

CHAPTER 12

SMALL ISLAND DEVELOPING STATES

12 SMALL ISLAND DEVELOPING STATES (SIDS)

Abstract – Small Island Developing States

Survey responses from NMHSs in 19 Small Island Developing States (SIDS) indicate that all of have observation and telecommunications networks and forecasting and warning programmes in place. Most of these are considered inadequate, however, with widespread deficiencies in network equipment, informatics and professional staff capacities. A sizeable majority identifies the lack of forecast training as reducing the effectiveness of their forecast and warning services. In addition, few, if any, have warnings programmes in place for less frequently occurring hazards. Without exception, they stress that improving their forecasting and warning infrastructures and services would enhance their countries' disaster risk reduction capacities. Though most have contingency plans to maintain services in emergencies, all of them advocate improved emergency coordination with neighbouring NMHSs. All of them also cite needs for better technical coordination between their National Meteorological Services (NMSs) and National Hydrological Services (NHSs), since few have combined NMHSs. Most also stress needs for improved coordination with WMO Regional Specialized Meteorological Centers (RSMCs) and other stakeholders. Only a minority possess hazard databases or provide targeted support to the housing sector, though somewhat more provide support to land-use planning and fresh water sectors. Without exception, SIDS NMHSs endorse the provision of value added services though most point out that they lack expertise in data management, archiving and data customization. Most of them also advocate expansion of educational and outreach efforts targeted at the public, media and other stakeholders. Virtually all identify inadequate financial and human resources as major limitations. While the NMHSs in most of the 19 SIDS are members of their national disaster risk coordination committees, most feel constrained by inadequate recognition or lack of clarity regarding their roles and some by the structures themselves. The preceding survey results underpin the following conclusions and recommendations aimed at enhancing the contributions to disaster risk reduction of NMHSs in Small Island Developing States:

- All NMHSs in Small Island Developing States should be active participants in their national disaster risk reduction systems. Those few who are not already members should seek membership in their national disaster risk coordinating committees. All of them should strive to ensure that these committee structures make effective use of NMHSs' hazard warning and related capacities.
- Most Small Island Developing States NMHSs need to improve their archiving systems for hazard data and their access to impacts data. This generates associated requirements for capacity development related to data rescue, quality assurance, data management and archiving.
- Most Small Island Developing States NMHSs require capacity development and training in disaster risk applications such as hazard and impact analysis, hazard mapping, risk zone analysis and product customization.
- Every effort should be made to establish and maintain adequate hydrometeorological observation and telecommunications networks in Small Island Developing States where virtually all such networks are inadequately resourced and five or six do not operate on a round the clock basis. This will require substantial investments in infrastructures and capacity development in most SIDS NMHSs, reinforced by continuing injection of adequate operating funds.
- Small Island Developing States NMHSs' hazard warning capacities should be strengthened. There are virtually universal needs for upgrading of forecasting infrastructures and professional staff expertise, with no warning services proved by three NMHSs and less than 24-hourly services provided in several others. Warning programmes should also be expanded to address all hydrometeorological hazards with disaster-causing potential and warnings should be routed to all important stakeholders.

- Official warnings of hydrometeorological hazards should emanate from a single competent issuing authority, ideally the NMHS. In some circumstances, they may benefit from assessment and interpretation by civil defence authorities before being widely disseminated.
- Verification programmes for hydrometeorological hazard warnings should be implemented by all NMHSs in Small Island Developing States to monitor warning accuracy and timeliness, assess improvements in skill, and demonstrate their' warning capabilities to stakeholders.
- The roughly one quarter of SIDS NMHSs who have not already done so should establish back-up arrangements to maintain hazard warnings and other services in emergency situations, possibly through partnership agreements with neighbouring NMHS.
- NMHSs in SIDS should encourage the establishment of national readiness systems within their countries.
- Operational coordination should be improved between NMSs and NHSs in SIDS and with neighbouring NMHSs and RSMCs. In some countries, this may require policy direction or partnership agreements to clarify their respective responsibilities of NMSs and NHSs, particularly in relation to issue of hazard warnings.
- Most Small Island Developing States NMHSs should increase emphasis on the provision of products and services to sensitive economic sectors such as land-use planning, housing and development and water resources which do not receive such services in one half of the SIDS.
- Most SIDS NMHSs should increase emphasis on education and outreach directed at key stakeholders and the public at large given that little attention has been paid to this critical area in many of the NMHSs. The conduct of joint training with disaster authorities is a related priority.
- Most Small Island Developing States NMHSs need wide ranging support from WMO in capacity building, infrastructure development and resource mobilization. Capacity development is particularly needed in relation to disaster risk tools and products in addition to more traditional areas such as infrastructure maintenance and operations, data management and forecast and warning production.

The present chapter centres on the assessment of the survey responses from NMHSs in Small Island Developing States. Its internal structure follows the sequence outlined earlier in section 2.6.1.

12.1 The Response to the Survey

As noted earlier, 19 Small Island Developing States (SIDS) responded to the WMO country-level survey and these are listed in Annex 2.

12.2 The Hazards affecting Small Island Developing States (SIDS)

Figure 182 lists the number of responding Small Island Developing States who identified themselves as being affected by the specified hazards.

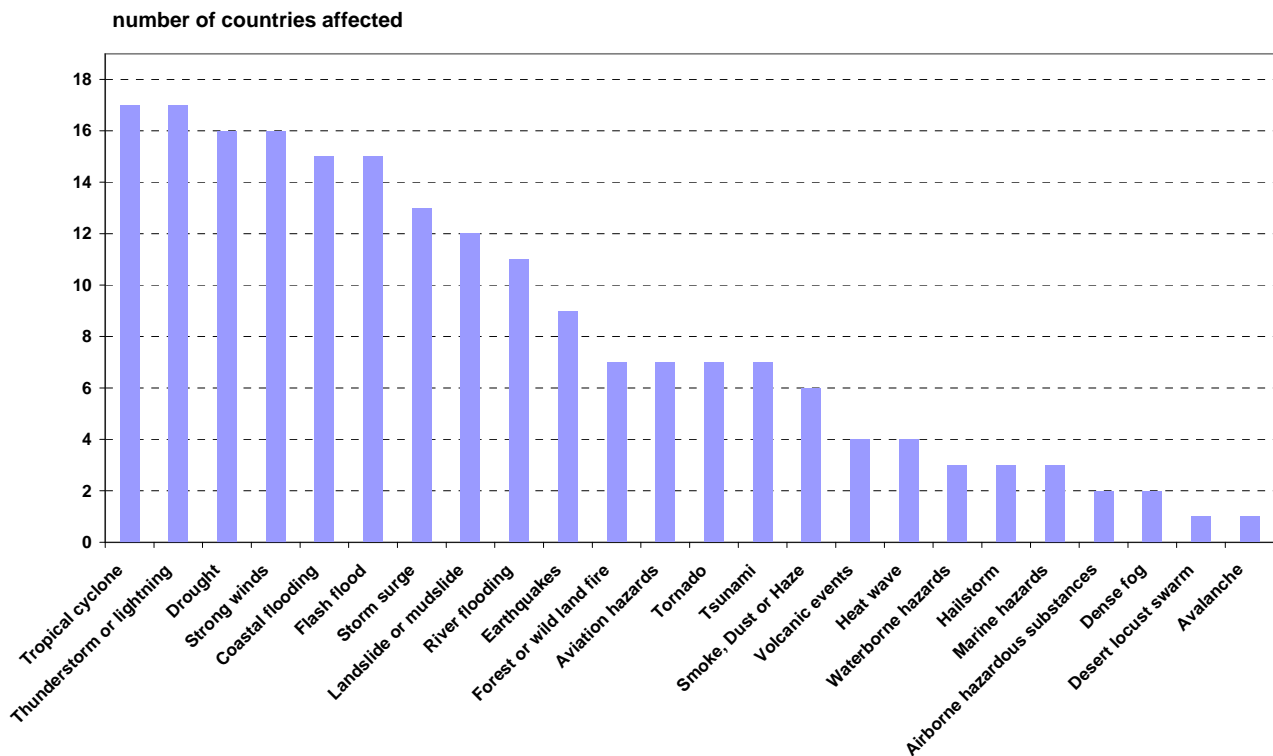


Figure 182. Number of responding Small Island Developing States (SIDS) who identified themselves as being affected by specified hazards.

