

RESULTS OF THE SURVEY ON  
IMPACTS OF ACHIEVED RESULTS ON MEMBERS  
CONDUCTED IN AUGUST-DECEMBER 2015

FULL REPORT



December 2015

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## Introduction

A survey on the “Impacts of Achieved Results on Members” was undertaken in August-December 2015. The 191 Members of the World Meteorological Organization (WMO) were requested to respond to a questionnaire comprising 75 questions. To ensure comparability to the baseline data collected in 2012 and 2013, the majority of the survey questions remained unchanged with only minor modifications. To be able to identify regional trends and gaps, the data was also analyzed by Regional Association (RA).

As of December 2015, a total of 104 Members (54%) had responded to the survey. Of these, one submitted an incomplete response. The following is the level of response per RA:

RA I (Africa): 53%;  
RA II (Asia): 44%;  
RA III (South America): 75%;  
RA IV (North America, Central America and the Caribbean): 68%;  
RA V (South-West Pacific): 29%; and  
RA VI (Europe): 63%.

The National Meteorological and Hydrological Services (NMHSs) that submitted responses are: Antigua and Barbuda; Algeria; Argentina; Armenia; Australia; Austria; Azerbaijan; Bahamas; Belgium; Belize; Benin; Bosnia and Herzegovina; Brazil; British Caribbean Territories; Botswana; Bulgaria; Burkina Faso; Cameroon; Canada; Chile; China; Comoros; Congo; Costa Rica; Cote d'Ivoire; Croatia; Curaçao and Sint Maarten; Cyprus; Dominica; Dominican Republic; Ecuador; Egypt; El Salvador; Estonia; Fiji; Finland; France; Gabon; Gambia; Germany; Ghana; Greece; Guatemala; Guinea; Guyana; Honduras; Hong Kong, China; Hungary; Iceland; Indonesia; Islamic Republic of Iran; Ireland; Italy; Japan; Jordan; Kazakhstan; Kenya; Kuwait; Kyrgyzstan; Latvia; Libya; Lithuania; Macao, China; Malawi; Mali; Mongolia; Mauritania; Mauritius; Morocco; Myanmar; Netherlands; New Zealand; Pakistan; Panama; Paraguay; Peru; Philippines; Poland; Qatar; Republic of Korea; Russian Federation; Rwanda; Senegal; Serbia; Singapore; Slovakia; Slovenia; Somalia; South Africa; Sweden; Switzerland; Thailand; Togo; Trinidad and Tobago; Turkey; Ukraine; United Kingdom of Great Britain and Northern Ireland; United Republic of Tanzania; United States of America; Uruguay; Uzbekistan; Venezuela; Zambia; and Zimbabwe.

The results, which are presented in the order of questions in the questionnaire, reflect the views of the Members that responded. They will be used to measure performance against the established baselines and targets set in the WMO Monitoring and Evaluation System.

# Results of the Survey

## Expected Result 1:

Enhanced capabilities of Members to deliver and improve access to high quality weather, climate, water and related environmental predictions, information, warnings, and services in response to users' needs, and to enable their use in decision-making by relevant societal actors

**Key Outcome 1.1:** Improved access to seamless weather, climate, water, and related-environmental products and services

KPI 1.1.1: Number of Members demonstrating quantitative measurements of the socio-economic benefits of their products and services

Seventy-seven percent of 101 respondents indicated that the products and services that their NMHSs provided were considered beneficial for the sectors presented in Figure 1. The sectors where the NMHS products and services were mostly used included emergency management (71%), the general public (70%), agriculture (62%), the aviation industry (59%), and the marine industry (41%). A quarter of respondents indicated that their services were beneficial to other sectors, such as the energy, construction and water sectors. The health, tourism, environment, transportation, and mining sectors as well as the educational sector, academia, urban planning and the media were also mentioned. The question was not applicable to 25% of respondents.

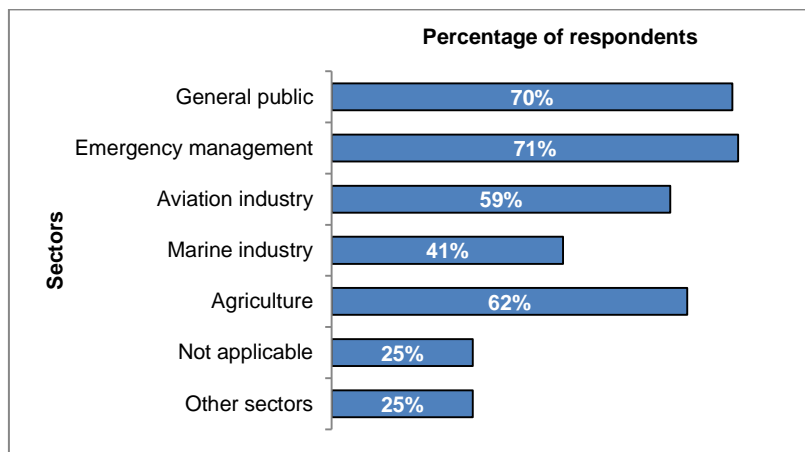


Figure 1: Sectors in which NMHS products and services are used

KPI 1.1.2: Percentage of NMHSs with regular access to products provided by global and regional centres

Globally, about half of the 103 respondents indicated that they had 'mostly reliable' access to products delivered by the WMO global and regional centres, whereas another 43% rated their access as 'highly reliable' (Figure 2). Seven percent regarded their access as intermittent. Of these, three belonged to Region I, one respondent to Region II and another one to Region III. Only one Member from Region I, standing for 1% of the overall respondents, reported no access to products at all.

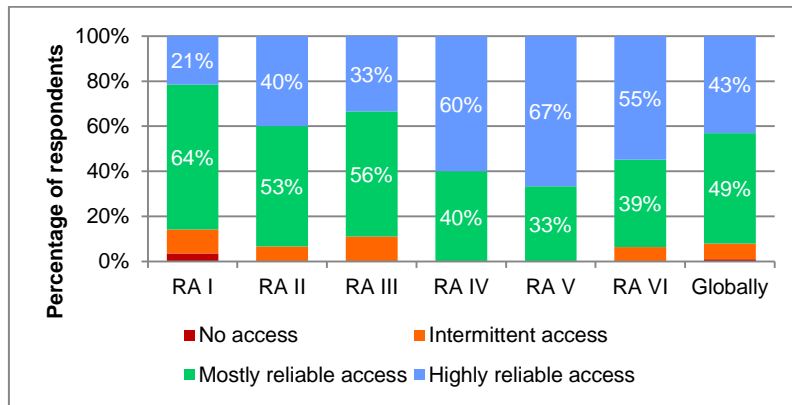


Figure 2: Access to products delivered by WMO Global and Regional Centres shown as number of NMHSs

Globally, 81% of 104 respondents noted improvements in the level of access to products provided by the global and regional centres in the past two years (Figure 3). These were most pronounced in Regions II and IV where almost all respondents reported enhanced access. In the rest of the regions, a quarter to a third of respondents did not observe such improvements in 2015.

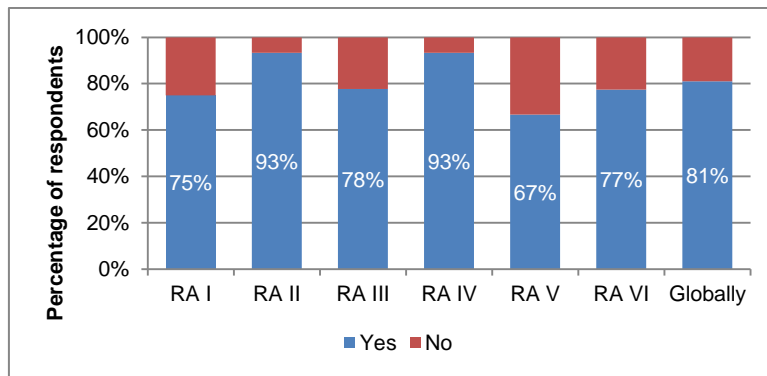


Figure 3: Improvement in level of access to products provided by global and regional centres (by region)

The majority of respondents used the WMO World Weather Watch Global Telecommunication System (86%) to access data and products, as evident from Figure 4. All respondents in Regions II and III indicated using the GTS. Regions I and IV had the lowest level of GTS utilization at 74% and 64%, respectively.

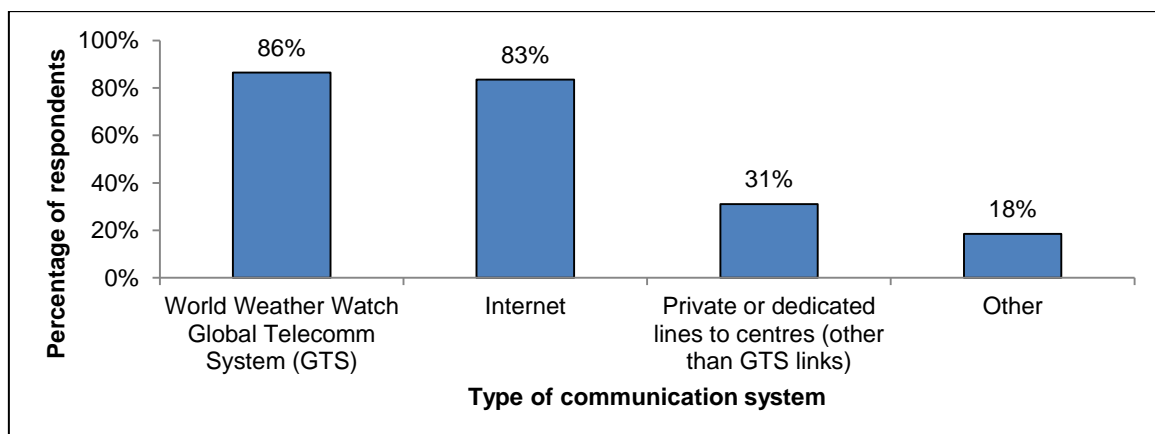


Figure 4: Communication systems used to access data and products

Another large portion of respondents (83%) used the internet to access data and products, whereas 31% utilized private or dedicated lines. Close to a fifth of respondents used other communication systems, including satellite systems and aeronautical systems. Other systems mentioned include the Regional Meteorological Data Communication Network (RMDCN), the National Oceanic and Atmospheric Administration (NOAA) network, and MSGWIS via the internet.

**Key Outcome 1.2:** Delivery of weather, climate, water and related environmental products and services to users' communities is improved

**KPI 1.2.1:** Number of NMHSs expressing user satisfaction with the (a) availability, (b) reliability and (c) range of products that are (d) received in time and (e) are an essential contribution to decision-making

As presented in Figure 5, the majority of the 104 respondents to this question indicated high user satisfaction with their products and services, based on surveys conducted and other information at their disposal. About 80% rated the timeliness and availability of NMHS products as 4 (satisfactory) or 5 (very satisfactory). Over three-quarters of respondents assigned a positive score in terms of user satisfaction with the reliability of products and their contribution to decision-making, whereas 70% reported user approval of the range of products.

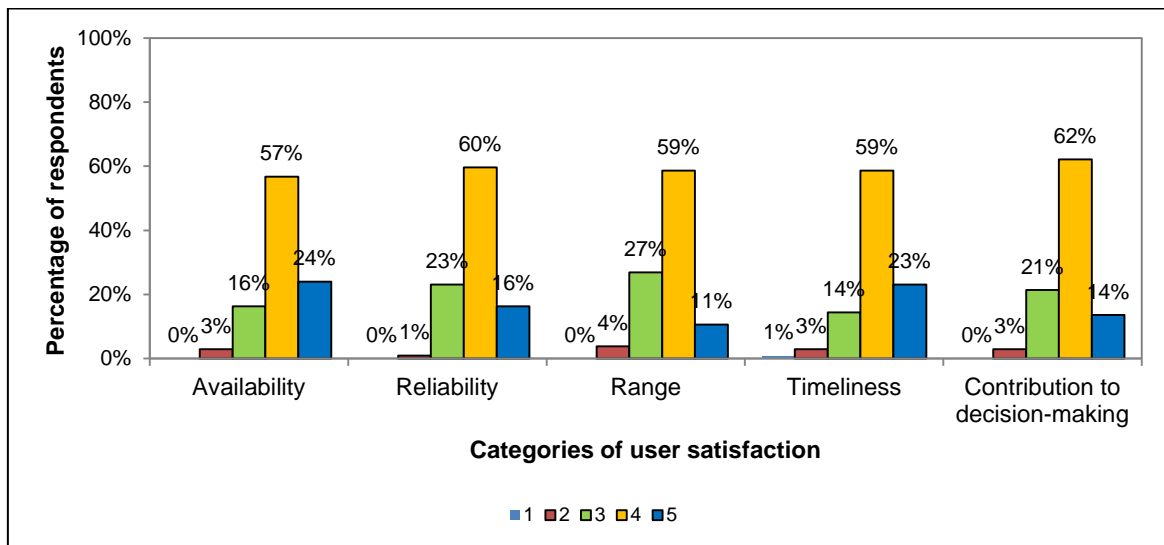


Figure 5: User satisfaction with NMHS products as related to availability, reliability, range, timeliness and contribution to decision-making (1=very dissatisfied; 5=very satisfied)

Further analysis of the data points to some regional differences from the results presented in Figure 5. As compared to the global average, user satisfaction was at a much lower level (50-60%) in Region I in all categories of user satisfaction except timeliness, where it stood at 68%. Satisfaction was similarly lower in Region III with respect to reliability (56%), range of products (67%) and contribution to decision-making (67%).

## Expected Result 2:

Enhanced capabilities of Members to reduce risks and potential impacts of hazards caused by weather, climate, water and related environmental elements

**Key Outcome 2.1:** Multi-hazard early warning systems are implemented

**KPI 2.1.1:** Number of NMHSs contributing to implementation of multi-hazard early warning systems

Globally, 93% of 103 respondents were contributing to the implementation of a multi-hazard early warning system in their respective countries. This includes all respondents from Regions II, III and V, 93% of respondents from Region IV, and 94% from Region VI. In Region I, 86% of respondents were contributing to multi-hazard warning systems, as indicated in Figure 6.



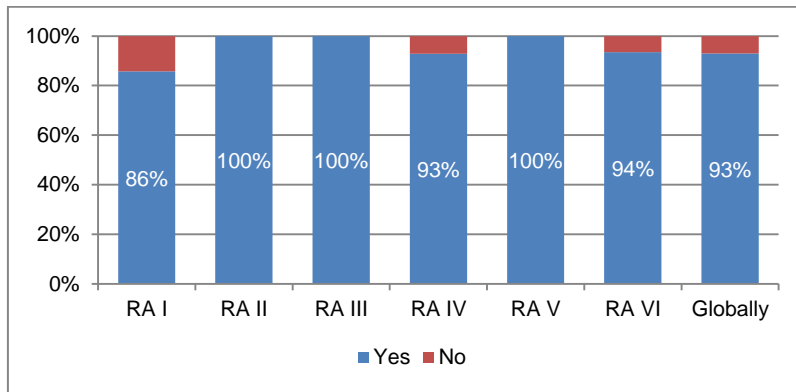


Figure 6: NMHSs contributing to multi-hazard early warning systems

Furthermore, 88% of 94 respondents globally indicated that their contribution was recognized under a formal agreement, Memorandum of Understanding or other government mandates. This level was lower in RA IV (71%). In all other regions, it ranged from 87% to 100%.

93% of 104 respondents indicated participation in a disaster risk reduction platform, as presented in Figure 7. This rate was lower in Region IV where it stood at 80%.

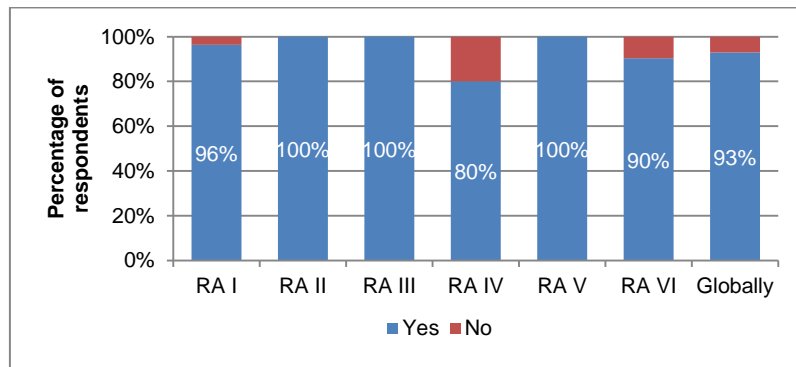


Figure 7: NMHSs participating in national disaster risk reduction platforms

## Key Outcome 2.2: National integrated flood management plans are developed

### KPI 2.2.1: Number of Members establishing flood management plans

Globally, 90% of 102 respondents had a flood management plan established or under development in 2015. This rate was below the global average in Region IV and V at 80% and 83%, respectively (Figure 8).

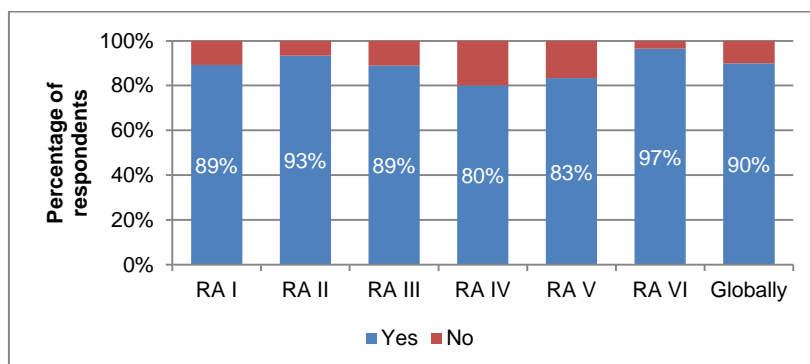


Figure 8: Members with flood management plans established or under development

**KPI 2.2.2: Number of NMHSs participating in regional hydrological forecasting systems for transboundary river basins**

As illustrated in Figure 9, over half of 101 respondents participated in regional hydrological forecasting systems for transboundary river basins. The question was not applicable to a fifth of respondents.

