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## EDUCATION AND TRAINING

Report on Education and Training Activities

### Introduction

As an important part of the overall capacity development activities of WMO, since the last EC the thrust of the Education and Training Programme derived from the overall direction of WMO’s priority programme areas. Activities also took into account the need to foster cooperation between development partners, increase networking among experts and assisting countries to build their internal capacity for national training. These activities and their outcomes are highlighted in this report.

### Impact Evaluation of fellowships

In June 2016, the sixty-eighth session of the Executive Council, taking note of the importance of the WMO Fellowship Programme to many Members and its contributions to the wider WMO Capacity Development Programme, decided that an impact evaluation of the Programme should be undertaken.

The objectives of the evaluation are: (i) to examine the implications of Decision 67 (EC-68) vis-à-vis the mandate of WMO in the area of education and training with a view to identifying areas where activities of its Fellowship Programme are expected to make an impact; (ii) identify the benefits accrued through fellowships to the Members, with the aim of making a case for enhanced delivery of the WMO Fellowship Programme; and (iii) to seek increased fellowship opportunities for NMHSs in WMO Member States so as to improve their operations and contributions to current and future national development needs.

The evaluation report, which is under preparation, will cover among other things: (i) modality for implementation of the Fellowship Programme (FP); (ii) role of the WMO Regional Training Centres; (iii) effectiveness of the FP; (iv) current and emerging fellowship demands and delivery in the Regions; (v) broadening of partnership to expand training and fellowships; (vi) review of existing internal evaluations and audits of the programme; and (vii) impact, relevance and sustainability of WMO fellowships.

### Plan for SYMET-13

Further to Decision 66 (EC-68), the Education and Training Office embarked on: (i) a search for suitable host and venue for the Thirteenth WMO Symposium on Education and Training (SYMET-13); (ii) resource mobilization to complement the allocation from the WMO regular budget; and (iii) internal consultation with WMO technical and other departments on the delivery of programme and activities of SYMET-13.

As regards venue, the Coordinating Director of the Caribbean Meteorological Organization (CMO) has graciously offered to host the Symposium in Barbados. Barbados also hosts the WMO Regional Training Centre at the Caribbean Institute for Meteorology and Hydrology (CIMH). The US-NWS has authorized the use of the US Voluntary Cooperation Programme Trust Fund, to complement the allocation from the WMO regular budget. Other funding possibilities are being pursued to meet the required budget.

Concerning the programme orientation, departments in the WMO Secretariat have been engaged in working out areas of focus.

### WMO Global Campus Feasibility Studies

EC-66 in June 2015, requested a feasibility study for a WMO Global Campus, to be considered for decision at Cg-18 in 2019. The following report outlines the progress made since EC-68, and plans for the coming years.

1. Governance

In 2016, the EC Panel of Experts on Education and Training formed a Working Group on Global Campus Activities, which has taken responsibility for the feasibility study and, in coordination with the ETR Office, will report to the WMO Executive Council and Congress. The working group completed a Global Campus Roadmap in April 2017. This Roadmap outlines the background to the efforts, benefits to Members, priority areas for development, and linkages to the WMO Service Delivery and Capacity Development Strategies, as well to external organizations and standards. In addition, it provides a status report of the feasibility study priority activities as of April, which will also be highlighted below. The UK Met Office seconded an expert to the initiative for a period of two years.

1. Global searchable calendar of events, catalogue of learning resources, and quality assurance

A trial Global Campus calendar was established at the Caribbean Institute for Meteorology and Hydrology (CIMH) in 2016. Following the creation of a technical task team under WMO ETR coordination, the initial trial and several additional prototypes were tested before settling on the installation of a calendar database and API developed at EUMETSAT for the WMO/CGMS VLab. This calendar system will be implemented in stages over the rest of 2017, focusing first on entries related to aviation and climate services training, but branching out from there after the system, the process for making submissions, and the quality assurance processes are stabilized.

The task team has also investigated several platforms for hosting a catalogue of learning resources for sharing with the ETR community. These resources will be useful for either self-study or for adoption within courses. The team has narrowed its choices to a few existing systems to build upon, and will be reporting a recommendation to the working group by the middle of the year. WIS will continue to be investigated as a resource submission and catalogue platform in the long-term as well. In the meantime, resource information and links are already being collected and offered on web pages in the areas of aviation and climate services training.

Quality assurance processes for both the calendar and catalogue will be managed by providing quality guidelines that should be follow for submissions, and oversight by a Submissions Review Panel.

1. Aeronautical meteorology and climate services offerings

In the formative stages of the WMO Global Campus, efforts will focus on calendaring and cataloguing events and learning resources related to these two WMO priority areas. Representatives of the relevant Commissions are assisting in gathering the appropriate entrees.

1. Additional priority areas

The WMO Global Campus Roadmap will serve to build clarity around the expected outcomes of the feasibility study and long-term benefits of a WMO Global Campus. In addition, new web pages have been built on the WMO public website to communicate about Global Campus activities and a biannual newsletter is intended to be produced. Social networking platforms, such as Facebook and LinkedIn groups, are intended to create more active and ongoing communication possible. The communication mechanisms are intended to promote new partnerships, as well as share successes of existing partnerships. Best practices for training delivery, including e-learning, will also be important topics of communication.

