TERMINAL REPORT

PROJECT TITLE
Reducing risks of tsunami, storm surges, large waves and other natural hazards in low elevation coastal zones

ORGANIZATION
Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) and World Meteorological Organization (WMO)

Total project budget
US$ 1,818,274

Funding received to date
US$ 1,481,049

Percentage of total project budget spent
70.9%

Percentage of funding received to date that has been spent
87.0%

Interest earned on funding received from ESCAP
US$ 0

Date of signature of LOA for this project
28 April 2011

Date of project completion
31 December 2015

ANNEXES
1. Monsoon Forum participating institutions
3. Report of EOC training, Cox’s Bazar
4. Report of EOC training, Lat Koke Kone and Pyinsalhu
5. Proposed local warning dissemination system for fishermen at sea, Bangladesh
6. Outcomes of meeting between RIMES, BMD, DDM and CCP, 8 December 2015
7. Composition of national and sub-national/local working groups for project implementation
8. Climate information application experience, Irrigation Department, Sri Lanka
9. Report of training on seasonal forecast model customization for Bangladesh
10. Report of training on short-range weather forecasting using WRF model for Maldives
11. Report of training on seasonal forecast model customization for Maldives
12. Report of training on medium-range weather forecasting for Myanmar
13. Report of training on seasonal forecast model customization for Myanmar
14. Report of training on IT support for forecasting for Myanmar
15. Report of training on seasonal forecast model customization for Sri Lanka
16. Recommendations of the 7th Meeting of the RIMES Council
17. Report of the external evaluation of the project

ATTACHMENTS
Equipment inventory
Financial audit report

This terminal report is accepted.

A. I. Blikberg
Mr. Alf Blikberg, Programme Officer
Trust Fund for Tsunami, Disaster and Climate Preparedness

A.R. Subbiah
Director, RIMES Program Unit
22 April 2016
OVERALL ASSESSMENT

Briefly state the main results of the project. These could include key activities and, more importantly, should include any evidence of capacities the project has built. Is there any evidence that the project has reduced gender inequalities?

- **Expected Outcome 1**: Regular multi-stakeholder national forums gather information and assess disaster risk management and emergency preparedness capacities in participating countries, and assist them in planning at national to local levels to be able to take proactive actions to reduce risks from coastal hazards, through the development of a basic set of standard operating procedures between NMHSs, other stakeholders, and communities at risk.

  **Indicators:**
  - A multi-stakeholder early warning national forum established in each target country
  - At least 6 multi-stakeholder national forums organized, with participation of and recommendations from local institutions and authorities, NGOs, and representatives from select at-risk communities
  - At least twice a year visits made in each select community, and wider user feedback received

  **Accomplishments against indicators:**
  - Multi-stakeholder early warning national forums established in Bangladesh, Maldives, Myanmar, and Sri Lanka; State-level forum in Tamil Nadu, India has already been institutionalized within IMD/RMC; Forum is not established in Thailand – RIMES has engaged with RID instead.

  - Forums supported by the project in the countries are:
    - Bangladesh: 3rd until 7th forum
    - Maldives: 1st until 4th forum
    - Myanmar: 7th until 15th forum
    - Sri Lanka: 4th until 12th forum

    These forums provided recommendations for improving the countries’ early warning systems, as well as monitored the progress of implementing these recommendations. Participation became wider during the years, with representatives from additional user agencies.

  - Local level user dialogues:
    - EWS audits in 2012 were the first opportunity for local level dialogue between the NMHS, NDMO, local authorities, and end users
    - Community level EWS audits were followed by user dialogues, awareness-raising, and receipt of user feedback for an average of 3 visits during the project
Expected Outcome 2: Selected communities at-risk are connected to the warning system, with institutional capacity to receive and disseminate warnings 24/7 through effective communication pathways and to respond to emergencies

**Indicators:**
- At least 12 warning points connected to the early warning system at sub-national and national levels
- At least 100 EOC volunteers trained in emergency operations
- At least 3 communication pathways for receiving and disseminating warnings established at each EOC, and tested

**Accomplishments against indicators:**
- Primary and secondary warning points were identified in all pilot sites in Bangladesh, India, Maldives, Myanmar, and Sri Lanka
- Total of 111 people trained on warning dissemination and response in Bangladesh and Myanmar. Training for Maldives and Sri Lanka shall be taken up by RIMES at a later date, noting that these two countries are RIMES signatory Member States. Training was not required in India, noting its capacity in these areas.

  - Communication pathways established at EOCs in pilot sites:
    - Maldives: Satellite phone, mobile phone, teleconference phone, and email communication systems for receipt of warnings from MMS; megaphones, public address system, hand-operated siren for local dissemination of warnings
    - Myanmar: VHF radio communication for receipt of warnings from DMH; public address systems and handheld megaphones for local warning dissemination
    - Sri Lanka: VHF radio communication and mobile phones for receipt of warnings from DMC; megaphones, public address system, and hand-operated siren for local dissemination of warnings

Planned assistance to Bangladesh was dropped, as DDM is not in a position to sustain the proposed VHF radio communication system for fishermen at sea.

For India, supplementary communication system by email was established at the pilot sites.

Expected Outcome 3: Selected communities at-risk use location-specific warning information products

**Indicators:**
- At least 12 sub-national and local working groups established
- At least 12 local working groups trained in impact, vulnerability, capacity, and user need assessments
- At least 12 demonstration locations, with risk profiles prepared
- Thresholds for various hazard magnitudes and intensities in at least 12 sites identified
- Warning information needs in at least 12 communities identified
- At least 90 disaster managers trained in preparing impact outlooks and response options, based on localized disaster risk information
- At least 12 communities demonstrated improved response to warning/disaster risk information issued by NMHSs
- Warning system gaps identified in at least 12 locations
Accomplishments against indicators:

- 6 local working groups were established at local levels in Bangladesh, Myanmar, and Sri Lanka, and 2 at sub-national levels in India and Maldives.
- 6 working groups were trained in Bangladesh, Maldives, Myanmar, and Sri Lanka on impact, vulnerability, capacity, and user need assessments.
- Risk profiles were prepared for the 9 pilot sites: Bangladesh (2), India (2), Maldives (1), Myanmar (2), Sri Lanka (2).
- Local level hazard thresholds identified for the pilot sites in Bangladesh, India, Maldives, Myanmar, and Sri Lanka.
- Warning information needs identified for 9 pilot sites (Bangladesh, India, Maldives, Myanmar, and Sri Lanka).
- Total of 270 disaster management practitioners trained in preparing impact outlook and management options in Bangladesh, India, Maldives, Myanmar, Sri Lanka, and Thailand. In India, training of agriculture extension specialists and farmers was replicated in Thiruvarur District, with support from the Department of Agriculture, Tamil Nadu.
- Lat Koke Kone Village Tract and Kunyagon Township in Myanmar reported utilization of cyclone warnings during Cyclone Komen, with improved access to DMH forecasts and warnings through the VHF-based communication system established under the project.
- User agencies in the agriculture, water supply and irrigation, energy, health, and disaster management sectors in Bangladesh, India, and Sri Lanka reported improved management of climate risks with the use of seasonal and sub-seasonal forecasts.
- Gaps in risk information availability at the pilot sites were identified and addressed with the development of forecast models for generation of seamless weather and climate forecast products. In India, impact forecasting and decision support systems were developed for management of weather risks in agriculture, animal husbandry, public health, energy, and water management sectors.

Expected Outcome 4: Generation of location-specific warning information products, through the established WMO infrastructure, including the RSMCs, with support from trained government institutions and local disaster management organizations

Indicators:

- Most relevant NWP techniques and products identified and analyzed for further cascading forecasting process (at least from 3 global centers).
- Data and products assessed (at least from 3 centers) as inputs for downscaling, and documented.
- Uncertainties in forecasting products (at least from 3 centers) evaluated and documented for local application.
- Downscaled high-resolution disaster risk information generated (at least from 3 centers) and used by disaster management institutions in assessing potential impacts and possible response options.
- At least 2 NMHS scientists from each target country demonstrate ability to produce tailored location-specific disaster risk information.

Accomplishments against indicators:

- Forecasters from NMHSs of project countries trained on correct interpretation and application of various NWP/EPS, satellite-based, and guidance products.
- Data and product needs of BMD and DMH for generating user-relevant severe weather forecast products have been assessed.
- Downscaled high-resolution location-specific disaster risk information, including daily guidance products, generated by IMD-RSMC.
- Forecasters from NMHSs of India, Maldives, Myanmar, Sri Lanka, and Thailand trained on severe weather forecasting, including provision of public weather services.
- More than 22 professional staffs of NMHSs of Bangladesh, Maldives, Myanmar, and Sri Lanka trained on forecast model customization, model.
output validation, and forecast model calibration to generate seamless forecasts, in response to user demands

- **Expected Outcome 5:** Countries in the Indian Ocean and Southeast Asia, which are not targeted by the project, learning from project experience, lessons and successes, express interest to replicate methods and tools

  **Indicators:**
  - At least 5 new countries participate each year, and share which tool, method, practice, etc. may be replicated
  - 6 country reports shared with ICG/IOTWS
  - At least 10 institutions informed of project progress, experiences, and lessons

  **Accomplishments against indicators:**
  - 6 non-project countries participated in the project meeting in September 2011 and identified approaches for replicating project activities
  - Project successes and experiences shared to 13 non-project countries at the 6th RIMES Council Meeting 29-30 May 2014, and to 14 non-project countries at the 7th RIMES Council Meeting on 9 July 2015
  - Project experiences and lessons shared with 10 institutions in an early warning conference organized by UNDP Georgia in October 2015, and with 2 research/academic institutions in India in a seminar in September 2015
## ACTIVITY WORK PLAN