12.2.1 Access to Data on Hazards and their Impacts

Annex 3 presents an overview of the hazard databases maintained by survey respondents in Small Island Developing States and includes some supplementary information on related metadata and impacts information. Most NMHSs in Small Island Developing States who contributed to the WMO Disaster Risk Reduction country-level survey (84% or 16 of 19) stated that another agency was responsible for providing official information on the impacts of disasters in their country. Most of them (79% or 15 of 19) also stated that they had access to such official, reliable, information. In addition, however, roughly one quarter (26% or 5 of 19) of the survey respondents reported that

they maintained their own internal database of official information on the impacts of hazards that affected their countries and regularly updated this database³⁴.

12.2.2 Value Added Services based on Historical Hazard Data

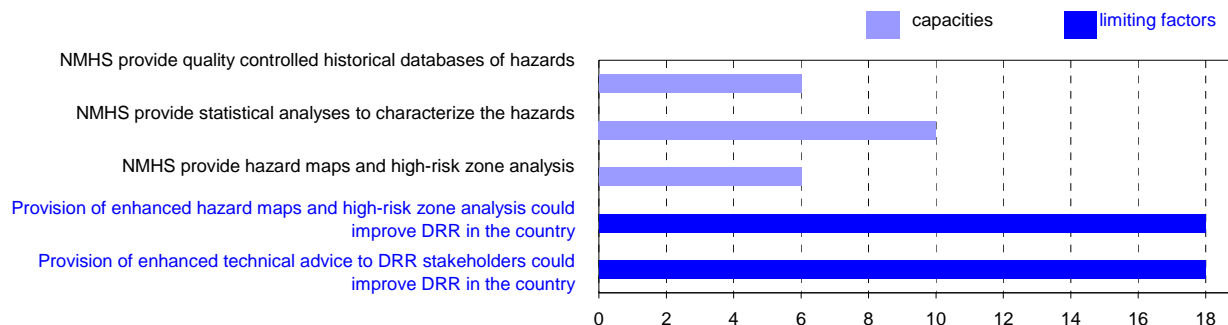


Figure 183. Provision of hazard information by NMHSs in Small Island Developing States.

The following draws attention to the extent of value added services provided by NMHSs in Small Island Developing States (SIDS) who maintain historical archives of hydrometeorological hazards. Almost three quarters of SIDS NMHSs who contributed to the country-level survey (71% or 12 of 17) stated that they provided technical advice on hazards and roughly half (53% or 9 of 17) provided statistical analyses to characterize them. Less than a third of them (29% or 5 of 17), however, reported that they maintained quality controlled historical databases of hazards or provided analyses of the potential impacts of hazards and just one more (35% or 6 of 17) undertook hazard mapping and high-risk zone analysis. Most SIDS NMHSs identified a number of factors that limited their ability to provide hazard data products. They cited as limiting factors professional staff with appropriate training (94% or 17 of 18), data rescue (83% or 15 of 18), customization of data for stakeholders (78% or 14 of 18), ability to archive and update (72% or 13 of 18) and quality assurance (61% or 11 of 18). All SIDS respondents to the WMO survey also considered that the provision of enhanced value added NMHS services in support of hydrometeorological risk assessment would strengthen their contributions to disaster risk reduction activities. The following specialized services were identified as useful enhancements - analyses of the potential impacts of hazards (100% or 18 of 18), hazard mapping and high-risk zone analysis (100% or 17 of 17), and provision of technical advice (94% or 17 of 18).

12.3 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 Small Island Developing States' responses regarding their countries' national systems for disaster risk reduction, the impact of these systems on the NMHSs and the extent of NMHSs contributions to them.

³⁴ 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.

12.3.1 Legislation and Governance

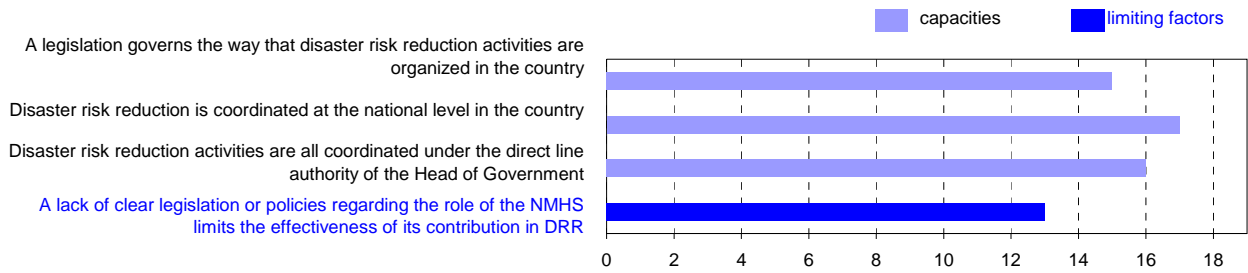


Figure 184. Legislation and coordination in support of disaster risk reduction at the national level in Small Island Developing States.

Most Small Island Developing States (SIDS) who contributed to the WMO Disaster Risk Reduction country-level survey (84% or 16 of 19) reported that disaster reduction activities were coordinated at the national level 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 (74% or 14 of 19) and in just over half (53% or 10 of 19) coordination was centred under one ministry. At the same time, however, about two thirds of the SIDS respondents (67% or 12 of 18) considered that a lack of clear legislation or policies regarding the role of the NMHS (e.g. as the sole issuer of hydrometeorological hazard warnings) limited their contributions to disaster risk reduction.

12.3.2 National Structures/Mechanisms for Disaster Risk Reduction

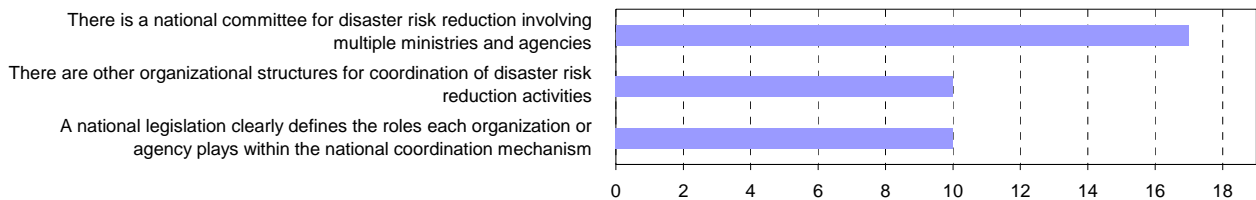


Figure 185. National structures for coordination of disaster risk reduction in Small Island Developing States.

Most Small Island Developing States NMHSs who responded to the WMO survey (84% or 16 of 19) indicated that their countries had a national committee for disaster risk reduction that involved multiple ministries and agencies and all of them stated that they were members of their national coordinating committee. Just over half the SIDS contributors to the survey (53% or 10 of 19) reported that the roles of each participating agency in their national coordination committees were defined by legislation. The same number (53% or 10 of 19) pointed out that other organizational structures for coordination also existed in their countries. However, just under half of these NMHSs (44% or 8 of 18) felt that their contributions to disaster risk reduction were limited by their national disaster risk reduction organizational structure.

12.3.3 NMHS Contributions to National Disaster Risk Reduction Systems

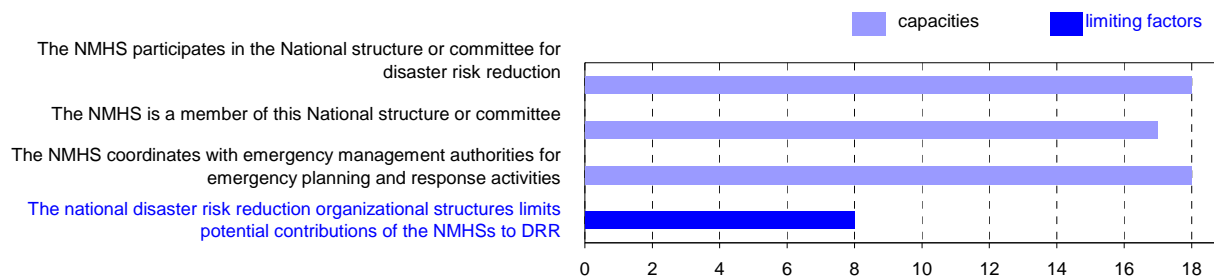


Figure 186. NMHS participation in national structures for disaster risk reduction in Small Island Developing States.