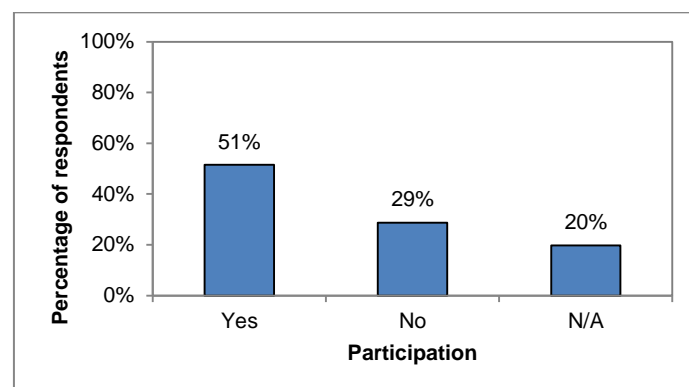


Figure 9: NMHS participation in regional hydrological forecasting systems for transboundary river basins

River basins and the respective year of establishment of the regional hydrological forecasting systems included the following:

<ul style="list-style-type: none"> <li>- Akavango (2014);</li> <li>- Amazon (2014);</li> <li>- Amu Darya;</li> <li>- Amur (1976, 2013);</li> <li>- Araz;</li> <li>- Arda (2014);</li> <li>- Bug (2012);</li> <li>- Caspian Sea;</li> <li>- Catamayo-Chira (2011, in development);</li> <li>- Coco (in development);</li> <li>- Congo (1999);</li> <li>- Cuareim (in development);</li> <li>- Danube (various years indicated ranging from 1992 to 2007, 2002);</li> <li>- Desna (2001);</li> <li>- Dnieper (2001);</li> <li>- Dniester (2001);</li> <li>- Drava;</li> <li>- Elbe (not known);</li> <li>- Esquipulas-Ocotepeque-Citalà Basin (</li> <li>- Gambia (1998, 1999, 2006);</li> <li>- Goascoràn (2002);</li> <li>- Great Lakes (1909);</li> <li>- Hiitolanjoki (2000);</li> <li>- Irtysh (1970s);</li> <li>- Ishim (1970s);</li> <li>- Jänisjoki (2000);</li> <li>- Kür;</li> <li>- Lake of the Woods (1949);</li> <li>- Latoritsa (2001);</li> <li>- Lempa (2002);</li> <li>- Limpopo (2012);</li> <li>- Mackenzie River (1997);</li> <li>- Maritza (2008);</li> <li>- Mauri (in development);</li> <li>- Mekong (a few years ago);</li> </ul>	<ul style="list-style-type: none"> <li>- Odra (2010);</li> <li>- Ogooué (1999);</li> <li>- Olifant (2014);</li> <li>- Orange (2014);</li> <li>- Ostua-Metapan Basin;</li> <li>- Ottawa River (1983);</li> <li>- Oubangui (1999);</li> <li>- Ouémé (1998);</li> <li>- Pasvik (1985);</li> <li>- Paz (2002);</li> <li>- Prypiat (2001);</li> <li>- Pungwe (2010);</li> <li>- Puyango-Tumbez (2011);</li> <li>- Rainy River (1949);</li> <li>- Rhone (1983);</li> <li>- Rhine (1995, 2002);</li> <li>- Richelieu (late 1990s);</li> <li>- Rio Grande (1970);</li> <li>- Rio de la Plata (1970s, expanded under framework agreement in 2014);</li> <li>- Rio Hondo (2007);</li> <li>- Saint John (1970s);</li> <li>- Sanga (1999);</li> <li>- Sava (2010);</li> <li>- Senegal (1998, 2006);</li> <li>- Siversky Donets (2001);</li> <li>- Syr Darya (1970s);</li> <li>- Talas (1970s);</li> <li>- Tana (2000);</li> <li>- Tohmajoki (2000);</li> <li>- Tobol (1970s);</li> <li>- Torne (1980);</li> <li>- Tysa (2001);</li> <li>- Ural (1970s);</li> <li>- Usuri (2013);</li> <li>- Uzh (2001);</li> </ul>
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<ul style="list-style-type: none"> <li>- Meurthe (1983);</li> <li>- Meuse (2006);</li> <li>- Mono (1998);</li> <li>- Moselle (1983);</li> <li>- Mura (2006);</li> <li>- Narva (2012);</li> <li>- Niger (1998, 2006);</li> <li>- Nile (1990, 2000);</li> </ul>	<ul style="list-style-type: none"> <li>- Volta (1998);</li> <li>- Vuoksi (1990);</li> <li>- West transboundary basins (Iran);</li> <li>- White Volta (2010);</li> <li>- Zambezi (1965, 2004, 2012, 2013, 2014);</li> <li>- Zarumilla (2011, in development).</li> </ul>
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### Expected Result 3:

Enhanced capabilities of Members to produce better weather, climate, water and related environmental information, predictions and warnings to support in particular disaster risk reduction and climate impact and adaptation strategies

**Key Outcome 3.1: Improved climate monitoring, long range forecasts and long-term projections**

KPI 3.1.1: Number of Members issuing (a) monthly predictions, (b) seasonal predictions, (c) climate watch bulletins and (d) long-term projections

Seasonal predictions constituted the most common climate product issued by Members globally (85% of 99 respondents) except for Region VI where this proportion was considerably lower (62%). Climate watch bulletins were released by the majority of respondents (80-89%) in Regions II, III and IV and by two-thirds of respondents in the rest of the regions.

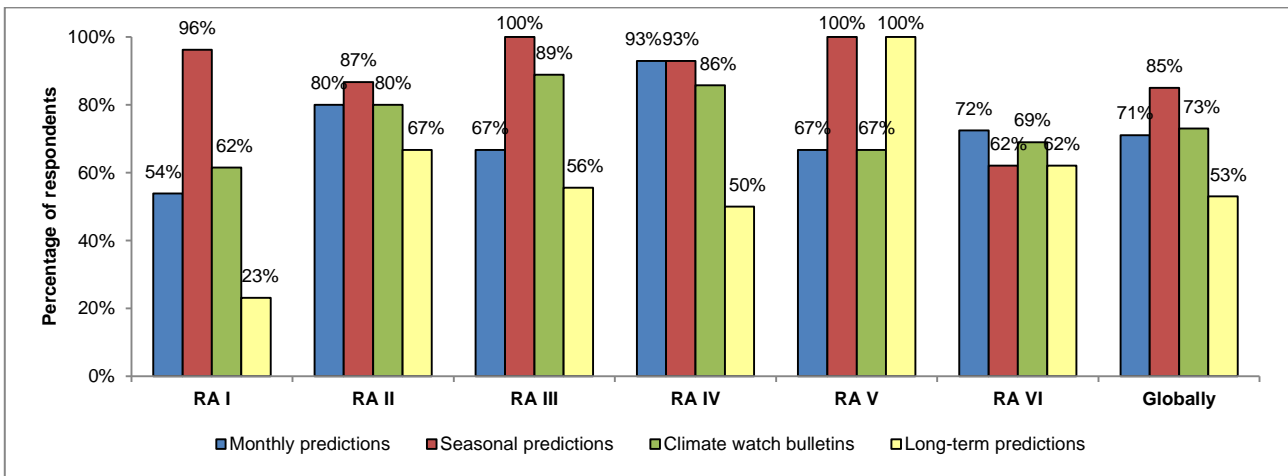


Figure 10: Regional and national-scale products issued in Member states (by region)

Monthly predictions were most prevalent in Region IV (93%) and Region II (80%). In Region I, half of respondents issued monthly predictions, whereas only 23% prepared long-term predictions. In the rest of the regions, 50-67% of respondents issued monthly and long-term predictions. All six respondents from Region V produced long-term predictions, as indicated on Figure 10.

KPI 3.1.2: Perceived quality of the issued (a) monthly predictions, (b) seasonal predictions, (c) climate watch bulletins and (d) long-term projections

Figure 11 presents the global average with respect to the perceived quality of the issued climate products. Over 50% of respondents rated their products to be of high to very high quality, with climate watch bulletins seen as the best quality product. Long-term predictions scored slightly lower, though 45% of respondents assigned them a 4-5 rating. Seventeen percent and 13% of respondents gave a low rating to the quality of long-term predictions and seasonal projections,

respectively. This portion was slightly lower for the quality of monthly predictions and climate watch bulletins at 10% and 9%, respectively.

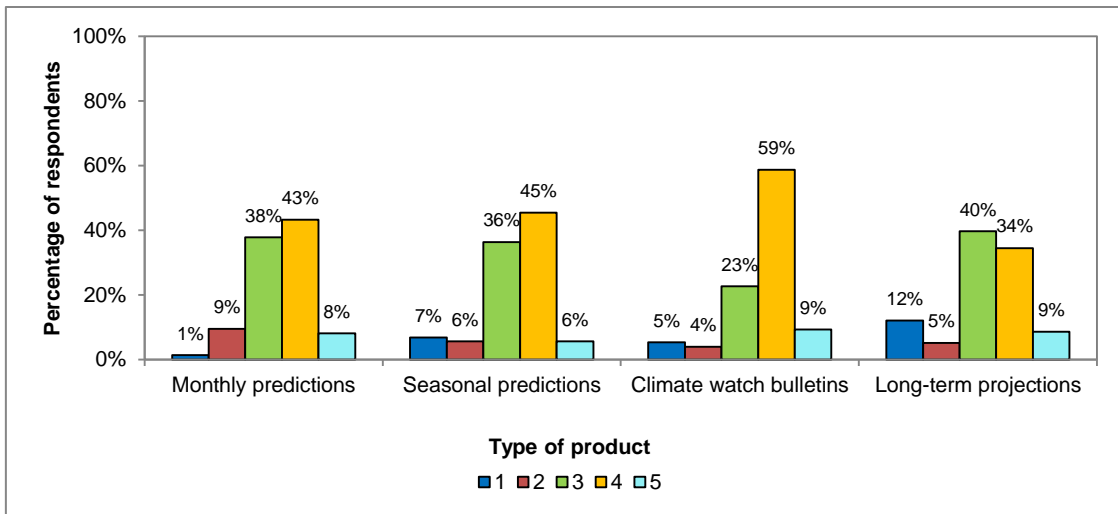


Figure 11: Quality of the regional and national-scale products issued (1=very low; 5=very high)

Whereas the majority of respondents by region provided an average or above-average rating, it should be noted that 22% of respondents from Region VI evaluated the quality of the issued monthly predictions negatively (rating 2). A similar proportion of respondents from the same region (29%) assessed the quality of seasonal predictions as poor (rating 1 and 2). Similar ratings were observed in Region I where 20% of respondents scored negatively the quality of climate watch bulletins. More than 40% of respondents from Regions I and IV disapproved of the quality of long-term predictions.

**KPI 3.1.3: Perceived timeliness of the issued (a) monthly predictions, (b) seasonal predictions, (c) climate watch bulletins and (d) long-term projections**

More than 70% of respondents rated the timeliness of monthly and seasonal predictions as ‘timely’ or ‘very timely’ (see 4-5 rating categories in Figure 12), whereas a fifth as average. Only 6-8% assigned the lowest rating (categories 1 and 2).

68% rated the issuance of climate watch bulletins as ‘timely’ or ‘very timely,’ as presented in Figure 12, and 22% provided an average rating. Nine percent of respondents gave the lowest rating (categories 1 and 2) to the timeliness of climate watch bulletins.

Long-term projections had the lowest rating in terms of timeliness (61%) in categories 4 and 5, whereas 17% of respondents rated them as ‘very untimely’ or ‘untimely’.

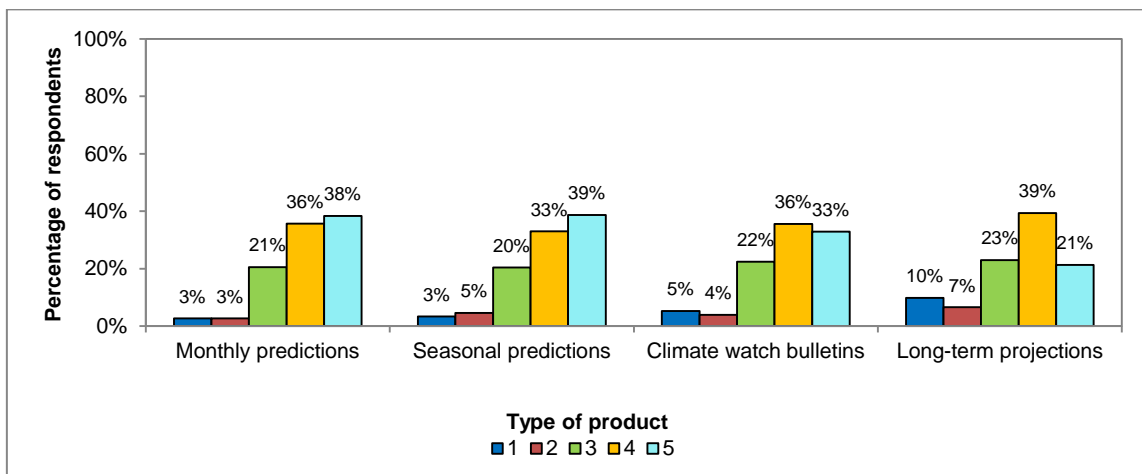


Figure 12: Timeliness of the regional and national-scale products issued (1=very untimely; 5=very timely)

Regional analysis does not point to any serious timeliness issues, with the exception of Region I where 20% of respondents found the issuance of climate watch bulletins to be untimely or very untimely. The same proportion in Region VI assessed negatively the timeliness of long-term predictions. Regarding the latter, the percentage was significantly higher in Region I where 44% of respondents disapproved of their timeliness.

**Key Outcome 3.2: Climate information and prediction products for climate adaptation and risk management are improved**

**KPI 3.2.1: Perceived quality of the products of WMO Regional Climate Centres used at the national level**

For the purposes of this survey, the definition of WMO RCC included not only the operational Regional Climate Centres (RCCs) formally designated by WMO through Technical Regulations, but also candidate RCCs in demonstration phase.

About 15-20% of 96 respondents did not find the question applicable to their country. For the rest, the quality of the four products provided by WMO RCCs is illustrated on Figure 13. Regional climate monitoring products constituted the best rated product, with 66% of respondents globally assessing their quality as 'high' to 'very high.' In Regions II, III and IV, satisfaction was as high as 73-78%. Long-range forecasts were next in term of rating (58%), with Regions II and III exceeding this average again at 67% and 71%, respectively.

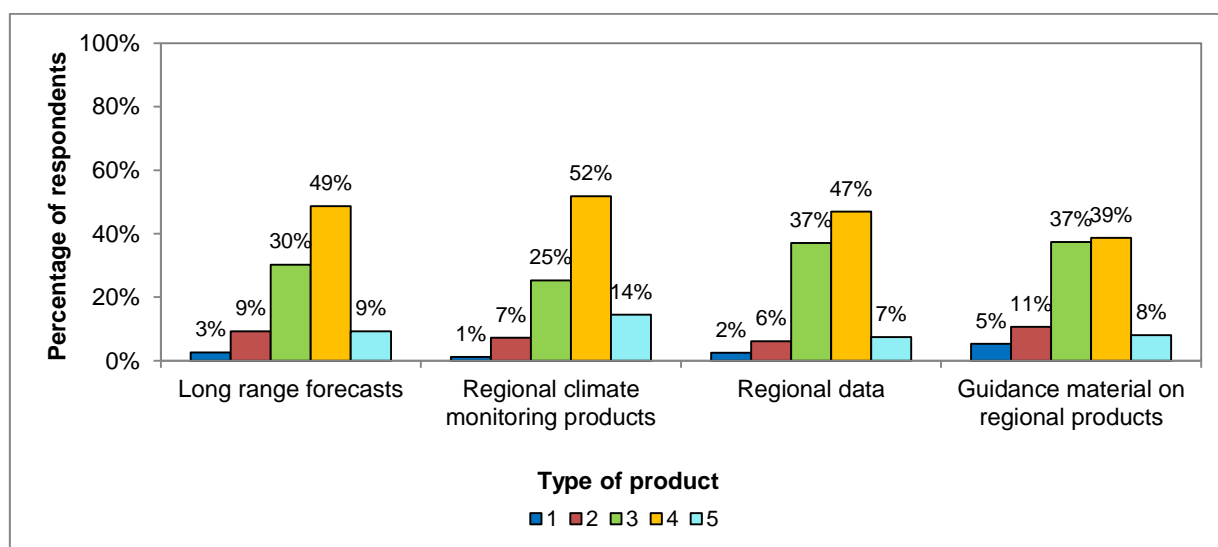


Figure 13: Quality of WMO RCC products based on use by NMHSs (1=very low; 5=very high)

In terms of regional data, 54% of respondents globally provided a rating of 4-5. The satisfaction of respondents from Regions III and IV was above this average at 67%, whereas respondents from Region I were least satisfied (only 35% provided a rating in the 4-5 categories). The quality of the guidance material on regional products was least appreciated, with less than half of respondents assessing it highly. In Regions II, IV and V, satisfaction was above this average at around 60%.

Disapproval was slightly greater with the quality of guidance material on regional products and that of long range forecasts, with global ratings of 16% and 12% in the lowest categories, respectively. Almost all respondents who expressed dissatisfaction with these two types of RCC products came from Regions I and VI. Globally, 8% assigned a low rating to the quality of regional climate monitoring products and regional data, also predominantly from Regions I and VI.

