations. The National Climate Services (NCS) embodied the GFCS and will provide a single office, a single point of entry for stakeholders to find all forms of climate services and products. He exhorted all participants in the workshop to rigorously discuss how to adopt and establish the NCSs in an integrated fashion, and noted that their deliberations and recommendations would form significant input to a position paper to be drafted for NMSs to use in their work to establish their NCSs.

1.4 The representative of Y. Bhg. Dato' Madinah Mohamad, Deputy Secretary of Environment, Maximilian T. Conrad conveyed her best wishes and addressed the participants with her prepared remarks, in which she extended a warm welcome and gratefulness to WMO. He noted a number of needs for adaptation, and that many actors will be required to act in consonance to achieve them. He expressed the need to uphold the UNFCCC, and to move into a state of environmentally conscientiousness and friendliness at all levels. Tradeoffs and co-benefits will obtain, as actions in areas such as energy security, air quality and human health also can be beneficial to energy, for example. Noting that policy and decisions should be based on the results needed, he stressed that scientific, user targeted climate information is essential. Maximilian Conrad explained that implementation through the 5 components in the GFCS may require some reorganization of activities through the WMO. The immediate challenge will be to work with partners to implement the GFCS quickly. The time has come for NMSs to provide National Climate Services at high levels. He wished all a successful workshop and useful outcomes and declared the workshop officially open at 10:15 hrs.

2. SESSION II: IPCC AND THE UNFCCC: THE INTERNATIONAL SCIENCE AND POLICY PROCESS

Four expert panelists; namely, Fredolin T. Tangang, Vice-Chair of IPCC Working Group I, Xianfu Lu, (presented by Ko Barret, USA), UNFCCC Secretariat, Gray Munthali, Malawi Meteorological Service and Michael Coughlan, Bureau of Meteorology, Australia summarized the international science and policy processes through the perspective of IPCC and UNFCCC programmes, relating those programmes to the considerations at the intergovernmental, regional and national levels.

2.1 The panellists covered the following topics:

- IPCC AR4 Synthesis and Policy Imperatives: Capacity Development for Policy makers through Science,
- Science-policy Advice on Climate Change and Key Socio-economic Sectors (A Focus on Nairobi Work Programme),
- Lessons Learned from National Adaptation Programmes of Action (NAPA), in more than 40 LDCs,
- Science-Policy Interaction - Challenges and Opportunities.

2.2 The panelists noted that society requires sound, science based policy, and that the IPCC reports are intended to be policy-relevant, not policy prescriptive. They concluded that IPCC Assessment Reports can be integrated into the NCS framework, used in the development of policy at the country level and packaged into information for decision-making for relevant stakeholders. The Nairobi Work Programme deals with key science and policy issues on adaptation. Priority areas of work are identified at the national level. The Nairobi Work Programme stresses the importance of dialogue between providers and users (how to talk and listen), provision of technical guidance on application of climate data and scenarios, and capacity building. Demands for climate information and services are likely to grow as the focus of adaptation is shifting from assessment to delivery of actions.

2.3 The panel noted that, while policy makers are generally receptive to new findings, often such findings are not formulated to fit into policy making. The science-policy interface is an engine for enabling information exchange, not a barrier. Once barriers are identified, they turn into opportunities -- by changing the direction of the research, or by adapting the policy process so it's more receptive to the research. The panel noted that, if scientists and policy makers stay in largely separate environments, there will be only sporadic connections. In order for the information to be useful it must satisfy four necessary conditions: science information must be relevant, compatible, and accessible, and policy makers must be receptive.

2.4 According to the panel, policy success can be judged from three different viewpoints: political benefits for government; client and stakeholder satisfaction with specific programs or services; and, scientific and expert evaluations (measuring stated aims against achieving real outcomes). Some challenges that were noted included: different knowledge sharing across disciplines and sectors, flows not well understood, few organizations have a learning culture, knowledge is sticky within organizations and hard to shift across gaps, mechanisms for overcoming divergence and fragmentation are not easily available in each sector, and the advice/policy schism. Considering methods of interaction, direct face to face interaction was considered best, but not always possible, so institutionalized mechanisms for sharing knowledge are also needed. Such mechanisms benefit from the use of spherical forums, cross-sectoral bodies, and long term partnerships (which occur best around high quality projects of mutually needed importance).

2.5 The discussion following the panel presentations brought forward several points: Climate change will impact people through extreme weather events; so, resources invested into the occurrence and trends of extreme events within given climate variability will be very powerful for meteorological services to be able to inform policy. Develop the seamless approach to projecting

and understanding the whole weather-climate spectrum. A variety of different models will evolve for that because of different capacities, boundary organizations, translation (from climate information into sectorally relevant information), role of policy makers, etc. Climate modelling will continue to focus on the longer ranges in the spectrum, and seasonal and intraseasonal period projections will be caught in the middle. Since policy makers care about impacts especially in that time range, it's a dilemma. The major adaptation planning time frame corresponds to that period.