Ongoing communication will also address the plan to encourage development of systems for shared academic credit and common continuing professional development certification. Addressing the issues around the development of a shared credit/certification system will likely form a core activity in the next year.

A Translations Resource Centre has been developed by the COMET Programme and the Meteorological Service of Canada to encourage the increased quality and quantity of available resources in multiple languages. The needs for addition guidance, coordination, and collaboration for translations will also be discussed.

1. Collaboration and resources required for a WMO Global Campus

The WMO Global Campus Feasibility Study has been possible through the collaboration and contributions of many WMO Members. NOAA NWS, UK Met Office, the COMET Programme, all members of the EC Panel of Experts in Education and Training, WMO RTC Directors, CIMH Barbados, KMA, and many others have especially provided strong assistance to the WMO Secretariat in the study. Long-term resourcing to ensure a vibrant Global Campus will be required, but much effort is being placed in working to keep the required resources low, and the ongoing collaboration high.

### Key achievements

1. Interventions through cooperation with development partners and institutions
* Forecast competency

WMO has made arrangement with the China Meteorological Administration to host its fellows who are interested in enhancing their forecast competency after graduation. CMA hosts these fellows for up to four months on an annual basis immediately after graduation before they return to their home country. This experience has proved to be of great help to the beneficiaries.

As an operational attachment, NOAA hosted about 24 fellows through US VCP funds each year in recent years. The NOAA’s four-month Tropical Desk for Latin America and African Desk, as well as its Pacific Desk, play a key role in training operational staff of National Weather Service staff. NOAA also supports WMO Members development of their forecast competencies through their cooperative agreement with the COMET Programme, which serves over 145,000 international registered users from over 190 countries with its 800 hours of online learning resources. Environment Canada, Meteorological Service of Canada also sponsors the development of new resources and hosting courses each year. NOAA and MSC also serve WMO Members by sponsoring translations of many of these resources into Spanish and French. The COMET/UCAR RANET programme also has conducted training events in over 50 countries to support weather observations and early warning systems. Finally, NOAA hosts hurricane forecast training via its week-long hurricane attachment programme, at Miami, USA (approximately 4 persons per year) and its RA IV Workshop on Hurricane Forecasting and Warning, held in Miami, Florida, USA, in cooperation with WMO TCP/WDS (8 RA IV participants supported through the ETR Office in 2016).

* Instrument maintenance and calibration course

In the last four years, the contributions made by Canada and Norway to the WMO GFCS enabled the mounting of courses on instrument maintenance and calibration in China, India, Barbados Kenya, Morocco and Fiji, with experts from RA I, RA II, RA III, RA IV, and RA V as beneficiaries.

* Research

Experts from a number of countries had the opportunity to benefit from short-term attachment up to six months at a time, in Kyoto University, Japan, for training under Kyoto University’s Global Centres of Excellence (GCOE) Programme on “Sustainability/Survivability Science for a Resilient Society Adaptable to Extreme Weather Conditions”. The programme focuses on adaptation to climate change, extreme weather phenomena such as cyclones, storms, floods, droughts, and sea level rise, and subsequent water-related hazards that seriously affect people and societies around the world.

Starting from 2013, experts are also invited to ECMWF for a research secondment. So far two experts from developing countries have benefited.

WMO fellows in the University of Reading have a chance to attend an annual students conference to expose to a wider scientific and student community to help boost their networking with other peers.

WMO fellows in China’s Nanjing University of Information Science and Technology and Hohai University now can attend the annual International Seminar on Climate System and Climate Change (ISCS) sponsored by the China Meteorological Administration (CMA) and other development agencies thanks to the cooperation of Beijing Climate Centre (BCC)/CMA with WMO. Instructed by top level international climatologists and experts on related fields, the two-week summer school widens views of young scientists and students to face international challenges on climate and climate change, enhance their research ability and strengthens academic exchanges.

* Other Member support for meteorology, hydrology, and climate

Many RTCs and other training centres provide substantial support to developing countries for fellowships and short-term training. This support is in the form of waiving tuition fees, local expenses, and in some cases air ticket support. RTCs in Argentina, China, Egypt, India and the Russian Federation provided support to fellowships through waiver of tuition fees. China, Islamic Republic of Iran, Israel, Italy, Republic of Korea, Philippines, Peru, Turkey and Qatar are each able to provide support to participants through national or institutional sources. Many other providers also support WMO Members through generous support programmes, including MeteoFrance, the UK Met Office, UNESCO-IHE in Delft, Netherlands, and the Lebniz Universitate of Hannover.

1. Coordination of management practices

It is broadly understood that development of management capacity is not done through one avenue. Aside from the basic education that is acquired by managers, there is no doubt that the primary responsibility rests on various entities to put in place machinery for ensuring that an appropriate framework is put in place for enabling adequate management skills and practices. However, given the need to harmonize a number of activities at the international level, share experiences that matter, and also in light of the tradition of cooperation between Members, WMO has a number of activities in place in support capacity development on management of meteorological and hydrological services.