**KPI 3.2.2: Number of Members operationally developing and disseminating climate products and information for national needs**

Figures 14 and 15 present the proportion of Members developing and disseminating a range of climate products and information for national needs. Between 93 and 104 responses were received to this set of questions. As evident from Figure 14, almost all Members who responded contributed to national local climate assessments (94%) and provided basic climate products derived from national climate data (92%). A large segment of respondents also provided climate diagnostics and climate analysis (89%), conducted hazards and extreme value analysis (84%) as well as issued specialized climate products (83%). Many NMHSs further published national climate watch advisories and bulletins (80%), while 78% published monthly and longer climate predictions, including seasonal climate outlooks.

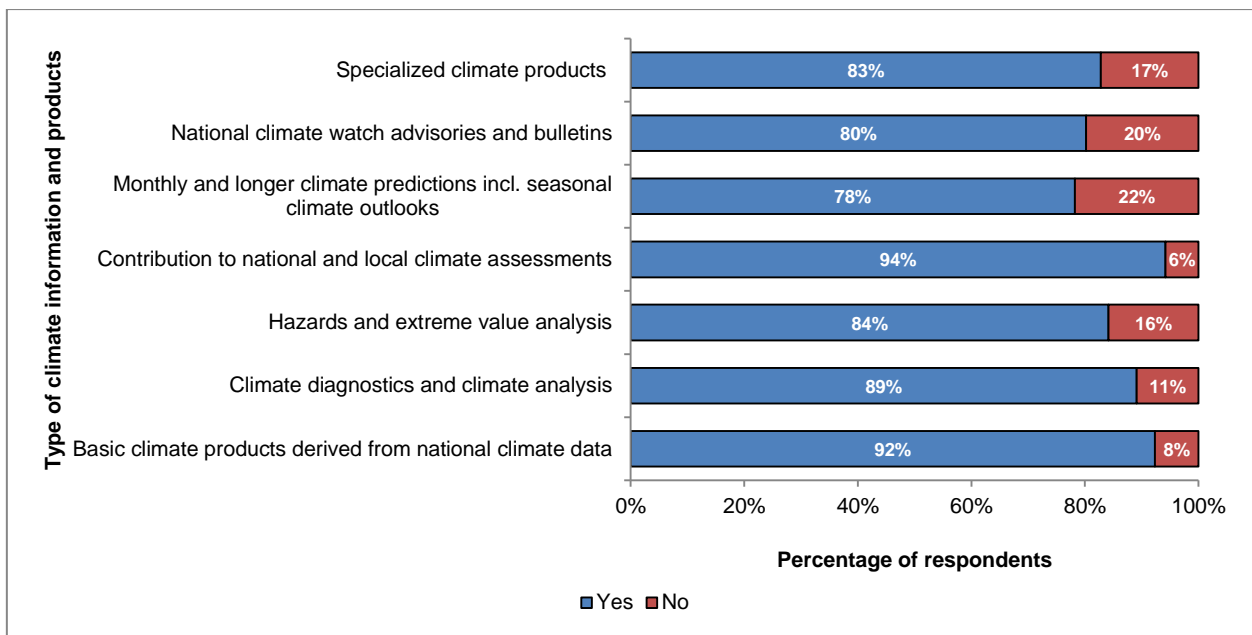


Figure 14: Climate information and products developed and disseminated for national needs

Considerably fewer NMHSs developed and disseminated the climate information and products presented in Figure 15. Sixty-eight and 67% produced policy- and adaptation-oriented climate information and products, respectively. Sixty-five percent issued downscaled long-term climate projections, whereas 60% produced regional-scale climate model products and generated risk identification and risk assessment products (58%). New models and/or analytical tools as well as products based on interdisciplinary models were developed by 49% and 42% of respondents, respectively. Only 39% provided global-scale climate model products.

Ninety-three percent of 103 respondents indicated that the products and information developed and disseminated by their NMHS for national needs took into account global and regional products and their related guidance material. This was not the case for 14% of respondents from Region I as well as 7% and 6% of respondents from Regions II and VI, respectively.

Globally, 85% of 102 respondents participated in Regional Climate Outlook Forums (RCOFs) and the development of regional climate outlook consensus statements. Region VI was the only exception where 37% of respondents had not participated in such activities.

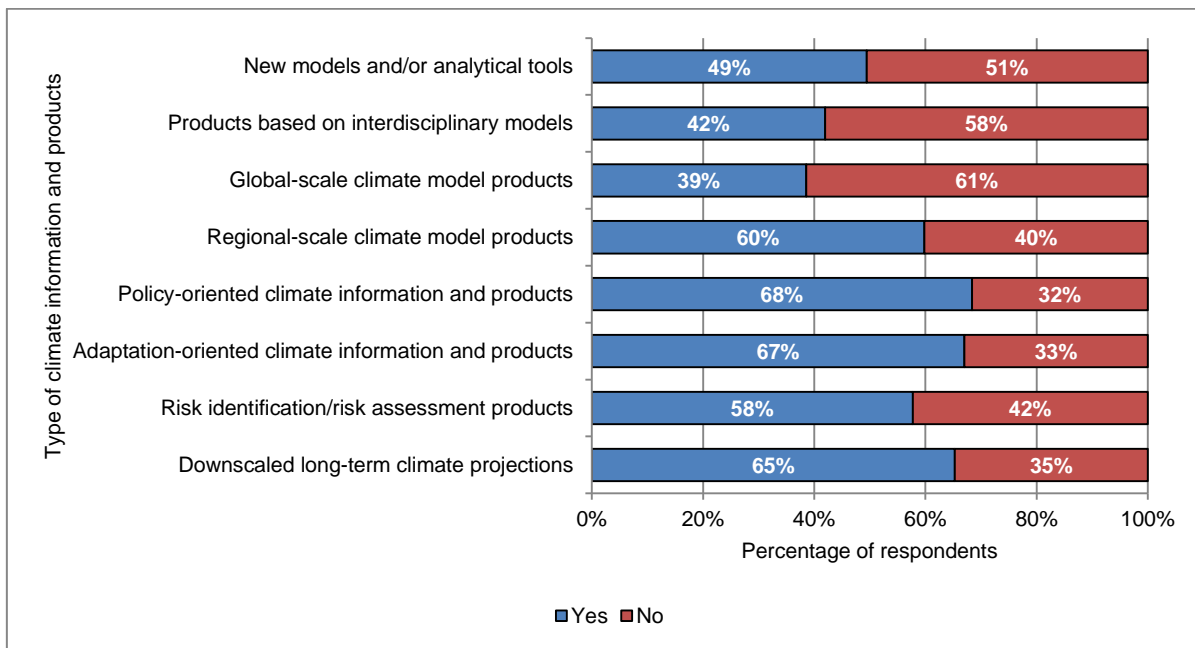


Figure 15: Climate information and products developed and disseminated for national needs (continued)

Likewise, 83% of 102 respondents globally indicated that the providers of climate information and products in their countries had technical training in the development of climate products, except for Regions III and VI where 44% and 31% of respondents did not support this statement, respectively.

**KPI 3.2.3: Perceived quality of the national climate information and products available in Member countries**

Figures 16-17 present Members' ratings of the quality of climate information and products, based on 97-104 responses to this set of questions.

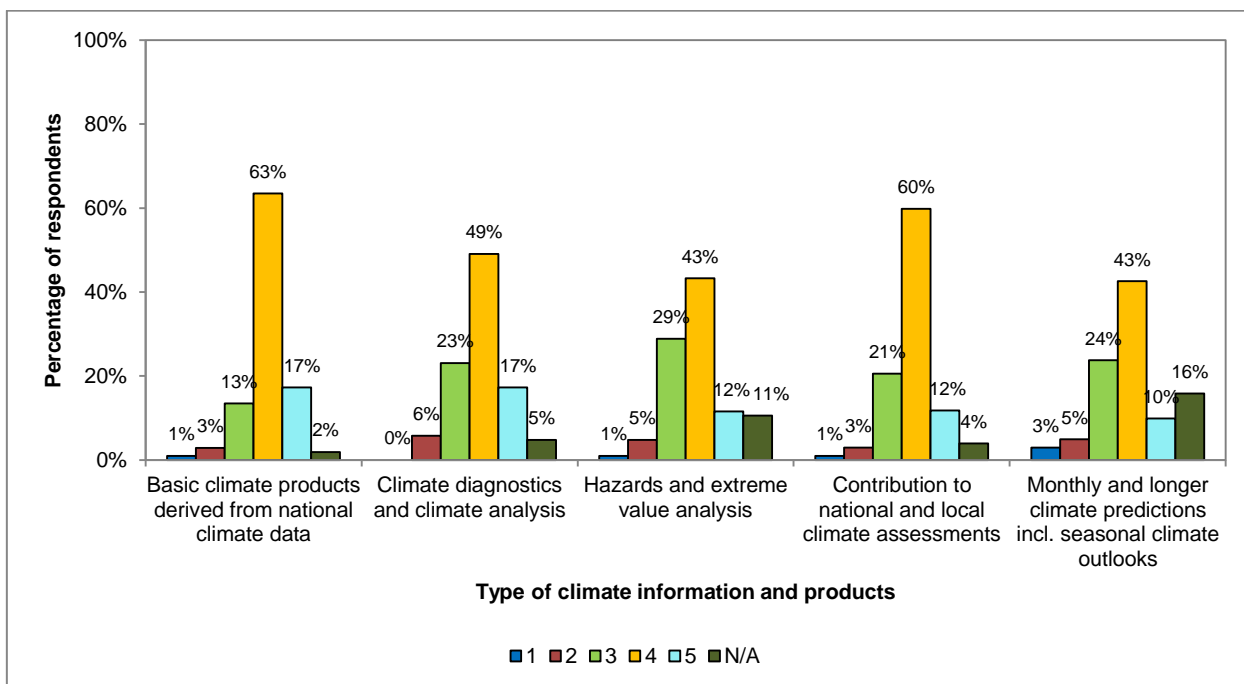


Figure 16: Quality of the climate information and products developed and disseminated for national needs (1=very low, 5=very high)

The two products/services considered of highest quality included (1) the basic climate products derived from national climate data, with 80% of respondents rating their quality as above average and (2) NMHS contribution to national and local climate assessments, with 72% of respondents



rating their quality as above average (4-5 categories). These were followed by climate diagnostics and analysis which were given such a rating by 66% of respondents. About half assessed the quality of the hazards/extreme value analysis and the monthly and longer climate predictions, including statistical and model-based seasonal climate outlooks, as above average. Only 13-23% of respondents scored the quality of the products in Figure 16 as average (category 3).

Only 8% percent of respondents rated the quality of monthly and longer climate predictions as 'low' or 'very low,' and 6% that of climate diagnostics/climate analysis and hazards/extreme value analysis. Likewise, 4% of respondents were dissatisfied with the quality of basic climate products and their contribution to national and local climate assessments.

Figure 17 shows that over half of respondents rated the quality of specialized climate products and that of national climate watch advisories and bulletins as above average (4-5 categories). The quality of specialized climate products and national climate watch advisories/bulletins received an average rating by 24% and 23% of respondents, respectively; they were negatively evaluated by 8%. For 17-29% of respondents, the climate information and products displayed in Figure 17 were not applicable. The specialized climate products were the only exception, which were not relevant to 12% of respondents only.

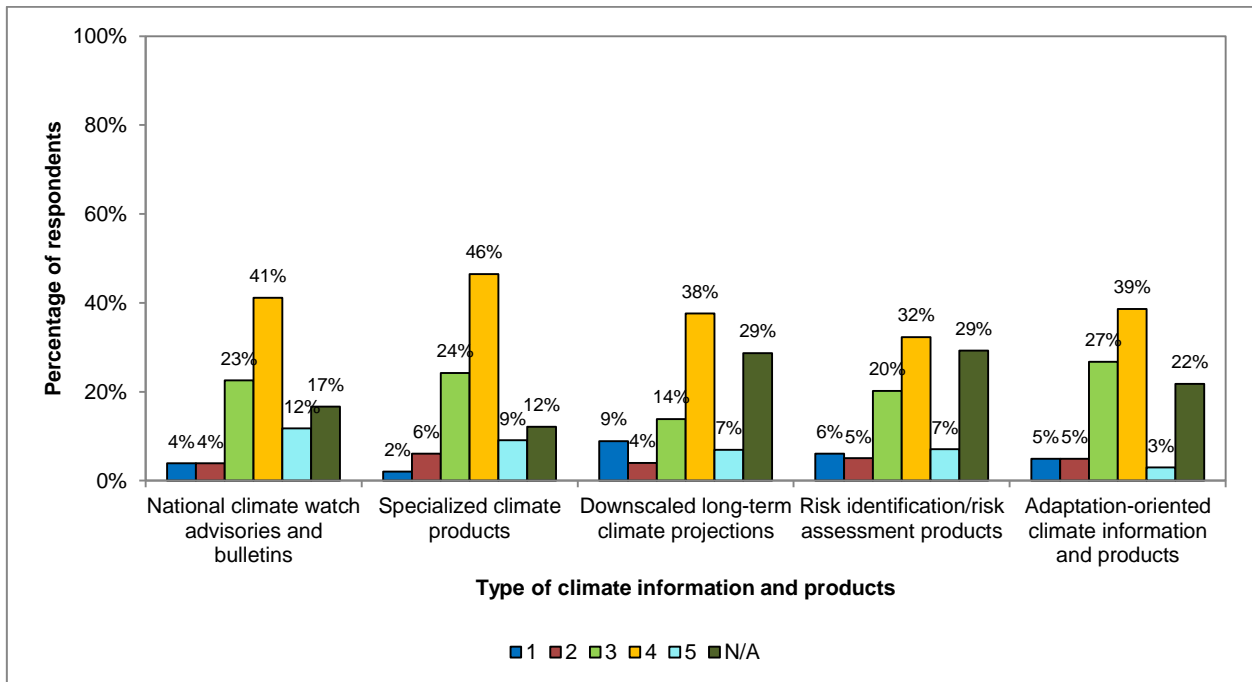


Figure 17: Quality of the climate information and products developed and disseminated for national needs (continued); 1=very low, 5=very high

The quality of the rest of the products and information presented in Figure 17 received slightly lower ratings. Forty-five percent of respondents assessed the quality of downscaled long-term climate projections as above average, 42% that of adaptation-oriented climate information and products, and 39% that of risk identification and risk assessment products. Eleven percent of respondents considered the latter to be of low to very low quality. Thirteen percent provided a negative rating to the quality of downscaled long-term climate projections, while 10% were dissatisfied with that of adaptation-oriented climate information.



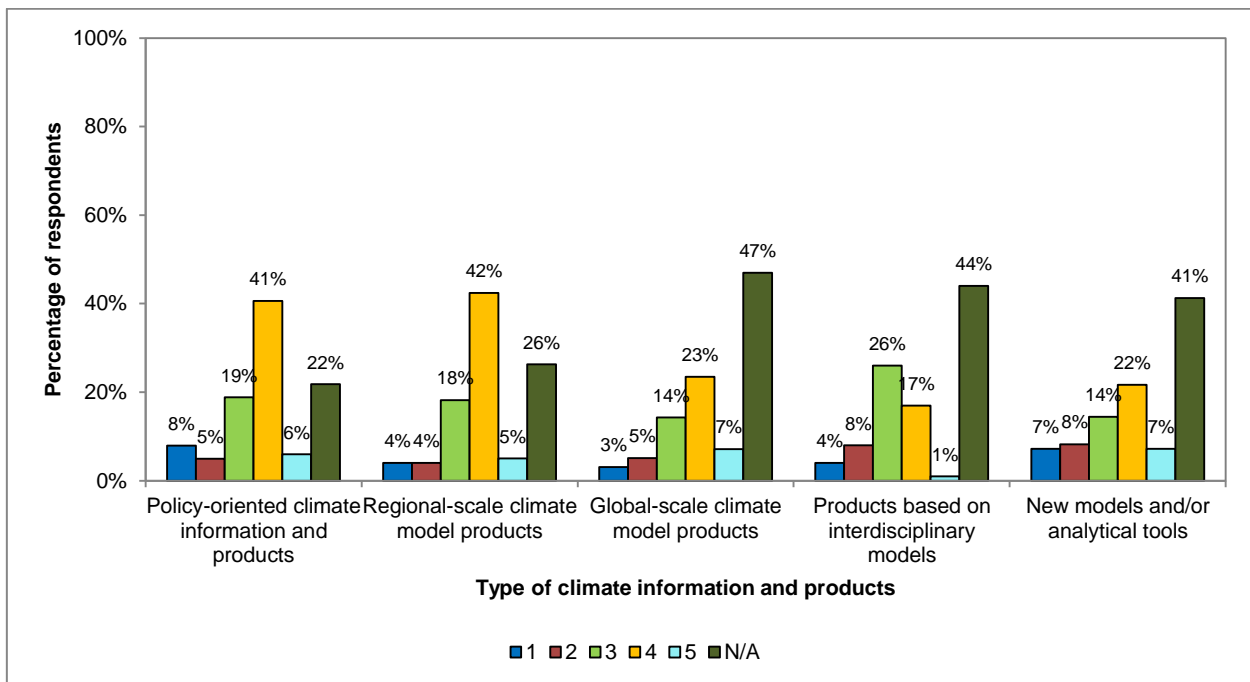


Figure 18: Quality of the climate information and products developed and disseminated for national needs (continued); 1=very low, 5=very high

Figure 18 shows that 15% of respondents rated negatively the quality of new models and analytical tools, 13% that of policy-oriented climate information and products, and 12% that of products based on interdisciplinary models. Only 18% rated the quality of products based on interdisciplinary models as above average. The rating was slightly higher for global-scale climate model products (31%) and new models and analytical tools (29%). It should be noted that products based on interdisciplinary models, new models and/or analytical tools, and global-scale climate model products were not applicable to 43-44% of respondents. They also represented the products with the poorest rating in terms of quality.

