CHAPTER 8

SOUTH-WEST PACIFIC

WMO REGIONAL ASSOCIATION V

8 THE SOUTH-WEST PACIFIC (WMO Regional Association V)

8.1 Abstract

Survey responses from 14 NMHSs in the South-West Pacific who contributed to the WMO country-level survey indicate that most NMHSs have observational networks but feel that these are inadequate. Three of them do not operate on a 24-hourly basis. Moreover, while all NMHSs have 24-hourly telecommunications systems these also have many deficiencies including one or two countries without 24-hourly operation. Though all but one operate forecasting and hazard warning programmes, mostly on a 24-hourly basis with emergency backup systems in place, they identify widespread needs for improvements in infrastructure and capacity. Furthermore, in many countries, hazard warning services do not encompass all significant hazards. Roughly a third of the NMHSs do not maintain hazard archives or have access to information on their impacts. All of them, however, endorse the provision of enhanced data services but identify associated needs for training and capacity building. About half point to inadequate linkages with disaster partners and advocate better coordination with neighbouring NMHSs, Regional Specialized Meteorological Centers (RSMCs) and other key stakeholders. A majority does not have combined NMHSs and also draws attention to needs for closer collaboration between their National Meteorological Services (NMSs) and National Hydrological Services (NHSs). Only about a third of NMHSs in the region provide special services to key economic sectors such as land-use planning, development and water. Though most provide some training on forecast techniques and other topics to their staff, only half of them pursue joint training activities with disaster stakeholders. Moreover, most advocate increased emphasis on outreach activities. Finally, all South-West Pacific NMHSs identify inadequate resources and infrastructure as constraints, laying particular stress on budgets and professional staff. In a large majority of cases, the NMHSs participate in national disaster risk coordination committees but many of them feel restricted by these structures and by a lack of clarity regarding their roles. Furthermore, roughly half of them cite needs to expand and reinforce partnerships with other disaster stakeholders. Taken as a group, the NMHSs in the seven Pacific Small Island Developing States (SIDS), identify weaker infrastructures and capacities than the regional norm, are less well integrated into their national disaster risk coordination mechanisms, and are more poorly resourced. Conversely, the seven non-SIDS NMHSs possess somewhat better than average infrastructures and scientific and technical capacities but share the overall regional view that inadequate resources and infrastructure represent serious constraint. The preceding survey results underpin the following conclusions and recommendations directed at enhancing the capacities of South West Pacific NMHSs to contribute to disaster risk reduction:

- All South-West Pacific NMHSs should be integrated into their national disaster risk reduction systems. Those who are not already members should seek membership in their national disaster risk coordinating committees and all should, where necessary, press for clear direction regarding their roles and responsibilities.
- All South-West Pacific NMHSs should pursue strengthened partnerships with other organizations involved in disaster risk management, including key external partners such as Red Cross/Crescent.
- Some South-West Pacific NMHSs need to establish hazard data archives and most of them need to improve their archiving and access systems for hazard and impact data. There are associated needs for capacity building in data rescue, quality assurance and data management and archiving.
- Most South-West Pacific NMHSs need capacity development 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 infrastructures across the region. Priority should be given to ensuring their 24-hourly operation and to enhancing weak capacities in SIDS.
- NMHSs' hazard warning infrastructures and capacities should be strengthened across the South-West Pacific. Warning capacities should be established in those NMHS without such capacities and

warnings should be provided on a 24-hourly basis in all countries. Warning programmes should address all significant hazards with warnings routed to all important stakeholders. There are associated requirements for improved training of forecasters, access to latest forecasting techniques, and strengthened computing and applications capacities.

- Official warnings of hydrometeorological hazards should emanate from a single competent issuing authority in each country, ideally the NMHS. In some circumstances, warnings may benefit from assessment and interpretation by civil defence authorities before being widely disseminated.
- All South-West Pacific NMHSs should implement verification programmes for hydrometeorological hazard warnings to monitor warning accuracy and timeliness, assess improvements in skill, and demonstrate their warning capabilities to stakeholders.
- Those South-West Pacific NMHSs who have not already done so should establish back-up arrangements to maintain hazard warning services in emergency situations, perhaps through partnership agreements with neighbouring NMHS.
- South-West Pacific NMHSs NMHSs should encourage the establishment of national readiness systems within their countries.
- Operational coordination should be improved between NMSs and NHSs and with neighbouring NMHSs and RSMCs. In some cases, this may require policy direction or partnership agreements between NMSs and NHSs to clarify respective responsibilities, particularly in relation to warnings.
- South-West Pacific NMHSs should target products and services to sensitive economic sectors such as land-use planning and development.
- Most South-West Pacific NMHSs should give much higher priority to education and outreach activities directed at key stakeholders and the public at large.
- Many South-West Pacific NMHSs need particular support from WMO in infrastructure development, technology transfer and capacity building and in relation to strategic partnerships, education and training and public outreach.

The present chapter centres on the assessment of the survey responses from NMHSs in the South-West Pacific (WMO RA V). Its internal structure follows the sequence outlined earlier in section 2.6.1.

8.2 The Response to the Survey

The 14 countries in the South-West Pacific who contributed responses to the WMO country-level survey are listed in Annex 2.

8.3 The Hazards affecting Countries in the South-West Pacific

Figure 97 below lists the number of contributing countries in the South-West Pacific (WMO RA V) who identified themselves as being affected by the specified hazards.

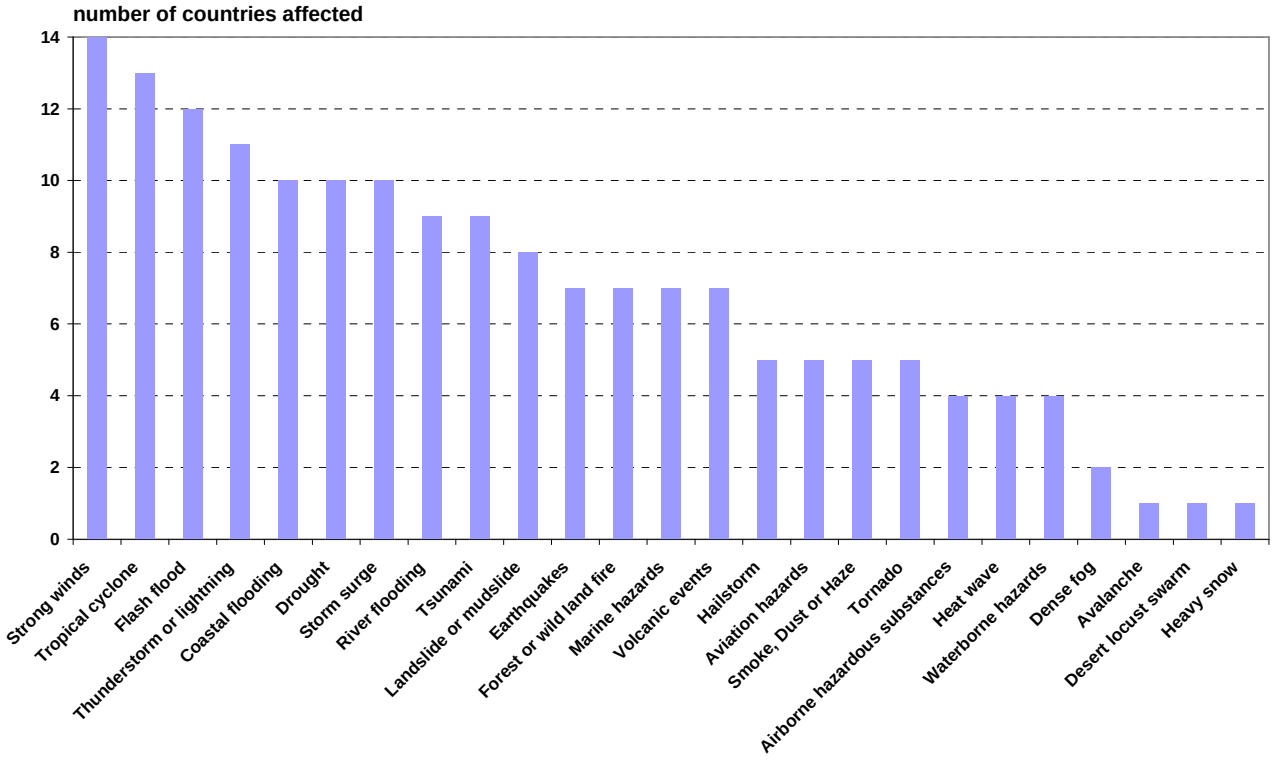

Figure 97. Number of responding countries in the South-West Pacific who identified themselves as being affected by specified hazards.

8.3.1 Access to Data on Hazards and their Impacts

Annex 3 presents an overview of the hazard databases maintained by survey contributors in the South-West Pacific (RA V) and includes some supplementary information on related metadata and impacts information. Almost two thirds of responding NMHSs in the region (64% or 9 of 14) 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. However, almost half (43% or 6 of 14) also reported that they maintained their own internal database of official information on the impacts of hazards that affected their countries and, moreover, regularly updated this database[21].

[21] 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.

8.3.2 Value Added Services based on Historical Hazard Data

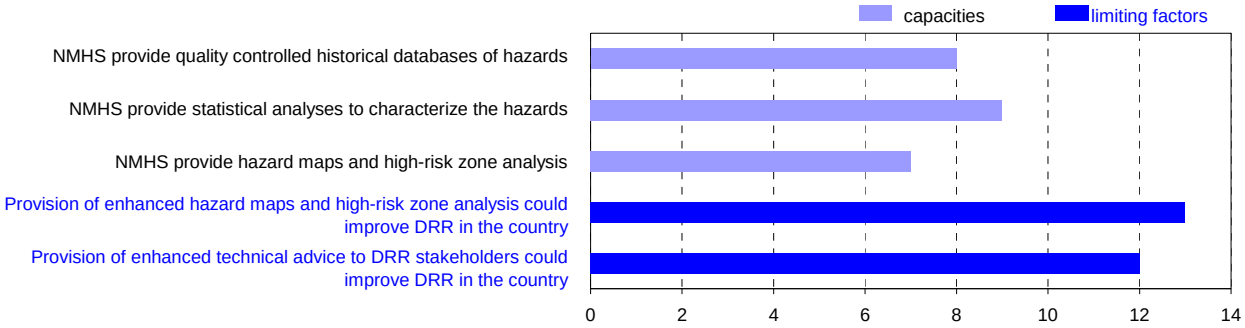

Figure 98. Provision of hazard information by NMHSs in the South-West Pacific.