2.6 The discussion also covered the need to redesign the NMSs to include the participation in the National Climate Service. Participants cautioned that if climate data and information systems needed in the NCS were developed separate from NMSs, it would make duplicative parallel services that would drain resources and fragment and weaken both. The NMS acting within the full network of systems coordinated through the WMO will provide the important link to enable the full suite of information to cascade from the Global centres on through the regional centres to the national scale. But, the NMSs are uniquely placed to ensure the cascading back up, too, as shown in the Regional Climate Outlook Forums in which the local scale users were asking for tailored products that could satisfy or feed into demands for services up through the global level. The NMSs participation in the NCS should emulate the smooth, collaborative action of a championship football team. NMSs can be a key player in the multidisciplinary team of the NCS, which can grasp and succeed in adapting to climate variability as all team members work together.

3. SESSION III: REGIONAL AND NATIONAL PERSPECTIVES ON CLIMATE SERVICES FOR CLIMATE CHANGE ADAPTATION AND RISK MANAGEMENT

3.1 M.V.K. Sivakumar gave the introductory presentation: Global Framework for Climate Services (GFCS). He explained that the WCC-3 Declaration decided to establish the GFCS to strengthen production, availability, delivery and application of science-based climate prediction and services. A subsequent inter-governmental meeting approved the forming of a High Level Task Force (HLTF) for GFCS and endorsed the composition. He noted that the primary goal of GFCS is to enable better management of risks of climate variability and change at all levels. It aims to provide a cooperative framework; enable users to benefit; mobilize the use of climate science globally; and foster mechanisms for sharing new advances in science and information through a cooperative global infrastructure.

3.2 The presentations and discussion illuminated Members' activities and services to address climate variability and change, from the perspectives of NMSs with limited resources, those that were moderately resourced, and those that were well-resourced. The presentations included country-specific evidence of climate change, current situations and trends, some impacts within the countries, key climate change issues, and considerations of issues in the area of science-policy interaction in national activities addressing adaptation to climate change.

3.3 The regional and national experiences in RA I: Africa were summarized by J.R. Mukabana, PR of Kenya with WMO and Director of Kenya Meteorological Department (KMD); D. Diarra, Chief of Agrometeorological Division of the Meteorological Service of Mali; and, Deon Terblanche, Senior Manager, Research Department of South Africa Weather Service.

3.4 Regional and national experiences in RA II: Asia were summarized by Q.Z. Chaudhry, PR of Pakistan with WMO and Vice-President of RA II, Director of Pakistan Meteorological Department (PMD); Shen Xiaonong, Deputy Director of China Meteorological Administration (CMA); and, Arjumand Habib, PR of Bangladesh with WMO and Director, Bangladesh Meteorological Department (BMD).

3.5 The regional and national experiences in RA III: South America were summarized in presentations provided by Divino Moura, PR of Brazil with WMO and Third Vice-president of WMO; M. Arenada, PR of Chile with WMO and Vice-President of RA III; and, Elizabeth Silvestre Espinoza, Peruvian Meteorological and Hydrological Service (SENAMHI).

3.6 The regional and national experiences in RA IV: North America, Central America and the Caribbean were summarized by Arthur Rolle, PR of Bahamas with WMO and President of RA IV; Dennis Gonquez, PR of Belize with WMO; and, Ko Barret, Deputy Director of the NOAA Climate Program Office, USA.

3.7 The regional and national experiences in RA V: South West Pacific were summarized by Sri Woro B. Harijono, PR of Indonesia with WMO and Vice-President of RA V; Yap Kok Seng, PR of Malaysia with WMO; and, Salesea Kaniaha Nihmei, Manager, Climate Section, Vanuatu Meteorological Service.

3.8 The regional and national experiences in RA VI: Europe were summarized in presentations contributed by Ivan Ĉaĉić, PR of Croatia with WMO and President of RA VI; Anahit Hovsepian, Head of Climate Research Division, and Deputy Head of the Scientific Applied Centre on Hydrometeorology and Ecology Armenia; Milan Dacić, PR of Serbia with WMO; and, Stefan Rősner, Deutsche Wetter Dienst (DWD), Germany. Due to unforeseen eruption of volcanic ashes, Messrs Ivan Ĉaĉić, Milan Dacić and Stefan Rősner, the speakers of this segment were not able to attend. As a result, other participants made the presentations on their behalf.