KPI 3.2.4: Number of Members providing targeted/tailored climate information, products and services, through formal mechanisms including National Climate Outlook Forums, to support user requirements in their countries for adaptation and climate risk management in key socio-economic sectors

As evident from Figure 19, the general public was the sector to which the vast majority of the 103 respondents (94%) provided targeted/tailored climate information, products and services. Other sectors widely serviced by Members included agriculture, including fisheries and livestock (90%), emergency management (89%) and water resources management (88%). Between 83% and 85% of respondents provided products and services to the transport and energy sectors as well as to government, policy makers, agencies, NGOs, etc. Three-quarters serviced the public health sector. Over 60% they provided information, products and services for urban design/management as well as for tourism and recreation. A fifth of respondents serviced other sectors, such as the academia (including education and scientific research), insurance, forestry, and the justice system. Other sectors mentioned included the media, the private sector, the aviation industry, and public works, though these were mentioned by individual respondents only. No major differences were observed from one region to another.

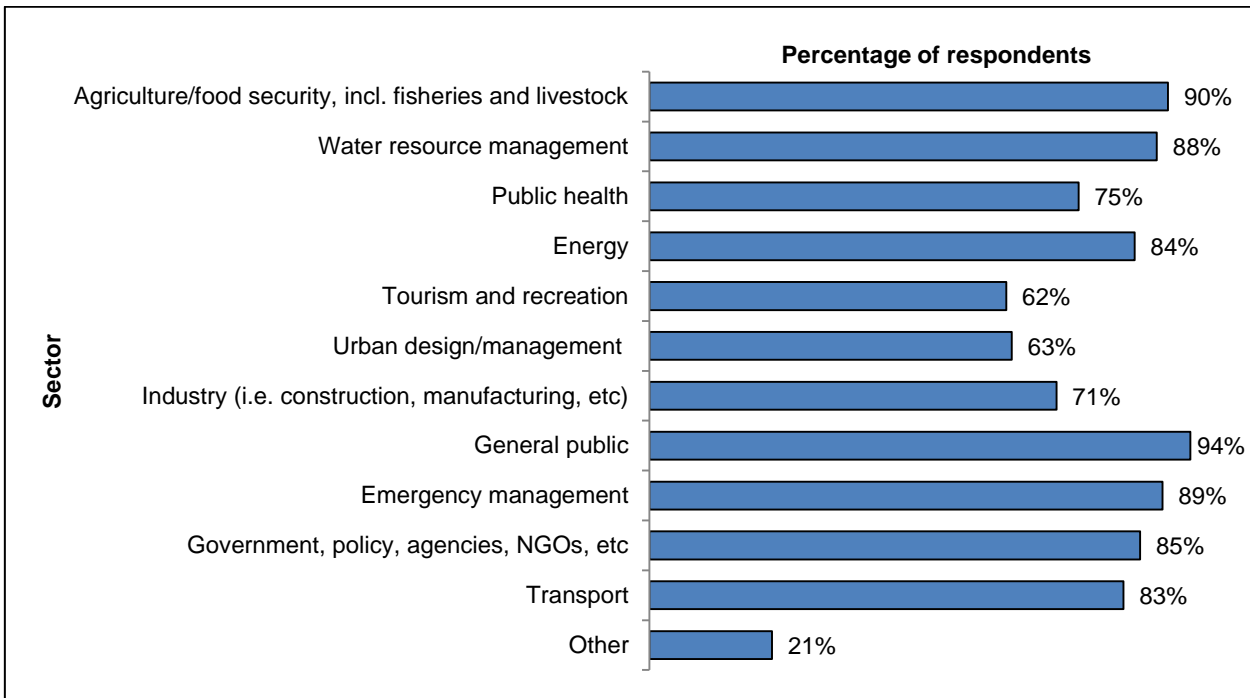


Figure 19: Sectors to which NMHSs provide targeted/tailored climate information, products and services

Figure 20 presents the extent to which liaison occurs between the climate providers and users and those involved in the dissemination of climate outlooks through the following mechanisms: Regional Climate Outlook Forums (RCOFs), National Climate (Outlook) Forums, user-organized forum, web-based dissemination with and without feedback from users.

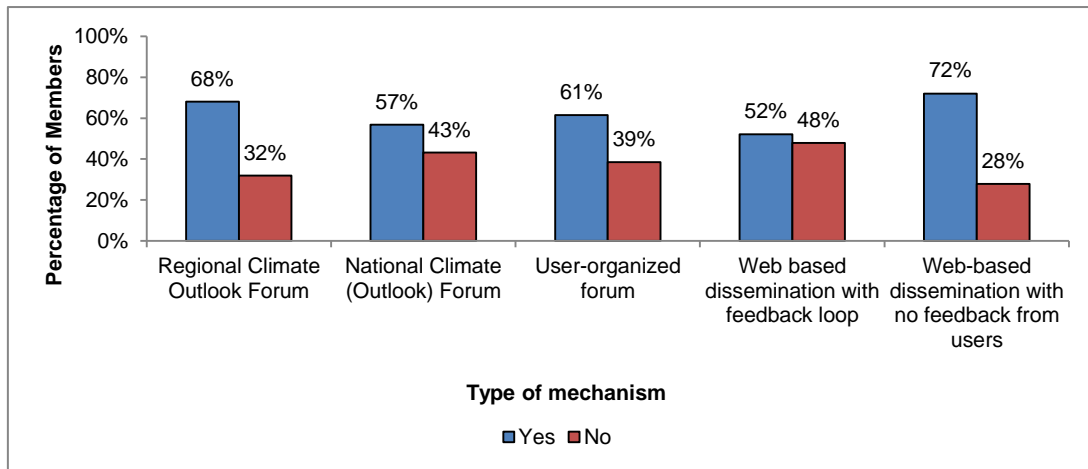


Figure 20: Type of mechanisms used in the dissemination of climate outlooks

Globally less than half of 98 respondents indicated that the climate providers in their respective countries measured performance statistics related to user satisfaction with national climate information, products and services (i.e. they collected user feedback, responded to it, and tracked progress). This was a common practice for 60% of respondents from Regions II and V, as evident from Figure 21. User satisfaction was measured by 22% of Region III and 36% of Region I respondents only.

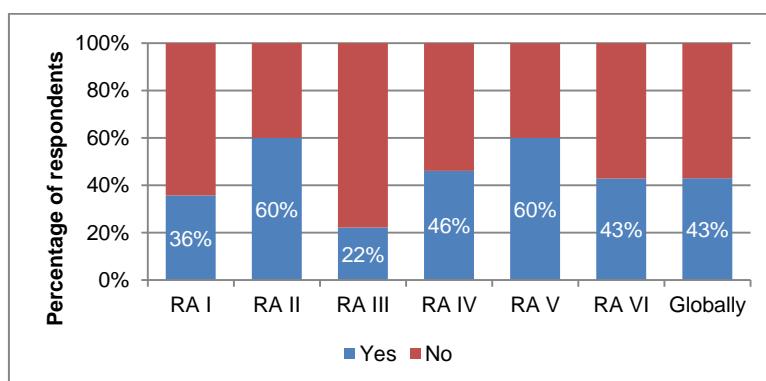


Figure 21: Members measuring user satisfaction with national climate information and services

**Key Outcome 3.3:** Hydrological information and products, including water resources, are improved

**KPI 3.3.1:** Number of Members using a Quality Management Framework for Hydrology based on current guidance materials

A Quality Management Framework (QMF) for Hydrology was in use in 39% of the 97 Members who responded to this question, with the breakdown by region presented in Figure 22. Only a fifth of respondents from Region I reported the use of QMF for hydrology in their respective countries.

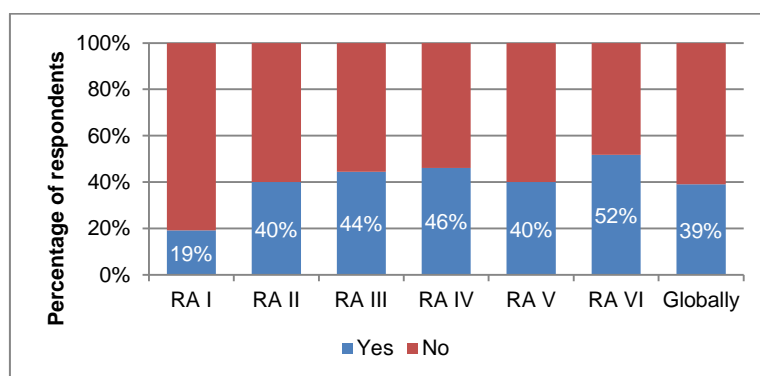


Figure 22: Members using QMF for Hydrology based on current guidance materials

**KPI 3.3.2:** Number of regional hydrological databases developed in transboundary river basins

Thirty-eight NMHSs (or 40% of 94 respondents) reported the development of new regional hydrological databases for transboundary river basins in the past two years. These included Amu Darya, Amur, Aral Sea, Arda, Catamayo, Chira-Piura, Congo, Cuareim, Danube, Desna, Dnieper, Drava, Elbe, Gambia, Hiitolanjoki, Ili, Irtysh, Ipel, Jänisjoki, Juba-Shebelle, La Plata, Latoritsa, Lempa, Limpopo, Mekong, Meuse-Moselle, Mono, Mur, Negro, Niger, Nile, Odra, Olopa, Omo, Oresecom, Ostua, Quemé, Praguachon, Pasvik, Prut, Prypiat, Pungwe, Puyango-Tumbes, Raab, Rhine, Sava, Senegal, Syr Darya, Tana, Tisza, Tobol, Tohmajoki, Tome, Ural, Usuri, Uzh, Versant, Volta, Vuoksi, Zambezi, Zarumilla.

In addition, the Lake of the Woods Control Board Secretariat set-up the WatFlood model for Winnipeg River basin (which includes boundary waters of Namakan Lake, Rainy Lake and Lake of the Woods) in 2013; this was updated with 2014 data.

## Expected Result 4:

Enhanced capabilities of Members to access, develop, implement and use integrated and interoperable Earth- and space-based observation systems for weather, climate and hydrological observations, as well as related environmental and space weather observations, based on world standards set by WMO

**Key Outcome 4.1:** WMO Integrated Global Observing System implementation phase is completed

KPI 4.1.1: Percentage of progress in achieving the key implementation tasks, milestones and deliverables specified by the WIGOS Implementation Plan (WIP)

Thirty-five NMHSs, or 35% of 101 respondents, initiated or implemented a WIGOS demonstration national project in 2015. Their geographical distribution is presented on Figure 23.

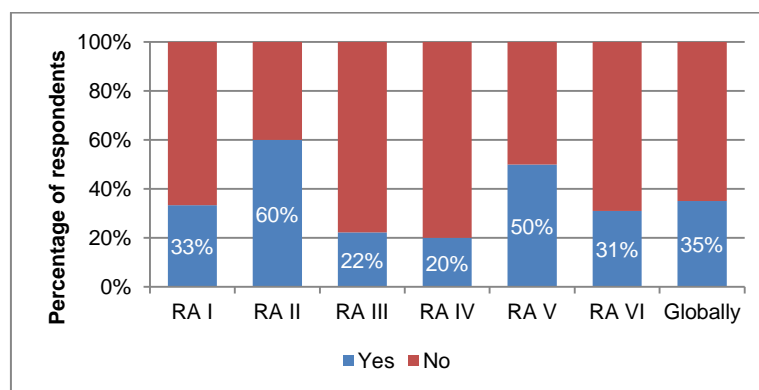


Figure 23: NMHSs with WIGOS demonstration national projects in 2015 (by region)

Their assessment of progress in achieving the key implementation tasks, milestones and deliverables of the WIGOS Implementation Plan is described in Figure 24.

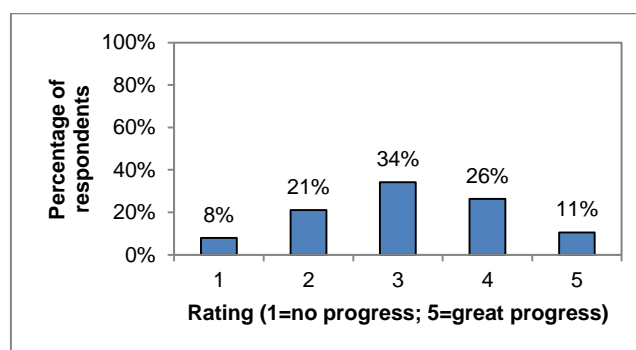


Figure 24: Progress in achieving the key implementation tasks, milestones, and deliverables specified in the WIGOS Implementation Plan

Whereas regional analysis was difficult to conduct due to the low number of respondents to this question, only limited progress had taken place in RA IV where four out of five respondents provided a low rating of 1-2. In Region I, three out of ten respondents assigned such rating. Most progress was registered in RA II where 6 out of 9 respondents reported significant progress (4-5 categories). It was followed by RA VI where 4 respondents assessed progress as average and the same number as significant.

#### KPI 4.1.2: Increased availability of observations for users

Globally, 78% of 81 respondents indicated an increase in the availability of observations for users/user groups. Advances were most significant in Regions II, V and VI, as exhibited in Figure 25. They were least evident in Regions I and IV.

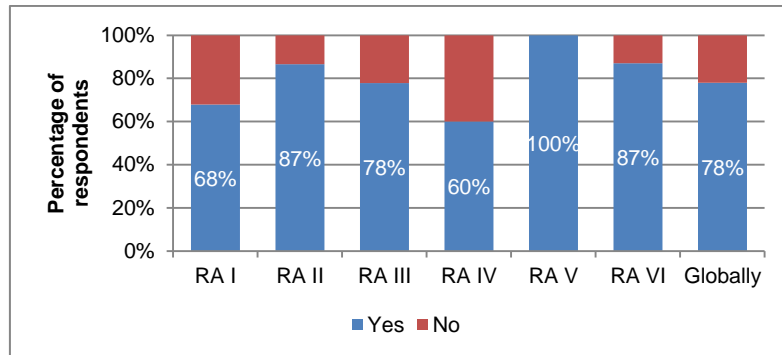


Figure 25: Members with increased availability of observations for users/user groups

#### Key Outcome 4.2: WMO information System is developed and implemented

KPI 4.2.1: Progress in the implementation of WIS by NMHSs as measured by (a) the percentage of registered WIS centres that have been endorsed as WIS compliant; (b) number of NMHSs with improved observational data and products as a result of implementation of WIS functions

Over half of 96 respondents implemented some functions of the WIS defined in the Manual on WMO Information System (WIS), WMO-No 1060, over the past two years. Members implementing such functions were most numerous in Regions II and V and least prevalent in Regions I and III, as demonstrated by Figure 26.

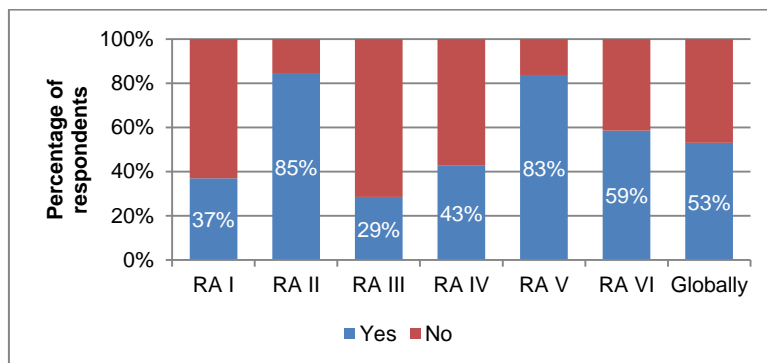


Figure 26: Members implementing functions of the WIS in 2014-2015 (by region)

The specific functions in operationalization were as follows:

- Global Information System Centres (GISCs);
- Data (data access and retrieval; data exchange, metadata management and archival, etc.);
- Data Collection or Production Centres (DCPCs);
- National Centres (NCs);
- Climate database management systems (e.g. CLIDATA, MCH).

Over 68% of 66 respondents improved data access by means of obtaining more observational data, whereas 58% indicated improvements in receiving more products. Regarding users, two-thirds of 66 respondents indicated that users improved data access by obtaining more

observational data, whereas 54% of respondents remarked that users improved data access through acquiring more products.

Figure 27 presents Members' rating of the maturity of the WIS functions implemented at their respective NMHS. Globally, over half of 67 respondents indicated basic implementation of some functions (category 1 and 2). About a fifth fully implemented functions appropriate to their centres, while another fifth approached or had reached systematic continuous improvement of full functionality (see 4-5 rating categories in Figure 27). In Region I, close to 70% of respondents assessed the maturity of the implemented WIS functions as basic, as compared to 31-42% in the rest of the regions.

