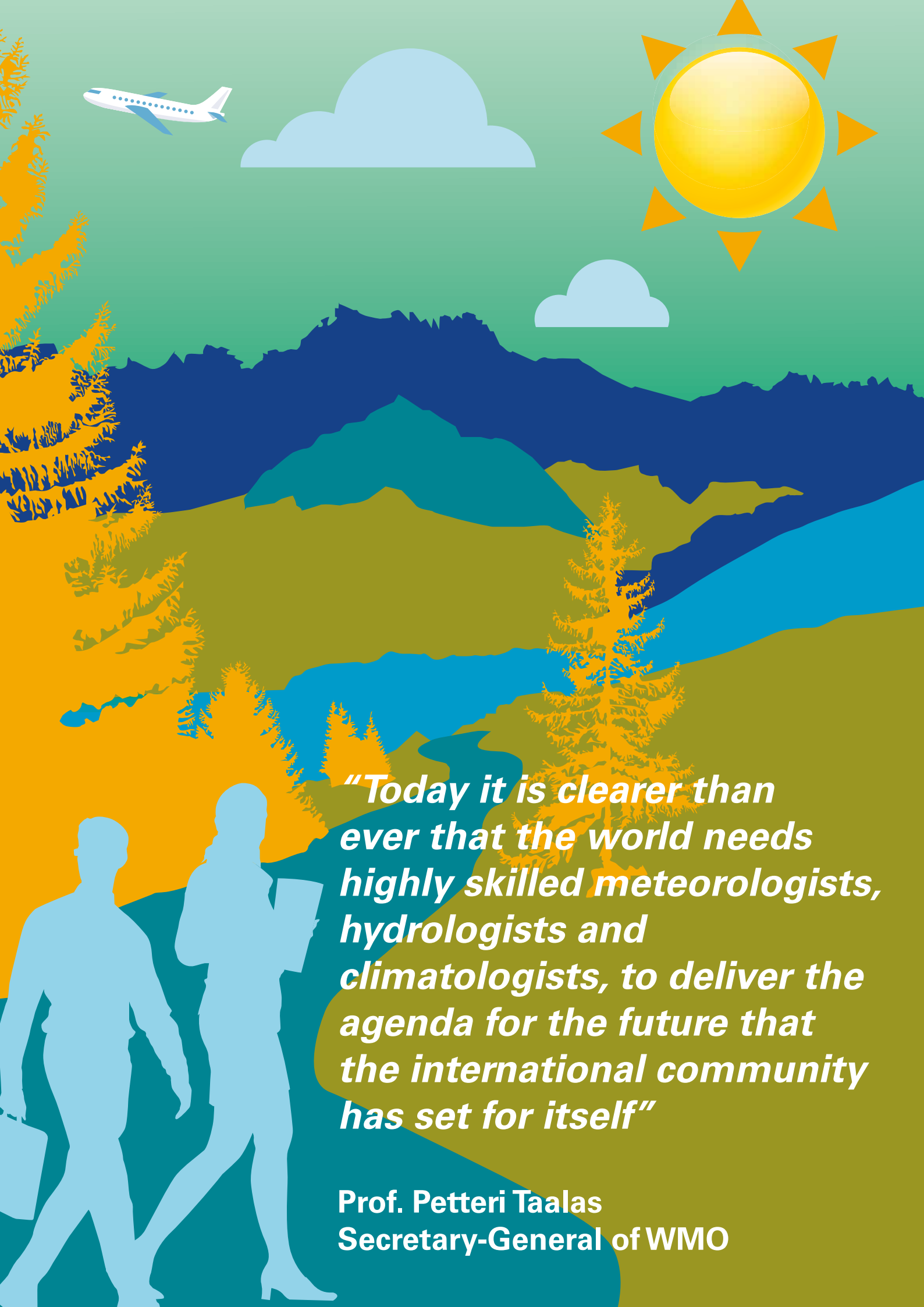




WORLD
METEOROLOGICAL
ORGANIZATION

DEVELOPING METEOROLOGICAL AND HYDROLOGICAL SERVICES THROUGH WMO EDUCATION AND TRAINING OPPORTUNITIES

ETR-25



“Today it is clearer than ever that the world needs highly skilled meteorologists, hydrologists and climatologists, to deliver the agenda for the future that the international community has set for itself”

