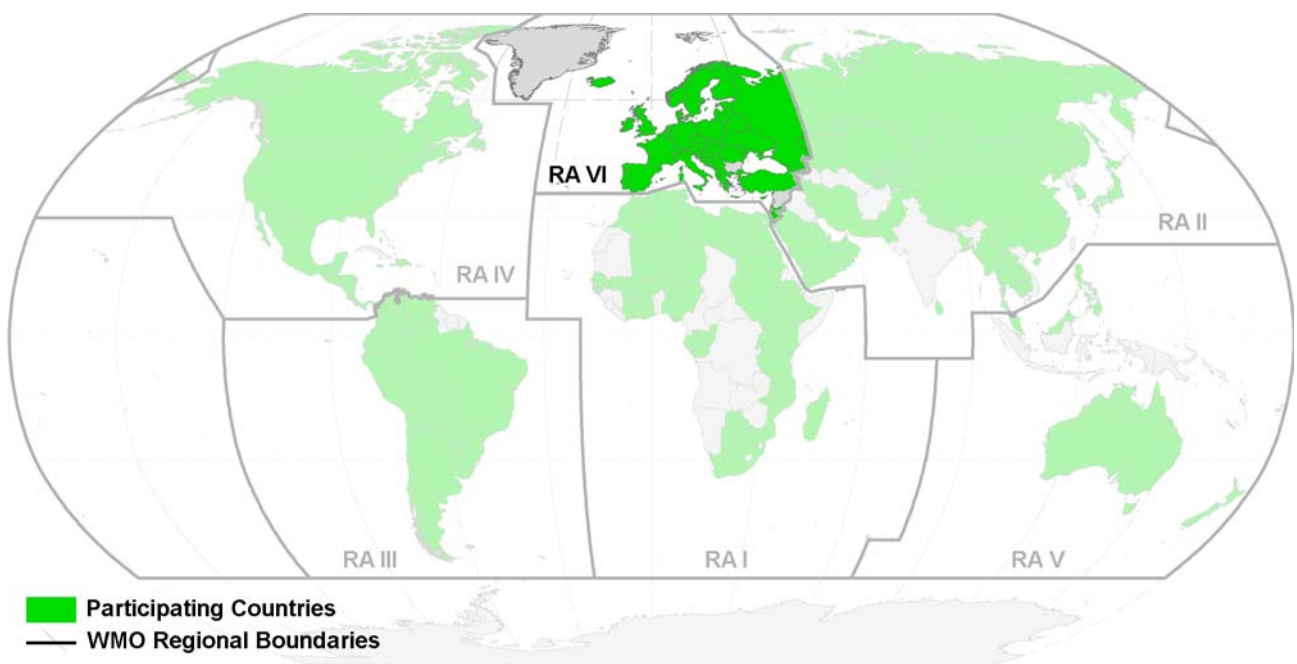


CHAPTER 9



EUROPE

WMO REGIONAL ASSOCIATION VI

9 EUROPE (WMO Regional Association VI)

9.1 Abstract

Survey responses from 44 European NMHSs indicated that virtually all operate observation and telecommunications networks and forecast/warning centres on a round-the-clock basis and most of them have emergency contingency plans in place. However, about half consider that their observing and telecommunications networks are inadequate and most also believe that upgrading their forecasting and warning services would enhance disaster risk reduction. Almost all of them advocate better coordination with nearby NMHSs, Regional Specialized Meteorological Centres (RSMCs) and other stakeholders. Across Europe, NMHS hazard warning programmes are generally in place though not all significant hazards are always addressed. Moreover, competing private sector hazard warning services are present in about a third of the countries. Over half the countries have separate National Meteorological Services (NMSs) and National Hydrological Services (NHSs) and advocate improved coordination between them. Fewer than half of the NMHSs provide value-added services to critical sectors such as land-use planning, development and housing and fresh water supply and, though endorsing the value of such services; many point to their lack of related expertise. Most of them also consider that educational outreach programmes for the media, public and disaster authorities should receive greater emphasis. In addition, many cite needs for additional forecast training and joint training with stakeholders. Most also feel constrained by limited resources, identifying operating budgets and professional staff as particular issues. While most of the 44 NMHSs participate in their national disaster risk coordination committees, at least some feel constrained by inadequate recognition and by a lack of clarity regarding their roles. At sub-regional levels, NMHSs in North-West Europe have, on average, better infrastructures and capacities and are more closely integrated into disaster risk mechanisms. In Eastern Europe, infrastructures and capacities match the regional picture but national coordinating committees are less widely established and NMHSs more often feel constrained by them. Southern European NMHSs, in contrast, have generally weaker than average infrastructures and capacities while coordination with other disaster stakeholders is less well established. The preceding survey results provide a substantive rationale for the following conclusions and recommendations aimed at enhancing European NMHSs' capacities to contribute to disaster risk reduction:

- All European NMHSs should be integrated into their national disaster risk reduction systems. Those who are not already members, particularly some in Eastern and Southern Europe, should seek membership in their national disaster risk coordinating committees. Where necessary, NMHSs should press for clear direction regarding their roles and responsibilities.
- Though most European NMHSs maintain records of the most common hydrometeorological hazards, progressively fewer do so for less frequently occurring ones. Consequently, needs exist to improve data management and archiving systems for hazard data in a considerable number of countries along with associated needs for related training and capacity development.
- A significant number of European NMHSs require capacity development and training in disaster risk applications such as hazard and impact analysis, hazard mapping, risk zone analysis and product customization in order to provide enhanced services for disaster risk reduction.
- Roughly half the European NMHSs consider that their observation networks inadequate; with a few NMHSs not maintaining 24-hourly observational coverage. Similarly, many NMHSs point out deficiencies in their telecommunications systems with one reporting that it does not have 24-hourly telecommunications capability. Therefore, needs exist to upgrade some observation and telecommunications systems in Europe, with particular emphasis on their 24-hourly operation.
- Needs also exist to strengthen many European NMHSs' hazard warning infrastructures and associated capacities. In a few instances the NMHSs do not provide 24-hourly warnings services

and one NMHS does not have forecasting and warning capabilities. These latter NMHSs should be particular targets for upgrading and capacity building initiatives.

- Official warnings of hydrometeorological hazards should emanate from a single competent issuing authority in each country, ideally the NMHS. In some circumstances, they may, nevertheless, benefit from interpretation by civil defence authorities before being widely disseminated.
- Verification programmes for hydrometeorological hazard warnings should be implemented by all European NMHSs to monitor warning accuracy and timeliness, assess improvements in skill, and demonstrate NMHSs' warning capabilities to stakeholders.
- European NMHSs who have not already done so should establish back-up arrangements to maintain services in emergency situations, possibly through partnership agreements with neighbouring NMHS.
- NMHSs should encourage the establishment of national readiness systems within their countries.
- Operational coordination should be improved between NMSs and NHSs in Europe and with neighbouring NMHSs and RSMCs, particularly in relation to issue of hazard warnings.
- European NMHSs should increase emphasis on the provision of enhanced products and services to sensitive economic sectors such as land-use planning, housing and development and water resources. These sectors do not receive special services in about half the countries.
- Most European NMHSs should increase emphasis on education and outreach directed at key stakeholders and the public at large since fewer than half of them currently giving high priority to such activities.
- European NMHSs identify wide ranging needs for support from WMO particularly in relation to technology transfer and capacity building, education, training and public outreach and infrastructure and strategic partnership development.

The present chapter centres on the assessment of the survey responses from NMHSs in Europe (WMO RA VI). Its internal structure follows the sequence outlined earlier in section 2.6.1.

9.2 The Response to the Survey

The 44 countries in Europe who contributed responses to the WMO country-level survey are listed in Annex 2. It is important to note here that, under the WMO Regional Association system, the survey responses from Kazakhstan are not included in the analysis for Europe while those from Russia are included.

9.3 The Hazards affecting Countries in Europe

Figure 119 below lists the number of responding countries in Europe (WMO RA VI) who identified themselves as being affected by the specified hazards.

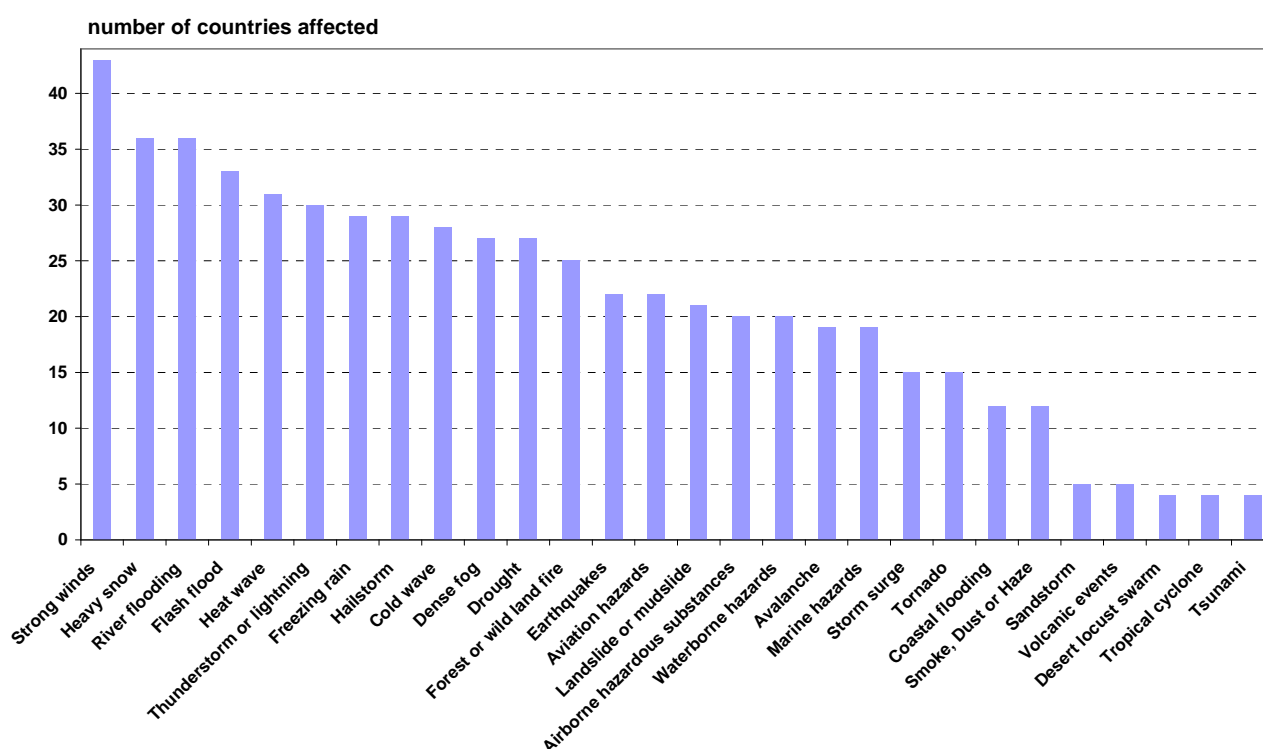


Figure 119. Number of responding countries in Europe who identified themselves as being affected by specified hazards.

9.3.1 Access to Data on Hazards and their Impacts

Annex 3 presents an overview of the hazard databases maintained by survey respondents in Europe (RA VI) and includes some supplementary information on related metadata and impacts information. Over half of the NMHSs in the region (56% or 24 of 43) who contributed to the WMO country-level survey stated that another agency was responsible for providing official information on the impacts of disasters in their country and that they had access to such official, reliable, information. In addition, however, roughly one third (34% or 15 of 44) of respondents reported that

they maintained their own internal database of official information on the impacts of hazards that affected their countries and most of them (76% or 13 of 17) regularly updated this database²⁵.