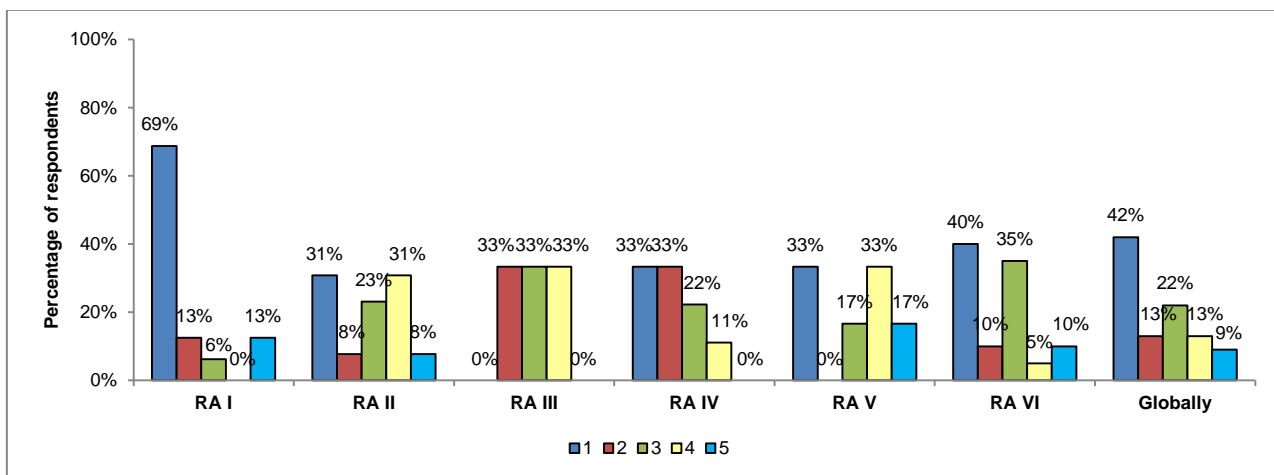


Figure 27: Maturity of WIS functions implemented at NMHSs (by region)  
 1=basic implementation of some functions 3=full implementation of functions appropriate to centre  
 5=systematic continuous improvement of full functionality appropriate to centre

**KPI 4.2.2: Number of NMHSs whose data processing and management capabilities have enhanced as a result of implementation of WIS functions**

Of the 64 respondents who had implemented some WIS functions, forty-eight (or 75%) indicated improvement in data processing and management capabilities. All five respondents from Region V and 75-85% of those from Regions I, II, III and VI supported this statement. Only five Members from Region IV replied to this question. Of these, three found their capabilities enhanced as a result of implementation of WIS functions; the other two responded negatively.

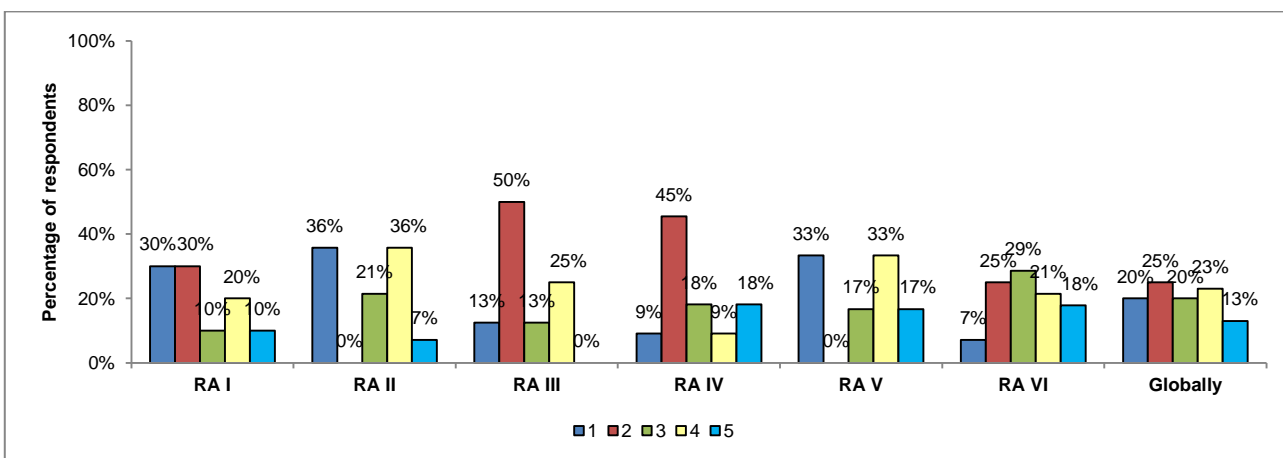


Figure 28: Level of data processing and data management capabilities (by region)  
 1=basic implementation of some functions 3=full implementation of functions appropriate to centre  
 5=systematic continuous improvement of full functionality appropriate to centre

In terms of the level of data processing and data management capabilities, 45% of 87 respondents globally indicated basic implementation of some WIS functions (category 1 and 2), as presented in

Figure 28. A fifth implemented fully functions of WIS, whereas 36% approached or had achieved systematic continuous improvement of full functionality appropriate to centres (category 4 and 5). Implementation was basic for 50-60% of respondents from Regions I, III and IV. In the rest of the regions, this was the case for a third of respondents.

**Key Outcome 4.3: Progress in implementing the Global Climate Observing System**

**KPI 4.3.1: Percentage of progress in achieving the tasks of the GCOS implementation plan**

Globally, three-quarters of 101 respondents asserted that their national climate user community had access to data archives at national or global climate data centres operated by their NMHS in 2015. Data archives were most accessible in Regions III, IV and VI, as evident from Figure 29. They were least accessible in Regions I and V.

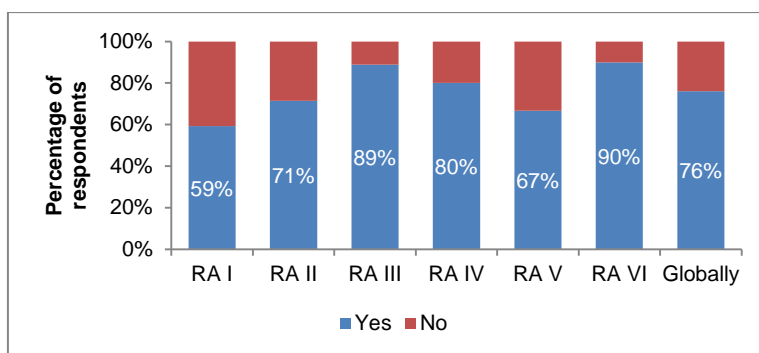


Figure 29: Access of national climate user communities to data archives at national or global climate data centres (by region)

In terms of satisfaction, 59% of 100 respondents provided an 'above average' rating to the quality of climate observations in terms of meeting user needs. As exhibited in Figure 30, over a third assessed their quality as average, whereas 5% provided a negative score. The highest scores were registered in Region VI where three-quarters of respondents provided an above-average rating of 4 or 5. While the majority of respondents from Region I assigned average or above-average ratings, 15% indicated poor quality of climate observations.

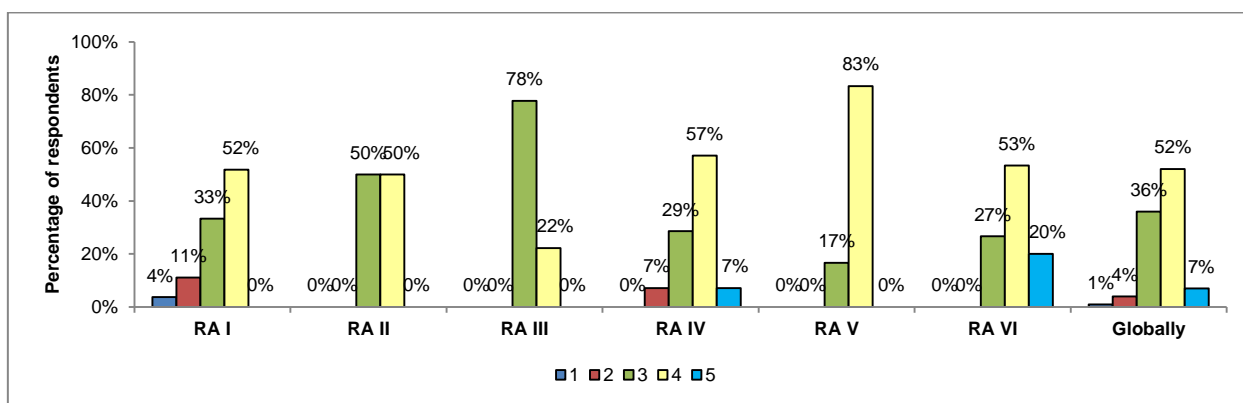


Figure 30: Quality of climate observations provided by NMHSs in meeting user needs (by region)

**Key Outcome 4.4: Data rescue and data management systems improved**

**KPI 4.4.1: Number of NMHSs undertaking data rescue or being involved in regional collaborative data rescue initiatives such as MEDARE**

33% of 101 respondents benefited from a WMO-coordinated data rescue project, as illustrated in Figure 31.

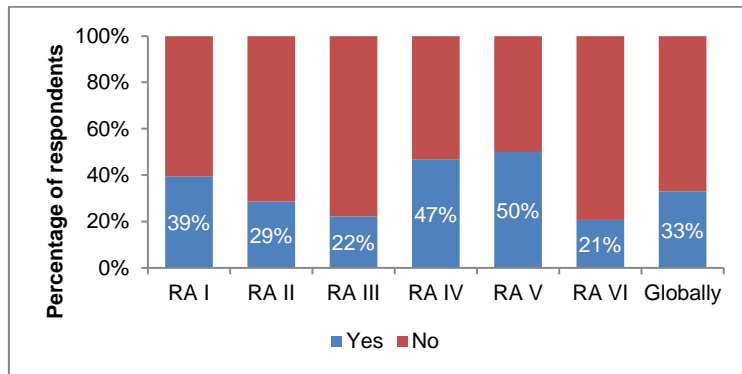


Figure 31: Members benefiting from WMO-coordinated data rescue projects (by region)

In addition, 53% percent of 102 respondents indicated that a data rescue project had been carried out in their country during the past two years.

74% of the same number of respondents pointed to a continued need for WMO-coordinated data rescue projects in their country. As evident from Figure 32, this need was considered highest in Region IV, followed by Regions I, V and III, respectively. About half of respondents from Regions II and VI expressed such an opinion.

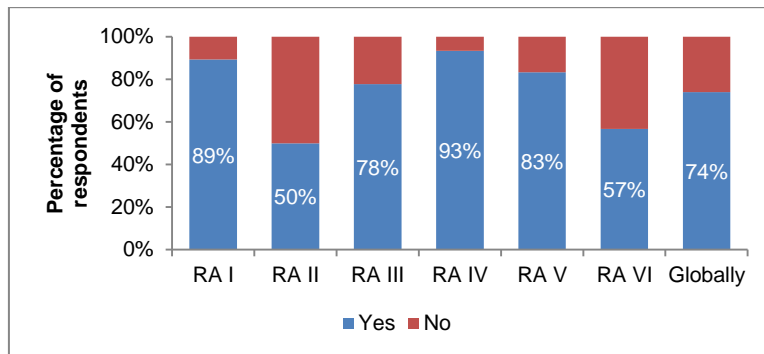


Figure 32: Members indicating a continued need for WMO-coordinated data rescue projects (by region)

**KPI 4.4.2: Number of Members implementing modern climate data management systems and/or climate monitoring systems**

Figure 33 describes the level of adequacy assigned by 102 respondents to the climate data management systems in use in their NMHSs. Globally, over half considered them to be adequate or very adequate; 36% assessed their adequacy as average, whereas 12% rated them as sub-standard. The latter pertained mostly to Regions I and II where a fifth of respondents assigned a poor rating of 1-2, as well as Region IV where this proportion stood at 14%. Whereas the adequacy of climate data was considered highest in Region V (83%), it should be noted that only 6 Members replied to this question. At 67%, Region VI also demonstrated a high level of adequacy of climate data management systems, followed by Regions II, III and IV where positive ratings accounted for 43-53%.



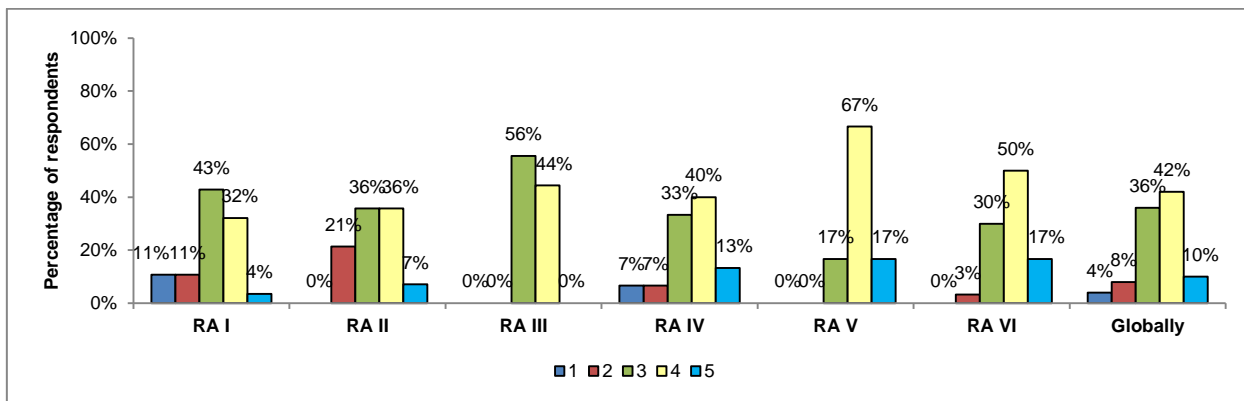


Figure 33: Level of adequacy of the Climate Data Management System in use at NMHSs by region

Globally, 82% of 102 respondents had a climate monitoring and/or watch systems in use in their country. As illustrated in Figure 34, all 6 respondents from Region V (100%) indicated the existence of such systems in their countries. They were equally prevalent in Regions II, III and VI. Forty percent of respondents from Region IV and over a quarter from Region I lacked climate monitoring and/or watch systems.

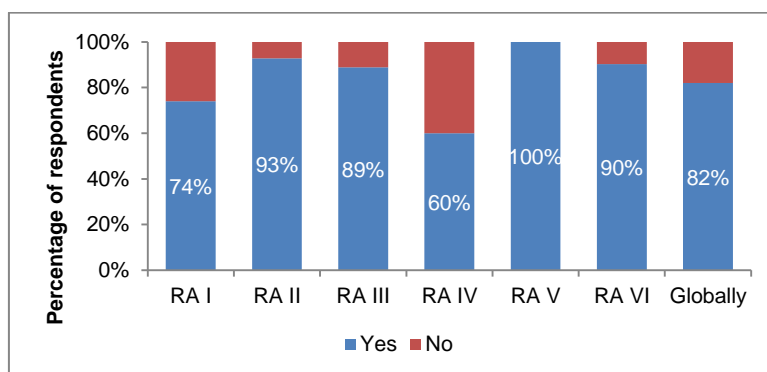


Figure 34: Members with climate monitoring and/or watch systems in use (by region)

## Expected Result 5:

Enhanced capabilities of Members to contribute to and draw benefits from the global research capacity for weather, climate, water and the related environmental science and technology development

**Key Outcome 5.1:** Research in climate prediction/projection to improve the skills of seasonal, decadal and longer timescales is enhanced

KPI 5.1.1: Number of new activities advancing climate research capacity at the global and regional level, especially for early career scientists and scientists from developing and LDC countries

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

KPI 5.1.2: Number of early career scientists and scientists from developing and least developed countries that WCRP funded to participate in activities to advance climate research

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 5.1.3: Degree of satisfaction among NMHSs with the skill of climate predictions**

Ninety-five respondents expressed their degree of satisfaction with the skill of climate predictions, as presented in Figure 35. Of these, 38% assessed the skill of climate predictions as 'high' or 'very high,' whereas 44% provided an average rating. Seventeen percent found the level of skill to be 'low' or 'very low'. Whereas the majority of respondents in all regions evaluated the level of skill as average or above average (category 4 and 5), a quarter of respondents from Regions I and VI assigned a poor rating (category 1 and 2).

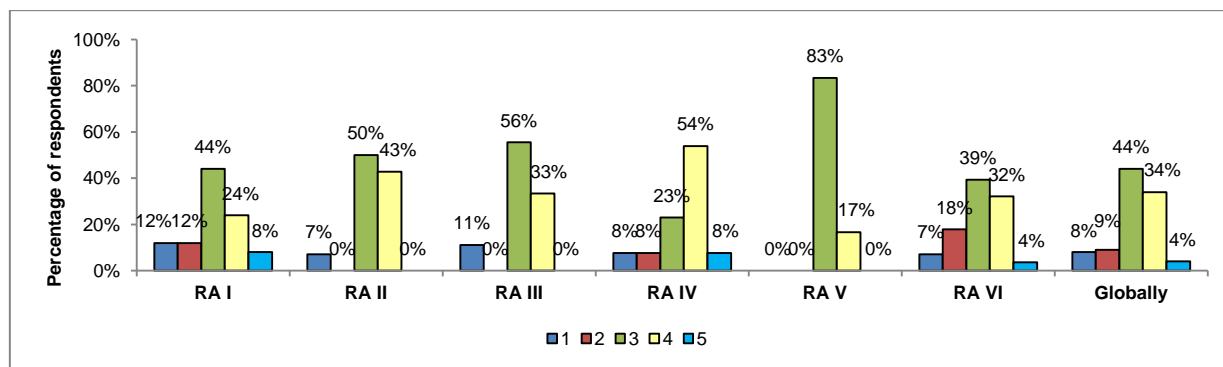


Figure 35: Level of skill of climate predictions issued by NMHSs and other mandated institutions

**Key Outcome 5.2: Research in the prediction of high-impact weather on time scales of hours to seasons is enhanced**

**KPI 5.2.1: Number of total research projects (new, ongoing and completed) on operational products and services**

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 5.2.2: Number of Members whose operational products and services have improved as a result of WMO research projects**

As presented in Figure 36, over three-quarters of 74 respondents indicated that their operational nowcasting service had improved as a result of WMO research projects. A similar proportion (72%) saw the access and use of outputs of operational ensemble modelling systems enhanced. About half indicated advances in the design and operational use of mesoscale prediction systems as a result of WMO research projects. Other improvements mentioned were linked to seasonal predictions, flash floods, climate predictions issued by Global Centres, meteorological information systems for specific applications, and various weather prediction models (e.g. ALADIN/Algeria, ALADIN/Dust and AROME/Algeria).