The following draws attention to the extent of value added services provided by NMHSs in the South-West Pacific who maintain historical archives of hydrometeorological hazards. Just over two thirds of NMHSs who contributed to the country-level survey (71% or 10 of 14) stated that that they provided technical advice on hazards and almost as many (64% or 9 of 14) provided statistical analyses to characterize them. Over half the respondents (57% or 8 of 14) reported that they maintained quality controlled historical databases of hazards and most of these (50% or 7 of 14) indicated that they undertook hazard mapping and high-risk zone analysis with slightly fewer (43% or 6 of 14) providing analyses of the potential impacts of hazards.

Over half of the contributing NMHSs identified factors that limited their ability to provide hazard data products. Identified as constraints were professional staff with appropriate training (62% or 8 of 13), customization of data for stakeholders (62% or 8 of 13), data rescue (54% or 7 of 13), quality assurance (46% or 6 of 13) and the ability to archive and update (38% or 5 of 13). All survey respondents (100% or 13 of 13) 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 - analyses of the potential impacts of hazards and hazard mapping and high-risk zone analysis (100% or 13 of 13), and provision of technical advice (92% or 12 of 13).

8.4 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 South-West Pacific countries' national systems for disaster risk reduction and the impact of these systems on the NMHS.

8.4.1 Legislation and Governance

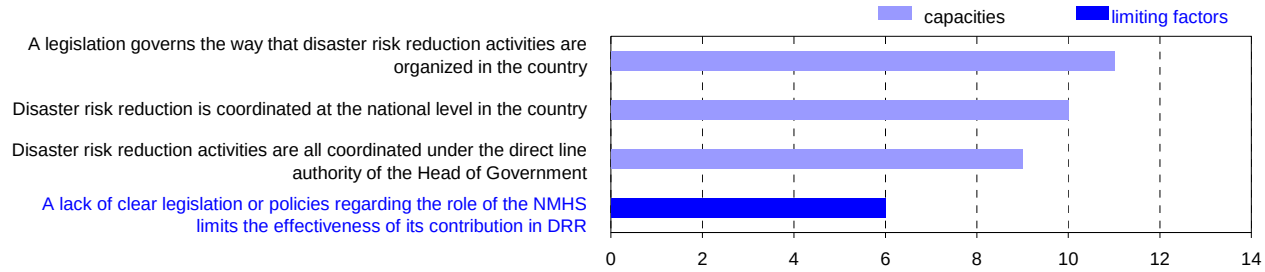

Figure 99. Legislation and coordination in support of disaster risk reduction at the national level in the South-West Pacific.

Over three quarters of South-West Pacific (RA V) NMHSs who contributed to the survey (77% or 10 of 13) reported that disaster reduction activities were coordinated at the national level, in most instances (64% or 9 of 14) under the direct line authority of the head of government. The organization of these activities was governed by legislation in most countries (79% or 11 of 14). In slightly over half (57% or 8 of 14), coordination was centred under one ministry. At the same time, a sizeable minority of respondents (43% or 6 of 14) considered that a lack of clear legislation or policies regarding the role of their NMHS (e.g. as the sole issuer of hydrometeorological hazard warnings) limited their contributions to disaster risk reduction.

8.4.2 National Structures/Mechanisms for Disaster Risk Reduction

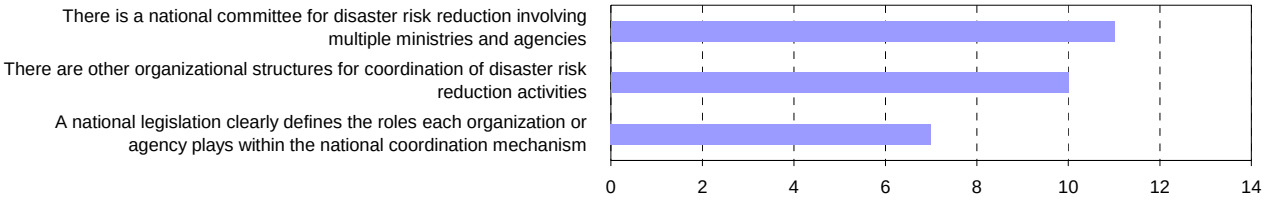

Figure 100. National structures for coordination of disaster risk reduction in the South-West Pacific.

Most South-West Pacific survey contributors (79% or 11 of 14) indicated that their countries had a national committee for disaster risk reduction that involved multiple ministries and agencies and three quarters of them (75% or 9 of 12) stated that they were members of their national coordinating committee. Half the respondents (50% or 7 of 14) reported that the roles of each participating agency in the national coordination mechanism were defined by legislation. Over two thirds (71% or 10 of 14) also pointed out that other organizational structures for coordination also existed in their countries. Almost one half of the responding NMHSs (46% or 6 of 13) felt that their contributions to disaster risk reduction were limited by their national disaster management structure and a similar number (50% or 7 of 14) by a lack of linkages with other involved organizations.

8.4.3 NMHSs Contributions to National Disaster Risk Reduction Systems

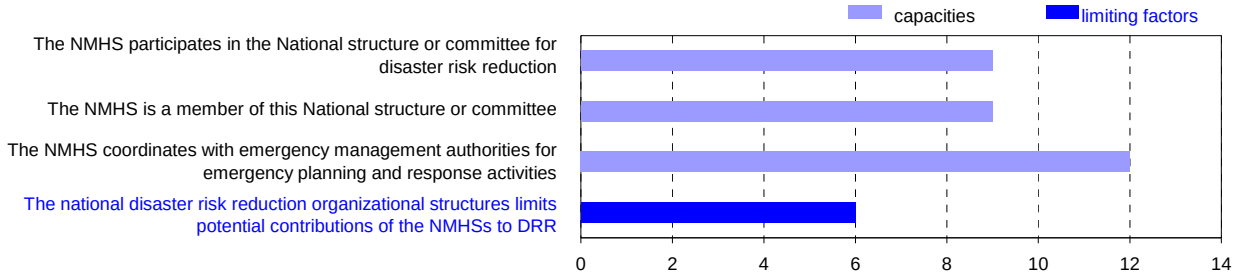

Figure 101. NMHS participation in national structures for disaster risk reduction in the South-West Pacific.

All South-West Pacific NMHSs (100% or 14 of 14) who contributed to the WMO survey indicated that they provided support to agencies responsible for disaster risk reduction at the national level including support to emergency response operations and emergency planning and preparedness. Most (86%) supported disaster prevention (e.g. hazard mapping, advice, historical hazard data) and a smaller number (64%) supported post-disaster reconstruction (e.g. hazard data as input to reconstruction decisions). In addition, most respondents to the survey (92%) extended their support to provincial or state government disaster-related activities and municipal or local levels. However, half (50% or 7 of 14) the responding NMHSs 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 respondents (85% or 11 of 13) considered that their contributions would be enhanced by a “readiness system” that required appropriate responses by authorities to information issued by the NMHS.

8.4.4 NMHS Collaboration with other Partners

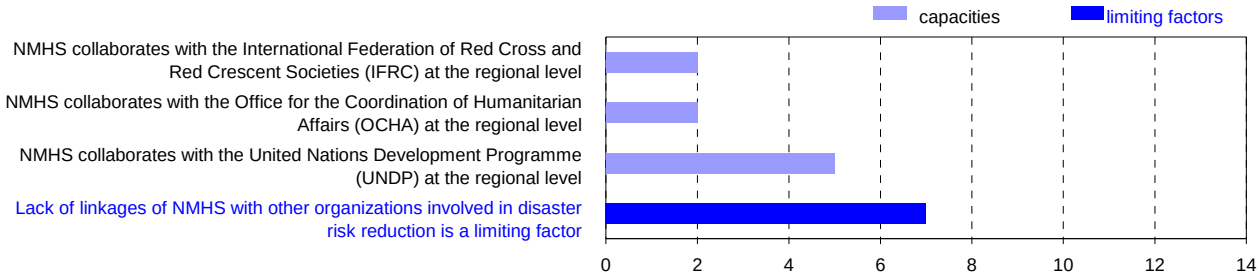

Figure 102. NMHS collaboration with partner agencies at the regional level in the South-West Pacific.

Almost all contributors to the survey (92% or 12 of 13) in the South-West Pacific reported that they coordinated with emergency management authorities for emergency planning and response and the same number (86% or 12 of 14) stated that coordination was at the national level. A significant number (80% or 8 of 10) participated in activities of international organizations and/or on the level of a WMO Region or a regional economic grouping (62% or 8 of 13). Fewer of them (43% or 6 of 14), however, collaborated with their National Red Cross and Red Crescent Societies, interacted with the office of the United Nations Coordinator (29% or 4 of 14) in their country or participated in disaster reduction activities of the UNDP (45% or 5 of 11), the Office for the Coordination of Humanitarian Affairs (22% or 2 of 9) or the IFRC (20% or 2 of 10).

8.4.5 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 Services[22], in the South-West Pacific are concerned parent ministries include: Environment and Heritage; Science and Technology; Natural Resources, Environment and Meteorology; Works and Police Department; Civil Aviation; Transport, Civil Aviation and Meteorological Services; Environment and Water Resources; Infrastructure and Public Utilities; Science, Technology and Innovation; Transport; Transport, Communication and Tourism Development; Police; State Owned Enterprises; and National Weather Service. Parent departments of the National Hydrological Services include: Agriculture; Lands and Natural Resources; and Environment and Water Resources.

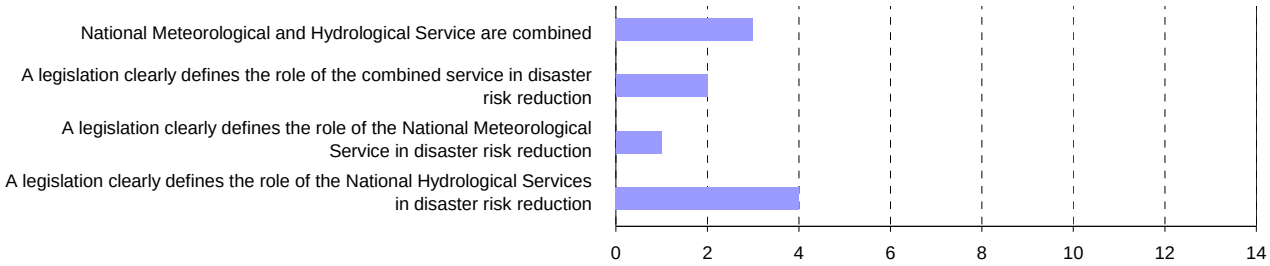

Figure 103. Organizational structure of meteorological and hydrological services in the South-West Pacific.