9.3.2 Value Added Services based on Historical Hazard Data

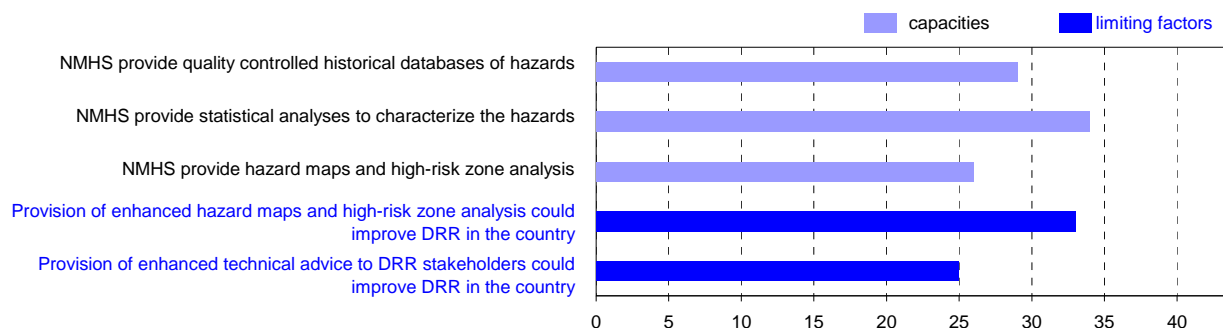


Figure 120. Provision of hazard information by NMHSs in Europe.

The following draws attention to the extent of value added services provided by NMHSs in Europe who maintain historical archives of hydrometeorological hazards. Most NMHSs who contributed to the country-level survey (80% or 33 of 41) stated that they provided technical advice on hazards and about the same number (83% or 34 of 41) provided statistical analyses to characterize them. Over two thirds of respondents (71% or 29 of 41) reported that they maintained quality controlled historical databases of hazards and most of these (63% or 26 of 41) indicated that they undertook hazard mapping and high-risk zone analysis. About a quarter of respondents (28% or 11 of 40) stated that they provided analyses of the potential impacts of hazards.

More than a third of contributing NMHSs identified factors that limited their ability to provide hazard data products. Identified as limiting factors were quality assurance (42% or 16 of 38), ability to archive and update (41% or 16 of 39), professional staff with appropriate training and customization of data for stakeholders (39% or 15 of 38), and data rescue (36% or 14 of 39). Most NMHSs (85% or 34 of 40) considered that the provision of enhanced value added services in support of hydrometeorological risk assessment would strengthen their contributions to disaster risk reduction activities. The following specialized services were identified as valuable enhancements - hazard mapping and high-risk zone analysis (92% or 33 of 36) analyses of the potential impacts of hazards (89% or 32 of 36) and provision of technical advice (81% or 25 of 31).

9.4 The National Context for Disaster Risk Reduction

National legislative, governance and organizational structures for disaster risk reduction establish the context within which NMHSs make their contributions to safety of life and property. The following sections summarize survey responses regarding European countries' national systems for disaster risk reduction and the impact of these systems on their NMHSs.

²⁵ It is important to note, that, to date, no systematized, universally accepted, methodology or protocol has been established on a global basis for the creation and maintenance of hazard and hazard impacts databases.

9.4.1 Legislation and Governance

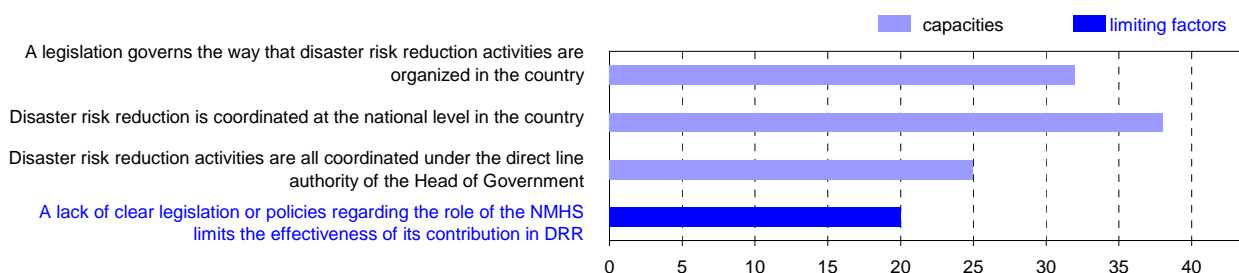


Figure 121. Legislation and coordination in support of disaster risk reduction at the national level in Europe.

Most European (RA VI) NMHSs who contributed to the survey (93% or 38 of 41) reported that disaster reduction activities were coordinated at the national level, in a majority of cases (63% or 25 of 40) under the direct line authority of the head of government. The organization of these activities was governed by legislation in about three quarters of the countries (78% or 32 of 41). In just under half (46% or 19 of 41) coordination was centred under one ministry. At the same time, almost half the survey respondents (49% or 20 of 41) considered that a lack of clear legislation or policies regarding the role of their NMHSs (e.g. as the sole issuer of hydrometeorological hazard warnings) limited their contributions to disaster risk reduction.

9.4.2 National Structures/Mechanisms for Disaster Risk Reduction

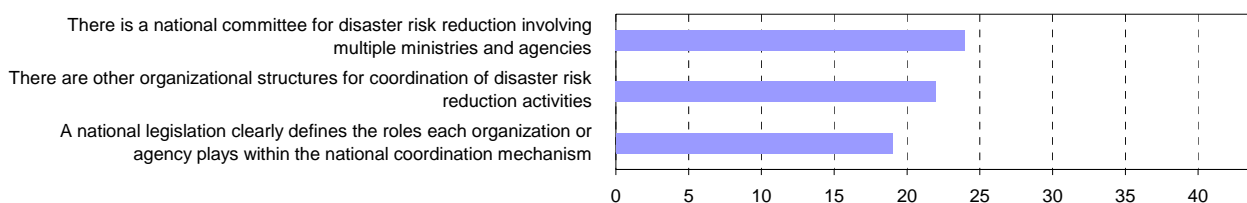


Figure 122. National structures for coordination of disaster risk reduction in Europe.

Almost two thirds of European contributors (62% or 24 of 39) indicated that their countries had a national committee for disaster risk reduction that involved multiple ministries and agencies. However, almost three quarters of them (74% or 29 of 39) stated that they were members of their national coordinating committee. Half of the survey respondents (50% or 19 of 38) reported that the roles of each participating agency in the national coordination mechanism were defined by legislation. Just over half (55% or 22 of 40) pointed out that other organizational structures for coordination also existed in their countries. A significant number of European NMHSs (41% or 17 of 41) felt that their contributions to disaster risk reduction were limited by their national disaster management structures and a lesser number (33% or 14 of 42) by a lack of linkages with other involved organizations.

9.4.3 NMHS Contributions to National Disaster Risk Reduction Systems

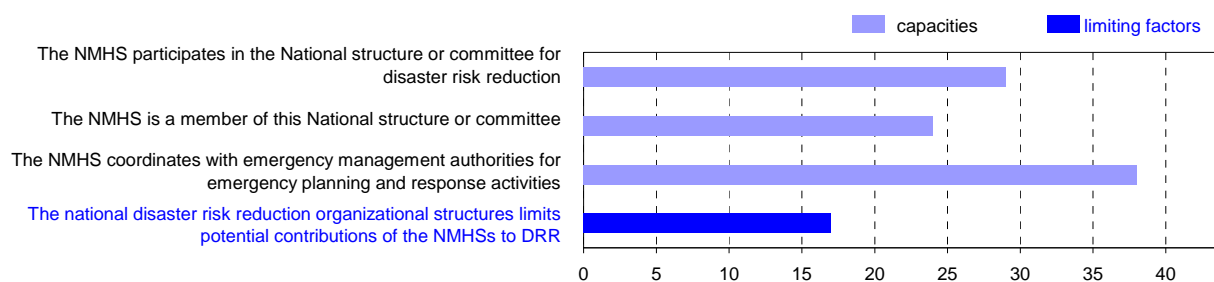


Figure 123. NMHS participation in national structures for disaster risk reduction in Europe.

All contributing European NMHSs (100% or 42 of 42) indicated that they provided support to agencies responsible for disaster risk reduction at the national level and the same number stated that they provided support to emergency response operations and emergency planning and preparedness. Most (95% or 41 of 43) also supported disaster prevention (e.g. hazard mapping, advice, historical hazard data) and a smaller number (76 or 31 of 41) supported post-disaster reconstruction (e.g. hazard data as input to reconstruction decisions). Virtually all survey respondents (98% or 40 of 41) reported that they extended their support to provincial or state government disaster-related activities and about three quarters (77% or 30 of 39) also provided support to municipal or local levels. About a third (33% or 14 of 42) of NMHSs who contributed to the survey, however, pointed to inadequate linkages with other involved organizations (e.g. emergency planners, emergency response agencies) as limiting their contributions to disaster risk reduction. Finally, three quarters of responding NMHSs (76% or 29 of 38) considered that their contributions would be enhanced by a “readiness system” that required appropriate responses by authorities to information issued by the NMHSs.

9.4.4 NMHS Collaboration with other Partners

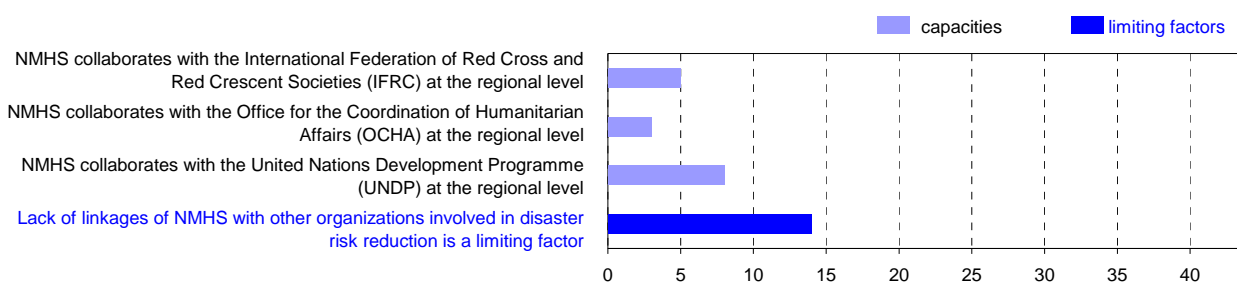


Figure 124. NMHS collaboration with partner agencies at the regional level in Europe.

Almost all survey contributors (95% or 38 of 40) in Europe reported that they coordinated with emergency management authorities for emergency planning and response and a similar number (98% or 40 of 41) stated that coordination was at the national level. A significant number (44% or 19 of 43) participated in activities on the level of a WMO Region or a regional economic grouping. Considerably smaller numbers (75% or 12 of 16) of them, however, participated in activities of international organizations, collaborated with their National Red Cross and Red Crescent Societies (26% or 11 of 43), interacted with the office of their national United Nations Coordinator (24% or 10 of 42) or participated in disaster reduction activities of the UNDP (47% or 8 of 17), the Office for the Coordination of Humanitarian Affairs (23% or 3 of 13) or the IFRC (36% or 5 of 14).

9.4.5 The Organization and Priorities of NMHSs

The priorities of individual NMHSs are, inevitably, influenced by the missions and priorities of their parent government ministries or departments. In consequence, the orientation of NMHSs may be more broadly focussed in some countries than in others. A parent department with a civil aviation mandate might, for example, emphasize provision of NMHS services to aviation while one with a natural resources or environment mandate might encourage its NMHS to provide warnings and other services to a broader range of sectors. Where National Meteorological Services, or combined National Meteorological and Hydrological Services²⁶, in Europe are concerned parent ministries include: Science; Equipment, Environment and Urbanism; Environment; Environment and Spatial Planning; Protection of Nature; Agriculture, Forestry and Water Economy; Natural Resources and Environmental Protection; Science, Education and Sport; Sustainable Development; Transport; Environmental Protection and Natural Resources; Transport and Energy; Transport and Communications; Defence; Traffic, Railroads and Development; Environment, Heritage and Local Government; Science Policy; Agriculture, Viticulture and Rural Development; Environment and Water Management; Equipment; Home Affairs; Science, Technology and Higher Education; and Research and Education. Correspondingly, parent departments of National Hydrological Services include: Environment, Food and Rural Affairs; Energy and Natural Resources; Environment; Interior; Agriculture, Forestry, Environment and Water Management; Agriculture and Forestry; Development; Petroleum and Energy; Water; National Infrastructures; Public Works; Industry; Water Law; Transport; Environment, Transport, Energy and Communications; and Environment and Management of Water Resources.