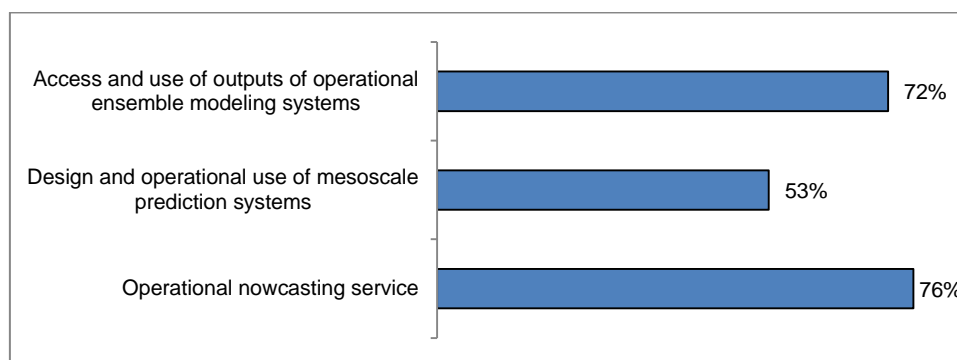


Figure 36: Areas in which operational products and services provided by NMHSs have improved as a result of WMO research projects

WMO research projects particularly contributed to advances in operational forecasting in Regions I, II and IV, with 82-90% of respondents supporting this statement. They were equally effective in Regions I and V with respect to access and use of outputs of operational ensemble modeling systems. In the rest of the regions, this was true for 50-70% of respondents. Efforts at enhancing the design and operational use of mesoscale prediction systems affected Regions II and III to a lesser extent, where only 36% and 22% of respondents indicated improvements as a result of WMO research projects, respectively.

**KPI 5.2.3: Number of NMHSs in developing and least developed countries participating in regional and international research initiatives on high impact weather or severe weather forecasting demonstration projects**

Thirty-three Members, representing 49% of the 67 respondents from developing and least developed countries, participated in regional or international research initiatives on high-impact weather or a severe weather forecasting demonstration projects in the past two years.

Their rating of improvements in the capabilities of their respective NMHS to forecast high-impact weather as a result of participation in these activities is presented in Figure 37. Sixteen Members (47% of 34 respondents) assessed highly the outcome of their participation in these initiatives, while a similar share of respondents (41%) provided an average rating. Twelve percent found little or very little improvement in the capabilities of their NMHS. The low number of respondents to this survey question does not allow drawing any regional trends and patterns.

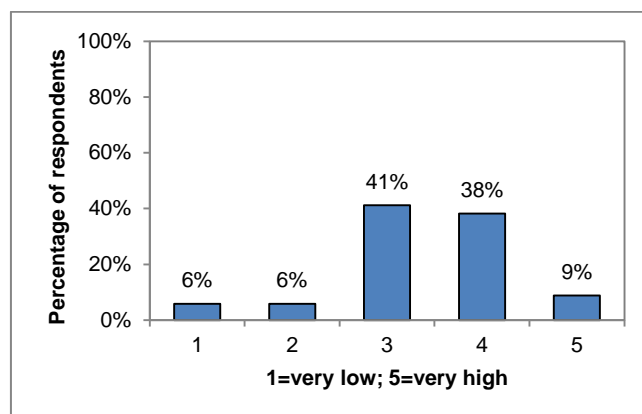


Figure 37: Improvements in capabilities in forecasting high-impact weather

**Key Outcome 5.3: Atmospheric chemistry observations and assessment meet needs of environmental conventions and policy assessments**

**KPI 5.3.1: Degree of Member satisfaction with the (a) usefulness and (b) timeliness of Global Atmospheric Chemistry Bulletins**

As exhibited in Figure 38, half of 79 respondents found the WMO Global Atmospheric Chemistry Bulletins to be useful or very useful. Thirty percent assigned them an average rating, whereas close to a fifth expressed doubts about their value. These skeptics were mostly from Regions I, IV and VI.

The results were similar regarding the timeliness of the WMO Global Atmospheric Chemistry Bulletins. Half of 77 respondents found the WMO Global Atmospheric Chemistry Bulletins to be 'timely' or 'very timely.' About a third gave them an average rating, whereas 18% expressed dissatisfaction, as evident from Figure 38. Critics represented Regions I and IV, as well as Region VI to a lesser extent.

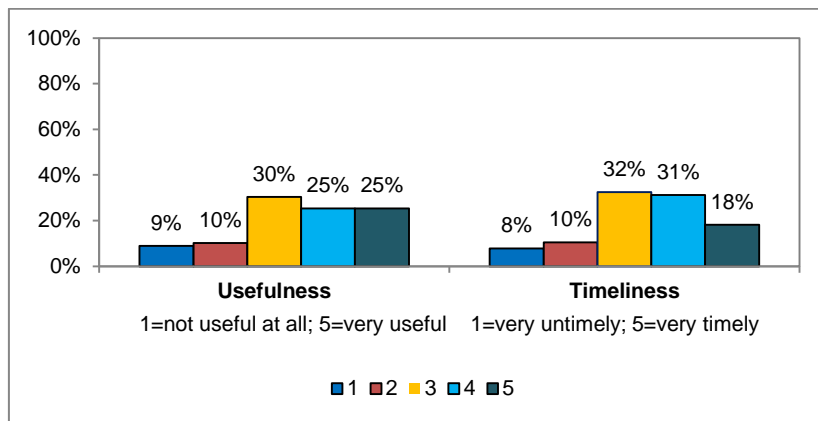


Figure 38: Rating of the usefulness and timeliness of the Global Atmospheric Chemistry Bulletins

**KPI 5.3.2: Degree of Member satisfaction with the usefulness of (a) GAW measurement guidelines and reports, (b) Sand-and-Dust storm forecasting, and (c) the chemical weather activities of GURME**

Of the 65 respondents to whom the measurement guidelines and procedures developed in the GAW Programme were relevant, 79% highly appreciated their usefulness (see 4-5 rating categories in Figure 39(a)). Twelve percent found them moderately useful, while 9% expressed doubts about their utility.

Regarding the sand-and-dust storm forecasting system and information, 61% of 46 respondents positively assessed their usefulness, as evident from the 4-5 rating categories in Figure 39(b). A quarter of respondents found them moderately useful, whereas 15% raised concerns about their value.

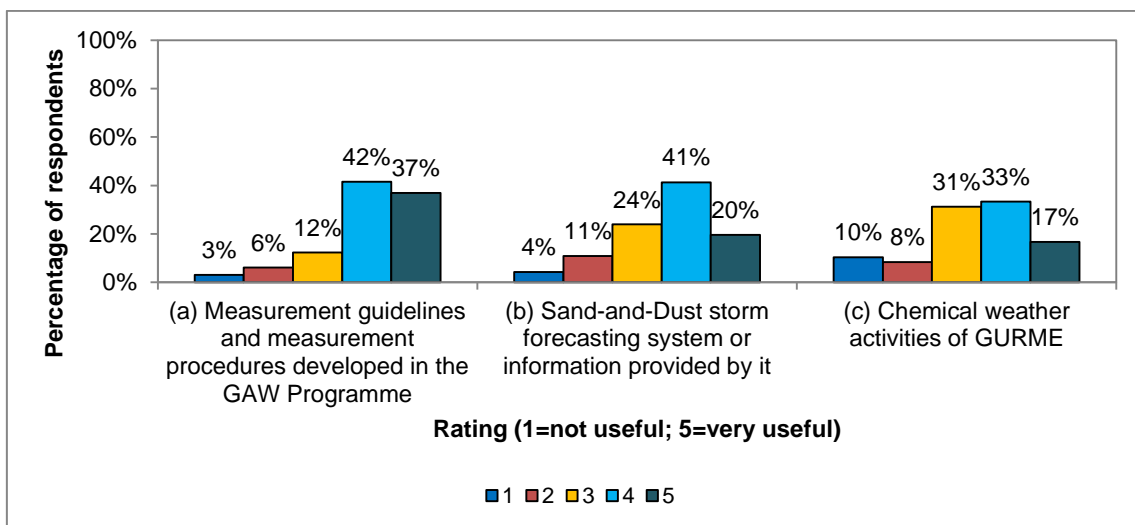


Figure 39: Rating of the usefulness of (a) measurement guidelines and measurement procedures developed in the GAW Programme; (b) Sand-and-Dust storm forecasting system or information; and (c) Chemical weather activities of GURME

The chemical weather activities of GURME were highly valued by half of 48 respondents, as presented in Figure 39(c). A third rated their usefulness as average, while 18% gave them a negative rating of 1-2.

## Expected Result 6:

Enhanced capabilities of NMHSs, in particular in developing and least developed countries, to fulfil their mandates

**Key Outcome 6.1:** Visibility and relevance of NMHSs in national and regional development agendas is improved, particularly in developing and least developed countries

KPI 6.1.1: Number of NMHSs with (a) increased contribution to national policy setting; (b) improved awareness by users on type of services NMHSs can deliver; (c) improved user accessibility; (d) improved timeliness; and (e) increased accuracy of forecasts and warnings

As illustrated in Figure 40, Members observed significant improvements in their visibility and relevance in the national development agenda, especially with regard to user accessibility to forecasts and warnings. Eighty-four percent of 103 respondents globally reported moderate to significant increases in this regard. A similar proportion (80%) indicated improvements in terms of awareness by users on the types of services which NMHSs can deliver.

Other important factors included the timeliness and accuracy of forecasts and warnings. The former contributed to enhanced visibility and relevance of NMHSs at the national level according to 75% of 103 respondents; the latter played a role in the opinion of 79% of 103 respondents.

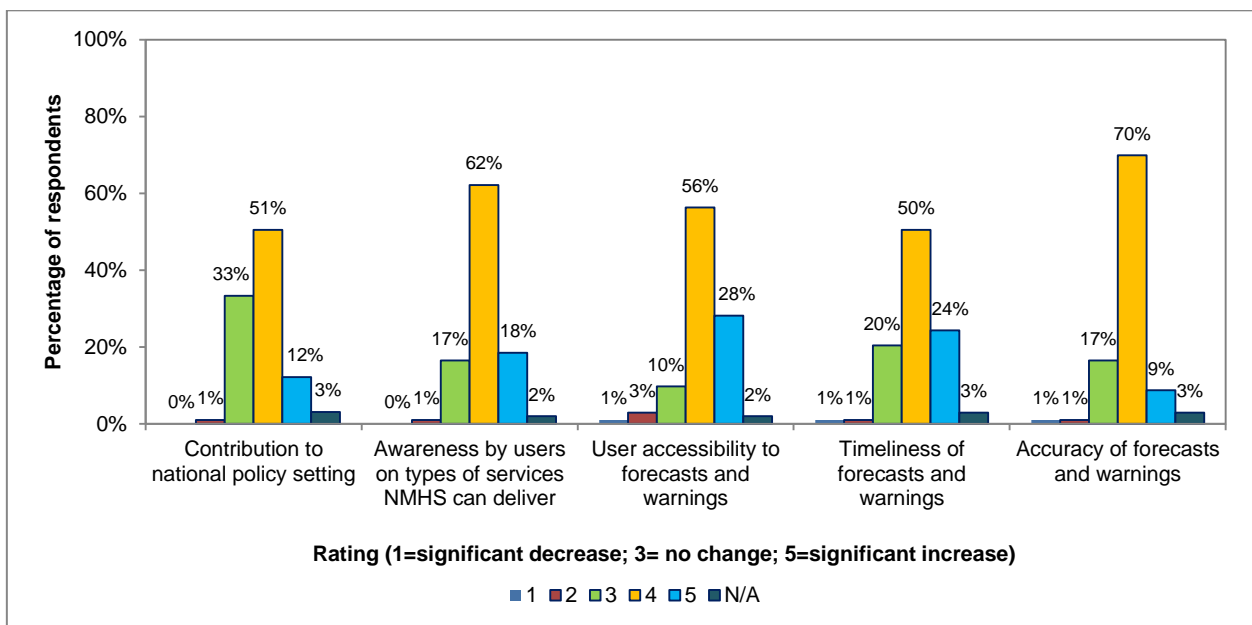


Figure 40: Change in the visibility and relevance of NMHSs in the national development agenda

Globally, close to two-thirds reported increased contribution to national policy setting, especially in Region II where 83% of respondents noted moderate to significant increase in visibility and relevance. For the rest of the regions, this area saw least improvement, with 33% of respondents globally indicating no change in the past two years. Impact on national policy was even lower in Regions III and VI, where 56% and 43% of respondents observed no change, respectively.

About a third of respondents from Region I noted no change or even a decrease in their visibility and relevance with respect to user accessibility, as opposed to the rest of the regions where 90%-100% of respondents reported improvements. The same was true for Region I in terms of timeliness of forecasts. No change was further observed by 33% and 25% of respondents from Regions IV and VI, respectively. In terms of accuracy, no change in visibility and relevance was observed by a fifth of respondents from Regions I, IV, V and VI. Regarding awareness of the types of services delivered, this was the situation for a third of respondents from Regions III and V and a fifth from Region I.

As evident from Figure 41, slightly less improvement was noted in terms of the visibility and relevance of the regional services provided by NMHSs in the regional development agenda, though the question was not applicable to 19% of 101 respondents. Close to 60% accounted the increased visibility and relevance to improved user accessibility to forecasts and warnings

delivered by Regional Centres. In Regions II, III, IV and V, 75-100% of respondents supported this statement, as compared to 55% in Regions I and VI.

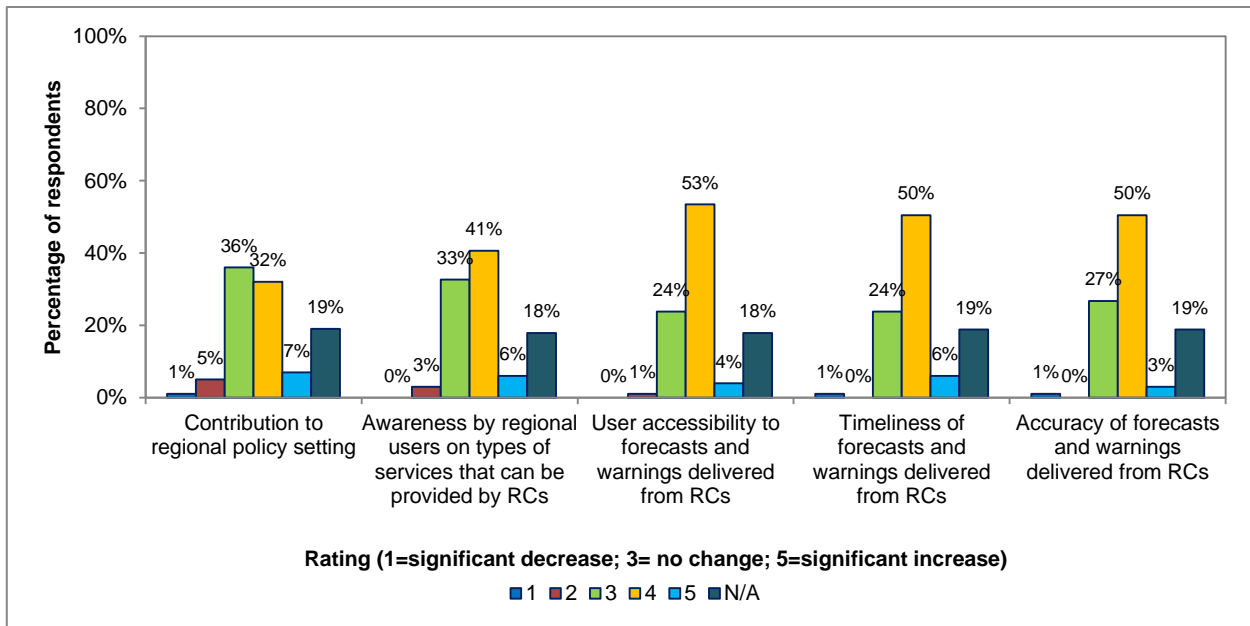


Figure 41: Change in the visibility and relevance of the regional services delivered by NMHSs in the regional development agenda

Globally, over half of respondents observed improved visibility and relevance due to enhanced timeliness and accuracy of forecasts. This percentage was highest in Regions III and IV (77-79%) and average (55-69%) in the rest of the regions. About a quarter of respondents globally reported no change in this regard.

In terms of contribution to regional policy setting, 39% indicated that the visibility and relevance of their NMHS had increased over the past two years. Regions V and VI were below this average at 33% and 29%, respectively. Regions I, II and III were considerably above the average at 60%. No change was observed by 36% of respondents.

Regarding increased awareness by regional users of the types of services that can be provided by Regional Centres, 47% noted increased visibility and relevance globally, with the highest gains in Region IV (85%), followed by Region II (69%), Region III (67%), and Regions I and V (50%). The least positive improvement was observed in Region VI (36%), with the vast majority of respondents observing no change or even a decrease in visibility (5%).

**Key Outcome 6.2:** Infrastructure and operational facilities of NMHSs and Regional Centres are improved, particularly in developing and least developed countries

KPI 6.2.1: Number of NMHSs with improved infrastructure and operational facilities

Improvements to the infrastructure and operational facilities of NMHSs were reported as follows by the 102 respondents to this question:

- 84% in the surface observing network;
- 82% in forecasting (mostly with respect to the general public, agriculture, energy and emergency management, and to a lesser extent to aviation, surface transport, climatological forecasting, marine forecasting, and seasonal forecasting);
- 75% in early warning and hazard risk assessments;
- 72% in numerical weather prediction and data-processing;
- 64% in equipment for meteorological/environmental satellite data; and
- 36% in the upper-air observing network.

Improvements in the upper-air observing network were particularly challenging for Region I where only 15% of respondents reported enhancements. Region VI performed best in terms of numerical weather prediction, with 93% of respondents reporting progress, followed by Region II (79%). In the rest of the regions, 20-30% of respondents did not observe any improvements in this respect.