4. SESSION IV: CLIMATE KNOWLEDGE, INFORMATION AND OBSERVATIONS IN SUPPORT OF CLIMATE ADAPTATION AND RISK MANAGEMENT

Technology Needs Assessment for Adaptation was presented by Michael Coughlan, Superintendent, Bureau of Meteorology, Australia. The presentation, Climate Change and Adaptation, Emphasizing the Local Climate Knowledge was provided by Rodney Martinez, Scientific Coordinator of CIIFEN. Climate Data Management—Tailoring Data Packages and Tools for Adaptation was covered in a presentation provided by Aryan Van Engelen, EUMETNET. The presentation provided by Roger Street, UKCIP, covered Climate Impact Assessment for Adaptation. Climate Services for the Agriculture Sector were addressed by M.V.K. Sivakumar, Director of Climate Prediction and Adaptation Branch, WMO Climate and Water Department. And, Climate Services for the Water Sector was the topic of Manoj Khanna, Senior Scientist, Water Technology Centre, Indian Agricultural Research Institute, India.

5. SESSION V: REGIONAL WORKING GROUP DISCUSSIONS

5.1 Amir Delju, Senior Scientific Coordinator, Climate Prediction and Adaptation Branch of WMO presented the findings of the WMO Questionnaire on the Role of NMSs in Adaptation to Climate Variability and Change.

5.2 The presentation summarized the questionnaire results on the role of NMSs in adaptation activities, with examples of successes and of limitations, and conclusions. The central conclusion was that the effective input of climate information into decision support tools can lead to the development of more proactive and successful adaptation strategies.

5.3 The participants were organized into two regional working groups: Group I comprised those participants from RAs I, II and III; Group II consisted of participants from RAs IV, V and VI. The Groups discussed the findings and information gained through the earlier Sessions, and developed recommendations and conclusions encompassing the key issues, needs, gaps, challenges and opportunities for NMSs in establishing National Climate Services.

6. SESSION VI: PRESENTATION OF THE CONCLUSIONS AND RECOMMENDATIONS OF THE WORKSHOP

6.1 Conclusions presented by the regional working groups

6.1.1 National and regional institutional arrangements for providing climate services in different regions can be used as possible models:

- China and the United States are complex models suitable for larger, well-resourced countries:
  - China's service structure has full coverage at National, Regional, Provincial, Prefecture and County levels,
  - CMA provides climate observation and monitoring, diagnosis, predictions, climate impact assessments on global, regional and national scales,
  - The U.S. NOAA provides national leadership through atmospheric, oceanic, and fisheries Services,
  - NOAA is a leader in environmental data and meteorological satellite services;
- Europe is providing a good regional approach:
  - A RA RCC network with three nodes,
  - The Southern European Climate Outlook Forum (SEECOF);
- Need to work on identifying the basic (required) characteristics of a low resources NMS in supporting a simple NCS;
- Then identify pathways of incremental enhancement toward a well-resourced NCS;
- Full implementation probably in the 5-15 year frame.

6.1.2 Bedrock capabilities of NMSs within the WMO network of GPCs, RCCs & RSMCs:

- Sound, systematic observational and data management practices,
- Systematic monitoring of climate variability and change ,
- Engaging in and/or applying the outputs of climate research,
- Early alerting systems for climate extremes,
- Capacities for operational, reliable and authoritative communicating of weather and climate information,
- Ability to cover nationally important socio-economic sectors as well as vulnerable areas (coasts, cities, mountain and forest regions),
- Engaging in and informing the national climate policy debate and climate actions through linkages to climate sensitive sectors in government and industry,
- Participate in regional efforts for communicating climate information including climate outlook forums,
- Provision of or access to training in meteorological and related disciplines.

6.1.3 Two principles should guide the developing of climate services within the NMSs – their contribution in the National Climate Services of their countries and territories:

- It is critical that all NMSs focus on consolidating and where possible expanding their existing capabilities. They should aim to be the authoritative, national voice in delivering the critical climate data, information and services needed by their respective communities of stakeholders to manage and live with climate variability and change;

- NMSs have a particular capacity to contribute to *adaptation* actions that will address the consequences of climate variability and trends on time scales that matter to decision makers, although there was some concern expressed about unintended consequences that might accompany an NMS increasing its role into the UNFCCC negotiation procedures.

6.2 Recommendations made by the group

6.2.1 Build on the assets that underpin the comparative advantages of NMSs that are linked within the operational WMO structure:

The fundamental resource for a National Climate Service is a well established climate database. The climate observations, monitoring and related applications of an NMS are essential components of support to ensure global safety.

The comparative advantages of NMSs in the observation, cataloguing and projection of climate variability and trends underscore the rationale that any structure for a nation's national climate service would wisely use the NMS as its foundation.

6.2.2 Capitalize on, and enhance the climate information and services focus:

- Risk assessment: While a few NMSs may be resourced to provide risk assessment services in particular sectors, all NMSs can potentially provide the climate information needed in risk assessment. The NMS, in conjunction with the nationally relevant information and services they can tap through their respective RCCs and RSMCs, should be considered an environmental resource within their National Climate Service. In order to fulfill their role in supporting their nation's sustainable development, they should be funded at a level to enable their full collaborative interaction with other components in the NCS as well as across the WMO structure.