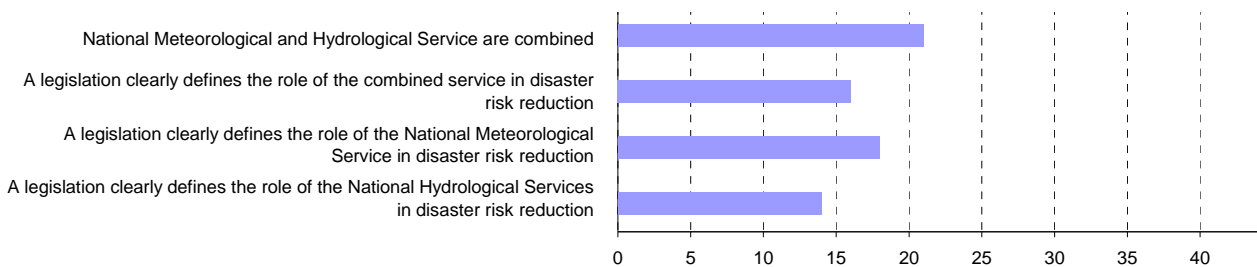


Figure 125. Organizational structure of meteorological and hydrological services in Europe.

The internal organization of National Meteorological and Hydrological Services within individual countries can also influence their ability to deliver well-coordinated hydrometeorological warnings and other services in support of disaster risk reduction. In Europe, almost half (48% or 21 of 44) of the contributors to the WMO country-level survey stated that they had a combined National Meteorological and Hydrological Service. Many of these (52% or 16 of 31) indicated that their country had national legislation that clearly defined the NMHSs role in disaster risk reduction²⁷. Almost three quarters of those (72% or 18 of 25) with a separate NMSs and NHSs stated that they had legislation that clearly defined the role of the NMSs in disaster risk reduction. A somewhat smaller number (58% or 14 of 24) reported legislation that applied to the role of the NHSs. At the same time, a majority (63% or 15 of 23) of European contributors thought that legislation or partnership agreements were needed to better define the respective roles of their NMSs and NHSs in disaster risk reduction. In addition, most European NMHSs (91% or 20 of 22) considered that better technical coordination between their NMSs and NHSs would result in enhanced joint products and services with a slightly smaller majority (82% or 18 of 22) advocating that better coordination would result in enhanced issuance of warnings.

²⁶ Parent departments of NMS and NMHS have been grouped together due to ambiguities in responses regarding the existence or otherwise of combined NMHS.

²⁷ A possible anomaly exists in relation to the reported NMHS organization in several countries.

9.4.6 Operational Coordination between NMSs and NHSs

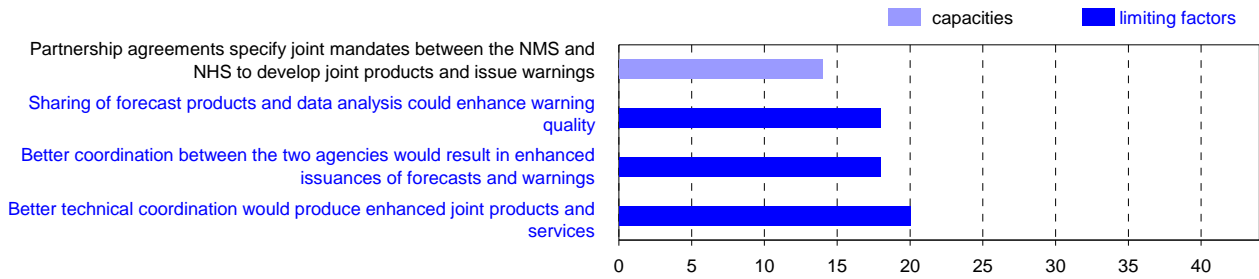


Figure 126. Coordination between NMS and NHS in Europe.

More than half (61% or 14 of 23) the survey contributors from European countries with separate NMSs and NHSs identified that partnership agreements were in place specifying mandates between their NMS and NHS to develop joint products and issue warnings. A larger number (72% or 18 of 25) indicated that the two agencies shared forecast products and data analyses that could enhance warning quality. Many of these (50% or 12 of 24) stated that coordination took place before warnings were issued for hazards of mutual concern a smaller number (29% or 7 of 24) indicated that coordination also took place for any hazard warning was issued. Some contributing NMHSs (57% or 8 of 14), however, reported that there was no coordination on warnings. Most respondents (82% or 18 of 22) to the survey felt that better overall coordination between the two agencies would enhance issuance of forecasts and warnings and slightly more (91% or 20 of 22) considered that improved technical coordination would result in enhanced joint products and services.

9.5 NMHS Infrastructure, Products and Services

The following sections summarize the information contained in survey response related to observational networks, telecommunications systems, warning and forecast production systems and their products, dissemination systems and related aspects of the overall operational capacities of the NMHSs in Europe (WMO RA VI).

9.5.1 Observation and Monitoring Networks and Systems

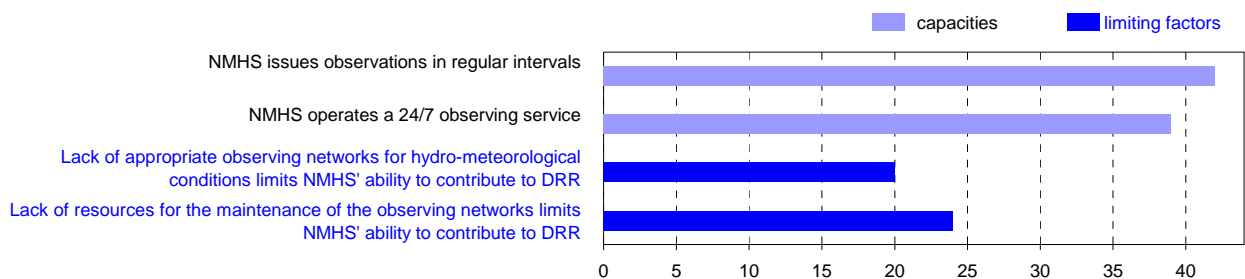


Figure 127. Observation and monitoring networks and systems in Europe.

Most European NMHSs who contributed to the survey (98% or 42 of 43) stated that they had an operational observing capacity that issued observations at regular intervals and most of these (91% or 39 of 43) reported that the observing service operated 24-hourly/year-round. Over half (62% or 21 of 34) of them indicated that their observation network included sea level monitoring stations. However, almost half the respondents (49% or 20 of 21) also considered that a lack of

appropriate hydrometeorological observing networks limited their ability to contribute to disaster risk reduction. Moreover, some (23% or 9 of 39) identified the availability of a dedicated 24-hour/year-round observing service as an additional limiting factor. Major challenges in maintaining observation networks were also stressed, with a majority of respondents (78% or 32 of 41) highlighting limited resources (e.g. financial, replacement parts, personnel, etc), half (50% or 20 of 40) citing limited professional staff with appropriate training, and a few (18% or 7 of 39) mentioning hazard-related damage.

9.5.2 Telecommunications and Informatics

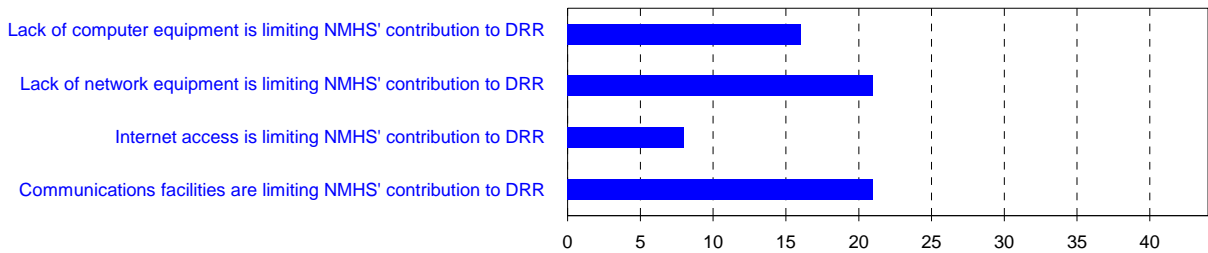


Figure 128. Telecommunication and informatics in Europe.

Almost all European NMHSs who contributed to the survey (98% or 42 of 43) reported that their telecommunications systems were available 24-hourly/year-round. Confirmation was provided by responses indicating that almost all forecasting staff (98% or 42 of 43) in the region had access to real time hydrometeorological data. However, over half of respondents (55% or 21 of 38) went on to identify that their ability to deliver critical products for disaster risk reduction was limited by communications facilities. Other limitations were cited in major areas of informatics, with three quarters of respondents (74% or 28 of 38) highlighting the unavailability of application software, over half (57% or 21 of 37) identifying network equipment (57% or 21 of 37), computers (44% or 16 of 36) and inadequate Internet access (22% or 8 of 37). Finally, most contributing NMHSs (88% or 30 of 34) considered that upgrading the operational infrastructure for forecasting and warning services would enhance disaster risk reduction capacities in their countries.

9.5.3 Data Exchange

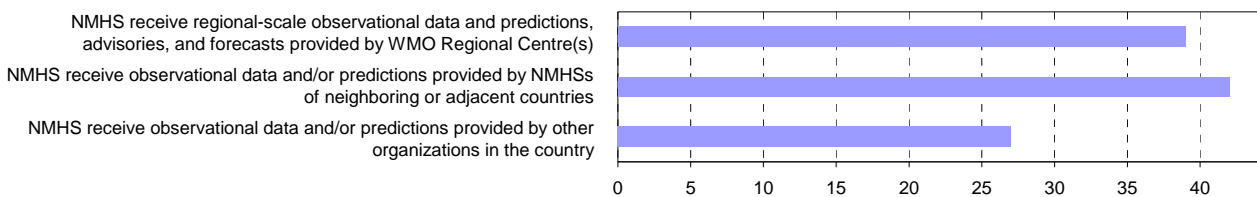


Figure 129. Data exchange in Europe.

Survey responses from NMHSs in Europe (RA VI) identified that almost all (98% or 42 of 43) forecasting staff had real time access to hydrometeorological data. Most contributors to the survey (91% or 39 of 43) also used regional scale observational data and forecasts provided by WMO Regional Specialized Meteorological Centres, data from neighbouring countries (95% or 42 of 44) and from other organizations in their countries (63% or 27 of 43). In addition, more than half of them (69% or 22 of 32) received real time marine observations from the GTS and some (54% or 13 of 24) relayed sea level observations on that global network. Conversely, however, over half of the respondents to the WMO survey (55% or 21 of 38) indicated that their NMHSs were limited in their ability to deliver critical products and services for disaster risk reduction by communications

facilities. Equally, significant numbers stated that their NMHSs were limited by customization of data for stakeholders (39% or 15 of 38), quality assurance (42% or 16 of 38) or ability to archive and update (41% or 16 of 39). A substantial majority of contributing NMHSs in Europe considered that they required better coordination with neighbouring NMHS (91% or 30 of 33) on hydrometeorological data exchange and with RSMCs (96% or 25 of 26).

9.5.4 Forecast and Warning Capability

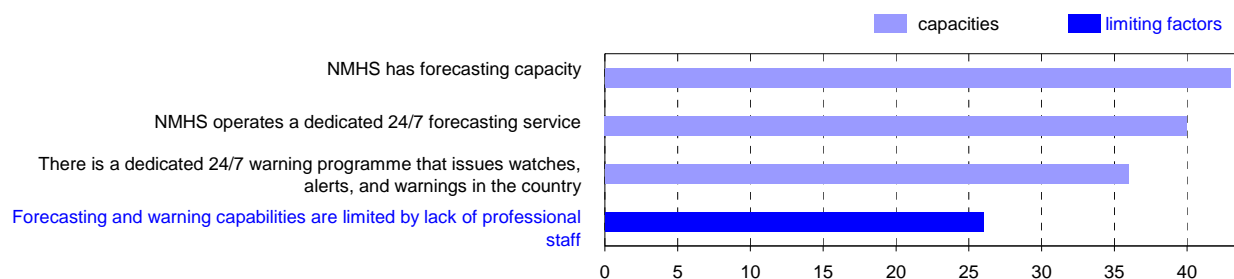


Figure 130. Forecast and warning capabilities in Europe.