Regarding early warning and hazard risk assessments, Regions V (100%)<sup>1</sup> and Region VI (80%) saw greatest enhancements, closely followed by Region II (79%). Regional performance was highest in terms of surface observing networks and forecasting with results close to the global average in all regions. The regional results for improvements in equipment for meteorological / environmental satellite data were similarly close to the global average above, except for Region II and Region V where 77% and 100% of respondents reported improvements, respectively.

**Key Outcome 6.3:** Education and training development activities at national and regional levels are improved, especially in developing and least developed countries

**KPI 6.3.1:** Number of institutions providing education and training support for GFCS related activities

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 6.3.2:** Degree to which Members are getting value for money from the WMO Fellowship Programme

Fifty-five respondents indicated that they had requested one or more fellowships in the past four years under the WMO Fellowships Programme. Their satisfaction was extremely high, as evident from Figure 42, with 75% of respondents positively rating the Programme's value for money (categories 4 and 5). A quarter found it moderately useful, whereas no respondent provided a negative assessment.

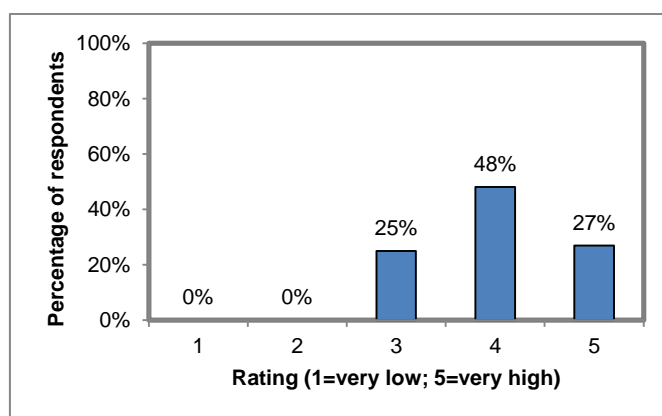


Figure 42: Value obtained from the WMO Fellowship Programme

**KPI 6.3.3:** Degree of Member satisfaction with the RTCs in use

Figure 43 presents the degree of Member satisfaction with the RTCs in use, as assessed by 79 respondents on a scale of 1-5, where 1=very low and 5=very high. Satisfaction was highest (96%) with the RTCs in Region VI, followed by Region IV and Region II where 88% and 84% of respondents assigned an above-average rating of 4 or 5, respectively. In the rest of the regions, this percentage was at about 70%, with the rest of respondents having provided an average score. Only 3-6% of respondents evaluated negatively the services provided by RTCs.

<sup>1</sup> It should be noted that only six Members from Region V replied to this question.



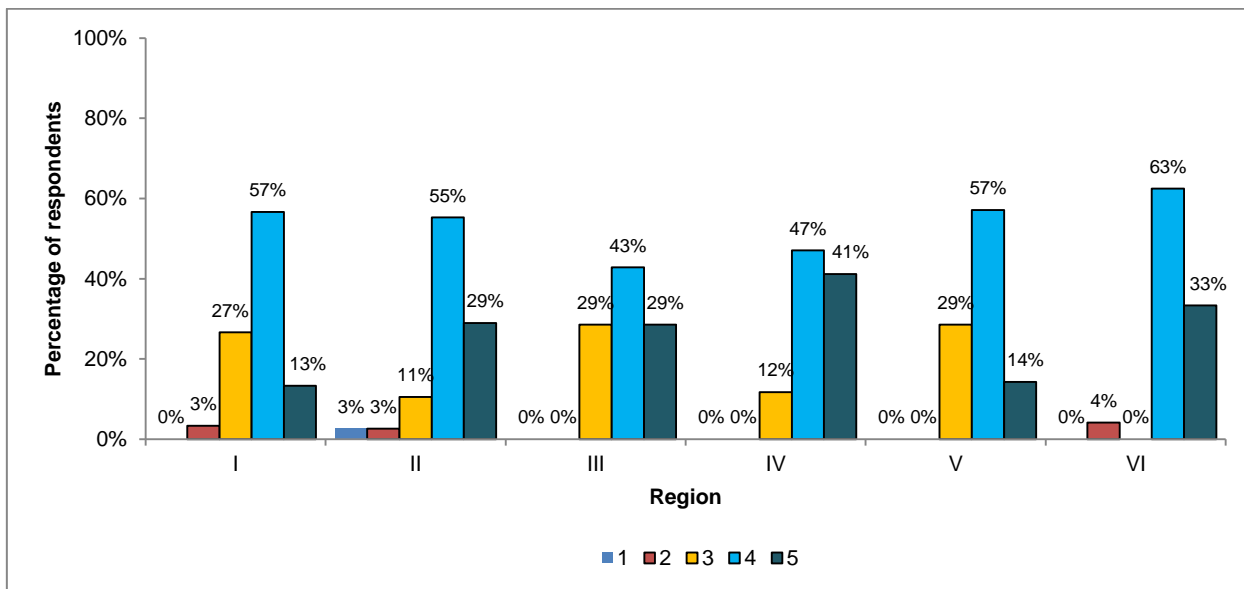


Figure 43: Rating of satisfaction with RTCs (by region)

**Key Outcome 6.4: Capacities of NMHSs are enhanced through cooperation and partnerships with other national and regional organizations**

**KPI 6.4.1: Development projects and activities funded through voluntary contributions**

Of 103 respondents, 58% received development funding or assistance from international partners to support projects and activities. Of these, 78% believed that the capacity of their NMHS had enhanced or significantly enhanced both in the short- and long-term as a result of the implemented activities (Figure 44). This proportion was lower than this global average in Regions III and VI where 50% and 62% of respondents provided a similar assessment to improvements in the short term, respectively. The latter were more tangible in the long-term for Region III, with the percentage of respondents providing a score of 4 or 5 increasing to 71%; it stayed the same in Region VI. Long-term enhancements were also more palpable in Regions IV and V where all respondents considered them significant or very significant.

Globally, about a fifth of respondents were moderately satisfied with the impact of these activities in the short term, and a slightly lower portion (17%) in the long-term. Six percent saw no or limited improvement in the long term.

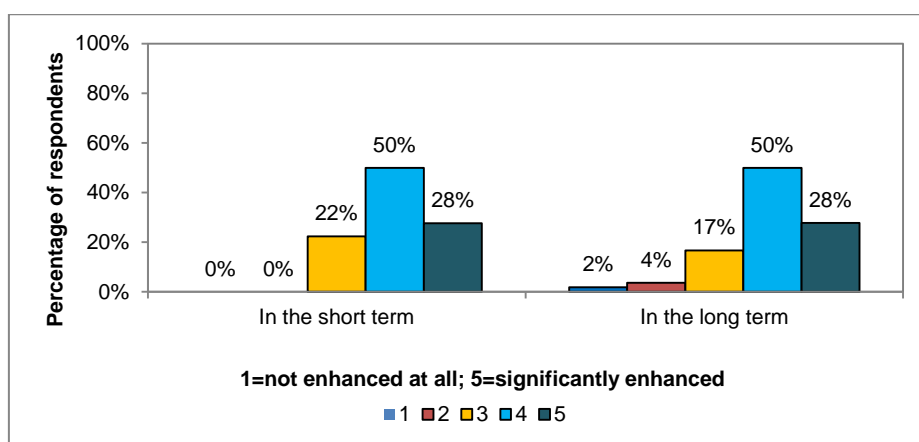


Figure 44: Rating of success in enhancing NMHS capacities as a result of projects and activities implemented with funding from international partners



## Expected Result 7:

New and strengthened partnerships and cooperation activities to improve NMHSs' performance in delivering services and to increase the value of the contributions of WMO within the UN system, relevant international conventions and national strategic issues

**Key Outcome 7.1:** WMO leadership and contribution in relevant UN system and other international partners' initiatives and programmes is improved

**KPI 7.1.1:** Number of reports of WMO and its co-sponsored programmes submitted to UN and other international conventions, particularly the UNFCCC, UNCCD and UNCBD

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 7.1.2:** Number of contract/cooperation agreements within which WMO is engaged with partners

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 7.1.3:** Number of NMHSs implementing projects with the UN and other international and/or regional organizations

Globally, 73% of 101 respondents implemented projects or activities in partnership with United Nations (UN) and other international organizations over the last two years.<sup>2</sup> Figure 45 presents the breakdown by region. The vast majority were realized in cooperation with multilateral partners, including UN organizations and the World Bank. A large number of activities were implemented in partnership with regional organizations, such as the European Union, the Inter-American Development Bank (IDB), the Asia-Pacific Economic Cooperation (APEC), the Secretariat of the Pacific Regional Environment Programme (SPREP), etc. Quite a few involved the participation of bilateral partners, such as the Finnish Meteorological Institute (FMI), the Japan International Cooperation Agency (JICA), the China Meteorological Administration (CMA), the United States

<sup>2</sup> The following is an exhaustive list of the partner organizations mentioned: ACTS, Asian Development Bank (ADB), Asian Disaster Preparedness Centre (ADPC), APEC, APEC Climate Centre, Asia Pacific Space Cooperation Organization (APSCO), Australian Agency for International Development (AusAID), the Australia-Indonesia Centre, Barcelona Supercomputing Centre (BSC), the Caribbean Community Climate Change Centre (CCCCC), Central American Institute for Aeronautical Training (ICCAE), Central European Initiative (CEI), Centre for International Climate and Environmental Research – Oslo (CICERO), CMA, CCAFS, Coordination Group for Meteorological Satellites (CGMS), Danube Commission, Department for International Development (DFID), Environment Canada, European Centre for Medium-Range Weather Forecasts (ECMWF), European Network of Environment Professionals (ENEP), EUMETNET, EUMETSAT, European Regional Development Fund (ERDF), the European Union, FMI, Finnish-Peruvian ICI Project Website (FINAMPO), French Research Institute for Development (IRD), Food and Agriculture Organization (FAO), Group on Earth Observations (GEO), Global Environmental Facility (GEF), GIZ (German Society for International Cooperation), GOAL, Hydrological Centre, USA, Indian Ocean Commission, Inter-American Climate Institute, IDB, Inter-American Institute for Cooperation on Agriculture (IICA), Inter-Governmental Panel on Climate Change (IPCC), International Atomic Energy Agency (IAEA), International Civil Aviation Organization (ICAO), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Hydrological Programme (IHD), International Red Cross (IRC), IRI, International Sava River Basin Commission, JICA, Japan Meteorological Agency (JMA), Korea International Cooperation Agency (KOICA), Korea Meteorological Administration (KMA), Mekong River Commission, MeteoSwiss, National Oceanic and Atmospheric Administration (NOAA), NORSAR, Norwegian Meteorological Institute, Oxfam, Programme on Climate Information for Resilient Development in Africa (CIRDA), Proyecto Relampago (Argentina), Regional Committee for Hydrological Resources (CRRH), RIMES, Secretariat of the Pacific Community (SPC), SPREP, Swiss Development Cooperation (SDC), Tropical Agricultural Research and Higher Education Centre (CATIE), UCAR, UK Met Office, United Nations Framework Convention for Climate Change (UNFCCC), United Nations Development Programme (UNDP), United Nations Economic Commission for Africa (UNECA), United Nations Environment Programme (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Office for Disaster Risk Reduction (UNISDR), USAID, World Health Organization (WHO), World Food Programme (WFP) and the World Bank.

Agency for International Development (USAID), etc. Collaboration with universities, research institutes and NGOs involved the International Research Institute (IRI), the University Corporation for Atmospheric Research (UCAR), the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), the Hydrological Research Center (USA), Oxfam, and others.

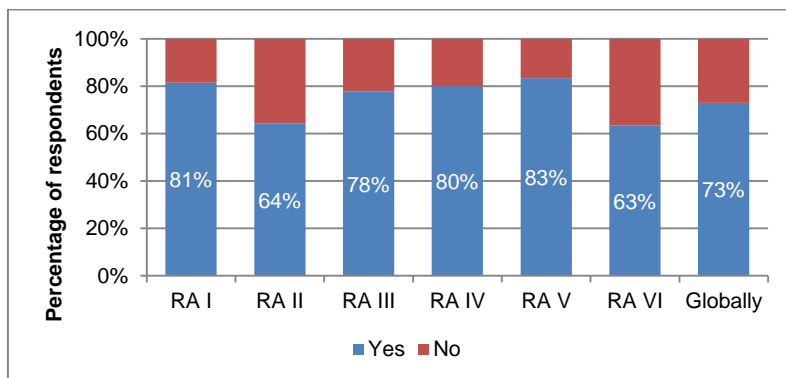


Figure 45: NMHSs implementing projects in partnership with UN and other international organizations (by region)

Sixty-five percent of the 103 Members actively contributed to the work of IPCC. Of these, 67% did so by nominating and supporting authors and review editors and 88% by contributing to government/expert review of IPCC reports.

**Key Outcome 7.2:** Public, decision-makers and other stakeholders are increasingly aware of key WMO and NMHSs issues, activities and priorities through enhanced communication

**KPI 7.2.1:** Uptake of WMO public information outputs as measured by (a) number of unique visitors on the WMO website; (b) number of times WMO was mentioned in press articles; (3) number of Facebook fans; and (d) number of Twitter followers

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 7.2.2:** Degree to which NMHSs make use of WMO public information outputs

As evident in Figure 46, there is a high level of utilization of WMO non-technical, public information outputs, such as website, press releases, videos, World Met Day materials, In the Media, Facebook, Twitter, etc.

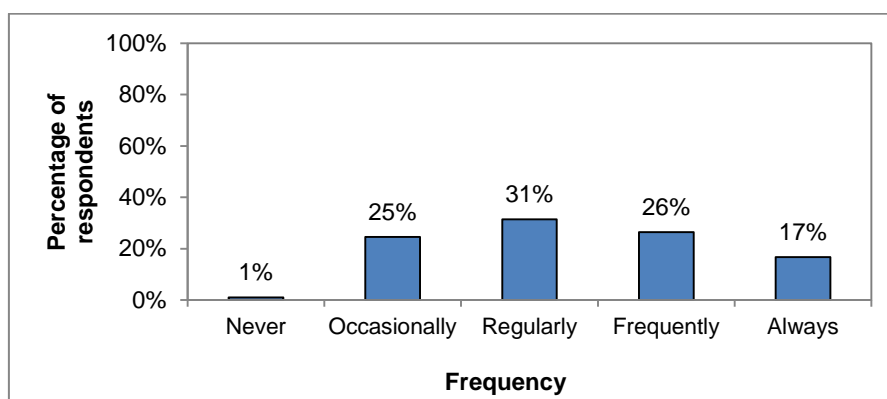


Figure 46: Frequency of use of non-technical, public information outputs

Of 102 respondents, 57% indicated that they used them frequently or on a regular basis. Seventeen percent indicated that they always made use of the non-technical materials produced by WMO, while a quarter of respondents only used them occasionally. A mere 1% stated that they never used them.

**KPI 7.2.3:** Number of NMHSs that have provided training to senior managers and/or communication officers in media relations, social media or other aspects of communications

The senior managers and communication officers at 60% of 102 Members globally received training in media relations, social media or other aspects of communication. As evident from Figure 47, Members from Regions II and V were most active in providing communications training. Fifty-seven percent of respondents in Regions I and VI and less than half in Region III provided such training.

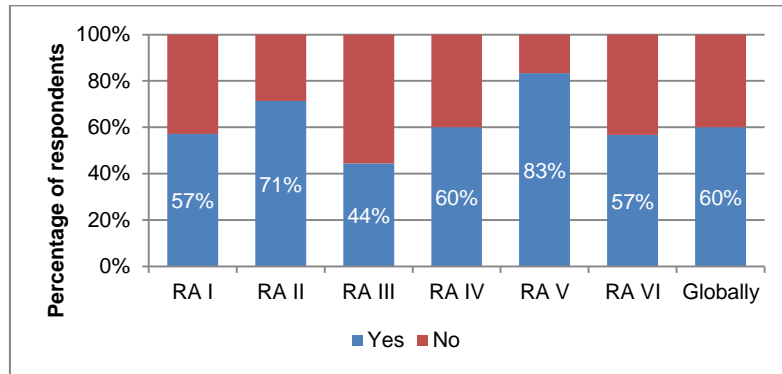


Figure 47: Communications training provided to senior managers and/or communication officers (by region)

## Expected Result 8:

### An effective and efficient Organization

#### Key Outcome 8.1: Effective and efficient WMO Congress and EC

**KPI 8.1.1:** Degree of Member satisfaction (rating of 3-5) with documentation for Cg, EC and its working groups

Two-thirds of 130 respondents rated the technical content of Cg-17 and EC-67 documentation as average to above average, while 82% provided such rating to the language quality of documents.<sup>3</sup>

**KPI 8.1.2:** Degree of Member satisfaction (rating of 3-5) with supporting services for Cg and EC (interpretation, conference activities and facilities)

Close to 80% of 130 respondents provided a rating of 3-5 (average to above average) to the quality of interpretation at Cg-17 and EC-67; 94% expressed satisfaction with the paperless sessions, while 92% were happy with the efficiency of badge delivery.<sup>4</sup>

**KPI 8.1.3:** Decrease in the total cost of sessions held under similar conditions

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

#### Key Outcome 8.2: An effective and efficient WMO Secretariat

**KPI 8.2.1:** Percentage of implemented accepted oversight recommendations for improved business effectiveness on the agreed deadline

<sup>3</sup> Based on surveys conducted by the WMO Secretariat during Cg-17 and EC-67

<sup>4</sup> Ibid.

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 8.2.2: Unqualified opinion of the external auditor in the financial period**

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 8.2.3: Increase in the efficiency of fulfilling requirements for linguistic and publishing services**

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**KPI 8.2.4: Issuance of statements of internal control in the financial period**

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

**Key Outcome 8.3: Effective and efficient constituent bodies (RAs and TCs)**

**KPI 8.3.1: Degree of Member satisfaction (rating of 3-5) with constituent body documentation**

No constituent body meetings were held in 2015 apart from the Sixteenth Session of RA I. Regarding the latter, no survey results are available due to the low number of respondents.

