

WMO Mid-Term Performance Assessment Report

2016-2017

Ref.: 11932/2018-11 SP0

I. Background

This report assesses progress in implementation of the Expected Results and Key Outcomes of the WMO Strategic Plan 2016-2019. Performance is assessed along the Key Performance Indicators (KPIs) endorsed by EC-69 (Decision 69 (EC-69)).

A large share of the data comes from the Country Profile Database (CPDB) in which a Monitoring and Evaluation (M&E) component was integrated in 2017 to facilitate data collection and access to information. The data collection took place between November 2017 and February 2018, with the active involvement of the Regional Offices and the M&E Focal Points at the national level. The response rate varied by question, with the most representative data collected from Region I (Africa), followed by Region VI (Europe). For the rest of the regions, the data was often too scarce to be able to draw regional conclusions and trends. These data gaps affect the validity and reliability of the global average.

The term 'Members responding' is extensively used in the report and refers to Members that provided data in CPDB and/or responded to surveys.

Other data sources include surveys (e.g. the CAeM Global Survey on Aeronautical Meteorological Service Provision, the Survey on Assessment of the Current Levels of Service Delivery of NMHSs, and surveys conducted at constituent body meetings on the quality of documents and conference services). The report also presents information collected by the Secretariat (e.g. number of Regional Training Centres providing education and training support on GFCS-related activities, percentage of oversight recommendations implemented, etc.).

Throughout the report, comparison is made, to the extent possible, between performance in the past biennium and the end of the previous financial period.

II. Performance Assessment by Expected Result

Expected Result 1: Improved service quality and service delivery

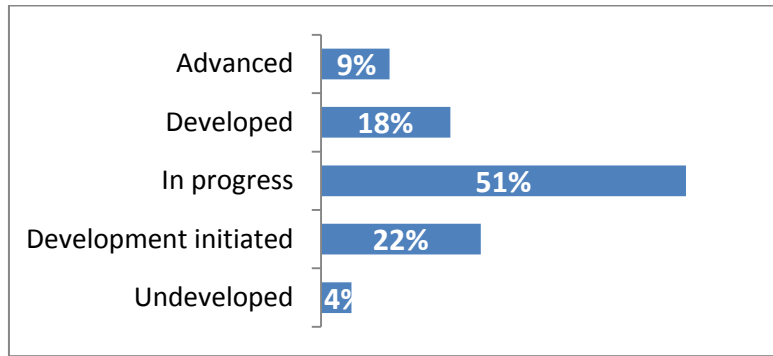
Key Outcome 1.1: Delivery of weather products and services to users' communities is improved
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KPI 1.1.1: Status of Members' service delivery

Figure 1 presents the status of Members' service delivery based on the Survey on Assessment of the Current Levels of Service Delivery of NMHSs conducted in 2015 and updated in 2016-2017.¹ The service delivery of NMHSs has been classified into the following categories defined in the Service Delivery Progress Model of the WMO Strategy for Service Delivery: "undeveloped," "development initiated", "in progress," "developed," and "advanced."

¹ Survey updated at the Severe Weather Forecasting Demonstration Project (SWFDP) Workshop held in Dakar, Senegal. The Secretariat further collected additional information.

Figure 1: Status of Service Delivery of Members



Source: Survey on Assessment of the Current Levels of Service Delivery of NMHSs Based on the Goals of the WMO Strategy for Service Delivery

The above results are based on 99 Members. Information is not available on 92 Members.

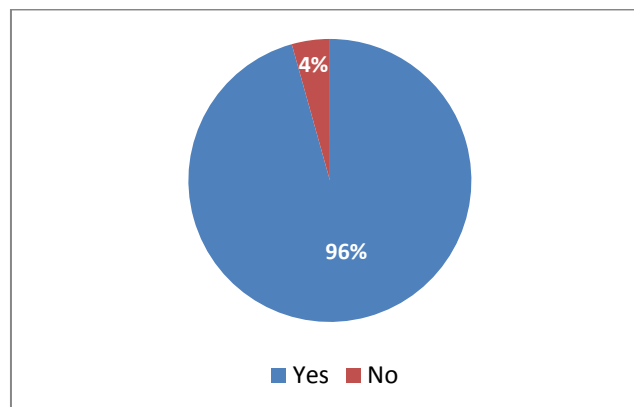
Of those with “undeveloped” service delivery or “development initiated,” 68% are from Region I and 8% from Region II. The rest are evenly distributed among the rest of the regions. Half of Members responding have their status of service delivery “in progress.” Of these, a third are from Region VI, 26% from Region I, and 14% from Regions II and III each.

Half of the Members with “developed” service delivery are from Region VI and another quarter from Region II. Of those with “advanced” service delivery, 44% are from Region VI.

KPI 1.1.2: Number of Members that have an established disaster risk reduction governance mechanism

As evident from Figure 2, the vast majority of Members responding have national committees or platforms in place for coordinating disaster risk reduction activities (88 out of 92 Members, or 96%). The National Meteorological Services (NMSs) are members in these structures along with relevant ministries, agencies and other stakeholders. Only 4 Members do not have coordination committees in place. Information is not available on 89 Members.

Figure 2: Members with national DRR committees and platforms



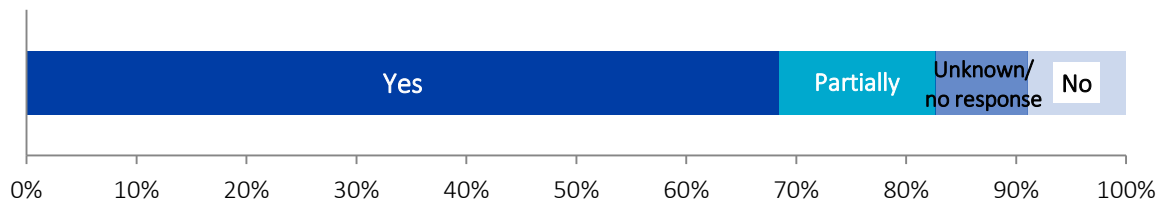
Source: CPDB, Q 3.1, February 2018

KPI 1.1.3: Number of Members implementing Quality Management Systems

Aeronautical meteorological service providers have fully implemented a quality management system (QMS) in 68% of Member States and Territories (130 out of 191). As evident from Figure 3, a QMS is partially implemented in a further 14% (27 Members). Of the remainder, the status of QMS implementation is either zero (i.e. not implemented) or unknown (i.e. no information available).

Therefore, about one-third of Members with responsibility to provide meteorological services for international air navigation face a regulatory risk due to the absence or only partial implementation of a QMS. Reasons for partial or zero implementation of a QMS include a lack of funding, lack of human resources and a low priority afforded by governments at the national level.

Figure 3: QMS Implementation by Members



Source: 2016-2017 CAeM Global Survey on Aeronautical Meteorological Service Provision

From a regional perspective, the implementation of QMS for aeronautical meteorological service provision in 2016-17 was as follows:

Table 1: QMS Implementation by Region

QMS for AeM	Yes	Partial	No	Unknown
RA I	53%	23%	9%	15%
RA II	71%	3%	20%	6%
RA III	67%	33%	0%	0%
RA IV	50%	32%	9%	9%
RA V	67%	10%	14%	9%
RA VI	94%	2%	0%	4%

Some improvement or significant improvement to the status of implementation of QMS for aeronautical meteorological service provision is required in all regions, with the exception of Region VI where implementation is already well above the global average.

Key Outcome 1.2: Delivery of climate products and services is improved

KPI 1.2.1: Number of Members providing climate services

145 out of 191 Members (76%) report providing climate services. As shown in Table 2 and Figure 4 below, the provision is highest in Region II with 91% of Members responding providing climate services. It is followed by Region V with 90%, Region VI with 80% and Region III with 75%. The regions that report the lowest incidence of

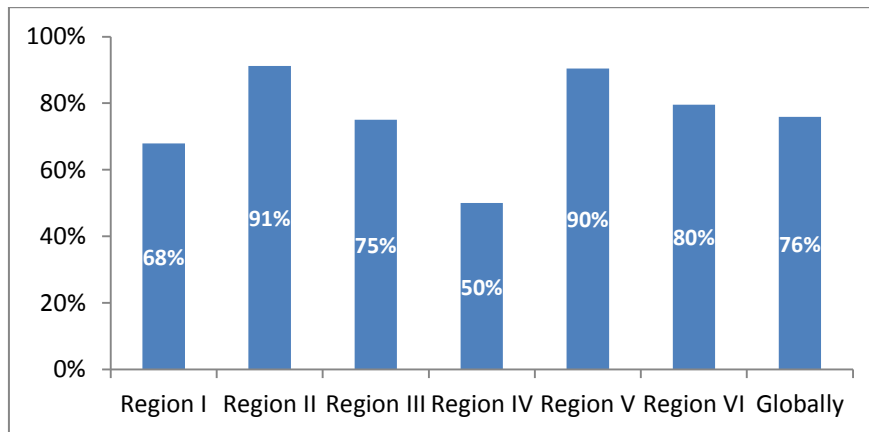
climate services provision include Region IV at 50% and Region I at 68%. Information is not available on the remaining 46 Members.

Table 2: Provision of Climate Services by Members²

	Members providing climate services		Members not providing climate services	
	No.	%	No.	%
Region I	36	68%	17	32%
Region II	31	91%	3	9%
Region III	9	75%	3	25%
Region IV	11	50%	11	50%
Region V	19	90%	2	10%
Region VI	39	80%	10	20%
Globally	145	76%	46	24%

Source: CPDB, Q 5.1, February 2018

Figure 4: Members Providing Climate Services



Source: CPDB, Q 5.1, February 2018

Less data are available on the specific sectors to which climate services are provided. Table 3 presents the provision of climate services by Members for the GFCS priority sectors of agriculture, disaster risk reduction, energy, health and water. Slightly more Members responding report providing climate services for agriculture (62 Members responding globally) than for each of the other GFCS sectors for which between 54 and 59 Members report providing climate services. Notably, out of the 19 sectors listed in CPDB,³ Members report that only in the case of "government" (for which 68 Members globally provide climate services) does the incidence of climate services provision exceed that for the GFCS sectors detailed below.

² Members not providing climate services is calculated as the difference between total members and those providing climate services based on CPDB, Question 5.1.

³ Government, local authorities, scientific, commercial, water resources, agriculture, fisheries, forestry, transport, energy, human health, tourism (including coastal zone), recreation and sport, aviation, maritime transport, environmental protection, building, finance and insurance, emergency planning and response.

Table 3: Provision of climate services for GFCS priority sectors by Members

WMO Members	Provision of CS for Agriculture		Provision of CS for DRR		Provision of CS for Energy		Provision of CS for Health		Provision of CS for Water	
	No. Members	% of Members	No. Members	% of Members	No. Members	% of Members	No. Members	% of Members	No. Members	% of Members
Region I	23	43%	17	32%	20	38%	17	32%	21	40%
Region II	6	18%	6	18%	7	21%	6	18%	6	18%
Region III	4	33%	3	25%	3	25%	4	33%	3	25%
Region IV	7	32%	8	36%	6	27%	7	32%	8	36%
Region V	5	24%	6	29%	6	29%	5	24%	6	29%
Region VI	17	35%	16	33%	16	33%	15	31%	15	31%
Globally	62	32%	56	29%	58	30%	54	28%	59	31%

Source: CPDB, Q 6.2, February 2018

In 2016-2017 concerted efforts have been undertaken to address gaps at the national level in climate services provision. Support has been earmarked both from WMO regular budget resources and extra budgetary projects to strengthen the full climate services value chain at national and regional levels. A more detailed description of activities is provided in KPI 1.2.2.

KPI 1.2.2: Number of Members with improved capacity to deliver climate services in support of GFCS priority sectors

167 Members provided a self-assessment of their capacity to deliver climate services, as presented in Table 4.

Table 4

WMO Members	Level of provision of Climate Services by WMO Members					
	N/A	Poor	Partly satisfactory	Satisfactory	Advanced	Total responses
Region I	6	1	16	21	3	47
Region II	4	1	7	17	3	32
Region III	1	1	3	5	0	10
Region IV	0	0	4	8	1	13
Region V	1	0	3	11	4	19
Region VI	5	0	12	20	9	46
Globally	17	3	45	82	20	167

Source: CPDB, Q 5.2, February 2018

Nearly half (82) of the Members responding indicated that their provision of climate services is "satisfactory", while 45 rated provision as "partly satisfactory" and 20 as "advanced." Notably, 17 Members found the provision of climate services to be "not applicable." Data is not available on 24 Members.