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 the South-West Pacific, only a few survey respondents (21% or 3 of 14) stated that they had a combined National Meteorological and Hydrological Service and even fewer (22% or 2 of 9) indicated that their country had national legislation that clearly defined the NMHS role in disaster risk reduction. Only one survey contributor (10% or 1 of 10) with a separate NMS and NHS stated that they had legislation that clearly defined the role of the NMS in disaster risk reduction. A somewhat larger number (36% or 4 of 11) reported legislation that applied to the role of the NHS. At the same time, a majority (60% or 6 of 10) of respondents considered that legislation or partnership agreements were needed to better define the respective roles of their NMSs and NHSs in disaster risk reduction.

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

8.4.6 Operational Coordination between NMSs and NHSs

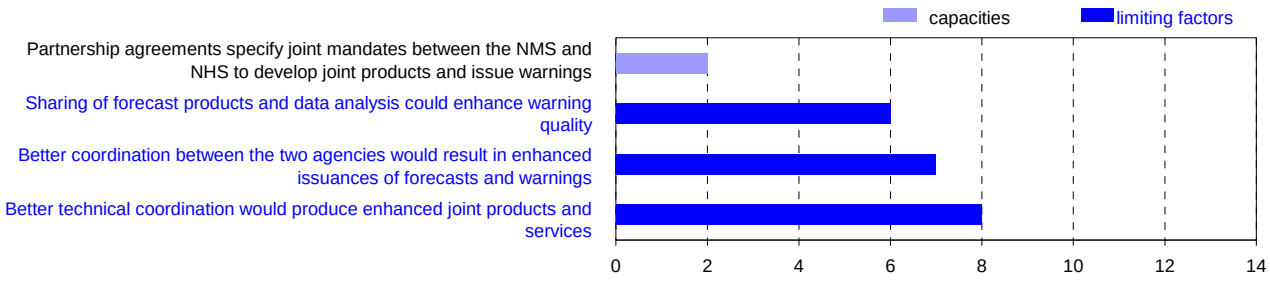

Figure 104. Coordination between NMS and NHS in the South-West Pacific.

Only a few (18% or 2 of 11) respondents from South-West Pacific countries with 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. A somewhat larger number (50% or 6 of 12) indicated that the two agencies shared forecast products and data analyses that could enhance warning quality. Most of these (45% or 5 of 11) stated that coordination took place before warnings were issued for hazards of mutual concern with two indicating that coordination also took place for any hazard warning was issued. However, a few contributing NMHSs (38% or 3 of 8) reported that there was no coordination on warnings. Over two thirds of respondents (70% or 7 of 10) considered that better overall coordination between the two agencies would enhance issuance of forecasts and warnings and slightly more (69% or 8 of 9) considered that improved technical coordination would result in enhanced joint products and services.

8.5 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 the NMHSs in the South-West Pacific region.

8.5.1 Observation and Monitoring Networks and Systems

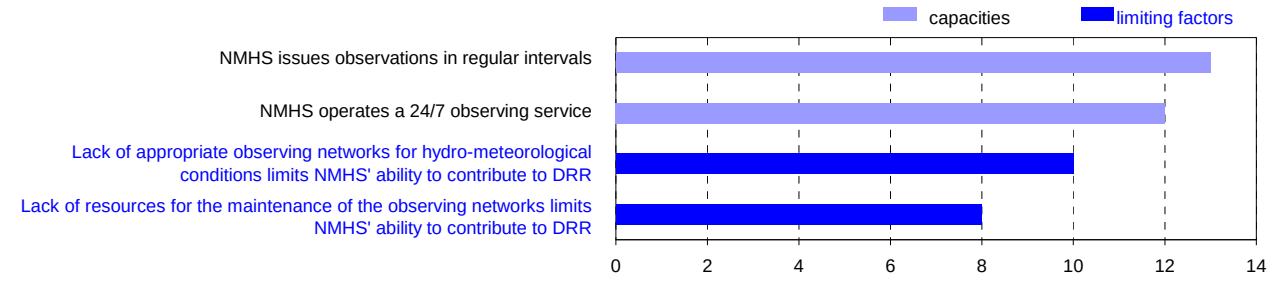

Figure 105. Observation and monitoring networks and systems in the South-West Pacific.

Most South-West Pacific NMHSs who contributed to the survey (93% or 13 of 14) stated that they had an operational observing capacity that issued observations at regular intervals. Most of these (100% or 12 of 12) reported that the observing service operated 24-hourly/year-round. Over half (57% or 8 of 14) indicated that their observation network included sea level monitoring stations. However, most respondents (71% or 10 of 14) also considered that a lack of appropriate hydrometeorological observing networks limited their ability to contribute to disaster risk reduction

and some (21% or 3 of 14) identified the availability of a dedicated 24-hourly/year-round observing service as an additional limiting factor. Major challenges in maintaining observation networks were also stressed. Among these, with most NMHSs (77% or 10 of 13) cited limited resources (e.g. financial, replacement parts, personnel, etc), many (69% or 9 of 13) cited a lack of professional staff with appropriate training, and over half (62% or 8 of 13) pointed to hazard related damage.

8.5.2 Telecommunications and Informatics

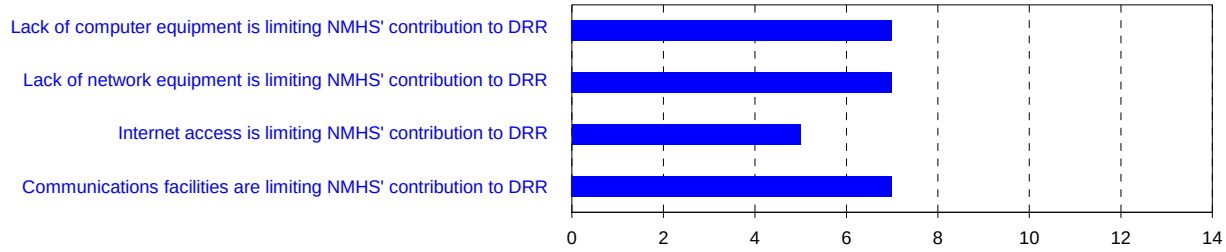

Figure 106. Telecommunication and informatics in the South-West Pacific.

All South-West Pacific NMHSs who contributed to the survey (100% or 14 of 14) reported that their telecommunications systems were available 24-hourly/year-round. Partial confirmation was provided by responses indicating that most forecasting staff (86% or 12 of 14) in the region had access to real time hydrometeorological data. However, almost two thirds of respondents (64% or 7 of 11) went on to identify that their ability to deliver critical products for disaster risk reduction was limited by communications facilities. Other limitations on NMHS capacities were cited in major areas of informatics, with many NMHSs (91% or 10 of 11) highlighting the lack of application software, network equipment (64% or 7 of 11), computers (64% or 7 of 11) and inadequate Internet access (50% or 5 of 10). Finally, all responding NMHSs (100% or 11 of 11) considered that upgrading the operational infrastructure for forecasting and warning services would enhance disaster risk reduction capacities in their countries.

8.5.3 Data Exchange

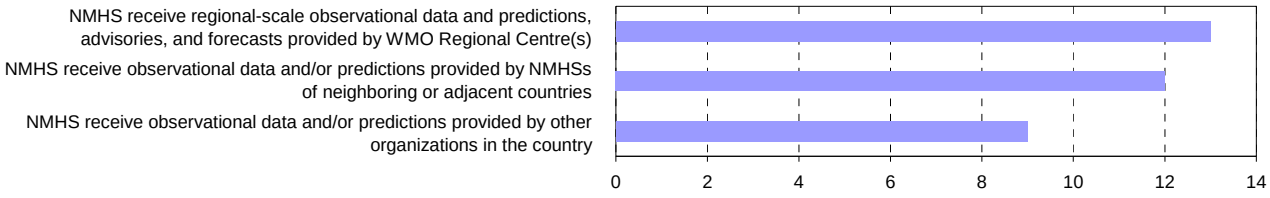

Figure 107. Data exchange in the South-West Pacific.

Survey contributions from NMHSs in the South-West Pacific (RA V) identified that most (86% or 12 of 14) forecasting staff had real time access to hydrometeorological data. All respondents (100% or 13 of 13) also used regional scale observational data and forecasts provided by WMO Regional Specialized Meteorological Centres, data from neighbouring countries (92% or 12 of 13) and from other organizations in their countries (69% or 9 of 13). In addition, more than half (64% or 9 of 14) received real time marine observations from the GTS and some (44% or 4 of 9) relayed sea level observations on that global network. Conversely, however, almost two thirds of contributors to the suevey (64% or 7 of 171) indicated that their NMHSs were limited in their ability to deliver critical products and services for disaster risk reduction by communications facilities. Equally, a significant number (62% or 8 of 13) stated that their NMHS was limited by customization of data for stakeholders. Almost half the respondents in the South-West Pacific (46% or 6 of 13) cited quality assurance and more than a third (38% or 5 of 13) identified ability to archive and update as limiting

factors on their ability to deliver hazard data products. A majority of these NMHSs (79% or 11 of 14) considered that they required better coordination with neighbouring NMHSs on hydrometeorological data exchange and, in the same context, over half (64% or 9 of 14) advocated improved coordination with RSMCs.

8.5.4 Forecast and Warning Capability

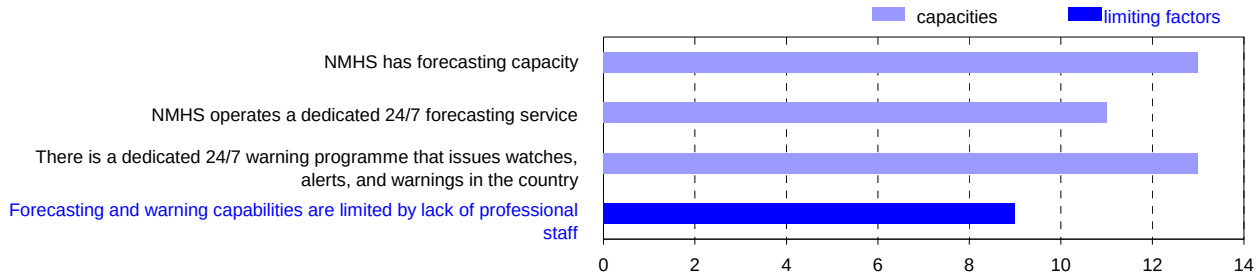

Figure 108. Forecast and warning capabilities in the South-West Pacific.