The ongoing activities include preparation and update of guidelines, support to online courses, offer of long-term fellowships and cooperation with China in the coordination of the annual Study Tour of Permanent Representatives and Senior Managers, inter alia, as a way of exchanging views and experiences on management issues. As WMO and those Members who have participated over the years have seen the great benefit of the China Study Tour, plans are underway to develop a similar activity with another Member on an experimental basis, while others are being encouraged to consider initiating such activities.

In continuation of the WMO initiatives on management training, one-day discussion sessions and exchange of views on management training within regional association sessions have been initiated. The WMO Education and Training Office will also work with the WMO RTCs on how to incorporate management issues into their training curricula and schedules.

1. Continuing education, development of competencies and bringing new science into curricula and support to VLab
* Continuing education

In 2016, the combined RTCs offered 161 short courses addressing continuing education and training needs. Over 2,629 foreign students were served by the RTCs in 2016 for both Fellowships and continuing education (see Annex I).

In addition to diploma programmes, most of the RTCs have been very proactive in developing and delivering courses to address WMO focus areas, including recent courses on weather forecasting, climate services, disaster risk reduction, aeronautical meteorology, and improving weather and climate observations. All RTCs are encouraged to design continuing education courses in concert with the advice of WMO technical programmes, including the WMO competency frameworks, to ensure consistency with their latest guidance.

* Competencies

Over the last four years the WMO technical commissions have been implementing new competency frameworks in many services areas of NHMSs. While the BIP-M, MT, H, and HT describe qualifications achieved most often through university study, competencies are usually developed through training and on-the-job experience.

The competency frameworks that have been approved so far by the WMO Executive Council or Congress, as well as those in development, are listed in Annex IV.

These competency frameworks are expected to aid Members by:

* 1. Promoting high standards and consistency of services;
	2. Assisting in defining job skill requirements in the new areas, such as climate services;
	3. Guiding human resource allocation for developing climate services;
	4. Guiding personnel assessment;
	5. Specifying the contents of courses and other learning opportunities that will develop critical job skills;
	6. Specifying desired learning outcomes, learning activities and learning assessment approaches for training.

All Members countries will benefit from careful study of these frameworks, particularly with the intention of adapting them to the unique service requirements and mandates of their NMHSs. And national and Regional Training Centres should work diligently to meet the education and training needs identified by these frameworks, including the appropriate background knowledge, but also addressing practical skills. Competency-based training will also require better assessment and feedback practices, as well as documentation of competency development.

* Bringing new science into curricula

WMO’s technical programmes work with Members to continually upgrade the level of science and operational practices. RTCs, NMHS training centres, and other education institutions should be aware of these developments by carefully reviewing the published WMO Guides and additional guidance offered to inform the creation of up-to-date courses. One of the goals of the ETR Office is to support this guidance with more direct recommendations for course designs, but to also encourage the RTCs and other training partners to package and share their up-to-date learning resources with other education and training partners in the Region. A principle goal of the WMO Global Campus feasibility study is to develop a shared calendar of course offerings and also a catalogue of learning resources that address recommended practices based on the latest science and good practice.

* Training of Trainers

This year marks the fourth offering of the WMO Online Course for Trainers by the WMO ETR Office, following its conversion to a blended Online/Workshop format in 2014. The online course takes place over nine weeks, with 6-8 hours per week of required effort. It builds skills and knowledge that support development of the WMO Competencies for Training Providers, and offers a transcript stating which competencies and performance components are addressed. Three audiences are addressed: Trainers, Training Managers, and Part-Time Trainers. In three years, a total of 135 certificates of completion have been issued to participants from four WMO Regions. In 2017, the course has 60 participants from RA II and RA V, with a few additional from RA VI. In 2016, the online course was also offered for the first time in Russian and was completed by 39 additional participants. The course is supported by 24 volunteer facilitators from EUMETSAT, Eumetcal, NOAA, Météo-France, ECMWF, EC-MSC Canada, WMO VLab, SMN Argentina, RSHU, CIMH Barbados, INMET Brazil, IPMA Portugal, IMS Israel, MeteoSwiss, BMKG Indonesia, and RTC National Water Academy, Pune, India, most of whom were past participants. The course has been offered in English, Spanish, French, and Russian, and has received strong statements of from participants.

### Partnership and resource mobilization

1. China Scholarship Council (all aspects on meteorology and hydrology, including postgraduate studies)

China is a major destination of WMO fellows. The arrangement for this is based on the Memorandum of Understanding (MoU) between WMO and the Ministry of Education of the People’s Republic of China (MOE-PRC) which was signed in April 2007 for cooperation in the implementation of long-term fellowships in the fields of meteorology and operational hydrology. Up to 15 fellowships for BSc and MSc studies can be awarded each year to candidates from developing countries under the initial agreement. Most candidates are to be selected from African countries, while the remaining will be selected from Least Developed Countries in Asia and Pacific Regions, and Small Island Developing States (SIDS). This MoU is under review to make provision for full coverage of tuition and stipend for 15 fellows by China Scholarships Council (CSC), with WMO’s expenses limited to provision of air ticket and complementary medical insurance, with effect from 2017. A new MoU with the CSC is under review to be signed in 2017.