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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</thead>
<tbody>
<tr>
<td>Project initiation</td>
<td>May 2011</td>
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<td>Project initiation meetings reviewed project goal, objectives, activities, and milestones:</td>
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<td>o At the project team level, the start-up meeting also reviewed the project baseline, developed the 6-monthly rolling work plan, and identified points of synergy with ongoing RIMES activities</td>
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<td>o At project country level, start-up meetings with National Meteorological and Hydrological Services (NMHSs) also developed the country work plan, finalized the terms of references and identified the composition of the national and local working groups, nominated project focal point/s, and confirmed pilot sites for the project, based on the following criteria:</td>
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<td> Location at the coast</td>
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<td> At high risk to coastal hazards, such as cyclone, storm surge, inundation from heavy rain spells, tsunami</td>
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<td> Has at least 30-year climate data</td>
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<td> Local institutions willing to participate actively in the project</td>
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<td>o Meeting with India Meteorological Department (IMD) agreed to conduct designed national level activities at the state level (Tamil Nadu) instead.</td>
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<td>o The project did not take off in Thailand, due to non-responsiveness from the Thai Meteorological Department (TMD). TMD participation in the project became limited to regional level activities</td>
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<td>o At the regional level, the start-up meeting, involving RIMES, the World Meteorological Organization (WMO), NMHSs from the project countries, as well as NMHSs from Cambodia, China, Lao PDR, Pakistan, Philippines, and Vietnam, briefed participants on WMO’s project role, as well as strategies and approaches in implementing Component 4 of the project. The meeting noted that the project shall contribute to WMO’s Severe Weather Forecasting Demonstration Project (SWFDP). The meeting also noted the project’s approach as consistent with WMO’s Public Weather Services (PWS) Programme, in terms of the project’s level of engagement with users of weather products and services. The meeting also took stock of each country’s baseline capacity in generating locally relevant forecast products.</td>
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<td>Activity</td>
<td>Time Frame</td>
<td>Trust Fund Contribution</td>
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<td><strong>1. Strengthening institutional systems for early warning</strong></td>
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<td>1.1 Establish multi-stakeholder early warning national forums</td>
<td>May 2011 – Jan 2012</td>
<td><strong>Technical inputs:</strong> Forecast Application Scientist (1mo): US$ 4,000 Project Coordinator (1mo): US$ 2,000</td>
<td><strong>Technical inputs:</strong> Forecast Application Scientist: US$ 4,308 Project Coordinator: US$ 2,151</td>
<td>The Monsoon Forum is a dialogue platform for generators and users of early warning information. Centered around the seasonality of the monsoon, allowing for twice-a-year meetings, Monsoon Forums evaluate the performance of the climate outlook issued for the previous season, including user responses before and during the monsoon; issue the climate outlook for the incoming season; facilitate forecast interpretation and translation by user agencies into impact outlooks and response options; review recommendations of past forums and progress in implementing these recommendations; and identify further gaps and recommendations to fill/address these gaps. The Forums are multi-hazard, and includes earthquake, tsunami, landslides, and other natural hazards that are relevant to users, in addition to weather- and climate-related hazards. At the start of the project, Monsoon Forums have already been established in Bangladesh, India, Myanmar, and Sri Lanka. The project assisted in institutionalizing these Forums within respective NMHS that convenes the Forum. In Maldives, the project assisted in establishing the Forum. Unlike Forums in other project countries, which are held at the capital city, Forums in Maldives were “roving”, conducted in key atolls and in Male to reach out to as many users as possible, considering the country’s geographical spread. In Thailand, the Monsoon Forum was not established due to limited project engagement by TMD.</td>
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<td><strong>Total for the Activity:</strong> US$ 18,000</td>
<td><strong>Total for the Activity:</strong> US$ 16,948</td>
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<td><strong>Bangladesh:</strong> Monsoon Forum in Bangladesh was established in 2010, with Bangladesh Meteorological Department (BMD) as convener. Forum participants come from the agriculture, fisheries, livestock, forestry, water, environment, infrastructure, power, aviation, land and water transport, health, disaster management, and tourism sectors, including the media, mass-based organizations, and UN and international organizations.</td>
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<td><strong>India:</strong> IMD has established regular meetings with forecast users for communication of forecast and warning information products.</td>
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<td><strong>Maldives:</strong> Monsoon Forum in Maldives was established under the project in July 2012, convened by Maldives Meteorological Service (MMS). Forum participants come from the agriculture, environment, education, health, tourism, and disaster management sectors, including police and national</td>
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<td>Activity</td>
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<td>1.2</td>
<td>May 2011 - Dec 2015</td>
<td>Technical inputs: Forecast Application Scientist (3mos): US$ 12,000</td>
<td>RIMES travel: Airfare: US$ 28,402 Visa, local travel: US$ 7,672 DSA: US$ 35,686 Meeting costs: Participants travel: US$ 11,995 Participants local costs: US$ 18,947 Meeting package, consumables, etc: US$ 60,873 Total for the Activity:</td>
<td>defense, local authorities, the media, and mass-based organizations. The 1st Monsoon Forum is the first opportunity for MMS to issue seasonal forecast directly to user agencies. Myanmar: Monsoon Forum in Myanmar was established in 2007, with the Department of Meteorology and Hydrology (DMH) as convener. Participants come from the agriculture, fisheries, livestock, forestry, water, environment, health, and disaster management sectors, including local authorities, the media, and mass-based and UN organizations. Sri Lanka: Monsoon Forum in Sri Lanka was established in 2009, with the Department of Meteorology (DOM) as convener, and participated by other technical agencies that monitor and generate forecast and warning information for landslides, flood, and drought. Participating user agencies are from the agriculture, fisheries, water, environment, power, health, tourism, and housing sectors, including local authorities and the media. Annex 1 provides the list of institutions in each country that are represented in the Monsoon Forum. Bangladesh: Total of 5 forums were organized from 2011-2015, timed before the onset of the southwest (summer) monsoon. Below are key user demands and recommendations received, and the status of their implementation.</td>
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<td>User demands/ recommendations</td>
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<td>MF-3, Jun 2011</td>
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<td>- Modernization/densification of observing and monitoring networks</td>
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<td>- Capacity building of BMD personnel</td>
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<td>- Use of graphics and simple language in forecasts, with detailed description</td>
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<td>- Use of electronic and social media for dissemination</td>
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<td>- Receive and evaluate user feedback</td>
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<td>MF-4, Jun 2012</td>
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<td>- More frequent water level observations during heavy rain spells</td>
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<td>- Regular forecast updates, especially during the peak monsoon</td>
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<td>- Zone-wise forecasts of rainfall intensity and duration</td>
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<td>- Forecast information to include threshold values</td>
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<td>- Weather channel on TV, to air during the monsoon</td>
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<td>- National level training on forecast interpretation and translation undertaken under the project in Sep 2013, involving 34 participants from 16 government and non-government institutions</td>
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<td>Activity</td>
<td>Time Frame</td>
<td>Trust Fund Contribution</td>
<td>Trust Fund Contribution Spent</td>
<td>Description of results</td>
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</table>
|          |            | 64,000                   | US$ 175,586                   | o Training on forecast interpretation and translation  
|          |            |                          |                               | o BMD and Flood forecasting and Warning Centre (FFWC) to recommend required depth, width, and velocity of peripheral rivers  
|          |            |                          |                               | o Earmark retention reservoirs, flood plains, and flood flow areas to keep them non-structured  
|          |            |                          |                               | o Monitor implementation of Forum recommendations:  
|          |            |                          |                               | - Reporting during the Forum  
|          |            |                          |                               | - Regular EWS performance evaluation  
|          |            |                          |                               | - Wider dissemination of successes and lessons  
| MF-5, Jun 2013 |          |                          |                               | o 1 rainfall observing station every 30 sqkm for optimum rainfall monitoring  
|          |            |                          |                               | o Rainfall thresholds for landslides  
|          |            |                          |                               | o Investment in BMD and FFWC for generating products and providing services that meet user needs  
|          |            |                          |                               | o Include analysis of forecast accuracy in the review of previous season performance  
|          |            |                          |                               | o Divisional Weather Service Centers for forecast translation and dissemination, and support application  
|          |            |                          |                               | o Research on climate and health for warning of potential disease outbreak  
|          |            |                          |                               | o Investment in shelters in cyclone-prone areas  
|          |            |                          |                               | o Use of historical climate, current climate trends, and climate projections in risk analysis during project design  
|          |            |                          |                               | o Twice-a-year forum: in February/March before the first cyclone season, and in May prior to the southwest monsoon  
| MF-6, May 2014 |          |                          |                               | o Use of long-term station-wise historical rainfall data to guide preparedness planning  
|          |            |                          |                               | o Updating of normal rainfall values  
|          |            |                          |                               | o Development of climate, storm inundation, and flood forecast models for location-specific forecasting  
|          |            |                          |                               | o Media training  
|          |            |                          |                               | o Synchronization of BMD warning signal system with Standing Order for Disasters system  
|          |            |                          |                               | o Formulation of new projects to address gaps in user systems  
| MF-7, May 2015 |          |                          |                               | o Forecast and warning information:  
|          |            |                          |                               | - Inclusion of potential dry spells in climate outlook  
|          |            |                          |                               | - Trend in thunderstorm events in past 10 years or more  

Total for the Activity: US$ 189,000
### Activity

<table>
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<tr>
<th>Time Frame</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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<tbody>
<tr>
<td></td>
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<td>- Trend in seasonal rainfall in different locations, using long-term data</td>
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<td>- Validated forecasts at different time scales</td>
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<td>- Correlation of sea surface temperature and fish migration</td>
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<td>o Dissemination:</td>
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<td>- More user-friendly BMD website</td>
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<td></td>
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<td>- Mobile application</td>
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<td></td>
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<td>- Toll-free voice messages</td>
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<td></td>
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<td>- SMS for nor’wester warning to local river port authorities</td>
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<td>- Interactive system to respond to queries</td>
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<td>- Fishermen cooperatives</td>
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<td>o Improved data sharing between BMD, FFWC, Bangladesh Inland Water Transport Authority (BIWTA), Bangladesh Agricultural Development Corporation (BADC), and Cyclone Preparedness Programme (CPP)</td>
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</tbody>
</table>

### Maldives

Four (4) forums were organized in Maldives from 2012 to 2015 – the 1st Forum in Fuvahmulah, 2nd in Male, 3rd in Gan, and the 4th in Male (held back-to-back with WMO-organized meeting to establish a National Climate Outlook Forum (NCOF). Below are key user demands and recommendations received, and the status of their implementation.