Almost all NMHSs (93% or 13 of 14) in the South-West Pacific indicated that they had an operational forecasting capability. Most (85% or 11 of 13) of them stated that this was a dedicated 24-hourly/year-round forecast service and that a meteorologist was required to be on-site to operate this service. The same number (93% or 13 of 14) also reported that they had a dedicated hazard warning programme that issued watches, alerts and warnings on a 24-hourly/year-round basis. All of them (100% or 13 of 13) indicated that a meteorologist was on site during the operational hours of the warning programme.[23] In addition, most NMHSs in the region (93% or 13 of 14) stated that they provided a marine forecast and warning service to mariners and coastal zone users and a few (29% or 4 of 14) also prepared marine forecasts for the Global Maritime Distress and Safety System (GMDSS).

On the negative side, three quarters of the South-West Pacific contributors to the WMO survey (75% or 9 of 12) indicated that their NMHS was limited in its ability to deliver critical products and services for disaster risk reduction by professional staff. Most (91% or 10 of 11) also cited application software as limiting and almost two thirds (64% or 7 of 11) cited computers. Almost all respondents (92% or 12 of 13) considered that upgrading their NMHS operational forecasting and warning services would enhance disaster risk reduction in their countries. More specifically, most (92% or 11 of 12) advocated the upgrading or technical training of professional staff, also drawing attention to needs for access to tools and latest forecasting technologies.

8.5.5 Forecast and Warning Products

Table 7 in Annex 4 summarizes information on hazard warnings and products issued by NMHSs in the South-West Pacific who responded to the survey. The survey responses indicated that the hydrometeorological hazards affecting the greatest number of South-West Pacific countries were, in declining order, strong winds, tropical cyclones, flash floods, thunderstorms and lightning, droughts, coastal flooding, storm surges, river flooding, tsunami, and landslides or mudslides closely followed by earthquakes, forest or wild land fires, marine hazards and volcanic events[24].

[23] There is an apparent anomaly in responses in that 11 NMHS in the South-West Pacific reported that they operate a dedicated 24-hourly/year-round forecast service but 13 NMHS state that they have a 24-hourly/year-round warning program.

[24] 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 7 reveals that most affected NMHSs issued warnings for the majority of the above hazards that affected them. The most notable exceptions were landslides and mudslides where warnings were issued by only half of the affected NMHSs and flash floods and forest or wild land fires where warnings were issued in roughly three quarters of the affected countries. This suggests that South-West Pacific NMHSs should re-examine the extent of their hazard warning programmes and, where necessary, expand them to include additional phenomena that have the potential to cause major disasters.

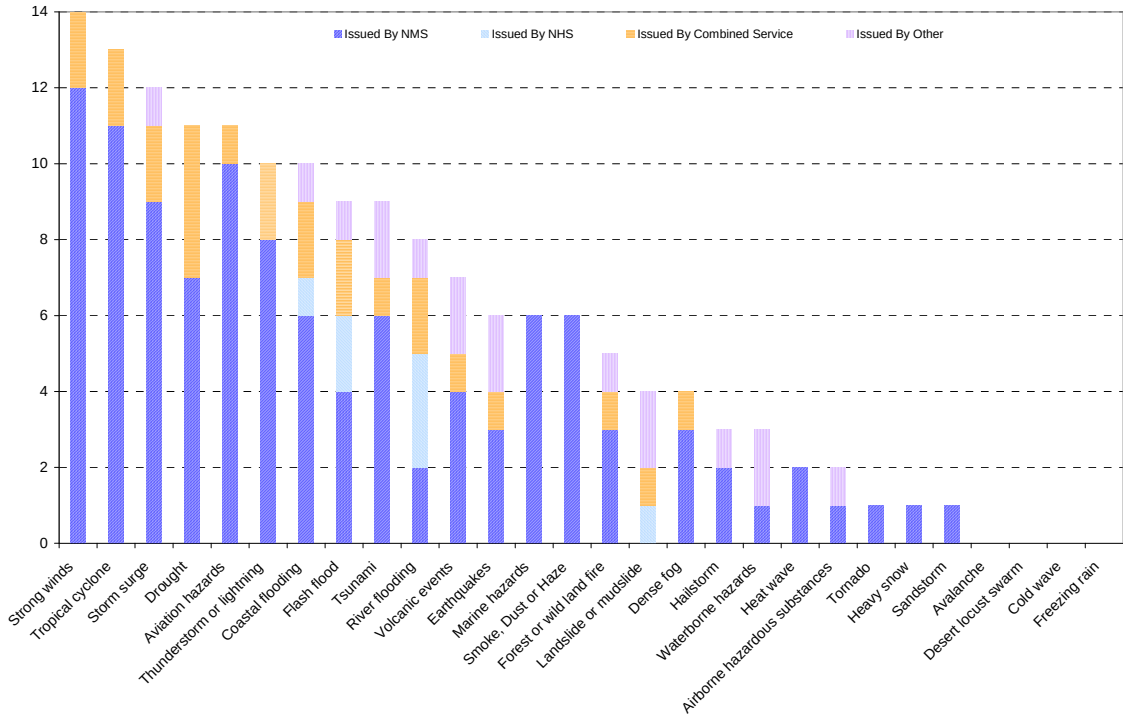

Figure 109. Agencies mandated for issuance of warnings in the South-West Pacific.

The survey contributions from the South-West Pacific clearly indicate that NMSs and, to a much lesser extent, combined NMHSs are the issuers of almost all warnings for the major hydrometeorological hazards in the region. The only exceptions are the few cases where NHSs issue warnings for river flooding, flash floods, coastal flooding, and landslides or mudslides. The data also indicate that NMHSs (or, as the case may be, NMSs or NHSs) were not the sole issuers of warnings in all cases but that a competing warning service exists in some countries. Survey respondents in the South-West Pacific reported that, in a majority of instances, official warnings for the major hydrometeorological hazards included information regarding their potential impacts. Finally, as in other regions, almost all contributing NMHSs in the South-West Pacific considered that further improvements to their warnings were necessary. Again, this represents an opportunity to expand individual warning programmes to include additional important hazards such as those cited earlier as being areas of deficiency in some countries.

8.5.6 Coordination of Warnings

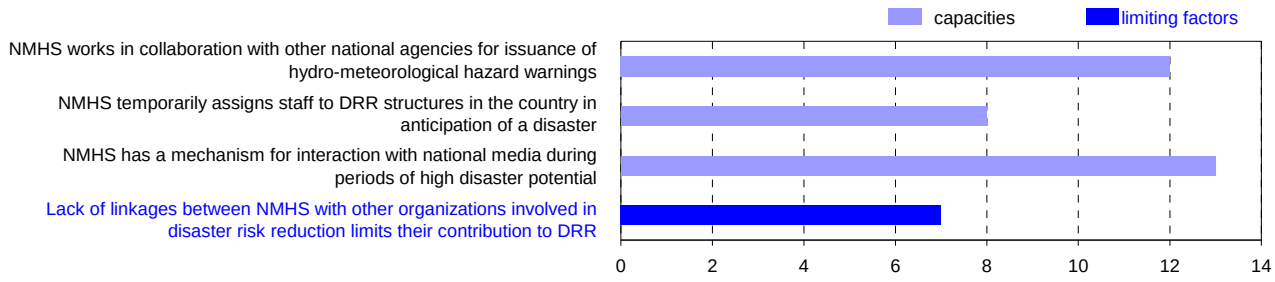

Figure 110. External coordination for issuance of warnings in the South-West Pacific.

Early warnings of hydrometeorological hazards represent a vital contribution to disaster risk reduction. In the South-West Pacific, most NMHSs (86% or 12 of 14) who contributed to the survey reported that they worked in collaboration with other agencies (e.g. agriculture, aviation, etc) with respect to hazard warnings. Most of these (79% or 9 of 12) discussed the hazard's characteristics and potential impacts with these agencies prior to issuing a warning. In addition, most respondents (93% or 13 of 14) stated that they had a mechanism for interaction with their country's media during periods of high disaster potential. Moreover, over half of them (57% or 8 of 14) indicated that they temporarily assigned staff to disaster risk management structures in anticipation of a disaster. A few NMHSs (28% or 3 of 14) in the region pointed out that there were other public or commercial entities that provided competing warning services in their countries. All respondents to the survey (100% or 11 of 11) considered that their NMHS required better coordination of watches and warnings with neighbouring NMHSs and most of these (100% or 9 of 9) also advocated improved coordination with WMO Regional Specialized Meteorological Centres.

8.5.7 Products and Services for Selected Socio-Economic Sectors

As a further refinement, Figure 111 illustrates the provision by NMHSs of specialized alerts, warnings and other products to significant socio-economic sectors in South-West Pacific that can be seriously affected by hazardous events. In the context of disaster risk reduction, it is noteworthy from Figure 111 that less than a third (29%) of responding NMHSs indicated that they provided support to development and housing, just over a third (36%) provided support for the land-use planning and under a half (43%) provided services to the fresh water sector.

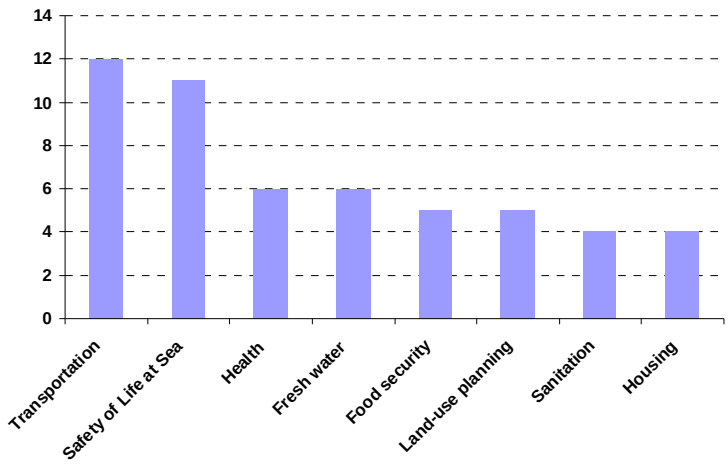

Figure 111. NMHS provision of services to selected economic sectors in the South-West Pacific.

