CONSULTANCY MISSION REPORT FOR Maldives

Dr. Y.E.A. Raj, Mission Expert on Meteorology,

Mr. Abdul Majid, Mission Expert on Hydrology and

Mr. Ahmed Kamal, Mission Expert on DRR.

10 October 2014

As part of the project on Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, three expert consultants, one on meteorology, one on hydrology, and one on Disaster Risk Reduction, conducted a highly successful two-day mission to Maldives on 10–11 August 2014. The purpose of the mission was to collection and compile data, information, examples, and diagrams on standard operating procedures (SOPs) best practices, gaps and needs, and recommendations for inclusion in the Manual on Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazard Early Warning System which will meet the needs of the 13 beneficiary countries involved in the Project.

PHOTO

Acknowledgments

These workshops were conducted as Activity 1.3 of Project Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System. The lead organizations for the project are the ESCAP/WMO Typhoon Committee and the WMO/ESCAP Panel on Tropical Cyclones in association with a wide cross section of partner agencies. Very kind appreciation is expressed to ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries who have funded this project; to the (Different organizations involved in the two day meetings) for their vital assistance, support, and active participation in these successfully workshop; and Typhoon Committee Secretariat who provided excellent and very time consuming support, coordination, detailed arrangements, and insights for the missions.

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1. Introduction

The Economic and Social Commission of Asia and Pacific (ESCAP) approved a submitted project *Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System* (EWS) and funded it through the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and South East Asia. ESCAP/World Meteorological Organization (WMO) Typhoon Committee (TC) and the WMO/ESCAP Panel on Tropical Cyclones (PTC) in cooperation with other agencies had recognized a strong need to create synergies in early warning systems among different types of coastal hazards by reviewing existing Standard Operating Procedures (SOPs).

2. Project Overview

The goal of the project is to promote community resilience to coastal multi-hazards through effective SOPs for multi-hazards EWSs. The project is collaboration with multiple agencies and organizations. It involves thirteen beneficiary countries in TC and PTC regions. The designated target groups include National Meteorological and Hydrological Services, National Tsunami Warning Centres, and National Disaster Management Offices in TC and PTC Members' countries.

Activity 1 is to collect, review, analyze, and synergize existing SOPs in TC and PTC Members' countries and develop a Manual/Handbook of SSOP Procedures. The third item in Activity 1 is to synergize existing SOPs and develop additional SOPs as needed to meet identified gaps and needs and compile a Manual of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning Systems (EWS), mainly focusing on the hydro-meteorological aspect, to meet the needs of diverse users, like decision makers, early warning issuers, media, researchers, operational, public, including fishermen at community level.

To complete Activity 1.3 and to meet the success indicator, in addition to the three in-country pilot workshops already carried out, consultants visited targeted countries in the Panel of Tropical Cyclone region, Myanmar, Sri Lanka and Maldives and 3 targeted countries in the Typhoon Committee region, Cambodia, Malaysia and Viet Nam. The missions to the PTC region countries were conducted during 4 – 11 Aug 2014 and to the TC region countries during 28 Aug – 5 Sep 2014.

3. Purposes of the Mission Visits

a. To review existing coastal multi-hazards EWS SOPs of hydro-meteorological services, disaster management, media, roles of elected official, and others from national to district to local levels,
b. To identify best practices, gaps and needs, and recommendations for internal and cross-cutting SOPs, and
c. To compile data, information, examples, and diagrams collected on SOPs best practices, gaps and needs, and recommendations for inclusion in the Manual on Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazard Early Warning System which will meet the needs of the 13 beneficiary countries involved in the Project.

4. Missions Dates and Team Members

Dates:

a. PTC Countries

Myanmar	4 - 5 August 2014
Sri Lanka	7 - 8 August 2014
Maldives	10 -11 August 2014

b. TC Countries

Malaysia	28 - 29 August 2014
Cambodia	1 - 2 September 2014
Viet Nam	4 - 5 September 2014

Team members:

a. For the PTC countries' missions:

- Dr. Y.E.A. Raj (Dr. Yesudhas Eben Aruma Raj), Former Deputy Director General, Regional Meteorological Centre, Chennai, India Meteorological Department
- Mr. Abdul Majid, Former Director of National Flood Forecasting Bureau, Pakistan
- Mr. Ahmed Kamal, Member (Disaster Risk Reduction - DRR), National Disaster Management Authority, Prime Minister's Office, Pakistan

b. For TC countries' missions:

- Dr. Tokiyoshi Toya, Former Regional Director for Asia and the South-West Pacific, WMO;
- Mr. Abdul Majid, Former Director of National Flood Forecasting Bureau, Pakistan;
- Mr. Amir Ali Khan, Assistant Professor, National Institute for Disaster Management, New Delhi, India.

5. Workshop Programme Overview

The programme for the two-day workshop for all the three countries as designed by the project manager and the SSOP committee is given in Appendix 1a. Another program slightly modified as specific to Maldives and was made available to the consultants is given in Appendix 1 b.

The actual program as it took place is given below.

Day 1 10 Aug 2014, Venue: Adsaree Hall, Male

0845-0845 - Introduction by the Consultants
Mr. Abdul Majid
Mr. Ahemd Kamal
Dr. Y.E.A. Raj

0915-1030 - With participants, Brief presentation by the consultants

0845-1200 - Discussion with the participants DRR & Hydro, and

Met.

1315-1530 Interaction with media

1530-1630 - Discussions

Day 2 11 Aug 2014

0830-1100 - Interaction between DRR and participants associated with Disaster management with several NGOs such as Red Crescent

Interaction between Hydro and Met consultants with MMS personnel (parallel)

1100-1300 Combined session

1330-1500 - Summarising, briefing by the consultants and discussions on recommendations.

Brief description of the proceeding during 10-11 August 2014 at Male is given below. List of participants is given in Appendix 2.

The proceedings of Day 1 i.e., 10 Aug 2014, commenced at about 0845 hours. Dr. Ali Shareef, Deputy Director General of Maldives Meteorological Services (MMS) welcomed the consultants and the various other participants. The consultant Mr. Abdul Majid, Mr. Ahmed Kamal and Dr. Y.E.A. Raj provided a briefing to the participants about the purpose of their visit and the scope of the mission. A short briefing was provided by the personnel from MMS from their end. A combined session was held during the pre-lunch period. Elaborate briefing was provided by the participants from the fishing industry on the warning services made available to them by the MMS. The personnel from National disaster management service gave a briefing to the DRR consultant. The participants from Red Crescent provided a detailed briefing about the work undertaken by them to disseminate warning messages to people and school students, in organising drills and in imparting training in the various aspects of disaster management. Discussions pertained to disaster management in schools, in the tourisms fields especially in resort islands. Localised flooding and their effects were also briefed.

In the afternoon session there was extensive discussion with media. There were 5 participants hailing from Maldives broadcasting commissions and private TV channels. However no participants from print media or radio participated. The media personnel wanted better and visually attractive products which includes graphics and animation from the MMS and said that expectation from public in this respect is very high. Frequent updates in the MMS website also was demanded by the media personnel.

On 11 Aug 2014 during 0820-1030 hours the DRR consultant held discussions with participants from the various islands. The MET and Hydro consultants had interaction with the personnel of the MMS. 8 personnel from MMS participated and several aspects of the replies to the questionnaire were also discussed. At 1100 hours the other consultants also joined with the DRR consultant and continued the discussions. In the post lunch session the consultants

summarised the proceedings and provided a briefing about the likely recommendations. The workshop closed at 1500 hours. Director General of MMS met the consultants on 11 Aug 2014.

6. Mission Summary / Early warning system

6.1 Meteorology/ EWS

Maldives is an island nation in the Indian Ocean – Arabian Sea, consisting of 1192 islands out of which 192 are inhabitable. The total area of all the islands put together is 298 sq.km only and the total population is nearly 394,000 with Male the capital island having a population of nearly 104,000. The average elevation of the islands is just 1.5 metres with the highest point at 2.4m. The estimated coastal length is 664 kms. The aggregate of the numerous islands of Maldives lie between latitudes 0.8°S to 7.1°N and longitudes 72.5°E to 73.76°E. The northern most island is located at 7.15°N and the southernmost island at 0.75°S. The annual normal rainfall is nearly 250 cm in the north and increases to 380 cm in the south. The northern most atoll at 7.1°N is Haa Alif Atoll and Gan island at 0.75°S is the southernmost atoll. Appendix 3 depicts the geographical locations of the various atolls and islands of Maldives.
The major coastal weather hazards that affect the Maldives are listed below:

a. *Cyclonic Storms (CS):* Being located close to the equator the CS may not be a major threat to Maldives as they generally do not form or move in the equatorial latitudes of 5°N to 5°S. However the northern islands can be occasionally affected. Appendix 4a presents the frequency of Depression/CS/Severe CS in the various 2.5°x2.5° squares over the region 50°E-100°E, 5°N-35°N based on the 50 year data 1964-2013 (source: Cyclone eAtlas, IMD-India Meteorological Department). As shown with in the longitudes 70-75°E where Maldives islands lie, the frequencies of D/CS/SCS respectively are 10,1,1 in the area 70-72.5°E, 7.5-10°N; 3,0,0 in 5-7.5°N; Within 72.5°-75°E the frequencies are 5,1,1 in 7.5-10°N and 2,0,0 in 5-7.5°N. Thus south of 7.5°N the frequencies within 70-75°E are 5,0,0 whereas north of 7.5°N they are 15,2,2. Appendix 4b presents the tracks of storms which originated in the latitudinal belt of 5-9°N in the Maldives region during 1964-2013. As shown there have been 6 such systems.

The above analysis clearly shows that the northern islands of Maldives do carry some risk from depressions and cyclonic storms however rare the occurrences are. Sometimes a CS moving north of 10°N over the North Indian Ocean also can affect some of the islands under favourable synoptic conditions. Tropical cyclone Neelam which affected the southwestern pats of Bay of Bengal and crossed the north Tamil Nadu coast during Oct-Nov 2012, thorough moved very far away from Maldives still affected the islands by causing flooding in as many as 50 islands.

b. *Heavy rainfall:* The Maldives islands receive normal annual rainfall of 200-400 cm depending on the location and so heavy rainfall and its effects such as local flooding are always likely.

c. *Strong winds over the seas, Rough seas, high waves, high swells:* As the islands lie in the region close to the equator, winds over the sea would be relatively weaker. However during monsoon season strong local winds could be a feature which can give rise to high waves and rough seas. Further during heavy rain, low visibility is another risk. Inter-island transport is one of the major activities in Maldives which could be substantially influenced by the severe weather conditions over the sea.

d. *Tsunami waves:* (Not strictly a weather event but ocean generated)

The EWS for coastal multi hazard existing in Maldives maintained by the MMS is given below:

1) Nearly 100 personnel work in MMS and out of this 40 work in Male.
2) 5 surface observatories are maintained.
3) 8 Manual rain gauges are maintained by MMS.
4) 23 AWS/ARG with GPRS technology, transmitting weather data once in 5 minutes.
5) No pilot balloon observations.
6) One RS/RW observatory at GAN Island (0.5° S), one observation per day.
7) GTS connectivity is available. Internet connectivity is widely available.
8) One Doppler weather radar which has been installed in one of the islands, is presently not functional.
9) Two tide gauges and two seismology meters have been installed.
10) One satellite receiving system called CMA cast is functioning in Maldives. Satellite pictures are received from Indian and Chinese Satellites.

MMS receives International meteorological data through GTS. The websites of INCOIS, Indonesia and Australia in which Tsunami warning messages are uploaded are accessed by MMS to access Tsunami warning messages on real time basis. Tropical cyclone advisories are received via GTS and also from WMO designated RSMC, New Delhi and La-Re Union. GTS, Fax, email, internet and direct access to the website of the Advisory centres are the major sources of communication. Local data is received through phone and SMS also.

Sufficient backup provision is available and the observatory at GAN could take the responsibility of providing EWS in case the Hulhule (Male) observatory fails. The forecasting office at Male functions round the clock 24 hours 7 days a week. Real time data are displayed through the website. Climatic data is systematically archived and made available to the users. The centre at Male handles all the weather warnings. The country has installed sufficient equipment and sensors in place but sometimes failure of sensors do occur. Insufficient technical expertise, lack of funds and equipment are a few other constraints.

The website of MMS, www.meteorology.gov.mv is found to be very basic with only a handful of links. However it is just adequate and facilitates quick dissemination of the warning messages. Marine and general weather forecasts are issued. In most of the weather forecasts issued by MMS sea condition forecast is included. Continuous forecasts of wave and swell both height and period are important in view of the geography of Maldives and that there are more than 1000 islands. Some islands which are not inhabited are now used as holiday resorts for foreign tourists. In collaboration with RIMES, Bangkok, INCOIS, Hyderabad, India has issued forecast of several ocean parameters such as wave, swell, wind, SST, current, high wave alert etc. specifically for the islands of Maldives. The forecasts are available for Days 1, 2 and 3 for various times for southern, central and northern parts separately. The forecasts are depicted in pictorial form and the grid point values in text file format are also provided. This must be considered as a major initiative by all the institutions involved i.e., MMS, RIMES and INCOIS. Appendix 5 presents the forecasts of wave, swell wind and current available on a specific day (30 May 2014) issued by INCOIS specifically for Maldives.

The definition of heavy rainfall, squally winds, rough seas etc., as defined by MMS are region specific and may not be similar to the practice followed by other countries.

For Tsunami warning MMS depends mainly upon the inputs and forecast products generated by countries such as India, Indonesia etc., which have Tsunami Observation systems in the Indian Ocean. The website of MMS contains a link to the Pacific Tsunami warning centre of NOAA.

Appendix 6 presents the criteria for issuing Earth quake and Tsunami alerts and that for issuing weather advisories and warnings. Appendix 7 presents the weather advisories and warning flow chart. As shown, there are four alert levels, 1, 2, 3 and 4 with colour codings White, Yellow, Red and Green for Tsunami warning. Appendix 8 presents the sequence of bulletins issued during the occurrence of an earthquake. The levels 1, 2, 3 indicate increasing severity of the event with 2 upgraded as tsunami advisory, 3 as tsunami warning. Alert 4 indicates cancellation of the warning and that severe weather/Tsunami threat no longer exits. In the weather advisory issued on 28/05/2006 (Appendix 9), the first two bulletins forecast heavy rain/thunderstorms and the third bulletin describes the presence of a CS though located very far away. Appendix 10 presents a timeline for issuing warnings for tsunami. The formats given in Appendixes 8 and 9 are the two major formats where by warnings are issued by MMS to the users, i.e., one for earthquake and tsunami and the other for weather related hazards. The warnings are region specific to the atoll level. No island specific warnings are issued.