<table>
<thead>
<tr>
<th>User demands/recommendations</th>
<th>Status of implementation</th>
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<tbody>
<tr>
<td>MF-1, Jul 2012</td>
<td>o Localized marine forecasts</td>
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<td>o Monitoring of wave heights and direction</td>
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<td>o Verification of seasonal forecasts at island level to increase user confidence in the forecast</td>
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<td>o Conduct of drills before and after monsoon season</td>
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<td>o Sector-based early warning SOP</td>
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<td></td>
<td>o Public awareness on EW SOP and on flood risks</td>
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<td></td>
<td>o Identification of flood-prone areas</td>
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<td></td>
<td>o Wider participation in Monsoon Forum</td>
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<td></td>
<td>o Localized marine and ocean state forecasts now available through RIMES-INCOIS support</td>
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<tr>
<td>MF-2, Apr 2014</td>
<td>o Simpler terminologies</td>
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<td>o Alarm system for severe/ high-impact events</td>
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<td>o Media training on forecast communication</td>
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<td>o Public awareness to aid understanding of risks, forecasts, and forecast application to reduce risks</td>
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<td></td>
<td>o Mobilization of local resources to supplement government resources for addressing gaps and needs</td>
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<td>Activity</td>
<td>Frame</td>
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<tr>
<td>CoS-MF, Oct 2014</td>
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<td>Enhanced MMS users relations to build trust</td>
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<tr>
<td>o Toolkit introduction for users</td>
<td>MF-3</td>
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<tr>
<td>o Enhanced MMS - users relations to build trust</td>
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<tr>
<td>o Awareness program for schools</td>
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<tr>
<td>o Improved reliability of marine weather and tidal forecasts</td>
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<tr>
<td>o Forecasts customized for different users (e.g. fisheries, tourism sectors)</td>
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<td>o Forecasts of weather, climate, and geophysical risks for fishing communities</td>
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<tr>
<td>o Development of forecast and warning plan</td>
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<tr>
<td>o Participation of fisheries and insurance sectors in potential impacts and impact management strategies</td>
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<tr>
<td>Dissemination</td>
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<tr>
<td>o Use of SMS, mobile applications, and social media for warning dissemination</td>
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<tr>
<td>o Display boards in public and tourist areas</td>
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<tr>
<td>o Training for Maldives Coast Guard/MNDF on marine forecast application</td>
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<tr>
<td>o Media on forecast communication</td>
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<tr>
<td>o Special weather programs on radio and TV</td>
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<tr>
<td>o Integration of weather, climate, and geophysical risks into building codes</td>
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<tr>
<td>o Participation of fisheries and insurance sectors in potential impacts and impact management strategies</td>
<td></td>
</tr>
<tr>
<td>o Participation of fisheries and insurance sectors in potential impacts and impact management strategies</td>
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<tr>
<td>Myanmar: Total of 9 forums were organized from 2011 to 2015, timed before and after the southwest monsoon. Below are key user demands and recommendations received, and the status of their implementation. The last forum under the project obtained commitments from high-level decision-makers to sustain Forum-catalyzed processes for preparedness in the agriculture, health, disaster management, and local governance sectors. This involves identification of agency focal points for forecast translation to potential impacts and management options, forecast-based identification of impact management strategies, interaction with end users to communicate potential impacts and management strategies, and supporting end users to design and implement potential impacts and management strategies.</td>
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<td>Activity</td>
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<table>
<thead>
<tr>
<th>User demands/recommendations</th>
<th>Status of implementation</th>
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</table>
| MF-7, Nov 2011 | o Improved spatial and temporal resolutions in forecast  
|                  | o Sector-specific forecast-based decision support systems  
|                  | o Improved warning communication (e.g. use of color coded scheme)  
|                  | o Use of agriculture extension system and fishermen groups for warning dissemination  
|                  | o Training on forecast interpretation and translation  
|                  | o Awareness raising to improve responses to warnings  
|                  | o Mechanism for receiving user feedback  
|                  | o Training on forecast interpretation and translation undertaken in Aug 2012 and Sep 2013 under the project  |
| MF-8, May 2012 | o Simpler forecast products/advisories  
|                  | o Alarm system for fishermen  
|                  | o Core group for developing impact outlook  
|                  | o Use village libraries to disseminate awareness materials  
|                  | o Integration of climate information into farmers’ training center  
|                  | o DMH partnerships with NGOs/local organizations on public education and awareness  
|                  | o DMH convened the core group to analyze winter season forecast and potential impacts  |
| MF-9, Oct 2012 | o Information products:  
|                  | o Region-specific climate change projections  
|                  | o Active seismic faults  
|                  | o DMH capacity building on agro-meteorology  
|                  | o Development of region-wise climate change projections ongoing under TTF-24  |
| MF-10, May 2013 | o Initiation of farmers’ school  
|                  | o Dedicated forecast communication channel for farmers  
|                  | o Mechanism to help farmers to respond to forecast-based advisories  
|                  | o Farmer participation in Monsoon Forums  
|                  | o Forum sessions on geological hazards  
|                  | o Under TTF-23, FARM School initiated in Nov 2013 with curriculum adaptation workshop; farmers’ training was undertaken from Mar-Jun 2015 in Nyaung Oo and Monywa  
|                  | o DMH-Ministry of Agriculture and Irrigation (MOAI)-Myanmar Television (MRTV) agreed to collaborate on developing programs for the Farmers Channel  
<p>|                  | o MF-11 included a learning  |</p>
<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>MF-11, Nov 2013 session on earthquakes in Myanmar, including lessons learned from the magnitude 6.8 event on 24 March 2011</td>
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<td></td>
<td></td>
<td></td>
<td>o Weekly agromet forecasts</td>
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<td></td>
<td>o Mobile application and social media for forecast and warning dissemination</td>
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<td>o Better forecast communication by the media</td>
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<td>o Awareness programs on thunderstorms and earthquakes</td>
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<td></td>
<td>o DMH-Water Resources Utilization Department (WRUD) collaboration on water utilization research</td>
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<td></td>
<td>o Agro-advisory expert system developed under TTF-23, providing 3- and 10-day agromet forecasts/ bulletins</td>
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<tr>
<td></td>
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<td></td>
<td>o Forecasts available through Facebook</td>
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<td></td>
<td>MF-12, May 2014 Use SSB communication system and call centers for warning dissemination</td>
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<td></td>
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<td></td>
<td>o Sustained awareness and vigilance during the monsoon</td>
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<td>o Sensitize planning departments of local governments</td>
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<td>MF-13, Nov 2014 Analysis of extreme events</td>
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<tr>
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<td></td>
<td>o User institutions to disseminate information and learning from Monsoon Forums</td>
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<td></td>
<td>o Multi-hazard risk assessments to guide building of shelters</td>
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<td></td>
<td>o Make ShakeCast available to users</td>
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<td></td>
<td>o Expand tsunami risk assessment and evacuation planning using INSPIRE and ESCAPE tools to other high risk areas</td>
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<td>o Participation of high-level decision-makers and Agricultural Bank in the Monsoon Forum</td>
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<td>o Updated ShakeCast transferred to DMH under TTF-23</td>
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<td></td>
<td>o Half-day session, involving high-level decision-makers, included in 15th Monsoon Forum</td>
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<td>MF-14, May 2015 Improved sea and water level monitoring networks</td>
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<td>o Data sharing mechanism between DMH and stakeholders</td>
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<td></td>
<td>o Region-wise climatology of rainy days</td>
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<td></td>
<td></td>
<td>o Flood model outputs</td>
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<td></td>
<td></td>
<td></td>
<td>o Capacity building:</td>
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<td></td>
<td></td>
<td></td>
<td>o Application of forecasts at different timescales, water management –DOA and Dry Zone farmers</td>
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<td></td>
<td></td>
<td></td>
<td>o FARM School expansion</td>
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<td></td>
<td></td>
<td></td>
<td>o Awareness raising:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>o Lightning and storm warnings</td>
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<tr>
<td>Activity</td>
<td>Time Frame</td>
<td>Trust Fund Contribution</td>
<td>Trust Fund Contribution Spent</td>
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<tr>
<td>Video clips/ short movies on seasonal preparedness</td>
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<td>MF-15, Oct 2015</td>
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<tr>
<td>o Densification of observation network</td>
<td></td>
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<tr>
<td>o Forecasts and warnings:</td>
<td></td>
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<tr>
<td>‒ Presentation of forecasts in graphical form and in local language, and with accompanying explanation on terminologies and concepts used</td>
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<td>‒ Water bulletin for the dry zone</td>
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<td>‒ Flood alarm system for mobile phones</td>
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<td>‒ Agromet and earthquake bulletins on Facebook</td>
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<tr>
<td>‒ Warnings through SMS (in cooperation with telecom companies) and radio</td>
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<tr>
<td>‒ Increased frequency of forecast dissemination via the farmers’ channel</td>
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<tr>
<td>o Institutional collaboration for expanding the agro-advisory system developed under TTF-23</td>
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<tr>
<td>o Capacity building of users:</td>
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<tr>
<td>‒ Training on water management for Department of Agriculture (DOA) extension specialists, in collaboration with DMH</td>
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<tr>
<td>‒ Research for and development of drought-/flood-tolerant crop varieties</td>
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<tr>
<td>‒ Disaster management (DM) training for and strengthening of disaster response capacity of Ministry of Health (MOH)</td>
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<tr>
<td>‒ Establishing a DM Department within MOH</td>
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<tr>
<td>‒ Flood modeling training for Department of Irrigation (DOI) staff</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>o Resilience:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‒ Development of climate-friendly agriculture</td>
<td></td>
<td></td>
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<tr>
<td>‒ Use of historical climate data and climate change projections in MOAI’s long-term planning</td>
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</tbody>
</table>

**Sri Lanka:** Total of 9 forums were organized from 2011 to 2015, timed before and after the southwest monsoon. Below are key user demands and recommendations received, and the status of their implementation.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
</tr>
</thead>
</table>
| MF-4, Nov 2011 | | | | - Improved spatial resolution of forecasts  
- Wind outlook, for use in assessing soil erosion  
- Use dissemination systems of organizations/  
institutions, including broadcast media, for warning  
dissemination  
- Make forecast products available at websites of  
DOM and Department of Irrigation (DOI)  
- Capacity building on forecast interpretation and  
translation into potential impacts  
- Integration of forecast application in institutional  
programs and extension/ outreach activities  
- Awareness raising on forecasts and warnings,  
including integration into school curriculum  
- Training on forecast interpretation and translation  
undertaken under the project in Jul 2012 and Oct 2013 |
| MF-5, May 2012 | | | | - Monthly updates to the seasonal outlook  
- Posting of seasonal outlook in DOM website  
- Monthly updates to the seasonal outlook  
now available  
- Seasonal outlook available from DOM website |
| MF-6, Nov 2012 | | | | - Forecast that integrates agro-climatic zones  
- Seasonal outlook that includes season onset, mid-  
season dry spell, mid-season above normal rainfall,  
season withdrawal, above normal ambient  
temperature, in addition to rainfall  
- Forecast-based agrimet advisory service, in  
collaboration with DOA  
- Awareness raising with rubber farmers |
| MF-7, Apr 2013 | | | | - Issue of monthly forecast and mid-season updates by  
SMS  
- Forecast update to include observed rainfall during  
the past month  
- Mechanism for forecast-informed water management  
- DOM-Rubber Research Institute of Sri Lanka  
(RRISL) awareness program for estate managers |
| MF-8, Dec 2013 | | | | - 10-day forecasts to complement monthly and  
seasonal forecasts  
- Immediate dissemination of short-term forecasts  
- User notification in case forecast updates could not  
be provided  
- Preferred schedule for post-season/ northeast  
monsoon forum is October  
- 10-day forecasts now available, with support from  
the project |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>MF-9, May 2014</td>
<td></td>
<td></td>
<td>o Disseminate forecasts by email to stakeholders through line departments of relevant ministries o User notification when forecasts become available</td>
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<tr>
<td>MF-10, Oct 2014</td>
<td></td>
<td></td>
<td>o Mechanism for changing user perceptions and conventional practices o Special forum for politicians and the media</td>
</tr>
<tr>
<td>MF-11, Apr 2015</td>
<td></td>
<td></td>
<td>o Hazard return periods o Rainfall range in seasonal forecasts o Potential heavy rainfall in landslide-prone areas, with at least 1 hour lead time o Monsoon Forum’s advisory role in the National Council, for seasonal and long-term preparedness</td>
</tr>
<tr>
<td>MF-12, Nov 2015</td>
<td></td>
<td></td>
<td>o Monthly forecast and seasonal outlook customized for catchment areas, for application in hydro-power generation o DOM participation in RRISL’s monthly scientific discussions to provide inputs for better seasonal and sub-seasonal planning</td>
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</tbody>
</table>

The Monsoon Forum process has reached maturity in Sri Lanka over the past 6 years, with substantive application experiences in the agriculture, water, and energy sectors (experiences in forecast application are reported under Component 3 – Activity 3.7). Participating institutions and DOM relations is very robust, with DOM earnest in meeting user demands for products and services. Annex 2 provides the report of the 12th Monsoon Forum in Sri Lanka.

In Myanmar, the Forum is on its 9th year. However, level of maturity, in terms of forecast application, is lower than in Sri Lanka. ESCAP support through TTF-23 and this project has greatly contributed to building DMH capacity to respond to user demands.