**Prof. Petteri Taalas
Secretary-General of WMO**

Secretary-General's note

As the authoritative voice of the UN on weather, water and climate, one of the primary roles of WMO is to set global standards for national and international monitoring and prediction of the atmosphere over all timescales, as well as the monitoring and prediction of the water cycle. The work of WMO is critical to the attainment of various internationally agreed development goals. Today it is clearer than ever that the world needs highly skilled meteorologists, hydrologists and climatologists to deliver the agenda for the future that the international community has set for itself. Herein lies the critical importance of the WMO Education and Training Programme (ETRP), as it constitutes an important part of capacity development for experts, managers and individuals who are delivering services within National Meteorological and Hydrological Services (NMHSs) and allied institutions.



1. Global need for skilled human resources for National Meteorological and Hydrological Services

A WMO survey carried out in 2017 identified the following issues related to training needs and priority training areas for NMHSs:

- **Age:** In 67% of respondent Members, 51% or more of the NMHS workforce is 40 years of age or older. For some Regions and Members, losses to levels of human resources due to retirement are expected to be worryingly high. Some Regions are expecting average retirement rates of almost 30% of all staff members. For example, 27% of Members' staff are due to retire in the next five years.
- **Gender:** Only 14% of respondent Members have achieved gender balance in their NMHS workforce. Almost one-quarter (23%) of survey respondents have 20% or fewer women in their NMHS workforce.
- **Capacity strengthening:** There is a serious need for capacity strengthening across all professional areas. Most

Members indicated a need for capacity development for meteorological technicians, meteorologists, climatologists, management staff, and researchers.

- **Training needs:** More than 19 000 people worldwide need training in various professional areas. The following seven areas were indicated by 20 or more respondents as being of priority:
 - (a) Weather Forecasting and numerical weather prediction (NWP)
 - (b) Instruments and Observation
 - (c) Climates Services
 - (d) Agrometeorology
 - (e) Hydrology/Hydrometeorology
 - (f) Management and Administration
 - (g) Atmospheric Sciences and Research



2. Dealing with education and training challenges

Meeting human resources-related needs is often a challenge. Taking contemporary and future needs into account, WMO proposes the following list of actions as a way of dealing with the challenges of human resources capacity development for meteorological and hydrological services:

- (a) The development and implementation of WMO competency frameworks, and an augmentation of existing curricula and learning outcomes with advances in science and technology;
- (b) Continuous education and enhancement of research capabilities to keep pace with developments in science and technology;
- (c) Broadening of partnerships with other organizations and agencies;
- (d) Fellowships for educating future generations of the workforce;
- (e) Embedding education and training as critical elements in the management and modernization of all NMHSs, and in all capacity development projects;
- (f) The promotion of research and operational capacity through stronger connections to WMO research programmes, graduate-level fellowships and personnel exchanges;
- (g) The sharing of experience and competencies through an exchange of human resources, learning resources, and the dissemination of good practices;
- (h) Enhancing the capacity of WMO Regional Training Centres (RTCs) to deliver services in multiple formats to meet regional needs;
- (i) Regular updates of national and regional training needs analyses;
- (j) Continued emphasis on the WMO Global Campus as a potential mechanism to aid in meeting each of these priorities.



3. Meeting present and future needs through Education and Training

WMO is well equipped to support these needs through its vast network of 60 development partners, national institutions and RTCs. WMO has 28 RTCs with 38 institutions as components, hosted in 28 countries, which provide tremendous support to Members in their capacity development. One of the ETRP's roles is to provide guidelines to the wider education and training community, and to coordinate their activities. When required, qualifications comply with the WMO Basic Instruction Packages (BIPs). Competencies comply, as required, with a series of frameworks related to job tasks that build on the BIPs. This work helps the worldwide education and training community to develop and adapt learning outcomes and competency standards to suit their organizational needs.