8.5.8 Dissemination Systems and Target Audiences

The following Figures 112 and 113 summarize the survey responses relating to the dissemination of hazard products by NMHSs in the South West Pacific. 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 6 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.

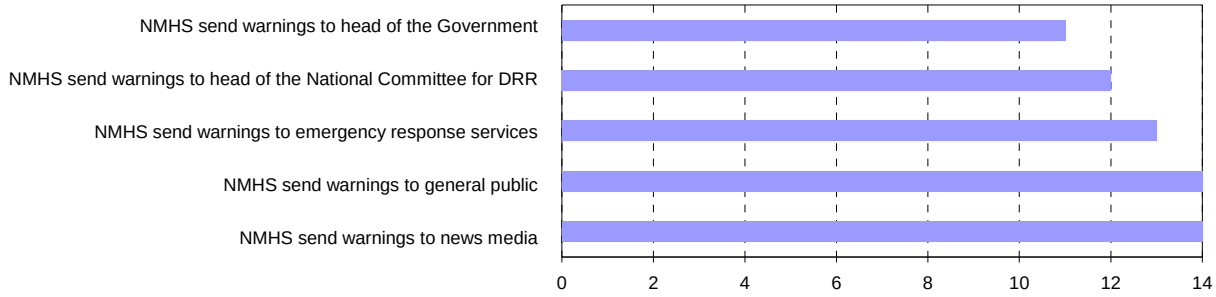

Figure 112. Warning target audience in the South-West Pacific.

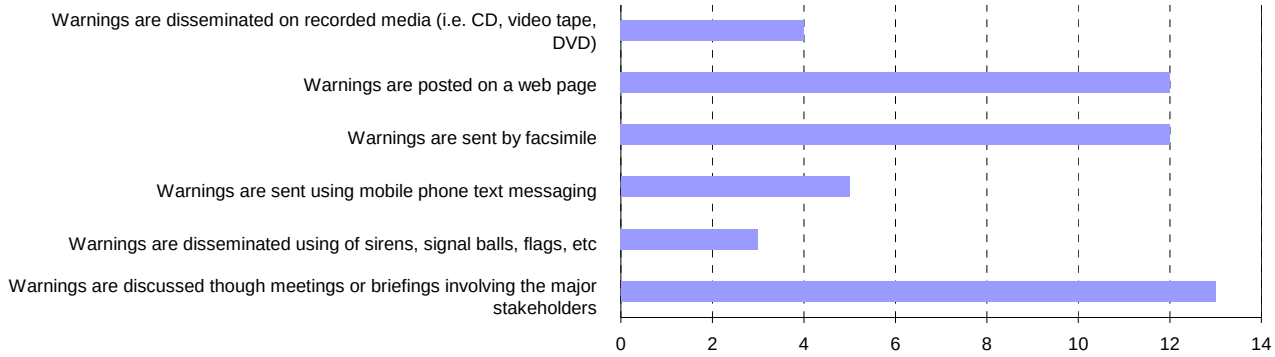

Figure 113. Warning dissemination methods in the South-West Pacific.

As might be expected, virtually all contributors to the WMO survey from the South-West Pacific indicated that they disseminated hazard warnings to the public and the media and to emergency response agencies and other relevant government authorities. A significant percentage of responding NMHSs also 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 the South-West Pacific were via briefings, facsimile, web page and Internet and hard copy mailings, with sirens and other signal devices also being used fairly widely.

8.5.9 Product Utility and Product Improvement

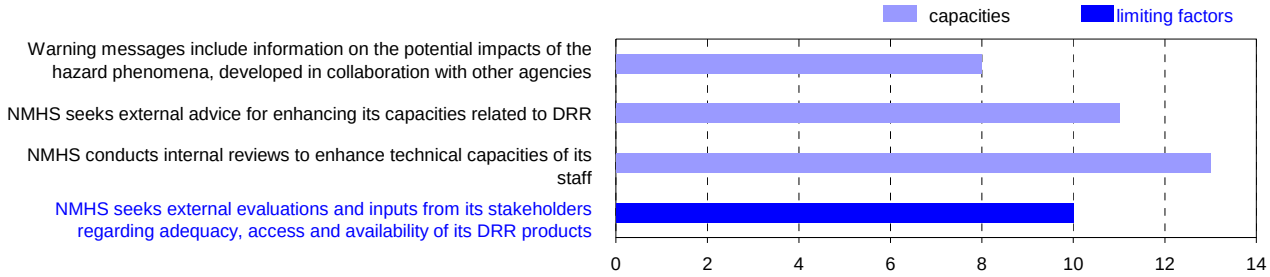

Figure 114. Ongoing feedback and improvement of products in the South-West Pacific.

Just over half (57% or 8 of 14) of responding NMHSs in the South-West Pacific indicated that they work with other agencies with respect to hazard warnings. Three quarters of them (75% or 9 of 12) also stated that they had regular interaction with disaster risk authorities to enhance their warning capabilities and content. Just over half (57% or 8 of 14) of those who included information on potential risks (impacts) in warning statements indicated that they collaborated with other agencies to develop risk information. Almost all survey contributors (92% or 11 of 12), however, stated that they sought external advice to enhance their capacities to support disaster risk reduction, specifically to enhance monitoring and forecasting, watches and warnings (93% or 13 of 14), or overall products and services (86% or 12 of 14). Moreover, almost two thirds of respondents (64% or 9 of 14) indicated that their NMHSs had a quality control mechanism to enhance their warning capabilities and content. Three quarters of these (75% or 9 of 12) stated 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. Just over half of them (58% or 7 of 12) also stated that it provided for training for stakeholders to understand hazards, warnings and their implications. In addition, many NMHSs (71% or 10 of 14) 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.

Despite the preceding activities, most South-West Pacific contributors to the survey (86% or 12 of 14) believed that the lack of public understanding of hazards, watches and warnings limited the public response to them. More than half (57% or 8 of 14) also considered that the lack of joint training between NMHS staff and disaster risk and emergency authorities and managers limited their disaster risk reduction efforts. Furthermore, most NMHSs (86% or 12 of 14) in the region felt that educational modules for media, public and disaster risk authorities would enhance their effectiveness in disaster risk reduction.

8.5.10 Internal NMHS Training and Capacity Enhancement

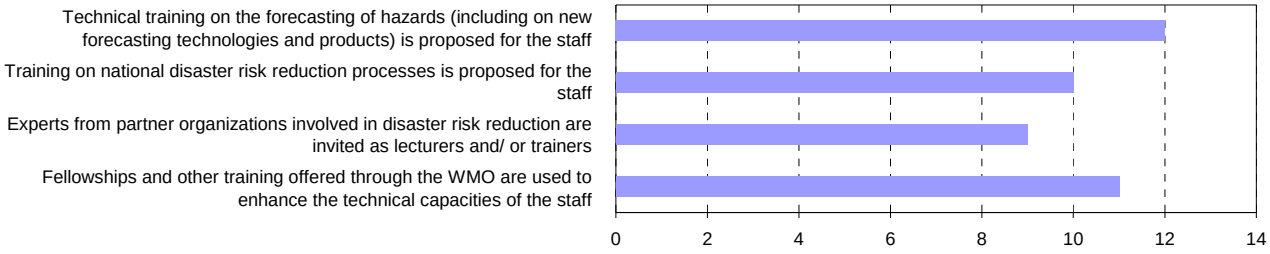

Figure 115. Training and capacity building of NMHS' staff in the South-West Pacific.

Most contributing NMHSs (86% or 12 of 14) in the South-West Pacific indicated that they provided ongoing technical training to staff on forecasting of hazards, including up to date training on new forecasting technologies and products. Most (93% or 13 of 14) also reported that they conducted internal reviews and sought staff inputs to enhance their capacity building and technical training activities. In addition, most of them (79% or 11 of 14) stated that they utilized Fellowships and other training offered through WMO to enhance the technical capacities of their staff. Many (71% or 10 of 14) provided training to staff on their country's disaster risk reduction processes and related topics and most of these (64% or 9 of 14) invited experts from partner organizations involved in disaster risk reduction as lecturers and/or trainers. The majority (79% or 11 of 14) of South-West Pacific contributors to the survey also conducted evaluations of the suitability of communications, workstations, and software and all of them implemented upgrades to these systems to support disaster risk reduction. However, only half of responding NMHSs (50% or 7 of 14) reported that they held or participated in joint training activities for NMHS staff and emergency response agencies.

Balancing the preceding, over half of the survey respondents (57% or 8 of 14) indicated that lack of forecaster training at their NMHS reduced the effectiveness of their warning service. A similar number (69% or 9 of 13) reported that (lack of) professional staff with appropriate training limited their ability for real time monitoring of hazards. About the same number (57% or 8 of 14) stated that a lack of joint training with emergency and disaster risk authorities and managers and with media limited their contributions to disaster risk reduction. Equally, many contributors to the survey (62% or 8 of 13) also 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 (92% or 12 of 13) considered that upgrading and improving their operational forecasting and warning activities would enhance their disaster risk capacities. Most of these (100% or 11 of 11) advocated the conduct of cross-border training activities with neighbouring NMHSs, targeted at common hydrometeorological hazards.

8.5.11 Outreach Activities

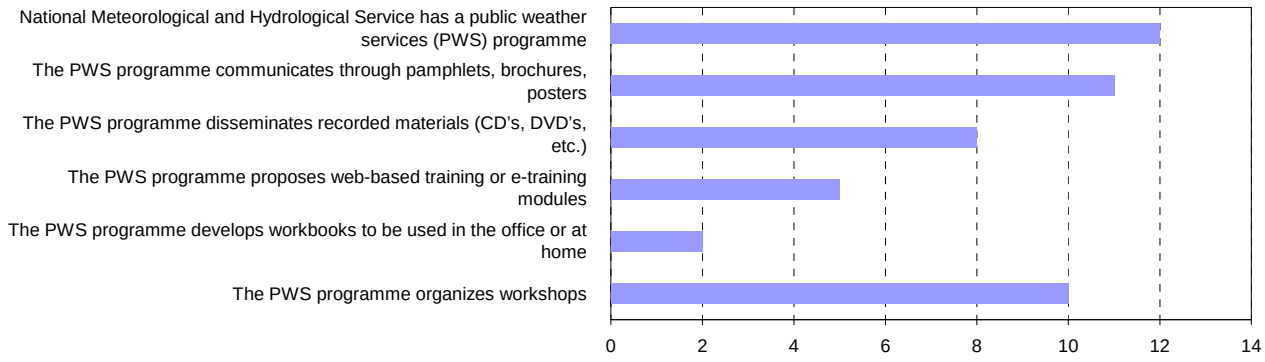

Figure 116. Outreach activities in the South-West Pacific.