- The NMSs should pursue funding opportunities by stressing the service to society, as illustrated in the experience of linking the integrated, multi-partner programme Climate for Development in Africa (CLIMDEV) with the GCOS Implementation Plan for funding by the Department for International Development (DFID).

- NMSs should focus the reorganization and strengthening of their capabilities to provide climate information and services, and should resist activities that would involve them in political processes and issues.

6.2.3 The political will of the national government should ensure the ability of the NMS to provide effectively its uniquely significant information and services in its National Climate Service:

- Responsibility for the climate science component of the National Climate Service should reside in the NMSs of each country;

- The NMS is uniquely placed and experienced to be the authoritative and scientific provider of climate information and services;

- Political will is needed to establish a nation's NCS;

- Establishment of the NCS, and of the unique and authoritative role of the NMS to provide climate science-based information and services, should be codified with appropriate law.

6.2.4 Structural capacities of NMSs should be leveraged, and enhanced:

- NMSs can contribute fully in their role in National Climate Services with high capacities, as they can enter this process under the programmatic umbrella of the WMO.

- Building upon the sustainable activities of an established climate database and an operational climate monitoring programme, NMSs should accelerate implementation of a national Climate Watch System.

- Existing Regional Climate Outlook Forums should be continued, and established in areas not currently being served with an RCOF. The NMSs can engage in forecasts with appropriate downscaling for the NMS level, enriching their contribution in the National Climate Service. Models of possible RCOFs can be drawn from currently employed methods: NMS-only; NMS with partner organizations; occurring in situ, offering the advantage of face-to-face interaction among the climate scientists and the user sector representatives, or via teleconference or video conferencing, with the concurrent advantages of reaching widely to involve a broad spectrum of scientists and user representatives across intra-national and national borders.

- Various levels of services must be provided by NMSs, leveraging the information and expertise available through their operational linkages in the regional partnering interactions with the RCCs and RSMCs. In order to further develop their ability to provide national climate information NMSs need to explore and enhance their participation in operational regional climate forums.

7. SESSION VII: CLOSING SESSION

7.1 M.V.K. Sivakumar described the steps that will be taken in finalizing the report and presenting its conclusions. He noted that the information from the workshop represents a significantly high level of input from the Organization, and would inform a position paper being drafted on guidance for NMSs to establish National Climate Service support activities in their NMSs. He gave a Vote of Thanks to the participants and to the Host Country.

7.2 Yap Kok Seng thanked the WMO and the participants.

7.3 The Workshop was adjourned 21 April 2010, at 17:15 hours.

WMO INTER-REGIONAL WORKSHOP ON POLICY ASPECTS OF CLIMATE CHANGE

Petaling Jaya, Malaysia, 19-21 April 2010

PROGRAMME

MONDAY, 19 APRIL 2010

9:00 hrs **Registration**

SESSION I OPENING CEREMONY

9:30 hrs **Doa Recitation**

9:35 hrs **Welcoming Remarks**
Yap Kok Seng
Director General
Malaysian Meteorological Department and Permanent Representative of Malaysia with WMO

9:40 hrs **Welcoming Remarks**
M.V.K. Sivakumar
WMO Secretary-General Representative

9:45 hrs **Opening Address**
Y.Bhg. Dato' Madinah Mohamad
Secretary-General, Ministry of Science, Technology and Innovation

10:15 hrs **Tea/Coffee Break followed by Group Photo**

SESSION II IPCC AND THE UNFCCC: THE INTERNATIONAL SCIENCE AND POLICY PROCESSES

Chairman: Michael Coughlan Rapporteur: Stefan Rősner

11:00 hrs IPCC AR4 Synthesis and Policy Imperatives
Capacity Development for Policy makers through Science
Fredolin T. Tangang
Professor & Head of the Malaysian Research Centre for Tropical Climate Change System (IKLIM) and Vice-Chair of IPCC Working Group I

11:20 hrs Science-Policy Advice on Climate Change and Key Socio-economic Sectors - (A Focus on Nairobi Work Programme)
Xianfu Lu (presented by Ko Barret, USA)
ATS Programme, UNFCCC Secretariat, Germany

11:40 hrs Lessons Learned from National Adaptation Programmes of Action (NAPA) in more than 40 LDCs
Gray Munthali
Deputy Director of Malawi Meteorological Service

12:00 hrs Science-Policy Interaction - Challenges and Opportunities
Michael Coughlan
Head, Climate Policy, Climate and Oceans Branch, Bureau of Meteorology, Australia

12:20 hrs **Discussion**

13:00 hrs **Lunch Break**

SESSION III REGIONAL AND NATIONAL PERSPECTIVES ON CLIMATE SERVICES FOR CLIMATE CHANGE ADAPTATION AND RISK MANAGEMENT

Chairman: Sri Woro B. Harijono Rapporteur: Manoj Khanna

14:30 hrs Global Framework of Climate Services - An Introductory presentation by WMO
M.V.K. Sivakumar
Director, Climate Prediction and Adaptation Branch, WMO