Almost all NMHSs (98% or 43 of 44) in Europe who contributed to the country-level survey indicated that they had an operational forecasting capability and most (93% or 40 of 43) of these stated that this was a dedicated 24-hourly/year-round forecast service. All respondents (100% or 39 of 39) stated that a meteorologist was required to be on-site to operate this service. Most contributors (84% or 36 of 43) also reported that they had a dedicated hazard warning programme that issued watches, alerts and warnings on a 24-hourly/year-round basis. All who responded to the question (100% or 35 of 35) indicated that a meteorologist was on site during the operational hours of the warning programme. In addition, most NMHSs (89% or 31 of 35) stated that they provided a marine forecast and warning service to mariners and coastal zone users and about half of these (50% or 16 of 32) also prepared marine forecasts for the Global Maritime Distress and Safety System (GMDSS). On the negative side, three quarters of survey contributors (74% or 28 of 38) indicated that their NMHS was limited in its ability to deliver critical products and services for disaster risk reduction by application software. Roughly two thirds (68% or 26 of 38) cited professional staff as limiting and almost one half (44% or 16 of 36) cited computers. Most European respondents (85% or 35 of 41) considered that upgrading their NMHSs operational forecasting and warning services would enhance disaster risk reduction in their countries. More specifically, most (94% or 32 of 34) of them advocated the upgrading or technical training of professional staff.

9.5.5 Forecast and Warning Products

Table 8 in Annex 4 summarizes information on hazard warnings and products issued by NMHSs in Europe who responded to the survey. The survey responses indicated that the hydrometeorological hazards affecting the greatest number of European countries were, in declining order, strong winds, heavy snow, river flooding, flash floods, heat waves, thunderstorms and lightning, hailstorms, freezing rain, cold waves, droughts, dense fog, and forest or wild land fires²⁸. Additional hazards identified as of concern to roughly half of European countries included earthquakes, aviation hazards, landslides or mudslides, waterborne hazards and airborne hazardous substances.

²⁸ The survey responses do not provide information on the magnitudes of the impacts associated with individual hazards, simply that they occur in the reported number of countries.

Examination of the data in Table 8 reveals that most affected NMHSs issued warnings for the most common of the above hazards, with warnings service being provided less widely for the less common hazards. The most notable deficiency areas were in relation to landslides or mudslides, where only about half of affected NMHSs reported that they had a warning programme, and tornadoes, where only about two thirds of affected NMHSs had a warning programme. Desert locust swarms, a much less widely experienced hazard, represented another anomaly where four countries reported that they were affected but only one NMHS issued warnings. It will clearly be necessary to implement warnings for these latter hazards in all affected countries if effective support for disaster risk reduction is to be ensured.

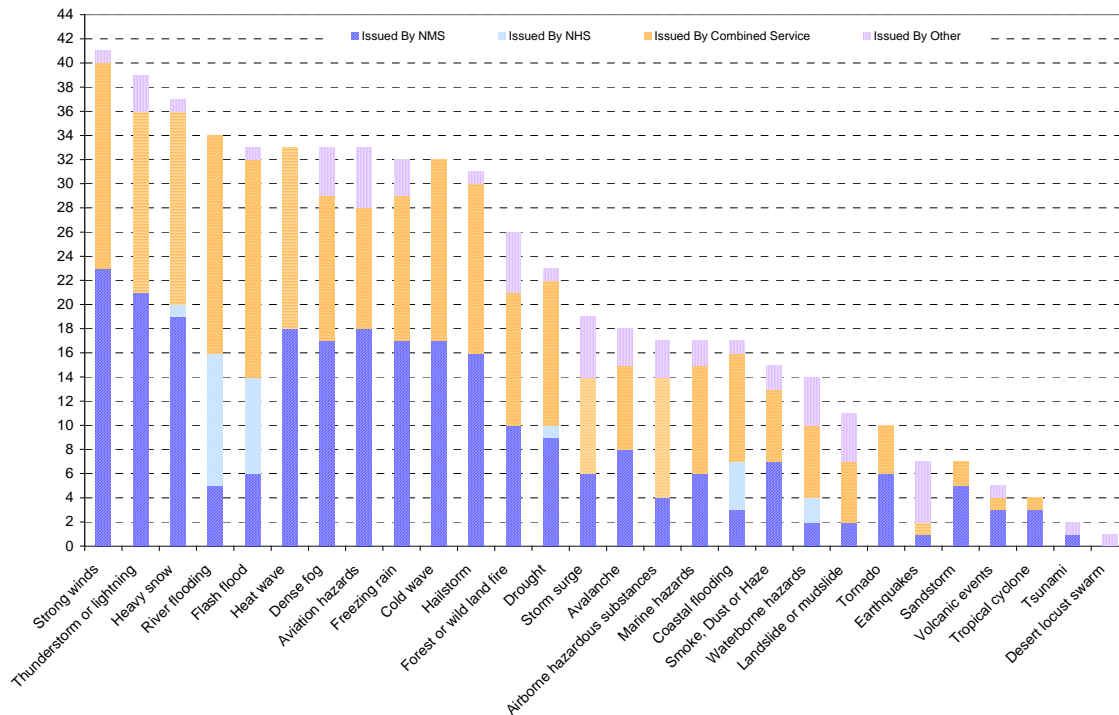


Figure 131. Agencies mandated for issuance of warnings in Europe.

Survey contributions from European NMHSs indicate that, broadly speaking, NMSs and combined NMHSs are responsible for roughly equal numbers of warnings for most major hazards, probably reflecting organizational structures across Europe. A striking exception, however, is the situation with respect to river flooding, flash floods and coastal flooding where combined NMHSs are responsible for roughly three times as many warnings as NMSs and warnings issued by NHSs also exceed those issued by NMSs. Furthermore, a possible survey anomaly is a reported situation where one NHS is responsible for issue of warnings of heavy snow. The survey data also indicate that the NMHSs (or, as the case may be, NMSs or NHSs) are the sole issuers of warnings in a majority of European countries but that competing warning services are also present in up to about a third of the countries in the region. Survey responses suggest that official warnings for the major hazards include information regarding their potential impacts in about a third to one half of European countries. The inclusion rate for impacts information, however, also varies somewhat between different hazards for which warnings are issued. Finally, the fact that a large majority of contributing NMHSs considered that further improvements were needed to their warnings opens the door to inclusion of impacts information and additional hazards in European NMHSs warning programmes.

9.5.6 Coordination of Warnings

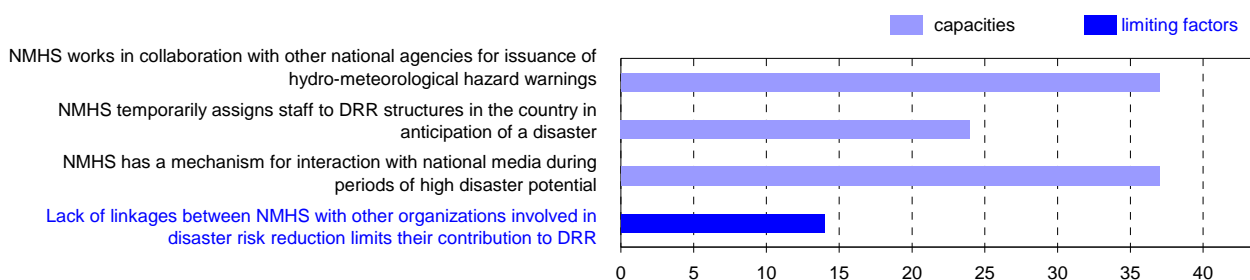


Figure 132. External coordination for issuance of warnings in Europe.

Early warnings of hydrometeorological hazards represent a vital contribution to disaster risk reduction. In Europe, most NMHSs (90% or 37 of 41) who contributed to the WMO country-level survey reported that they worked in collaboration with other agencies (e.g. agriculture, aviation, etc) with respect to hazard warnings. Most of them (82% or 31 of 38) discussed the hazard’s characteristics and potential impacts with these agencies prior to issuing a warning. In addition, most survey respondents (88% or 37 of 42) stated that they had a mechanism for interaction with their country’s media during periods of high disaster potential. Over half of them (59% or 24 of 41) indicated that they temporarily assigned staff to disaster risk management structures in anticipation of a disaster. Roughly a third of NMHSs (34% or 15 of 44) pointed out that there were other public or commercial entities that provided competing warning services in their countries. Almost all survey contributors in Europe (91% or 30 of 33) considered that their NMHSs required better coordination of watches and warnings with neighbouring NMHSs and most of these (88% or 23 of 26) also advocated improved coordination with WMO Regional Specialized Meteorological Centres.

9.5.7 Products and Services for Selected Socio-Economic Sectors

As a further refinement, Figure 113 illustrates the provision by NMHSs of specialized alerts, warnings and other products to significant socio-economic sectors in Europe that can be seriously affected by hazardous events. In the context of disaster risk reduction, it is noteworthy from Figure 113 that less than half (45%) of responding NMHSs indicated that they provided support to development and housing or land-use planning and, equally, less than half (47%) provided services to the fresh water sector.

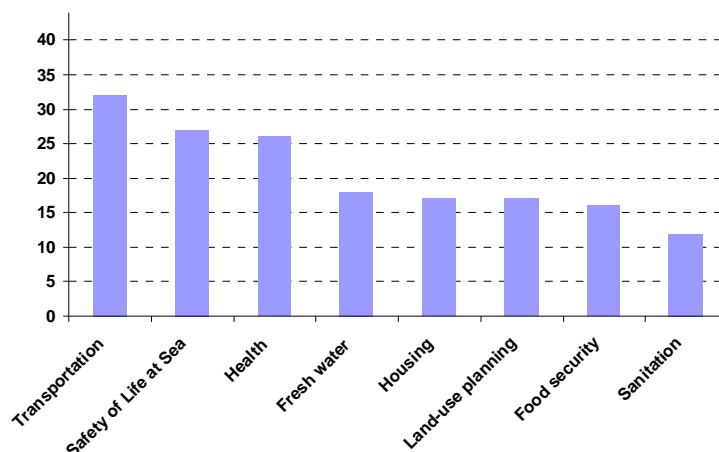


Figure 133. NMHS provision of services to selected economic sectors in Europe.

9.5.8 Dissemination Systems and Target Audiences

The following Figures 134 and 135 summarize the survey responses relating to the dissemination of hazard products by NMHSs in Europe. They provide information on the types of products that are disseminated, to whom they are provided and on the methods of dissemination that are used to convey the products to the recipients. The same information is also presented in numerical form in Table 7 of Annex 5 where the figures represent the number of responding NMHSs who reported that they provided the specified product to the indicated target audience or, as appropriate, utilized a particular means of dissemination.

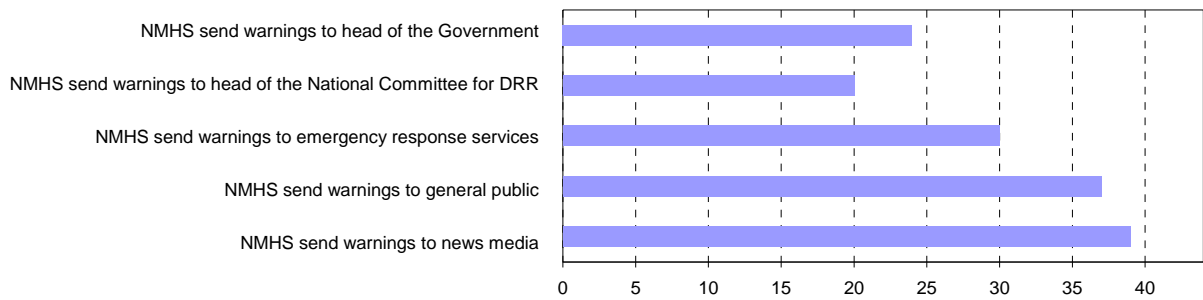


Figure 134. Warning target audience in Europe.