Forums in Bangladesh and Maldives have built NMHS-user relations. A few more years would be required to build user confidence in using weather/climate/marine/ocean state forecasts in planning and decision-making.
<table>
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<tr>
<th>Activity</th>
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<th>Trust Fund Contribution Spent</th>
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</thead>
<tbody>
<tr>
<td>1.3 User dialogue and system evaluation at community level</td>
<td>May 2011 – Dec 2015</td>
<td>Technical inputs: Forecast Application Scientist (2mo): US$ 8,000</td>
<td>Technical inputs: Forecast Application Scientist: US$ 6,793</td>
<td>Early warning system (EWS) evaluation tools were prepared:</td>
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<tr>
<td></td>
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<td>Meeting costs: NTWC/NMHS travel: US$ 18,000 NTWC local costs: US$ 10,800 Meeting package, consumables, etc.: US$ 24,000</td>
<td>Meeting costs: NTWC/NMHS travel: US$ 3,422 NTWC local costs: US$ 3,255 Meeting package, consumables, etc.: US$ 5,724</td>
<td>b) Community level EWS audit tool</td>
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<td><strong>Total for the Activity:</strong> US$ 121,550</td>
<td><strong>Total for the Activity:</strong> US$ 35,511</td>
<td>First visits to the pilot sites allowed interaction between the NMHS, the National Disaster Management Organization (NDMO), local authorities, and community representatives, which also constituted the audit team. The audits determined each site’s:</td>
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<td>o Exposure and vulnerability to natural hazards</td>
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<td>o Warning focal points and communication channels for receiving forecasts and warnings, and for onward dissemination</td>
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<td>o Mechanism for hazard monitoring</td>
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<td>o Mechanism for customizing warnings/ advisories, integrating risk knowledge, forecasts/ warning received, and observations from local monitoring of hazard</td>
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<td>o Preparedness for managing risks and emergencies</td>
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<td>o Feedback arrangements</td>
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<td>Audit results were evaluated to ascertain gaps, which were then taken up with local authorities for action.</td>
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<td>Subsequent visits focused on dialogue with users, awareness-raising, and receipt of feedback. The table below summarizes the visits made to the pilot sites.</td>
</tr>
<tr>
<td>Total for Component 1:</td>
<td>US$ 328,550</td>
<td><strong>US$ 228,045</strong></td>
<td><strong>US$ 328,550</strong></td>
<td><strong>US$ 228,045</strong></td>
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<tr>
<th>Activity</th>
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<td>Activity</td>
<td>Time Frame</td>
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<tr>
<td>2. Connecting pilot communities to national early warning system for 24/7 readiness</td>
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<tr>
<td>2.1 Establish 24-hour warning points in selected communities</td>
<td>May 2011 -Jan 2012</td>
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<tr>
<td>2.2 Establish, train and practice Emergency Operations Centers (EOCs)</td>
<td>Dec 2011 -Dec 2015</td>
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<td>Activity</td>
<td>Time Frame</td>
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</table>
| Curriculum adaptation, training: US$ 10,000 Meeting package, consumable, materials: US$ 39,000 | | Total for the Activity: US$ 187,080 | Total for the Activity: US$ 33,094 | (total 34 participants). The training:  
- Familiarized participants on DRM and forecast terminologies, and BMD and FFWC products and services  
- Reviewed the hazards in the pilot site  
- Facilitated hazard and risk analysis  
- Reviewed agency roles and responsibilities for emergency management, as laid out in the Standing Orders on Disaster  
- Refreshed participants on the early warning system for coastal hazards  
- Facilitated simulations on warning/forecast receipt and EOC actions  
- Synthesized learning and lessons |
<p>| | | | | Annex 3 provides the training report. |
| India: Pilot sites are well connected to the state level disaster management system, and have well trained emergency response personnel. Hence, this activity was not implemented in Tamil Nadu. |
| Maldives: EOC was established at the Fuvahmulah Atoll Council, as agreed by the National Disaster Management Center (NDMC), MMS, MNDF, Maldives Police, and the Atoll Council. Space, office furniture and equipment, and utilities were contributed by the Atoll Council. Equipment for receiving and disseminating warning were acquired through the project, under Activity 2.3. |
| An Island Emergency Plan was drafted through a write-shop from 14-15 April 2015, led by NDMC and the Atoll Council, and participated by Island Councils, MNDF, Maldives Police, Maldivian Red Crescent, Maldives Rural Development Corporation, Fuvahmulah Basic Services, and representatives of various schools, with technical inputs from RIMES and MMS. The Plan details the structure for, roles and responsibilities of various stakeholders on, and the SOP for early warning, preparedness planning, and emergency response. |
| EOC training was not undertaken under the project, but shall be taken up by RIMES at a later date. |</p>
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<tr>
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<th>Trust Fund Contribution</th>
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<tr>
<td><strong>Myanmar:</strong></td>
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<td>EOCs were established at Kunyangon Township and Pyinsalu Sub-Township government buildings, manned by respective Natural Disaster Prevention Committees (NDPCs), as agreed with the Relief and Resettlement Department (RRD). Space, office furniture and equipment, and utilities were provided by Kunyangon Township and Pyinsalu Sub-Township Administration Departments. Equipment for receipt and dissemination of warnings were acquired through the project, under Activity 2.3. EOC training was undertaken in Lat Koke Kone (Kunyangon) from 27-29 January 2016, with 34 participants; and in Pyinsalu (Labutta) from 3-5 February 2016, with 43 participants. The training, facilitated by RIMES and DMH, in collaboration with GAD and RRD:</td>
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</table>
| | | | | o Refreshed participants on the concept of early warning, in the context of Myanmar’s early warning system  
  o Reviewed hazards at the pilot sites and forecast and warning products and services from DMH  
  o Introduced the concept of seamless forecasts and their application in preparedness planning and emergency management  
  o Facilitated a drill on forecast and warning receipt and EOC actions  
  o Identified ways to sustain preparedness and response capacities  
| | | | | Annex 4 provides the training report.  
| | | | | **Sri Lanka:** EOCs were established within Village Disaster Management Committees in Kalutara and Pottuvil, in collaboration with DMC. Equipment for receipt and dissemination of warnings were acquired through the project, under Activity 2.3. EOC training was not undertaken under the project, but shall be taken up by RIMES at a later date.  
| | | | | In collaboration with NMHSs, disaster management agencies, and local authorities in the pilot sites, and based on gaps in existing communication system for receipt and further dissemination of warnings, equipment for ensuring redundancy in warning communication were selected. Criteria used are: low capital cost, low maintenance cost, ease of operation, and ability to |
| 2.3 | Ensure effective warning communication pathways for selected | Jun 2011 – Dec 2015 | Technical inputs:  
  Forecast Application Scientist (0.5mo): US$ 2,000  
  Project Coordinator (1mo): Technical inputs:  
  Forecast Application Scientist: US$ 2,200  
  Project Coordinator: US$ 2,200 |
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<th>Trust Fund Contribution Spent</th>
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<tr>
<td>communities</td>
<td></td>
<td>US$ 2,000</td>
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<tr>
<td>RIMES Travel:</td>
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<tr>
<td>Visa, local travel: US$ 3,000</td>
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<td>Visa, local travel: US$ 1,282</td>
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<tr>
<td>DSA: US$ 10,500</td>
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<td>DSA: US$ 3,714</td>
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<tr>
<td>Meeting costs:</td>
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<td>Meeting costs:</td>
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<tr>
<td>NTWC/NMHS travel: US$ 4,800</td>
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<td>NTWC local costs: US$ 3,133</td>
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<tr>
<td>NTWC local costs: US$ 2,880</td>
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<td></td>
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<td>NTWC local costs: US$ 3,001</td>
</tr>
<tr>
<td>Low-cost communication system: US$ 90,000</td>
<td></td>
<td></td>
<td></td>
<td>Low-cost communication system: US$ 68,361</td>
</tr>
<tr>
<td>Total for Activity:</td>
<td></td>
<td>US$ 118,430</td>
<td></td>
<td>Total for the Activity: US$ 87,282</td>
</tr>
</tbody>
</table>

Total for Component 2: US$ 311,510 US$ 126,976

withstand extreme weather conditions.

**Bangladesh:** In consultation with BMD, it was decided to pursue a VHF system to reach fishermen at sea (Annex 5 shows the system design), and to anchor this system with DDM (Annex 6). Subsequent discussions with DDM revealed that DDM is not in a position to sustain the system, in terms of hosting it and taking on the recurrent cost. With this in mind, RIMES decided to drop this initiative.

**India:** One (1) laptop computer (refer to attached equipment inventory for details) was provided to the climate data center in each of 5 villages in Nagapattinam that is covered by the farmers’ field school for climate risk management, for receiving forecasts and advisories by email.

**Maldives:** Modern equipment (refer to attached equipment inventory for details) for receipt and processing of forecasts and warnings, and for subsequent local dissemination were provided to Fuvahmulah EOC. Similar set of equipment was provided to NDMC. The set of equipment supports forecast and warning communication by satellite phone, SMS, email, public address system, megaphones, and sirens.

**Myanmar:** Communication systems established are VHF system, public address system, and megaphones. Attached equipment inventory lists the equipment supplied to the sites.

**Sri Lanka:** Communication systems supported by the project are VHF system, SMS, public address system, megaphones, and sirens (refer to attached equipment inventory for details).
<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Description of results</th>
</tr>
</thead>
</table>
| 3.1   | Constitute sub-national and local working groups | May 2011 - Jan 2012 | Technical inputs: Forecast Application Scientist (1mos): US$ 4,000  
Project Coordinator (1mo): US$ 2,000  
RIMES Travel:  
Airfare: US$ 2,400  
Visa, local travel: US$ 1,000  
DSA: US$ 5,600  
Meeting costs:  
NTWC/NMHS travel: US$ 160  
NTWC local costs: US$ 320  
Meeting package, consumables, etc: US$ 4,800  
**Total for the Activity:** US$ 20,280 | **Annex 7** summarizes the working groups established in each country, for providing inputs and guidance to:  
National working group:  
o Finalization of project work plan  
o Selection of pilot sites  
o Institutionalization of Monsoon Forum  
o User training  
o Criteria setting for EWS audit  
o Recommendations for EWS improvement  
o Integration of forecasts and warnings in planning and decision-making  
o Replication in other high risk areas and sectors  
Sub-national/ local working group:  
o User dialogues  
o EWS audit  
o Addressing EWS gaps  
o Identification of 24-hour warning focal point  
o EOC establishment and training  
o Receive training on need and risk assessments, site profiling, and threshold determination  
o Site profiling  
o Threshold determination  
o Need assessment  
o Demonstrations of forecast and warning applications  
o End of season evaluation  
o Improving EWS  
o Documentation  
o Project evaluation |