14:50 hrs **Discussion**

RA I: AFRICA

15:00 hrs *Joseph Mukabana*
Permanent Representative of Kenya with WMO

15:20 hrs *Daouda Diarra*
Chief, Agrometeorological Division, Meteorological Service of Mali

15:40 hrs *Deon Terblanche*
Senior Manager, South Africa Weather Service

16:00 hrs **Tea/Coffee Break**

RA II: ASIA

16:20 hrs *Qamar uz Zaman Chaudhry*
Permanent Representative of Pakistan with WMO and Vice-President of RA II

16:40 hrs *Shen Xiaonong*
Deputy Director of China Meteorological Administration (CMA)

17:00 hrs *Arjumand Habib*
Permanent Representative of Bangladesh with WMO

17:20 hrs **Discussion**

18:00 hrs **Adjournment**

20:00 hrs **Dinner hosted by the Secretary General, Ministry of Science, Technology and Innovation, Malaysia**

TUESDAY, 20 APRIL 2010

SESSION III (cont.d)

Chairman: Qamar ur Zaman Chaudhry Rapporteur: Rodney Martinez

RA IV: NORTH AMERICA, CENTRAL AMERICA AND THE CARIBBEAN

8:30 hrs *Arthur Rolle*
Permanent Representative of Bahamas with WMO and President of RA IV

8:50 hrs *Dennis Gonquez*
Permanent Representative of Belize with WMO

9:10 hrs *Ko Barret*
Deputy Director, Climate Program Office, NOAA, USA

9:30 hrs **Tea/Coffee Break**

RA V: SOUTH WEST PACIFIC

9:50 hrs *Sri Woro B. Harijono*
Permanent Representative of Indonesia with WMO and Vice-President of RA V

10:10 hrs *Yap Kok Seng*
Permanent Representative of Malaysia with WMO

10:30 hrs *Kaniaha Salesa Nihmei*
Manager, Climate Section, Vanuatu Meteorological Service

10:50 hrs **Discussion**

SESSION III (cont.d)

Chairman: Arthur Rolle Rapporteur: Aryan Van Engelen

RA III: SOUTH AMERICA

11:30 hrs *Antonio Divino Moura* (*presented by M.V.K. Sivakumar)*
Permanent Representative of Brazil with WMO and Third Vice-President of WMO

11:50 hrs *Myrna Araneda*
Permanent Representative of Chile with WMO and Vice-President of RA III

12:10 hrs *Elizabeth Silvestre (presented by Myrna Araneda)*
Scientific Director, Meteorological Service (SENAMHI), Peru

12:30 hrs **Lunch**

SESSION III (cont.d)

RA VI: EUROPE

14:00 hrs *Ivan Čačić (presented by Anahit Hovsepyan)*
Permanent Representative of Croatia with WMO and President of RA VI

14:20 hrs *Anahit Hovsepyan*
Head of Climate Research Division, and Deputy Head of the Scientific Applied Centre on Hydrometeorology and Ecology, Armenia

14:40 hrs *Milan Dacić (presented by Amir Delju)*
Permanent Representative of Serbia with WMO

15:00 hrs *Stefan Rösner (absent)*
Focal Point, Regional Climate, Deutsche Wetter Dienst (DWD), Germany

15:20 hrs **Tea/Coffee Break**

15:40 hrs **Discussion**

SESSION IV: CLIMATE KNOWLEDGE, INFORMATION AND OBSERVATION IN SUPPORT OF CLIMATE ADAPTATION AND RISK MANAGEMENT

Chairman: Ivan Čačić Rapporteur: Anahit Hovsepyan

16:00 hrs Technology Needs Assessment for Adaptation
Ko Barret
Deputy Director, Climate Program Office, NOAA, USA

16:20 hrs Climate Change and Adaptation Emphasizing the Local Climate Knowledge
Rodney Martinez (presented by M.V.K. Sivakumar)
Scientific Coordinator of CIIFEN, Ecuador

16:40 hrs Climate Data Management - Tailoring Data Packages and Tools for Adaptation
Aryan Van Engelen(presented by Paul Llanso)
EUMETNET, Programme Manager of the European Climate Support Network (ECSN)

17:00 hrs Climate Impact assessment for Adaptation
Roger Street (presented by Michael Coughlan)
Technical Director, Climate Impacts Programme, United Kingdom

17:20 hrs Climate Services for the Agriculture Sector
M.V.K. Sivakumar
Director, Climate Prediction and Adaptation Branch, WMO

17:40 hrs Climate Services for the Water Sector
Manoj Khanna
Senior Scientist, Indian Agricultural Research Institute (IARI)