As for dissemination of warning messages, the National Disaster Management Centre (NDMC) plays an important role. There have been a few other Government departments such as Maldives National Defence force, Police services, Ministries of Education, Health, Tourism, Local Government authority, City council, Local council etc., which are involved in the implementation of EWS. The Red Crescent of Maldives has several branches and sub units and plays a crucial role in ensuring last mile connectivity of severe weather warnings. They frequently organise programmes and drills for school students. The media also plays a pivotal role but would like MMS to provide better inputs, graphics and animation. The media personnel present in the meet wanted further improvement in the website of MMS.

The MMS participants also informed that fisherman warnings are frequently communicated through coast guard. VHF sets are also used. 20,000 fishermen carry out fishing and the no. of boats is nearly 1200. There are also large no. of personnel employed in operating the boats. All these show the importance of the sea area forecasts and the need for continuous updates.

Best practices

- Good observational organisation
- A robust forecasting system
- Good and efficient disseminating system of forecasts and warnings
- Conducting user meets and translation workshops occasionally
- NWP capacity
- Utilising substantially, products available from other national weather services
- Receiving forecasts of several crucial ocean parameters in collaboration with INCOIS and RIMES.
- Availability of good communication network, including network within the islands, Good internet connectivity in most of the islands.
- Trained manpower.
- Systematic archival of climate data.

Gaps, needs and Recommendations

- Considering that Maldives consist of several atolls and islands, a denser observational network, fully automated (AWS/ARG) is desirable.

- Installation of 2-3 Doppler weather radars despite high cost of procurement and maintenance. A DWR can help in continuous monitoring of weather which could substantially help in enhancing observational and hence forecasting capability.
- Too basic website which needs enhancement.

6.2 Hydrology/EWS

6.2.1 General

a. Floods are the most frequent natural hazard in Maldives, but it is urban flooding and not the river flooding. There is no separate flood forecasting department or division under MMS. Flood forecast and/ or flood situation is included in the weather forecast as and when heavy rain is expected. Floods are always associated with heavy rains, which occur due to active monsoon or under the indirect effect of the tropical cyclone. Whenever a heavy rain warning is issued floods are also forecast and included in the text of the warning. Flood situation becomes much more critical when strong winds and heavy rain occur at the time of high sea tide. There is widespread inundation under this situation with low lying areas coming under as deep as around 3 feet of water as was the case in 2012 because of 2 cyclones which affected indirectly and caused 200 mm of rain in 6 hours. Tsunami also caused heavy and widespread inundation 80 islands were completely inundated.

b. *Flood Forecasting system and flood warning criteria*

Flood forecasts are included in the weather forecasts relating to the heavy rain. Heavy rain/flood forecasts are based upon the use of meteorological charts/ maps using the data from international sources through GTS, Fax and Internet, V-Sat communication and Broadband network etc. Use of the satellite pictures as received from Indian and Chinese weather satellites and that of the weather radar is made in making the rain/ flood forecast. The radar is however unserviceable since last two years due to maintenance problems involving some costly spare parts. Criteria for issuing heavy rain/ flood warning is in the form of issuing three colour coded weather advisories and warnings as given here under.

1) White advisory information is issued when the rainfall of more than 50 mm is expected to occur within 24 hours. Winds between 20-30 MPA and high tide waves are also included under this condition.
2) Yellow advisory is issued when torrential rain is expected and heavy rain has already occurred for more than 02 hours.
3) Red advisory/warning is issued when floods are expected (or have occurred) and also destructive tide or swell wave or storm surge is expected or has occurred.
4) Green advisory is issued when the condition returns to normal.

6.2.2 Dissemination of weather and flood forecast

Dissemination of weather and flood forecast is done in accordance with the flow chart titled “weather advisories and warnings flow chart” given at Appendix 7.

6.2.3 Gaps and needs

a. Presently no information relating to floods is being given. In the criteria of issuing the weather advisory, floods are mentioned under the criteria for the red advisory. However it is not clear as to whether it is a stage when the flood have actually occurred or it is a stage when the

flood is expected. Even though in the given criteria for the red advisory it is mentioned as "flash flood is expected" but under the yellow advisory stage it is mentioned as "torrential rain is expected and if heavy rain occurred for more than two hours". It is thus obvious that if the criteria for the yellow warning stage has been fulfilled, then floods must have occurred even within the yellow stage prior to the red stage condition. Therefore, this is an anomaly, which needs to be removed.

b. Recommendation

The criteria for the yellow stage relating to the heavy rain and floods need to be amended to include the occurrence of floods as well. The amended criteria may read as "torrential rain and floods is expected or heavy rain and floods have already occurred". Similarly under the red stage instead of the mention that "flash flood is expected" it could be mentioned as "flood has occurred".

6.3 DRR/EWS

6.3.1 General

As a part of the SSOP Mission meetings both combined as well as separate were held with all relevant stakeholders of Maldives which mainly included representatives from NDMC, MNDF, Fisheries and Agriculture, Fishermen Association, EPA, Climate Change, Tourism and Education, Maldives Red Crescent, Media, Local Government Authority, Fishermen, Regional Airports, Health Protection Agency, Boat Captain etc. All relevant issues were shared by the participants. Representatives of Defence Forces, Maldives Red Crescent, and Fishermen Association showed special interest in discussing the DRR and the Response system put in place. Appendix 12 depicts some photos of Mission's engagement in Maldives.

6.3.1 Disaster Risk Reduction

a. Disaster Risk Scenario

The disaster risk scenario for Maldives can be described as moderate in general. Despite this, Maldives is among the most severely affected countries hit by the Asian Tsunami on December 26, 2004. The Maldives experiences moderate risk conditions owing to a low probability of hazard occurrence and high vulnerability from exposure due to geographical, topographical and socio-economic factors.

Maldives has tsunami hazard largely from the east though relatively low hazard is from the north and south also. So, islands along the eastern fringe of eastern atolls are at greater hazard. Islands along the western fringe of western islands have relatively low tsunami hazard. Historically, Maldives has been affected by three earthquake sources in the Indian Ocean. Of the total 85 tsunamis generated since 1816, 67 originated from the Sumatra sub-duction zone in east and the remaining 13 from the Makran coast zone in north and Carlsburg Transform fault zone in south. The northern atolls are at greater hazard from cyclonic winds and storm surge. This reduces gradually to very low hazard in southern atolls.

Sea level rise due to climate change has uniform hazard throughout the country. The IPCC in its Third Assessment Report 2001 estimates a projected sea level rise of 0.09 m to 0.88 m for 1990 to 2100. The impact on Maldives is directly proportional to the elevation of Islands. With about three-quarters of the land area of Maldives less than a meter above mean sea level, the

slightest rise in sea level will prove extremely threatening. Male is estimated to be inundated by 15% by 2025 and 50% by 2100 under conservative scenarios of climate change.

Overall, Maldives has moderate hazard levels except for the low probability and high consequential tsunami hazard in the near future, and high probability and high consequential Sea level rise hazard in the distant future.

b. Risk from Physical Vulnerability

Risk from physical vulnerability is more a function of exposure concentration. As such Male tops the list with highest risk. The islands with risk index 5 (very high) and risk index 1 (very low) are given in the Table-1, Appendix 13 below. Risk index 1 means "safe island". Risk from social vulnerability has no significant trend except Male being in low risk. The risks are randomly spread across the country as several factors drive the vulnerability.

6.3.2 Disaster Prevention, Mitigation and Preparedness

Government has undertaken new initiatives to change its focus from the traditional approach to Disaster Management:

- Beginning with the Disaster Management Bill that is in the process of finalization. The Bill seeks to provide a platform at all levels to address disaster risk reduction.
- The Government has developed conceptual designs for enhanced mitigation features on the proposed 'Safe Island' concept.
- Population consolidation and the creation of safe islands are part of the solution to climate change as discussed in the 7th National Disaster Management Plan.
- Formulation of the second National Environmental Action Plan (NEAP) identified issues that have to be addressed for proper environmental management.
- The NAPA under the integrated Climate Change Strategy (CCS) is an attempt by the Government to develop a countrywide program that encompasses immediate and urgent adaptation activities that address current and anticipated adverse effects of climate change.
- The Health Master Plan 2006-2015 identifies policy direction and goals for national disaster preparedness at all levels of the health sector.
- The education sector has included the focus on Disaster Management under the policy guidelines of providing safety for children.
- The Government's Telecom Policy emphasizes on an Emergency Communication Plan and the department is working in this direction.

6.3.3 Building Resilience to Hazards

Following the Tsunami, a National Disaster Management Centre was established to facilitate the response and coordination. The Ministry for Defense and National Security, Ministry of Finance, Ministry of Planning and National Development lead the emergency response and relief efforts in collaboration with other departments, UN agencies and other development partners. NDMC is the focal point for response, relief and recovery activities. NDMC is carrying out a more holistic model, wherein the processes of hazard identification and mitigation, community preparedness, integrated response efforts and recovery are planned for and undertaken contiguously within a risk management context to address issues of vulnerability. More than 200 staff representing ministries in the government has been trained on basic concepts of disaster management and other subjects related to disaster

management carried out at national and internal levels. Community preparedness plans have been developed in 30 islands and disaster management task forces instituted with training on basic emergency response as part of the Community Based Disaster Program.

6.3.4 Mainstreaming DRR into Design and Implementation

The ambitious concept of "Building Back Better" – a phrase coined by former US President Bill Clinton in his role as UN Secretary General Envoy for Tsunami recovery – has been the guiding principle in the recovery and reconstruction program. Building Back Better envisions the kind of society that people of Maldives will enjoy in five, ten and even fifteen years. Some of the features for building back better include utilization of cast concrete elements for quay walls that would replace the original structure made of 'gunny sacks'. The National Recovery and Response Plan (NRRP) was an important tool for guiding the government's efforts in responding to the Tsunami. School level Standard Operating Procedures (SOPs) were completed for most schools in the country with staff being trained on emergency preparedness and decentralized management including regular mock drills being conducted within the school as well as activities carried out for community awareness with the involvement of parents in DRR. Ministry of Health and Family have specific SOP for the health sector while Ministry of National Defense Force, Ministry of Tourism, Arts and Culture SOPs in place for their respective sectors.

Best Practices

- Good progress has been made by the Government to establish and equip national institutions such as the National Disaster Management Center (NDMC) and sectorial agencies to institutionalize disaster risk reduction.
- The Disaster Management Bill, National Development Plan and subsequently the Strategic National Action Plan (SNAP) for DRR and Climate Change Adaptation highlights the Government's commitment of ensuring that key development plans, strategic and legislative frameworks are in place to adequately manage disasters in the country.
- The SNAP was designed to promote collaboration among policy makers, experts and practitioners of disaster risk reduction and climate change adaptation in the country for the development of a comprehensive risk management approach. It aims to build resilience of the nation and the island communities to disasters by sustaining the progress made by consolidating learned best practices and by incorporating risk reduction into the strategy for decentralization.
- Government's Decentralization Act 2010 was a positive effort of defining three-tier administrative constituencies consisting of city, atoll and island councils to pave the way for decentralized DRR responsibilities. All these policies, plans, strategies and legislative frameworks were considered necessary to also facilitate budget allocation.
- For capacity building, human resource is being developed with funds being allocated for various technical training. Maldivian Red Crescent funding contributed to 25 trained individuals in the vulnerability capacity assessment.
- The Decentralization Act gives sectorial agencies the mandate for decentralization of DRR at sub-national government levels to also promote community participation. Further the local

government authority's mandate is for relief and recovery. Clearly, the legal provision for decentralization exists however ownership of the processes is at the national level with few agencies making gradual progress to implementation it.

- Other DRR related activities undertaken by MoE in collaboration with Care Society includes First Aid training for teachers and students. School health and safety training have been conducted in 13 islands, establishment of child friendly schools are in progress whereas the guidelines to abide by in cases of Natural Hazards and Man-made disasters have also been sent to atolls. These guidelines are available in the MoE website.
- Further, the Maldivian Red Crescent (MRC) has established five branches in Male and 12 units established in 12 atolls while training program produced more than 150 First Aiders, 2 Regional Disaster Response Team (Red Cross and Red Crescent) members, 2 Search and Rescue Trainers, 3 Community Based Disaster Risk Reduction Trainers with more than 30 Vulnerability and Capacity Assessment (VCA) volunteers and staff were trained. Furthermore, VCA trainings were conducted in all units of MRC with community action plans by MRC.
- Safe houses/shelters were constructed in 5 islands namely: Dhuvaafaru in Raa Atoll, Muli in Meemu Atoll, Gan and Fonadhoo in Laamu Atoll and Vilufushi in Thaa Atoll.
- Maldivian Red Crescent has trained special teams who are deployed across the country that can provide basic search and rescue; first aid, triage and coordination.
- Maldives / Male Water and Sewerage Company – Pvt (Ltd) was initially mandate was to supply water to Male only. Now to 8 islands both water supply and sanitation services are being provided. Also now, it is providing electricity to one island and has established UNOCHA's standards. The Company is preparing Evacuation Plan and the Recovery Plan as for selected islands. All these are monitored by Emergency Response Teams. Committee of the Company overlooks the response and preparedness for the natural and man-made disasters. Water and sanitation system gets corrupted after disasters which the Company is also planning to address. The company has got good anti-fire system as well except for 2-3 islands. Remaining shall also be covered. As a part of Contingency Plan, the company is working on the enhancement of water supply storage, expansion of the pumping network and from next year on-wards they shall be developing more pumping systems.
- Maldives Transporting and Contracting Company has a major role in harbor is dredging and sea transport, and major role in evacuation. Their main partners are National Defence Force and Police. SOPs and trained staff are there along with equipment. Workforce and equipment is limited at harbors and islands. Back up is perfect in Male. Beach erosion, high tides are the issues. Erosion taken care by EPA.