All Small Island Developing States NMHSs who contributed to the survey (100% or 19 of 19) indicated that they provided support to agencies responsible for disaster risk reduction at the national level. All of them (100% or 19 of 19) also provided support to emergency planning and preparedness and emergency response operations. Almost as many (95% or 18 of 19) provided support to disaster prevention but only about half (53% or 10 of 19) supported post-disaster reconstruction. The majority of SIDS NMHSs (94% or 16 of 27) extended their support to provincial or state government disaster-related activities and almost all who responded (88% or 15 of 17) also provided support to municipal or local levels. Almost two thirds (61% or 11 of 18) of responding NMHSs, 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, most SIDS NMHSs (94% or 17 of 18) considered that their contributions would be enhanced by a “readiness system” that required appropriate responses by authorities to information issued by the NMHSs.

12.3.4 NMHS Collaboration with other Partners

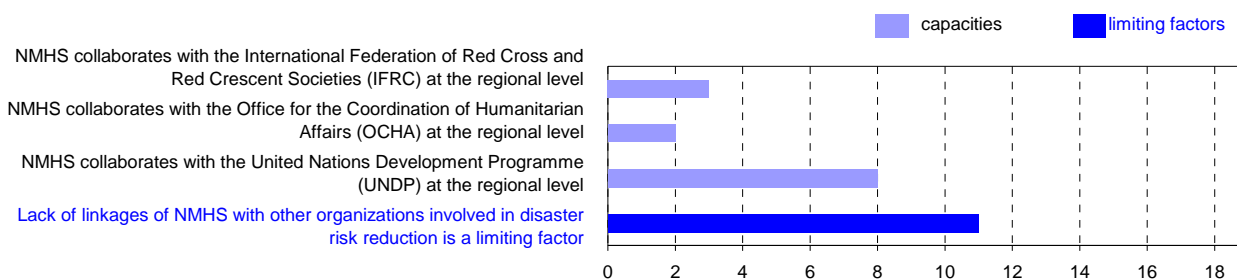


Figure 187. NMHS collaboration with partner agencies at the regional level in Small Island Developing States.

A solid majority (89% or 17 of 19) of SIDS NMHSs who contributed to the country-level survey indicated that they coordinated with emergency management authorities for emergency planning and response activities. In addition, almost two thirds of respondents (63% or 12 of 19) reported that they collaborated with their National Red Cross and Red Crescent Societies and almost as many (61% or 11 of 19) participated in disaster-related activities on the level of a WMO Region or a regional economic grouping. Smaller numbers interacted with the office of their national United Nations Coordinator (47% or 9 of 19) and/or participated in disaster related activities of international organizations (73% or 8 of 11), the UNDP (57% or 8 of 14), the IFRC (23% or 3 of 13), or the Office for the Coordination of Humanitarian Affairs (OCHA) (15% or 2 of 13).

12.3.5 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 Services³⁵ in Small Island Developing States are concerned, parent ministries include: Civil Aviation; Agriculture and Rural Development; Environment and Natural Resources; Infrastructure and Public Utilities; Public Utilities and Environment; Transport and Communication; Transport and Aviation; Local Government and the Environment; and Environment and Water Resources. Correspondingly, parent departments of National Hydrological Services include: Lands and Natural Resources; Agriculture, Forestry and Fisheries; Environment and Natural Resources; Environment and Water Resources; Lands; Works and Energy; Public Works and Utilities; Housing, Transport, Works and Water; Public Utilities and the Environment.

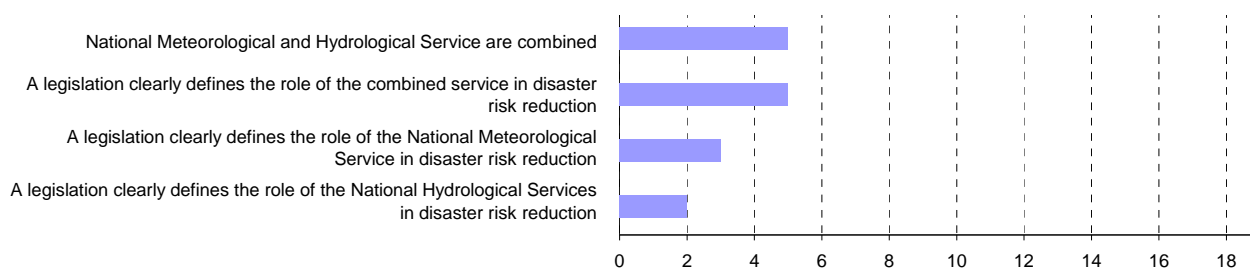


Figure 188. Organizational structure of meteorological and hydrological services in Small Island Developing States.

The internal organization of National Meteorological and Hydrological Services can also influence their ability to deliver well-coordinated hydrometeorological warnings and other services in support of disaster risk reduction. Roughly one quarter of survey contributors (26% or 5 of 10) from Small Island Developing States stated that they had a combined National Meteorological and Hydrological Service and about a third of respondents (36% or 5 of 14) indicated that their country had national legislation that clearly defined the NMHS role in disaster risk reduction. Less than a quarter of those with separate Services (20% or 3 of 15), however, indicated that legislation existed that clearly defined the role of their National Meteorological Service (NMS) in disaster risk reduction. Even fewer (15% or 2 of 13) indicated that such legislation was in place for their National Hydrological Service (NHS). At the same time, a majority (83% or 10 of 12) of SIDS contributors to the WMO country-level survey 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, all of those who responded (100% or 11 of 11) considered that better technical coordination between their NMSs and NHSs would result in enhanced joint products and services, with a slightly smaller number (82% or 9 of 11) advocating that better coordination would result in enhanced issuance of warnings.

³⁵ Parent departments of NMS and NMHS have been grouped together due to ambiguities in responses regarding the existence or otherwise of combined NMHS.

12.3.6 Operational Coordination between NMSs and NHSs

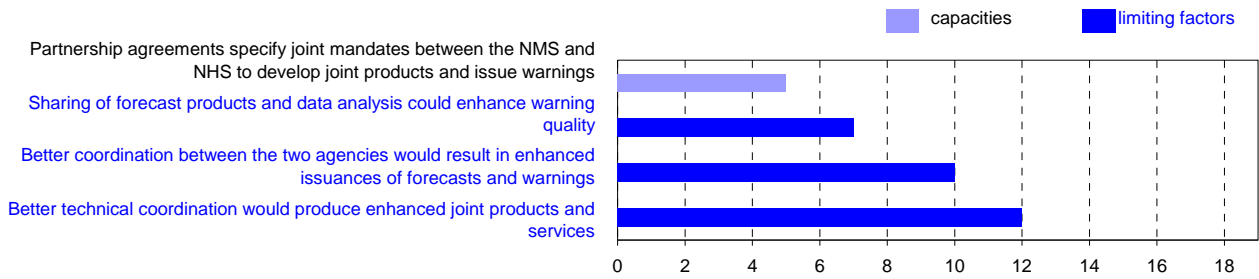


Figure 189. Coordination between NMS and NHS in Small Island Developing States.

A third (33% or 5 of 15) of survey respondents from Small Island Developing States that had separate NMSs and NHSs identified that a partnership agreement was in place specifying mandates between their NMSs and NHSs to develop joint products and issue warnings. Somewhat more (47% or 7 of 15) indicated that the two agencies shared forecast products and data analyses that could enhance warning quality. Just over half of these (29% or 4 of 14) stated that coordination took place before warnings were issued for hazards of mutual concern. In addition, almost as many (21% or 3 of 14) indicated that coordination also took place for any hazard warning was issued. Two NMHSs (20% or 2 of 10), however, reported that there was no coordination on warnings. All SIDS respondents to the question (100% or 11 of 11) considered that better technical coordination between their NMSs and NHSs would result in enhanced joint products and services. Furthermore, most SIDS (84% or 16 of 19) felt that better overall coordination between the two agencies would enhance issuance of forecasts and warnings.

12.4 NMHS Infrastructure, Products and Services

The following sections summarize the information contained in survey responses 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 NMHSs in Small Island Developing States.

12.4.1 Observation and Monitoring Networks and Systems

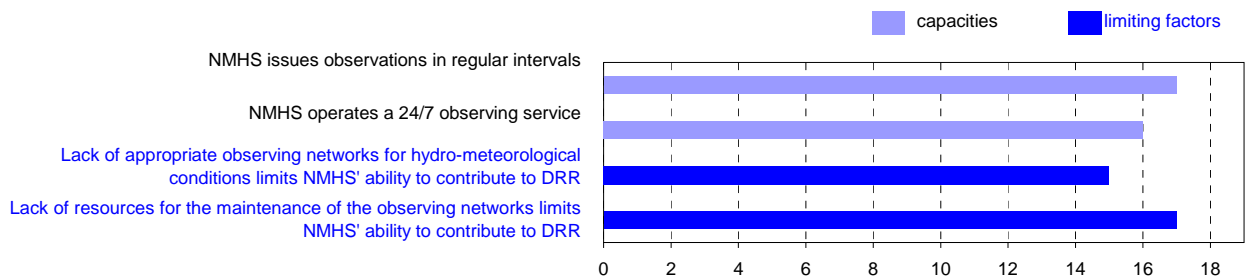


Figure 190. Observation and monitoring networks and systems in Small Island Developing States.