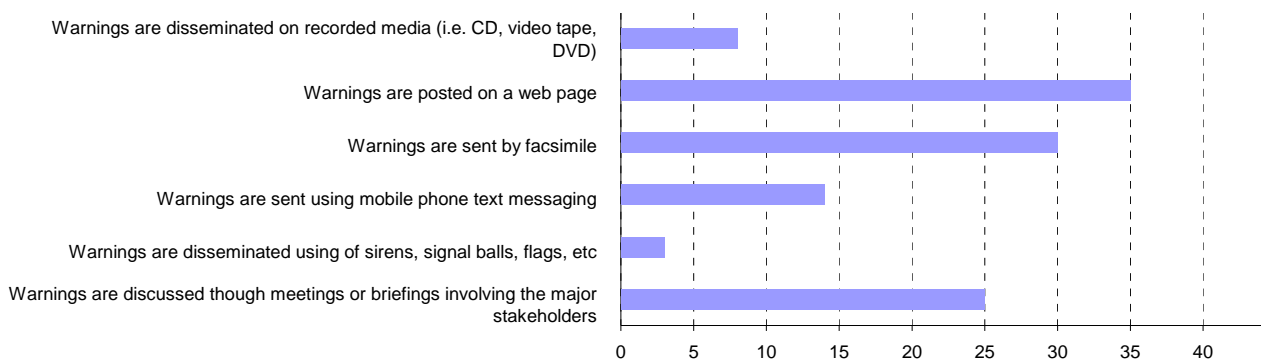


Figure 135. Warning dissemination methods in Europe.

As might be expected a very high percentage of survey respondents from Europe indicated that they disseminated hazard warnings to the public and the media and to relevant government authorities. In contrast, however, a relatively low percentage of contributing European NMHSs disseminated warnings and other products to external partners in disaster risk reduction such as national Red Cross and Red Crescent Societies and others. The major dissemination methods in Europe were via web page, facsimile, briefings and Internet downloads. Substantial numbers of European NMHSs also used hard copy mailings and a few used sirens and other signal devices.

9.5.9 Product Utility and Product Improvement

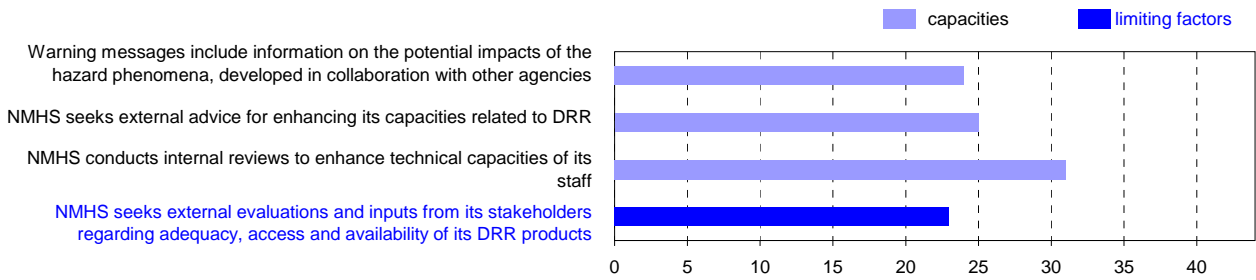


Figure 136. Ongoing feedback and improvement of products in Europe.

Most (90% or 37 of 41) NMHSs in Europe who contributed to the survey indicated that they worked with other agencies with respect to hazard warnings. Most (90% or 26 of 29) also stated that they had regular interaction with disaster risk authorities to enhance their warning capabilities and content. Almost two thirds (63% or 24 of 38) of those who included information on potential risks (impacts) in warning statements indicated that they collaborated with other agencies to develop risk information. A majority (63% or 25 of 40) of European respondents also stated that they sought external advice for enhancing their capacities to support disaster risk reduction, specifically to enhance monitoring and forecasting, watches and warnings (83% or 24 of 29), or overall products and services (79% or 22 of 28). Moreover, almost two thirds of them (63% or 27 of 43) indicated that their NMHSs had a quality control mechanism to enhance their warning capabilities and content. Most of these (90% or 26 of 29) indicated that the mechanism provided for regular interaction with stakeholders (disaster risk authorities) and included feedback from stakeholders and the public after an event had occurred (88% or 23 of 26). Less than half (44% or 12 of 27), however, stated that it provided for training for stakeholders to understand hazards, warnings and their implications. About half of responding European NMHSs (56% or 23 of 41) reported that they sought external evaluations and inputs from stakeholders regarding the adequacy, relevance, method of access and availability of their disaster risk reduction products. Most survey contributors (78% or 32 of 41), however, believed that the lack of public understanding of hazards, watches and warnings limited the public response to them. Roughly half (56% or 23 of 41) also considered that the lack of joint training between NMHS staff and disaster risk managers limited their disaster risk reduction efforts and a similar number (50% or 21 of 42) advocated the need for joint training with emergency authorities and managers. Furthermore, most European NMHSs (80% or 33 of 41) who contributed to the survey felt that educational modules for media, public and disaster risk authorities would enhance their effectiveness in disaster risk reduction.

9.5.10 Internal NMHS Training and Capacity Enhancement

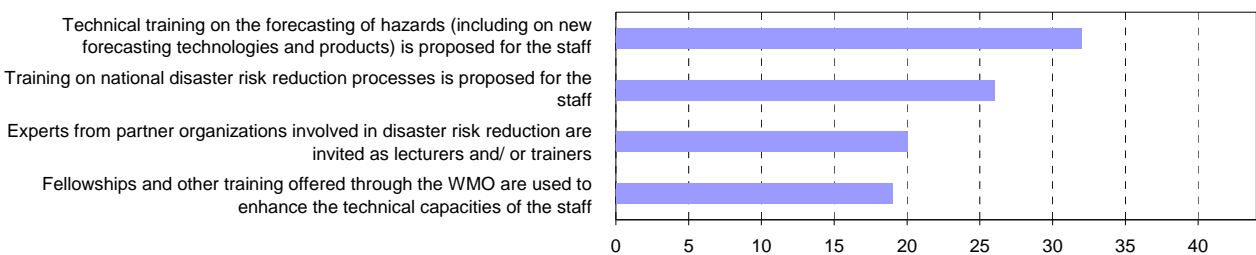


Figure 137. Training and capacity building of NMHS' staff in Europe.

Three quarters of responding NMHSs (74% or 32 of 43) in Europe indicated that they provided ongoing technical training to staff on forecasting of hazards, including up to date training on new forecasting technologies and products. A similar number (74% or 31 of 42) also reported that they conducted internal reviews and sought staff inputs to enhance their capacity building and technical training activities. In addition, some (44% or 19 of 43) stated that they utilized Fellowships and other training offered through WMO to enhance the technical capacities of their staff. Over half (60% or 26 of 43) provided training to staff on their country's disaster risk reduction processes and related topics and many of them (47% or 20 of 43) invited experts from partner organizations involved in disaster risk reduction as lecturers and/or trainers. The majority of European survey contributors (71% or 30 of 42) also conducted evaluations of the suitability of communications, workstations, and software and many (79% or 31 of 39) implemented upgrades to these systems to support disaster risk reduction. However, less than half of responding NMHSs (48% or 20 of 42) in Europe reported that they held or participated in joint training activities for NMHS staff and emergency response agencies.

Balancing the preceding, over one third of European contributors (37% or 15 of 41) indicated that lack of forecaster training at their NMHS reduced the effectiveness of their warning service. A similar number (39% or 15 of 38) reported that (lack of) professional staff with appropriate training limited their ability for real time monitoring of hazards. Over half (56% or 23 of 42) stated that a lack of joint training with disaster risk managers and with media limited their contributions to disaster risk reduction. Half the European respondents (50% or 21 of 42) to the WMO country-level survey stated that the lack of joint training between NMHS staff and emergency authorities and managers limited their disaster risk reduction efforts. Equally, half (50% or 20 of 40) identified that their ability to provide hazard data products was limited by the lack of professional staff with appropriate training. Not surprisingly, most responding NMHSs (85% or 35 of 41) in Europe considered that upgrading and improving their operational forecasting and warning activities would enhance their disaster risk capacities. Most of them (92% or 32 of 34) considered that upgrading and improving the technical training of the professional forecasting staff would enhance these capacities. Most (85% or 28 of 33) also advocated the conduct of cross-border training activities with neighbouring NMHSs, targeted at common hydrometeorological hazards.

9.5.11 Outreach Activities

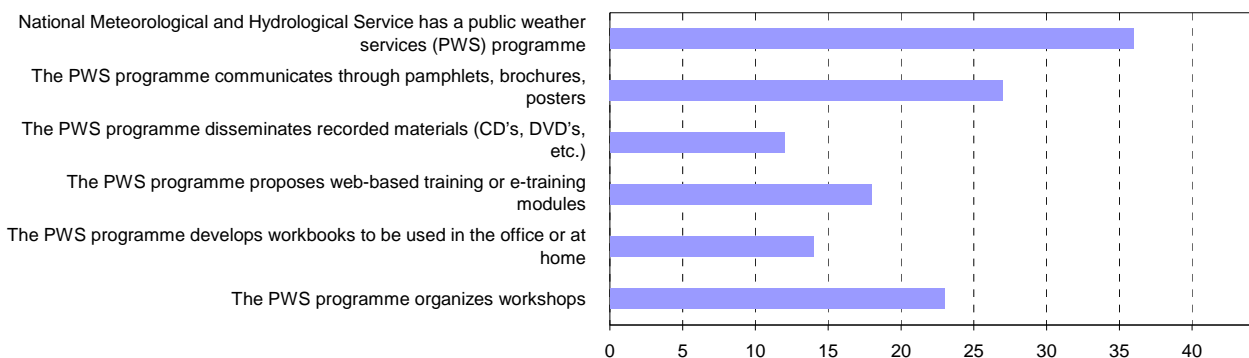


Figure 138. Outreach activities in Europe.

Outreach activities aimed at the general public and other stakeholders represent an important component of any effective disaster risk reduction programme. Within NMHSs, outreach activities are often part of a public weather services programme. In Europe (RA VI), most NMHSs (82% or 36 of 44) who contributed to the WMO survey identified that they had such a public weather services programme. Less than half (44% or 12 of 27) the respondents, however, stated that their NMHS quality control programme included training for the stakeholders to understand the hazards, warnings and their implications. About a quarter of the responding NMHSs (26% or 11 of 42)

provided education and training on hazards, watches, warnings, etc to disaster risk reduction managers and authorities and operational emergency response managers. Relatively few (17% or 7 of 42) respondents identified that they provided training targeted at the trainers (i.e. of disaster risk authorities, emergency response staff, media, etc). Similarly, relatively few (14% or 6 of 42) provided educational modules and training programmes targeted at the general public and few (15% or 6 of 41) provided training to the media. Almost half (48% or 20 of 42) the European NMHSs, however, reported that they pursued joint training activities with emergency response agencies. The following materials and methods were identified as being used in NMHS public outreach programmes in Europe: - pamphlets, brochures, posters (69% or 27 of 39), workshops (59%), Web-based training (45%), workbooks for office or home use (36%), recorded materials (CDs, DVDs, etc) (32%) and E-training modules (21%).

Most (78% or 32 of 41) European contributors to the country-level survey judged that the lack of understanding of the effects of hazards limited the public's response to warning services. In addition, more than half (56% or 23 of 41/42) also felt that the lack of joint training with the media and disaster risk managers and with emergency authorities and managers (50% or 21 of 42) limited their disaster risk reduction efforts. As a consequence, most NMHSs (80% or 33 of 41) in Europe considered that educational modules that they could target at media, public and disaster authorities would enhance their effectiveness in disaster risk reduction.