Gaps and Recommendations

Key gaps found include:

- The inadequate capacity limits a holistic approach to implementation of DRR measures. This is exacerbated by delayed endorsement of the DM Bill to give national institutions the legal mandate to effectively coordinate implementation of DRR initiatives in the country.
- The Decentralization Act is focused on emergency response and does not promote an integrated approach which local councils can advocate as many are currently formulating development plans at the sub-national levels.
- The current budgetary allocation to key sectorial agencies and different levels of government

is insufficient to effectively promote an integrated approach DRR. Further to limited capacity at the national level, there is ongoing lack of capacity in local government authorities to assist island councils in addressing DRR in their development planning process. This limits further investment in capacity development and acquisition of key equipment for adequately prepare, prevent and respond to disasters in the country.

- To date, less than 5% of islands focus on community DRR Drills and around 20 % of the islands development plans have integrated DRR in their development plans.
- Further gaps exist for Government to have a comprehensive national hazard risks assessment and information system to inform sectors and communities to take effective action on DRR. The limited information on disaster risks affects well informed support for planning and decision-making by Government and other agencies. Coupled with this are limitations in staff capacity to collate, interpret and analyze relevant data and carry out risk assessments.
- The national database hosted by National Disaster Management Centre has remained been under repair. Associated with this is lack of technical expertise that hinders implementation of data compilation and management. Owing to financial and logistical difficulties a number of Automatic Weather Stations (AWS) are not in operation. Doppler Weather radar at Hulhule is also out of service, as a result of unavailability of financial resource and technical support. Due to lack of financial resources MMS is unable to provide repair and maintenance training to technicians working in this key area. Some photos of various products of Maldives Meteorological Services are attached at Appendix14.
- Maldives has ad-hoc mechanisms to disseminate information on disasters and disaster risk reduction to communities and general public. The Maldives Meteorological Services and Ministry of Health website provides updated information on weather changes, onset of disasters/epidemics and ongoing disasters when it occurs. However, the public awareness of the information update on these two websites is limited.
- There is insufficient technical capacity at island and atoll level to implement the plans and conduct drills. Consequently, schools also face constraints in funding allocation for disaster management and drill activities.
- Inadequate awareness and advocacy on the importance of disaster preparedness contributed to lack of systematic institutionalization of disaster preparedness and contingency planning in key government agencies.
- The absence of a legal framework for DRR affected enforcement of key requirements to prepare and respond to disaster in a cost-effective way. Consequently, inadequate human and institutional capacity with ad hoc preparedness and response interventions increases the level of vulnerability particularly for people in remote and isolated atolls and islands.
- In Male, the Sewer network is an old one. Population has exponentially expanded when established 9 Sewer pumping system (then the population was 20,000, now the population is 100,000. Major vulnerabilities in this context include: i) Over capacities due to entry of flood water, ii) Contamination, iii) Threat of water / flood not coming; iv)Limited pumping network unable to get rid from the water; v) Sea water intrusion.
- Girls School / Amenia School – Male has an old building – ceilings are weak. The school has its own SOPs which are being modified. The school has no place to evacuate the students from disasters. New SOPs are being written to include evacuation routes once it is needed due to emergency. Ministry of Education, NDMC and Maldives Red Crescent all are aware of the SOPs. Ministry of Defence have made assessment for the building. Buildings are in bad stages / shapes and should be revamped on regular time interval. Vulnerability of the

building is from fire, unrest. Awareness programs are needed. Earthquake awareness needed. Drawback in the implementation of SOPs is always observed.

Recommendations

Some key recommendations include:

- *Proactive Disaster Risk Mitigation*: The hazard and risk information needs to be incorporated into the national policy and planning. Proactive planning and investments in mitigation measures – structural and non-structural go a long way in mitigating the long term impacts of natural disasters. A beginning needs to be made to construct buildings and structures that can resist natural hazard forces at least in zones 5 and 4. Islands should be carefully selected for the development activities based on the hazard and risk information.
- *Community Based Disaster Risk Management*: In Maldives, inhabited islands with small populations may be targeted for building community's capacity to face natural disasters. This would require suitable training for Island Chiefs and Atoll Chiefs. Island-wise disaster management plans would be a useful starting point with activities like preparedness drills included. Other influential local stakeholders such as school teachers, religious heads and boat owners would also need to be targeted with customized training programs and related activities.
- *Basic Disaster Awareness*: This is to encourage families to have their own disaster plans, communities to build emergency water and food supply systems and house owners/construction workers to be sensitive to safe building construction practices should be promoted through awareness programs using various locally appropriate media.
- *Early Warning Dissemination*: In Maldives, the northern atolls are at high risk to cyclones and the southern atolls are at risk to Tsunamis. The communities in these atolls need to be well prepared to receive warnings promptly and react appropriately. The island offices and well established GSM network in the country are potentially the most useful tools for warning dissemination. Requisite infrastructure and training is needed to promote better preparedness. Appendix 14 depicts some of the Early Warning Dissemination Products presently being maintained by MMS.
- *School Safety and Hospital Casualty Drills:* There is an urgent need for introducing school safety programs in all the islands. The country has a robust educational infrastructure which may be suitably equipped to deal with natural disasters. School safety programs would promote a culture of safety in the community. Program may cover multi-hazards, and may include: i) Training of Teachers and students, ii) Formal curriculum based education, iii) Non-formal aspects such as school disaster management plans, preparedness drills, structural and non-structural mitigation exercises.
- A systematic awareness and education on DRR is needed to enhance the knowledge and skills of stakeholders to give DRR the levels of attention in overall development planning and budgetary response it requires. Also an emphasis on the local government authorities in terms of funding and resources is essential given their proximity to local communities.
- It is recommended that provision of training on DRR to government, civil society organizations and private organizations is critical to enhance capacity and retain the trained staff.
- A lead technical agency may be constituted to support the functions of National Disaster

Management Center to collect, interpret and analyze risk information besides to make available reports and documents in the Disaster Risk Assessment for policy and decision-makers.

- Provision of necessary support to enhance national capacities to carry out the task of operating an integrated database system. Improved allocation of sufficient funds for maintenance of scientific equipment used at MMS is also vital to maintain the systems operational for the continuous monitoring of natural hazards which may affect the country. Further, international assistance and support is required to provide training for the staff in the responsible agencies in Disaster loss data management and repair and maintenance of hazard monitoring systems.
- Maldives need to develop a strategy for dissemination of updated disasters including risk and preparedness i.e. a Disaster Information System to the public and communities. This can be supported by the set-up of an updated and well organized website by the National Disaster Management Centre (NDMC).
- It is recommended that availability of information on the website is widely marketed and encouraged for use as well as monitoring usage and access to the website to keep count users.
- The media need to take an active role in supporting delivery of information on disasters, their risks and required preparedness messages to the public. This should be done through Maldives Broadcasting Commission.
- All schools are provided with a specific allocation for disaster management activities in schools and fully utilize teachers for DRR as many have been trained.
- Priority be assigned in establishing a research unit within existing institutions to conduct studies into the relevant DRR areas with local academics. Efforts should be geared towards set up of a multi-sectorial platform led by National Disaster Management Centre for easy access to the public including sectors for their own purposes.
- Initial efforts of the civil society organizations with key government agencies to support communities' needs to be strengthened to scale-up disaster preparedness and contingency planning.
- Future investments are necessary to formalize existing institutional mandates to facilitate easy access to available capacity and resources in the country to promote whole of government approach on disaster preparedness and response programs
- No comprehensive system exists to effectively coordinate the dissemination of information after a hazard event has been formulated and is in the process of being commissioned. As a result, there has been ad-hoc information sharing hence it is important to establish the system as soon as possible including alternative communication system for outreach to atolls and islands.
- There is a centralized system of warehousing in Maldives (only at Male level). This needs to be taken to the district/island level.
- Dire need to have special system / drainage system for the collection and resending/drainage of the sea water again into the sea. Tsunami may cause damage to water supply and sanitation system.

7. Standard Operating Procedures

7.1 Meteorology /SOP

The consultants had access to the following SOP documents being used by MMS and other related departments, for the management of Multi hazard weather events.

a. SOP published by National Multi Hazard Early Warning Centre (NMHEWC), MMS which contains 4 chapters in 25 pages. The full document is enclosed as Annexure 1. The sub headings of the SOP are given in Appendix 11. As shown this well drafted SOP contains sections titled as: purpose, assignment of responsibilities, duties of meteorological observers and forecasters, check list of earthquake events, operational procedures for Tsunami and weather hazards, criteria for issuing weather advisories and warnings, weather advisories and warning flow chart, Alert and warning flow chart, warning dissemination flow chart, warning dissemination flow charts at stages 1,2,3, Warnings / Information time line flow chart (Appendix 10). It also includes several flow charts of the various aspects of warnings. When the alerts are to be issued for various levels are clearly mentioned. Colour coding for different levels are also included. There are 4 levels for Earthquake / Tsunami and 3 levels for weather advisories.

b. An SOP for dissemination Tsunami warning bulletins – recently updated 27 pages (Annexure 2)

c. An SOP for MHEW prepared exclusively for schools 15 pages (Annexure 3)

d. SOP for MHEW prepared exclusively for the tourism sector (Annexure 4)

The above SOPs are well written, contain detailed instructions and include several flow charts. They generally satisfy the requisites of SOPs which could be adopted for inclusion in the SSOP manual. Integrated SOPs are however not available.

SOPs for issuing warnings for cyclonic storms, heavy rainfall and sea conditions could be still more detailed. Cyclone warning procedures are not fully covered. An SOP for cyclone warning for a country like Maldives consisting of more than 1000 islands, would be substantially different from a cyclone SOP which suits countries such as Sri Lanka and India. All the port warning signals and procedures cannot be adopted in to to, as a cyclone crossing the coast is not clearly defined for Maldives.

The MMS has been rendering excellent multi hazard early warning services to Maldives for severe weather events. Detailed SOPS have also been prepared for weather related hazards and tsunami specifically for schools and tourism sector. The SOP for weather warning procedures could be more detailed. There is also the requirement of an SOP for cyclone warning, as howsoever rare is the occurrence of cyclones/depressions in Maldives, they can still affect the northern islands. Further swells resulting from even a distant cyclone can affect all the islands.

There is sufficient material available in the various SOPs prepared by MMS which could be considered for inclusion in the SSOP manual. SOPs prepared for other counties when used for Maldives will definitely require specific customisation owing to the geographical location of Maldives and that it is a union of large number of very small islands.

Best practices

- The SOP for National multi hazard early warning centre, MMS, is a detailed, well drafted document. It contains detailed SOP for warning of weather hazards, Tsunami and Earthquakes
- Considering the importance of Tourism industry to the Island's economy, separate SOP has been prepared for Tourism Industry to follow in the event of severe weather
- Separate and detailed SOP for schools
- SOPs clearly state the format, process and procedures for each warning
- SOPs clearly specify the follow up action to be taken

- SOPs undergo frequent updating
- SOP refresher trainings are conducted
- Strict monitoring of the implementation of the SOP

Gaps, needs and Recommendation

- SOP for several weather events such as heavy rainfall, rough seas could be more detailed and exhaustive
- A detailed SOP for cyclone warning including port warning should be available. Such an SOP should be prepared taking into consideration the low latitude location of the islands besides the fact that Maldives is a union of large number of small islands and atolls

7.2 Hydrology /SOP

a. No special SOP for hydrological disaster like floods etc. exist, since no flood forecasting functions are provided by the MMS.

b. *Gaps/need*

Since floods are associated with heavy or even moderate rain in Maldives, it is necessary to inform the people of the level of flooding expected on account of rain spell being forecast. However this calls for some study of the past events to establish the relationship of the incident rainfall with the flood water level on the ground. This requires the water level data of the past rain events, which is currently not available. It is therefore recommended that water level recording at some representative location in Male (Maldives) may be started so as to obtain sufficient data to enable formulation of relationship between incident rainfall and the water level.

7.3 DRR/SOP

- The Government's National Development Plan and Strategic National Action Plan on Climate Change Adaptation and Disaster Risk Reduction are the overall policy and planning framework for DRR in the country.
- Other partners such as the UN and civil society organizations have supported the government on developing contingency plan in different sectors.
- The established institutions' technical capacity varies among the different sectors where some have more technical expertise and equipment whereas others are not fully equipped.
- Ministry of Tourism, Arts and Culture – developed detailed Standard Operating Procedures (SOPs) for Hotel Operator authorization on Disaster Management.
- Ministry of Health and Family - Standard Operational Procedures for Government agencies were developed when a large percentage of employees fall victim to an epidemic and private sector. This will in operation once the Public Health Bill that outlines the actions to be undertaken during the epidemics is completed.
- H1N1 SOPs were developed for schools and health facilities.
- A national pandemic influenza preparedness plan and Tsunami SOPs were also developed.
- Overall, the Public Health Bill once endorsed will give Ministry of Health the mandate to enforce health protection measures in emergency and non-emergency situations.
- The Ministry of Education has completed and implemented the School Emergency Operation Guide for most schools in the country.
- Vessels and aircrafts located in four regions in the country for different purposes are ideally

suited for search and rescue teams as well as medical evacuation. Necessary SOPs in this context are required to be prepared and enforced.