3.2 | Training of local working groups in impact, vulnerability, coping strategy, user need | May 2011 - Apr 2012 | Technical inputs: Forecast Application Scientists (2mos): US$ 8,000  
Project Coordinator (1mo): US$ 2,000  
Technical inputs: Forecast Application Scientist US$ 4,400  
Project Coordinator: US$ 2,200  
RIMES Travel:  
Airfare: US$ 2,338  
Visa, local travel: US$ 993  
DSA: US$ 5,957  
Meeting costs:  
NTWC/NMHS travel: US$ 56  
NTWC local costs: US$ 206  
Meeting package, consumables, etc: US$ 3,253  
**Total for the Activity:** US$ 19,403 | Training of local working groups were undertaken on dates indicated on the table below, and covered:  
o Overview of early warning  
o Identification of historical hazards and their impacts on lives and livelihood systems |
<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Description of results</th>
</tr>
</thead>
</table>
| assessments | | | o Determination of hazard thresholds  
| | | | o Exposure, vulnerability, and risk assessments  
| | | | o Assessment of user needs for forecast and warning information |
| RIMES travel:  
Airfare: US$ 6,500  
Visa, local travel: US$ 1,500  
DSA: US$ 6,000  
Training:  
Curriculum adaptation, training materials: US$ 3,500  
NTWC/NMHS travel: US$ 2,400  
NTWC local costs: US$ 5,040  
Meeting package, consumables: US$ 9,500 | | | |
| Total for the Activity: US$ 44,440 | | | |
| Technical inputs:  
Forecast Application Scientists (1.5mos): US$ 6,000  
Project Coordinator (1mo): US$ 2,000 | | | Pilot sites were selected for local level activities (see list below) based on the following criteria:  
 o Coastal location  
 o At high risk to hazards such as cyclone, storm surge, inundation from heavy rain spells and tsunami  
 o Have at least 30-year climate data  
 o With local institutions that are willing to actively participate in project implementation |
| Total for the Activity: US$ 8,000 | | | |
| 3.3 Demonstration site selection and profiling | Jun 2011 - Apr 2013 | Technical inputs:  
Forecast Application Scientists: US$ 6,600  
Project Coordinator: US$ 2,200 | | |
| Technical inputs:  
Forecast Application Scientists (1.5mos): US$ 6,000  
Project Coordinator (1mo): US$ 2,000 | | | |
<table>
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<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4</td>
<td>Jun 2011 - Apr 2013</td>
<td>Technical inputs: Forecast Application Scientist (1mos): US$ 4,000 Project Coordinator (1mo): US$ 2,000</td>
<td>Technical inputs: Forecast Application Scientist: US$ 4,400 Project Coordinator: US$ 2,200</td>
<td>Bangladesh: Thresholds for cyclone (based on maximum wind speed) and flood (based on river level), established by BMD and FFWC, respectively, were adopted for the pilot sites. Rainfall intensity and duration thresholds, leading to flash flood, were determined for Cox’s Bazar, from historical rainfall and impact data. India: Thresholds for rainfall, temperature, and wind at each stage of paddy growth, determined for Kilvelur and Nagapattinam by the State Commission of Agriculture, were adopted. Maldives: Thresholds for heavy rains, swells, tidal waves, strong wind, tsunami, beach erosion, and earthquake were determined for Fuvahmulah from focus group discussions with the local working group and with community members, which included elderly residents with anecdotal information on past hazards and their impacts. Myanmar: Thresholds for storms, cyclone, waves, rainfall, and tsunami, established by DMH, were adopted for the pilot sites. Sri Lanka: Thresholds for storms, cyclone, lightning, rainfall, and tsunami,</td>
</tr>
<tr>
<td>Activity</td>
<td>Time Frame</td>
<td>Trust Fund Contribution</td>
<td>Trust Fund Contribution Spent</td>
<td>Description of results</td>
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<tr>
<td>User need assessment</td>
<td>Jun 2011 - Apr 2013</td>
<td>Technical inputs:</td>
<td>Technical inputs:</td>
<td>established by DOM, were adopted for the pilot sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forecast Application</td>
<td>Forecast Application Scientist:</td>
<td>Threshold values for all above-mentioned parameters were reported in Progress Report Nos. 2 and 3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scientist (1.5mos): US$ 6,000</td>
<td>US$ 6,600</td>
<td>User needs for warning and forecast information and services were determined through interviews and focus group discussions with relevant stakeholders, in collaboration with respective NMHS. Needs common to the countries include:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Coordinator (1mo): US$ 2,000</td>
<td>US$ 2,200</td>
<td>o User- and hazard-specific forecast and warning parameters, lead times, and accuracies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RIMES Travel:</td>
<td>RIMES Travel:</td>
<td>o Last mile dissemination and communication of forecasts and warnings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Airfare: US$ 3,250</td>
<td>Airfare: US$ 3,547</td>
<td>o Public awareness on warning systems for various hazards</td>
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<tr>
<td></td>
<td></td>
<td>Visa, local travel: US$ 1,800</td>
<td>Visa, local travel: US$ 1,323</td>
<td>o Preparedness planning and decision-making that are based on risk information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DSA: US$ 2,100</td>
<td>DSA: US$ 1,534</td>
<td>Findings from the assessments were reported in Progress Report Nos. 2 and 3.</td>
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<tr>
<td></td>
<td></td>
<td>Meeting costs:</td>
<td>Meeting costs:</td>
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<tr>
<td></td>
<td></td>
<td>NTWC/NMHS travel: US$ 2,400</td>
<td>NTWC/NMHS travel: US$ 1,573</td>
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<td></td>
<td></td>
<td>NTWC local costs: US$ 720</td>
<td>Meeting package, consumables, etc.: US$ 962</td>
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<td></td>
<td></td>
<td>Meeting package,</td>
<td>Total for the Activity: US$ 17,739</td>
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<td></td>
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<td>consumables, etc.: US$ 1,200</td>
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<td>Total for the Activity: US$ 19,470</td>
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<tr>
<td>Activity</td>
<td>Time Frame</td>
<td>Technical Inputs:</td>
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</table>
| Training of disaster managers in disaster risk information translation | Oct 2011 - Oct 2013 | - Senior Scientist (2mos): US$ 13,000  
- Climate Scientist (1.5mos): US$ 7,500  
- Forecast Application Scientists (2.5mos): US$ 10,000  
- Project Coordinator (2mos): US$ 4,000  
- RIMES travel: Airfare: US$ 9,750  
- Visa, local travel: US$ 3,600  
- DSA: US$ 9,450  
- Training: Curriculum adaptation, training materials: US$ 10,000  
- NTWC/NMHS travel: US$ 4,800  
- NTWC local costs: US$ 4,320  
- Meeting package, consumables: US$ 14,400  
- Total for the Activity: US$ 90,820  

Country-specific training curricula on climate information interpretation, translation, and application were prepared and delivered for Bangladesh, Maldives, Myanmar, and Sri Lanka. The training covered:
- Key elements of an end-to-end early warning system
- Hazards: historical impacts, thresholds, observation and monitoring
- Forecast and warning generation: process, and products from the NMHS
- Forecasts: terminology, uncertainty
- Warning dissemination: SOP, channels
- Forecast application: interpretation and translation into potential impacts, identification of impact management options, communicating and managing uncertainty

In India, training was customized according to user demand in the agriculture sector, particularly on building capacity of agriculture extension specialists and lead farmers for climate risk management (CRM). Training was three-tiered: a) training of agriculture extension specialists as trainers, b) training of lead farmers as CRM champions, and c) training of farmers as climate risk managers. The training took a demonstration and experiential approach, and included:
- Weather, climate, and hazards
- Weather-/ climate-related impacts on plant growth, and pests and diseases
- Forecasts: products, uncertainty
- Rainfall observation and monitoring
- Climate forecast application: planting strategies, assessment of irrigation requirement, flood risks, managing uncertainty
- Low-cost and location-specific technologies for managing extreme weather/ climate events
- Assessing the economic value of climate information

For Thailand, the project brought the Royal Irrigation Department (RID) on board, with training provided on application of short-term weather forecast in increasing lead time for flood warning, as well as for guiding operation and management of Bhumibol and Sirikit reservoirs.

The table below summarizes the training outputs.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Description of results</th>
</tr>
</thead>
</table>
| 3.7 | Demonstration of location-specific disaster risk information in reducing disaster risks | Jan 2013 – Dec 2015 | Technical inputs:  
Senior Scientist: US$ 59,826  
Climate Scientist: US$ 35,500  
Forecast Application Scientists: US$ 48,807  
RIMES travel:  
Airfare: US$ 21,445  
Visa, local travel: US$ 4,534  
DSA: US$ 22,468  
NTWC/NMHS travel:  
Local travel: US$ 4,800  
DSA: US$ 5,520  
Utilities: US$ 7,066  
Total for the Activity: US$ 205,813 | Level of climate information application in the countries differs. User uptake depends on availability of accurate information, while desiring longer lead time. Accuracy-lead time relationship, however, is inversely proportional – as lead time increases, accuracy decreases. Hence, utilization of probabilistic forecast hinges on user understanding and acceptance of forecast uncertainty, and willingness to apply forecast in planning and decision-making within a risk management framework. Efforts for location-specific seamless forecasts (3-day, 10-day, monthly, and seasonal) under this project aim to assist partner NMHSs in generating higher quality forecast products to meet user demands. Bangladesh: Application of weather and climate forecasts has made significant impact in increasing lead times of flood forecast and warning products in Bangladesh. FFWC’s medium-range flood forecast product, which makes use of 10-day rainfall forecast, is now operational. Generation of monthly and seasonal flow outlooks, based on monthly and seasonal rainfall outlooks, is on experimental basis. The Department of Agriculture, Water Supply and Sewerage Authority, Directorate General of Health Services, and BRAC have reported use of seasonal forecast in planning. Despite project efforts to raise awareness and build capacity on forecast translation and application, many are still |
| Bangladesh | Multi-sectoral | 17-19 Sep 2013 | 34 |
| India | Training of trainers | Jun-Oct 2012 | 14 |
| India | Training of lead farmers | Jun-Oct 2012 | 10 |
| India | Training of farmers | Jun-Oct 2012 | 50 |
| Maldives | Multi-sectoral | 24-26 Sep 2013 | 26 |
| Maldives | Training, Multi-sectoral, Yangon | 31 Jul-1 Aug 2012 | 33 |
| Maldives | Training, Multi-sectoral, Naypyitaw | 10 May 2012 | 18 |
| Maldives | Training, Multi-sectoral, Naypyitaw | 11-13 Sep 2013 | 24 |
| Sri Lanka | Multi-sectoral, local | 26-27 Jul 2012 | 31 |
| Sri Lanka | Multi-sectoral, national | 9-11 Oct 2013 | 41 |
| Thailand | Introductory | 19-23 Nov 2012 | 25 |
| Thailand | Intensive | 4-15 Feb 2013 | 5 |
| Total trained | | | 311 |

**Replication.** In India, the Department of Agriculture in Tamil Nadu supported the replication of the training of agriculture extension specialists and farmers in Thiruvanur District.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Description of results</th>
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</thead>
<tbody>
<tr>
<td>Total for the Activity: US$ 209,980</td>
<td></td>
<td>uncomfortable in using probabilistic forecasts due to inherent uncertainty.</td>
<td></td>
</tr>
</tbody>
</table>

**India:** Experiences of climate information application in India is currently limited to short- and medium-range forecast products through:

- Climate data centers at the project’s pilot sites, in collaboration with the Centre for Ecology and Research and retired agriculture extension specialists as CRM champions. These data centers access 3- to 10-day weather forecasts from IMD and RIMES. Using these forecast products, retired agriculture extension specialists evaluate potential impacts on cropping and identify management options. The center then communicates the forecast and crop management advisories to farmers.
- Decision support systems (DSS) in agriculture, animal husbandry, public health, and energy. The project is assisting Tamil Nadu State Planning Commission in developing impact forecasting and decision support systems, in line with their climate risk aware development planning. Three- to ten-day weather forecasts are used to evaluate: potential disease outbreak in humans and livestock, potential impacts/ favorable conditions on crop growth, and wind power potential as supplementary source to meet energy demands. (DSS development is reported separately under Activity 3.8).