18:00 hrs **Discussion**

18:40 hrs **Adjournment**

WEDNESDAY, 21 APRIL 2010

SESSION V: BREAK-OUT GROUP DISCUSSIONS

8:30 hrs Presentation on the findings of the WMO Questionnaire on the Role of NMHSs in Adaptation to Climate Variability and Change
Amir H. Delju
Senior Scientific Coordinator, Climate Prediction and Adaptation Branch, WMO

8:50 hrs **Discussion on the Organization of Break Out Groups**

9:00 hrs **Meetings of Regional Break-out Groups**

Group I: RA I and II
Group II: RA III and VI
Group III: RA IV and V

10:30 hrs **Tea/Coffee Break**

10:50 hrs **Meetings and Regional Break-out Groups (cont.d)**
12:00 hrs **Lunch**

13:30 hrs **Regional Break-out Groups (cont.d)**

SESSION VI: RECOMMENDATIONS AND CONCLUSIONS - (KEY ISSUES, NEEDS, GAPS, CHALLENGES AND OPPORTUNITIES FOR NMHSs)

Chairman: Yap Kok Seng Rapporteur: Amir H. Delju

14:30 hrs **Consideration of the Reports of Break Out Groups**

15:00 hrs **Discussions**

15:30 hrs **Tea/Coffee Break**

15:50 hrs **Presentation of Recommendations of the Workshop and Discussion**

SESSION VII: CLOSING SESSION

16:50 hrs **Vote of Thanks**
M.V.K. Sivakumar
WMO Representative
Yap Kok Seng
Host country, Director General of Malaysian Meteorological Department (MMD)

17:10 hrs **Closure of the Workshop**

WMO INTER-REGIONAL WORKSHOP ON POLICY ASPECTS OF CLIMATE CHANGE

Petaling Jaya, Malaysia, 19-21 April 2010

LIST OF PARTICIPANTS

Myrna ARANEDA (Ms)
Permanent Representative of Chile with WMO and Vice-President of RA III
Director
Dirección Meteorológica de Chile
Avenidad Portales 3450
Santiago
Chile
Tel: +56 2 4364501
Fax: +56 2 4378212
maraneda@meteochile.cl

Ko BARRETT (Ms)
Deputy Director
Climate Program Office
1315 East-West Highway RM 12102
Silver Spring, Maryland (MD) 20910
USA
Tel: +1 301 734-1220
Fax : +1 301 713-0517
ko.barrett@noaa.gov

Qamar uz Zaman CHAUDHRY
Permanent Representative of Pakistan with WMO
Director General
Pakistan Meteorological Department
Headquarters Office
Sector H-8/2
Islamabad 44000
Pakistan
Tel: +92 51 9250367
Cell: +92 333 5141337
Fax: +92 51 9250368
pakmet_islamabad@yahoo.com
dgmetpak@hotmail.com

Michael COUGHLAN
Head, Climate Policy Section
Climate and Oceans Branch
Bureau of Meteorology
PO Box 1289
Melbourne, Victoria, 3122
Australia
Tel: +61 3 9669 4086
Cell: +61 40901 5872
Fax: +61 3 9669 4725
m.coughlan@bom.gov.au

Daouda DIARRA
Chief of Agrometeorological Division
Direction Nationale de la Météorologie
Boîte postale 237
Bamako
Mali
Tel: + 223 20 20 6204
Fax: + 223 20 20 2110
diarradz@gmail.com

Dennis GONGUEZ
Permanent Representative of Belize with the WMO
Acting Chief Meteorologist
National Meteorological Service of Belize
Ministry of Natural Resources and the Environment
Philip Goldson International Airport
P.O. Box 717
Ladyville, Belize C.A.
Tel: +501 225 2012 (Office)
Cell: +501 601 4530
Fax: +501 225 2101
dennis_gonguez@yahoo.com

Arjumand HABIB (Ms)
Permanent Representative of Bangladesh with WMO
Director
Bangladesh Meteorological Department
Meteorological Complex
Abhawa Bhaban
Agargao
Dhaka 1207
Bangladesh
Tel: +88 02 8116634 (8144968)
Fax : +88 02 8118230
info@bmd.gov.bd
swc@bmd.gov.bd

Sri Woro HARIJONO
Permanent Representative of Indonesia with WMO and Vice-President of RA V
Director
Indonesia Agency for Meteorology, Climatology and
Geophysic (BMKG)
Jl. Angkasa No. 2 Kemayoran
Jakarta Pusat
Indonesia
Tel: +62 21 4248016 (ext 1101)
Cell: +62 813 10821287)
Fax: +62 21 5346146
sriworo@bmg.go.id