1. Hohai University, Nanjing, China (hydrology and water resources, with preference for postgraduate studies)

WMO and Hohai University in Nanjing, China have been cooperating under the aegis of an agreement between WMO and the Government of China, signed in 2007, on the training of experts from least developed and developing countries. In order to strengthen this collaboration, a Memorandum of Understanding was signed in May 2014 between the two partners which should provide up to three MSc scholarships per year to the WMO Members, with preference given to nominations from least developed and developing countries. A recently signed agreement with Hohai increased the number of fully funded WMO fellows in that university to 20, with WMO’s expenses limited to provision of air ticket and complementary medical insurance.

1. Nanjing University of Information Science and Technology, Nanjing, China – (Meteorology and doctorate degree)

A Memorandum of Understanding was signed in January 2012 between WMO and the Nanjing University of Information Science and Technology (NUIST) which should provide up to five scholarships per year to the WMO Members, with preference given to nominations from Least Developed and Developing Countries (LDDCs) and Small Island Developing States (SIDS). This agreement, which is specific to NUIST, was negotiated with the university administration in response to the growing requests for fellowships in China. NUIST also gives a rare opportunity, through this arrangement, for fellows to purse PhD scholarships, as that level of studies is not usually supported by WMO. NUIST has given an allowance for an annual intake of ten WMO sponsored fellows, with WMO’s expenses limited to provision of air ticket and medical insurance.

1. France

There is an arrangement between WMO and Météo-France and its training centre, Ecole Nationale de la Météorologie (ENM), to work together in development of competencies of experts from least developed and developing countries. Courses include initial training leading to a diploma, specialized training, vocational training and meteorology and management.

1. Germany

Since late 2009 WMO has been able to support fellows from Africa, Asia and Pacific, Europe and South America to undertake a two-year Masters Programme in Water Resources and Environment (WATENV) at Leibniz Universität Hannover, Germany. A new MoU with the University is under review to be signed in 2017.

1. India

Negotiations are ongoing with the India Meteorological Department (IMD) for development of an agreement on placement of WMO fellows in India. It is expected that IMD will waive tuition and hostel accommodation through the pending arrangement, which will afford opportunity for placement of fellows from least developed and developing countries in India at a cost, of stipend per fellow, to the WMO regular budget fund.

1. Japan (Non-degree research attachment)

There is an informal arrangement with the Disaster Prevention Research Institute (DPRI), Kyoto University to fully fund 1-3 fellows nominated on an annual basis for a research and attachment programme at the Institute. All expenses are paid by DPRI. A MoU is under view to be signed in 2017.

1. Rep. of Korea

WMO entered into an agreement with Ewha Womans University in May 2012 to jointly promote education of women in meteorology. Under this arrangement, EWU provides up to three scholarships per year for study in EWU master’s programmes to fellows through WMO.

1. Russian Federation

The Government of the Russian Federation annually offers assistance for people from other countries to study at the Russian State Hydrometeorological University (RSHU) in the Russian Federation in such fields as Meteorology and Hydrology but also Ecology, Economics and Management, Oceanography. The Russian Federation authorities fully covers tuition fee.

1. The United Kingdom of Great Britain and Northern Ireland (UK) (Master degree)

There is an ongoing cooperation with the UK Met Office to support fellows from developing countries, on an annual basis, for an MSc programme in Applied Meteorology and Climate with Management, Department of Meteorology. The UK makes substantial contribution through the UK VCP Trust Fund toward implementation of this activity.

1. UNESCO-IHE Institute for Water Education, Delft, Netherlands (Master degree)

There is an existing cooperation with UNESCO-IHE Institute for Water Education in Deft, Netherlands, on placement of fellows for an MSc degree in Hydrology and Water Resources and Hydraulic Engineering, etc. The Institute waives tuition fee for WMO nominated fellows of up to three each year. A new MoU with the University is under review to be signed in 2017.

1. USA (skills enhancement training)

In cooperation with WMO, the National Oceanic and Atmospheric Administration/National Weather Service (NOAA/NSW), supports fellows from developing countries to acquire skills at the National Centre for Environmental Prediction (NCEP) International Desks. Training emphasizes the understanding of atmospheric dynamics and the application of numerical model guidance for the generation of quantitative precipitation forecast products, sub-seasonal and climate forecasts. It also applies, as appropriate, the WMO competencies standards for general forecasters. All expenses are paid by the USA VCP trust fund.

***(m) AEMET***

AEMET, through the framework of CIMHET and funding by the AEMET trust fund and the Spanish Agency for International Development Cooperation (AECID), has in 2016 conducted six short-course training activities on air quality monitoring and forecasting, hydrological forecasting, agrometeorology, satellite meteorology, climate change regionalized scenarios and climatic data management, that have benefitted approximately 120 students in RA III and RA IV. In addition, they have completed the first edition of a blended BIP-M course, which included a 12-month online phase and a 2-month residence phase that took place in Madrid, graduating 12 students. In addition, AEMET has trained Mexican instructors to teach meteorological observers, and contributed experts to many WMO-sponsored courses.