In addition to the WMO Education and Training (ETR) Office monitoring their activities through annual reports and consultation on course offerings, a review process is applied to WMO RTCs after every two financial periods (eight years, being two four-year periods). This should ensure relevant training for thousands of professionals every year, especially in developing countries where such individuals are in the highest demand.

(a) Fellowship programme to enhance formal education

The Fellowship Programme has helped those NMHSs that urgently need qualified staff to deliver basic services, and has equipped participants with up-to-date scientific and technical knowledge. The fellowships have enabled suitable staff to advance to positions with greater responsibility, and have added much value to the operations of the NMHSs.

Several fellows have engaged in networking with partners, and have participated in international events such as WMO constituent body meetings, Executive Council expert working groups, and meetings of the IPCC and COP. The Programme has been very supportive of gender equality and is coping well with new demands relating to climate change, disaster risk reduction and other scientific and technical issues.

Impacts of the Fellowship Programme are enhanced when fellows return motivated to their home countries, and when there is favourable career development, knowledge transfer and a conducive working environment. Cost-sharing and cost-effective measures that have long been part of the Programme are thus being reinforced and in-country training deploying the expertise of more developed countries is being encouraged whenever possible.

(b) Continuous Education

There is a strong focus on continuous education and the enhancement of research capabilities to keep pace with developments in science and technology. Not only do they need to keep pace with these advances, but they may also need highly specialized knowledge. More and more, meteorologists have to communicate the potential impact of weather, climate and water hazards in a timely manner to diverse users.

Training takes the form of fellowships; secondments; short, multi-week and multi-year courses; online courses for trainers; and blended-learning courses combining online and on-site activities. It is organized through RTCs, which are often hosted and managed by NMHSs, and through partnerships with leading educational and training institutions worldwide. The RTC could include universities, training centres of NMHSs or other training institutions. Thus, RTCs cover a wide range of education and training from short-term face-to-face courses, to online courses and long term undergraduate or postgraduate degree courses. Each year, WMO organizes courses for instructors of NMHSs, RTCs, and other education and training partners around the world. Thousands of experts are then trained directly by WMO and its RTCs on an annual basis through continuous training activities.

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(c) Leadership and Management of NMHSs

When delivering services, scientific and technical staff at NMHSs should take scientific and technological developments into account. Some of these experts eventually take on management roles for which they might not be fully prepared. Hence WMO is working closely with Members and partners to enhance management and leadership skills within NMHSs. WMO's emphasis on the development of leadership and management skills will bring innumerable benefits.

This programme supports the work of managers by enhancing their human resources management and development skills thereby helping their NMHSs and allied institutions deliver better services for a tangible impact on society through improved governance. Key areas of training are:

- (i) Securing the critical mass of human resources necessary to offer quality services;
- (ii) The provision and maintenance of adequate infrastructure for observations, and data communication and exchange;
- (iii) The identification and management of experts, including their continuous professional development;
- (iv) Understanding and meeting the needs of clients/ service users;
- (v) Dealing with changing political and socioeconomic drivers;
- (vi) Strategies for collaboration with partners and interaction with competitors, nationally and internationally; and
- (vii) Compliance with national policies, and achieving legislative backing for the institution.

The activities being carried out under this intervention are:

- Regional training on leadership and management, targeted at current and potential leaders of NMHSs in all Regions;
- Holding of workshops and dialogue on leadership and management challenges at the margins of WMO meetings and events;
- Development of resources to enhance the work of Permanent Representatives (PRs) of WMO Members and senior managers of NMHSs.
- As part of the leadership training activities, familiarization visits are staged for newly appointed PRs, with the aim of supporting management capability particularly in least developed and developing countries. From a WMO perspective, the visits have proved to be useful for the work of the PRs.