- National Disaster Management Center has a focal point in each of the inhabited islands and an agreement has been formulated by the NDMC with the Communication Authority of Maldives, CAM, to shut down the normal phone system and to switch on the emergency system during a disaster so that emergency communications can take place among the focal points.
- Ministry of Education has a guideline for School Emergency Operations Procedures (SEOP), through which schools in 12 atolls have drafted SEOPs and conducted drills involving school children and teachers in 2011. Consequently, 13 more schools practiced drills in 2012.
- Although School Emergency Operations Procedures (SEOP) has been set in numerous schools, there is insufficient technical capacity at island and atoll level to implement the plans and conduct drills. Comprehensive action needs to be taken in this regard.
- The Ministry of Education (MoE) at the regional level has mandated all educational institutions to produce Standard Operating Procedures/Plans (SOPs) and operate at community level during the initial phase of emergencies. Further, MoE has prepared operational procedures during school emergencies to all schools, personalized to respective islands. This included training of one staff from 75% of schools in responding to disaster as education focal points.
- Formulation of technical guide to carry out the disaster risk assessment process in a standardized format and systematic matter needs to be given priority.
- The meet overall challenges towards disaster prevention, mitigation, preparedness and vulnerability reduction SOPs are required to be formulated to address: a) Weak institutional establishments to integrate at all levels of government; b) Inadequate awareness and advocacy including gender sensitive policies and plans; and c) Limited capacity to interpret technical information into analysis to guide development planning and policy design;
- Maldives is at the infant stage of systematically contributing to building resilience to hazards due to various factors and one being Disaster Management was not a top priority until the lessons learnt from the Tsunami in the region. Standard SOPs are required to address issues like: a) No clear mandates for coordination, monitoring and reporting; b) Inadequate funding and at times financial restrictions and shortfalls; c) Inadequate human capacity in terms of new and emerging disaster preparedness, prevention and response under DRR strategies as well as limited technical expertise available in country; d) No legal framework on DRR
- Prior to the Tsunami, emergency preparedness and response programs in the reconstruction were quite new in the country and highly likely to gain momentum however the main challenge remains in the different sectorial codes of practices, guidelines and standards as there is no formal mechanism for tracking and reporting. Hence this would require comprehensive guidelines/SOPs.
- National Geographic Information System is not yet capable to utilize information to identify risks/hazard zones. The NGIS needs to be enhanced to make such information available to ensure that the decisions are fact based. In this regard easy-to-understand SOPs are required.
- If something happens in mid-night then no one is listening the radio/TV. So no way at this time to issue / forewarn the people at mid night. Necessary changes in the existing procedures/SOPs are needed.
- Evacuating the people to deep sea may be one of the good SOP
- Evacuation from Island to Island is very difficult. This needs to be proactively taken in hand

through well thought out SOPs.

- There are routine broadcasts from MMS. Based on frequency, urgency MMS relay / broadcast the warnings. MMS needs to build its image within the people through enhanced engagement with the media. For that matter awareness programs are required to educate public etc. Standard SOPs are required in this context.
- MMS should immediately have a Media Spokesperson. Standard SOPs for effective Media engagement on DRR/DRM be prepared and enforced.
- No written SOPs for Police. Only instructions of NDMC are followed. There are 72 police stations in the country. The Police has terrestrial communication system. All the islands do not have Police stations. During disaster, Ministry of Defence actions are implemented and there is law and order situation at times. SOPs have been drafted with Airports Company (how to act during disasters for airports). The purpose of the Airport Emergency Plan document us to, set out the responsibilities and required actions/role of various personnel agencies involved in dealing with contingencies affecting the airport. Draft Airport Emergency Plan is attached as Appendix 15

8. Conclusions

The purpose of the workshop was to review existing coastal multi-hazards EWS SOPs of hydro-meteorological service, disaster management, media, elected official, and others from national to district to local levels; identified best practices, gaps and needs, and recommendations for internal and cross-cutting SOPs; and then to compile data, information, examples, and diagrams collected on SOPs best practices, gaps and needs, and recommendations for inclusion in the Manual on Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazard Early Warning System which will meet the needs of the 13 beneficiary countries involved in the Project. These purpose have been met and were described above.

Now the challenge is to take the information from these six missions and develop a Manual/Handbook of Synergized Standard Operating Procedures for Coastal Multi-hazards Early Warning Systems focusing on the hydro-meteorological aspects to meet the needs of diverse users and to create a Manual that can and will be used. This development will be done in collaboration and coordination with the five consultants, the beneficiary countries, the Task Force, the TC Advisory Working Group, and 7 partner organizations. This Manual/Handbook will then form the foundation for the training and working meeting scheduled under Activity 2 of the project.

List of Appendixes

Common

1a. Originally planned schedule of meets for Days 1 and 2

1b. Slightly modified schedule as drafted for Maldives

2. List of participants

Met

3. Geographical location of atolls and islands of Maldives

4a. Frequency of Depression/Cyclonic Storm/Severe cyclonic storms over 2.5°x2.5° square in the region 50 °E-100°E, 5°N-35°N, 1964-2013

4b. Tracks of Depressions/CS/SCS which originated in the Maldives area, 1964-2013

5. A section of sea forecasts issued by INCOIS (in collaboration with RIMES) for Maldives

6. Criteria for issuing Earth quake, Tsunami alerts and weather services and warning flow chart

7. Weather advisories and warning flow chart

8. Earthquake and Tsunami advisories Alert Levels 1,2,3 and 4

9. Weather advisories – Alert levels 1,2 and 3

10. Earth quake and Tsunami time line

11. Headings and sub headings of SOP of the NMHEWC of MMS

DRR

12. Photos of Mission's engagement in Maldives

13. Table-I Safe island from physical vulnerability risk

14. Photos of various products of MMS

15. Airport Emergency Plan, Male Airport – Section 10

Annexures

1. SOP published by NMHEWC, MMS (enclosed)
2. SOP for disseminating Tsunami warning bulletins
3. SOP for schools
4. SOP for the tourism sector.

(annexures 2-4 not enclosed)

Appendixes (General)

Appendix IA Guide to Writing Effective SOPs

Appendix II Checklist for Effective SOPs for EWS

Appendix III Information on Early Warning System Overview

Appendix IV Early Warning System Checklist Items

Appendix V General Basic Information on EWS for NHMS, Warnings, Communications, and Relationships

Appendix 1a (p 24-27)

Consultants Visits for the Synergized Standard Operating Procedures (SSOPs)
Maldives – 10-11 August 2014

SSOPs Schedule			
Time	**Activity**	**Participants**	**Venue**
Day 1			
08:30 – 09:00	***Registration***		
09:00 – 09:40	Introduction to the SSOP Project	Consultants and All Participants	DMH
09:40 – 09:50	Questions/Discussion of Overall Project	Consultants and All Participants	DMH
09:50 – 10:00	***Coffee Break***		
10:00 – 12:00	**Parallel Meetings I (2 Groups)**		
	Group -1 These discussions should focus on developing a useful, comprehensive Manual of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP Manual) which will meet the needs of the countries. 1. Identify specific existing coastal related MOUs/SOPs which could be synergized. 2. Identify existing coastal MOUs/SOPs which need improvement. 3. Identify specific areas both technical and non-technical where additional coastal related SOPs are needed 4. Collect recommendations for SSOP Manual.	Meteorological and Hydrological Consultants and Warning Services Participants (Met/Hydro/Seismo)	DMH
	Group-2 These discussions should focus on developing a useful, comprehensive Manual of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP Manual) which will meet the needs of the countries. 1. Identify specific existing coastal related MOUs/SOPs which could be synergized. 2. Identify existing coastal MOUs/SOPs which need improvement.	DRR Consultant and DRR Participants	DMH

	3. Identify specific areas both technical and non-technical where additional coastal related SOPs are needed 4. Collect recommendations for the SSOP Manual.		
12:00 – 13:00	***Lunch Break***		
13:00 – 14:40	**Continue Parallel Meeting I**		
14:40 – 15:00	***Coffee Break***		
15:00 – 17:00	**Parallel Meetings II (2 Groups)**		
	Group -1 These discussions should focus on developing a useful, comprehensive Manual of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP Manual) which will meet the needs of the countries. 1. Identify what the district and local different agencies need and when, for both short notice events like tsunami or longer notice events like a tropical cyclone. 2. A focused discussions and identifying especially what is needed to get information/warnings to the "last kilometer" and how to receive information back from this level. 3. Identify any specific coastal related MOUs/SOPs which exist and which could be synergized. 4. Identify existing coastal MOUs/SOPs which need improvement. 5. Identify specific areas both technical and non-technical where additional coastal related SOPs are needed 6. Collect recommendations for the SSOP Manual.	Hydrological and DRR Consultants and Decision Makers participants. (Warning services representatives are encourage to attend but only as observers)	DMH
	Group-2 These discussions should focus on developing a useful, comprehensive Manual of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP Manual) which will meet the needs of the countries. 1. Identify what the media needs and	Meteorological Consultant and Media participants. (Warning services representatives are encourage to attend but only as observers)	DMH

	when, for both short notice events like tsunami or longer notice events like a tropical cyclone. 2. Identify any specific coastal related MOUs/SOPs which exist and which could be synergized. 3. Identify existing coastal MOUs/SOPs which need improvement. 4. Identify specific areas both technical and non-technical where additional coastal related SOPs are needed 5. Collect recommendations for the SSOP Manual.		
Day 2			
09:00 – 10:20	**Discussion with District and Local Representatives**		
	These discussions should focus on developing a useful, comprehensive Manual of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP Manual) which will meet the needs of the countries. 1. Identify what the district and local different agencies need and when, for both short notice events like tsunami or longer notice events like a tropical cyclone. 2. A focused discussions and identifying especially what is needed to get information/warnings to the "last kilometer" and how to receive information back from this level. 3. Identify any specific coastal related MOUs/SOPs which exist and which could be synergized. 4. Identify existing coastal MOUs/SOPs which need improvement. 5. Identify specific areas both technical and non-technical where additional coastal related SOPs are needed 6. Collect recommendations for the SSOP Manual.	Meteorological, Hydrological and DRR Consultants and District and Local Representatives. (Warning services representatives are encourage to attend but only as observers)	DMH
10:20 – 10:40	***Coffee Break***		
10:40 – 12:00	**Continued Discussion**		
12:00 – 13:00	***Lunch Break***		

Combined Meeting Present Results and to Seek Solutions Needed for SSOP Manual			
13:00 – 13:15	Summary of Parallel National Meteorological / Hydrological/ Tsunami Warning Services	Meteorological and Hydrological Consultants lead and all participants	DMH
13:15 – 13:30	Summary of Parallel Disaster Risk Reduction Management Offices	DRR Consultant lead and all participants	DMH
13:30 – 13:45	Summary of Parallel Decision Makers – Government Officials and Others	Hydrological and DRR Consultants lead and all participants	DMH
13:45 – 14:00	Summary of Parallel Media	Meteorological Consultant lead and all participants	DMH
14:00 – 14:15	Summary of District and Local Representatives	Meteorological, Hydrological, and DRR Consultants lead and all participants	DMH
14:15 – 14:35	***Coffee Break***		
14:35 – 16:30	Discussion of the integration, collaboration, and coordination needed by the five areas discussed. 1. Focus discussion on what is needed and how the SSOP Manual can help fulfill the needs. 2. What does the SSOP need to contain. 3. Recommendations for SSOP Manual	Meteorological, Hydrological, and DRR Consultants lead and moderate and all participants	DMH
16:30 – 17:00	1. Summary of the meeting and results 2. Final comments by participants	Meteorological, Hydrological, and DRR Consultants and all participants	DMH

Appendix 1b (p28-29)

SSOP Consultant meeting **DAY – 1 (10 August 2014) Rev 8**			
	Event	**Consultant**	**Local Participants** (No. of Participants)
0800 – 1200	1	DRR & HYDRO	NDMC (4)and MNDF (6)
0800 – 1000 (Parallel)	2	MET	Fisheries & Agriculture / Marine Research Center/Fisherman Association/Fisherman(Central Area
1000 – 1030	3	DRR, MET & HYDRO, Others	TEA (20)
1030 – 1200 (Parallel)	4	MET	EPA / Environment / Climate Change / Tourism & Education / Maldives Red Crescent
1200 – 1300	5	DRR, MET&HYDRO	Lunch
1300 – 1530	6	DRR, MET & HYDRO	Media (MBC, TVM, VOM and others) (12)
1530 – 1545	7	DRR, MET & HYDRO, Others	TEA (20)
1545 - 1630	8	DRR, MET & HYDRO	Consultants and anyone else available to discuss aspects of the first day
SSOP Consultant meeting **DAY – 2 (11 August 2014)**			
	Event	**Consultant**	**Local Participants**
0800 – 1200	9	DRR	Local Gov't Authority(2)/ Male' City Council(2)/Police(6)/ Health Protection Agency (2) MACL(2)/MWSC(1)/STO(1)FENAKA(1)/MTCC(1)/LAALE'/ MAJEEDIYA/AMEENIYA/VILINGILI SCHOOLS(4) District Managers/ fisherman (7)
0800 – 1200 (Parallel)	10	MET & HYDRO	Maldives Meteorological Service ()
1200 - 1300		CONSULTANTS/PARTICIPANTS	LUNCH (35)
1300 –	11	DRR, MET & HYDRO	(As many of the participants from all of the

1500			different agencies and groups who participated in first 1 ½ days as possible attend. This group discussion is very important) Discussion of the **integration, collaboration, and coordination** needed by the six areas discussed. 1. Focus discussion on what is needed and how the SSOPs can help fulfill the needs for integration, collaboration, and coordination. What is being done now, what can be improved, and how SSOPs can be used and developed? 2. What does the SSOP Manual need to contain/ recommendations to help integration, collaboration, and coordination (Might want to start with a short summary of the first 6 meetings to start the discussion)
1500 - 1515	12	CONSULTANTS/PARTICIPANTS	TEA (30)
1515 - 1630	13	DRR, MET, & HYDRO	Consultants and anyone else available to discuss and summarize the outcomes of the meetings

Appendix 2 (p30-36) List of Participants

Expert Mission to PTC Country of Maldives under the Project of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, 10-11 August 2014
Day 1 (10 August 2014)

Region	Name of Participant	Designation	Organization/Dept.	Tel. No.	E-mail Address	Signature
			08:00 – 12:00			
Male`	Mr. Hisaan Hassan	Project Director	National Disaster Management Centre	773 3002	mip@ndmc.gov.mv	
Male`	Mr. Ismail Shareef	Colonel	National Disaster Management Centre	778 8677		
Male`	Mohamed Fahumee	Captain	Maldives National Defence Force	9944100		
Male`	Hussain Rasheed	First Lieutenant	Maldives National Defence Force	7777686		
Male`	Ahmed Faiz Rashaad	First Lieutenant	Maldives National Defence Force	9632373		
Male`	Ahmed Nafiu Mohamed	First Lieutenant	Maldives National Defence Force	9995984	–	–
Male`	AazaadRushdhy	Sergeant Major	Maldives National Defence Force	9745580		
			08:00 – 10:00			
Male`	Adam Manik	Deputy Director General	Ministry of Fisheries & Agriculture	795 7888		
Male`	Aminath Aroosha	Director	Ministry of Fisheries & Agriculture	755 2495	–	–