Anahit HOVSEPYAN (Ms)
Head of Climate Research Division
Deputy Head of the Scientific Applied Centre on Hydrometeorology and Ecology
Armenian State Hydrometeorological and Monitoring Service
54 Leo Street
0002 Yerevan
Armenia
Tel: +374 10 533 616
Fax: +374 10 532 952
anahit_hovs@yahoo.dom

Manoj KHANNA
Senior Scientist
Water Technology Centre
Indian Agricultural Research Institute (IARI)
New Delhi 110012
India
Tel: +91 9818403246
mkhanna@iari.res.in

Joseph MUKABANA
Permanent Representative of Kenya with WMO
Director
Kenya Meteorological Department
Dagoretti Corner, Ngong Road
P.O.Box 30259
0100 GPO Nairobi
Kenya
Tel: +254 20 3874214
Fax: +254 20 3876955
director@meteo.go.ke

Gray Katundu MUNTHALI
Deputy Director
Department of Climate Change and Meteorological Services
P. O. Box 1808
Blantyre
Malawi
Tel: +2651822014
Cell: +265999912643
Fax: +2651822215
gmunthali@metmalawi.com
graymunthali@yahoo.co.uk

Kaniaha Salesa NIHMEI
Manager, Climate Services,
Vanuatu Meteorological Service
PMB 9054
Nambatu Area
Port Vila
Vanuatu
Tel: +678 23866
Fax: +678 22310
skaniaha@meteo.gov.vu

Arthur ROLLE
Permanent Representative of Bahamas with WMO
President RA IV (North America, Central America and the Caribbean)
Director
Department of Meteorology
Seban House
Crawford Street
Nassau
Bahamas
Tel: +1 242 356 3726
Fax: +1 242 356 3739
rollearthur@gmail.com

SHEN Xiaonong
Deputy Administrator
China Meteorological Administration
46 Zhongguancun Nandajie
100081 Beijing
China
Tel: +86 10 68406662
Fax: +86 10 62174797
sxn@cma.gov.cn
guoji@cma.gov.cn

Fredolin TANGANG
(Vice-Chair IPCC Working Group I)
Professor & Head
Research Centre for Tropical Climate Change System (IKLIM)
Faculty of Science and Technology
National University of Malaysia
43600 Bangi
Selangor Darul Ehsan
Malaysia
Tel: +603-89213826 / +6013-3472116
Fax: +603-89253357
ftangang@gmail.com
tangang@ukm.my

Deon TERBLANCHE
Senior Manager
Research Department
South Africa Weather Service
Private Bag X097
Pretoria 0001
South Africa
Tel: +2712 367 6114
Fax: +2712 367 6189
deon.terblance@weathersa.co.zq

YAP Kok Seng
Permanent Representative of Malaysia with WMO
Director-General
Malaysian Meteorological Department
Ministry of Science, Technology & Innovation
Jalan Sultan
46667 Petaling Jaya
Selangor Darul Ehsan
Malaysia
Tel: +60 3 796 78001
Fax: +60 3 795 49372
yks@met.gov.my

Edvin ALDRIAN (Advisor to Dr Harijono)
Director
Center for Climate Change & Air Quality
Indonesia Agency for Meteorology, Climatology and
Geophysic (BMKG)
Jl. Angkasa No. 2 Kemayoran
Jakarta
Indonesia
Tel: +62 21 4248016 (ext 1101)
Cell: +62 813 10821287
Fax: +62 21 4246314
edvin@bmg.go.id

MALAYSIAN METEOROLOGICAL DEPARTMENT
Petaling Jaya

LUCIA ENGGONG (Ms)
Head of International and Communication Section
Malaysian Meteorological Department
Ministry of Science, Technology and Innovation
46667 Petaling Jaya
Selangor Darul Ehsan
Malaysia
Tel: +603 7967 8100
Fax: +603 7955 0964
lucia@met.gov.my

WAN AZLI WAN HASSAN
Malaysian Meteorological Department
Jalan Sultan
46667 Petaling Jaya
Selangor Darul Ehsan
Malaysia
Tel: +603 7967 8230
Fax: +603 7955 0964
wanazli@met.gov.my

SUBRAMANIAM MOTEN
Director
Research Section
Malaysian Meteorological Department
1st Floor, Airport Administration Center
Kuala Lumpur International Airport
64000 Sepang
Selangor Darul Ehsan
Malaysia
Tel: +603 8787 2161
Fax: +603 8787 1019/1020
subra@met.gov.my

JAILAN SIMON
Director
Climatology and Hydrology Section
Malaysian Meteorological Department
46667 Petaling Jaya
Selangor Darul Ehsan
Malaysia
Tel: +603 7967 8162
Fax: +603 7955 0964
jailan@met.gov.my

LIM Wei Urn
Assistant Director
Environment and Natural Resources Section
Economic Planning Unit (EPU)
Prime Minister's Department
Block B5 & B6
Federal Government Administrative Centre
62502 Putrajaya
Malaysia
Tel: +603 8872 3241
Fax: +603 8888 4323
limweiurn@epu.gov.my