Most SIDS NMHSs who contributed to the WMO country-level survey (89% or 16 of 18) stated that they had an operational observing capacity that issued observations at regular intervals. Almost all of these (94% or 15 of 16) reported that the observing service operated 24-hourly/year-round. In addition, over half (56% or 10 of 18) of them indicated that their observation network included sea level monitoring stations. However, more than three quarters (78% or 14 of 18) considered that a

lack of appropriate hydrometeorological observing networks limited their ability to contribute to disaster risk reduction. Furthermore, almost half of these (33% or 6 of 18) 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 highlighted by almost all SIDS NMHSs. They drew particular attention to inadequate resources (94% or 17 of 18) (e.g. financial, replacement parts, personnel, etc), lack of professional staff with appropriate training (89% or 16 of 18) and hazard-related damage (59% or 10 of 17).

12.4.2 Telecommunications and Informatics

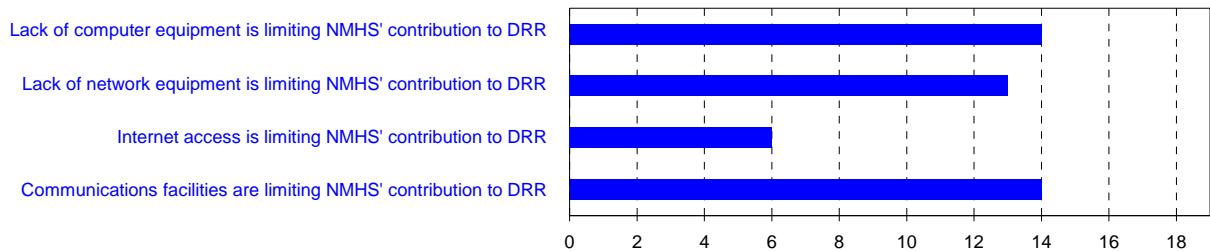


Figure 191. Telecommunication and informatics in Small Island Developing States.

Most SIDS NMHSs who responded to the WMO country-level survey (88% or 15 of 17) reported that their telecommunications systems were available 24-hourly/year-round. Partial confirmation was provided by responses indicating that most SIDS forecasting staff (72% or 13 of 18) had access to real time hydrometeorological data. However, a large majority of SIDS contributors to the survey (88% or 14 of 16) went on to identify that their ability to deliver critical products for disaster risk reduction was limited by communications facilities. Other limitations on NMHSs capacities were cited in major areas of informatics, with all respondents neither (100% nor 16 of 16) citing application software, over three quarters (81% or 13 of 16) identifying network equipment and computers and a substantial number (40% or 6 of 15), drawing attention to inadequate Internet access. Finally, almost all SIDS NMHSs (94% or 16 of 17) considered that upgrading the operational infrastructure for forecasting and warning services would enhance disaster risk reduction capacities in their countries.

12.1.1 Data Exchange

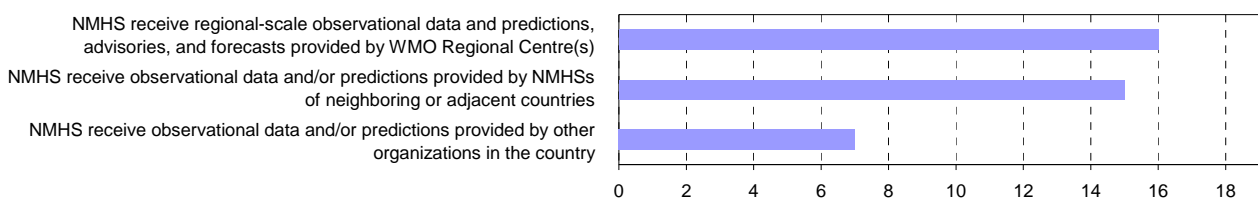


Figure 192. Data exchange in Small Island Developing States.

Survey contributions from NMHSs in Small Island Developing States identified that almost three quarters (72% or 13 of 18) of SIDS forecasting staff had real time access to hydrometeorological data. Most SIDS NMHSs who responded (94% or 15 of 16) stated that their forecasters also used regional scale observational data and forecasts provided by WMO Regional Specialized Meteorological Centres and data from neighbouring countries (82% or 14 of 17) and some (41% or 7 of 17) used data and predictions from other organizations in their countries. Over half (61% or 11 of 18) received real time marine observations from the WMO Global Telecommunications System (GTS) and some (31% or 4 of 13) relayed sea level observations on that global network. However, most SIDS contributors (88% or 14 of 16) 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 ability to archive and update (72% or 13 of 18), quality assurance (61% or 11 of 18) and by customization of data for stakeholders (78% or 14 of 18). In addition, a substantial majority of SIDS NMHSs considered that they required better coordination with RSMCs (93% or 13 of 14) and with neighbouring NMHSs (88% or 14 of 16) on hydrometeorological data exchange to enhance their countries disaster risk activities.

12.4.3 Forecast and Warning Capability

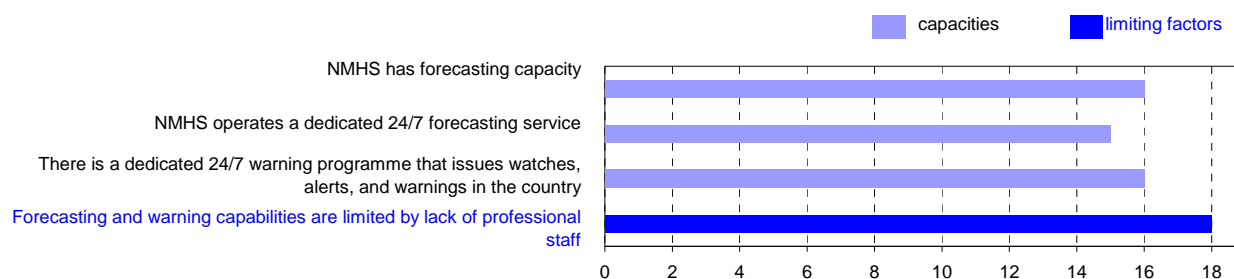


Figure 193. Forecast and warning capabilities in Small Island Developing States.

Almost all NMHSs (88% or 15 of 17) in Small Island Developing States who responded to the WMO country-level survey indicated that they had an operational forecasting capability. A solid majority (88% or 14 of 16) of them stated that this was a dedicated 24-hourly/year-round forecast service. Most SIDS respondents (88% or 15 of 17) said that a meteorologist was required to be on-site to operate this service. Most of them (83% or 15 of 18) also reported that they had a dedicated hazard warning programme that issued watches, alerts and warnings on a 24-hourly/year-round basis. Almost all of these (88% or 14 of 16) indicated that a meteorologist was on site during the operational hours of the warning programme. Most responding NMHSs (89% or 16 of 18) also stated that they provided a marine forecast and warning service to mariners and coastal zone users and one of them (5% or 1 of 20) also prepared marine forecasts for the Global Maritime Distress and Safety System (GMDSS). One NMHS (6% or 1 of 18) reported that other public or commercial entities in their country provided competing hazard warning services. Conversely, all SIDS survey contributors (100% or 17 of 17) indicated that their NMHS was limited in its ability to deliver critical products and services for disaster risk reduction by professional staff and all respondents (100% or 16 of 16) also cited application software as a limiting factor. In addition, over three quarters of them (81% or 13 of 16) stated that their ability was limited by computers. All SIDS NMHSs (100% or 17 of 17) also considered that upgrading their operational forecasting and warning services would enhance disaster risk reduction in their countries. More particularly, all who responded (100% or 18 of 18) advocated the upgrading or technical training of professional staff.