9.6 NMHS Contingency Planning

Most contributing NMHSs in Europe (76% or 32 of 34) reported that their NMHS had a contingency plan to maintain the continuity of products and services in the event of organizational emergencies such as power failure or communications disruption. Almost half of them (47% or 15 of 32) stated that their contingency plans involved an agreement or protocol with neighbouring NMHSs to support them in the event of catastrophic failure. In addition, most (71% or 30 of 42) also reported that they conducted or participated in drills and exercises to ensure disaster preparedness. However, most European contributors to the survey (81% or 26 of 32) identified needs for improved coordination with neighbouring NMHSs, specifically citing the need for support from them in the event of disruption of services.

9.7 Overarching Factors

NMHSs participating in the country-level survey were asked to respond to a series of questions directed at obtaining expressions of opinion from them regarding overarching factors or realities that either limited or could enhance their ability to make optimal contributions to disaster risk reduction. To varying degrees, the responses to these questions also served to validate statements, expressions of opinion and/or recommendations contained in responses to earlier sections of the survey. The following summarizes the inputs that fall under the above broad category:

9.7.1.1 NMHS Visibility

Most NMHSs in Europe (83% or 35 of 42) who responded to the survey considered that they needed higher visibility and recognition within government as a major contributing agency to disaster risk reduction. Over half (61% or 25 of 41) also felt that their contributions to disaster risk reduction were limited by the lack of understanding by government authorities of the value provided by the NMHSs. Most respondents (93% or 37 of 40) considered that improved ministerial level understanding of the socio-economic benefits of hydrometeorological products and services would increase the visibility of the NMHSs at the national level.

9.7.1.2 Organization and Governance

Close to half of responding NMHSs in Europe (41% or 17 of 41) considered that their national organizational structure for disaster risk reduction limited their potential contributions in this area. A larger number (49% or 20 of 41) considered that the effectiveness of their contributions to disaster

risk reduction was limited by the lack of clear legislation or policies regarding the role of the NMHSs (e.g. as the sole issuer of warnings). In addition, a majority of the contributors (65% or 15 of 23) from European countries with separate NMSs and NHSs considered that there was a need for legislation or partnership agreements to better define the role each agency played in disaster risk reduction.

9.7.1.3 Coordination and Partnership

A third (33% or 14 of 42) of NMHSs in Europe who responded to the survey considered that their contributions to disaster risk reduction were limited by a lack of linkages between the NMHSs and other involved organizations. In addition, most responding NMHSs (83% or 34 of 41) considered that better coordination with neighbouring or adjacent countries would improve their contributions to their own nation's disaster risk reduction activities. Many (65% or 26 of 40) also considered that better coordination with WMO Regional Specialized Meteorological Centres would improve their contributions.

9.7.1.4 Resources and Capacity

Most contributing NMHSs in Europe (88% or 29 of 33) indicated that resources and infrastructure limited their ability to deliver critical products and services for disaster risk reduction, specifically identifying financial resources (92% or 35 of 38) and professional staff (68% or 26 of 38) as key limiting factors. In consequence, most (85% or 35 of 41) considered that upgrading and improving NMHS operational forecasting and warning services would enhance the disaster risk reduction capacity within their country.

9.8 WMO Support

The following list summarizes the needs for support from WMO expressed by the NMHSs in Europe who responded to the survey. They needs are listed in the descending order of priority assigned to them by European NMHS who contributed to the country-level survey.

1. Technology transfer, capacity building, technical guidelines and technical training (e.g. forecasting tools and methodologies, hazard mapping, and other inputs to risk assessment tools, etc.).
2. Education, training and public outreach programmes in disaster risk reduction (e.g. targeted at National Meteorological and Hydrological Service and their stakeholders).
3. Provision of technical advice and specifications (e.g. to enhance observing networks, operational infrastructures, relevant products and services for disaster risk reduction applications).
4. Strengthening strategic partnerships with stakeholders (e.g. disaster risk managers, media, etc.).
5. Advocacy for enhanced visibility of National Meteorological and Hydrological Service' in the area of disaster risk reduction.
6. Cost-benefit analysis of hydro-meteorological services in disaster risk reduction.
7. Strengthening strategic partnerships with other technical organizations and agencies (e.g. meteorology, hydrology, ocean services, etc.).
8. Establishment of regional emergency protocols for the National Meteorological and Hydrological Services in support of each other in case of disruption of services due to the impact of a disaster.
9. Resource mobilization.
10. Assist members in the development of the national disaster risk reduction plans.

9.9 Sub-Regional Considerations

Climate, exposure to individual hydrometeorological hazards and even the organization and orientation of National Meteorological and Hydrological Services vary considerably across Europe. The following sections examine the survey responses from three major European sub-regions – North-West Europe, Eastern Europe and Southern Europe. Annex 2 lists the countries included in each of these sub-regions.

9.9.1 North-West Europe

As listed in Annex 2, the countries included in the North-West Europe sub-region are as follows: Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom. The following paragraphs briefly assess the responses from this selected group of NMHSs against the backdrop of the preceding analysis of the survey responses from Europe as a whole. Figure 139 below illustrates the number of responding countries in the sub-region who stated that they were affected by the specified hazards.

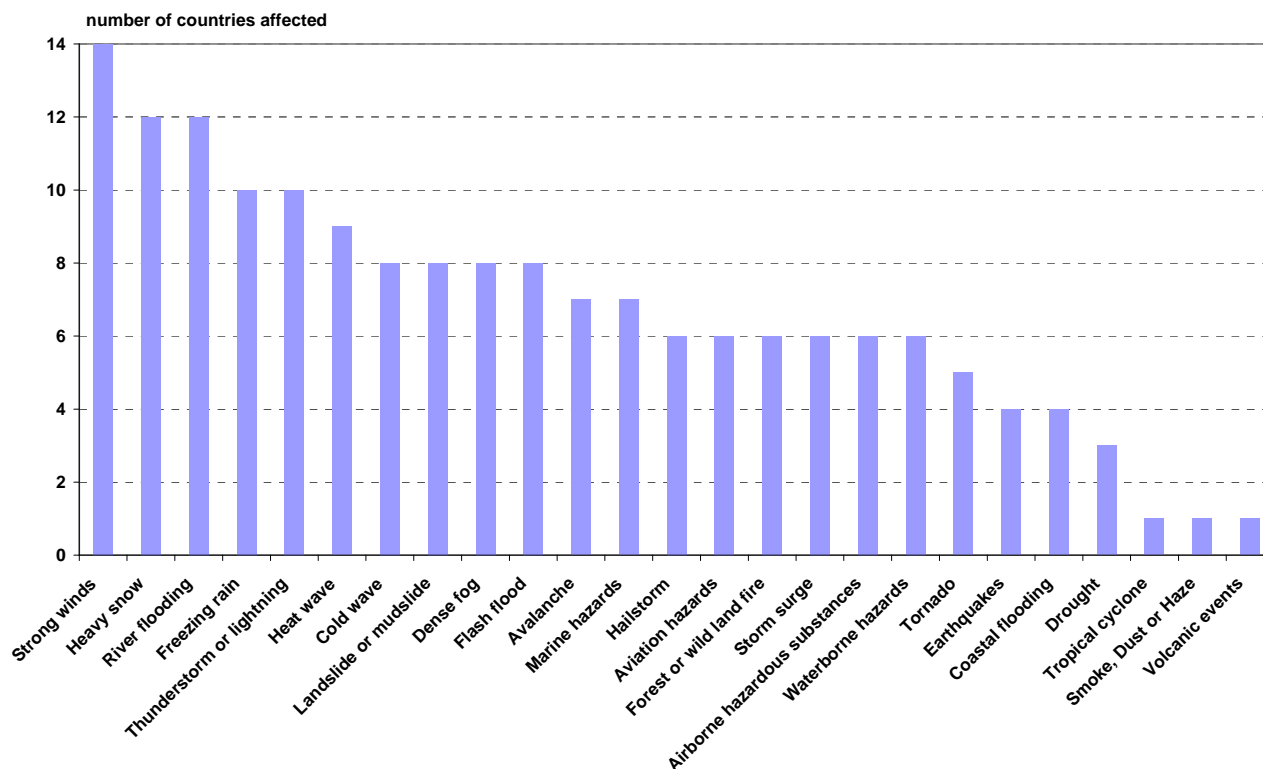


Figure 139. Number of responding NMHSs in North West Europe who identified themselves as being affected by specified hazards.

The hazards that affect most North-West European countries are strong winds, heavy snow, river floods, freezing rain, thunderstorms or lightning, heat waves, flash floods, dense fog, cold waves, landslides or mudslides, marine hazards and avalanches followed by hailstorms, storm surge, airborne hazards, waterborne hazards, forest and wild land fires and coastal flooding. Other hazards such as earthquakes, droughts, tropical cyclones, smoke, dust and haze and volcanic hazards are at the bottom of the list in numbers of responding countries affected by them.

The following overview examines the sub-regional picture for North West Europe drawing attention to differences from the general European situation. The sub-regional situation with respect to hazard databases, access to impacts information and provision of value added services based on data archives was broadly similar to that for Europe as a whole. However, a noticeably lower percentage of NMHSs in North-West Europe identified data rescue, quality assurance, archiving and updating and customization of data as factors that limiting their ability to provide hazard data products. Where legislative, governance and disaster risk structures were concerned, the sub-regional pattern generally mirrored that for all of Europe. However, a noticeably lower percentage of North-West European respondents felt constrained by their national coordination systems for disaster risk reduction than was the case for the region as a whole. Moreover, only one country in the sub-region identified that it had a combined National Meteorological and Hydrological Service.

Where operational infrastructure and capacities are concerned, visibly lower percentages of North-West European respondents identified their disaster risk reduction contributions as being limited by inadequate observational networks, telecommunications, informatics and data management/data exchange capacities, applications software, Internet access and availability of trained professional than was the norm across the European region. In addition, significantly smaller percentages of contributing NMHSs in North-West Europe expressed needs for improved coordination and collaboration with neighbouring NMHSs and with RSMCs. This pattern also prevailed in relation to internal training of NMHS staff, joint training with disaster agencies and activities related to product improvement where North-West European respondents presented a somewhat more positive than average picture. The survey responses revealed a more uneven pattern where public outreach was concerned. However, sub-regional responses generally either matched or were more positive than those for the total region. Moreover, almost all NMHSs in North-West Europe had a contingency plan in place to maintain operations in emergency situation and, in many instances, this involved partnership agreements with neighbouring NMHSs. Finally, North-West European respondents expressed significantly lower levels of concern regarding the lack of understanding by government authorities of the value of their contributions to disaster risk reduction. Taken overall, the sub-region, therefore, presented a somewhat more positive picture than Europe as a whole with respect to its capacity and involvement in disaster risk reduction.

9.9.2 Eastern Europe

As illustrated in Annex 2, the countries included in the Eastern Europe sub-region are as follows: Belarus, Czech Republic, Estonia, Georgia, Latvia, Lithuania, Poland, Russian Federation, Slovakia and Ukraine. The following paragraphs briefly assess the responses from this selected group of NMHSs against the backdrop of the preceding analysis of the survey responses from Europe as a whole. Figure 140 below illustrates the number of responding countries in the sub-region who stated that they were affected by the specified hazards.