**Maldives:** No significant weather/climate/risk information application has been reported for the Maldives, with product development for 3-day weather and marine/ocean state forecasts just recently completed, and for monthly and seasonal climate outlooks still ongoing. These products are still being validated, for forecast system refinement. RIMES shall take these products forward by introducing and integrating them into user systems.

**Myanmar:** Forecast and warning application in Myanmar are in the following areas:

- Cyclone warning. Lat Koke Kone Village Tract and Kunyangon Township (both in Kunyagon) reported access to and use of forecasts and warnings for Cyclone Komen in late July/ early August 2015. The solar powered VHF-based communication system, established under the project, enabled local authorities to access, disseminate, and use warnings to manage disaster risk, despite power outage during the event.
<table>
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<tr>
<th>Activity</th>
<th>Time Frame</th>
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<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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<tr>
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<td>o 3-day and 10-day agro-meteorological forecasts. Linked to TTF-23, these forecasts are being used in providing agro-advisories to farmers in the country’s Dry Zone. Ten-day forecast products are currently being validated, for improving resolution.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>o Seasonal outlook. Current use of seasonal outlook is limited to guidance for managing resources/ risk in various sectors. Efforts are ongoing to develop the seasonal climate model for Myanmar (refer to reports under Activities 3.8 and 4.5).</td>
</tr>
</tbody>
</table>

**Sri Lanka:** Among the project countries, Sri Lanka has the most number of institutions that are actively utilizing seamless forecast products in planning and decision-making. Seasonal climate outlook is supplemented by mid-season updates and monthly, 10-day, and 3-day forecasts.

- Department of Agriculture reported that the seasonal climate outlook is used in pre-season planning meeting to determine cultivation extent and select crop type and varieties, as well as in making decision to advise farmers for early/late planting. The monthly forecast is used in making decision to mobilize support for farm inputs (e.g. seeds).
- Irrigation Department reported use of seasonal climate outlook in pre-season planning for ensuring water supply in support of identified cultivation extent. For the Yala season (March to August) in 2014, Irrigation Department decided to fill existing water storages, construct agro-wells, and control water supply for irrigation, in anticipation of the predicted below average rainfall. The Ministry of Irrigation and Water Resources also issued a circular:
  - Encouraging farmers to maximize the use of rains for land preparation
  - Limiting land preparation to 21 days only
  - Advising farmers to select quick maturing (3 to 3.5 months) paddy varieties
  - Informing farmers that water for irrigation shall be available for 90 days only in support of the 3.5 month rice varieties
- Rubber Research Institute of Sri Lanka extended the distribution of rubber tree seedlings in 2012, in response to predicted early onset of monsoon and above average rainfall in production areas.
- Ceylon Electricity Board (CEB) reported that with predicted below normal rainfall during the Yala season in 2015, CEB scheduled
<table>
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<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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</thead>
<tbody>
<tr>
<td>3.8</td>
<td>May 2012 – Dec 2015</td>
<td><strong>Technical inputs:</strong> Senior Scientist (9mos): US$ 58,500 Climate Scientist (3mos): US$ 15,000 <strong>Total for the Activity:</strong> US$ 73,500</td>
<td><strong>Technical inputs:</strong> Senior Scientist: US$ 60,751 Climate Scientist: US$ 15,423 <strong>Total for the Activity:</strong> US$ 76,174</td>
<td>RIMES assisted partner NMHSs in developing forecast models to respond to user demands for higher resolution forecast products. <strong>Bangladesh:</strong> RIMES’ multi-model seasonal forecasting scheme was customized to provide monthly rainfall forecast and seasonal rainfall outlook for 6 climatological zones in Bangladesh. Forecast validation and model calibration shall be undertaken in collaboration with BMD. Training of one (1) BMD technical staff from 21 December 2015 – 13 January 2016 at RIMES was undertaken for this purpose (refer to report under Activity 4.5). <strong>Maldives:</strong> RIMES’ 3-day weather research forecast (WRF) model was customized for Maldives, and was transferred to MMS in September 2015. RIMES’ multi-model seasonal forecasting scheme was customized to provide monthly rainfall forecast and seasonal rainfall outlook for 3 climatological zones in Maldives has been completed. In collaboration with MMS, RIMES shall pursue forecast validation, and model calibration and integration into MMS operations. One (1) MMS technical staff was trained at RIMES from 14 December 2015 – 5 January 2016 for this purpose (refer to report under Activity 4.5). <strong>Myanmar:</strong> RIMES’ multi-model seasonal forecasting scheme was customized to provide monthly rainfall forecast and seasonal rainfall outlook for 3 climatological zones in Maldives has been completed. Forecast validation and model calibration shall be undertaken in collaboration with MMS. Training of one (1) MMS technical staff was trained at RIMES from 14 December 2015 – 5 January 2016 for this purpose (refer to report under Activity 4.5).</td>
</tr>
</tbody>
</table>
validation and model calibration shall be undertaken in collaboration with DMH. Training of one (1) DMH technical staff from 16 November – 11 December 2015 at RIMES was undertaken for this purpose (refer to report under Activity 4.5).

**Sri Lanka:** 10-day forecast model development, which involved model customization, product validation, and model calibration, has been completed. Customization of monthly and seasonal forecast models was also completed. Forecast validation and model calibration shall be undertaken in collaboration with DOM. Two-week training of one (1) DOM technical staff in October 2015 at RIMES was undertaken for this purpose (refer to report under Activity 4.5).

**India:** As reference information, supporting forecast information provided to the pilot sites from IMD, RIMES interpreted IMD outputs, satellite products, and products from the European Centre for Medium Range Weather Forecasts (ECMWF), Center for Ocean-Land-Atmosphere Studies (COLA), U.S. National Weather Service’s Climate Prediction Center (CPC), and RIMES. Analysis results were provided to retired agriculture extension specialists at the pilot sites for analysis and translation into impact outlook.

In collaboration with Tamil Nadu State’s agriculture, animal husbandry, and public health departments, as well as Tamil Nadu Electricity Board (TNEB), 3-day and 10-day weather forecast-based impact forecasting and decision support systems were developed, with the following features:

- Agro-advisory system correlates weather forecast with crop-weather calendar and associated farm level operations.
- Animal husbandry system correlates endemic data with weather forecast, and provides location-specific alerts via SMS and email on potential outbreak of anthrax, foot and mouth disease, or brucellosis.
- Public health system correlates endemic data with weather forecast, and provides location-specific alerts via SMS and email on potential outbreak of malaria, dengue, or swine flu.
- Wind energy system determines potential wind power from forecast of effective wind velocity between 10m and 100m above ground, and analyzes peak power demand and supply.
<table>
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<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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<td>In response to the interest by the Public Works Department, impact forecasting and decision support system development is being extended to assessment of seasonal climate impact on and management of water supply for irrigation and domestic consumption, with focus on Kosathaliyar and Tamraparani-Amaravathi river basins, respectively.</td>
</tr>
</tbody>
</table>

**Thailand:** The project assisted the Royal Thai Irrigation Department in developing a flood forecast model for upper Chao Phraya river basin that makes use of TMD’s weather forecast products of up to 10 days lead time. The model forecasts river discharge upstream of Nakhon Sawan, and inflow to Bhuminol and Sirikit reservoirs.

<table>
<thead>
<tr>
<th>Total for Component 3:</th>
<th>US$ 472,490</th>
<th>US$ 468,177</th>
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<tbody>
<tr>
<td>4. Capacity building for the generation of location-specific warning information products</td>
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<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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<tbody>
<tr>
<td>4.1</td>
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<td>Component 4 activities were implemented by the World Meteorological Organization in the context of its Severe Weather Forecasting Demonstration Project (SWFDP) in the Bay of Bengal region.</td>
</tr>
</tbody>
</table>

The technical planning workshop, held from 23-27 January 2012 in New Delhi:
- Received guidance on hazards for which warnings would be issued, as well as on hazard thresholds
- Defined user-specific requirements for forecasting and warning services
- Agreed on timetable and milestones, implementation arrangements, and composition of the project management team
- Identified synergies with other WMO initiatives