Members further ranked their capacity (on a scale of 1-5, with 1 being the lowest) to deliver climate services to 19 sectors, including the GFCS priority sectors of agriculture, disaster risk reduction, energy, health and water.⁴ Table 5 summarizes, on a global level,

⁴ Government, local authorities, scientific, commercial, water resources, agriculture, fisheries, forestry, transport, energy, human health, tourism (including coastal zone), recreation and sport, aviation, maritime transport, environmental protection, building, finance and insurance, emergency planning and response.

Members' perceptions of their capacity to deliver climate services in support of the GFCS priority sectors.

On average, only 55 Members responded to the various parts of this question. For those that responded, the average perceived level of climate service capacity is between Level 3, *co-design of products*, and Level 4, *tailored products accessible for use*, other than in the health sector, where the average perceived level of capacity is slightly lower. Agriculture and water are the sectors for which the highest number of respondents rate themselves at Level 4, *tailored products accessible for use*, while disaster risk reduction and health are the sectors for which the most respondents rank themselves at Level 1, *initial engagement with sector*.

Table 5: Capacity of Members to Deliver Climate Services in Support of GFCS Sectors

Status of climate service provision (scale of 1-5)	WMO global Members' capacity to deliver climate services (self-assessment)				
	Agriculture	DRR	Energy	Health	Water
Level 1: initial engagement with sector	6	10	9	10	5
Level 2: definition of needs	10	6	11	13	10
Level 3: co-design of products	10	5	7	7	8
Level 4 - tailored products accessible for use	21	15	16	15	21
Level 5 - climate services guide policy decisions and investment plans in sectors	7	12	10	3	9
d/n respond	135	141	136	141	136
average rating by WMO global respondents	3.24	3.27	3.13	2.75	3.36

Source: CPDB, Q 6.2, February 2018

Members generally perceived themselves as less capable of carrying out research on climate extremes than in providing climate services. As shown in Table 6, 50 Members responding assess their climate extreme research capacity as "satisfactory" and 45 as "partly satisfactory." Of the 12 Members responding that rate themselves as "advanced" in this research area, 6 are in Region VI, while of the 11 that rate themselves "poor", 5 are in Region I. Data is not available on 60 Members.

Table 6: Level of capability of climate extreme research by Members

WMO Members	Level of capability of climate extreme research by WMO Members					
	N/A	Poor	Partly satisfactory	Satisfactory	Advanced	Total responses
Region I	8	5	19	9	3	44
Region II	2	4	13	10	1	30
Region III	1	0	2	5	0	8
Region IV	1	1	2	3	0	7
Region V	1	0	6	10	2	19
Region VI	0	1	3	13	6	23
Globally	13	11	45	50	12	131

Source: CPDB, Q 5.11, February 2018

Members further self-assessed their capacity to deliver a wide variety of climate service functions; Table 7 provides a summary of selected key capacities.

About half of Members responding indicate they:

- provide simple statistics based on observed data - 53% of Members globally, ranging from as many as 68% in Region I to as few as 33% in Region V; and
- have carried out data (metadata) rescue - 47% of Members globally, ranging from as many as 60% in Region I to as few as 33% in Region V.

Table 7: Climate Service Capacities of Members

Selected climate service functions	Region I		Region II		Region III		Region IV		Region V		Region VI		WMO Global Members	
	No. Members	% of Members	No. Members	% of Members	No. Members	% of Members	No. Members	% of Members	No. Members	% of Members	No. Members	% of Members	Members providing service	% of Members
Provision of simple stats. based on observed data	36	68%	15	44%	6	50%	9	41%	7	33%	28	57%	101	53%
Data (metadata)rescue	32	60%	13	38%	5	42%	6	27%	7	33%	26	53%	89	47%
Basic climate monitoring, assessment	20	38%	15	44%	6	50%	4	18%	6	29%	25	51%	76	40%
Implementation of Climate Watch System	9	17%	7	21%	3	25%	4	18%	3	14%	16	33%	42	22%
Dev't and prov. of prediction products on seasonal scale	9	17%	5	15%	2	17%	1	5%	2	10%	5	10%	24	13%
Participation in and cont. to RCOF	24	45%	13	38%	4	33%	3	14%	5	24%	12	24%	61	32%
Participation in and cont. to NCOF	20	38%	9	26%	5	42%	3	14%	6	29%	13	27%	56	29%
Applying dynamical and/or stat. downscaling of GCM runs	8	15%	7	21%	1	8%	4	18%	6	29%	9	18%	35	18%
Running Global and/or Regional Climate Models	24	45%	8	24%	3	25%	8	36%	6	29%	15	31%	64	34%
Analyzing and providing products relevant to El Nino and La Nina updates, GSCU	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%

Source: CPDB, Q 6.2, February 2018

Notable capacity gaps cited by Members responding include:

- Implementation of Climate Watch System⁵ - 22% of Members provide this service, including only 4% in Region V and 17% in Region I;
- Development and provision of prediction products on a seasonal scale - 13% of Members, including only 5% in Region IV and 10% in Region V; and
- Analysis and provision of products relevant to El Niño and La Niña updates, Global Seasonal Climate Updates – 0% of the survey respondents provide this service.

As regards participation in and contribution to Regional Climate Outlook Forums (RCOFs) and National Climate Outlook Forums (NCOFs), Members in Region I report higher participation (RCOFs: 45%, and NCOFs: 38%) than do Members globally (RCOFs: 32%, and NCOFs: 29%).

In 2016-2017 concerted efforts have been undertaken to address capacity gaps at the national and regional levels in climate services provision, including the functions listed in Table 7. Activities included providing support to: capacity assessment, data rescue, installation of Climate Data Management Systems, numerous NCOF and RCOF mechanisms, capacity building for operational seasonal forecasts, development of customized climate services toolkits, user interface with sectoral users in-country, and development of tailored sectoral climate services. In particular, WMO and its partners carried out a large number of activities targeted at strengthening the capacities of the GFCS Partners Advisory Committee (PAC) focus countries (Bhutan, Burkina Faso, Columbia, Dominica, Moldova, Papua New Guinea, Peru and Tanzania).

KPI 1.2.3: Number of Members with climate services integrated in National Adaptation Plans

As of December 2017, a total of 193 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) have submitted their Nationally Determined Contributions (NDCs), which describe the measures Parties will take to reduce national emissions and adapt to climate change.⁶ Sixty-six Parties (35%) explicitly used climate services terminology. Sectors identified in the adaptation component of the communicated NDCs include water, agriculture, health, ecosystems, infrastructure, forestry, energy, disaster risk reduction, food security, coastal protection, and fisheries.

KPI 1.2.4: Number of Members with formalized user interface mechanisms

Globally, 56 Members responding have participated in NCOFs. Of these, 20 are in Region I. The GFCS Office works with 8 of the 20 to support the development of National Frameworks for Climate Services (NFCS). In the next financial period, WMO will look to identify indicators that report on the effectiveness of the NCOFs in productive dialogue between users and providers of climate services.

⁵ As defined in [Guidelines for Climate Watches](#)

⁶ This information is extracted from UNFCCC 2016, GIZ 2017 and WRI 2018 reports.

Table 8: Participation in and contribution to NCOFs

WMO Members	# Members participating in NCOFs	% of total Members
Region I	20	38%
Region II	9	26%
Region III	5	42%
Region IV	3	14%
Region V	6	29%
Region VI	13	27%
Globally	56	29%

Source: CPDB, Q 6.1, February 2018

With support from the Norwegian Refugee Council, the GFCS Office has been working in 18 African countries to develop NFCS. The latter is an institutional mechanism to coordinate, facilitate and strengthen collaboration among national institutions to improve the co-production, tailoring, delivery and use of science-based climate predictions and services. NFCSs create the space for sustained dialogue between users from climate-sensitive sectors and providers for the identification of gaps, needs and priorities to enable improvements and sustainable delivery of climate services.

There are five steps in the NFCS process.⁷ Seven African countries (Burkina Faso, Cameroon, Chad, Ivory Coast, Mali, Niger, and Senegal) have completed all five steps with two of these having resulted in a formal decree (Chad and Senegal). The NFCS process has started and is ongoing in eleven African countries (Benin, Congo, Democratic Republic of the Congo, Gambia, Madagascar, Malawi, Mauritania, Rwanda, South Africa, Tanzania, and Togo).

Key Outcome 1.3: Delivery of hydrological products and services is improved

KPI 1.3.1: Number of Member-driven project proposals on E2E EWS on short-to-medium term hydrological forecasting developed and presented for funding that build collaboration between NMSs and NHSs

2015 Baseline	2017 Actual
0	1

The Dominican Republic’s hydrological component of the Coastal Inundation Forecasting Demonstration Project - Caribbean was developed in 2017 under the Climate Risk and Early Warning Systems initiative. By the end of 2019, WMO aims to have at least one more such project initiated on End-to-End Early Warning System (E2E EWS) for hydrological forecasting in the Volta Basin under the Integrated Drought Management Programme.

⁷ (1) Baseline Assessment; (2) Initial National Consultation Workshop; (3) National Action Plan on Climate Services joint development with sectoral users; (4) High-level endorsement of the National Action Plan on Climate Services by all entities; (5) Launch of the National Climate Service Framework and implementation National Climate Service Action Plan priorities, including rigorous monitoring and evaluation.

KPI 1.3.2: Number of GDPFS Hydrological Centres established to support delivery of hydrological climate services and water resources management

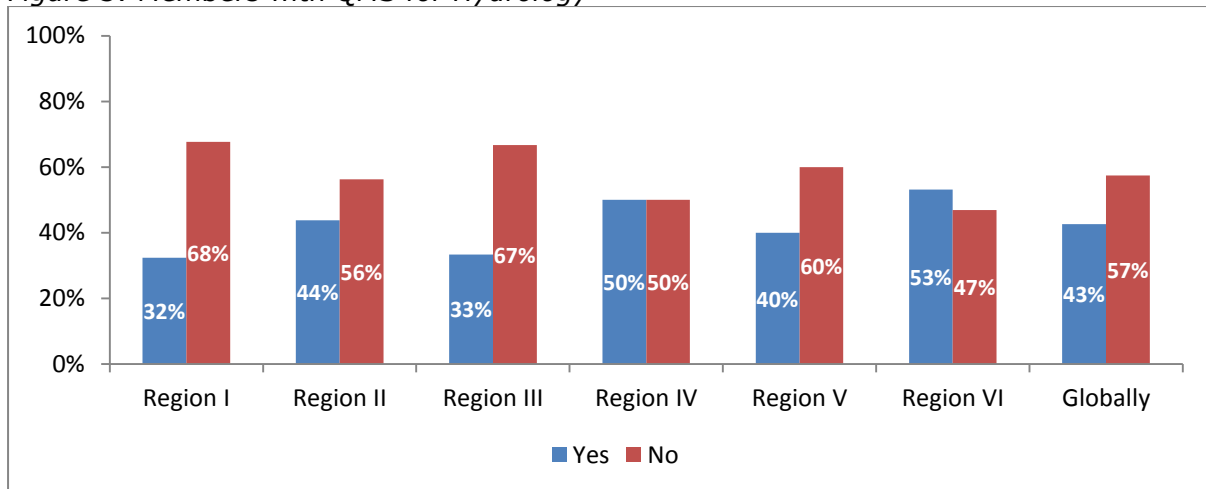
As of December 2017, there were no Global Data Processing and Forecasting Systems (GDPFS) Hydrological Centres established yet. The Commission for Hydrology (CHy) is developing its strategy and process for designation of hydrological centres within the GDPFS framework. The structure and function of the hydrological centres will be proposed after its adoption by CHy and the Commission for Basic Systems (CBS).

KPI 1.3.3: Number of Members that have adopted QMS practices for hydrology

A QMS for Hydrology is in use in 43% of 108 Members responding, with the breakdown by region presented in Figure 5. Only a third of Members responding in Regions I and III reported the use of QMS for hydrology. The proportion is slightly higher in Region V at 40%. Half of Members responding in Region VI have a functional QMS for hydrology. Data is lacking on the remaining 83 Members.

The information on the status of QMS implementation is scarce, based on 33 Members responding only. Of these, eight implement QMS for the whole National Hydrological Service (NHS), seven for hydrological observations, and four for hydrological forecasting. Twelve reported "none" as status of implementation.