(d) WMO Global Campus Initiative

The recent WMO survey revealed that, for specialized meteorological and hydrological training needs, Members expect that WMO will train an average of 1 200 experts annually. However, with the resources available to it today, WMO can only offer an average of 110 fellowships each year and a similar number of continuing education opportunities. Thus it is necessary to devise other means of meeting the challenge and hence the introduction of the Global Campus initiative.

The WMO Global Campus is an initiative aimed at helping to meet training goals through greater collaborative work between RTCs and other training institutions. A major and important innovation for the use of all Members, the WMO Global Campus is based upon the tried and tested practice of linking existing facilities to create a coordinated, distributed network. An underlying premise is that all interested institutions can contribute to, and benefit from, the proposed networking arrangements.

The WMO Global Campus initiative complements the current work of RTCs and other institutions that provide education and training to WMO Members. It will help the wider community to create and implement standards and best practices, promote products through shared communication mechanisms, share and reuse high-quality learning resources, and foster partnerships that provide capacity beyond what any individual Member could create.

Tangible aspects of the WMO Global Campus include:

- (i) Learning Events Calendar: The calendar is a searchable database of announcements for courses and other related events, and it receives contributions from RTCs and other training providers for use by all Members;
- (ii) WMO Global Campus E-Library: A growing library of learning resources;
- (iii) Quality assurance processes, to ensure that shared materials are up-to-date, of high quality and come from trusted sources;
- (iv) Increased collaboration and sharing; and
- (v) Promotion of new methods of training delivery.

4. Where do I find the rules and regulations governing education and training?

A key publication for all WMO standards and recommended practices can be found in number 2 of the WMO Basic Documents series entitled “*Technical Regulations*”, Volumes I to IV (WMO-No.49). The regulations covering the education, training and competency of personnel involved in the delivery of meteorological, climatological and hydrological services are outlined in Volume I. The WMO Technical Regulations are supported and elaborated by two further groups of publications:

- **Manuals**, which expand upon the information in Volumes I to IV, and may also contain recommended practices further to those contained in their parent volumes; and
- **Guides**, which do not contain any additional recommended practices but are there to assist organisations as they implement the standards and recommended practices.

The ETR Office maintains several Guides to support the material in Volume I of the WMO Technical Regulations: “*Guide to the Management and Operation of WMO Regional Training Centres and Other Training Institutions*” (WMO-No. 1169); “*Guidelines for Trainers in Meteorological, Hydrological and Climate Services*” (WMO-No. 1114); “*Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology*” (WMO-No. 1083); and “*Guide to Competency*” (WMO-No. 1205). These publications, and more, can be found either in the WMO Library (<https://library.wmo.int/>) under WMO Publications, or at <https://www.wmo.int/pages/>.

Important Considerations

Qualifications and competencies, what is the difference and why do they matter?