**KPI 8.3.2: Degree of Member satisfaction (rating of 3-5) with constituent body supporting services**

No constituent body meetings were held in 2015 apart from the Sixteenth Session of RA I. Regarding the latter, no survey results are available due to the low number of respondents.

**KPI 8.3.3: Decrease in the total cost of constituent body sessions held under similar conditions**

No relevant questions in the survey. The data is collected by the WMO Secretariat using other sources.

## **WMO Services and Activities**

### ***Overall satisfaction with WMO services and activities***

Globally, 85% of 97 respondents highly valued the services and activities provided by WMO. Twelve percent found them moderately useful, while only 3% questioned their utility. Satisfaction was high throughout the six regions, as evident from Figure 48.

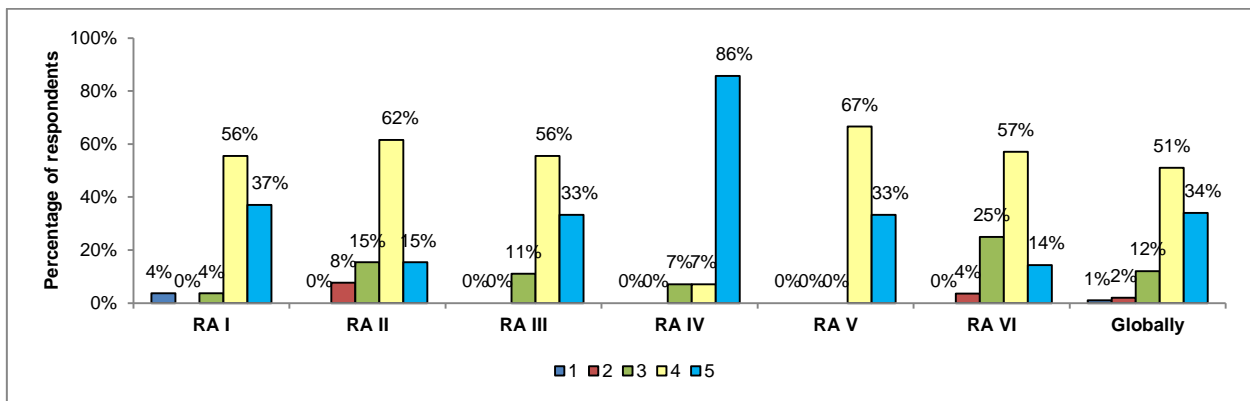


Figure 48: Usefulness of WMO services and activities by region (1=not useful at all; 5=very useful)

### **Areas in which WMO activities and services have been beneficial**

The two areas of WMO services and activities that the 90 respondents value most are:

- Capacity building, including trainings, workshops, fellowships, study tours, etc.
- Climate services, with the Global Framework for Climate Services (GFCS) specifically highlighted.

Other WMO activities and services that are also highly appreciated by Members include:

- Observing systems and data collection, exchange and rescue, with WIS and WIGOS featuring widely in Members' responses;
- The role of WMO as convener and sponsor of meetings/conferences and as well as providing platforms for cooperation with other NMHSs, donors and key stakeholders.
- Standardization and provision of guidelines, procedures, manuals and other publications;
- Communication to the public.
- Aeronautical Meteorology Programme (AMP) and related Quality Management System (QMS).
- Data collection and exchange as well as data access.
- Improvement in seasonal forecasts.
- Research (e.g. WWRP, WCRP).
- Various WMO programmes, such as the Disaster Risk Reduction (DRR) Programme, the Tropical Cyclone Programme (TCP), the Severe Weather Forecasting Demonstration Project (SWFDP), the Marine Meteorology and Oceanography Programme (MMOP), the Public Weather Services (PWS) Programme, the Voluntary Cooperation Programme (VCP) and assistance to least developed countries.
- Meteorological services, and specifically the Public Weather Services (PWS) Programme and the development of medium- and long-term weather and climate diagnostics and prognosis.

### **Ability to respond to users' needs and contribute to decision-making**

Globally, 61% of 101 respondents indicated significant improvement in their ability to respond to users' needs and contribute to decision-making through participation in WMO activities, as presented in Figure 49. Over a third registered minor improvements, while only 3% did not assign any credit to WMO for their capacity development.

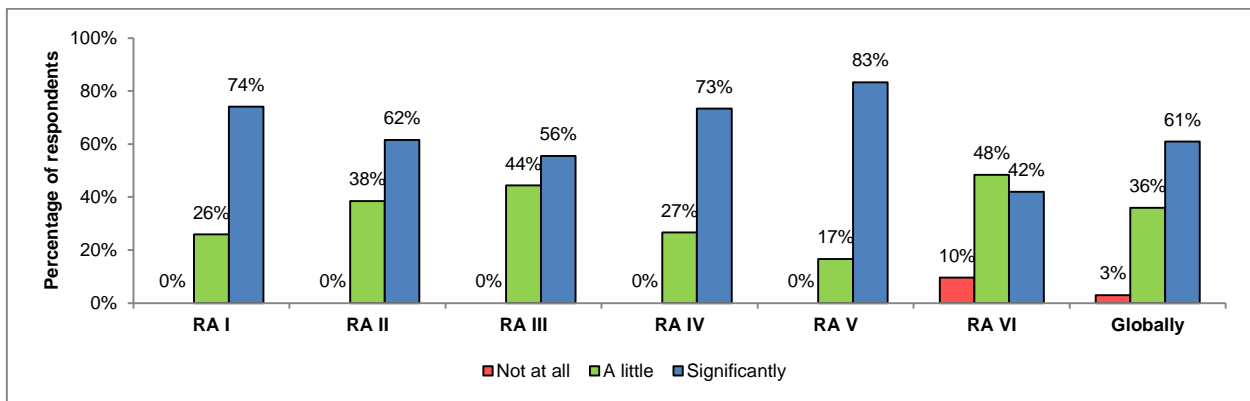


Figure 49: Improvement in the ability of NMHSs to respond to users' needs and to contribute to decision-makers as a result of participation in WMO activities (by region)

The impact was highest in Regions I, IV and V where 74%-83% of respondents reported significant improvements, and moderate in Regions II and III where 56% to 62% attributed enhancements in NMHS ability to respond to user needs to participation in WMO activities. Whereas the latter did not affect 10% of respondents from Region VI, it contributed 'a little' to almost half of respondents there and 'significantly' to 42%.

### **Major successes from leveraging off WMO activity in changing influence on decision-makers or users of services**

The two areas where respondents indicated highest achievements are:

- Climate services (including improved seasonal climate outlooks, utilization of regional climate outlooks in the production of local climate products, establishment of national climate centres, archival of climate-related data). GFCS and the reports of the Intergovernmental Panel on Climate Change (IPCC) were particularly singled out as contributing to building awareness of climate variability and need for increased resilience of the economy, infrastructure and society.
- Capacity development, particularly enhanced skills and knowledge of personnel, funding secured for trainings, technology transfer.

Other areas highlighted, though to a lesser extent, include:

- Communication to the public and decision-makers, including improved relations with the media and users.
- Early warning and disaster risk reduction, including development of impact-based risk warnings, more accurate and timely warnings for extreme weather, and contribution to the Sendai process as well as to national policy.
- Strengthened cooperation, including the First African Ministerial Conference on Meteorology (AMCOMET), various WMO constituent body meetings and meetings of their working groups and expert teams.
- Institutional and policy developments (e.g. development of national policies, legislation etc.).
- Improvements to the observation network and data availability (e.g. enhanced surface meteorological automatic weather stations, improved numerical weather prediction post processing systems, data availability to GISC users, improved marine meteorological observations, WIGOS implementation).

The following are a few highlights of achievements mentioned by respondents:

**Algeria:** "Success is the installation and commissioning of a calculator which allowed us to implement and run the models ALADIN/Algeria (08 km horizontal resolution) with a specialized

version ALADIN/Dust and also AROMA/Algeria with 03 km horizontal resolution. The ALADIN model is coupled with the ARPEGE model Météo France.”

**Belgium:** “Positive role of WMO for the establishment of a National Climate Centre in Belgium.”

**Belize:** “GFCS support for National Climate Outlook Forums has greatly assisted with the NMS publicizing seasonal outlooks. The country is now looking into developing drought and flood policies.”

**Brazil:** “WMO-INMET project to improve surface meteorological automatic weather stations network. Improved numerical weather prediction post processing system.”

**British Caribbean Territories:** “A major success comes from utilizing the regional climate outlook in the production of local climate products for specific economic sectors.”

**China:** “CMA has been working on developing impact-based risk warning operation in recent years, under the WMO's Guidelines on Multi-hazard Impact-based Forecast and Warning Services. During a heavy rainfall process in Anhui Province in July 2013, the risk was well estimated and the impact was well predicted. 2567 citizens were evacuated from the risky areas following the forecast of CMA. In the end, the devastating flood caused by this rainfall caused economic losses, but without leaving any casualties.”

**Congo:** “During the African Games that were held in Brazzaville, 4-19 September 2015, the Meteorological Service regularly issued forecasts for the organizers. On the closing day, equipment which was very sensitive to wind was supposed to be installed and risked being blown away or damaged due to an approaching storm. Thanks to the alert issued by the Meteorological Service, the equipment was removed and installed only after the storm. The event was delayed by a few hours.”

**Egypt:** “The prediction of rainfall which caused downpours on the mountains surrounding the Red Sea and the southern part of Egypt. The issuance of predictions to raise public awareness of extremely hot weather and protect the general public from the damage caused by hot weather to public health.”

**Fiji:** “Implementation of Quality Management System.”

**Gambia:** “The information on Seasonal Climate Outlook in terms of accuracy, availability and timeliness in the past significantly influenced decision-makers and farmers in planning.”

**Ghana:** “Participation in the METAGRI has enhanced the dissemination of climate information and participatory scenarios planning for peasant farmers in the northern part of the country.”

**Hong Kong, China:** “Participating in SOT and DBCP activities has enhanced the Observatory's capability of marine meteorological observations in data sparse oceans, in particular, in the South China Sea, which contributes to navigation safety in the region.”

**Ireland:** “Building on the Strategy for Service Delivery, we developed a new delivery mechanism for weather information into government agencies, which incorporated best practice consultant users on products and product design, and providing training and liaison with users to help them derive maximum benefit from the information delivered. This has been a very successful project, and the products have been well-received.”

**Latvia:** “The development of a competency assessment system has significant positive influence on the staff's position in the labor market and communication with the direct client.”

**Pakistan:** “WMO Lead Centres' Seasonal Outlook contributed to addressing queries of seasonal outlook from DRM agencies, policy makers, media, and the public.”



**Panama:** “The celebration of World Meteorological Day and World Water Day with the community of a specific area in the country’s capital.”

**Senegal:** “The Global Framework for Climate Services has helped formalize and recognize the climate services provided to the agricultural sector through a testimonial document by the Director of Agriculture.”

**Singapore:** “Publication of the IPCC ARG has renewed interest from the public and policy makers on extreme weather and resilience against climate change. This has paved the way for greater capacity building in our NMS.”

**Somalia:** “Since 1991, the hydrometric network fell into complete despair with no monitoring or collection of water level data in either of the two rivers within the Somali territories. Two decades of the civil strife in the country have resulted in loss and damage of most water and land related information collected in the previous half century. Recently, WMO supplied modern equipment to our Ministry. We also have participated in a regional training workshop on installation, operation and maintenance of the supplied equipment that use the GSM/GPRS. WMO/IGAD-HYCOS equipment will be installed at selected stations along the Juba-Shabelle River stations by our trained experts along with Banadir University as soon as possible. I...I”

**South Africa:** “Obtaining funding through parliamentary issuance of socio-economic benefits.”

**Sweden:** “Our involvement in RA VI Working Group on Climate and Hydrology (on the hydrology side) has provided a network and knowledge exchange that we have used both as EFAS coordination centre as well as in other cooperation where hydrology is a part.”

**Trinidad and Tobago:** “Hosting a national consultation on climate services; hosting a national climate outlook forum; and development of a 10-year strategic plan.”

**Ukraine:** “Obtaining a RETIM satellite system, modernization RETIM-2000, under the WMO Voluntary Cooperation Programme”

**Venezuela:** “Marked improvement of numerical models as a result of different courses, workshops or internships funded by WMO.”

### **Services and programme activities in need of improvement**

The majority of respondents indicated highest need for improvement in the following three areas:

- Observation and monitoring networks, including data management and rescue. The need to strengthen NMHS capacity for WIS and WIGOS implementation has been specifically highlighted;
- Training and capacity building (nowcasting, weather radar, climate products, agricultural meteorology in Spanish, classification of meteorological stations, marine meteorology, impact-based forecasting, disaster risk management and reduction, observations and quality control);
- Climate information, products and services to meet user needs. Several suggestions were directed at GFCS, including the building of a framework for local climate services, strengthened regional focus (Europe), regional project development and financial resource mobilization, and further guidance on implementation.

Other areas for improvement identified included:



- Infrastructure development and technical assistance (i.e. acquisition of tools and equipment, especially computer hardware and software; knowledge and technology transfer).
- Cooperation, especially at the regional and sub-regional level (e.g. strengthened support for regional activities and regional centres, improved coordination of professional training activities across regions and in the area of hydrology, formulation of common data policy, etc.). At the national level, respondents identify the need for improved inter-agency dialogue, heightened engagement of the scientific community, and increased visibility of WMO and NMHSs.
- Forecasting, particularly numerical weather prediction, development of nowcasting systems, issuance of monthly, seasonal and long-term forecasts.
- Communications, including improved access to information and services (e.g. through user-oriented websites). Several respondents mentioned the PWS Programme in this regard. Others referred to the need for enhanced internal communications (e.g. on training opportunities).
- Aeronautical and marine meteorological services, including Quality Management Systems.
- Disaster risk reduction, including the WMO DRR Programme and the development of various early warning systems (e.g. climate, drought, nuclear and airborne hazardous substance incidents).
- Standards and methodological guidance aimed at harmonization and meeting international norms. Specific issues mentioned included standards for automatic meteorological stations, standard on defining extremes, guidance on non-trivial measurements, etc.
- Research, especially climate research.

Several respondents highlighted the need to strengthen hydrological services as well as improve air quality monitoring systems. Others stressed the need to strengthen the Global Atmospheric Watch (GAW), space meteorology, and strengthen training elements of the Agricultural Meteorology Programme, such as the availability of courses in Spanish and the establishment of a technical training centre on agrometeorology in Central America.

In terms of governance, no specific matter was stressed by respondents. The issues raised ranged from increased frequency of regional association sessions to more action-oriented WMO meetings, transparency of budget alignment to strategic priorities, and increased awareness of gender issues. The need for improved cooperation among regional associations, technical commissions and programmes was also mentioned in terms of streamlining activities and avoiding duplication.

### ***Areas in which biggest improvements have been made over the past two years***

The biggest improvements were accounted in the areas listed below (ordered from most to least frequently appearing in respondents' answers):

- Modernization of the observation network and enhanced surface coverage (e.g. equipment and software, use of radar and satellite data, use of automated observation systems, acquisition of supercomputing systems, etc.).
- Data collection, management, rescue, processing, archiving, exchange and dissemination.
- Communications, especially information provided to the general public and the media, but also enhanced services via mobile platforms and social networks.
- Service delivery, including enhanced customer satisfaction, increased availability of products to meet user needs, more tailored, accurate and timely products, new approaches to the dissemination of warnings and weather information.

- Weather prediction, especially short-term forecasting, numerical weather prediction, nowcasting, seasonal forecasting and impact-oriented warnings.
- Aviation service delivery, QMS, improved competency assessment.
- Climate forecasting and observations as well as development of climatological databases and climate modeling.
- Disaster risk reduction (better multi-hazard early warning systems, including for flash floods, drought, climate, severe weather, tropical cyclones, nuclear incidents, transboundary smoke haze, volcanic ash and seismic activity).
- Capacity development (mostly staff training but also development of regional training centres).
- Institutional strengthening in a variety of areas, such as improved productivity and cost recovery, ISO certification, improved administrative procedures, enforcement of competency standards for employees, structural reviews, increased staff and customer satisfaction, better strategic planning etc.
- Partnerships and coordination among regional and national stakeholders.
- Hydrology, including water policy, water resources management, risk management, hydrological measurements and forecasting.
- Agricultural meteorology.

Some respondents also indicated improvements in the field of severe weather forecasting, marine observations, research, publications, and the increased role of NMHSs at the national level.

### ***Areas in which more development is needed***

The majority of respondents indicated highest need for improvement in the following five areas:

- Database management, including data collection, processing, access, rescue, archiving and sharing;
- Human capacity development;
- Modernization and expansion of the observation network (equipment and software, automation, improvement in telecommunication systems); radar use, upgrade and maintenance;
- Weather forecasting, especially short-term numerical prediction, modelling (e.g. development of mesoscale models, use of probabilistic forecast products), nowcasting and long-term forecasts (monthly and seasonal forecasts, long-term projections);
- Climate information, products and services, including GFCS and climate modelling;

Other areas that frequently appeared in respondents' answers are:

- Communications and service delivery (i.e. use of traditional and new media in the dissemination of weather and climate information, and especially enhanced use of social media).
- Multi-hazard early warning systems;
- Aviation services and QMS;
- Overall management, business development, strategic management, and resource mobilization.

- Service delivery;
- Water services and hydrological forecasting;
- Governance

A few respondents highlighted the need for future development in the areas of research (a few specific areas identified included climate research, micro-climate rainfall modeling, hydrological patterns, and application to other sciences); marine meteorology; partnerships and cooperation; agricultural meteorology; extreme weather forecasting, including tropical cyclones.