### Gaps and challenges

The WMO RTCs were established on the basis of the need to fill the gaps in training facilities at regional level, and they have all been working in various ways to meet that objective. With the support of Members, and particularly their host governments, RTCs remain important partners of the WMO Education and Training Programme in the development and implementation of its training activities at national, regional and international levels. As expected, mode of operation and level of delivery of the RTCs in the Region depend on the primary goal of their parent institution, the level of support they receive from their governing body, other resources available to them, cost of procuring training by potential beneficiaries, catchment population, language consideration, their outreach and to a certain extent their relationship with WMO, such as funds available for co-funding. Summaries of the profiles and recent activities of RTCs are attached as Annexes I and II to this report.

As part of the ongoing effort to refocus WMO support to and cooperation with the RTCs and enhance regional delivery and network among institutions at regional and global levels, a plan is underway to promote exchange of experts between the RTCs as a way of enhancing cooperation between them. Under the proposed plan, WMO is facilitating the exchange programme through the Education and Training Office for experts who are interested in teaching and research as well as in participating in WMO activities outside their home country. While the nominee will be referred to as a WMO Expert, the role of WMO will be limited to the process of screening, selection and facilitation of a bilateral contractual arrangement between the expert and the host institutions. The Secretary-General has invited interested Members to: (a) provide information on the area of specialization in which experts are needed; and (b) indicate the duration for which they intend to host the expert.

### Status of the WMO Regional Training Centres (RTCs)

1. Education and Training Activities of WMO RTCs in 2016

Thirty RTCs/Components, out of 39, have submitted their 2016 annual reports as of 23 March 2017. Based on these annual reports, a total number of 2,629 participants have benefitted from 316 courses organized by WMO RTCs in 2016. The table below shows the overall figures and a more detailed table is provided in Annex I.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2016** | **Courses** | **Female** | **Male** | **Participants** |
| Short-term | 161  |  355 | 955 | 1,310 |
| Long-term | 111  | 292 | 528 | 820 |
| DL Courses | 44  | 235 | 264 | 499 |
| Total | 316  | 882 | 1,747 | 2,629 |

According to the reports, almost 50% of the international participants were trained in short-term courses (up to 1 month length), 31% have received long-term courses (longer than 1 month) and 19% of the total international participants was in Distance Learning (DL) courses. Resident participants increased 16% from 2015, while distance learning participants increased 30% from 2015.

The reports show that gender balance is maintained more in distance learning courses (47% female), while females in long-term courses were 36% and 27% in short-term courses.

1. Status of the Reviews of WMO RTCs

The EC Panel of Experts on Education and Training (EC Panel) reviewed the RTCs in Argentina, Barbados, Islamic Republic of Iran and Nigeria in 2016; Regional Association II reviewed the RTCs in China, India, Qatar, Republic of Korea and Uzbekistan in 2017; and Regional Association IV reviewed the RTCs in Barbados and Costa Rica in 2017. Recommendations made by the EC Panel (with acknowledgement of the PR and relevant regional association) and the Regional Associations II and IV are presented in EC-69/Doc. 10.1(3).

The EC Panel are scheduled to complete reviews of the RTCs in Algeria, Costa Rica and Philippines in 2017 or early 2018; and, as soon as possible, the RTCs in Angola, Egypt, Kenya and Madagascar in 2018. The EC Panel will consider reviews of these RTCs in its next meeting in March 2018 and will make recommendations to EC-70 accordingly.

Regional Associations V and VI will review the RTCs in Indonesia, Israel, Italy, Philippines, Russian Federation and Turkey during their forthcoming sessions and the recommendations made will also be brought to EC-70 for decision. A table summarizing the review status of the RTCs is provided in Annex II.

### Gender parity

An increasing importance is being given to higher education for female professionals so that women in developing countries are properly represented and fully integrated into the decision-making process regarding issues related to weather, water and climate. It is in this regard that WMO entered into an agreement with Ewha Womans University in May 2012 to jointly promote education of women in meteorology. This opportunity is exclusively open to women, and it has proved to help in the development of research capability of many experts in least developed and developing countries. This targeted placement of female fellows notwithstanding, special attention is being given to selection of suitable female candidates during routine award process.

### Survey on education and training needs (preliminary analysis)

The Education and Training (ETR) Office conducted a survey on human resources status and education and training needs of NMHSs in 2016 and early 2017, which was completed by 80.1% of the Members (153, out of191). The participation rate was much higher than a similar survey conducted in 2006 which was completed by only 50.8% Members (95, out of 187).

According to the responses received, 19,153 experts are expected to be trained in 2017, and Members expect 1,156 experts to be trained through the support of WMO. This exceeds the numbers that can be supported by WMO regular budget.

RA I has the highest expectation of support from WMO with 518 experts, followed by RA II (258), RA III (135), RA VI (96), RA IV (87), and RA V (62) respectively.

Weather forecasting training is the top priority in all Regions. WMO priority areas are well reflected, even if not directly mentioned, particularly the GFCS (climate services, agrometeorology, hydrology), WIGOS (instruments and observations, calibration, IT), aviation (forecasting and observations), and Polar and High Mountain regions (climate services). Management and administration skills ranks high in many Regions.