12.4.4 Forecast and Warning Products

Table 11 in Annex 4 summarizes information on hazard warnings and products issued by NMHSs in Small Island Developing States (SIDS) who contributed to the WMO country-level survey. The survey responses indicated that the hydrometeorological hazards affecting the greatest number of Small Island Developing States were, in descending order, strong winds, thunderstorms and lightning, droughts, river flooding, flash floods, forest and wild land fires, earthquakes, tropical cyclones, heat waves, aviation hazards, landslides or mudslides, hailstorms, coastal flooding,

smoke, dust or haze, desert locusts and tsunamis³⁶. Examination of the data in Table 11 reveals that, while a majority of affected NMHSs issued warnings for the most common of the above hazards, the number of NMHSs issuing warnings then declined rapidly and progressively to almost none in the case of the least common hazards. The relatively limited range of hydrometeorological hazards for which warnings are issued in many SIDS countries suggests that consideration should be given to broadening NMHSs warning programmes to include all major hazards that have the potential to cause disasters and for which proven predictive techniques exist. This may, and likely will, require additional investments in infrastructure and capacity development in many SIDS NMHSs.

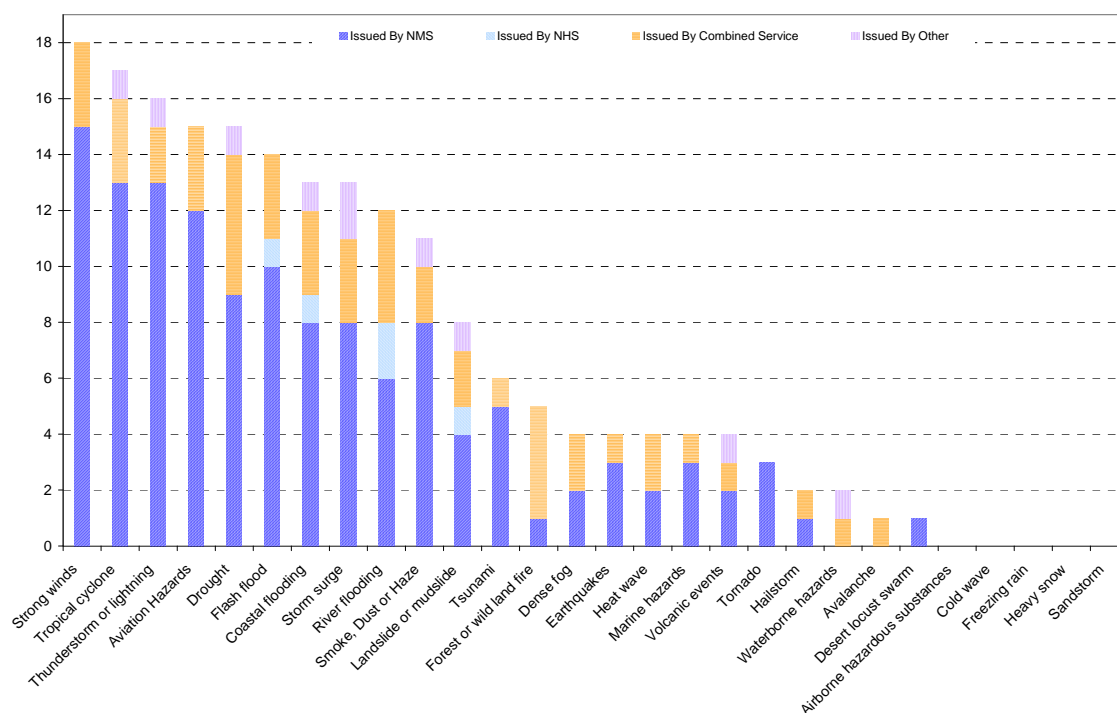


Figure 194. Agencies mandated for issuance of warnings in Small Island Developing States.

The survey responses indicated that National Meteorological Services (NMSs) in Small Island Developing States (SIDS) were responsible for the issuance the vast majority of warnings for hydrometeorological hazards. As with previous country groupings, exceptions were in the cases of river flooding, flash floods and coastal flooding where combined NMHSs and NHSs were major players. The survey data also indicated that the NMHSs (or, as the case may be, NMSs or NHSs) were the sole issuers of warnings for major hydrometeorological hazards in about two thirds of Small Island Developing States with competing warning services being present in the remainder. Official hazard warnings were indicated to include information regarding their potential impacts in about third to one half of SIDS countries. Finally, a very large majority of Small Island Developing States NMHSs who responded to the survey considered that further improvements to their warnings were necessary. This suggests that a receptive climate exists in these NMHSs towards enhancing their warning programmes to provide improved support for disaster risk reduction activities within their respective countries.

³⁶ 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.

12.4.5 Coordination of Warnings

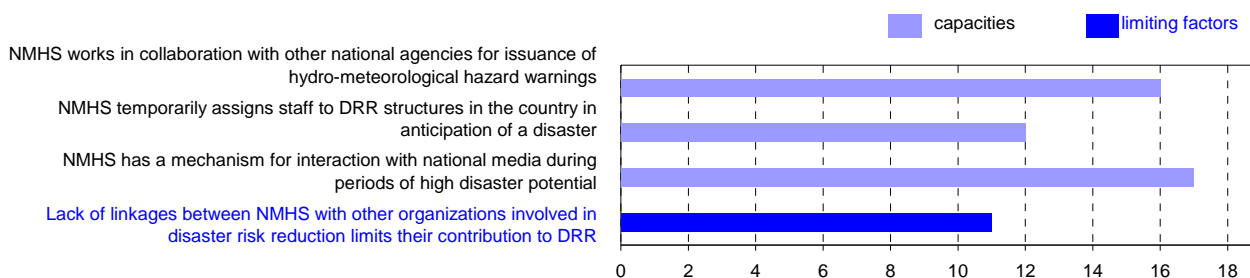


Figure 195. External coordination for issuance of warnings in Small Island Developing States.

Early warnings of hydrometeorological hazards represent a vital contribution to disaster risk reduction. In Small Island Developing States, most NMHSs who contributed to the WMO survey (83% or 15 of 18) reported that they worked in collaboration with other agencies (e.g. agriculture, aviation, etc) with respect to hazard warnings. Most of them (87% or 13 of 15) discussed the hazard's characteristics and potential impacts with these agencies prior to issuing a warning. In addition, a large majority (89% or 16 of 18) stated that they had a mechanism for interaction with their country's media during periods of high disaster potential. Over half of survey respondents (61% or 11 of 18) also indicated that they temporarily assigned staff to disaster risk management structures in anticipation of a disaster. One NMHS (6% or 1 of 18) pointed out that there were other public or commercial entities that provided competing warning services in their countries. Finally, all SIDS survey respondents (100% or 15 of 15) considered that their NMHSs required better coordination of watches and warnings with neighbouring NMHSs and well over three quarters of them (86% or 12 of 14) advocated improved coordination of watches and warnings with WMO Regional Specialized Meteorological Centres.

12.4.6 Products and Services for Selected Socio-Economic Sectors

Figure 196 illustrates the provision by NMHSs of specialized alerts, warnings and other products to significant socio-economic sectors in Small Island Developing States that can be seriously affected by hazardous events. In the context of disaster risk reduction, it is noteworthy from Figure 196 that just over a third (41%) of responding NMHSs indicated that they provided support to the housing sector, over a half (55%) to land-use planning and roughly two thirds (67%) to the fresh water sector.

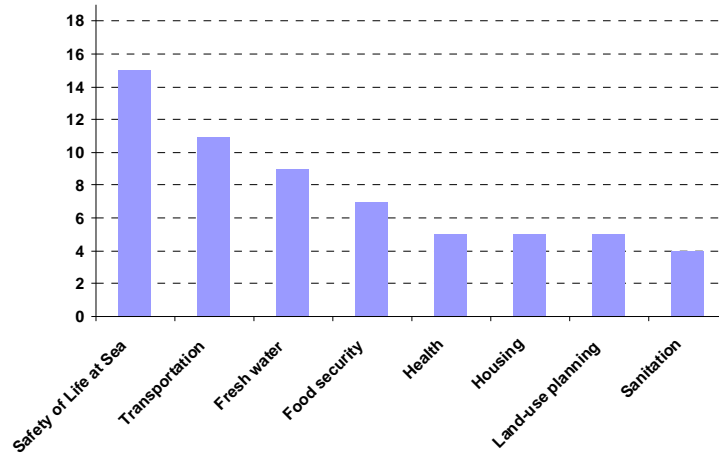


Figure 196. NMHS provision of services to selected economic sectors in Small Island Developing States.

12.4.7 Dissemination Systems and Target Audiences

The following Figures 197 and 198 summarize the survey responses relating to the dissemination of hazard products by NMHSs in Small Island Developing States. 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 10 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.