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 the South-West Pacific, most (86% or 12 of 14) contributors to the survey identified that their NMHSs had such a public weather services programme. Over half (58% or 7 of 12) of them stated that their NMHSs quality control programme included training for the stakeholders to understand the hazards, warnings and their implications and a similar number (57% or 8 of 14) provided training to the media. More than half (62% or 8 of 13) also provided education and training on hazards, watches, warnings, etc to disaster risk reduction managers and authorities and operational emergency response managers. However, less than half (43% or 6 of 14) the survey contributors identified that they provided training targeted

at the trainers (i.e. of disaster risk authorities, emergency response staff, media, etc). A majority (71% or 10 of 14) provided educational modules and training programmes targeted at the general public. Half of respondents (50% or 7 of 14) pursued joint training activities with emergency response agencies. The following materials and methods were identified as being used in NMHSs public outreach programmes in the South-West Pacific: - pamphlets, brochures, posters (85% or 11 of 13), workshops (71%), recorded materials (CDs, DVDs, etc) (57%), Web-based training (36%), and workbooks for office or home use (14%).

Most (86% or 12 of 14) South-West Pacific contributors to the WMO survey judged that the lack of public understanding of the effects of hazards limited public response to warning services. In addition, more than half (57% or 8 of 14) also felt that the lack of joint training with the media, disaster risk managers and emergency authorities and managers limited their disaster risk reduction efforts. As a consequence, most NMHSs (86% or 12 of 14) in the region considered that educational modules that they could target at media, public and disaster authorities would enhance their effectiveness in disaster risk reduction.

8.6 NMHS Contingency Planning

Most responding NMHSs in the South-West Pacific (79% or 11 of 14) reported that they 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 (46% or 6 of 13) also 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 (79% or 11 of 14) stated that they conducted or participated in drills and exercises to ensure disaster preparedness. However, all South-West Pacific contributors to the survey (100% or 11 of 11) identified needs for improved coordination with neighbouring NMHSs, specifically citing the need for support from them in the event of disruption of services.

8.7 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:

8.7.1.1 NMHS Visibility

A majority of contributing NMHSs in the South-West Pacific region (71% or 10 of 14) considered that they needed higher visibility and recognition within government as a major contributing agency to disaster risk reduction. Almost two thirds (64% or 9 of 14) 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 (86% or 12 of 14) considered that improved ministerial level understanding of the socio-economic benefits of hydrometeorological products and services would increase the visibility of their NMHSs at the national level.

8.7.1.2 Organization and Governance

Almost half of NMHSs in the region (46% or 6 of 13) considered that their national organizational structure for disaster risk reduction limited their potential contributions in this area. A similar number (43% or 6 of 14) believed that the effectiveness of their contributions to disaster risk reduction was limited by the lack of clear legislation or policies regarding the role of their NMHS (e.g. as the sole issuer of warnings). In addition, a majority of contributors (60% or 6 of 10) from 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.

8.7.1.3 Coordination and Partnership

Half (50% or 7 of 14) of the NMHSs in the South-West Pacific 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 of them (79% or 11 of 14) considered that better coordination with neighbouring or adjacent countries would improve their contribution to their own nation's disaster risk reduction activities. Many (64% or 9 of 14) also felt that better coordination with WMO Regional Specialized Meteorological Centres would improve their contribution.

8.7.1.4 Resources and Capacity

Most NMHSs in the South-West Pacific (92% or 12 of 13) who contributed inputs to the WMO country-level survey indicated that resources and infrastructure limited their ability to deliver critical products and services for disaster risk reduction, specifically identifying financial resources (82% or 9 of 11) and professional staff (75% or 9 of 12) and as key limiting factors. In consequence, almost all (92% or 12 of 13) respondents considered that upgrading and improving NMHS operational forecasting and warning services would enhance the disaster risk reduction capacity within their country.

8.8 WMO Support

The following list summarizes the needs for support from WMO expressed by the NMHSs in the South-West Pacific who contributed to the survey.

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

8.9 Sub-Regional Considerations

Significant differences exist in economic development and in climatic and hazard regimes across the vast extent of the South-West Pacific. The following sections summarize the responses to the WMO Disaster Risk Reduction survey from two sub-groups of countries in that region – Small Island Developing States (SIDS) and non-SIDS South-West Pacific countries. Annex 2 lists the countries falling into each of these categories.

8.9.1 Small Island Developing States in the South-West Pacific

The following paragraphs briefly compare the survey responses contributed by seven NMHSs in Small Island Developing States in the South-West Pacific against the preceding analysis of all survey responses from the South-West Pacific region.

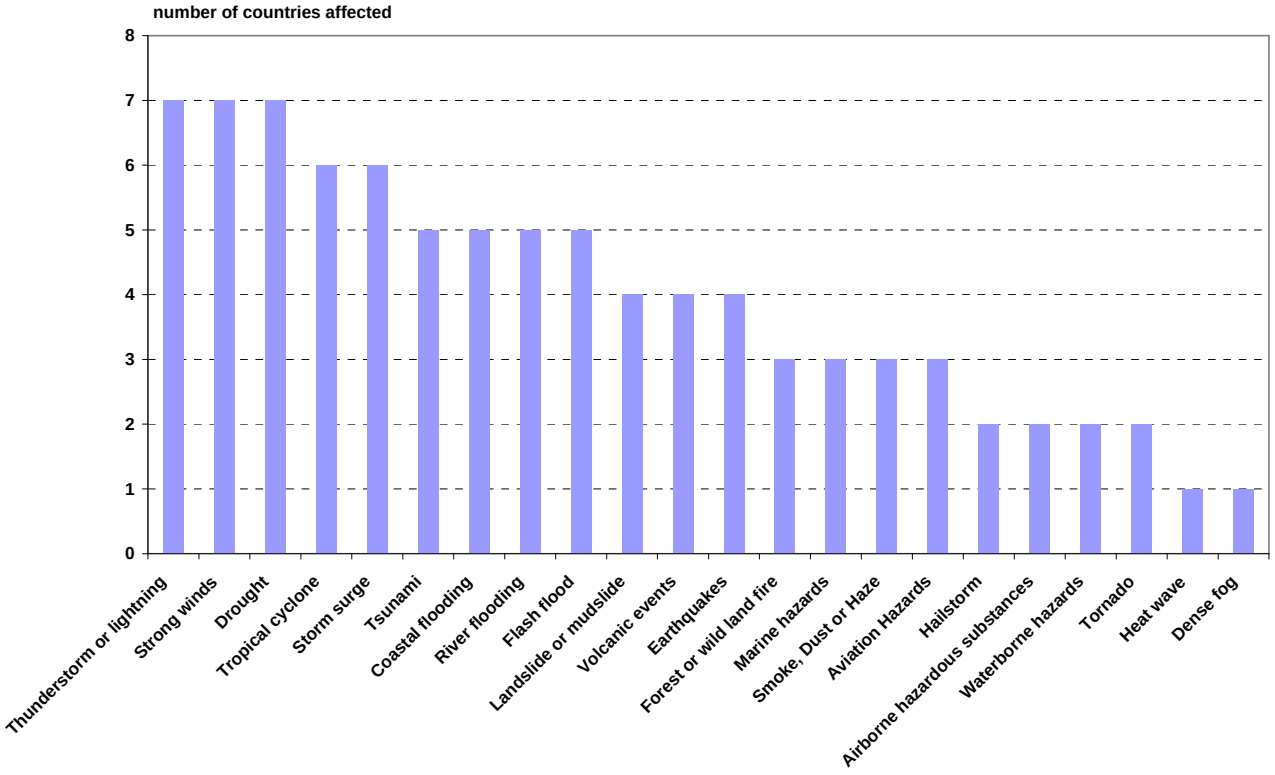

Figure 117. Number of responding Small Island Developing States in the South-West Pacific who identified themselves as being affected by specified hazards.

Figure 117 shows the number of responding members of South-West Pacific SIDS who stated that they were affected by the specified hazards. As Figure 117 illustrates, the hazards that affect most South-West Pacific SIDS countries are strong winds, thunderstorms or lightning, droughts, tropical cyclones, storms surges, flash floods, coastal flooding, river flooding, tsunami, landslides or mudslides, earthquakes and volcanic events. Other hazards – maritime hazards, aviation hazards, forest and wild land fires, smoke, dust or haze, tornadoes, hailstorms, airborne hazardous substances, waterborne hazards, dense fog and heat waves are experienced by less than half of the countries in question.

The responses to the survey indicated that the situation with respect to hazard impact databases and access to impacts information in the South West Pacific SIDS countries was, in many respects, similar to the overall regional picture. However, a noticeably lower percentage of SIDS NMHSs reported that they maintained official databases on the impacts of hazards and used hazard and impacts data to provide value-added services in support of hydrometeorological risk assessment. Legislative, governance and disaster risk coordination structures in the SIDS were similar to those across the region. A higher percentage of SIDS NMHSs stated that they were participants in their national committees or structures for disaster risk reduction. However, a lower percentage of them provided support for the reconstruction phase following disasters. It is noteworthy that proportionately more NMHSs in SIDS considered that their national disaster risk reduction committee structures limited their contributions to that priority area. Correspondingly, the SIDS NMHSs, without exception, advocated the implementation of “readiness level” systems as contrasted to this simply being a majority viewpoint across the region. Survey responses from SIDS in the South West Pacific suggested that partnerships were less widely developed than in the region as a whole. Similarly, a significantly higher percentage of SIDS respondents identified lack of linkages with national disaster risk reduction partners as limiting their contributions to disaster risk reduction. Only one SIDS respondent reported that they had a combined NMHS and related SIDS responses reflected stronger support for improved coordination between NMSs and NHSs.