ABDUL RAHIM NIK
Deputy Director General (Operation)
Forest Research Institute Malaysia (FRIM)
52109 Kepong
Kuala Lumpur
Malaysia
Tel: +603 6279 7017
Fax: +603 6273 1420
rahimnik@frim.gov.my

YUSOF MUDA
Senior Assistant Director
Forest Management Division
Forestry of Department Peninsular Malaysia (FDPM)
Head Quarters FDPM
Jalan Sultan Salahuddin
50660 Kuala Lumpur
Malaysia
Tel: +603 2616 4548
Fax: +603 2692 5657
yusoff@forestry.gov.my

AZMI MD. JAFRI
Deputy Director
Water Resources Management and Hydrology Division
Malaysian Department of Irrigation and Drainage (DID)
KM 7, Jalan Ampang
68000 Kuala Lumpur
Malaysia
Tel: +603 4253 1690
Fax: +603 4256 4037
azmijafri@water.gov.my

TAN Ching Tiong
Research Officer
Institute for Environment and Development (LESTARI-UKM)
National University of Malaysia (UKM)
43600 Bangi
Selangor Darul Ehsan
Malaysia
(attn: Prof. Dr. Joy Jacqueline Pereira)
Tel: +603 8921 4230
Fax: +603 8925 5104
fui_pin12@yahoo.com

MOHAMAD ZABAWI ABDUL GHANI
Deputy Director
Environmental Management & Agro-Industry
Strategic Resource Center
Malaysian Agricultural Research and Development Institute (MARDI)
P.O Box 12301
General Post Office
50774 Kuala Lumpur
Malaysia
Tel: +603 8943 7390
Fax: +603 8948 7639
bawi@mardi.gov.my

BORHAN JANTAN
Senior Assistant Director
Land Conservation Section
Land Resource Management Division and Conservation
Department of Agriculture
Level 7-17, Wisma Tani, No. 30
Persiaran Perdana, Precint 4
Federal Government Administration Centre
62624 Putrajaya
Malaysia
Tel: +603 8870 3426
Fax: +603 8870 1088 / +603 8888 4326
borhan@doa.gov.my

MOHD SYAZWAN FAISAL MOHD
Research Officer
National Hydraulic Research Institute of Malaysia (NAHRIM)
Lot 5377, Jalan Putra Permai
43300 Seri Kembangan
Selangor Darul Ehsan
Malaysia
Tel: +603 8938 2470
Fax: +603 8948 8009
syazwan@nahrim.gov.my

MAXIMILIAN T. CONRAD
Assistant Secretary
Conservation and Environmental Management Division
Ministry of Natural Resources and Environment
Aras 6, No. 25, Persiaran Perdana
Wisma Sumber Asli, Precint 4,
Federal Government Administrative Centre
62574 Putrajaya
Malaysia
Tel: +603 8886 1704
Fax: +603 8888 4473
maximilian@nre.gov.my

WMO SECRETARIAT
World Meteorological Organization
7bis, avenue de la Paix
Case postale No. 2300
1211 Geneva 2
Switzerland

M.V.K. SIVAKUMAR
Director
Climate Prediction and Adaptation Branch (CLPA)
Climate and Water Department (CLW)
World Meteorological Organization
7bis Avenue de la Paix
P.O. Box 2300
1211 Geneva 2
Switzerland
Tel: +41 22 730 8380
Fax: +41 22 730 8042
msivakumar@wmo.int

Amir H. DELJU
Senior Scientific Coordinator
Climate Coordination Activities (CCA)
Climate Prediction and Adaptation Branch (CLPA)
Climate and Water Department (CLW)
World Meteorological Organization (WMO)
7bis, Avenue de la Paix
Case Postale No. 2300
1211 Geneva 2
Switzerland
Tel: +41 22 730 8360
Fax: +41 22 730 8042
adelju@wmo.int

Paul D. LLANSO
Consultant to WMO
Climate Prediction and Adaptation Branch (CLPA)
Climate and Water Department (CLW)
World Meteorological Organization (WMO)
56 Cedar Summit
Asheville
NC 28803
Tel: +1 828 298 0503
pdllanso@gmail.com

INDEX OF FIGURES

Page number

World Meteorological Organization

Communications and Public Affairs Office

Tel.: +41 (0) 22 730 83 14 – Fax: +41 (0) 22 730 80 27

E-mail: cpa@wmo.int

Climate and Water Department (CLW)

Climate Prediction and Adaptation Branch (CLPA)

Tel.: +41 (0) 22 730 83 55 – Fax: +41 (0) 22 730 80 43

E-mail: dhwr@wmo.int

7 bis, avenue de la Paix – P.O. Box 2300 – CH 1211 Geneva 2 – Switzerland

www.wmo.int

World Meteorological Organization

Weather • Climate • Water