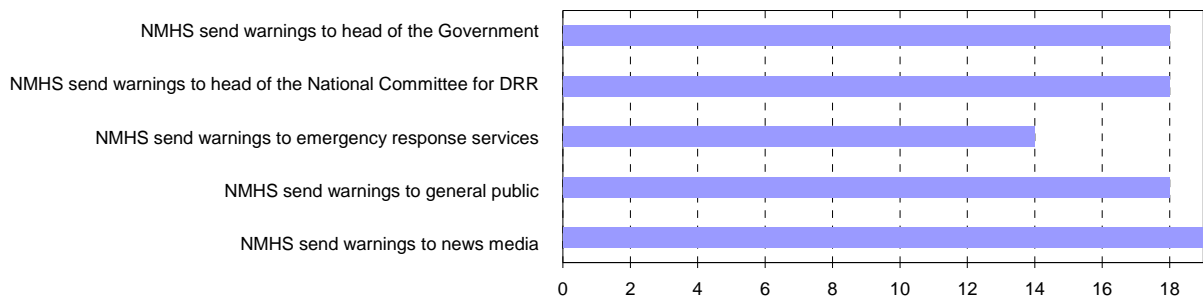


Figure 197. Warning target audience in Small Island Developing States.

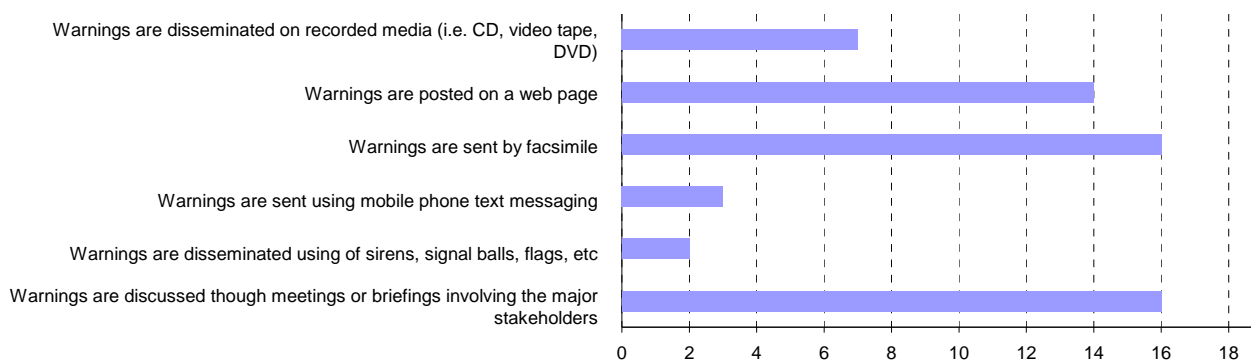


Figure 198. Warning dissemination methods in Small Island Developing States.

A very high percentage of survey contributors from Small Island Developing States indicated that they disseminated hazard warnings to the public and the media and to relevant government authorities. Moreover, over half of them 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 SIDS countries were via briefings, facsimile, briefings, web pages and Internet downloads and hard copy mailings. Some Small Island Developing States also used sirens and other signal devices to alert their populations.

12.4.8 Product Utility and Product Improvement

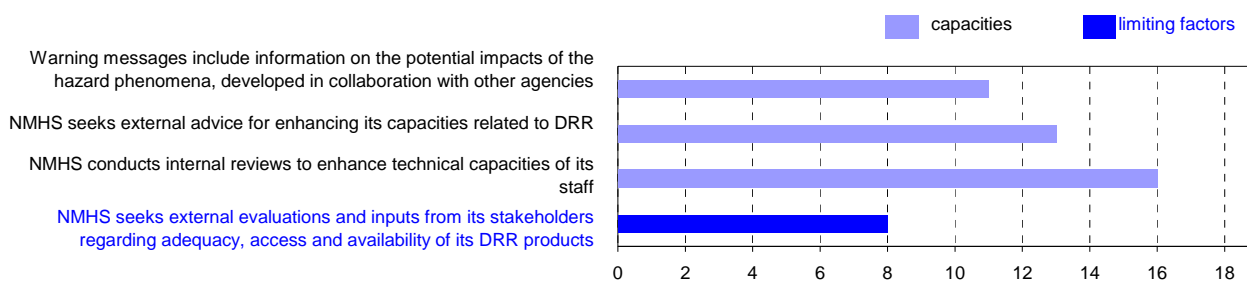


Figure 199. Ongoing feedback and improvement of products in Small Island Developing States.

Most contributing NMHSs in Small Island Developing States (83% or 15 of 18) indicated that they worked with other agencies with respect to hazard warnings. Most (88% or 14 of 16) sought advice to enhance monitoring and forecasting, enhance watches and warnings or overall products and services (82% or 14 of 17). Just over half of those (56% or 10 of 18) who included information on potential risks (impacts) in warning statements indicated that they worked with other agencies to develop risk information. In addition, about two thirds (67% or 12 of 18) of them stated that their NMHSs had a quality control mechanism to enhance their warning capabilities and content. Most SIDS NMHSs who contributed to the survey (81% or 13 of 16) stated that this mechanism provided for regular interaction with stakeholders (disaster risk authorities) and, in almost two thirds of cases (63% or 10 of 16), also provided for training for stakeholders to understand the hazards, warnings and their implications and for feedback from stakeholders after an event had occurred. Just over two thirds of SIDS survey respondents (67% or 10 of 15) stated that their mechanism also provided for training for the general public to understand hazards, warnings and their implications. In addition, just under half of them (44% or 8 of 18) indicated that their NMHSs sought external evaluations and inputs from stakeholders regarding the adequacy, relevance, method of access and availability of their disaster risk reduction products. However, almost SIDS contributors (89% or 16 of 18) believed that the lack of public understanding of watches, warnings and the effects of hazards limited the public response to them. Furthermore, over three quarters of them (78% or 14

of 18) considered that the lack of joint training between NMHS staff and disaster risk managers limited their disaster risk reduction efforts. Almost as many (72% or 13 of 18) stressed the need for joint training with emergency authorities and managers. In consequence, almost all SIDS NMHSs who contributed to the WMO country-level survey (94% or 17 of 18) felt that educational modules that NMHSs could target at media, public and disaster risk authorities would enhance their effectiveness in disaster risk reduction.

12.4.9 Internal NMHS Training and Capacity Enhancement

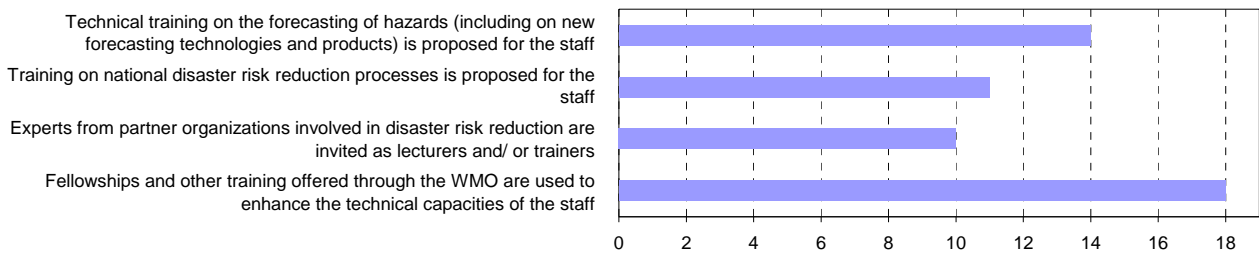


Figure 200. Training and capacity building of NMHS' staff in Small Island Developing States.

Almost three quarters of contributing NMHSs (72% or 13 of 18) from Small Island Developing States (SIDS) indicated that they provided ongoing technical training to staff on forecasting of hazards, including up to date training on new forecasting technologies and products. Even more (88% or 15 of 17) reported that they conducted internal reviews and sought staff inputs to enhance their capacity building and technical training activities. In addition, almost all SIDS respondents to the survey (94% or 17 of 18) stated that they utilized Fellowships and other training offered through WMO to enhance the technical capacities of their staff. Just over half of them (56% or 10 of 18) provided training to staff on their country's disaster risk reduction processes and related topics and almost all of these (50% or 9 of 18) invited experts from partner organizations involved in disaster risk reduction as lecturers and/or trainers. Furthermore, almost three quarters of SIDS survey respondents (71% or 12 of 17) stated that they conducted evaluations of the suitability of communications, workstations, and software to support disaster risk reduction and implemented upgrades to these systems. A smaller number of them (56% or 10 of 18) also held or participated in joint training activities for NMHS staff and emergency response agencies.