Where infrastructure and operational capacity were concerned, a significantly higher percentage of SIDS NMHSs identified a lack of resources for the maintenance of observational networks as a substantial limiting factor. In this context, all of them cited professional staff with appropriate training as a particular constraint. The picture with respect to telecommunications and informatics, however, closely paralleled that for the whole region. A higher proportion of SIDS respondents indicated that professional staff with appropriate training limited their data management and data exchange capacities. In contrast to the overall regional picture, no SIDS NMHSs reported that competing warning services existed in their country. All South West Pacific respondents, however, stated that their ability to deliver critical products and services for disaster risk reduction was limited by professional staff and by applications software. Efforts to improve the quality and utility of products generally mirrored those across the region except that a noticeably lower percentage of SIDS respondents reported that they collaborated with other agencies to develop risk information for inclusion in warning statements. Where staff training was concerned, however, SIDS NMHSs in the South West Pacific, without exception, considered that upgrading their operational forecasting and warning services would enhance their disaster risk reduction capacities. A higher percentage of them also drew attention to deficiencies in forecaster training, joint training with disaster risk and emergency authorities and training with the media.

All South West Pacific SIDS respondents considered that a lack of public understanding of hazards, watches, warnings and other products limited the response to them. Similarly, higher percentages of SIDS NMHSs than in the region as a whole identified the lack of joint training with emergency authorities, disaster risk managers and the media as limiting factors. However, only one SIDS NMHS indicated that it sought external reviews and inputs regarding the adequacy of its education and public outreach activities. Finally, the survey responses from South West Pacific SIDS reflected generally higher levels of concern regarding limited NMHS visibility and inadequate understanding of the value of NMHSs contributions, lack of clarity regarding their role and the need for improved linkages with other disaster partners. In summary, the capacities of NMHSs in Small Island Developing States to support disaster risk reduction are, not surprisingly, weaker than the norm across the South-West Pacific region as a whole.

8.9.2 Non-SIDS Countries in the South-West Pacific

The following paragraphs briefly assess the responses from the seven non-SIDS countries in the South-West Pacific who contributed to the WMO survey in comparison to all survey responses from the region. Figure 118 below shows the number of responding NMHSs in non-SIDS countries in the South-West Pacific who stated that they were affected by the specified hazards.

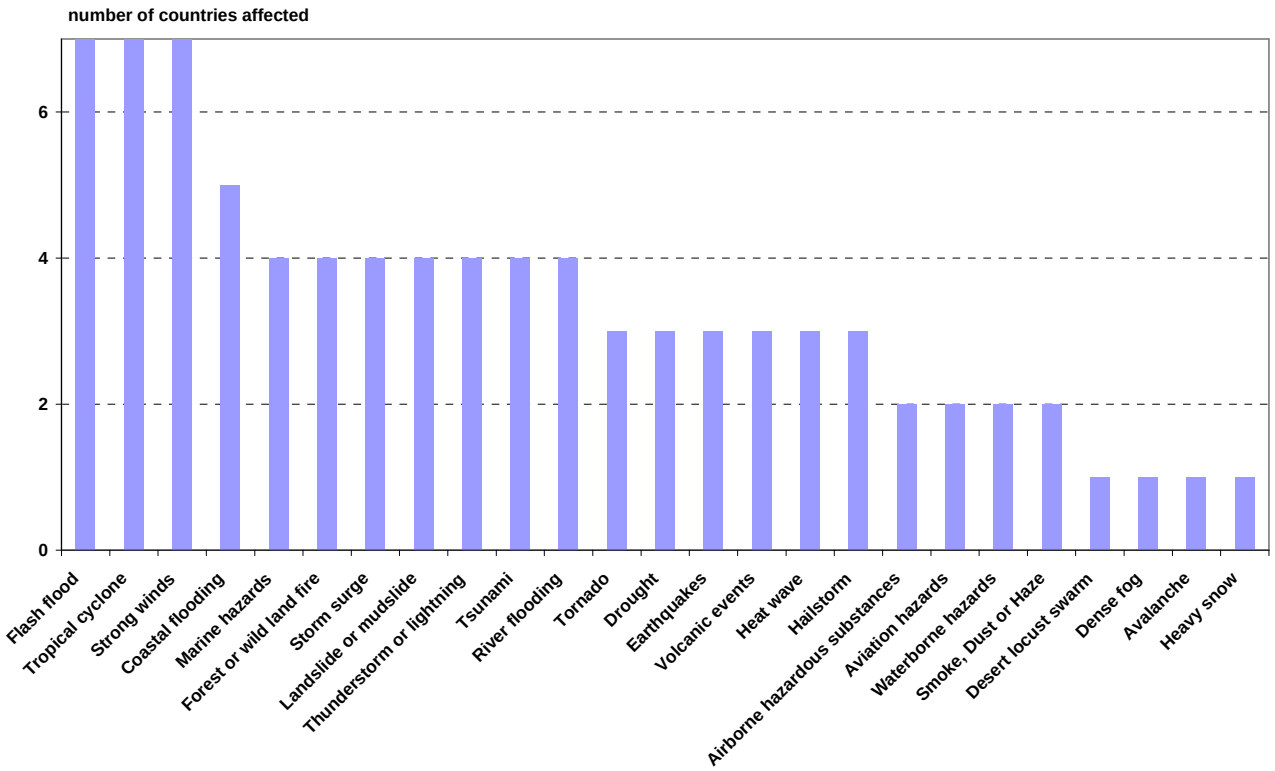

Figure 118. Number of responding non-SIDS countries in the South-West Pacific who identified themselves as being affected by specified hazards.

As Figure 118 illustrates, survey responses indicated that all responding non-SIDS countries in the South-West Pacific are affected by flash floods, strong winds and tropical cyclones. Coastal flooding, thunderstorms or lightning, storms surges, river flooding, marine hazards, landslides or mudslides, forest and wild land fires and tsunamis were reported to affect over half of these countries while tornadoes, hailstorms, heat waves, droughts, earthquakes and volcanic events were of concern in just under one half of them. Other hazards – airborne hazardous substances, waterborne hazards, aviation hazards, smoke, dust or haze, heavy snow, dense fog, desert locust swarms and avalanches - affected only one or two countries.

The responses to the survey indicated that the proportion of non-SIDS countries in the region who had access to official, reliable, information on the impacts of disasters or who maintained and regularly updated their own databases of such information was higher than the regional norm. Correspondingly, higher percentages of non-SIDS NMHSs used hazards and impacts data archives to provide value-added services in support of hydrometeorological risk assessments of other agencies. Survey responses illustrated that legislative, governance and disaster risk coordination structures in the non-SIDS countries were roughly similar to those across the South-West Pacific region as a whole. In contrast to the regional picture, however, only one non-SIDS respondent considered that a lack of clear national legislation or policies regarding the role of the NMHS limited their contribution to disaster risk reduction. A noticeably lower percentage of non-SIDS NMHSs also considered that their national organizational structures for disaster risk reduction limited their contributions to that priority area. Furthermore, relative to the overall regional view, proportionately fewer non-SIDS NMHSs advocated the implementation of “readiness level” systems. In addition, survey responses suggested that NMHS partnerships and collaboration were somewhat better developed in non-SIDS countries than was the case for the South West Pacific as a whole. Moreover, a lower percentage of contributors identified a lack of linkages with national disaster risk reduction partners as limiting their support to disaster risk reduction. Survey inputs from non-SIDS countries in the region also indicated somewhat less need to improve coordination and partnership between NMSs and NHSs.

Non-SIDS responses reflected the regional norm with respect to the lack of appropriate observing networks to support disaster risk reduction. However, relatively fewer non-SIDS NMHSs identified resource, maintenance and human resources deficiencies related to the maintenance of these observing networks. The non-SIDS picture with respect to telecommunications and informatics was similar to that for the whole region. Comparatively, however, fewer non-SIDS respondents cited deficiencies in staff expertise as limiting their data management and data exchange capacities. Competing warning services were reported to exist in proportionately more non-SIDS countries. About half of South West Pacific respondents from non-SIDS countries stated that their ability to deliver critical products and services for disaster risk reduction was limited by professional staff and over three quarters by applications software, again somewhat lower than the corresponding regional figures. Efforts to improve the quality and utility of products roughly mirrored those across the region. As an exception, however, noticeably higher percentages of non-SIDS respondents reported that they collaborated with other agencies to develop risk information for inclusion in warning statements and sought external evaluations and inputs regarding the adequacy, relevance, method of access and availability of their disaster risk reduction products. In addition, a somewhat lower percentage of NMHSs in the non-SIDS countries in the South West Pacific considered that upgrading their operational forecasting and warning services would enhance their disaster risk reduction capacities. Equally, lower percentages of them drew attention to deficiencies in forecaster training, joint training with disaster risk and emergency authorities and training with the media. However, as was general across the region, they unanimously advocated the value of cross border training activities targeted at common hydrometeorological hazards.

A smaller majority of non-SIDS respondents than the overall regional figure considered that a lack of public understanding of hazards, watches, warnings and other products limited the response to them. Similarly, fewer non-SIDS NMHSs identified the lack of joint training with emergency authorities, disaster risk managers and the media as limiting factors. However, non-SIDS respondents were equally supportive of the value of educational modules that NMHSs could target at media, the public and disaster risk reduction authorities. Finally, the survey contributions from non-SIDS countries in the South West Pacific reflected generally lower levels of concern regarding the negative impacts of limited NMHS visibility, lack of governmental understanding of the value of NMHS contributions, lack of clarity regarding their role or the need for improved linkages with other organizations involved in disaster risk reduction. As a group, however, they shared the regional view that their ability to deliver critical products and services for disaster risk reduction was limited by resources and infrastructure. In summary, NMHSs in non-SIDS countries in the South-West Pacific have, in general, somewhat higher capacities in terms of infrastructure and scientific and technical expertise than the regional norm.

8.10 Concluding Assessments and Recommendations for the South West Pacific

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

8.10.1 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, roughly a third of NMHSs in the South-West Pacific do not maintain records of even the most common hazards such as strong winds and very few maintain records of less frequent 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 those 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 about a third of the countries in the region.

8.10.2 Value Added Services based on Historical Hazard Data

Responses indicate that only about two thirds of NMHSs in the South-West Pacific provide technical advice and statistical analysis related to hazard data. The identified limitations suggest that this situation can be explained by a lack of expertise and a need for training and capacity building in data quality assurance, analysis, data rescue, archiving and data display techniques. Without exception, the respondents recommended that enhanced delivery of value added services would strengthen their contributions to disaster risk reduction and identified related needs for capacity building. The respondents' recommendation is strongly supported by the survey responses.