Figure 5: Members with QMS for Hydrology



Source: CPDB, Q7.24, February 2018

Expected Result 2: Reduced disaster risk

Key Outcome 2.1: Multi-hazard Early warning systems are implemented

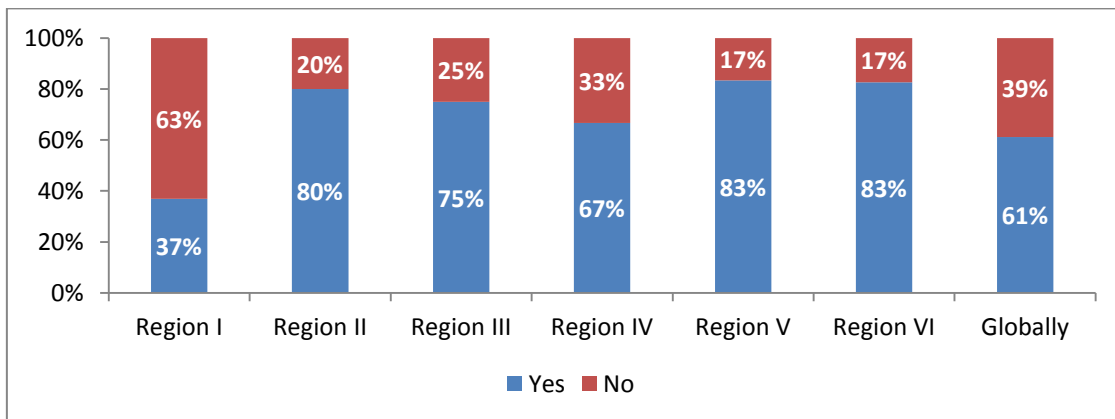
KPI 2.1.1: Number of Members with Multi-Hazard Early Warning Systems

Only 55 out of 90 Members responding (61%) have a Multi-Hazard Early Warning System (MHEWS) in place. The gap is widest in Region I where close to two-thirds of Members responding do not have a MHEWS, followed by Region IV where a third of Members lack such a system.

The same is valid for monitoring and forecasting systems for multiple hazards occurring simultaneously or cumulatively over time. Only two-thirds of Members responding have such systems in place globally. Of those who do, the majority issue warnings on potential cascading impacts as well. Only 15 out of 40 Members in Region I, or slightly over a third, have monitoring and forecasting systems for multiple hazards occurring simultaneously or cumulatively.

Data is missing on 101 Members.

Figure 6: MHEWS in place



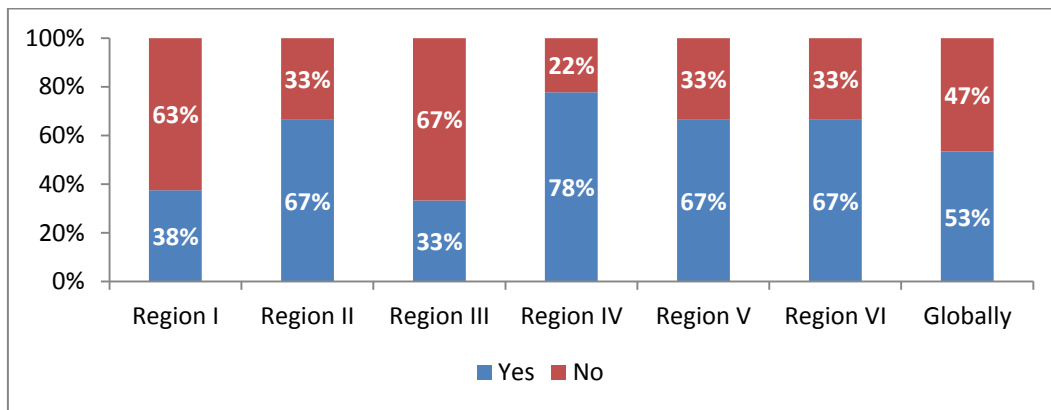
Source: CPDB, Q 3.3, February 2018

Globally, 70 out of 92 Members responding report the availability of accessible, understandable, usable and relevant disaster risk information and assessment at the national and local levels. The vast majority affirm that NMSs contribute to and are engaged in the development of risk assessments. The biggest deficiencies in the availability of disaster information are observed in Region I where 15 out of 40 Members responding (or 38%) do not have accessible, understandable, usable and relevant disaster risk information. Less than half of responding Members in Regions II, III, IV and V have provided monitoring data, which renders drawing regional trends and patterns difficult.

KPI 2.1.2: Number of Members evaluating the performance of MHEWS

Only half of Members responding evaluate the performance of MHEWS globally (47 out of 88). The practice is most prevalent in Region IV, though information is available on 9 Members from this region only. Almost two-thirds of Members in Region I do not evaluate the performance of MHEWS. There is insufficient information on Region II to be able to draw conclusions (only 3 Members provided data). In the rest of the regions, a third of Members do not evaluate the performance of MHEWS.

Figure 7: Members evaluating MHEWS performance



Source: CPDB, Q 3.11, February 2018

Ninety percent of the Members evaluating MHEWS performance translate the feedback and lessons learned into improvements of the system. In over 80% of these, NMSs are involved in the performance reviews. A smaller proportion of NMSs (60%) evaluate their own performance and role (e.g. service delivery and coordination) within the national MHEWS and disaster risk reduction platform as well as translate the findings into improvements of the MHEWS.

KPI 2.1.3: Number of Members issuing impact-based forecasts and warning services

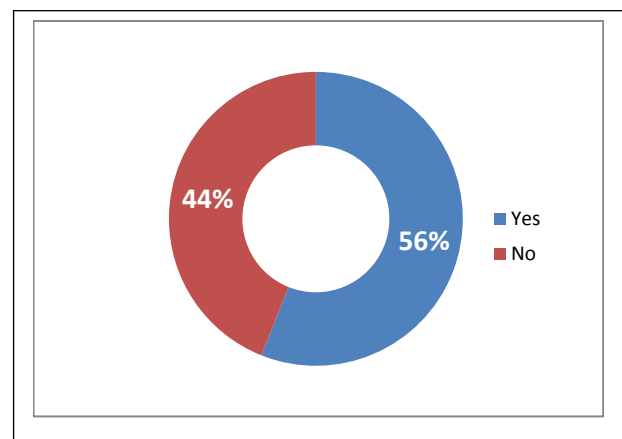
About half of 91 Members responding issue impact-based forecasts and warning services. Over 80% of those in Region VI provide such services, whereas the proportion is close to the global average (45%) in Region I. The majority highlight the need for training in this relatively new area of forecasting. Lack of adequate infrastructure is another major impediment, mostly in Africa. Another technical requirement involves the availability of reliable ensemble of NWP forecasts and the integration of radar, ground information and global and regional models to assist in forecasting and relate to areas at risk.

Scarce data is available on Regions II, III, IV and V. Table 9 presents the situation for the few Members that provided this information. Only 5 out of 12 Members responding in Region II and 2 out of 7 in Region IV issue impact-based forecasts. All 4 Members responding from Region III do so.

Table 9: Number of Members issuing impact-based forecasts and warning services

	Yes	No
Region I	17	21
Region II	5	7
Region III	4	0
Region IV	2	5
Region V	3	3
Region VI	20	4
Globally	51	40

Figure 8

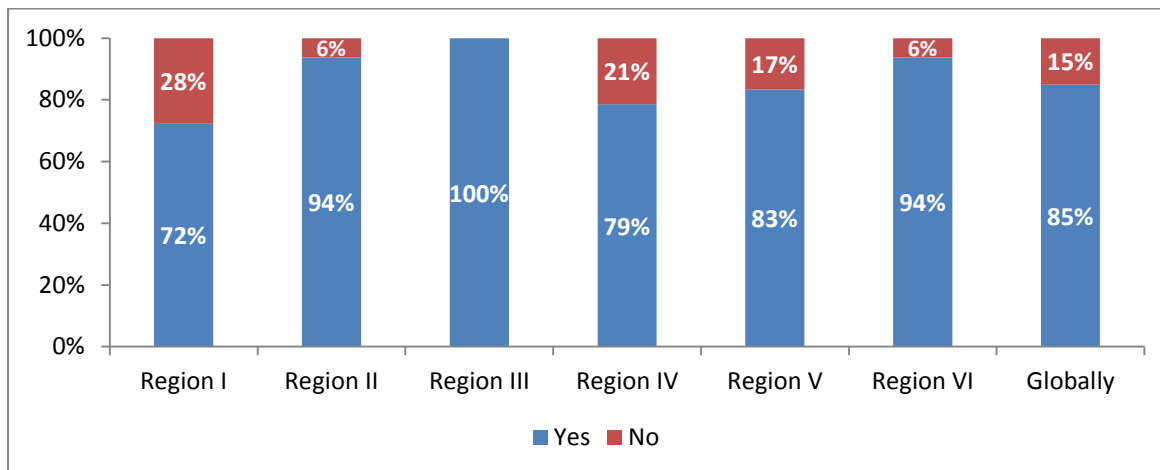


Key Outcome 2.2: National integrated flood management plans are implemented

KPI 2.2.1: Number of Members with flood management plans in place or under development

Globally, 85% of 113 Members responding have a flood management plan established or under development as of 2017 (see Figure 9). This rate is below the global average in Regions I and IV at 72% and 79%, respectively.

Figure 9: Members with flood management plans established or under development



Source: CPDB, Q 7.9, February 2018

KPI 2.2.2: Number of Members that have assessed their End-to-End Early Warning Systems on Floods

2015 Baseline	2017 Actual
0	2

In 2017, Burkina Faso and Fiji (Nadi River basin) applied early templates developed to assess national capabilities for End-to-End (E2E) Early Warning Systems (EWS) for Flood Forecasting. CHy formed a Task Team which is actively refining the templates and will be developing guidance material for their application. The latter will result in an overall assessment of each area in the E2E EWS, identifying which aspects require strengthening.

Source: WMO Secretariat, December 2017

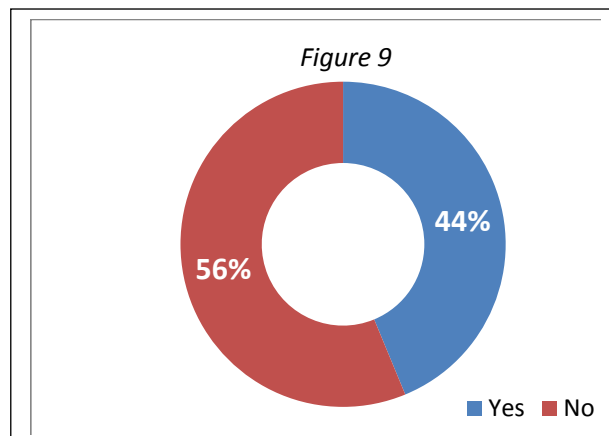
Key Outcome 2.3: Drought early warning systems are improved

KPI 2.3.1: Number of Members with National Drought Policies

Over half of Members responding (54 out of 96) do not have national drought policies in place. Table 10 presents the data disaggregated by region. There is insufficient data on Regions II, III, IV and V. No data is available on the remaining 95 Members.

Table 10: Number of Members with National Drought Policies

	Yes	No
Region I	15	25
Region II	7	3
Region III	3	2
Region IV	3	6
Region V	1	5
Region VI	13	13
Globally	42	54



Expected Result 3: Improved data-processing, modelling and forecasting

Key Outcome 3.1: Improved access to seamless weather, climate, water and related environmental data, products and services

KPI 3.1.1: Unified data management system for weather, climate and hydrological information in place, data freely available and supported by a Community of Practice

30% of the work on the development of a pilot Data Management System has been completed. This includes the launching of a project to develop a standard catalogue of global climate datasets with the label trusted datasets.

A community of practice has further been established to support the system, consisting of an international network of experts to provide information on global datasets and make it discoverable and accessible through the internet and WMO Information System (WIS).

15 global datasets are freely available. The data consists of monthly averages of key climate parameters (World Weather Records) and are made freely available through NOAA NCEI Data Centres serving as the World Data Centre for Meteorology.

KPI 3.1.2: Number of Members involved in “cascading forecasting process” as part of SWFDP

As of December 2017, **63 Members** of which **48 developing countries**, including Least Developed Countries and Small Island Development States, were involved in the cascading forecasting process of the Severe Weather Forecasting Demonstration Project (SWFDP) in six sub-regions: Southern Africa, South Pacific, Eastern Africa, Southeast Asia, Bay of Bengal and Central Asia.

Development of SWFDP in West Africa and the Eastern Caribbean has been initiated and with implementation of the cascading forecasting process in these sub-regions next year, the number of countries will grow to 75, covering eight sub-regions. Discussions have been started for implementation of SWFDP in RA III.

KPI 3.1.3: Number of new designated centres providing high value information

17 global, regional and lead centres were designated by EC-69, including the mapping of existing Regional Specialized Meteorological Centres (RSMCs) with geographical specialization.⁸ The designation was done in line with the procedure defined in the new Manual on GDPFS (WMO-No. 485), monitored by the relevant Technical Commissions and their Expert Teams, and confirmed by EC/Cg.