Counter balancing the preceding, three quarters of SIDS contributors to the WMO survey (76% or 13 of 17) indicated that a lack of forecaster training reduced the effectiveness of their warning service. An even larger number (89% or 16 of 18) reported that (lack of) professional staff with appropriate training limited their ability for real time monitoring of hazards. Over three quarters of contributors (78% or 14 of 18) also stated that a lack of joint training with disaster risk managers limited their NMHS disaster risk reduction efforts. A slightly smaller number (72% or 13 of 19) cited lack of joint training with emergency authorities and managers as a limiting factor. In addition, a substantial majority of survey respondents from SIDS (83% or 15 of 18) identified that the lack of joint training with media as a further limiting factor. Furthermore, almost all of them (94% or 17 of 18) identified that their ability to provide hazard data products was limited by the lack of professional staff with appropriate training. Not surprisingly in view of the preceding, all SIDS NMHSs who responded (100% or 17 of 17) considered that upgrading and improving their operational forecasting and warning activities would enhance their disaster risk capacities. More specifically, all contributing NMHSs (100% or 18 of 18) considered that upgrading and improving the technical training of the professional forecasting staff would enhance these capacities. Most of these (94% or 15 of 16) also advocated the value of cross-border training activities with neighbouring NMHS, targeted at common hydrometeorological hazards.

12.1.2 Outreach Activities

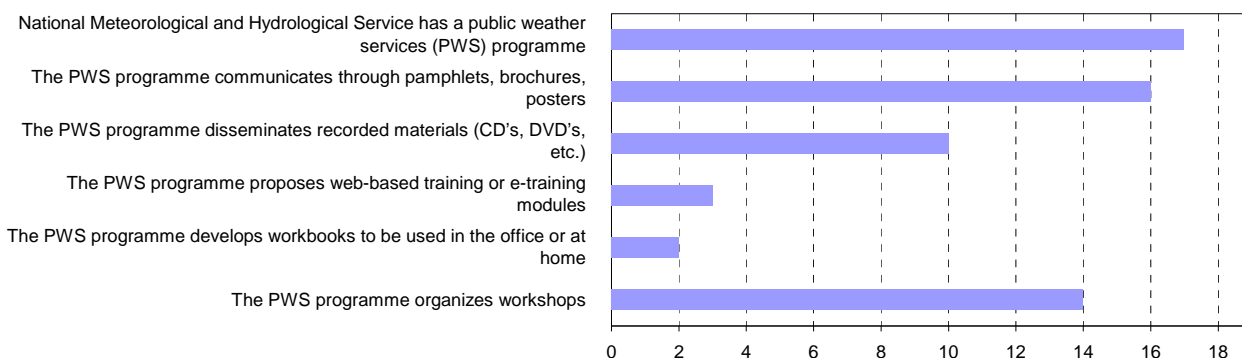


Figure 201. Outreach activities in Small Island Developing States.

Outreach activities aimed at the general public and other stakeholders are an important component of any effective disaster risk reduction programme. Within NMHSs, outreach activities are often part of a public weather services programme. In Small Island Developing States, most NMHSs (89% or 16 of 18) who contributed to the survey identified that they had a public weather services programme. Just over two thirds of them (71% or 12 of 17) provided education and training on hazards, watches, warnings, etc to disaster risk reduction authorities and operational emergency response managers on hazards, watches and warnings, etc. Equally, the same number (67% or 12 of 18) provided educational modules and training programmes targeted at the general public. A smaller number (61% or 11 of 18) participated in joint training activities with emergency response agencies and collaborated with schools and universities to develop educational programmes and curriculum for hydrometeorological hazards. Slightly fewer (39% or 7 of 18) provided training to the media. One half of SIDS respondents to the WMO survey (50% or 9 of 18) provided training targeted at the trainers (i.e. of disaster risk authorities, emergency response staff, media, etc). The following materials and methods were identified as being used in NMHSs public outreach programmes - pamphlets, brochures, posters (83% or 15 of 18), workshops (72%), recorded materials (56%), Web-based training (17%) and workbooks for office or home use (6% or 1 of 18).

On the other hand, almost all SIDS NMHSs who contributed to the WMO Disaster Risk Reduction country-level survey (89% or 16 of 18) judged that a lack of public understanding of the effects of hazards limited the public response to warning services. In addition, almost all of them (83% or 15 of 18) felt that the lack of joint training with the media limited their disaster risk reduction efforts. Moreover, slightly smaller numbers believed that lack of joint training with disaster risk managers (78% or 14 of 18) with emergency authorities and managers (72% or 13 of 18) was also limiting. As a consequence, virtually all NMHSs (94% or 17 of 18) from Small Island Developing States considered that educational modules that they could target at media, public and disaster authorities would enhance their effectiveness in disaster risk reduction.

12.5 NMHS Contingency Planning

Almost three quarters (72% or 13 of 18) NMHSs in Small Island Developing States reported that their NMHS had a contingency plan to maintain the continuity of products and services in the event of operational emergencies such as power failure or communications disruption. Most of these (63% or 10 of 16) indicated that their contingency plans involved an agreement or protocol with neighbouring NMHSs to support them in the event of catastrophic failure. In addition, just over three quarters (78% or 14 of 18) stated that they conducted or participated in drills and exercises to ensure disaster preparedness. However, all SIDS contributors (100% or 16 of 16) identified needs for improved coordination with neighbouring NMHSs, specifically citing the need for support from them in the event of disruption of services.

12.6 Overarching Factors

Small Island Developing States 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:

12.1.2.1 NMHS Visibility

Most NMHSs in Small Island Developing States who contributed to the WMO survey (78% or 14 of 18) believed that they needed higher visibility and recognition within government as a major contributing agency to disaster risk reduction. Over two thirds (67% or 12 of 18) 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. All SIDS respondents (100% or 18 of 18) 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.

12.1.2.2 Organization and Governance

Close to half of contributing NMHSs in Small Island Developing States (44% or 8 of 18) indicated that the national organizational structure for disaster risk reduction limited their potential contributions in this area. Two thirds of them (67% or 12 of 18) felt 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 large majority of respondents (83% or 10 of 12) from SIDS countries that had 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.

12.1.2.3 Coordination and Partnership

Close to two thirds (61% or 11 of 18) of NMHSs in Small Island Developing States considered that their contributions to disaster risk reduction were limited by a lack of linkages between their NMHS and other involved organizations. In consequence, a large majority of SIDS respondents to the WMO survey (89% or 16 of 18) believed that better coordination with adjacent countries would improve their contribution to their own nation's disaster risk reduction activities. More than two thirds of them (71% or 12 of 17) also felt that better coordination with WMO Regional Specialized Meteorological Centres would improve their contribution.

12.1.2.4 Resources and Capacity

Survey responses from most Small Island Developing States NMHSs (94% or 15 of 16) indicated that resources and infrastructure limited their ability to deliver critical products and services for disaster risk reduction. All SIDS NMHSs who responded to the survey question (100% or 17 of 17) identified professional staff as a limiting factor while a slightly smaller number (100% or 16 of 16) also cited financial resources as limiting. In consequence, all SIDS NMHSs (100% or 17 of 17) considered that upgrading and improving NMHSs operational forecasting and warning services would enhance the disaster risk reduction capacity within their country, unanimously (100% or 18 of 18) advocating the upgrading of professional staff.

12.7 Concluding Assessments and Recommendations for Small Island Developing States

The following summarizes assessments and conclusions related to the analysis of the survey responses from NMHSs in Small Island Developing States 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 preceding analyses of survey responses from Small Island Developing States.

12.7.1 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, a majority of Small Island Developing States NMHSs maintain records of the most common hazards such as strong winds or drought. However, 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 up to one third of SIDS.

12.7.2 Value Added Services based on Historical Hazard Data

Survey contributors' unanimous recommendation for provision of enhanced value added services is strongly supported by earlier responses that illustrate very limited provision of such services by NMHSs from Small Island Developing States. The implications of these recommendations are, however, that extensive training and capacity development will need to be undertaken in many NMHSs in Small Island Developing States to provide them with the capability to deliver the value added services under discussion.

12.7.3 Legislation and Governance

The identification by a solid majority of SIDS respondents of the negative impact of the absence of clear legislation or policies regarding their NMHS role suggests that NMHSs should press for clear policy direction from their governments in those countries where a lack of clarity undercuts their potential contributions to disaster risk reduction.