Expert Mission to PTC Country of Maldives under the Project of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, 10-11 August 2014

Day 1 (10 August 2014)

08:00 – 12:00

Region	Name of Participant	Designation	Organization/Dept.	Tel. No.	E-mail Address	Signature
Male`	Ms. Aminath Lubna	Senior Research Officer	Marine Research Centre	332 2242	alubna@mrc.gov.mv	
Male`	Dr. Mohamed Shiham Adam	Director General	Marine Research Centre	332 2242	msadam@mrc.gov.mv	

10:30 – 12:00

Male`	for Mohamed Musthafa Mariyam Rifga	Director Environment Analyst	Environmental Protection Agency	778 2393	mariyam.rifga@epa.gov.mv	
Male`	Aishath Faruhath Ali	Assistant Director	Environmental Protection Agency	999 8750	firaa.ali@gmail.com	
Male`	Mareen M. Husny	A.D Assistant Director	Ministry of Environment & Energy	3924244	mareen.husny@environment.gov.mv	
Male`	—	—	Ministry of Environment & Energy	—	—	—
Male`	Ali Shareef	Assistant Director	Climate Change Department	3018346	ali.shareef@environment.gov.mv	

Expert Mission to PTC Country of Maldives under the Project of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, 10-11 August 2014

Day 1 (10 August 2014)

08:00 – 12:00

.	Region	Name of Participant	Designation	Organization/Dept.	Tel. No.	E-mail Address	Signature
	Male`	Dr. Abdulla Shiham Hassan	Chief Executive Officer	MV TV	779 4144		
	Male`	–	–	Jazeera TV	–	–	–
	Male`	NiumaUgail	News Head	D24	789 2426		
	Male`	Ibrahim Hamad Salih		Channel One	743 4407	ibrahim_hamad@live.com	
	Male'	Mr. Ahmed Rashid	Human resource & Administration Director	Maldives Broadcasting Commission	777 4212	ahmed@broadcom.org.mv	
	Male'	Mr. Jaadhulla Saeed	Desk Editor	VTV	783 0684	jadhben@gmail.com	

Expert Mission to PTC Country of Maldives under the Project of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, 10-11 August 2014

Day 1 (10 August 2014)

08:00 – 12:00

Region	Name of Participant	Designation	Organization/Dept.	Tel. No.	E-mail Address	Signature
Male`	Mr. Mohamed Adheel	Project Officer	Maldives Red Crescent	798 5564	mohamed.adeel@redcrescent.org.mv	
			13:00-15:30			
Male`	Mr. Ibrahim Iqbal	Manager	Maldives Broadcasting ~~Commission~~ (TVM) Corporation	777 3305	ibrahim.iqbal@mbc.mv	
Male`	–	–	Voice of Maldives	–	–	–
Male`	–	–	CNM	–	–	–
Male`	–	–	Haveeru Online	–	–	–
Male`	–	–	Sun Media	–	–	–
Male`	Mr. Abdul Latheef Adam		MiadhuNoos	778 8020		
Male`	–	–	Dhi Media		–	–

Expert Mission to PTC Country of Maldives under the Project of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, 10-11 August 2014

Day 1 (10 August 2014)

08:00 – 12:00

Region	Name of Participant	Designation	Organization/Dept.	Tel. No.	E-mail Address	Signature
Male`	Dr. Abdulla Shiham Hassan	Chief Executive Officer	MV TV	779 4144		
Male`	–	–	Jazeera TV	–	–	–
Male`	NiumaUgail	News Head	D24	789 2426		
Male`	Ibrahim Hamad Salih		Channel One	743 4407	ibrahim_hamad@live.com	
Male'	Mr. Ahmed Rashid	Human resource & Administration Director	Maldives Broadcasting Commission	777 4212	ahmed@broadcom.org.mv	
Male'	Mr. Jaadhulla Saeed	Desk Editor	VTV	783 0684	jadhben@gmail.com	

Expert Mission to PTC Country of Maldives under the Project of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System, 10-11 August 2014

Day 2 (11 August 2014)

08:00 – 16:30

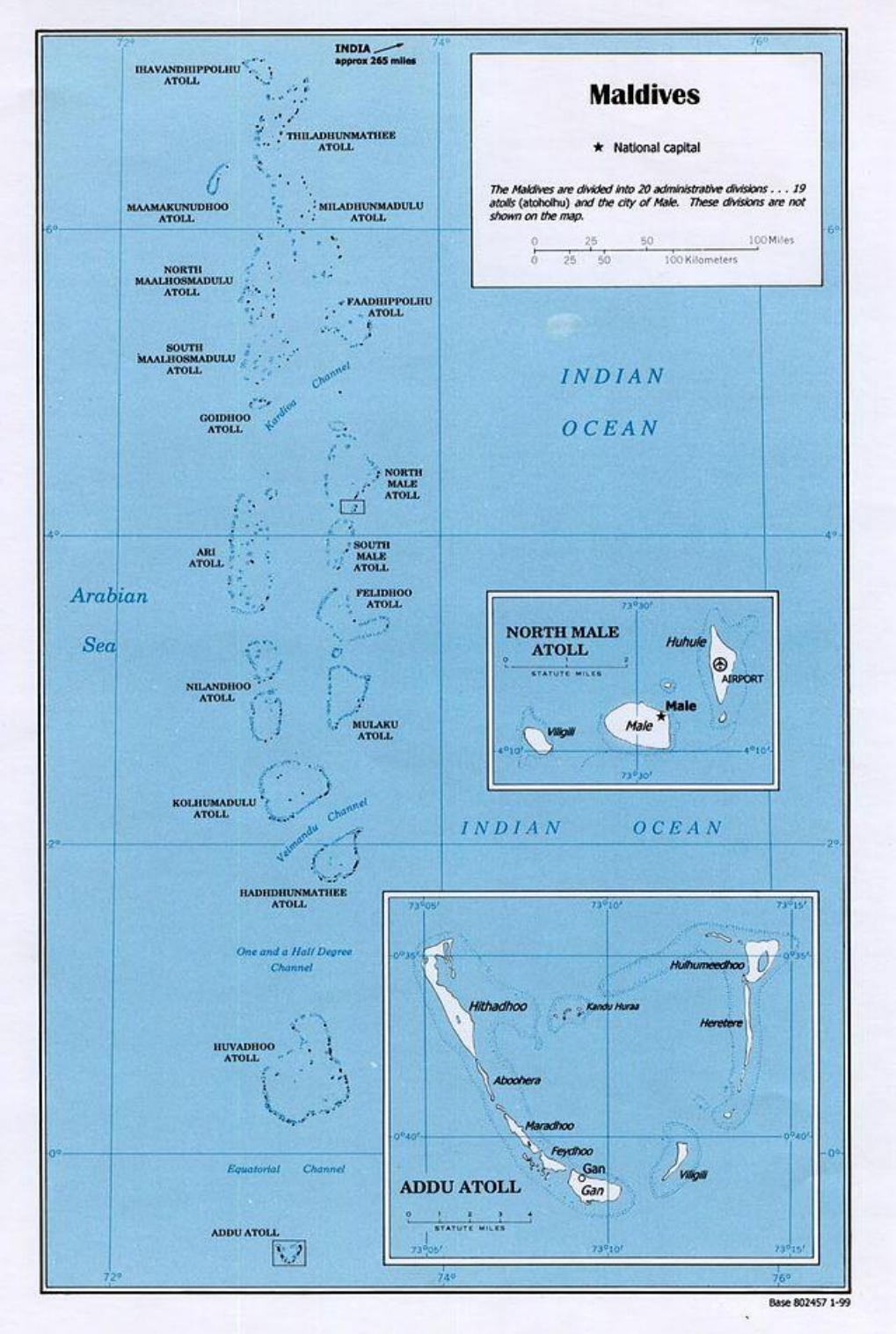
Region	Name of Participant	Designation	Organization/Dept.	Tel. No.	E-mail Address	Signature
Male`	Ahmed A		LAALE' International School			
Male`			Majeedhiyya School			
Male`	Abdulla Hafiz A.S.M.	Met forecaster	MMS	7865718	hafiz_met6hotmail.com	
Male`	Ahmed Adhil	Police chief station inspector	Maldives police Service.	999/697	ahmed adhil@gmail.com	
	AISHATH ADAM	D. PRINCIPAL	AMINIYA SCHOOL	7774024	aisthan@gmail.com.	
Male'	Mohamed Abdulla	Manager.	MACL	7903670	mabdulla1975@gmail.co	

Expert Mission to PTC country of Maldives under the Project of Synergized Standard Operation Procedures (SSOP) for Coastal Multi – Hazards Early Warning System 10 – 11 August 2014

Day 2 (11th August 2014)

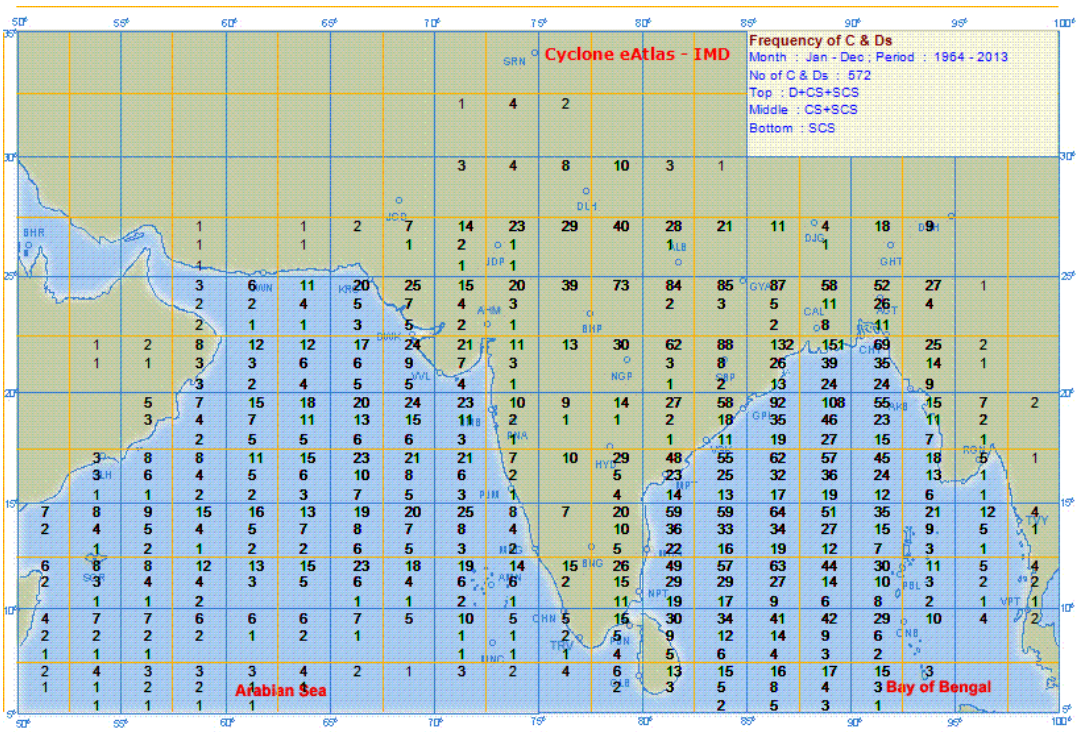
No	Name of Participants	Designation	Organization / Dept.	Email	Signature
1	Abdulla Wahid	Assistant Executive Director	Maldives Meteorological Service	wahid@meteorology.gov.mv	
2	Ali Shareef	Deputy Director General	Maldives Meteorological Service	shareef@meteorology.gov.mv	
3	Dr. Zahid	Director, Climatology	Maldives Meteorological Service	zahid@met.gov.mv	
4	Abdul Muhsin Ramiz	Director	Maldives Meteorological Service	abdul_muhusin@meterorology.gov.mv	
5	Ahmed Rasheed	Meteorologist	Maldives Meteorological Service	Rasheed@meteorology.gov.mv	
6	Ibrahim Humaid	Seismologist	Maldives Meteorological Service	Ibbe_h@hotmail.com	
7	Aishath Umar	Assistant Director	Maldives Meteorological Service	Aishath@meteorology.gov.mv	
8	Azeema Ahmed	Meteorological Technician	Maldives Meteorological Service	azymaahmed@gmail.com	
9	Hussain Waheed	Forecaster	Maldives Meteorological Service	husynwahyd@hotmail.com	
10	Fathimath Latheefa	Administrative Officer	Maldives Meteorological Service	fathun@meteorology.gov.mv	