### Conclusions and recommendations

Based on a series of interactions with Members, experts and development partners, the following have been identified as issues of priority:

1. Development and implementation of appropriate competency frameworks and augmentation of existing curricula with new science and technology issues;
2. Continuous education, enhancement of research capabilities to keep track with developments in science and technology research;
3. Broadening of partnerships with organizations, agencies and resource mobilization for formal and continuous education;
4. Fellowships for the education of future generation of meteorologists and hydrologists to boost succession management endeavours;
5. Embedding of education and training as critical elements in the management and modernization of NMHSs;
6. Promotion of research capability through stronger connections to WMO research programmes, graduate level fellowships and personnel exchanges;
7. Exchange of experience and competencies through exchange of human resources;
8. Enhancement of capacity of RTCs to deliver learning opportunities to meet the broader regional education and training needs;
9. Participation in the developing WMO Global Campus, in terms of sharing resources, information on upcoming events, and collaboration in education and training projects with partner institutions;
10. Need to support careers of the female gender in meteorology and hydrology;
11. Resource mobilization in support of national needs and institutional development.

The Regional Training Centres are required to continue to play various important roles in promoting the delivery of priority areas on education and training in the Regions. In this regard, it is important for them to get as much support and possible from their respective host countries. It is also necessary to requests RTCs to ensure that they all:

1. Align their courses along the lines recommended in WMO–No.1083 - *Manual on the Implementation of Education and Training Standards in Meteorology and Hydrology*;
2. Send their annual major reports and plans for their course offerings on a regular basis;
3. Broaden the focus of their activities in the areas of management and application of meteorological and hydrological knowledge to socioeconomic development;
4. Work more closely with other WMO centres such as the Regional Climate Centres (RCCs) and Regional Instrument Centres (RICs) and with scientific and research institutions in the areas of education and training;
5. Aim at continuous improvement of their approach to delivery of education and training activities, especially by taking into account relevant information provided by WMO.

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Annexes: 6

**Annex I: Trainees served by the WMO Regional Trainees Centres (RTC) in 2016**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Country** | **RTC/Component** | **Long-term Courses** | **Short-term Courses** | **DL Courses** |
| **Courses** | **Int. Participants** | **Courses** | **Int. Participants** | **Courses** | **Int. Participants** |
| **Nr.** | **Total** | **F** | **M** | **Nr.** | **Total** | **F** | **M** | **Nr.** | **Total** | **F** | **M** |
| Algeria | IHFR | 3 | 125 | 50 | 75 | 1 | 60 | 20 | 40 | 0 | 0 | 0 | 0 |
| Argentina | UBA | 3 | 12 | 4 | 8 | 2 | 23 | 8 | 15 | 2 | 1 | 0 | 1 |
| Argentina | SMN | 0 | 0 | 0 | 0 | 5 | 18 | 9 | 9 | 3 | 74 | 22 | 52 |
| Barbados | CIMH | 6 | 55 | 31 | 24 | 5 | 125 | 55 | 70 | 5 | 75 | 33 | 42 |
| China | NUIST | 3 | 60 | 3 | 57 | 11 | 247 | 80 | 167 | 0 | 0 | 0 | 0 |
| China | CMATC | 1 | 2 | 0 | 2 | 4 | 64 | 17 | 47 | 3 | 43 | 12 | 31 |
| Egypt | EMA | 1 | 0 | 0 | 0 | 16 | 12 | 2 | 10 | 0 | 0 | 0 | 0 |
| India | NWA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Indonesia | BMKG | 4 | 0 | 0 | 0 | 7 | 26 | 10 | 16 | 0 | 0 | 0 | 0 |
| Iran, Islamic Republic of | IRIMO | 2 | 3 | 0 | 3 | 11 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Israel | PTCAM | 0 | 0 | 0 | 0 | 1 | 23 | 7 | 16 | 0 | 0 | 0 | 0 |
| Italy | IBIMET | 0 | 0 | 0 | 0 | 1 | 23 | 9 | 14 | 1 | 29 | 11 | 18 |
| Kenya | IMTR | 6 | 19 | 4 | 15 | 5 | 229 | 31 | 198 | 2 | 16 | 1 | 15 |
| Kenya | UONBI | 10 | 31 | 11 | 20 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 1 |
| Madagascar | ESPA | 2 | 15 | 3 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Madagascar | ENEAM | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Niger | EAMAC | 6 | 107 | 10 | 97 | 9 | 123 | 17 | 106 | 0 | 0 | 0 | 0 |
| Nigeria | MRTI | 4 | 7 | 3 | 4 | 6 | 25 | 2 | 23 | 0 | 0 | 0 | 0 |
| Nigeria | FUTA | 4 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Peru | UNALM | 1 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Philippines | PAGASA | 1 | 4 | 0 | 4 | 15 | 34 | 15 | 19 | 0 | 0 | 0 | 0 |
| Philippines | UP | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Qatar | QAC | 7 | 6 | 1 | 5 | 4 | 23 | 4 | 19 | 0 | 0 | 0 | 0 |
| Republic of Korea | KMA | 7 | 0 | 0 | 0 | 32 | 60 | 40 | 20 | 0 | 0 | 0 | 0 |
| Russian Federation | ATI | 0 | 0 | 0 | 0 | 4 | 23 | 19 | 4 | 3 | 108 | 94 | 14 |
| Russian Federation | RSHU | 22 | 330 | 160 | 170 | 5 | 9 | 6 | 3 | 9 | 102 | 42 | 60 |
| Russian Federation | MGMTEH | 3 | 24 | 19 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| South Africa | SAWS | 6 | 7 | 2 | 5 | 8 | 54 | 11 | 43 | 4 | 50 | 20 | 30 |
| Turkey | TSMS | 0 | 0 | 0 | 0 | 9 | 108 | 22 | 86 | 0 | 0 | 0 | 0 |
| Uzbekistan | THMPC | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GRAND TOTAL** | **111** | **820** | **292** | **528** | **161** | **1,310** | **355** | **955** | **44** | **499** | **235** | **264** |