KPI 3.1.4: Number of Members implementing Climate Watch Systems

Table 11: Climate Watch System implementation by region

Region	# Members
Region I	9
Region II	7
Region III	3
Region IV	4
Region V	3
Region VI	16
Globally	42

42 of the 101 Members that provided monitoring data on climate services implement Climate Watch Systems (CWS) involving both the issuance and dissemination of specific advisories to the user community. Of these, almost 40% are in Region VI and only a quarter in Region I. In the rest of the regions, this is the case for about half of respondents.

Source: CPDB, Q 6.1, February 2018

Key Outcome 3.2: Weather forecasts and environmental-related predictions are improved

KPI 3.2.1: Number of Members operationally producing weather forecast products and information for national needs



“Operationally producing” is defined as producing on a routine basis (e.g. hourly, daily, etc.) derived products from Numerical Weather Prediction (NWP), including user-oriented products developed jointly with stakeholders, for national forecasting and warning services. The Centres running global NWP systems have been continuously improving their systems, including parameterization and resolution of the models. For example, ten years ago, the resolution of most global systems was in the

range of 20-30 km. Nowadays, there is significant improvement in this area, with resolution close to 10 km.

The number of Members/Centres having access to NWP products and those producing NWP products to support Members’ needs has grown significantly over the past couple of decades. Around 140 Members have access to or produce NWP products now. SWFDP alone facilitates access to NWP information to over 75 countries.

⁸ Annex 3 to Resolution 18 (EC-69)

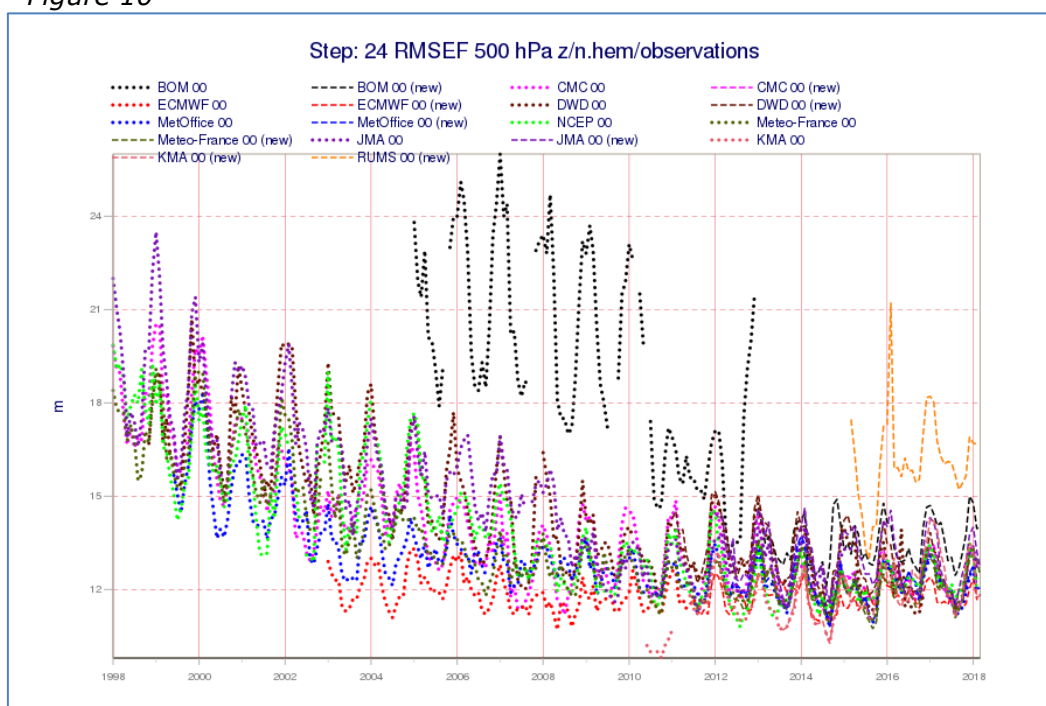
Source: GDPFS/NWP Annual Reports

Ref.: 11932/2018-11 SP0

KPI 3.2.2: Quality of issued weather forecasts and environmental-related predictions issued by RSMCs

The quality of forecasts has increased over the last twenty years. For example, the Root Mean Square Error of Forecast (RMSEF) of 500 hPa Geopotential height is used to measure the accuracy of weather forecasts and environmental-related predictions issued by RSMCs. In 1998, RMSEF value was close to 18 and has improved to 12 over the last few years. Note that the lower the values of RMSEF, the more accurate the forecast is.

Figure 10



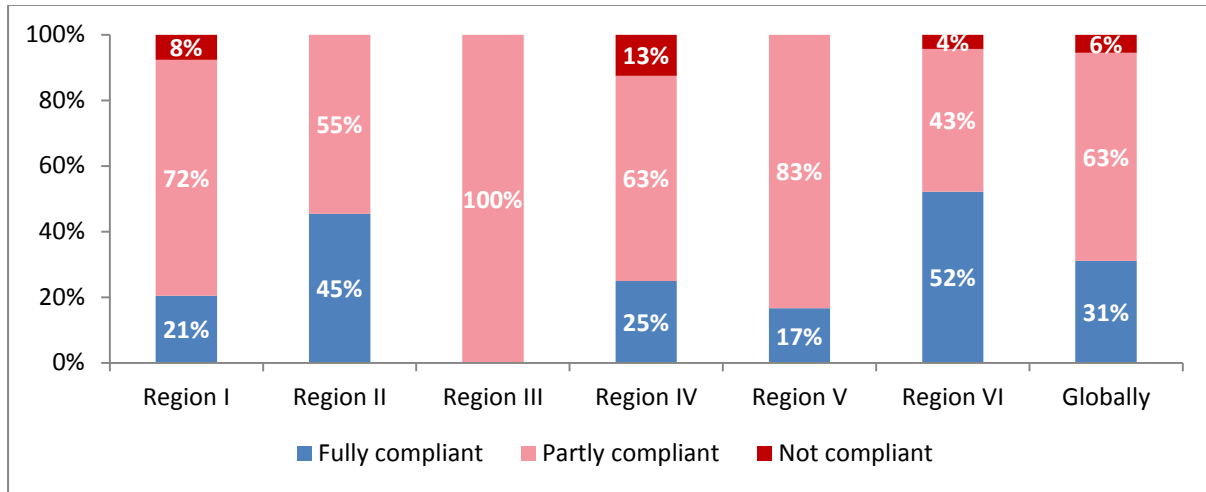
Source: European Centre for Medium-Range Weather Forecasts (ECMWF), March 2018

Key Outcome 3.3: Climate Services Information System and prediction products for climate adaptation and risk management strengthened

KPI 3.3.1: Number of Members with basic system capacity

The majority of NMSs responding globally are partly compliant with WMO No. 1131 on Climate Data Management System Specifications (57 out of 90 Members responding). Close to a third are fully compliant (28 out of 90), whereas 6% are not compliant. Of the latter, three Members are located in Region I, one in Region IV and one in Region VI. Information is not available on the remaining 101 Members.

Figure 11: NMS compliance with Climate Data Management System Specifications (WMO No. 1131)

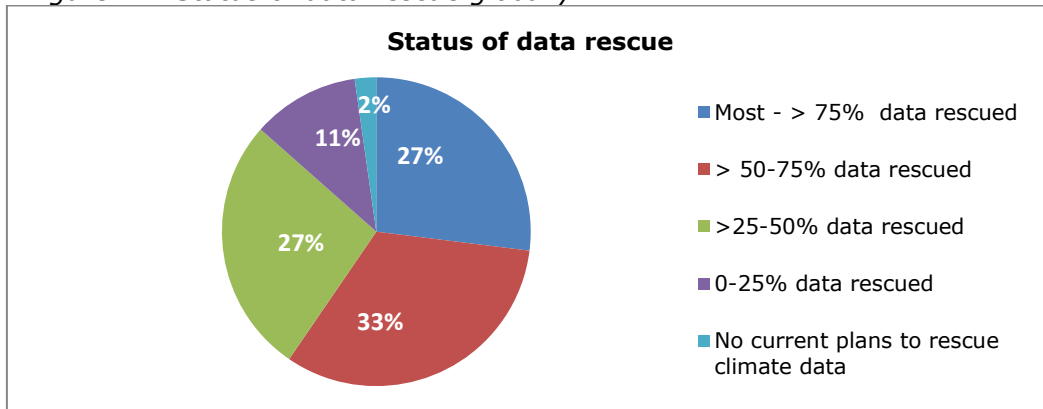


Source: CPDB, Q 4.15, February 2018

The status of data rescue globally is presented on Figure 12 for 89 out of 191 Members. Information is not available on the remainder of Members.

Of those who provided data, only a third rescue over 50% to most of the climate data in Region I. Most Members in Region I rescue 25%-50% of the data and about a fifth 0%-25%. Two Members further have no plans to rescue data. Over half to most of the climate data is rescued in Regions II, III, IV and V, though many Members did not provide this information, so it should be taken with a grain of salt. Over two-thirds of Members rescue more than half to most of the data in Region VI, though a quarter rescue 25%-50% and two Members only 0%-25%.

Figure 12: Status of data rescue globally



Source: CPDB, Q 4.16, February 2018

KPI 3.3.2: An integrated system to support global access to climate data and products

A Climate Services Toolkit Portal was piloted in 2017 as a first step to building an integrated system to support global access to climate data and products. It is expected to be fully operational for deployment by the end of the current financial period.

KPI 3.3.3: Number of RCOFs adopting objective seasonal forecasts on a regional scale

Two metrics are utilized to monitor the extent to which objective seasonal forecasts are adopted on a regional scale: (a) the number of RCOFs that make use of calibrated products from Global Producing Centres for Long-Range Forecasts (GPCLRF) and (b) the number of RCOFs which provide regular updates from Regional Climate Centres (RCCs). Regular updates involve dissemination of forecasts with a fixed production cycle, preferably at least once a month. As of December 2017:

- ❖ **3 RCOFs** used calibrated products from GPCLRF
- ❖ **3 RCOFs** provided regular RCC updates

KPI 3.3.4: Polar and High Mountain regions with RCCs and RCOFs

There are no Regional Climate Centres (RCCs) in polar and high mountain regions. No Regional Climate Outlook Fora (RCOFs) were further conducted there in 2016-2017.

- ❖ **0 RCCs**
- ❖ **0 RCOFs**

Key Outcome 3.4: Hydrological data, information and products in support of improved water resources management

KPI 3.4.1: Global Hydrometry Support Facility (GHSF) - HydroHub - elements operational

The governance of the HydroHub was established in 2017, with first meetings of the Advisory Council and the Innovation Committee. The IGAD HYCOS project was further completed in 2017. The project allowed acquisition of nearly 200 measuring devices for surface and groundwater. More than 80 of these have already been installed and more than 150 people trained. A regional hydrological database was also established.

Table 12 presents the four GHSF elements, results expected and targets for end-2019.

Table 12

Elements	Definition	2017 Actual
WHYCOS	HYCOS projects according to Members requests and priorities	1
Innovation Hub	Innovation calls and workshops	1
Help Desk	Establishment of a Hydrometry Help Desk: concept and implementation plan	0
HSIP	Hydrological services information platform, concept and implementation plan	0

KPI 3.4.2: Implementation of WHOS Phase I and II

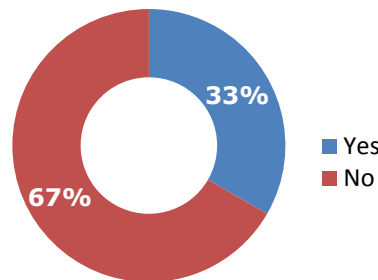
At its 15th session, CHy decided to continue the implementation of WHOS Phase I and to develop the architecture as well as prepare an implementation plan of WHOS Phase II. A first draft of the plan was prepared in 2017.

Key Outcome 3.5: Hydrological forecasting systems are implemented

KPI 3.5.1: Number of Members with operational Flash Flood Guidance System

55 NMSs and 32 NHSs issue flash flood warnings based on the Country Profile Database (Q 5.1 and Q 7.30). Only a third of 87 Members responding use a Flash Flood Guidance System (FFGS) for issuing warnings. The proportion is even lower in Region I where only a quarter of Members responding use FFGS. Data is scarce on Regions IV and V, where 4 out of 7 and 3 out of 6 Members responding utilize FFGS for issuing warnings, respectively. Region II and VI match the global average indicated on Figure 13 below.

Figure 13: Members with operational Flash Flood Guidance System



Source: CPDB, Q 5.6, February 2018

According to data available at the Secretariat, 7 Members developed operational capability to use FFGS in 2017, with another 17 being in the process of developing capacity and 11 Members considering adopting FFGS.