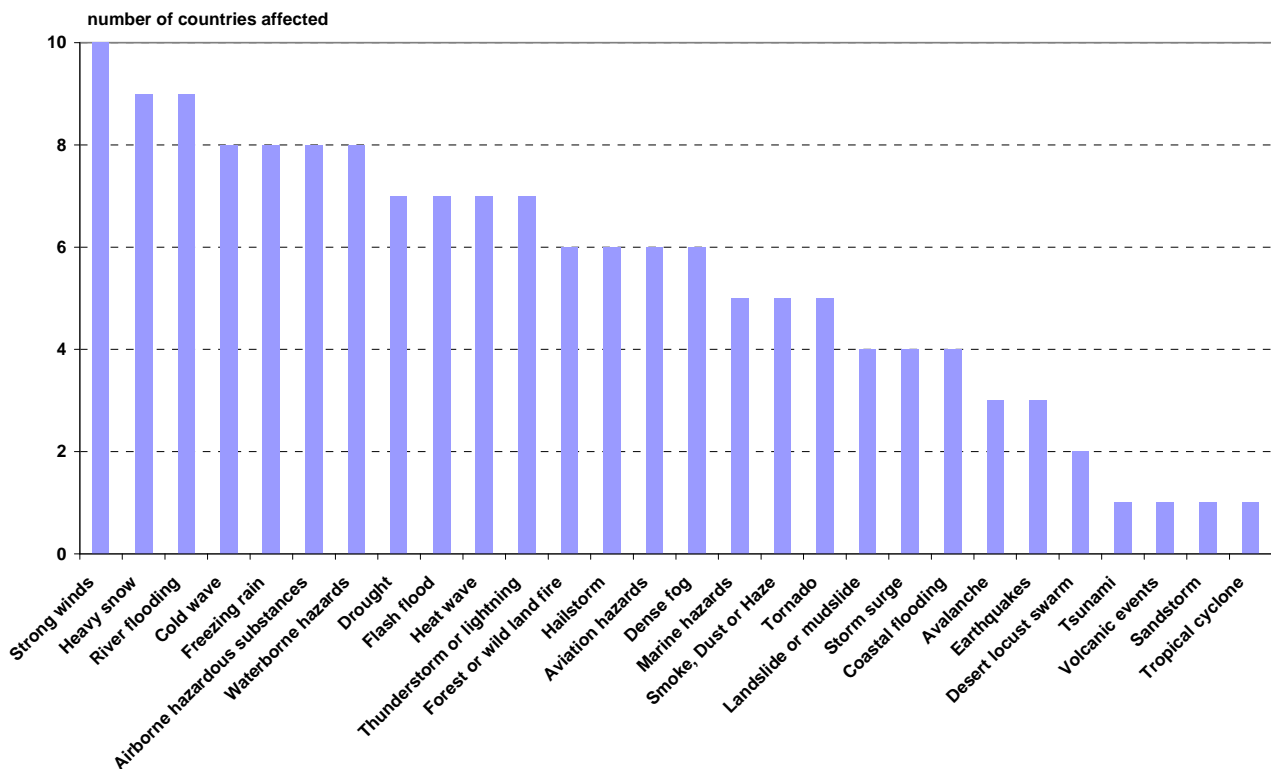


Figure 140. Number of responding NMHSs in Eastern Europe who identified themselves as being affected by specified hazards.

In descending order of breadth of occurrence, the major hazards identified by Eastern European NMHSs were strong winds, heavy snow, river flooding, freezing rain, cold waves, airborne hazardous substances, waterborne hazards, flash floods, thunderstorms and lightning, heat waves, droughts, dense fog, hailstorms, aviation hazards, forest and wild land fires, tornado, marine hazards, smoke, dust and haze with remaining hazards affecting relatively fewer countries in the sub-region.

The following comments on aspects of the country-level survey responses in Eastern Europe that differed noticeably from the overall European picture, presented earlier in this chapter. The responses indicated that proportionately more Eastern European NMHSs maintained historical hazard databases and provided mapping and risk zone analysis based on these data. However, more of them (almost two thirds) also maintained internal databases of information on the impacts of hazards. While the legislative and governance pattern in the sub-region generally matched that for Europe as a whole, relatively fewer Eastern European countries had a national coordinating committee for disaster risk reduction and proportionately more NMHSs stated that this structure limited their ability to contribute to that priority. All Eastern European NMHSs supported the implementation of a readiness system. All respondents also indicated that they had a combined NMHS.

In operational areas, the picture was much like that in Europe as a whole, with all or almost all contributing NMHSs indicating that they had observation networks and telecommunications and a forecast system that operated on a 24-hourly/year-round basis. A somewhat lower percentage of Eastern Europe respondents, however, identified themselves as being limited by data management challenges such as quality assurance, data customization and archiving and updating. The overall European pattern prevailed in relation to warnings coordination, product improvement, internal training and capacity enhancement and to outreach activities though possibly with a few more positive aspects in Eastern Europe. Almost the same proportion of responding NMHSs from the Eastern European sub-region had contingency plans in place to maintain their services in emergencies and slightly more of them indicated that they had involved neighbouring NMHSs in those plans. Survey responses relating to overarching areas generally matched the overall European pattern though, as noted earlier, a higher percentage of Eastern European respondents identified their national disaster risk management structures as limiting the NMHSs ability to contribute to that priority area.

9.9.3 Southern Europe

As outlined in Annex 2, the countries included in the Southern Europe sub-region are as follows: Albania, Armenia, Bosnia and Herzegovina, Croatia, Cyprus, Greece, Hungary, Israel, Italy, Jordan, Malta, Monaco, Portugal, Republic of Moldova, Romania, Serbia and Montenegro, Slovenia, Spain, the former Yugoslav Republic of Macedonia and Turkey. The following paragraphs briefly assess the responses from this selected group of NMHSs, against the backdrop of the preceding analysis of the survey responses from Europe as a whole. Figure 141 below illustrates the number of responding countries in the sub-region who stated that they were affected by the specified hazards.

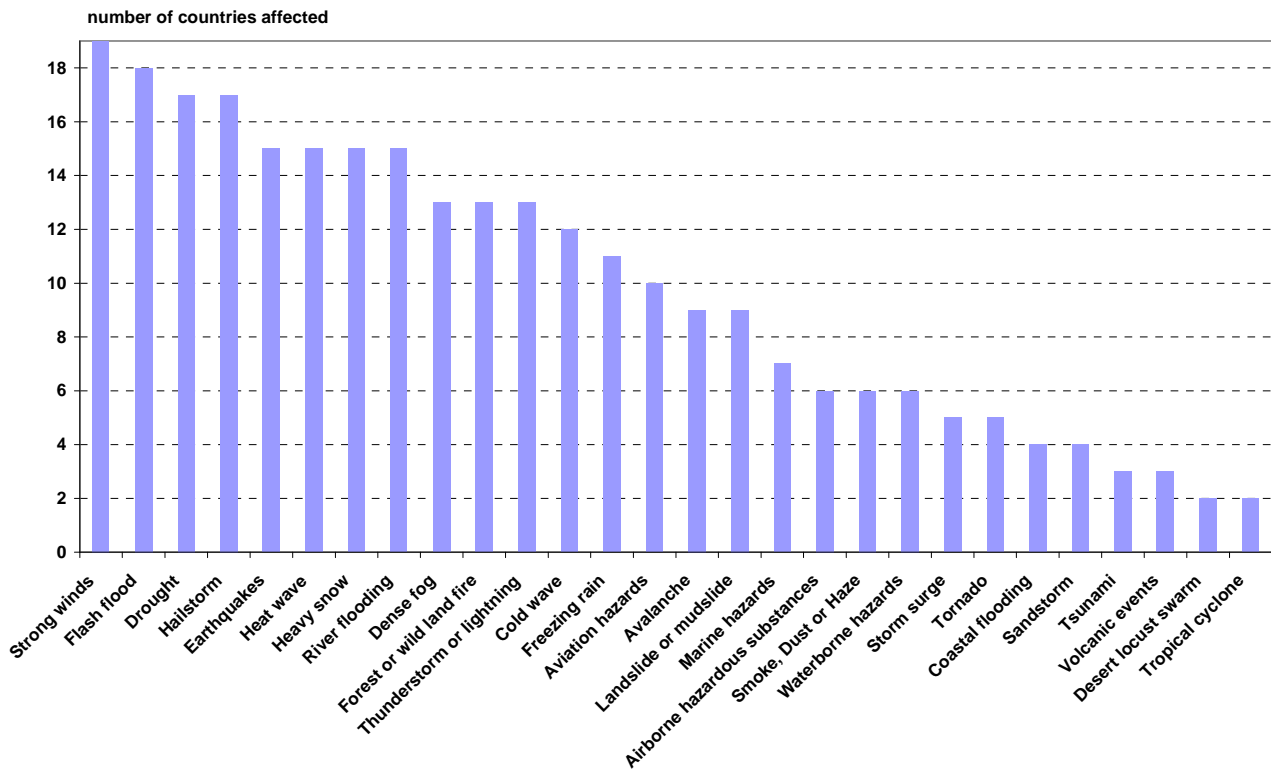


Figure 141. Number of responding NMHSs in Southern Europe who identified themselves as being affected by specified hazards.

The hazards affecting most countries in Southern Europe, not surprisingly, differ somewhat in relative distribution from those affecting Europe as a whole. In descending order of breadth of occurrence, the major hazards identified by Southern European NMHSs were as follows: strong winds, flash floods, hailstorms, droughts, heavy snow, river flooding, earthquakes, heat waves, thunderstorms and lightning, dense fog, forest and wild land fires, cold waves, freezing rain, aviation hazards, avalanches, landslides or mudslides and marine hazards, with remaining hazards affecting relatively few countries in the sub-region.

The following comments on aspects of the country-level survey responses in Southern Europe that differ noticeably from the overall European picture presented earlier in this chapter. A somewhat lower percentage of NMHSs maintained historical hazard databases and provided mapping and risk zone analysis based on these data. Legislative, governance, organizational and partnership aspects in the sub-region generally matched those for Europe as a whole. The survey responses, however, indicated that a lower level of operational coordination between NMSs and NHSs prevailed in Southern Europe and a significantly higher proportion of respondents stated that no coordination took place between these agencies on warnings issue. Similarly, a lower percentage of NMHSs in Southern Europe stated that they maintained a 24-hourly/year-round observation programme. Conversely, higher percentages indicated that lack of appropriate observation networks limited their ability for real time monitoring of hazards and to contribute to disaster risk reduction. Higher percentages of Southern European respondents also identified themselves as being limited by the telecommunications and informatics. In the latter sector, applications software, network equipment and computers were cited as weak areas relative to the overall European picture. The preceding weaknesses were stated to have a negative impact on data exchange in relation to which all Southern European respondents indicated needs for better coordination with neighbouring NMHSs. A somewhat lower than average percentage of Southern European respondents maintained a dedicated, round-the-clock, hazard warning service. In this context, Southern European contributors to the WMO country-level survey cited with greater frequency limitations imposed by lack of applications software, professional staff and computers. Furthermore,

this general pattern prevailed in relation to warnings coordination, product improvement, internal training and capacity enhancement and to outreach activities. In all of these areas, Southern European responses generally reflected weaker capacities or relative performance. In addition, a somewhat lower proportion of contributing NMHSs from the sub-region had contingency plans in place to maintain their services in emergencies. Furthermore, significantly fewer of them indicated that they had involved neighbouring NMHSs in those plans. In overarching areas, the main departures from the overall European picture were in coordination and partnership, where a lack of linkages with disaster risk reduction partners was identified by a higher proportion of Southern European respondents who more strongly advocated needs for better coordination with neighbouring NMHSs and RSMCs. In summary, the overall picture for Southern Europe was somewhat less positive than that for Europe as a whole.

9.10 Concluding Assessments and Recommendations for Europe

The following summarizes assessments and conclusions related to the analysis of the survey responses from European NMHSs that has been presented in this chapter. In order to facilitate identification of subject areas, the titles associated with individual assessments and conclusions presented below match those used during the analyses of European survey responses outlined in the preceding pages.

9.10.1 Access to Data on Hazards and their Impacts

NMHSs need to have easy access to official information on hazards and on the impacts of disasters in order to provide support for planning activities and to facilitate monitoring the effectiveness of their own services in support of disaster risk reduction. As Annex 3 illustrates, while most European NMHSs maintain records of the most common hazards such as strong winds, the number declines rapidly for less frequently occurring hazards. As the agencies responsible for monitoring and prediction of hydrometeorological hazards within their countries, NMHSs (or NMSs and NHSs) may, reasonably, be expected to maintain records of occurrences of significant hazards. Equally, it is important that NMHSs have ready access to official information on the impacts of disasters. The survey responses indicate that this is not the case in almost half the countries in the region.

9.10.2 Value Added Services based on Historical Hazard Data

The respondents' recommendations regarding enhanced valued added services are supported by earlier responses. Against the backdrop of the limiting factors identified above, however, the implications of these recommendations are that substantial training and capacity development will need to be undertaken in a significant number of the NMHSs in Europe to acquire the capability to deliver the added value services under discussion

9.10.3 Legislation and Governance

The responses suggest that, in those countries where a lack of clarity undercuts their potential contributions to disaster risk reduction, NMHSs should press for clear policy direction from their governments regarding their roles and responsibilities.