The preparatory training workshop on severe weather forecasting and warning services from 8-19 April 2013 in Macau:
- Trained forecasters from project countries on correct interpretation and application of various advanced forecasting products (NWP/EPS, satellite-based, and guidance products)
<table>
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<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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<tr>
<td></td>
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<td>sessions for forecasters to ensure that the 6 NMHSs are able to correctly interpret the various NWP/EPS, satellite-based and guidance products made available through the project</td>
<td>various NWP/EPS, satellite-based and guidance products made available through the project</td>
<td>o Trained additional NMHS participants on Public Weather Services, particularly for coastal communities. The training stressed the importance of user dialogue and engagement, for assessing needs and for education and outreach.</td>
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<td></td>
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<td>Travel and DSA: US$ 65,790 Visa, local arrangements, Meeting package, consumables: US$ 9,900</td>
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<td>Total for the Activity: US$ 145,070</td>
<td></td>
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<tr>
<td>4.2</td>
<td>May 2011 –Dec 2015</td>
<td>Technical inputs: Senior Scientist (1mo): US$ 6,500 Utilities: US$ 1,500</td>
<td>Technical inputs: Senior Scientist: US$ 6,500 Utilities: US$ 454 Travel and DSA: US$ 44,076</td>
<td>Capacities of BMD and DMH observational and forecasting systems, including their data and product needs for generating user-relevant severe weather forecasting and warning services, were assessed in 2012. Progress on generating necessary data and products for location-specific disaster risk information was reviewed and discussed with NMHSs of project countries at the 7th Meeting of the RIMES Council in New Delhi from 9-10 July 2015. IMD/RSMC progress in developing SWFDP-Bay of Bengal website was also reviewed. Mission by 4 WMO experts in Myanmar in November/December 2015:</td>
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<td></td>
<td></td>
<td>Assessment missions or meeting of the regional project management team to gather information and assessing the existing capabilities in the 6 NMHSs to provide severe weather forecasting and warning services</td>
<td>Travel and DSA: US$ 44,076</td>
<td>o Assessed DMH requirements for a fully integrated forecasting system o Assisted DMH on improving severe weather forecasting through routine verification process o Trained DMH for enhanced delivery of warnings and services to users</td>
</tr>
<tr>
<td>Activity</td>
<td>Time Frame</td>
<td>Trust Fund Contribution</td>
<td>Trust Fund Contribution Spent</td>
<td>Description of results</td>
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<tr>
<td>4.3 Evaluation of selected NWP/EPS, and satellite-based products,</td>
<td>May 2011 – Dec 2015</td>
<td><strong>Technical inputs:</strong> Senior Scientist (2mos): US$ 13,000</td>
<td><strong>Total for the Activity:</strong> US$ 14,000</td>
<td>IMD/RSWC first phase development of the password-protected SWFDP-Bay of Bengal web portal was completed. The portal [<a href="http://202.54.31.51/mme/fdp-bob/login.php">http://202.54.31.51/mme/fdp-bob/login.php</a> (user: swfdp-bob; password: imd)] has been functional since September 2015, providing selected NWP/EPS and satellite-based products to NMHSs.</td>
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<td>including those for marine forecasting, and definition of the</td>
<td></td>
<td><strong>Utilities:</strong> US$ 1,000</td>
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<td>guidance products to be made available by the WMO Regional Centre,</td>
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<td><strong>Total for the Activity:</strong> US$ 14,000</td>
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<td>through the project</td>
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<td>4.4 Downscaling for high-resolution location-specific disaster risk</td>
<td>May 2011 – Dec 2015</td>
<td><strong>Technical inputs:</strong> Senior Scientist (2mos): US$ 13,000</td>
<td><strong>Total for the Activity:</strong> US$ 15,000</td>
<td>Downscaling for high-resolution location-specific disaster risk information was carried out by IMD-RSWC. Also, IMD-RSWC initiated the issue of daily guidance products on location-specific hazard potential risks, in the form of probability and risk tables.</td>
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<tr>
<td>information</td>
<td></td>
<td><strong>Utilities:</strong> US$ 2,000</td>
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<tr>
<td>4.5 Training by secondment of NMHSs in generation of tailor-made</td>
<td>Feb 2012 - Dec 2015</td>
<td><strong>Technical inputs:</strong> Senior Scientist (2mos): US$ 13,000</td>
<td><strong>Total for the Activity:</strong> US$ 86,050</td>
<td>NMHSs of India, Maldives, Myanmar, Sri Lanka, and Thailand, as well as of Bhutan, Cambodia, Lao PDR, Nepal, Pakistan, Philippines, and Vietnam were trained on severe weather forecasting and warning services from 14-25 September 2015 in Bangkok. The training workshop covered:</td>
</tr>
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<td>location-specific disaster risk information; A reinforcing training</td>
<td></td>
<td><strong>Training costs:</strong> Travel and DSA: US$ 70,860</td>
<td><strong>Total for the Activity:</strong> US$ 84,114</td>
<td><strong>Severe weather forecasting:</strong></td>
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<tr>
<td>session for forecasters to ensure that the 6 NMHSs are able to</td>
<td></td>
<td>Visa, local arrangements, meeting package, consumables: US$ 6,195</td>
<td></td>
<td>o NWP process: data assimilation, model physics and resolution, EPS concepts</td>
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<tr>
<td>correctly interpret the various products available</td>
<td></td>
<td><strong>Total for the Activity:</strong> US$ 86,050</td>
<td></td>
<td>o NWP model products: access, statistical adaptation</td>
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<td></td>
<td></td>
<td>o Regional NWP/Limited Area Model (LAM)</td>
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<td></td>
<td></td>
<td></td>
<td>o Ensemble Prediction Systems (EPS) and probabilistic forecasting</td>
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<td></td>
<td></td>
<td>o Use of NWP and EPS products for severe weather forecasting during monsoon and pre-monsoon seasons</td>
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<td></td>
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<td></td>
<td>o Combining NWP model products in very short range forecasts of severe weather, including heavy rain and flash floods</td>
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<td></td>
<td>o Nowcasting using radar products</td>
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<td>Activity</td>
<td>Time Frame</td>
<td>Trust Fund Contribution</td>
<td>Trust Fund Contribution Spent</td>
<td>Description of results</td>
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<td>through the project, to prepare user-focused information</td>
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<td>○ Tropical cyclone forecasting and storm surge forecasting</td>
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<td>○ Forecast verification</td>
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<td>○ Access to SWFDP database</td>
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<td><strong>Warning services:</strong></td>
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<td>○ Web page development, linking SWFDP products to NMHS websites</td>
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<td>○ Development of non-severe weather related products</td>
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<td>○ Developing and communicating warnings, communicating uncertainty</td>
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<td></td>
<td></td>
<td>○ Dissemination of warnings and forecasts: social media, mobile technology, use of apps, websites, communication in rural and remote areas</td>
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<td>○ Dealing with the media</td>
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<td>○ Public education and outreach, setting up weather services for event organizers; responding to weather hazards</td>
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<td></td>
<td>○ Effective public weather service delivery to the disaster management community, service evaluation</td>
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<td>To assist partner NMHSs in responding to user demands for location-specific longer lead forecast products, and in support of this capacity building activity under Component 4, RIMES facilitated the following training workshops. The training developed technical skill of participants, transferred forecast technologies, and built capacity within the NMHS for forecast system maintenance.</td>
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<td>○ <strong>Bangladesh:</strong> Trained 1 BMD operational staff from 21 December 2015 – 13 January 2016 at RIMES on seasonal forecast model customization, for generating monthly rainfall forecast and seasonal rainfall outlook for 6 climatological zones in Bangladesh.  <strong>Annex 9</strong> provides the outputs and outcomes of the training.</td>
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<td>○ <strong>Maldives:</strong></td>
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<td>- Trained 1 MMS operational staff from 14 December 2015 to 6 January 2016 at RIMES on short-range weather forecasting, using the WRF model. The hands-on training covered WRF installation, model verification techniques, model run, and case runs to evaluate model performance.  <strong>Annex 10</strong> provides the outputs and outcomes of the training.</td>
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<td>- Trained 1 MMS operational staff from 14 December 2015 to 5 January 2016 at RIMES on short-range weather forecasting, using the WRF model. The hands-on training covered WRF installation, model verification techniques, model run, and case runs to evaluate model performance.  <strong>Annex 10</strong> provides the outputs and outcomes of the training.</td>
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<td>Activity</td>
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<td>Trust Fund Contribution</td>
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<td>January 2016 at RIMES on seasonal forecast model customization, for generating monthly rainfall forecast and seasonal rainfall outlook for 3 climatological zones in Maldives. Annex 11 provides the outputs and outcomes of the training.</td>
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<td>Trained 15 MMS professional staffs from 14-25 September 2015 on ocean state forecasting. Sessions included forecasting of waves, swells, and wind; tide prediction; wave surge, storm surge, and coastal flooding; and forecast validation.</td>
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<td>o Myanmar</td>
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<td></td>
<td>Trained 1 DMH professional staff from 16 November to 11 December 2015 at RIMES on medium-range forecasting using WRF model. The hands-on training covered WRF installation and configuration, model run, and model output visualization and verification. Annex 12 provides the outputs and outcomes of the training.</td>
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<td>Trained 1 DMH operational staff from 16 November to 11 December 2015 at RIMES on seasonal forecast model customization, for generating monthly rainfall forecast and seasonal rainfall outlook for 3 climatological zones in Myanmar. Annex 13 provides the outputs and outcomes of the training.</td>
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<td>Additionally trained 1 DMH technical staff from 4 to 19 January 2016 at RIMES, on IT support to forecasting. The hands-on training covered basics of Linux operating system; user, system, and network management; and software installation and support for WRF, SeisComP3, ShakeCast, and TideTool. Annex 14 provides the outputs and outcomes of the training.</td>
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<td>o Sri Lanka:</td>
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<td>Trained 1 DOM professional on seasonal forecast system customization from 24 August to 4 September 2015 at RIMES, for generating monthly rainfall forecast and seasonal rainfall outlook for 3 climatological zones in Sri Lanka. Annex 15 provides the outputs and outcomes of the training.</td>
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<td>DOM professional staffs were trained on forecast verification methods from 27-30 April 2015.</td>
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Total for Component 4: US$ 317,500 US$ 265,942
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<tr>
<th>Activity</th>
<th>Time Frame</th>
<th>Trust Fund Contribution</th>
<th>Trust Fund Contribution Spent</th>
<th>Description of results</th>
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<tbody>
<tr>
<td><strong>5. Regional sharing of experience, practice, lessons and successes</strong></td>
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<td>- Efforts by Sri Lanka in developing 3-day, 10-day, monthly, and seasonal forecast products, with project support, to meet user demands. (Sri Lanka only had daily forecast product when this ESCAP-supported project started in 2011.) These efforts are an encouragement to other NMHSs, which may find initial engagement with users as daunting or overwhelming.</td>
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<td>- ESCAP’s support in:</td>
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<td>- Establishment/ institutionalization of Monsoon Forums, which have enriched NMHS-user interactions for utilization of forecast and risk information for management of resources/ risks.</td>
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<td>- Development of impact forecasting and decision support systems for agriculture, animal husbandry, public health, energy, and water management sectors</td>
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<td></td>
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<td></td>
<td></td>
<td>- Integration of seamless weather and climate information into planning and decision-making in key sectors</td>
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<td></td>
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<td></td>
<td>o 10th session of the ICG-IOTWS, 24-26 March 2015, Muscat</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>o 39th session of WMO/ESCAP Panel on Tropical Cyclones, 5-9 March 2012, Nay Pyi Taw</td>
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<td></td>
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<td></td>
<td></td>
<td>o Seasonal Forum, 19-21 October 2015, Bhutan</td>
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<td>o Early warning conference, 29 October 2015, Georgia</td>
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<td></td>
<td>o RIMES Council meetings: 18 June 2012, New Delhi; 29-30 May 2014, Bangkok; and 9 July 2015, New Delhi</td>
</tr>
<tr>
<td>5.2 Sharing project outcomes, experiences in ICG/IOTWS meetings</td>
<td>May 2011 - Dec 2015</td>
<td>Technical inputs: Project Coordinator (0.5mo): US$ 1,000 Travel: Airfare: US$ 2,400 Visa, local travel: US$ 800 DSA: US$ 2,000</td>
<td>Technical inputs: Project Coordinator: US$ 500 Travel: Airfare: US$ 880 Visa, local travel: US$ 21 DSA: US$ 1,328</td>
<td>Project experiences and outcomes were also shared in:</td>
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<td>o 10th session of the ICG-IOTWS, 24-26 March 2015, Muscat</td>
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<td>o 39th session of WMO/ESCAP Panel on Tropical Cyclones, 5-9 March 2012, Nay Pyi Taw</td>
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<td>o Seasonal Forum, 19-21 October 2015, Bhutan</td>
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<td>o Early warning conference, 29 October 2015, Georgia</td>
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<td>o RIMES Council meetings: 18 June 2012, New Delhi; 29-30 May 2014, Bangkok; and 9 July 2015, New Delhi</td>
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<td>Activity</td>
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<td>Trust Fund Contribution</td>
<td>Trust Fund Contribution</td>
<td>Description of results</td>
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<td>Total for the Activity:</td>
<td>Total for the Activity:</td>
<td>Project efforts on agro-advisory system development were also shared to more than 100</td>
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<tr>
<td></td>
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<td>US$ 6,200</td>
<td>US$ 2,729</td>
<td>students and faculty of the Agricultural Research Center and Tamil Nadu University,</td>
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<td>Thanjavur, on 4 September 2015.</td>
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<tr>
<td>5.3 Documentation and sharing in print, web media</td>
<td>May 2011 - Dec 2015</td>
<td>Technical inputs:</td>
<td>Technical inputs:</td>
<td>Sharing of project experiences, lessons, and successes to wider audience was made</td>
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<tr>
<td></td>
<td></td>
<td>Project Coordinator (2mo):</td>
<td>Project Coordinator:</td>
<td>through RIMES website, electronic newsletter, and Facebook page.</td>
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<td></td>
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<td>US$ 4,000</td>
<td>US$ 4,050</td>
<td>Travel:</td>
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<td></td>
<td>Travel:</td>
<td>Travel:</td>
<td>Airfare: US$ 6,500</td>
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<td>Visa, local travel:</td>
<td>Visa, local travel:</td>
<td>US$ 5,000</td>
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<td>US$ 12,250</td>
<td>US$ 1,875</td>
<td>DSA: US$ 1,000</td>
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<td>Total for the Activity:</td>
<td>Total for the Activity:</td>
<td>US$ 27,750</td>
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<td>US$ 27,750</td>
<td>US$ 7,117</td>
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<td>Total for Component 5:</td>
<td>US$ 162,190</td>
<td>US$ 24,610</td>
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<td>Activity</td>
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<td>Trust Fund Contribution</td>
<td>Description of results</td>
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<td>6. Monitoring and Evaluation and Project Management</td>
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<td>6.2 End-of-project Review (back-to-back with 4.1)</td>
<td>Dec 2015</td>
<td>Technical input: Forecast Application Scientist (0.5 mo): US$ 2,000 Travel: Participant DSA: US$ 5,875 Meeting costs: US$ 1,225</td>
<td>Total for the Activity: US$ 9,100</td>
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<td>Activity</td>
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<td>Trust Fund Contribution</td>
<td>Description of results</td>
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<tr>
<td>Travel:</td>
<td></td>
<td>Airfare: US$ 7,800</td>
<td>Visa, local travel, etc:</td>
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<td>Visa, local travel, etc:</td>
<td>US$ 1,767</td>
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<td>DSA: US$ 11,100</td>
<td>DSA: US$ 6,938</td>
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<td>Audit:</td>
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<td>Professional fees: US$</td>
<td>Audit:</td>
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<td>6,000</td>
<td>Professional fees: US$ 4,251</td>
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<td>Total for the Activity:</td>
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<td>US$ 27,416</td>
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<td>Total for the Activity:</td>
<td>US$ 41,700</td>
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<td>Total for Component 6:</td>
<td>US$ 156,100</td>
<td>US$ 125,705</td>
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<tr>
<td>Total for all Components:</td>
<td>US$ 1,748,340</td>
<td>US$ 1,239,455</td>
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<td>Indirect Cost:</td>
<td>US$ 69,934</td>
<td>US$ 49,578</td>
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<td>TOTAL COST</td>
<td>US$ 1,818,274</td>
<td>US$ 1,289,033</td>
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</table>
**LESSONS LEARNED**