KPI 3.5.2: Number of Members with access to Community of Practice for End-to-End Early Warning System for Flood Forecasting

A Community of Practice on End-to-End Early Warning System for Flood Forecasting is under development. A first meeting of the relevant CHy Task Force was held. However, the community's launch is not expected prior to the end of the financial period. It will likely become operational by the sixteenth session of CHy in 2020.

KPI 3.5.3: Number of Members having access to quantitative subseasonal to seasonal hydrological forecasts for water resources management

As of December 2017, access to quantitative subseasonal to seasonal hydrological forecasts was not available yet. However, a Hydrological Status and Outlook System (HydroSOS) was launched in July 2017 as a first step, and fundraising was initiated for its implementation.

Expected Result 4: Improved observations and data exchange

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

KPI 4.1.1: Progress in the implementation of WIGOS Pre-Operational Phase as measured by a weighted score

A weighted score will be calculated once input from OSCAR/Surface and the WIGOS Data Quality Monitoring System (WDQMS) has been fully integrated into CPDB. This would allow for a more realistic assessment based on objective measures of performance. The following are highlights on progress in the five priority areas of the WIGOS Pre-operational Phase (2016-2019) identified by Cg-17.

- I. *WIGOS Regulatory Material.* Work is proceeding largely as planned. Draft regulatory and guidance material has been submitted to EC-70 for endorsement and is roughly 75% completed.
- II. *Observing Systems Capabilities Analysis and Review Tool (OSCAR), especially OSCAR/Surface.* Major developments are proceeding on track, thanks in large part to the substantial contribution made by Switzerland. The system has been operational for nearly two years, and new functionalities are added as resources materialize. It is currently estimated to be 75% completed.
- III. *WIGOS Data Quality Monitoring System (WDQMS).* The development of the NWP-based monitoring pilot has been proceeding well, and it is estimated to be 50% completed. The RA-I demonstration projects have stalled due to a lack of Member engagement. This is directly traceable to a lack of Regional WIGOS Centre for the region.
- IV. *Regional WIGOS Centres (RWC).* As of April 2018, only one centre has been established, covering part of Region VI. It is operating under EUMETNET funding and is located at DWD Headquarters in Offenbach. The Centre operates in pilot mode with partial functionality. The target is to have at least one RWC per region operating in pilot mode by the end of 2019.
- V. *National Implementation.* Work is proceeding very slowly in most countries.

KPI 4.1.2: Progress on maintenance and evolution of surface-based observing systems as measured by a weighted score

Score: 71%⁹

⁹ This weighted score is calculated on the basis of: (1) CBS Integrated Observing Systems deliverables (contribution to WIGOS Pre-Operation Phase, Rolling Review of Requirements; new AMDAR programme agreements; planning implementation of upper air network); (2) JCOMM observations deliverables (contribution to WIGOS pre-operational phase; new ocean observing network specifications and implementation metrics; updated data buoy and ship-based observations; sustainability of JCOMMOPS and its staff; Marine Climate Data System Technical

Rationalization was performed within the Rolling Review of Requirements (RRR) with regard to the list of Application Areas, making observed variables consistent across different databases, updating user requirements in OSCAR, and Statements of Guidance. Assessment of progress on the Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP) actions by identified actors was performed and recommendations made.

Substantial developments took place in the area of regulatory and guidance material and best practices: (i) guidance to address the Observing Network Design Principles was published within Guide to WIGOS (WMO No. 1165); (ii) Guide to Aircraft-Based Observations (WMO-No. 1200) was published; (iii) plans to develop some additional guidance for observing systems, particularly focusing on Automatic Weather Stations (AWS) and Weather Radars; (iv) integration of regulatory material from the Manual and Guide to the Global Observing System (GOS) into WIGOS regulatory material; and (v) initiation of an update to the Guide to Instruments and Methods of Observations on Unmanned Aerial Vehicles (UAV). A second WMO-ISO standard on Lidars was also published.

Intense collaboration between the Association of Hydro-Meteorological Equipment Industry (HMEI) and WMO took place on the matter of AWS tender specifications.

WMO was reconfirmed as the world authority on cloud classification, following the launch of the International Cloud Atlas (ICA)¹⁰ website on World Meteorological Day 2017. Process for translation of the ICA has been initiated. Delays were experienced in publishing an e-book version. Progress towards improving observations quality were achieved, in particular focusing on the matter of traceability.

With regard to Aircraft Meteorological Data Relay (AMDAR) Programme, regional workshops were held in 2017 in Regions V and VI. Consequently, new airlines expressed interest in joining the Programme. Substantial developments took place with regard to formalizing collaboration with the International Air Transport Association (IATA) and airline industry in support of AMDAR.

New marine meteorological and oceanographic observing network specifications were agreed in response to GCOS Implementation Plan, and identified gaps taken into account. Implementation Strategies for data buoy and ship-based observations were updated taking into account the new targets. Technical Regulations on the Marine Climate Data System (MCDS) were completed and approved by JCOMM-5. The World Ocean Database (WOD), USA, was recommended by JCOMM to be established as a Climatological Marine-Meteorological and Oceanographic Data Centre. JCOMMOPS has made significant progress in contributing to OSCAR/Surface and the WQMS. Efforts continued to be made on capacity development for data buoy programmes, in particular in Region II in support of application of regional ocean observations for increasing society's understanding and forecasting of typhoons.

KPI 4.1.3: Progress on maintenance and evolution of space-based observing systems as measured by a weighted score

Regulations; new Argos tariff negotiated by JTA-EC; training provided; development and implementation of RMIC network; and (3) CIMO deliverables (traceability concepts available for CIMO and Members approval, International Cloud Atlas website, best practices and guidance material, collaboration with other WMO bodies and programmes, plan for reshaping CIMO, testing of measurement systems).

¹⁰ <https://cloudatlas.wmo.int/home.html>

Score: 49%¹¹

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(1) *Improve user readiness for new-generation meteorological satellites, including coordinated product development and training.* WMO published two guidelines related to user readiness: "Best practices for Achieving User Readiness for New Meteorological Satellites – Reference User Readiness Project" (WMO-No. 1187) and "Satellite skills and knowledge for operational meteorologists" (WMO SP-12). Satellite user conferences and training events also supported in Regions II, III, IV, and VI, facilitating the transition to GOES-16 in the Americas, as well as two science workshops on radio occultation and sounding. WMO further assisted in the establishment of the JMA/BOM Himawari request protocol to enable Region II and V requests for Himawari-8 target observations.

(2) *Advance the WIGOS Space Component – Defining the physical Architecture for Climate Monitoring from Space in support of GFCS and DRR.* The Space Programme had a leading role in establishing the new inventory on space-based Essential Climate Variables (ECV) records within CGMS-CEOS WG Climate (e.g., assessing over 1000 entries in the inventory) and in formulating the response by space agencies to the 2016 GCOS Implementation Plan.

(3) *Advancing the WIGOS Space Component - Development of a 2040 Vision on WIGOS Space and activities in support of the WMO RRR process.* Draft version 2.0 of the Space Vision 2040 was drafted and integrated into 2040 WIGOS Vision. A sustainable framework of maintaining and upgrading of OSCAR/Space V2 was established through the formation of a Support Team and a Science and Technical Advisory Team, with the support of satellite operators.

(4) *WIS Support to WIGOS, GFCS, and GCOS – Improving Exchange and Availability of Satellite Data.* Guide to the Direct Broadcast Network was published (WMO-No. 1185) defining the minimum technical specifications and procedures applicable to the Direct Broadcast Network for Near-real-time Relay of Low Earth Orbit Satellite Data (DBNet) and providing guidance for implementing these specifications and procedures. WIGOS Metadata Standard was further reviewed to enable description of satellite observations.

(5) *Advancing the WIGOS Space Component - Development of Space Weather Services (Four-year Plan 2016-2019).* The Inter-Programme Team on Space Weather Information, Systems and Services (IPT-SWeISS) was established with the following achievements: i) support to ICAO's audit for designating global/regional space weather services for aviation users; ii) space weather observation requirements and the Statement of Guidance for space weather observation was updated as part of the WMO RRR process; iii) space-based capabilities for space weather observation in OSCAR/Space was updated and reviewed as support to gap analysis.

¹¹ This weighted score is calculated based on a variety of parameters, including for (1): (a) Ratio of Regions having more than 50% of their Members using new-generation satellite data, with positive impact on services (especially nowcasting), (b) ratio of Regions having more than 50% of their Members targeted by VLab or having participated in VLab training events; (c) SATURN portal available. For (2): (a) commitment in 2017 by the relevant satellite agency coordination mechanisms to perform system-level gap analysis in support of the physical Architecture, (b) gap analysis and SCOPE-CM, (c) requirements. For (3): (a) draft version 2.0 of the Space Vision 2040 available, (b) establishment of a sustainable framework of maintaining and upgrading of OSCAR/Space V2 with the support of the Satellite Operators and Space Agencies (CGMS, CEOS), and Global Space-based Inter-Calibration System (GSICS) Executive Panel and WGs. For (4): (a) updated user requirements, (b) DBNet regional network leads in place and statistics on latency and consistency available, (c) satellite data monitoring prototype available. For (5): (a) implementation of an operational framework with WMO Members for utilizing space weather information, (b) training and outreach, (c) space Weather, (d) space weather data exchange in the WIS Framework.

Key Outcome 4.2: WMO Information System is developed and implemented

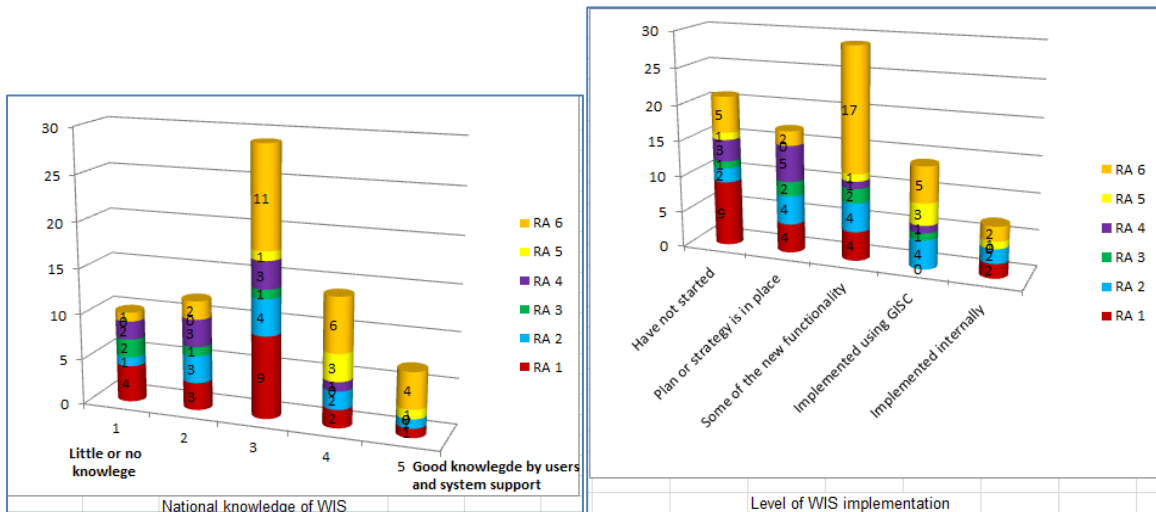
KPI 4.2.1: Progress in the implementation of WIS by NMHSs as measured by a weighted score

Score 26%¹²

The score reflects that the number of WIS centres has not changed significantly in 2017, while there has been an increase in the knowledge of WIS, especially in the English-speaking countries of Region I. However, there are too many Members with little or no knowledge of WIS, and too many Members that have not implemented WIS. A primary strategy for 2018 is to undertake WIS training in French-speaking countries of Region I as this area has yet to have such training beyond that of the Regional Telecommunication Hub centres. Note that now that OSCAR is operational, the WIS training will include training on the use of OSCAR.

Figure 14: National knowledge of WIS

Figure 15: Level of WIS implementation



Source: CPDB, Q 4.6 and 4.7, February 2018

KPI 4.2.2: Progress in the maintenance and evolution of WIS

Score 24%¹³

The score reflects that although Global Information System Centres (GISC) metadata catalogues are well along the path to reflecting available data and products from WMO

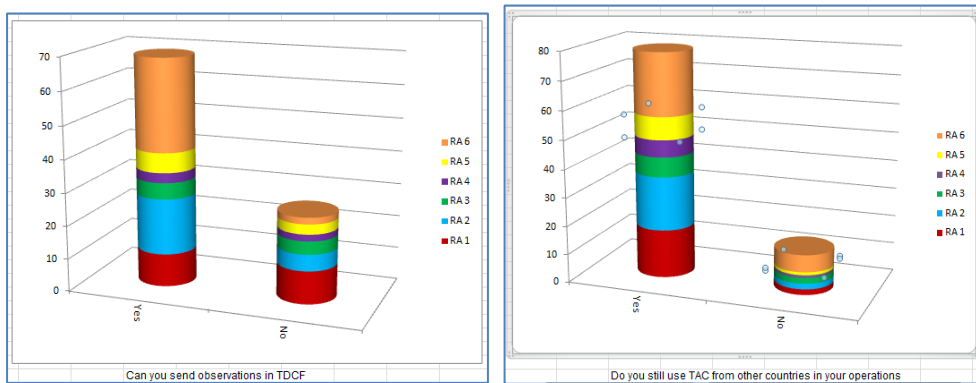
¹² This weighted score is calculated based on (1) the number of registered centres, (2) the proportion of National Centres recorded as compliant, (3) the average level of national implementation of WIS, (4) the average national knowledge of WIS, and (5) implementation of WIS Part C (Information Management).