Appendix 3



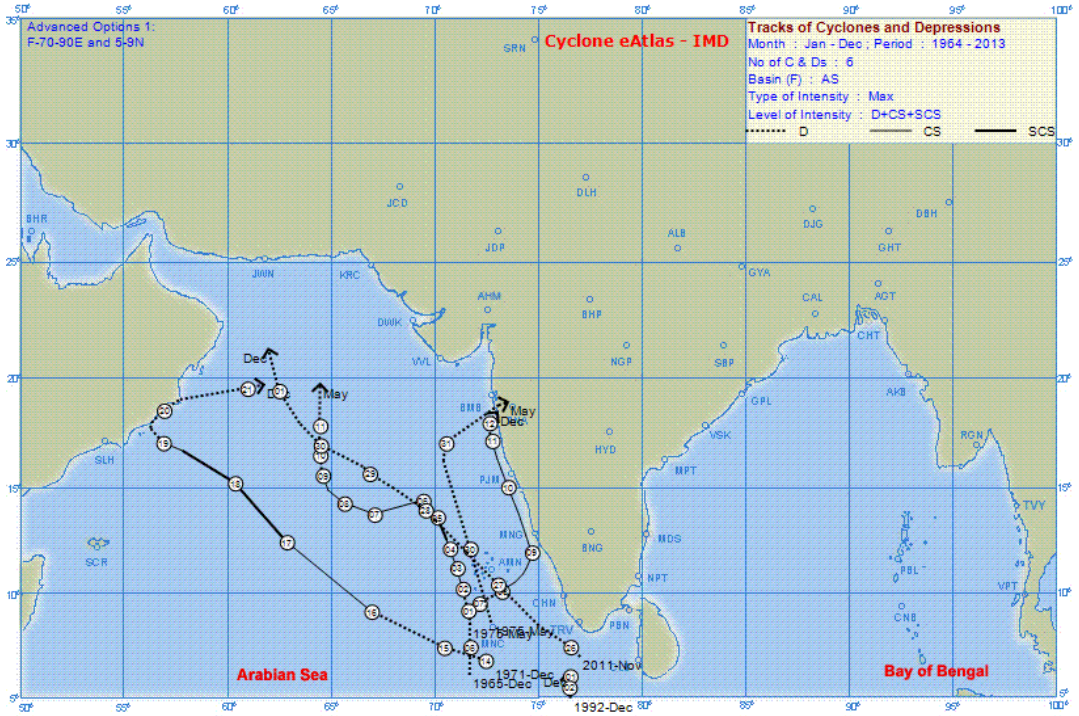
Geographical map of Maldives

Appendix 4a



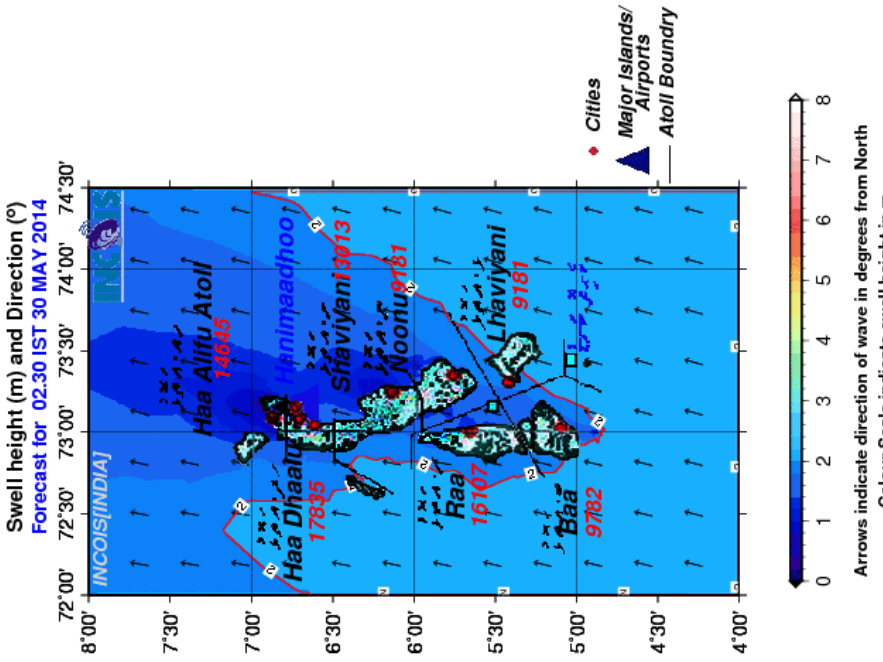
Frequency of Depression/Cyclonic Storm/Severe cyclonic storms over 2.5°x2.5° square in the region 50 °E-100°E, 5°N-35°N

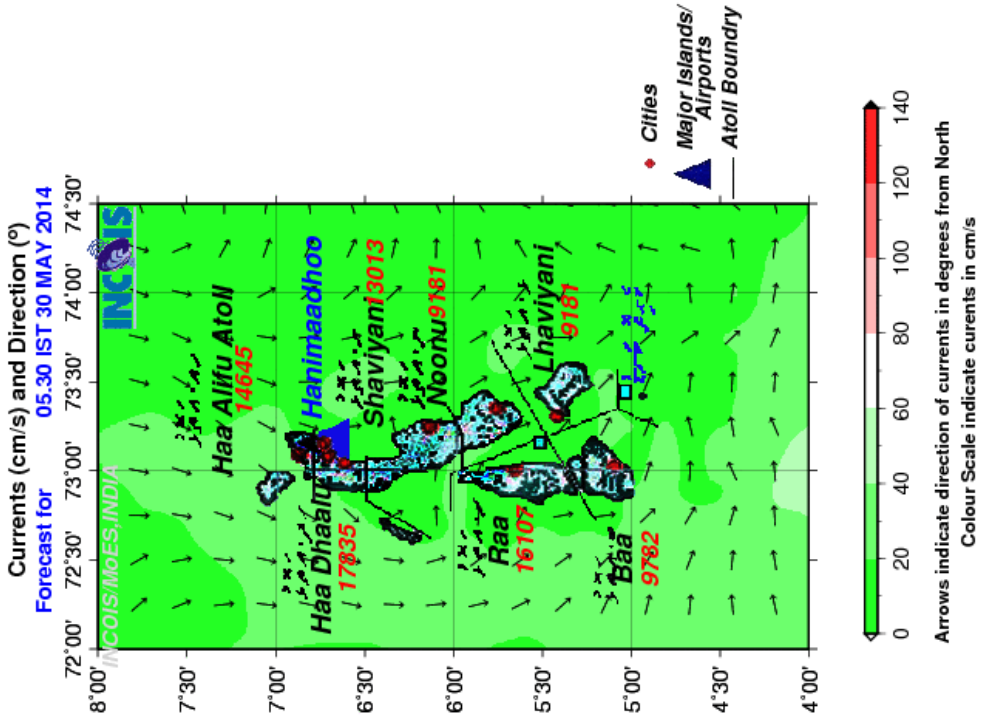
Appendix 4b

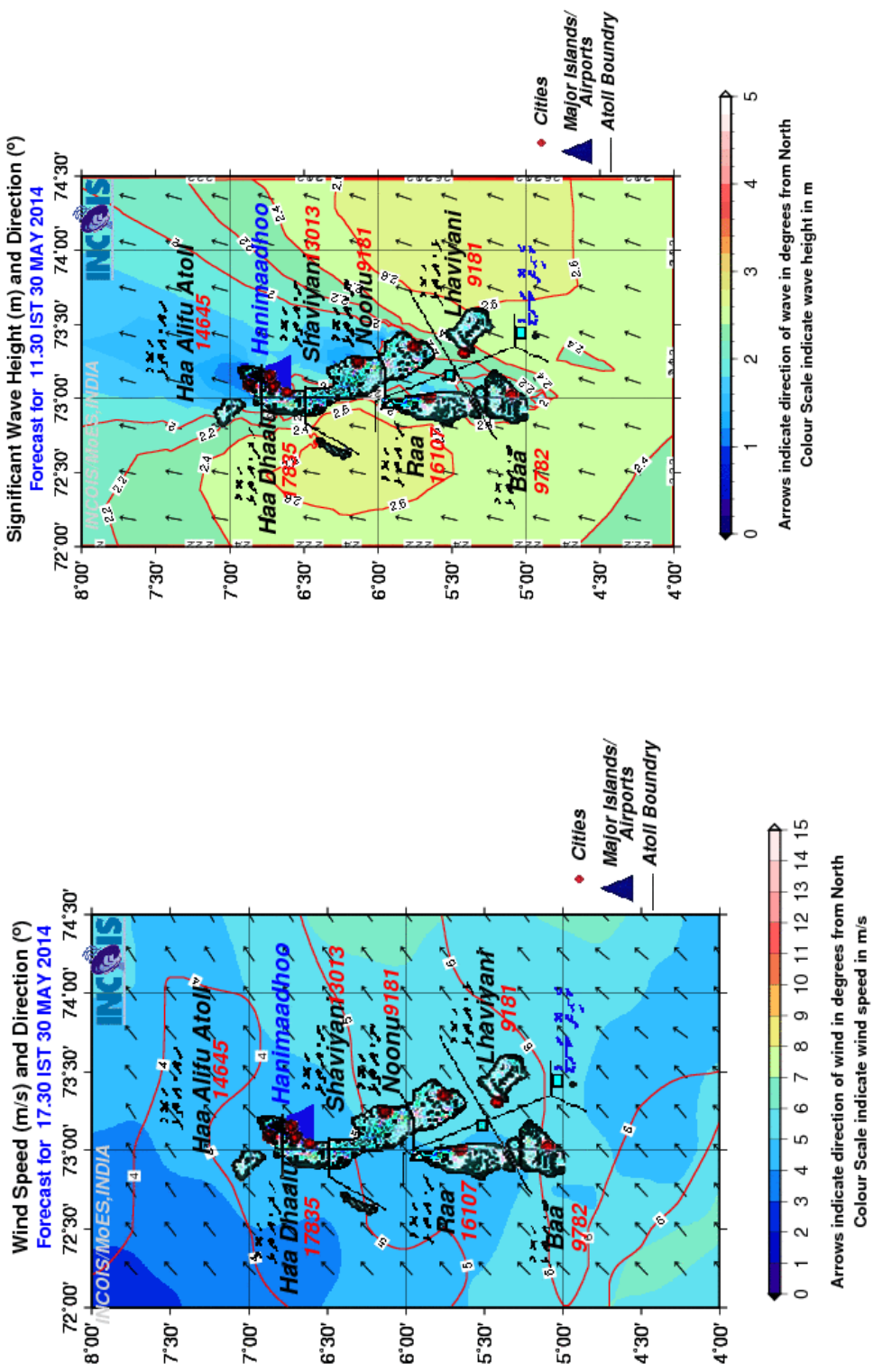


Tracks of Depressions/CS/SCS which originated in the Maldives area

Appendix 5 (page 39-40)







A section of sea forecasts issued by INCOIS (in collaboration with RIMES) for Maldives

Appendix 6 (page 41-42)

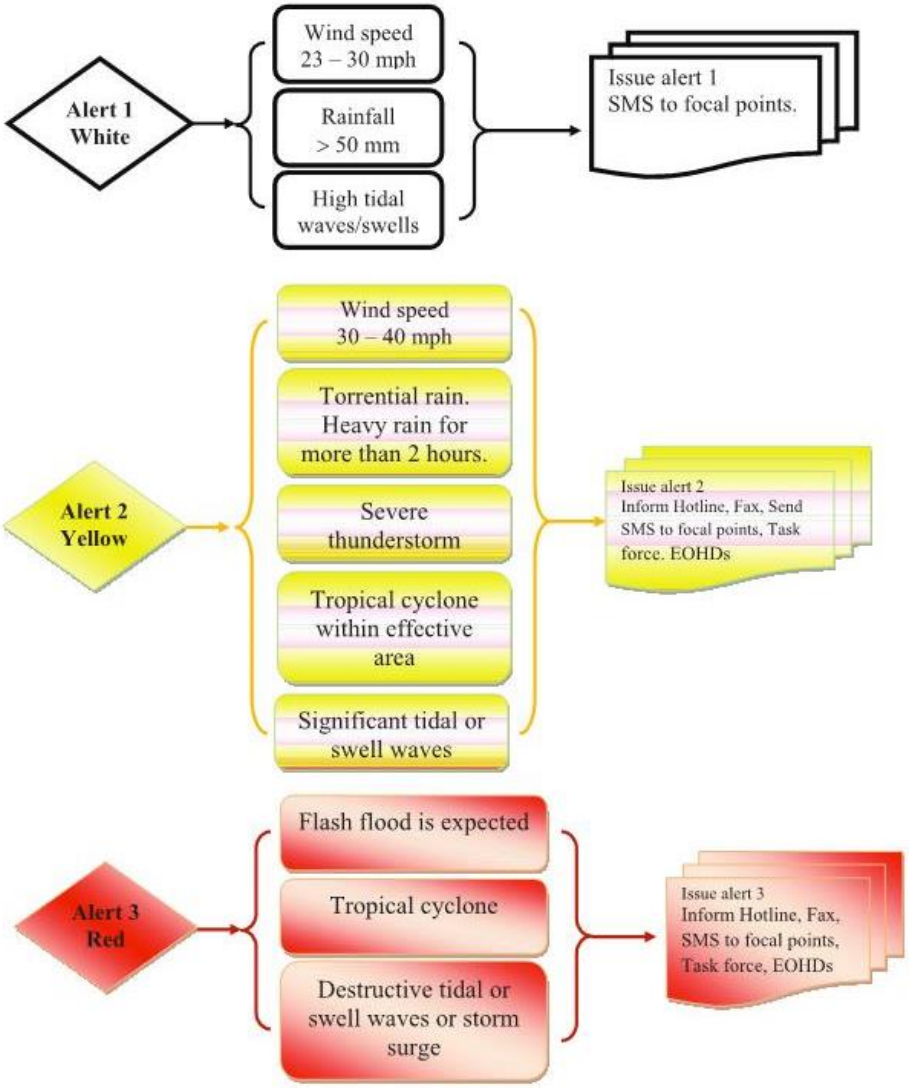
The criteria for issuing Earthquake and Tsunami Alerts			
Alert Level		**Description**	**Action**
1	WHITE	An earthquake occurred with magnitude of 7.0 in Richter Scale over the Northern Sumatra but there is no immediate threat from earthquake or possible tsunami	Earthquake Advisory for information
2	YELLOW	An earthquake occurred with magnitude of 8.5 in Richter Scale over the northern Sumatra. The earthquake has the potential to generate a widely destructive tsunami in the ocean or sea near the epicenter.	Earthquake and Tsunami Advisory, concerning **authorities** and people are advised to be on alert and be ready to move safer areas and high rising buildings.
3	RED	An earthquake occurred with magnitude of 8.5 in Richter Scale over the northern Sumatra. It is confirmed a widely destructive tsunami has originated at the epicenter.	**Tsunami Warning, e**vacuation of threatened population to high rising buildings and safe areas **strongly recommended**.
4	GREEN	If Tsunami Threat does not exist to Maldives Cancellation Message will issue immediately	Cancellation Message, authorities assume that the Tsunami threat does not exist to Maldives

The criteria for issuing weather advisories and warnings

Alert Level		Description	Action
1	WHITE	- Mean wind speed is expected or prevailed between 23 – 30 mph. - Rainfall of more than 50 mm is expected to occur within 24 hours. - High tidal waves are expected.	Weather Information, but no immediate threat.
2	YELLOW	- Mean wind speed is expected or prevailed between 30 – 40 mph. - Torrential rain is expected and if heavy rain occurred for more than 2 hours. - A severe thunderstorm is expected or experienced. - Tropical Cyclone is formed within effective areas of Maldives. - Significant tidal or swell waves expected or experienced.	Concern authorities and people living in the area to be on alert & be ready to take action. Travel by sea not advisable.
3	RED	-Flash flood is expected. -A tropical Cyclone is tracked to move closer or cross Maldives islands. -Destructive tidal or swell waves or storm surge is expected or observed.	Evacuation of population from threatened areas to safer places. Prohibition of sea transportation.
4	GREEN	The condition has improved.	Cancel warning

Appendix 7

Weather advisories and warnings flow chart



Appendix 8 (page 44-47)

بسم الله الرحمن الرحيم

Maldives Meteorological Service
Hulhule, Maldives

Alert Level 1 White

Earthquake Advisory

An earthquake has occurred with these preliminary parameters

Origin Date/Time: 03/04/2005, AT 08:10 HRS

Distance (approximate): 2600 km, East of Maldives (Male').