The September meeting among RIMES, WMO, and partner NMHSs was very useful in terms of clarifying WMO and RIMES roles in the project. This is important if the two institutions are to deliver project components effectively and in synergy with each institution’s programs. The face-to-face meeting along with NMHSs fostered good personal relations, facilitating coordination of project activities. The meeting, however, was held months into project implementation due to scheduling difficulties. Although much useful, the meeting was not a programmed activity, hence required resources from RIMES and WMO.

Active cooperation by the new Director General of Myanmar’s Department of Meteorology and Hydrology is a welcome sign that this project could deliver more efficiently and effectively in Myanmar. Thailand is a challenge though, with decisions being put on hold because of the replacement process of the Director General of the Thai Meteorological Department. Until date, not much progress has been made; the meeting along with WMO in September was, however, helpful in clarifying project goal, objectives, and activities, and how the project would benefit TMD.

Although still to benefit from improved forecasting capability through Component 4 of this project, Myanmar’s DMH has demonstrated its zeal in responding to user demands for usable information, with the generation and provision to users of the possible number of rainy days within the seasonal climate outlook and the 10-day weather forecast products.

Users’ analysis of potential impacts is still very general. Location-specific forecast is needed to downscale the risk analysis. This will be addressed through Component 4 of the project. Skill in forecast interpretation and translation relevant to the sector is also needed. This will be addressed through Component 3 of the project.

In Bangladesh, users are still reluctant to use probabilistic forecasts, particularly products of more than 10 days lead time, due to increased uncertainty. Also, BMD and FFWC focus has been on the improvement of short- to medium-range forecast products. Work is needed to build BMD capacity in generating skillful seasonal forecasts, and in educating users on the utility of seasonal forecasts in planning, as well as in decision-making when coupled with shorter-term forecasts.

Users now drive the Monsoon Forum process. Success of the Forum, however, also depends on the delivery of usable climate information. Users demand improved spatial and temporal resolutions of forecasts. Capacity building of partner NHMSs in this regard is, hence, of utmost importance. Users will continue to participate in the Forum if they see value in it.

Institutional users in Myanmar and Sri Lanka have now matured, able to undertake in-depth analysis of potential impacts based on forecasts, and subsequent analysis of possible impact management options. This is one of the key outcomes of NMHS-users dialogues through the Monsoon Forum.

With available resources, NMHSs continue to respond to user demands for improved forecast and warning information (e.g. DoM Sri Lanka is now generating monthly and district-wise seasonal forecasts from the daily forecast that it was generating when the project started). NMHS involvement in local level activities has brought them closer to the end users of their information, allowing direct receipt of user feedback.

Recent political events in Bangladesh and Maldives delayed implementation of project activities, which were scheduled from second quarter of 2013. The civil unrest in Bangladesh prevented the travel of project staff to implement local level activities, due to security concerns; while preparations for elections in the Maldives occupied focal government institutions.

In order to respond to repeated user demands at the Forums for location-specific forecasts, while products from Component 4 are not yet available, RIMES is working with NMHSs on generating forecasts for the pilot sites, using available resources at RIMES for the 3-day forecast, and developing multi-model ensemble systems for 10-day and seasonal forecasts. Statistical downscaling methodologies are used, and forecasts are issued by the NMHS on experimental mode. These systems shall be refined using data assimilation and feedback from forecast evaluations.
LESSONS LEARNED

With geographically dispersed islands, MMS approach to the Monsoon Forum is to make it “roam”, to be able to reach as many stakeholders as possible. The first forum was held in the project’s pilot site in Fuvahmulah; the second was held in Male, the country’s capital; and the third was held in Addu, Gan atoll, the southernmost part of the country.

Critical to decision support system (DSS) development is data availability. Political will and operational support from Tamil Nadu State Planning Commission and participating institutions greatly facilitated DSS development.

SUSTAINABILITY

Please elaborate on any progress towards ensuring that this project results in a long-term benefit to the project stakeholders.

The rationale for the project’s approach to engage local institutions in project implementation is to build local capacity to continue project initiatives and for these institutions to see the value and benefits of the project, hence, be convinced to commit resources to sustain and replicate project initiatives. These local institutions are involved in the project through the Local Working Group, which leads project implementation at the pilot sites. The Cox’s Bazar working group in Bangladesh provides an example of local institutions’ involvement; of note are the local governments at municipal and union levels.

The state-level project working group meeting in Tamil Nadu, India is evolving into a warning information provider-user forum. Chaired by IMD Regional Meteorological Centre, the working group currently involves the revenue administration, agriculture, animal husbandry, fisheries, and public works departments, with its current focus on agriculture. Specific actions were identified in view of activities supported by the project, including activities that integrate project outputs into existing systems (e.g. upgrading of existing rainfall observation-based hydrological model into a rainfall forecast-based model; and integration of no-regrets options, identified based on impact outlooks, into disaster preparedness and response system). Engagement of the State Planning Commission aims at garnering policy support and mobilizing financial resources for sustaining and upscaling project activities. Engagement of other user departments is planned in batches.

Very much impressed by the achievements of the Climate Risk Management Farmers Field School (CRMFFS), the Vice Chairperson of the Tamil Nadu State Planning Commission expressed keen interest in including CRMFFS in the State’s XII Five-Year Plan; the District Government also committed the upscaling of the initiative to cover all blocks in the district.

The Monsoon Forum process has pushed NMHSs to generate information products that are relevant to users. Conversely, the process has resulted to users’ greater appreciation of the NMHS and its products. NMHS-user partnerships are being deepend, for example Sri Lanka’s DoM and DoA’s plan to collaboratively develop a forecast-based agro-advisory service. The reduction in the Forum’s duration, from 2 days until the targeted half-day is a move to reduce meeting costs, in preparation for integration of the Forum into the NMHS budget.

The Department of Agriculture of Tamil Nadu State in India has taken steps in replicating project activities in Thiruvarur District, in particular: development of agro-advisory system, Climate Risk Management Farmers’ Field Schools in select blocks, and integration of climate risk management in district level planning in the agriculture sector. RIMES shall continue to provide technical assistance in these initiatives. The action plan, prepared by the Department in September 2013, has detailed activities and responsibilities for the Department and RIMES.

Tamil Nadu’s State Planning Commission is fully convinced of the climate risk management approach, and has taken the lead in integrating climate information into sectoral decision-making. Development of decision support tools is ongoing for 4 sectors, with plan for replication in at least 8 sectors. The
State Planning Commission is also considering expansion of the Climate Risk Management Field School to other livelihood systems (e.g. fisheries, animal husbandry, salt farming), water user associations, self-help groups, local administrative bodies, and the media. RIMES role is to provide technical assistance; local costs are borne by the State government.

In Myanmar, the BRACED consortium (consisting of 6 UN and international non-government organizations) has come forward to support DMH in bringing the Monsoon Forum at the regional level, with focus on 7 regions which are at high risk to climate-related hazards. This is a welcome opportunity for DMH, but a challenge as well, in terms of delivery of forecast products that are relevant to the regions.

NMHSs in the project countries have now built a solid relationship with users. This is demonstrated by demands for institutional user-based engagement, for example Sri Lanka’s Tea Research Institute’s request for DOM to meet extension workers for orientation on forecast products available at DOM and forecast application guidance; user demands for updates on and delivery of outputs from forecast application initiatives, such as in Myanmar; and others.

The process of early warning and response capacity development in Fuvahmulah, Maldives has been fully owned by the Fuvahmulah Atoll Council, Maldives Meteorological Service, and National Disaster Management Center. These institutions were fully involved in the establishment of the Atoll early warning center and preparation of the Atoll disaster management plan, with RIMES facilitation and provision of equipment through this ESCAP-supported project.

In Myanmar, Christian Aid is partnering with RIMES in a project that is funded by DFID, building on the initiatives by this ESCAP-supported project. Activities include establishment of sub-national Monsoon Forums in Shan, Karen, and Mon states, and equipping of local early warning centers for bringing warnings until the last mile.

Decision support systems developed for Tamil Nadu have high replication potential at a much reduced cost for customization. Demands for replication have been articulated by Armenia, Bangladesh, Bhutan, Lao PDR, and Vietnam through RIMES Master Plan 2016-2020.

The 15th Monsoon Forum in Myanmar obtained commitments from high-level decision-makers to integrate seasonal preparedness into planning and decision-making, using DMH forecast products and guidance services. The Ministry of Health is establishing a disaster preparedness and management department, with capacity to receive, interpret, and translate forecast information into impact scenarios and management options, and accordingly undertake preparedness actions. The Department of Agriculture has indicated its efforts in integrating hazard information at different timescales into its planning processes.

Myanmar Red Cross Society and BRACED Alliance partners were trained on early warning, with special sessions on forecast translation into impact outlooks and management options, to guide response and preparedness actions, respectively. The training used the modules developed under this project, but were customized for these organizations.