¹³ This weighted score is calculated based on (a) compliance with information metadata and representation standards, (b) measure of completeness of WIS catalogue, (c) measure of migration, (d) surface TDCF vs TAC, upper air TDCF vs TAC, (e) reliance on TAC, (f) use of data representations derived from data models, (g) progress in the development and implementation of WIS 2.0, and progress against milestones in the implementation plan.

activities in the WIS, Members are only halfway towards the desired level of compliance with information metadata and representation standards. These figures are measured from the World Weather Watch monitoring and information available from GISCs, including the number of metadata records that have to be created automatically to compensate for missing metadata from Members. Another aspect lowering the score is that although many Members are compliant in being able to transmit their observations in Table-Driven Code Forms (TDCF), many are still dependent on Traditional Alphanumeric Code (TAC) for visualizing data or receiving data from other Members.

Not included in the status report at this time is the progress on the implementation of WIS 2.0 as the plan will not be approved until Cg-18. However, CBS TECO 2018 will be reviewing the WIS 2.0 strategy for consideration of EC-70.

Figure 16: Ability to send observations in TDCF Figure 17: Use of TAC



Source: WIS Focal Points Survey, December 2017

Key Outcome 4.3: WMO Polar and High Mountain Observations, Research and Services are supported

KPI 4.3.1: Progress in implementation of WMO Polar and High Mountain Activities as measured by a weighted score

Score: 50%¹⁴

Observations, Research and Services. WMO was accepted as observer of the Arctic Council and engaged with its Working Groups. The Antarctic Observing Network further expanded by 5% in the reporting period, with additional partner organization stations. With regard to space observations, the Polar Space Task Group advanced systematic collection of satellite data over priority areas of Greenland, Antarctica, the Canadian and Russian Arctic, and permafrost “cold spots.” In terms of research, the Year of Polar Prediction (officially launched at EC-69) is on track with its Implementation Plan and Special Observing Period is underway.

Substantial progress was accomplished in developing the Arctic Regional Climate Centre Network, including the approval of an implementation plan. A demonstration phase is about to start. The first Pan-Arctic Regional Climate Outlook Forum (PARCOF-1) will take place in Ottawa, Canada, on 15-16 May 2018, with an overarching outcome of the first Arctic Climate Consensus Statement. PARCOF will also provide a platform for ArcRCC-

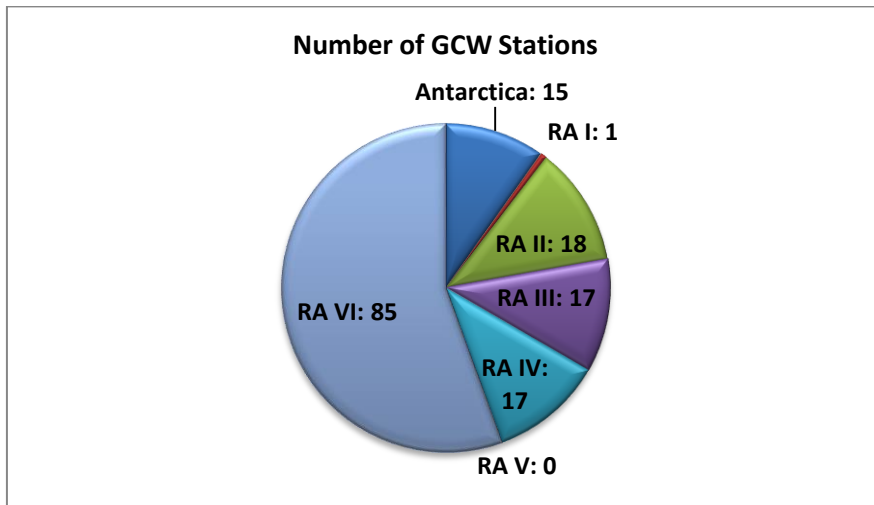
¹⁴ The weighted score reflects the scores for (a) the mid-term progress on the WMO engagement with the Arctic Council, (b) the evolution of the Antarctic Network, (c) the Polar Satellite Task Group activities, (d) the Year of Polar Prediction, (e) the High Mountain activities, and (f) the score on the progress on the implementation of the Global Cryosphere Watch.

Network to interface with the users. Efforts were made to develop an Antarctic RCC Network as well as another Network for the Third Pole region.

The scoping of WMO High Mountain activities is making progress, and there are plans to Organize a Global High Mountain Summit at the end of 2018 to refine such scoping.

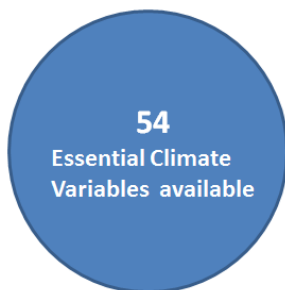
Global Cryosphere Watch (GCW). As of December 2017, there were a total of 153 stations committed to contribute to GCW as a component of WIGOS. These are located in 26 countries. Figure 18 indicates the distribution of stations by region. The stations are operated by 41 different organizations, of which 26 are non-NMHSs. Twenty percent of the stations were reflected in OSCAR and their data was made available on GTS. Twenty percent of the regulatory and operational manuals and guides were further made available and two seasonally hemispheric cryosphere assessments completed.

Figure 18



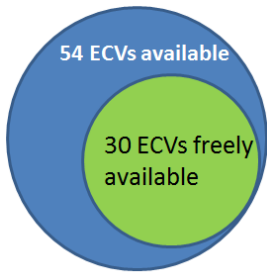
Key Outcome 4.4: Strengthened Global Climate Observing System (GCOS) in support of GFCS Observations and Monitoring component

KPI 4.4.1: Number of Essential Climate Variables available



As of December 2017, there were 54 ECVs available. The list is approved every five to six years as the process is aligned to the assessment cycle and the review of the GCOS Implementation Plan. The next update is due in 2021-2022.

KPI 4.4.2: Number of ECVs freely available



Of the 54 ECVs, 30 out of 37 ECVs observable from satellites were freely available as of December 2017. Climate observations are needed for climate research and policy decisions.

In principle, all 54 ECVs have products which are freely available to Members. Free is defined as without restrictions.

Expected Result 5: Advance targeted research

Key Outcome 5.1: Research in climate prediction and projection is enhanced for all relevant timescales

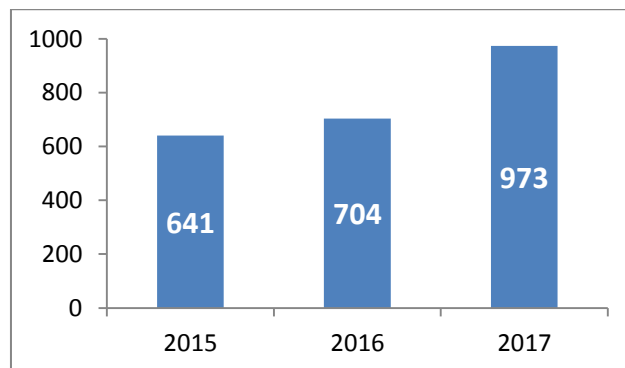
KPI 5.1.1: Number of Peer Reviewed papers published in "top five" journals that cite the Coupled Model Intercomparison Project (CMIP)

CMIP serves as a fundamental basis for international climate research as part of the World Climate Research Programme (WCRP). The process represents a remarkable technical and scientific coordination effort across dozens of climate modelling centres, involving some 1,000 or more researchers. It involves assessments of model performance during historical periods and quantifications of the causes of the spread in future projections. An important goal of CMIP is to make the multi-model output publically available in a standardized format.

As a proxy to measuring the advancement of research in climate prediction and projection, WMO tracks the number of peer reviewed papers citing CMIP and published in the following top five, high-impact journals: *Nature*, *Nature Climate Change*, *Journal of Climate*, *Geophysical Research Letters* and *Climate Dynamics*.

A 52% increase was noted in the number of peer-reviewed papers citing CMIP in these journals in the past biennium, rising in nominal terms from 641 in 2015 to 973 in 2017 (see Figure 19).

Figure 19: Peer-reviewed papers citing CMIP in top five journals



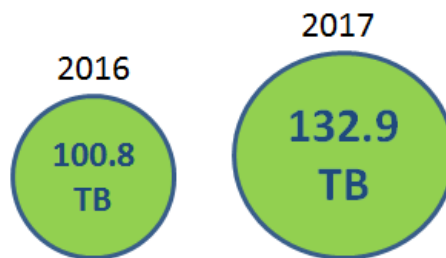
Source: WMO Secretariat, December 2017

KPI 5.1.2: Degree of uptake/usage of Sub-seasonal to Seasonal Prediction (S2S) project database

Ref.: 11932/2018-1.1 SP0

The Subseasonal to seasonal prediction project (S2S) is a joint undertaking by WCRP and the World Weather Research Programme (WWRP), with the aim to improve forecast skill on the subseasonal to seasonal timescale, with special emphasis on high-impact weather events, and to promote its uptake by operational centres. The S2S Database is made available from both the European Centre for Medium-Range Weather Forecasts (ECMWF) in the UK and the China Meteorological Administration in China. As illustrated in Figure 20, a growing volume of data is being downloaded from the S2S database measured in Terabytes (TBs). This demonstrates the increased uptake and usage of the database by a variety of users.

Figure 20: Volume of data downloaded from S2S database in Terabytes



Source: WMO Secretariat, December 2017

The creation of the S2S database of sub-seasonal forecasts (available to the research community three weeks behind real time) and re-forecasts is the signature achievement of S2S during its first phase. Launched publicly in May 2015, the S2S database has spurred major research activity on S2S predictability, modelling, and forecast verification and product development. To date, 23 articles using the S2S database have been published in the peer-reviewed literature. Several of the findings relate to the Madden-Julian Oscillation. More importantly, coordination across the WMO Global Producing Centres of Long-Range Forecasts (GPCLRFs) has taken place such that all of 11 operational centres now issue forecasts on Thursdays (including the 4 models with daily forecast starts) as compared with only 7 of 11 models at the project's outset. This greatly facilitates the generation of multi-model ensemble forecasts.

KPI 5.1.3: Number of NMHSs and academic institutions involved in the World Weather Research Programme (WWRP)

The WMO's ability to promote innovation will be critical to the future development of weather services and, in a broader sense, to accessibility of adequate services to all citizens. Achieving this goal depends critically on partnerships between the global public, private and academic sectors of the weather enterprise.

51 NMHSs and **10 academic institutions** participated in WWRP research development projects, forecast demonstration projects and regional funded projects in December 2017. Of these, the vast majority were NMHS from Region VI (39%) and Region II (22%). For the academic institutions, 50% of the total number were from Region II, 40% from Region IV and 10% from Region VI.

Key Outcome 5.2: Atmospheric composition observations and assessment meet needs of environmental conventions and policy assessments

KPI 5.2.1: Number of operational GAW stations

A network of measurement stations is the backbone of the Global Atmosphere Watch (GAW) Programme. This network consists of global and regional measurement stations, with additional measurements provided by contributing networks. More than 100 Members operate GAW stations.

280 GAW stations were operational as of December 2017, as shown on Figure 21. By definition the station in the GAW Station Information System (GAWSIS) is called "operational" if it shares data through the World Data Centres. There are still substantial geographical areas that are not covered by the atmospheric chemical composition observations. The majority of stations are concentrated in Europe and North America. Substantial fractions of stations are not reporting their data. Part of the issue could be related to the broken links between the World Data Centres and GAWSIS that does not allow immediate reflections of the data submission in the GAWSIS Database.

Figure 21: Operational GAW stations globally



Source: GAWSIS, December 2017

KPI 5.2.2: Number of GAW datasets available in the Data Centres

As of December 2017, there were **32,400 GAW datasets available** in the Data Centres. The number of the datasets reflects the total number of parameters measured at all stations and submitted to the World Data Centres.