\_\_\_\_\_\_\_\_\_\_**Annex II: Review Status of the WMO Regional Trainees Centres (RTC) in 2016**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Country** (Nr. of Components) | **Recognition** | **Review History** | **EC Panel ReviewRecommendation** | **RA ReviewRecommendation** | **EC/CgReconfirmation** |
| **RA I** | Algeria | 1973 (EC-25) | May 2005 (1st) | 2017 | October 2018 | EC-70 |
| Angola | 1982 (EC-34) | July 2006 (1st) | 2018 | October 2018 | EC-70 |
| Egypt | 1968 (EC-20) | February 1999 (1st)November 2008 (2nd) | 2018 | October 2018 | EC-70 |
| Kenya (2) | 1965 (EC-17) | January 2002 (1st)October 2009 (2nd) | 2018 | October 2018 | EC-70 |
| Madagascar (2) | 1982 (EC-17) | September 2005 (1st)November 2009 (2nd) | 2018 | October 2018 | EC-70 |
| Niger (2) | 1975 (Cg-7) | February 2002 (1st)November 2014 (2nd) | - | October 2018 | EC-70 |
| Nigeria (2) | 1967 (EC-19) | November 2005 (1st) | Ongoing!28-30 June 2016 (2nd) | October 2018 | EC-70 |
| South Africa | 2011 (Cg-16) | NOT REVIEWED YET | - | October 2018 | EC-70 |
| **RA II** | China (2) | 1993 (EC-45) | October 2003 (1st)April 2011 (2nd) | - | February 2017 | EC-69 |
| India (3) | 1986 (EC-38) | December 2002 (1st)March 2011 (2nd) | - | February 2017 | EC-69 |
| Iraq | 1976 (EC-28) | NOT REVIEWED YET | - | February 2017 | EC-69 |
| Islamic Republic of Iran | 1993 (EC-45) | October 2006 (1st) | 13-14 August 2016 (2nd) | February 2017 | EC-69 |
| Qatar | 2010 (EC-62) | NOT REVIEWED YET | - | February 2017 | EC-69 |
| Republic of Korea | 2015 (Cg-17) | NOT REVIEWED YET | - | February 2017 | EC-69 |
| Uzbekistan | 1994 (EC-46) | October 2002 (1st)April 2011 (2nd) | - | February 2017 | EC-69 |
| **RA III** | Argentina (2) | 1965 (EC-17) | March 2000 (1st)May 2009 (2nd) | 15-17 November 2016 (3rd) | December 2018 | Cg-18 |
| Brazil | 1975 (Cg-7) | September 2006 (1st)February 2015 (2nd) | - | December 2018 | Cg-18 |
| Peru | 2011 (Cg-16) | NOT REVIEWED YET | - | December 2018 | Cg-18 |
| Venezuela, Bolivarian Republic of | 1975 (EC-27) | March 2005 (1st) | 2017 | December 2018 | Cg-18 |
| **RA IV** | Barbados | 1975 (Cg-7) | April 2000 (1st)March 2009 (2nd) | May-December 2016 (3rd) | April 2017 | EC-69 |
| Costa Rica | 1968 (EC-20) | April 1999 (1st)March 2008 (2nd) | 2017 | April 2017 | EC-69 |
| **RA V** | Indonesia (2) | 2012 (EC-64) | NOT REVIEWED YET | - | December 2017 | EC-70 |
| Philippines (2) | 1984 (EC-36) | April 2002 (1st)November 2010 (2nd) | 2017 | December 2017 | EC-70 |
| **RA VI** | Israel | 1994 (EC-46) | February 2007 (1st)December 2013 (2nd) | - | September 2017 | EC-70 |
| Italy | 1983 (EC-35) | November 2004 (1st)November 2013 (2nd) | - | September 2017 | EC-70 |
| Russian Federation (3) | 1994 (EC-46) | June 2004 (1st)June 2011 (2nd) | - | September 2017 | EC-70 |
| Turkey | 1999 (EC-51) | April 2004 (1st)December 2011 (2nd) | - | September 2017 | EC-70 |