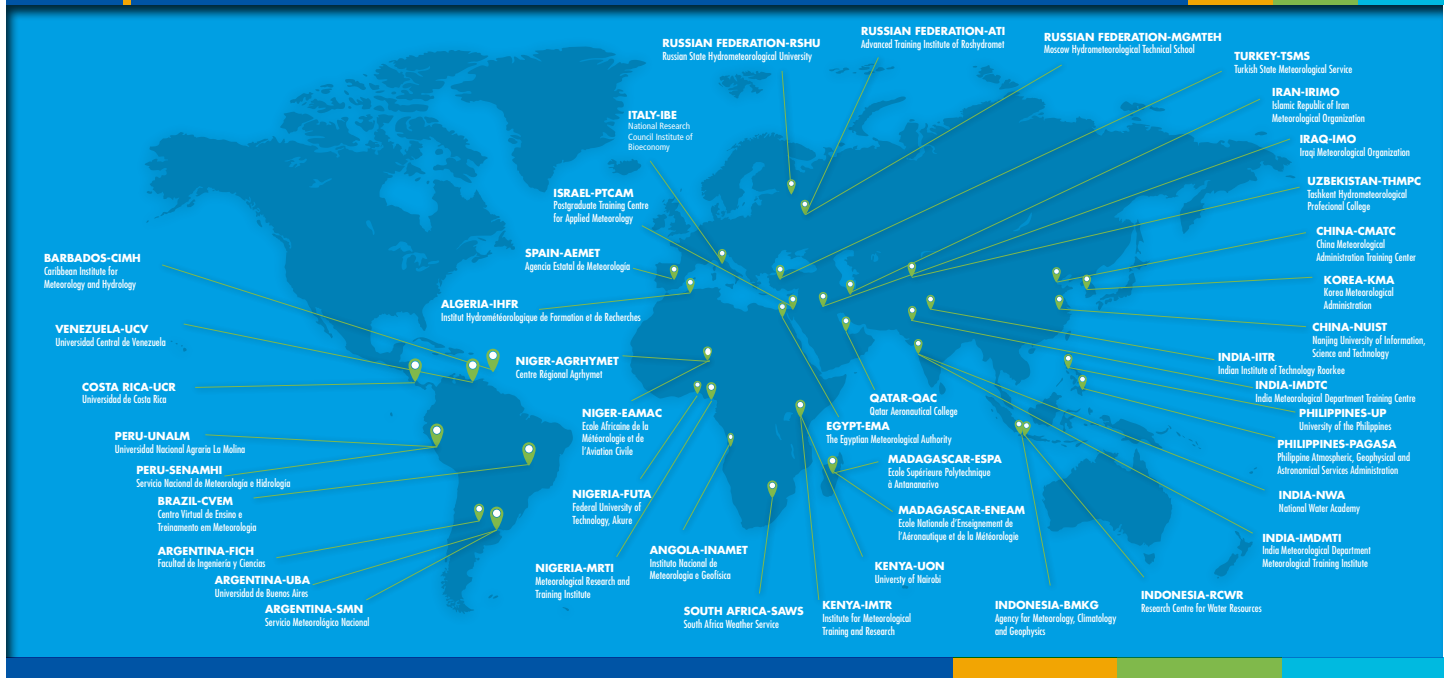
The WMO Technical Regulations refer to two terms related to education and training, “qualifications” and “competencies”. In some languages they mean the same thing, but within WMO they have two different but complementary uses.

Qualifications: Qualifications refer to the minimum core knowledge, usually obtained through education, to enter a profession. They are typically linked with academic achievement at post-secondary school level, and nationally may form the basis for recruitment, salary and career advancement.