KPI 5.2.3: Number of citations of atmospheric composition related bulletins

The WMO Greenhouse Gas Bulletin, Ozone Bulletin, Aerosol Bulletin and Ozone Assessments were cited **3,269** times in international and national media outlets in 2017. The annual WMO Greenhouse Gas Bulletin received exceptionally high coverage

and was the top story on the BBC website for almost a day. Interviews were given on the subject to a large number of television and radio stations.¹⁵ There was further a big social media echo.

Expected Result 6: Strengthened capacity development

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) contribution to implementation of Agenda 2030 and the SDGs; (c) improved awareness by users on type of services NMHSs can deliver; (d) improved user accessibility; (e) improved timeliness; and (f) increased accuracy of forecasts and warnings

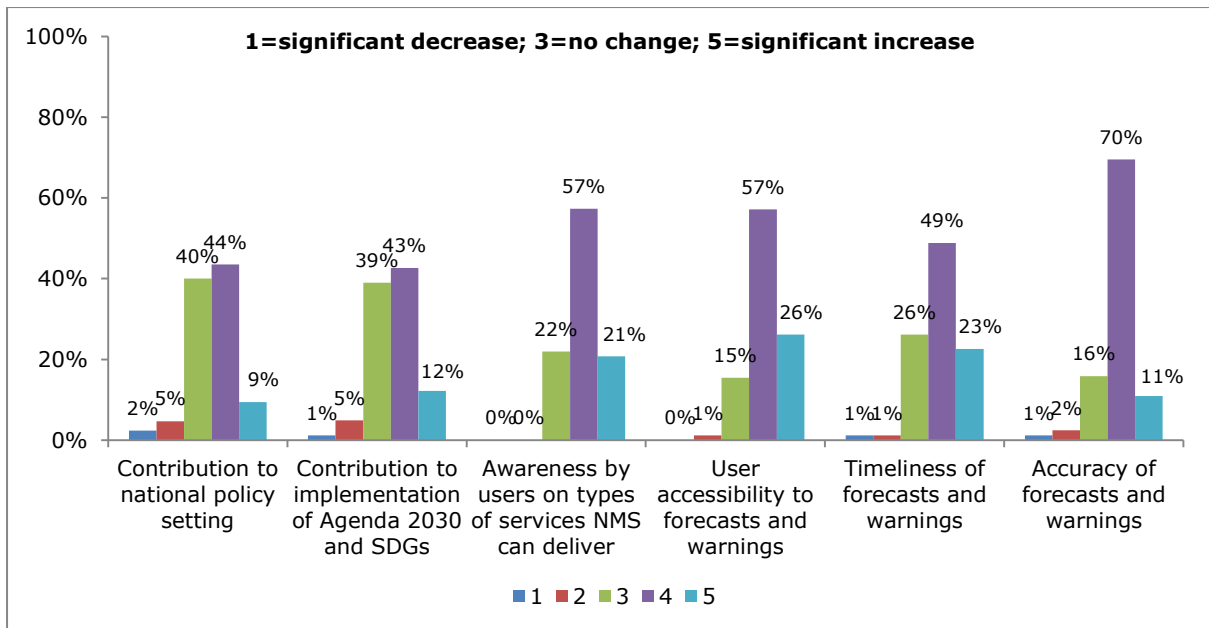
Members observed significant improvements in their visibility and relevance in the national development agenda in 2016-2017, especially with regard to user accessibility to forecasts and warnings, as illustrated in Figure 22. Eighty-three percent of 84 Members responding globally reported moderate to significant increase. A similar proportion (78%) indicated improvements in terms of awareness by users on the types of services which NMHSs provided. The results are similar to 2015 when roughly the same share of Members reported significant improvement in their visibility and relevance in these two areas.

Other important factors included the accuracy and timeliness of forecasts and warnings. The former contributed to enhanced visibility and relevance of NMHSs according to 81% of 82 Members responding; the latter played a role in the opinion of 72% of 84 Members. Similar results were registered in 2015.

Over half of 85 Members responding globally reported increased contribution to national policy setting, though a sizeable share (40%) noted no change in the past biennium. For comparison, two-thirds of Members noted moderate to significant increase in visibility and relevance due to their contribution to national policy setting in 2015. Information is not available on 106 Members.

Figure 22: Change in the visibility and relevance of NMSs in the national development agenda

¹⁵ BBC, BBC World, BBC Persian service, CBS, CNBC, ARD, Deutsche Welle, Radio France International, Swiss radio, Irish radio, Israel radio, Turkish television, UN Russian radio, etc.



Source: CPDB, Q 2.21, February 2018

A new question was included in 2017 with respect to Members' contribution to the implementation of Agenda 2030 and the Sustainable Development Goals (SDGs). Only 43% attributed their moderate increase in visibility and relevance at the national level to implementing Agenda 2030. For 12% the increase was significant. No change was observed by 39%, possibly speaking of a need to enhance the link between NMHS mandates and SDG implementation as well as improve NMHS visibility in this regard.

KPI 6.1.2: Number of NMHSs with (a) increased contribution to regional policy setting; (b) improved awareness by regional users on type of services that can be provided; (c) improved regional user accessibility; (d) improved timeliness of forecasts and warnings delivered from Regional Centres; and (e) increased accuracy of forecasts and warnings delivered from Regional Centres

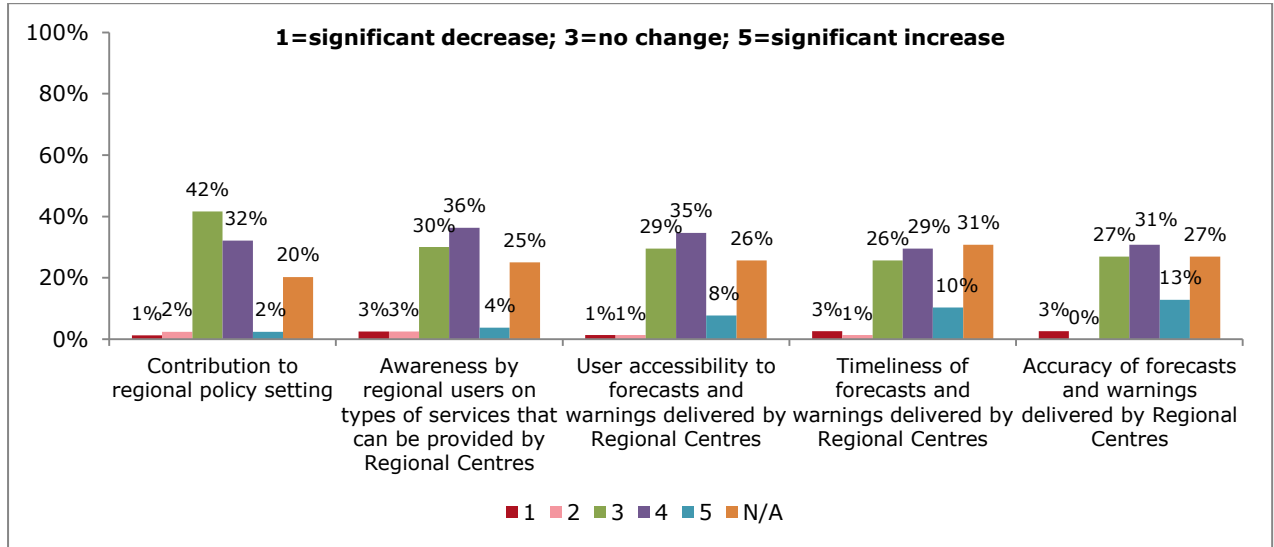
Improvement was noted across all parameters in the visibility and relevance of regional services provided by NMSs in 2017 (see Figure 23). However, it was more modest in comparison to 2015. For example, 43% of 78 Members responding indicated increased visibility and relevance due to improved user accessibility to forecasts and warnings delivered by Regional Centres in 2017, as compared to 60% two years earlier. Likewise, less than half observed improved visibility and relevance in 2017 due to enhanced timeliness and accuracy of forecasts. In 2015, over half of approximately the same number of Members responding reported so.

In terms of contribution to regional policy setting, 34% indicated that the visibility and relevance of their NMHS had increased over the past two years, as compared to 39% two years earlier. No change was observed by 42% of 84 respondents. Regarding increased awareness by regional users of the types of services that are provided by Regional Centres, 40% noted increased visibility and relevance in 2017 versus 47% in 2015.

Representative data is only available for Regions I and VI. The sample of respondents from the rest of the world is not large enough to be able to draw any regional trends and conclusions. Notably, 43% of Members responding in Region I experienced increased visibility and relevance in 2017 along all parameters except the timeliness of forecasts and warnings delivered by Regional Centres. The performance of Regional Centres and

regional policy setting were not applicable to the majority of Members from Region VI, with the remainder noting no considerable change in visibility and relevance regionally.

Figure 23: Change in the visibility and relevance of regional services delivered by NMSs in the regional development agenda

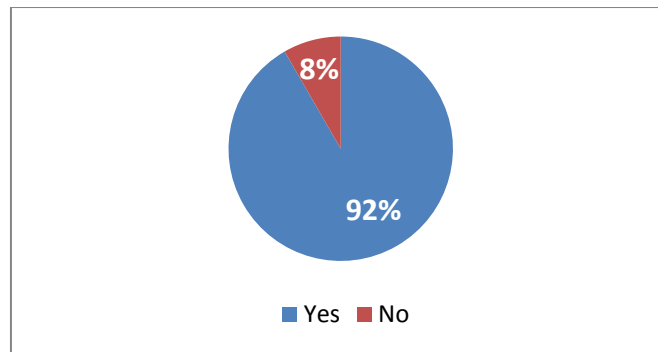


Source: CPDB, Q 2.22, February 2018

KPI 6.1.3: Number of Members with long-term strategic integrated national plans for weather, climate and water

The vast majority of Members responding have development and/or strategic plans in place or under development (154 out of 168 Members, or 92%). Of the 14 Members responding without such plans, 6 are in Region I, 6 in Region VI, 1 in Region IV and 1 in Region V. Information is not available on 23 Members.

Figure 24: Members with development/strategic plan in place or under development



Source: CPDB, Q 2.19, February 2018

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

Members continued enhancing their infrastructure and operational facilities in 2016-2017.

115 Members improved their infrastructure and operational facilities in forecasting;
112 in the surface observing network;
101 in numerical weather prediction and data-processing;
91 in early warning and hazard risk assessments;
88 in equipment for meteorological/environmental satellite data; and
69 in the upper-air observing network.

As compared to 2015, more Members seem to dedicate efforts to improving numerical weather prediction and data-processing as well as to early warning and hazard assessments. Improvements to the upper-air observing network continue being the most challenging, particularly in Region I, though matched by advances in equipment for meteorological/environmental satellite data relative to 2015. Most advances across regions were made in forecasting.

Other operational areas with significant improvements in infrastructure and operational facilities were related to aviation, agricultural meteorology and public weather services, among others.

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

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

2015 Baseline	2017 Actual
11	13

The number of Regional Training Centres (RTCs) providing education and training support for GFCS-related activities increased from 11 in 2015 to 13 in 2017. Given the level of specialization of RTCs, the above number is not expected to increase dramatically in the coming years. Examples of the short courses provided in 2017 include:

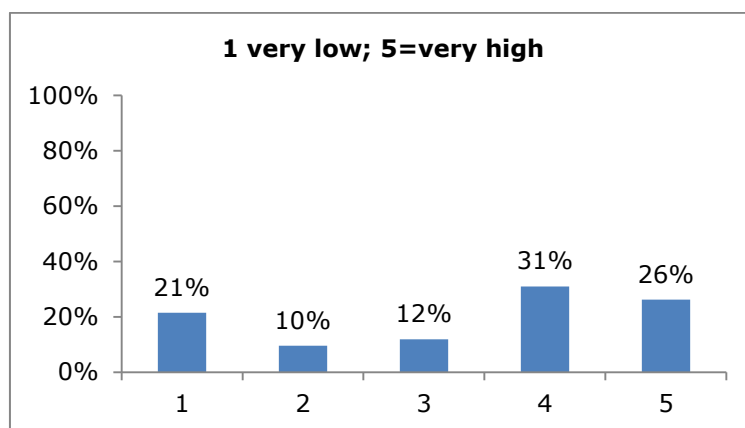
- China-CMATC:
 - o Course on Global Framework for Climate Services;
 - o International Training Course on the Adaptation to Climate Change
- France-ENM:
 - o Climatology Foundation for Climate Services
 - o Climate Change
- Israel-PTCAM:
 - o Climate Change and Agriculture
- Italy-IBIMET:
 - o Climate Services for Disaster Prevention
- Peru-UNALM:
 - o International Training Course on Seasonal Climate Forecast
- UK-Reading University:
 - o Urban Meteorology, Environment and Climate Services

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

Out of 87 Members responding, about half had requested fellowships through the WMO Fellowship Programme. Two-thirds of Members in Region I had requested a fellowship. In the rest of the regions, the proportion varies, with the lowest in Region VI (8%).