12.7.4 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, while most responding SIDS NMHSs are members of their national disaster risk reduction organizational structure, almost half consider that the structure itself limits their potential contributions to disaster risk reduction in their countries. Clearly, those few NMHSs that are not members of their national coordinating committees or structures should endeavour to acquire membership in these bodies. Moreover, the responses suggest that all SIDS NMHSs should be proactive within their national committees, seeking to gain credibility within these committees by contributing responsively and effectively to national disaster risk reduction priorities and activities and to influence their processes to optimize benefits to their communities.

12.7.5 NMHS Contributions to National Disaster Risk Reduction Systems

Experience elsewhere indicates that the survey respondents' recommendation for the establishment of a "readiness system" could, if implemented, enhance NMHSs contributions to disaster risk reduction. Consequently, this initiative should be pursued at the national level. Continuing efforts should be made to promote the contributions that NMHSs can make to disaster risk reduction, build linkages with other involved organizations, and 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.

12.7.6 NMHS Collaboration with other Partners

The survey responses indicate that a significant number of NMHSs in Small Island Developing States do not pursue collaboration and coordination 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. NMHSs should be proactive in expanding their partnerships with the broader disaster community both within and outside government circles.

12.7.7 The Organization and Priorities of NMHSs

The respondents' strong recommendation appears entirely valid. Close cooperation and coordination between National Meteorological Services and National Hydrological Services is an essential foundation for the provision of timely, accurate and consistent hydrometeorological hazard warnings and other services.

12.7.8 Operational Coordination between NMS and NHS

The survey responses summarized earlier clearly indicate that enhanced operational coordination between NMSs and NHSs would be beneficial in most or all SIDS countries. Furthermore, it is certainly required in those countries where no operational coordination takes place on the issue of hydrometeorological hazard warnings. 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 with respect to hazard warnings and other critical products for disaster risk reduction.

12.7.9 Observation and Monitoring Networks and Systems

The survey responses indicate that most NMHSs in Small Island Developing States consider that their observing networks are not optimal for disaster risk reduction and that five or six of them may not maintain a dedicated 24-hourly/year-round observation programme. Moreover, most responding NMHSs indicated that there were insufficient resources and trained staff to maintain their networks and in almost half of them this was compounded by hazard related damage to observation stations. These realities draw attention to the need for sustained resourcing of NMHSs in SIDS at levels sufficient to operate and maintain adequate observing networks and programmes. 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 real-time products to support disaster risk reduction. Consequently, every effort must 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.

12.7.10 Telecommunications and Informatics

The responses suggest that 24-hourly/year round telecommunications capability is not in place in up to 5 SIDS NMHSs. Furthermore, most responding SIDS NMHSs identified telecommunications facilities as limiting their ability to deliver critical products. In addition, all respondents drew attention to significant deficiencies in informatics including application software, computer hardware and network equipment while Internet access has also been identified as problematic in at least half a dozen SIDS countries. These realities strongly reinforce the survey contributors' recommendation that upgrading of operational telecommunications and informatics infrastructure is required in most SIDS NMHSs if they are to contribute optimally to disaster risk reduction. Moreover, upgraded systems will need to be supported by sustained long term operational funding if the improvements in capacity are to be made permanent.

12.7.11 Data Exchange

The survey respondents' recommendations for improved coordination with neighbouring NMHSs and RSMCs on hydrometeorological data exchange make good sense since collaboration and coordination are fundamental to effective and efficient exchange of data and products. In addition to implementation of the respondents' recommendations, however, the survey responses indicate that improved data exchange will require enhancements to telecommunications, quality assurance and archiving systems in virtually all NMHSs in Small Island Developing Countries. Furthermore, capacity building will be required in relation to data processing and customization of products.

12.7.12 Forecast and Warning Capability

The contributors' recommendations regarding upgrading of forecasting and warning services are validated by the responses summarized earlier in this section. Clearly, there are virtually universal needs for upgrading of professional staff, computing capacity and application software. The survey responses indicate that at least three SIDS NMHSs do not have operational forecast and warning services and several more do not operate their services on a round-the-clock basis. This is a serious deficiency in relation to provision of hazard warnings, forecasts and other support to disaster risk reduction. Major enhancements to forecasting infrastructure along with provision of appropriate training for professional staff will clearly be required before a significant number of SIDS NMHSs will be in a position to contribute optimally to disaster risk reduction within their countries.

12.7.13 Forecast and Warning Products

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

12.7.14 Coordination of Warnings

The respondents' strong recommendations 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 apparently the case in one SIDS country. 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 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 defence authorities as to their likely impacts before being relayed to local communities, perhaps accompanied by advice from authorities on actions that people should take to minimize loss of life and property.

12.7.15 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 systems to accommodate heavy rainfalls 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 some vulnerable socio-economic sectors do not receive special hydrometeorological services in one half or more of the Small Island Developing States. Consequently, NMHSs in Small Island Developing States have the opportunity to make major contributions to disaster risk reduction by enhancing the provision of relevant products and services to planning, development, water resources and other key socio-economic sectors.

12.7.16 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 and the general public. 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. While over half of NMHSs in Small Island Developing States already disseminate warnings to such important external partners, these external agencies should be further encouraged to access and utilize early warnings of hazards and other relevant NMHS products.

12.7.17 Product Utility and Product Improvement

The survey responses indicate that continuing emphasis is needed on increasing the awareness and understanding of SIDS stakeholders, including the public at large, disaster risk authorities and the staff of emergency agencies, regarding hazards, their impacts, and the content of watches, warnings and other disaster products, in parallel with efforts to make products more understandable, timely and accurate. They suggest that little emphasis has been placed on the educational dimension for the general public and other stakeholders in about half of the SIDS countries and that continued efforts are needed in the remainder. The survey contributors' recommendation regarding the need for and value of educational modules for the public, media and other stakeholders is validated by these responses. Most survey respondents also stressed the value of joint training for staff of NMHSs and those of disaster management and emergency response agencies. This makes good sense within the overall context of enhancing product utility through incorporation of feedback from key stakeholders and educating those clients regarding product format, content, accuracy, predictive skill and other relevant characteristics.

12.7.18 Internal NMHS Training and Capacity Enhancement

The survey respondents' recommendations for enhancement of staff training and conduct of cross border training directly address the deficiencies and limitations identified in the responses summarized earlier. As might be expected, responses from NMHSs in Small Island Developing States demonstrate general needs for extensive training and development to bring their forecast and warning capabilities and their knowledge of disaster management systems and requirements up to the standard required for effective support to disaster risk reduction. A large percentage of respondents, for example, reported that they did not provide regular training to their staff on forecasting techniques or on their countries' disaster risk reduction strategy and processes. Consequently, the needs are real in both areas but the efforts to address them are at present inadequate.

12.7.19 Outreach Activities

Survey responses indicate that NMHSs in almost a third of Small Island Developing States undertake, at best, very limited outreach activities directed at the media, disaster management authorities and the public at large. Moreover, the general viewpoint of SIDS NMHSs, as reflected in the survey responses, is that inadequate public and stakeholder awareness and understanding of hazards, warnings and other products and lack of joint training with key stakeholders significantly diminish the effectiveness of their contributions to disaster risk reduction. In short, very significant enhancement of outreach activities is appropriate in many SIDS countries. The respondents' recommendation regarding the value of educational modules is, therefore, well supported by other survey responses, though it is somewhat narrowly focussed on a single outreach tool or mechanism. When taken in combination with the requirements for internal staff training and development that have been identified earlier, the survey responses and the recommendation reinforce the message that enhanced training and capacity development within NMHSs should be matched by greater emphasis on outreach activities directed at the public and key stakeholder groups.

12.7.20 NMHS Contingency Planning

The survey responses indicate that over a quarter of responding NMHSs in Small Island Developing States do not have contingency plans to provide back-up service delivery capability in the event of emergencies. Establishment of a contingency plan is a prudent step for all NMHS to ensure maintenance of critical hazard warnings, products and services in the event of emergencies. In many instances, a partnership agreement with a neighbouring NMHS, such as is already in place in roughly half of the SIDS NMHS, can be an effective, low cost, approach to ensuring that back-up capability is in place. Consequently, the survey contributors' recommendation for enhanced coordination with neighbouring NMHS represents a well-supported approach to addressing the need to minimize disruption of hazard warnings and related services during emergency situations.