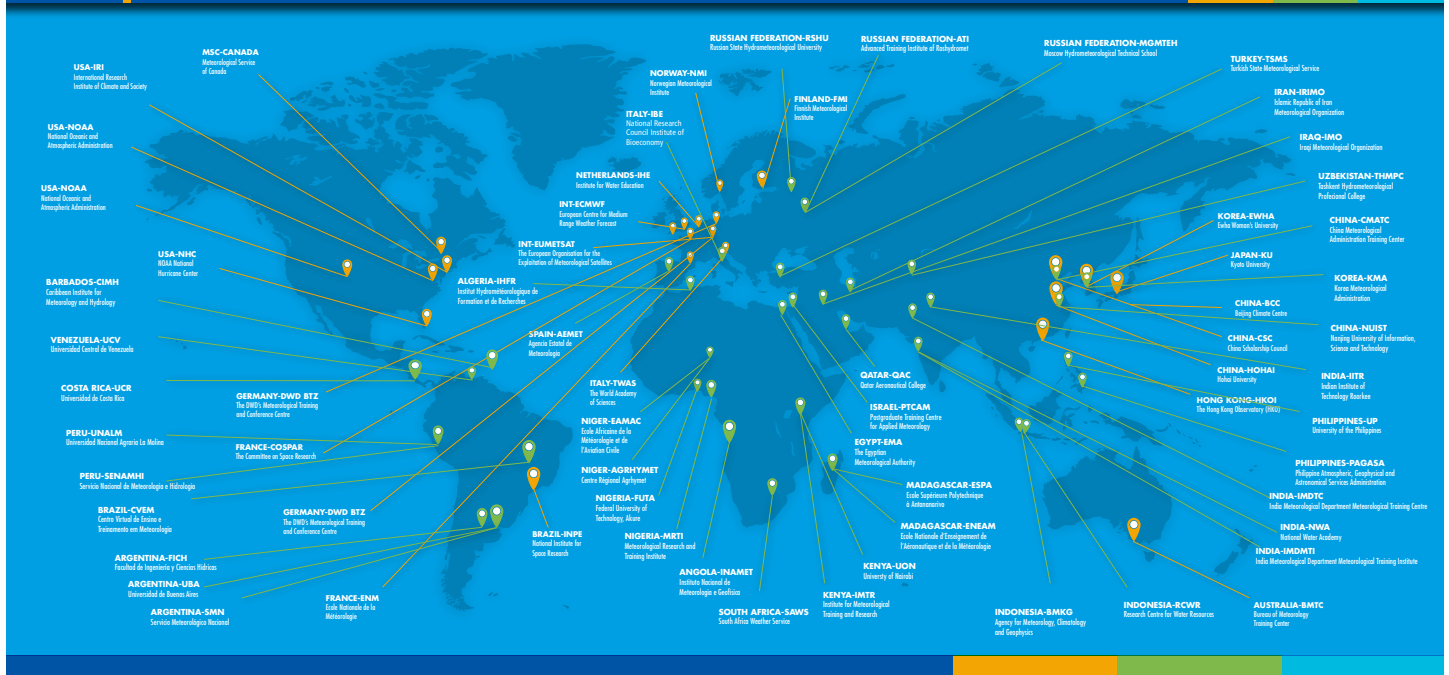
Holding a qualification in meteorology will not necessarily make an individual competent at being able to provide, for example, aeronautical meteorological services. Similarly, being rated as competent as a marine meteorological forecaster will not necessarily ensure that an individual is academically qualified as a meteorologist. With the exception of personnel involved in aeronautical meteorological forecasting, there are no international mandatory qualifications for personnel involved in the provision of weather, water or climate services. However, at a national level, there may be qualification requirements imposed by the employing organisation, the national public service or other government agency.

For the case of aeronautical meteorological forecasting, the academic requirement is a course of study that meets the learning outcomes in the BIP-M as described in WMO-No. 49, Vol I, and further elaborated in WMO-No. 1083. The ETR Office has provided a flow-chart, translated into all WMO languages, to assist Members in complying with this qualification requirement.

WMO REGIONAL TRAINING CENTRES



WMO REGIONAL TRAINING CENTRES
ADDITIONAL WMO EDUCATION AND TRAINING PARTNERS



Competencies: Competencies refer to the requisite skills, knowledge, and behaviours necessary to perform tasks in the fulfilment of a job.

In 2011, the Sixteenth World Meteorological Congress encouraged the WMO Technical Commissions to develop personnel competency frameworks for inclusion in WMO Technical Regulations, to complement existing standards and recommended practices. Members were then encouraged to adapt and implement the competency frameworks, as part of their Quality Management Systems to ensure that they are correctly documented and subject to review over time. The WMO competency frameworks were created to ensure a minimum global consistency in services, and thus they are overseen by WMO Technical Commissions and nationally by each NMHS.

The WMO competency system is tiered to provide a cohesive global framework whilst allowing for national and organisational differences. The competency requirements are typically service-based; see <https://www.wmo.int/pages/prog/dra/etrp/competencies.php> for a list of the approved competency frameworks. The top-level competency statements contained in WMO-No. 49, Vol. I are broad to allow for the differing service requirements, capabilities and demands in the 192 WMO Member States.

Descriptions, performance criteria, background skills and knowledge, and regional variations to the top-level competency statements can be found in the Manuals or Guides maintained by the various WMO Technical Commissions. They are to be published in a future compendium to the WMO Guide to Competency (WMO-No. 1205).