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**Annex III: Awarded participants for co-sponsored short courses in 2016 by Member**

|  |  |
| --- | --- |
| **Climate Change and Agriculture, Shefayim, Israel, 4-14 April 2016** | **6** |
| British Caribbean Territories (1), Burundi (1), Ethiopia (1), Ghana (1), Myanmar (1), The former Yugoslav Republic of Macedonia (1) |
| **Global Framework for Climate Services (GFCS), Beijing, China, 5-15 April 2016** | **4** |
| Bahamas (1), Bhutan (1), Thailand (1), United Republic of Tanzania (1) |
| **Observing Systems, Ankara, Turkey, 11-15 April 2016** | **0** |
| **Weather Radar Data Utilization for Meteorological Services, Seoul, Republic of Korea, 17 April-7 May 2016** | **0** |
| **Meteorological Communication, Data Processing, and TURKMETCAP, Alanya, Turkey, 25-29 April 2016** | **1** |
| Kazakhstan (1) |
| **Nowcasting Techniques on Thunderstorm and Severe Convection, Beijing, China, 23 May-3 June 2016** | **2** |
| Bhutan (1), Pakistan (1) |
| **Application of Meteorological Satellite Products, Beijing, China, 20 June-1 July 2016** | **3** |
| Malaysia (1), Myanmar (1), Pakistan (1) |
| **Weather Forecasting for Operational Meteorologists, Seoul, Republic of Korea, 11-29 July 2016** | **2** |
| Indonesia (1), Thailand (1) |
| **Agrometeorology, Beijing, China, 12-23 September 2016** | **3** |
| Ethiopia (1), Guinea (1), Uganda (1) |
| **Basics of Calibration, Ankara, Turkey, 3-7 October 2016** | **2** |
| Ukraine (1), Uzbekistan (1) |
| **Aeronautical Meteorology Services, Beijing, China, 24 October-4 November 2016** | **4** |
| Iran, Islamic Republic of (1), Mozambique (1), Papua New Guinea (1), Swaziland (1) |
| **Workshop on Aviation Meteorology for Forecasters, Doha, Qatar, 6-10 November 2016** | **4** |
| Bhutan (1), Lao People's Democratic Republic (1), Pakistan (1), Philippines (1) |
| **Radar Meteorology, Nanjing, China, 14-25 November 2016** | **5** |
| Armenia (1), State of Palestine (3), Uganda (1) |
| **Tropical Cyclones, Nanjing, China, 21 November-2 December 2016** | **4** |
| Mozambique (1), Papua New Guinea (1), Philippines (1), Yemen (1) |
| **Use and Interpretation of Mesoscale NWP for High-Impact Weather Forecasting, Hong Kong, China, 5-9 December 2016** | **2** |
| Argentina (1), Kazakhstan (1) |
| **Grand Total** | **42** |

**Annex IV: WMO Competency Frameworks**

1. Aeronautical Meteorological forecasters (CAeM);
2. Aeronautical Meteorological Observers (CAeM);
3. Marine Weather Forecasters (JCOMM);
4. Education and Training Providers (EC Panel of Experts on ETR);
5. Climate Services personnel (CCl);
6. WIS (CBS);
7. Public Weather Forecasters (CBS):
	1. PWS Forecaster;
	2. Weather Broadcasters and Communicators;
	3. Advisors engaged in user interaction, media liaison and outreach activities;
	4. Disaster prevention and mitigation weather advisor;
	5. Innovation, improvement, and deliver of meteorological and hydrological services and products;
8. Tropical Cyclone Forecasting (each Region has its own, with a global framework to be developed);
9. Observations (CIMO under review):
	1. Meteorological Observations;
	2. Observing Programme and Network Management;
	3. Instrument Calibration;
	4. Instrumentation (installation and maintenance);
10. Hydrology (CHy) (in development).

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**Annex V: WMO fellowship summary in 2016**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **RA** | **Request by Region** | **Awarded by Region** | **Awarded by Region%** | **Female request by Region** | **Female request by Region%** | **Female awarded by Region** | **Female awarded by Region by request%** |
| I | 113 | 44 | 39% | 22 | 19% | 10 | 45% |
| II | 20 | 9 | 45% | 13 | 65% | 7 | 54% |
| III | 21 | 14 | 67% | 4 | 19% | 2 | 50% |
| IV | 14 | 7 | 50% | 7 | 50% | 4 | 57% |
| V | 12 | 3 | 25% | 5 | 42% | 2 | 40% |
| VI | 1 | 1 | 100% | 1 | 100% | 1 | 100% |
| Total | 181 | 78 | 43% | 52 | 29% | 26 | 50% |

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**Annex VI: Current fellows by Region and gender**

|  |  |  |  |
| --- | --- | --- | --- |
| **RA** | **Female** | **Male** |  |
| I | 19 | 43% | 74 | 66% | 58% |
| II | 13 | 29% | 8 | 7% | 13% |
| III | 5 | 11% | 15 | 14% | 12% |
| IV | 5 | 11% | 8 | 7% | 8% |
| V | 3 | 6% | 5 | 5% | 8% |
| VI | 0 |  | 1 | 1% | 1% |
| Total | 45 | 111 |  |
| Grand total | 156 |  |

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