Location: NORTHERN SUMATRA, INDONESIA (Under Sea/ Land Area)

Magnitude in Richter scale: 8.3

Depth: 10 km

Detailed information would be disseminated as soon as available.

Issued Date: 03/04/2005 Time: 08:20 HRS

Office stamp

National Disaster Management Centre
Maldives Police Service
Maldives National Defense Force
T.V. Maldives
Voice of Maldives
Ministry of Atolls and Development
Ministry of Tourism and Civil Aviation
Ministry of Health
Ministry of Education
Telecommunication Authority of Maldives

بسم الله الرحمن الرحيم

Maldives Meteorological Service
Hulhule, Maldives

Alert Level 2 Yellow

Earthquake and Tsunami Advisory

Earthquake information:

An earthquake has occurred with these preliminary parameters

Origin Date/Time: 03/04/2005, AT 08:10 HRS

Distance (approximate): 2600 km, East of Maldives (Male').

Location: NORTHERN SUMATRA, INDONESIA (Under Sea/ Land Area)

Magnitude in Richter scale: 8.3

Depth: 10 km

Tsunami information:

THIS EARTHQUAKE HAS THE POTENTIAL TO GENERATE A WIDELY DESTRUCTIVE TSUNAMI IN THE OCEAN OR SEA NEAR THE EPICENTER.

Issued Date: 03/04/2005 Time: 08:20 HRS

Office stamp

National Disaster Management Centre
Maldives Police Service
Maldives National Defense Force
T.V. Maldives
Voice of Maldives
Ministry of Atolls and Development
Ministry of Tourism and Civil Aviation
Ministry of Health
Ministry of Education
Telecommunication Authority of Maldives

بسم الله الرحمن الرحيم

Maldives Meteorological Service
Hulhule, Maldives

Alert Level 3 Red

Tsunami Warning

An earthquake has occurred with these preliminary parameters.

Origin Date/Time: 03/04/2005, AT 08:10 HRS

Distance (approximate): 2600 km, East of Maldives (Male').

Location: NORTHERN SUMATRA, INDONESIA (Under Sea/ Land Area)

Magnitude in Richter scale: 8.3

Depth: 10 km

Tsunami information:

A WIDELY DESTRUCTIVE TSUNAMI HAS ORIGINATED AT THE EPICENTER.

Expected arrival time of tsunami to the Maldives:

EXPECTED ARRIVAL TIME BETWEEN 11.30 – 12.30 HRS.

Issued Date: 03/04/2005 Time: 08:20 HRS

Office stamp

National Disaster Management Centre
Maldives Police Service
Maldives National Defense Force
T.V. Maldives
Voice of Maldives
Ministry of Atolls and Development
Ministry of Tourism and Civil Aviation
Ministry of Health
Ministry of Education
Telecommunication Authority of Maldives

بسم الله الرحمن الرحيم

Maldives Meteorological Service
Hulhule, Maldives

Alert Level 4 Green

Tsunami Warning Cancellation

The tsunami which was originated from the earthquake, approximately 2600 km, East of Maldives (Male') on 03/04/2005, AT 08:10 has no treat to Maldives, since the expected arrival time of tsunami passed.

Issued Date: 03/04/2005 Time: 08:20 HRS

Office stamp

National Disaster Management Centre
Maldives Police Service
Maldives National Defense Force
T.V. Maldives
Voice of Maldives
Ministry of Atolls and Development
Ministry of Tourism and Civil Aviation
Ministry of Health
Telecommunication Authority of Maldives

Appendix 9 (page 48-50)

بسم الله الرحمن الرحيم

Maldives Meteorological Service
Hulhule, Maldives

Alert Level 1 White

Weather Advisory

Description of hazard: Heavy rain/thunderstorms with strong wind of 20-30mph observed and heavy thundershowers forecasted.

Region(s)/area to be affected: North/Central/South

Validity Period: 28/1400 to 29/0800 hours local time

Additional advisory will be issued if the condition deteriorates or condition persists beyond the validity period.

Issued Date (d/m/y): 28/05/06 **Time (local):** 1330

Office stamp

National Disaster Management Centre
Maldives Police Service
Maldives National Defense Force
T.V. Maldives
Voice of Maldives
Ministry of Atolls and Development
Ministry of Tourism and Civil Aviation
Ministry of Health
Ministry of Education
Telecommunication Authority of Maldives

بسم الله الرحمن الرحيم

Maldives Meteorological Service
Hulhule, Maldives

Alert Level 2 **Yellow**

Weather Advisory

Description of hazard: Heavy rain/thunderstorms with strong winds of 30-40mph observed for more than 2 hours and Heavy rain/thunderstorms forecasted with mean wind speed of 30-40mph.

Region(s)/area to be affected: Southern Atolls

Validity Period: 28/1400 to 29/0800 hours local time

Additional advisory will be issued if the condition deteriorates or condition persists beyond the validity period.

Issued Date (d/m/y): 28/05/06 **Time (local):** 1330

Office stamp

National Disaster Management Centre
Maldives Police Service
Maldives National Defense Force
T.V. Maldives
Voice of Maldives
Ministry of Atolls and Development
Ministry of Tourism and Civil Aviation
Ministry of Health
Ministry of Education
Telecommunication Authority of Maldives

بسم الله الرحمن الرحيم

Maldives Meteorological Service
Hulhule, Maldives

Alert Level 3 Red

Weather Warning

Description of hazard: Tropical Cyclone is predicted at about 250 nautical miles north of Maldives and is tracking towards Maldives. Storm surge is expected with waves ranging from 1 to 3m height.

Region(s)/area to be affected: North and Central Atolls.

Validity Period: 28/1400 to 29/0800 hours local time

Necessary Action(s) Required:
It is strongly advised not to travel by sea during the mentioned period. The appropriate authorities should take necessary actions.

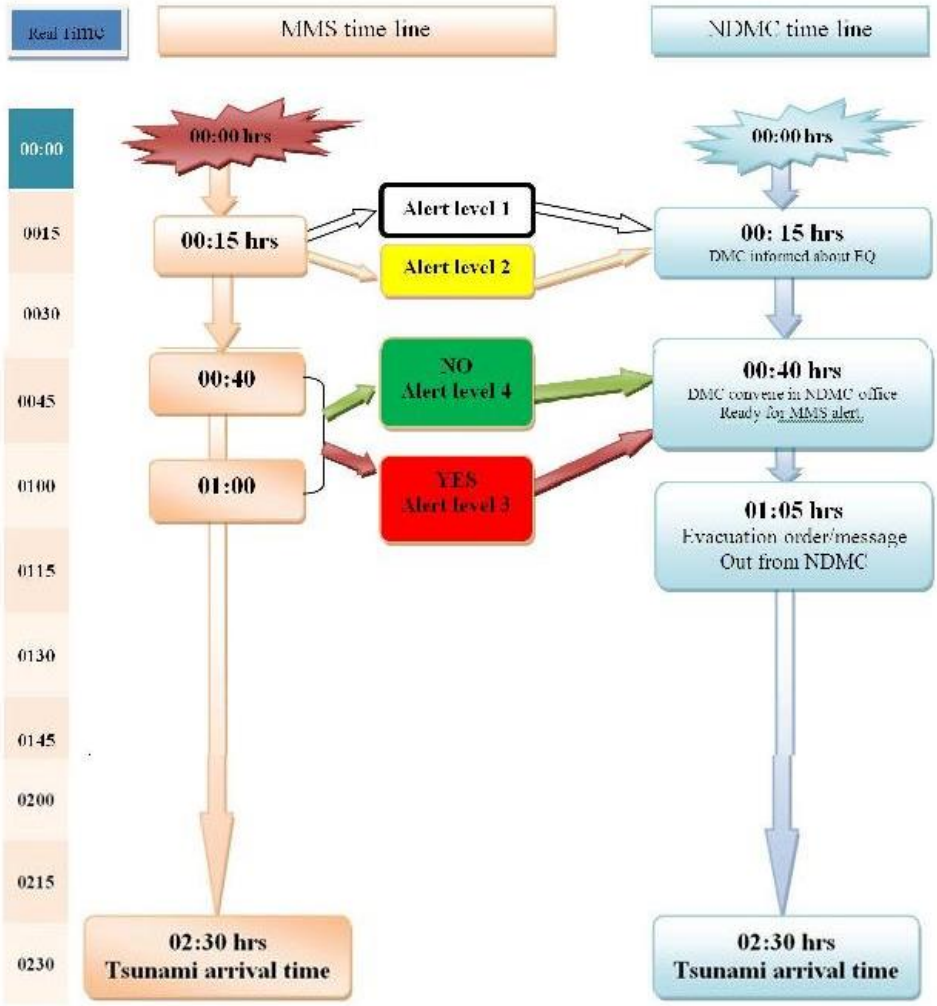
Issued Date (d/m/y): 28/05/06 **Time (local):** 1330

Office stamp

National Disaster Management Centre
Maldives Police Service
Maldives National Defense Force
T.V. Maldives
Voice of Maldives
Ministry of Atolls and Development
Ministry of Tourism and Civil Aviation
Ministry of Health
Ministry of Education
Telecommunication Authority of Maldives

Appendix 10

Earthquake & Tsunami timeline



Appendix 11

Headings and sub headings of SOP of the NMHEWC of MMS

Chapter-1

a. Purpose
b. Role and Mission
c. Products and Capacity
d. Assignment of responsibilities
    1. Duties of Geological observers
    2. Duties of Meteorological Observers
    3. Duties of Meteorological Forecasters
    4. Responsibilities of Taskforce team
    5. Responsibilities of the Emergency Operation Heads (EOHs)

Sample Daily check list for Geological Observers
Check list for EQ event

Chapter-2

Operation and maintenance of seismic and sea level observation network.

a. Specification
b. Data transmission / communication procedure / routes
c. Station management procedure

Daily checklist for Technical support unit

Chapter – 3

Event alarm operational procedures and criteria for tsunamigenic earthquake and weather hazards

1. Criteria for alert and warnings for the earthquake, Tsunamis
2. Criteria for issuing weather advisories and warnings

Weather advisories and warnings flow chart
National alert and warning flow chart on natural disasters
States of activities – various levels of emergency
Warning dissemination flow charts for stages 1 to 4
Warning / information time line

Chapter – 4

NTWC General process and flow charts for Earthquake and Tsunami

Appendix 12 (Page 53-54)

Meeting With MMS and Armed Forces Official

Meeting with NGOs, Media, Fishermen, Maldives Red Crescent

Photo With DG MMS, State Minister and Deputy Minister

Group Photo With MMS and Other Department Officials

Appendix 13 (page 55-56)

Table -1
Safe Islands from Physical Vulnerability Risk

S. No.	ISLAND	ATOLL	MULTI HAZARD PHYSICAL RISK INDEX
1	MALE	KAAFU	5
2	FOAMMULAH	GNAVIYANI	5
3	KULHUDUFFUSHI	HAA DHAALU	5
4	HULHUDHOO	SEENU	5
5	DHIDHDHOO	HAA ALIFU	5
6	DHIDHDHOO	ALIFU DHAALU	5
7	KELAA	HAA ALIFU	5
8	NOLHIVARAMU	HAA DHAALU	5
9	GADHDHOO	GAAFU DHAALU	5
10	NAIFARU	LHAVIYANI	5
11	THODDOO	ALIFU ALIFU	5
12	EYDHAFUSHI	BAA	5
13	KALHAIDHOO	LAAMU	5

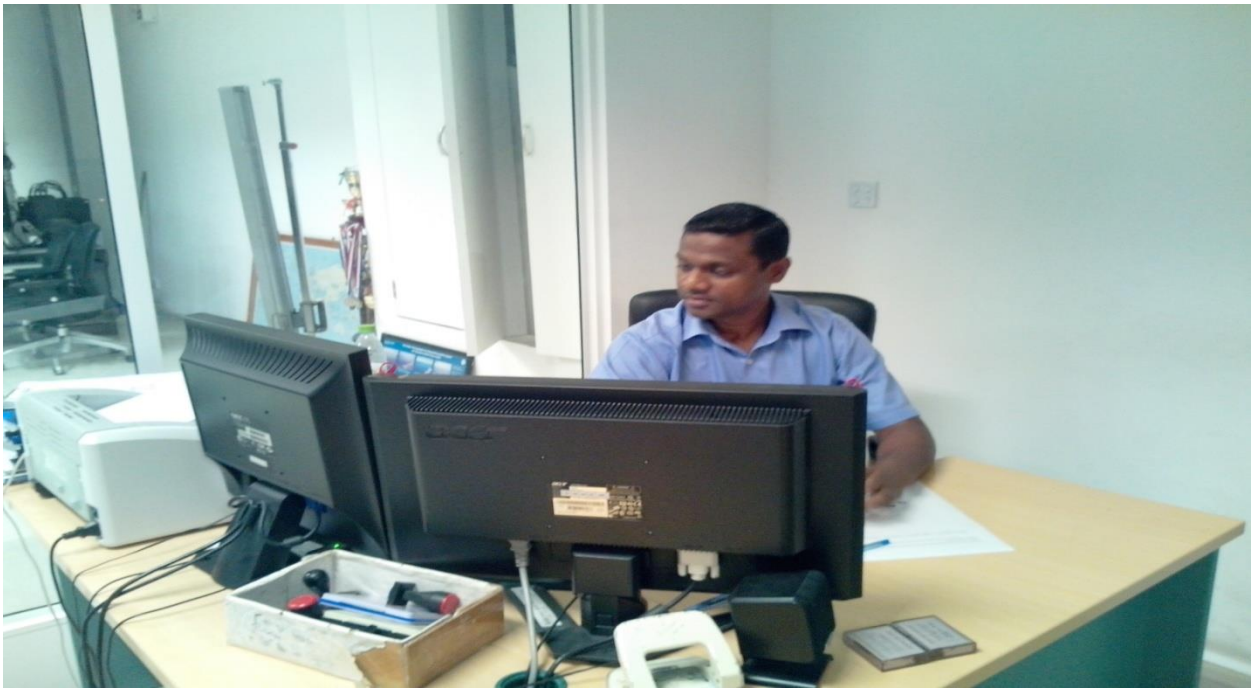
S.NO.	ISLAND	ATOLL	MULTI HAZARD PHYSICAL RISK INDEX
1	BODUFOLHUDHOO	ALIFU ALIFU	1
2	HIMENDHOO	ALIFU ALIFU	1
3	MAALHOSS	ALIFU ALIFU	1
4	MATHIVERI	ALIFU ALIFU	1
5	UKULHAS	ALIFU ALIFU	1
6	MANDHOO	ALIFU DHAALU	1
7	DHONFANU	B A A	1
8	KIHAADHOO	B A A	1
9	KUDARIKILU	B A A	1
10	HULHUDHELI	DHAALU	1
11	MEEDHOO	DHAALU	1
12	RIBUDHOO	DHAALU	1
13	DHARANBOODHOO	FAAFU	1
14	MAGOODHOO	FAAFU	1
15	THINADHOO	GAAFU DHAALU	1
16	FODHDHOO	NOONU	1
17	KANDOODHOO	THAA	1
18	OMADHOO	THAA	1
19	VANDHOO	THAA	1
20	RAKEEDHOO	VAAVU	1