When an NMHS or another provider implements one of the WMO competency frameworks, the process is to take the descriptions, performance criteria and background skills and knowledge, and adapt them to suit national requirements. **It is important to ensure that the reasons and rationale for adaptation are well documented.** The WMO Guide to Competency (WMO-No. 1205) provides Members with a recommended step-by-step approach on the introduction of Competency Frameworks to an organisation.

The PR of a country with WMO has a key role in implementing competency frameworks and qualifications. As that Member State's representative with WMO, the PR's approval is critical for the many decisions that the NMHS or other provider will need to make to fit the educational requirements into specific national circumstances.



Categories and classes, what is the difference, and do they matter?

Readers familiar with WMO education and training publications over the years will be aware of the terms WMO Class I to IV, as well as the categories of personnel “Meteorologist”, “Meteorological Technician”, and their hydrological equivalents “Hydrologist” and “Hydrological Technician”. The WMO Classes I to IV for personnel were introduced fifty years ago when the first edition of WMO-No. 258 was produced. However, WMO-No. 258 and all its editions have now been fully superseded by WMO-No. 1083.

The terms Meteorologist/Hydrologist and Meteorological Technician/Hydrological Technician were introduced in 2002 with the fourth edition of WMO-No. 258 to replace Classes I to IV. For consistency, the categories Meteorologist/Hydrologist and Meteorological Technician/Hydrological Technician were carried over to WMO-No. 1083 in 2011. Therefore, organizations should no longer be using the defunct terms Class I to IV.

The move to a competency-based system that goes beyond qualifications ensures that organizations employ individuals who are actually able to perform a job, and will continue to be able to do so because of the review cycle of the competency assessments.

Where do I start?

In most cases, the NMHSs or other service providers will already have existing models for the education and training of meteorological, hydrological and climatological personnel. If they do not, or should they wish to check that the model addresses the WMO regulations, a series of points to consider is laid out below. Readers are also encouraged to review the *Guide to the Management and Operation of WMO Regional Training Centres and Other Training Institutions* (WMO-No. 1169), which addresses many of these points.

Education and training occur within an organization principally to ensure that its people are able to carry out the roles of the organization. It takes time to develop and implement changes in education and training systems, particularly if the organization needs to guide a significant number of existing staff through the programme. The organization should try to identify challenges and opportunities on a one-year, five-year and ten-year horizon, starting by reviewing its organizational documents such as:

- Strategic and operational plans to identify the key services that have to be provided, and identify plans for changes

in processes, personnel, government regulation, client requirements, updates to IT systems, etc.;

- Risk Management reviews, to see what risks the organization faces due to poorly trained or poorly educated personnel;
- Staffing profiles, structures, locations and age ranges, to identify current or future potential staffing problem areas.

The organization should then:

- Consult with the heads of the various departments to identify how they see their staffing, education and training requirements changing in the next five or so years;
- Through the ETR Office and other networks, liaise with colleagues in similar countries, to see what challenges and opportunities they are facing;
- Check the education and training requirements against those in the WMO Technical Regulations and other publications, to ensure that the content is consistent with global requirements;
- Document the challenges and opportunities, and discuss them with senior managers to prepare an education and training plan that includes costs and staffing required to meet the organization’s needs. Planning will need to be flexible, as often the organization will not be able to invest as much in training as originally recommended.

These processes are part of an organization-wide “Training Needs Analysis”. The training unit within the organization will need to follow a similar process to ensure that staff numbers, competencies and infrastructure will meet organizational needs. Depending on national circumstances, the training group may not be able to deliver all the education and training itself. In this situation, building strong national and international partnerships with suitable training providers is essential, so the group are still seen to be assisting the organization with its education and training requirements.

Summary

Education and training are key requirements for all NMHSs. The ETR Office within the WMO Secretariat assists Members through advice, the development of publications, the provision of fellowships, coordinating short- and long-term courses with RTCs and other partners, and the provision of assistance and advice to RTCs and other training institutions.

As part of the development of the WMO Global Campus, the WMOLearn website <https://public.wmo.int/en/resources/training/wmolearn> has been created to provide a one-stop-shop for education and training advice.

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