8.10.3 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.

8.10.4 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 such as the Red Cross/ Red Crescent Society, 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 not all NMHSs in the South-West Pacific are part of their national disaster risk reduction system. Those NMHS that are not part of their national coordinating committees should endeavour to acquire membership on these committees and seek to contribute effectively to their national disaster risk reduction activities.

8.10.5 NMHS Contributions to National Disaster Risk Reduction Systems

The survey responses suggest that NMHSs in the South-West Pacific should devote continuing attention to building effective working relationships with national disaster authorities by providing timely, accurate and relevant products and services for disaster risk reduction. The responses also suggest that, in about half of the countries in the region, efforts are needed to expand and reinforce partnerships with other agencies and organizations involved in disaster related activities. Experience elsewhere indicates that the respondents' recommendation for the establishment of a "readiness system" could, if implemented, enhance NMHS contribution to disaster risk reduction and increase their visibility as contributing organizations. However, this should be pursued at the national level.

8.10.6 NMHS Collaboration with other Partners

The survey responses indicate that most NMHSs do not actively pursue coordination and collaboration with significant national, regional and international partners in the disaster community. Expanded collaboration and partnership can benefit NMHSs through broader utilization of their products and services and enhanced visibility and can result in more effective contributions to disaster risk reduction

8.10.7 The Organization and Priorities of NMHSs

The respondents' majority recommendation for enhanced coordination 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.

8.10.8 Operational Coordination between NMSs and NHSs

The survey responses summarized above clearly indicate that needs exist for enhanced operational coordination between NMSs and NHSs in a number of countries in the South- West Pacific. The survey respondents' recommendation should, therefore, be pursued at the country level through immediate action to achieve more effective operational coordination between the meteorological and hydrological communities, particularly with respect to hazard warnings and other critical products for disaster risk reduction.

8.10.9 Observation and Monitoring Networks and Systems

Responses indicate that a majority of respondents consider that their observing networks are not optimal to support disaster risk reduction. In particular, three NMHSs in the region do not have a dedicated 24-hour/year-round observation programme. Maintenance of observation networks was also identified as presenting challenges to most NMHSs, particularly in relation to availability of resources and trained staff. Moreover, hazard-related damage to observation stations was a compounding problem in over half of the countries in the South-West Pacific. Reliable, round the clock, observations, available in real time, are the essential raw material for the production of early warnings of hydrometeorological hazards, 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 24hourly/year round basis.

8.10.10 Telecommunications and Informatics

Survey responses indicate that 24-hourly/year-round telecommunications systems are in place in all but one or two countries. However, deficiencies have been widely identified in relation to telecommunications networks, computer hardware and software in most countries in the South-West Pacific and Internet access poses a problem in a significant number of them. The responses validate the respondents' recommendation that upgrading of telecommunications and informatics infrastructure should be undertaken in most NMHSs in the South-West Pacific.

8.10.11 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 also indicate, however, that improved data exchange will 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.

8.10.12 Forecast and Warning Capability

The respondents' recommendations are validated by the responses earlier in this section. Clearly, there are quite general needs for upgrading of professional staff, computing capacity and supporting applications software and for access to latest forecasting techniques and tools. However, the facts that one NMHS does not have an operational forecasting and warning capacity and two do not operate their forecasting service services on a round the clock basis represent major deficiencies in relating to disaster risk reduction.

8.10.13 Forecast and Warning Products

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

8.10.14 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 at least three South-West Pacific 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, 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 disseminated to the public, perhaps accompanied by advice from the authorities on actions that people should take to minimize loss of life and property.

8.10.15 Products and Services for Selected Socio-Economic Sectors

Experience around the globe demonstrates that the socio-economic sectors discussed earlier can 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 structures to withstand expected wind loads or heavy rains and other similar measures contribute to hardening societies and communities against disastrous impacts of hydrological and meteorological events. Equally, early warnings of hazards enable people to take avoidance or mitigating actions. The survey responses indicate that the target sectors do not receive special hydrometeorological services in more than half of the South-West Pacific countries. Consequently, NMHSs in the region could contribute substantively to disaster risk reduction by enhancing the provision of relevant products and services to land-use planning, development, water resources and other key socio- economic sectors.

8.10.16 Dissemination Systems and Target Audiences

Reliable and timely dissemination of accurate 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 external stakeholders should be targeted for receipt of hazard warnings on virtually the same level as government disaster authorities. It is encouraging to note that efforts are being made to implement this approach in the South-West Pacific and these are to be encouraged.

8.10.17 Product Utility and Product Improvement

The responses indicate that many NMHSs in the South-West Pacific have adopted and are using best practices in relation to assessing and attempting to improve the utility of their products. They also suggest, however, that much remains to be done to bring public and other stakeholders' knowledge and understanding of hazards, warnings and other NMHS products up to an adequate level. A main message is that greater emphasis is needed on increasing the awareness of stakeholders and the public at large with respect to hazards, hazard warnings and how to react to the latter as well as on building mutual understanding and support between NMHSs staff and disaster management agencies.

8.10.18 Internal NMHS Training and Capacity Enhancement

The respondents' recommendations for upgrading of operational forecasting and warning capabilities and for cross-border operational training of forecasters are strongly validated by the survey responses. These indicate that a few NMHSs do not provide ongoing training to forecaster staff and that most others advocate increased emphasis on this aspect. More broadly, however,

the responses also indicate that most NMHSs would benefit from much closer collaboration with disaster risk authorities and emergency managers in relation to both internal training programmes for NMHS staff and joint training programmes with disaster agencies. The overall responses provide clear evidence of needs for increased emphasis on orientation of NMHS staff towards provision of products and services for disaster risk reduction, drawing upon the training capacities of disaster management authorities and experts.

8.10.19 Outreach Activities

The respondents' recommendation that educational modules for stakeholders, the public and the media would be helpful is valid and strongly supported by the survey responses. Based on survey responses, the major weaknesses in outreach activities in the region relate to the need to increase emphasis on public awareness and understanding and on joint training activities for NMHS staff and those from disaster risk/emergency response agencies. The respondents' recommendation, in consequence, makes good sense though it is somewhat narrowly focussed on a single outreach tool or mechanism. From an overall perspective, the responses suggest that a much higher priority should be assigned to outreach activities by most NMHSs. As a useful first step, those NMHSs 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.

8.10.20 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 NMHSs. In many, perhaps most, instances, a partnership agreement with neighbouring NMHSs can be an effective and low-cost approach to ensuring back-up capability.

8.10.21 WMO Support

South West Pacific NMHSs who responded to the survey identified their highest priority needs for support from WMO as being in relation to infrastructure development and technology transfer and capacity building, followed by strengthening of strategic partnerships and education, training and public outreach programmes related to disaster risk reduction. Areas such as partnerships with other technical organizations, resource mobilization, national disaster risk reduction plans and enhancement of NMHS visibility were somewhat lower priorities in relation to WMO assistance. The identification of high priority needs for assistance with education, training and public outreach specifically related to disaster risk reduction further reinforces the similar requirements identified earlier. Moreover, the assignment of a high priority to the provision of assistance for strengthening strategic partnerships with key disaster risk reduction stakeholders also poses a special challenge for WMO.

8.11 Region-wide Capacities and Resources in the South-West Pacific

On an operational level, NMHSs in the South-West Pacific have access to operational products and expertise from WMO Regional Specialized Meteorological Centres at Darwin and Melbourne, Australia and Wellington, New Zealand, the Tropical Cyclone Centre at Nadi, Fiji and from the Pacific Tsunami Warning Centre to reinforce their national contributions to disaster risk reduction. Drawing on resources from the UK Met Office Pacific Fund, US NOAA GCOS Technical Support Programme and the Meteorological Service of New Zealand, enhancements to regional upper air (GUAN) and surface (GSN) observing stations are underway. These initiatives will improve the quality and reliability of atmospheric data available for disaster risk reduction applications. Hydrological infrastructures and expertise are poorly developed in the South West Pacific. In the face of their vulnerability to climatic extremes, including droughts, associated with ENSO events and flooding due to the passage of cyclones, Pacific Island Countries need improved capacities in water resources management. With funding support from the European Union Water Facility, a Pacific-HYCOS has, in consequence, been initiated as a component of WMO's World Hydrological Cycle Observing System. Pacific-HYCOS addresses flood and drought forecasting, water

resources assessment, water resources databases, groundwater and water quality monitoring and assessment. As it proceeds, the project will significantly enhance hydrological infrastructures and capacities across the region, generating expertise and information to support disaster risk reduction and other regional priorities. In addition, NMHSs can access programmes at a number of training institutions across the region their efforts to strengthen their capacities. These include the New Zealand NMS Regional Training Centre in Wellington, the Australian Bureau of Meteorology (BOM) Training Centre in Melbourne and the Meteorological Services Training Centre in Nadi, Fiji.

On a broader level, coordination and more general support for disaster risk reduction activities are available from a number of regional bodies. Examples include the WMO Regional Association V Tropical Cyclone Committee, Council of Pacific Regional Organisations and Programmes (CROP), the South Pacific Applied Geoscience Commission (SOPAC) Disaster Management Programme, the Secretariat of the Pacific Regional Environment Programme (SPREP) Pacific Climate Change Framework, US NOAA Pacific Disaster Programme and the Pacific Islands GCOS Advisory Group. Disaster risk reduction falls under the Sustainable Development component of the Pacific Plan aimed at enhancing economic growth, sustainable development, good governance and security for Pacific countries. The Strategic Action Plan for the Development of Meteorology in the Pacific (SDMP) represents a blueprint for the development of National Meteorological Services to fulfill their roles and responsibilities in disaster risk reduction. The SDMP, the Pacific Islands Global Climate Observing System (PI-GCOS) Action Plan and projects formulated under the Pacific Meteorological Services Needs Analysis Project (PMSNAP) provide foundations for further strengthening of the capacities of regional NMHSs. Resource mobilization efforts in support of capacity and infrastructure development can, moreover, target a broad range of potential partners with interests in the South-West Pacific including the World Bank and Asian Development Bank, the UNDP and national programmes such as AusAID, NZAID and donor agencies in the USA, France, China, Japan, the European Union and the United Kingdom.