Figure 25 presents the perceived value of the WMO Fellowship Programme by the 41 Members responding which benefited from it in 2016-2017. Whereas 57% rate highly its value and 12% consider it average, close to a third do not attach sufficient value to the Programme. Of these, most are located in Region I and two Members in Region IV. This perceived value might be influenced by the number of fellowships possible in total, which has been somewhat reduced in recent years, and also limitations on the number of fellowships possible for any single country. Fellowships are targeted to LDCs, but must also be distributed fairly among them, so many regrets are necessary.

Figure 25: Value obtained from WMO Fellowship Programme



Source: CPDB, February 2018

For comparison, 55 Members responding indicated that they had requested one or more fellowships in 2015, of which 75% rated positively the Programme's value for money (categories 4 and 5). The proportion was similar in 2012 at 73%. The increased dissatisfaction in the past biennium merits further analysis and evaluation.

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

Table 13 presents the level of satisfaction with the RTCs in each region for 2016-2017. The RTCs in Region II are the most appreciated, with 65% of respondents assigning an above-average rating of 4 or 5. They are followed by the RTCs in Region IV (58%) and Region VI (54%). This result might be due to the higher level of service that the RTCs in these regions are able to provide.

The RTCs in Region III were the least appreciated, with 42% of respondents having assigned a minimum ranking of 1. In Region V, the Members beneficiaries of services are split: 54% provided an above-average ranking of 4 and 38% a minimal ranking of 1. With the exception of Region II, the RTCs in all regions have room for improvement. However, the very large spread in the responses for nearly all the regions can be partially explained by sub-regional differences in benefits received, caused by limited

numbers of RTCs in some regions, language differences and intergovernmental arrangements for some RTCs that do not allow equal service to the entire region.

Table 13: Member satisfaction with RTCs (by region), 1= very low and 5= very high

Rating	RTCs Region I		RTCs Region II		RTCs Region III		RTCs Region IV		RTCs Region V		RTCs Region VI	
	#	%	#	%	#	%	#	%	#	%	#	%
1	4	12%	3	12%	5	42%	4	21%	5	38%	5	24%
2	3	9%	1	4%	0	0%	0	0%	0	0%	1	5%
3	11	32%	5	19%	3	25%	4	21%	1	8%	3	14%
4	10	29%	11	42%	3	25%	9	47%	7	54%	6	29%
5	6	18%	6	23%	1	8%	2	11%	0	0%	6	29%

Source: CPDB, Q 2.11, February 2018

Expected Result 7: Strengthened partnerships

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 high level events, documents and submissions where WMO and its co-sponsored programmes influence policy and/or decisions within the UN and other major bodies

Increased WMO involvement in global policy frameworks was registered in 2017 as measured by the number of submissions to key conventions and bodies. It rose from 10 submissions in 2015 to 16 in 2017. Of these, 13 were to the 23rd Conference of the Parties of UNFCCC (COP-23), where WMO further participated in 43 plenary and side events. The remaining contributions were to UN Convention on the Law of the Sea, the Montreal Protocol on Substances that Deplete the Ozone Layer, and the Committee on Earth Observation Satellites.

The visibility of WMO has increased among the Parties to UNFCCC and related communities. For the first time ever, WMO's Secretary General was invited to deliver a speech in the opening of COP-23, informing Parties on the record-breaking global temperatures, carbon dioxide concentrations and sea temperatures, as well as increasing ocean acidification and extreme events and their impacts around the world. WMO's scientific climate products, such as the Annual Statement on the State of the Global Climate and Greenhouse Gas Bulletin are well appreciated by policy makers and high-level officials involved in the climate change negotiations. As regards to the implementation of the Paris Agreement, noting Article 4 on transparency and article 14 on global stocktake, WMO's scientific products bring more transparency and assist in quantitative global stocktaking.

Furthermore, UNFCCC Secretariat agreed on a Memorandum of Understanding with WMO to conduct four projects in areas such annual climate statements, GHG monitoring, contributing to NAPs and cooperation between WMO-UNFCCC RCCs.

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

KPI 7.1.2: Uptake of WMO public information outputs

WMO mentions in the press marked **a 30% increase** from 36,300 in 2015 to 46,800 in 2017. The number of unique visitors to the WMO website also **rose by half a million** in the same period. Particular upsurge was observed in terms of WMO presence on social media, with the number of Facebook fans having **almost tripled** from 49,000 to 127,000 and that of Twitter followers having **doubled** from 22,500 to 42,600 from 2012 to 2015, respectively. WMO releases video material on YouTube; 238,000 hits were registered in 2017.

Expected Result 8: Improved efficiency and effectiveness

Key Outcome 8.1: Effective and efficient WMO Congress and EC

KPI 8.1.1: Degree of Member satisfaction with documentation for Cg, EC and its working groups

The new decision-focused, action-oriented format of the EC documentation is highly appreciated. A 26% increase was registered in the level of satisfaction with the technical content of EC-69 documents, which soared from 66% in 2015 to **92%** in 2017.

Participants in EC-69 were also pleased with the language quality of the documents, with **97%** expressing satisfaction (up from 81.5% in 2015).

KPI 8.1.2: Degree of Member satisfaction with supporting services for Cg and EC

All respondents to the satisfaction survey conducted after EC-69 were content with the interpretation services and the efficiency of badge delivery (**100%**).

Key Outcome 8.2: An effective and efficient WMO Secretariat

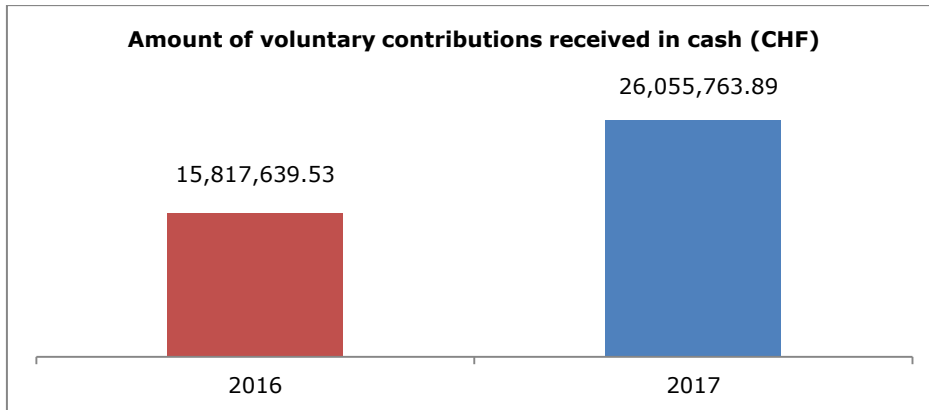
KPI 8.2.1: Percentage of implemented accepted oversight recommendations for improved business effectiveness

76% of the accepted oversight recommendations of the WMO Internal Oversight Office (IOO) were implemented in 2017. The rate of implementation was similar in 2015 (79%).

The implementation rate of accepted recommendations of the Joint Inspection Unit (JIU) was **81.6%** in 2017. Whereas data was not available in 2015, it stood at 75% in 2013 so the current rate is above the average.

KPI 8.2.2: Amount of extra-budgetary funding for Secretariat

A 65% increase was registered in the amount of voluntary contributions received in cash from 2016 to 2017. Major contributors included the World Bank, the United States of America, the International Bank for Reconstruction and Development (IBRD), Switzerland, Republic of Korea, Norway, Germany, the United Kingdom of Britain and Northern Ireland, Norway, Saudi Arabia, Woods Hole Oceanographic Institution (WHOI) and Canada, among others.



KPI 8.2.3: Staff satisfaction as measured by Engagement Index

A Staff Satisfaction Survey was conducted at the WMO Secretariat in 2016. An Engagement Index was developed as a way of measuring satisfaction and understanding the drivers behind staff motivation. The index was based on staff responses to four statements: (a) WMO gets the best out of you; (b) your job gives you a sense of personal achievement, (c) you are proud to work at WMO, and (d) you value WMO culture. The results were compared against benchmarks from European and Swiss public service organizations.

In 2016, the WMO Engagement Score stood at **79%**, which outperformed both benchmarks. 94% of staff expressed pride to work at WMO and 87% thought their job gave them a sense of personal achievement. Only 62% believed that WMO gets the best out of them.

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

KPI 8.3.1: Degree of Member satisfaction with constituent body documentation

Satisfaction with the documentation for regional association and technical commission sessions was very high, based on surveys conducted at RA II-16, RA IV-17, CAS-17 and JCOMM-5. A 16% increase was registered in the level of satisfaction with the technical

content of documents, which rose from 80% in 2013 to **96%** in 2017.¹⁶ At **98%**, participants were equally happy with the language quality of the documents.

KPI 8.3.2: Degree of Member satisfaction with constituent body supporting services

99% of respondents to the satisfaction surveys listed above were content with the interpretation services and the efficiency of badge delivery. Satisfaction with the latter increased from 86% in 2013, thus showing considerable improvement.

Key Outcome 8.4: Gender equality across WMO

KPI 8.4.1: Proportion of women and men in WMO constituent bodies and their working structures

Seven out of 14 sessions of WMO technical commissions and regional associations took place in 2016-2017. On average, 25% of delegates were women, which demonstrates progress as compared to the baseline of 20% but is still short of the desired target of 30%, as defined in the WMO Gender Equality Policy. The increase is due to the higher representation of women at technical commission meetings.

Table 14 compares the proportion of female and male delegates to constituent body sessions held in 2016-2017 to that in the previous financial period. An increase was noted in female representation at all sessions except at RA IV-17 and RA-II where a 2% decrease was observed. The highest increase in female delegates was registered at JCOMM-5 (20%) and CHy-15 (11%) which were both coupled with Women's Leadership Workshops for female delegates prior to the sessions. Female representation increased only minimally (1%-2%) at CAS-17 and CBS-16 sessions. A 4% increase in female participation was noted at RA VI-17 session. Female representation was the lowest at the RA II-17 session.

Table 14: Proportion of female and male delegates to constituent body sessions

CB Session	% women 2012-2015	% women 2016-2019	% men 2012-2015	% men 2016-2019
RA II	11%	13%	89%	87%
RA IV	21%	19%	79%	81%
RA VI	25%	29%	75%	71%
CAS	24%	25%	76%	75%
CBS	16%	18%	84%	82%
CHy	25%	36%	75%	64%
JCOMM	17%	37%	83%	63%
Average	20%	25%	80%	75%

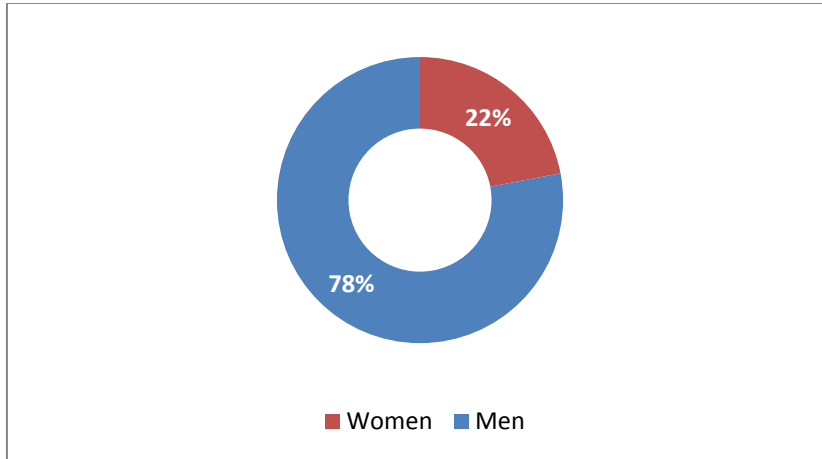
Source: Gender Database, WMO Secretariat, March 2018

A 2% increase was observed in the share of female members of constituent body working structures in 2017, as compared to the end of the previous financial period.

¹⁶ The comparison is based on 2013 data as only RA I-16 took place in 2015. An insufficient number of participants responded to the satisfaction survey distributed.

Whereas the share of women remained unchanged on RA working groups (21%), it rose from 19% in 2015 to 23% in 2017 on TC working groups and expert teams. The number of women on CBS working structures soared to 18% in 2017, up from one of the lowest levels at 12% in 2015. Female participation on CHy OPAGs also registered a notable increase of 7%, reaching 24% in 2017. It should be noted that the JCOMM and RA VI working groups were not yet formed at the time this report was prepared.

Figure 26: Membership in WMO constituent body working structures



Source: Gender Database, WMO Secretariat, March 2018