Appendix 14 (page 57-61)

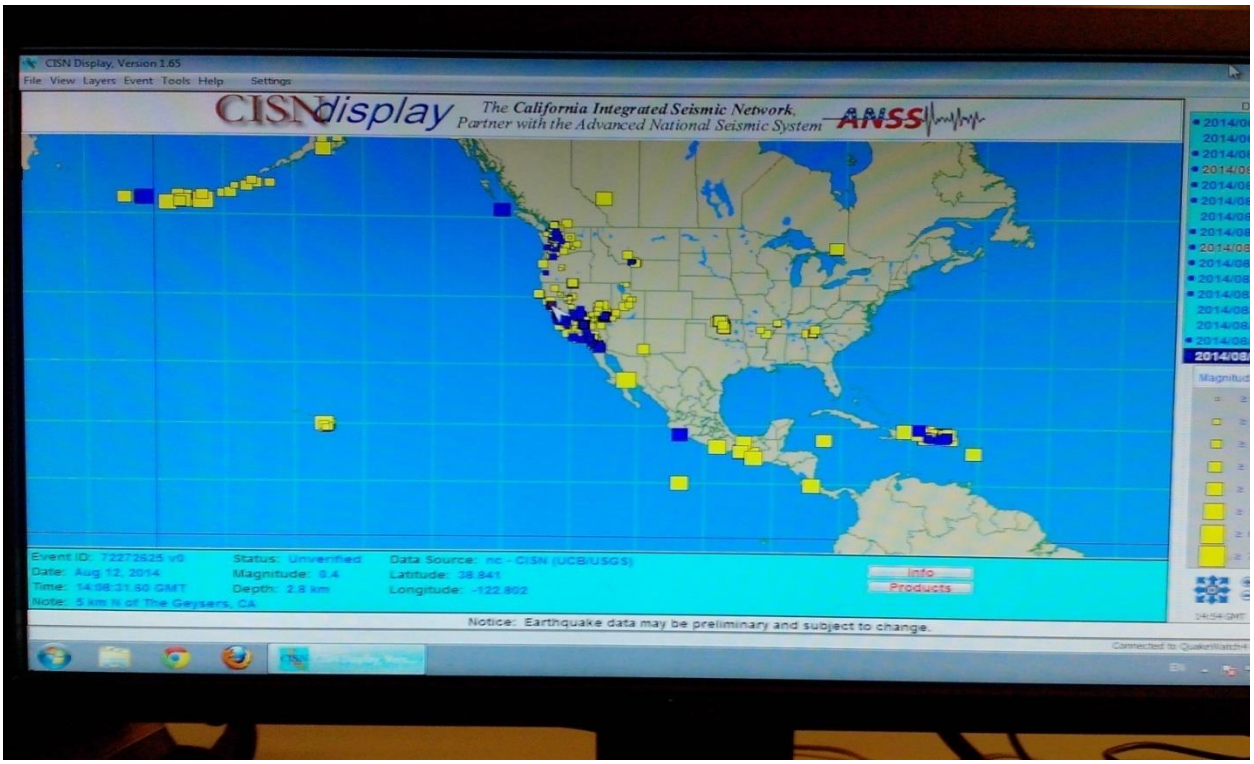
Office of Maldives Meteorological Services

MMS – Weather Radar System

MMS – Flood Forecasting Centre

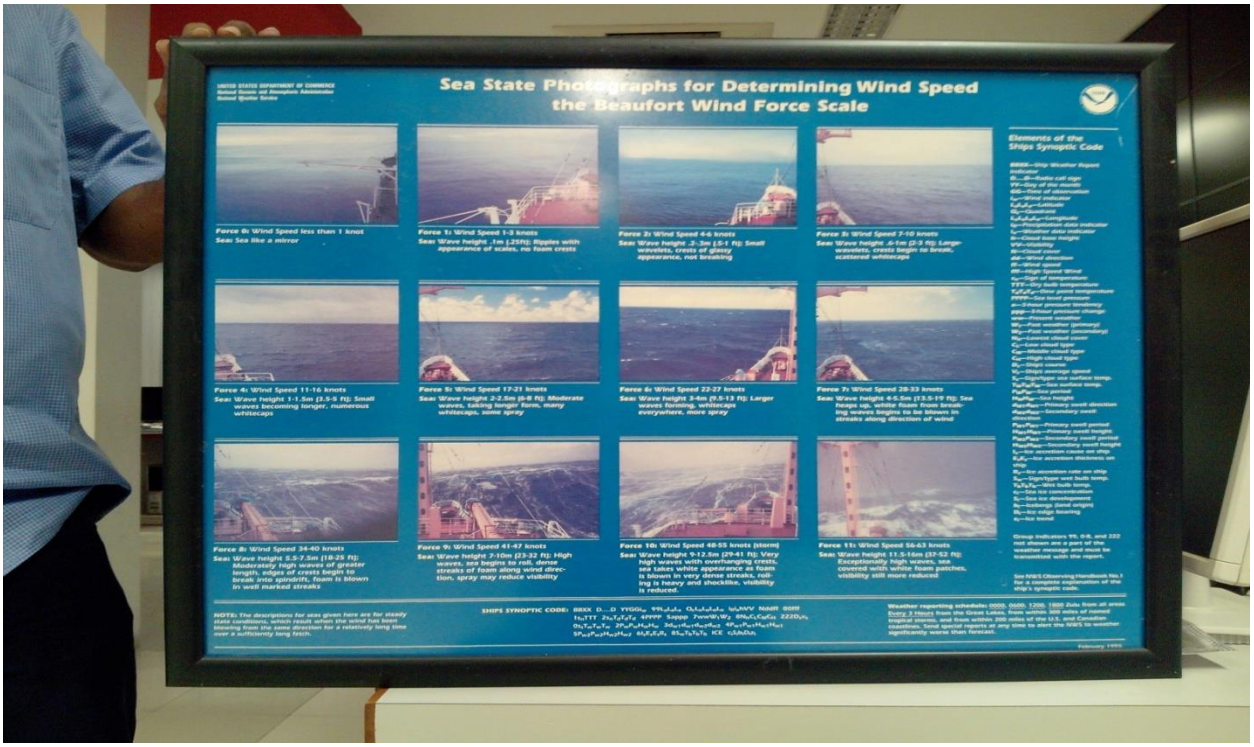


MMS – Computerized Forecasting Desk

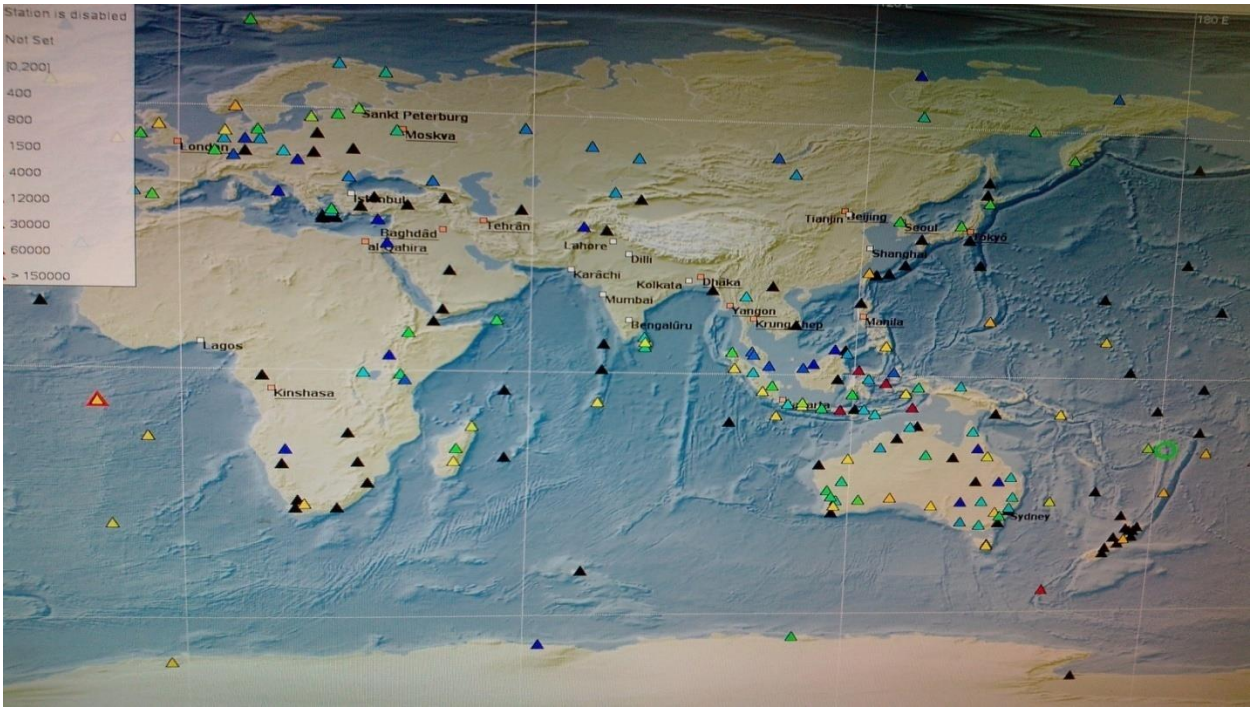


MMS – National Seismic System

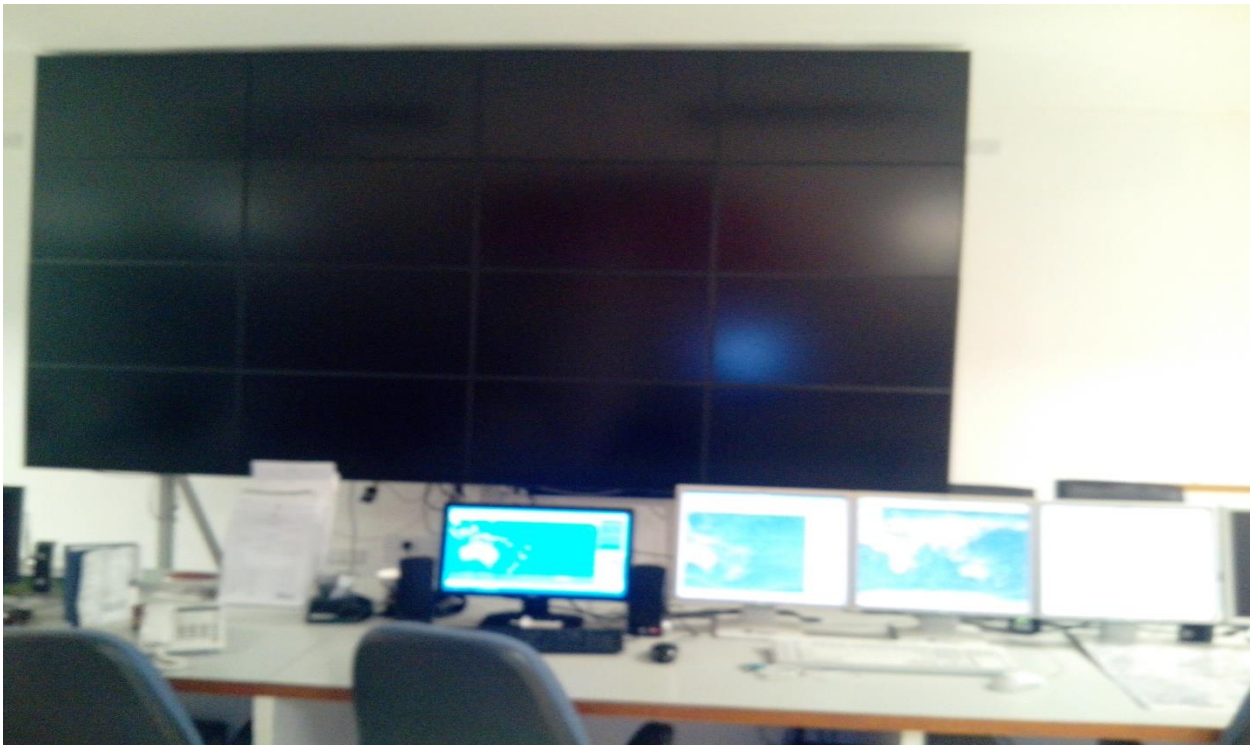
MMS - Multi-Disaster & Aviation System



MMS – Wind Force Scale



MMS – Global Information System



MMS – Imperial Display Panel for Monitoring Sea-Weather Situations

MMS – Multi Weather situation / function Platform