9.10.4 National Structures/Mechanisms for Disaster Risk Reduction

The degree to which NMHSs are integrated into national disaster risk reduction structures and their operational relationships with civil protection agencies, planning authorities and important non-governmental partners exercise a significant influence on their ability to contribute effectively to disaster risk reduction. For optimum effectiveness, state of the art NMHS scientific, technical and operational capacities must be mainstreamed into national planning, decision-making and disaster response structures and systems and, in addition, be well connected to important non-governmental partners. Responses to the survey indicate that many NMHS in Europe are not part of their national disaster risk reduction system. Those NMHS that are not members of their

national coordinating committees or structures should endeavour to acquire membership in these bodies and seek to contribute effectively to national disaster risk reduction activities.

9.10.5 NMHS Contributions to National Disaster Risk Reduction Systems

Experience elsewhere indicates that the respondents' recommendation for the establishment of a "readiness system" could, if implemented, enhance NMHSs contributions to disaster risk reduction and this should be pursued at the national level. Continuing efforts should be made to promote the contributions that NMHSs can make to disaster risk reduction and to encourage disaster authorities to build on NMHSs capacities. In parallel, however, the capacities of NMHSs must, where necessary, be enhanced to ensure that they can in fact deliver state of the art products and services in support of disaster risk reduction.

9.10.6 NMHS Collaboration with other Partners

Survey responses indicate that relatively few NMHSs in Europe pursue coordination and collaboration with significant national, regional and international partners in the disaster community. Expanded collaboration and partnerships can benefit NMHS through broader utilization of their products and services, increase their visibility, and result in more effective contributions to disaster risk activities. NMHS should be proactive in expanding their partnerships with the broader disaster community both within and outside government circles.

9.10.7 The Organization and Priorities of NMHSs

The respondents' majority recommendation appears entirely valid in light of the earlier responses. Close coordination between meteorological and hydrological authorities is an essential foundation for the provision of timely, accurate and consistent hydrometeorological hazard warnings and other services.

9.10.8 Operational Coordination between NMSs and NHSs

The survey responses summarized earlier clearly indicate that needs exist for enhanced operational coordination between NMSs and NHSs in many countries in Europe. The survey respondents' recommendation should, therefore, be pursued at the country level through actions to achieve more effective operational coordination between the meteorological and hydrological communities, particularly with respect to hazard warnings and other critical products.

9.10.9 Observation and Monitoring Networks and Systems

The survey responses indicate that about half of responding NMHSs in Europe consider that their observing networks are not optimal for disaster risk reduction and that a few do not maintain a dedicated 24-hour/year-round observation programme. Maintenance of their observation networks was also identified as presenting challenges to many NMHS, particularly in relation to the availability of resources and trained staff, with hazard-related damage being a compounding problem for some. Reliable, round the clock, observations, made available in real time, are the essential raw material needed for the production of early warnings, forecasts and other products to support disaster risk reduction. Consequently, every effort should be made to ensure that adequate observational networks and systems are put in place and maintained in operation on a 24-hourly/year-round basis.

9.10.10 Telecommunications and Informatics

Survey responses indicate that 24-hourly/year-round telecommunications systems are in place in all but one responding countries. However, significant deficiencies have been identified in relation to application software, network equipment, telecommunications facilities and computer hardware in many countries in Europe and Internet access poses a problem in a few of them. The responses validate the respondents' recommendation that upgrading of these systems is required in many NMHS.

9.10.11 Data Exchange

The respondents' recommendations for improved coordination with neighbouring NMHSs and RSMCs on data exchange make good sense since collaboration and coordination are fundamental to effective and efficient exchange of data and products. The survey responses, however, indicate that improved data exchange will also require enhancements to telecommunications systems and to data management, including quality assurance and archiving systems, in a significant number of NMHSs in the region. These responses also draw attention to related needs for capacity building in relation to data processing and customization of data and products.

9.10.12 Forecast and Warning Capability

The respondents' recommendations for upgrading of forecast and warning capabilities are validated by the responses summarized earlier in this section. Clearly, there are quite general needs for upgrading of professional staff, computing capacity and supporting applications software. However, the fact that one NMHS does not have operational forecast and warning services and a few more do not operate these services on a round-the-clock basis is a particularly serious deficiency in relation to issue of early warnings of hazards and other services for disaster risk reduction.

9.10.13 Forecast and Warning Products

The respondents' recommendation regarding the need to improve their warning products and services is soundly based.

9.10.14 Coordination of Warnings

The respondents' strong recommendation for improved coordination with neighbouring NMHSs and RSMCs in relation to watches and warnings makes good sense. Such coordination reduces the risk of ambiguous or, in the worst case, conflicting warning messages from different sources reaching the same audience. A compounding issue here is the increased potential for confusion that arises when commercial or other entities also issue hazard warnings, as is the case in some European countries. As a general principle, therefore, it is desirable to work towards a situation where official warnings for hydrometeorological hazards emanate from a single recognized issuing authority within each country. Ideally being prepared by NMHSs with the scientific and technical capacity to make such predictions, hydrometeorological warnings may, in some circumstances, benefit from assessment and interpretation by civil defense authorities as to their likely impacts before being relayed to local communities, perhaps accompanied by advice on actions that people should take to minimize loss of life and property.

9.10.15 Products and Services for Selected Socio-Economic Sectors

Experience around the globe demonstrates that the socio-economic sectors discussed earlier could benefit significantly from the incorporation of hydrometeorological information and products into their planning and decision-making processes. Sensible land-use planning to minimize risk of flooding and other hazards, engineering design of housing and other developments to withstand expected wind loads, design of drainage system to accommodate heavy rainfalls or rapid snowmelt and other similar measures contribute to hardening societies and communities against disastrous impacts of hydrometeorological events. Equally, early warnings of hazards enable people to take avoidance or mitigating actions to prevent disasters. The survey responses indicate that vulnerable target sectors do not receive special hydrometeorological services in roughly half of European countries. Consequently, NMHSs in the region have the opportunity to contribute substantively to disaster risk reduction by enhancing the provision of relevant products and services to planning, development, water resources and other key socio-economic sectors.

9.10.16 Dissemination Systems and Target Audiences

Reliable and timely dissemination of early warnings of hazards to stakeholders and the public at large is among the most useful services that NMHSs can provide in support of disaster risk reduction. Consequently, every effort should be made to ensure that warnings and other relevant products reach all important target audiences. In the context of disaster risk reduction, national Red Cross/Red Crescent Societies and similar non-government bodies should be targeted for receipt of hazard warnings on virtually the same level as government disaster authorities. Efforts to enable such important external partners to access and utilize early warnings of hazards and other relevant NMHS products should be strongly encouraged in Europe, given the relatively low percentage of NMHSs who currently disseminate to these stakeholders.

9.10.17 Product Utility and Product Improvement

The responses indicate that many, perhaps most, of the NMHSs in the region have adopted best practices approaches to assessing and attempting to improve the utility of their products. The majority of responses also indicate, however, that continuing emphasis is needed on increasing the awareness and understanding of stakeholders, including the public at large, disaster risk authorities, and the staff of emergency agencies, regarding hazards, their impacts and the content of warnings and other disaster products. As a specific initiative, roughly half of NMHS advocated implementation of joint training for staff of NMHS and those of disaster management and emergency response agencies. The respondents recommendation is well supported by survey other responses.

9.10.18 Internal NMHS Training and Capacity Enhancement

The respondents' recommendations, while valid, only partially address the deficiencies and limitations identified in the above responses. Taken overall, the survey responses support the need for continued emphasis by NMHSs on training and capacity building in forecast and warning preparation and also encourage an increased emphasis on the development of the capability to provide specialized support products and services for disaster risk reduction.

9.10.19 Outreach Activities

Survey responses indicate that fewer than half of the NMHSs in Europe have given high priority to outreach activities directed at the general public or disaster risk authorities and emergency managers and staff. The respondents' recommendation is, therefore, supported by other survey responses, though it is narrowly focussed on a single outreach tool or mechanism. Taken overall, the survey responses indicate the need for greater emphasis on outreach activities by most NMHS in the region. Even the best hazard warnings and disaster risk products will have little value if the recipients do not understand and know how to apply these products. As a useful first step, those NMHS that do not have a public weather service programme should give serious consideration to establishing such a programme to provide a foundation for enhanced outreach activities.

9.10.20 NMHS Contingency Planning

Establishment of back-up capability to maintain critical hazard warning services in the event of emergencies is a prudent step for all NMHS. In many, perhaps most, instances, a partnership agreement with neighbouring NMHS can be an effective and low-cost approach to ensuring back-up capability.

9.10.21 WMO Support

European NMHS who responded to the WMO survey identified their highest priority needs for support from WMO as being in relation to technology transfer and capacity building, followed by education, training and public outreach programmes related to disaster risk, infrastructure development and strengthening of strategic partnerships with stakeholders. Areas such as enhancement of NMHS visibility, cost-benefit analysis, partnerships with other technical

organizations, resource mobilization, emergency protocols and national disaster risk reduction plans were somewhat lower priorities in Europe. The identification by European NMHS, the majority of whom are well developed, of high priority needs for assistance with stakeholder education, training and public outreach specifically related to disaster risk reduction provides additional validation for requirements in these less traditional areas of focus of WMO training and development programmes.

9.11 Region-wide Capacities and Resources in Europe

National Meteorological and Hydrological Services in Europe can draw upon operational products, data, training and other assistance from an extensive regional network of data sources and centres of excellence to bolster their domestic capacities to support disaster risk reduction. EUMETNET, a network grouping 21 European National Meteorological Services, provides a framework to organize co-operative programmes between NMHSs across all aspects of their activities. As in other regions, WMO Regional Specialized Meteorological Centres (RSMCs) at Bracknell, Moscow, Offenbach, Rome and Toulouse supply a range of operational products. The European Centre for Medium-Range Weather Forecasting (ECMWF) disseminates medium range forecast products for the region and beyond. Domestic capacities in the acquisition, processing and application of satellite remote sensing data are reinforced by the EUMETSAT system. Since 1998, floods have caused some 700 deaths, about €25 billion in insured economic losses, and displaced about half a million people in Europe. In response, the European Commission is pursuing an action programme to increase awareness of flood risks, improve information exchange and promote best practices. Under the umbrella of GMES, a European Flood Alert System (EFAS) is being developed to assist Water Authorities and the European Commission to prepare and respond to flood events. In addition, a European Exchange Circle on Flood Forecasting (EXCIFF) is being implemented to facilitate the exchange of flood forecasting knowledge and experience. A WMO Regional Association working group on Flood forecasting has also been established to improve the capability of NMHSs in flood forecasting and warning. Furthermore, under the umbrella of WHYCOS, a MED-HYCOS has been implemented that involves eighteen countries from the Mediterranean rim that has improved the hydrological observation network in the sub-region and also established a Mediterranean Hydrological Information System (MHIS). In addition, a follow-up HYCOS project has been initiated to re-establish and upgrade the hydrological observing network, data exchange and forecasting capacities in the countries in the Sava River Basin. On a broader level, European NMHSs can access several disaster-related data sources such as the EM-DAT database, maintained by the WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED), NATHAN (Natural Hazards Assessment Network), maintained by Munich Re Group, the Swiss Re CatNet™, a web-based natural hazard information and mapping tool, and the European Severe Weather Database. A further regional resource is represented by Global Monitoring of Environment and Security (GMES), a European Union initiative to establish an integrated observational strategy (surface, remote and space based) that feeds into an integrated modeling and forecasting system to deliver services to the user community. Under the GMES umbrella, the EU is currently underwriting projects to provide regularly updated, Internet-accessible, forecasts of wind storms and to develop improved Forest Fire Danger Indices. The NMHS in Europe can also access the training expertise of WMO Regional Meteorological Training Centres located in Israel, Italy, the Russian Federation and Turkey in addition to the highly developed university and technological institute programs in meteorology and hydrology that exist in many countries in the region.