PACIFIC METEOROLOGICAL COUNCIL

SPREP Secretariat of the Pacific Regional Environment Programme

WORLD METEOROLOGICAL ORGANIZATION

"Science to Services for a Resilient Pacific"

Fifth Meeting of the Pacific Meteorological Council (PMC-5) Working Papers

7-9 August 2019
Apia
Samoa

Agenda Item 13.3: Upscaling the Development of Pacific Coastal Inundation Early Warning Forecast Systems

Purpose:

1. To update the Council on the regional progress of coastal inundation early warning system and impact-forecasting development research, methodologies, and successes;

2. To propose that the Pacific Islands Marine and Ocean Services (PIMOS) Panel undertake a regional needs assessment and actively seek funding to replicate, upscale and build upon the recent successes of operational models in Tuvalu and Fiji, thus improving the sustainability and compatibility of these services across the region.

Background:

1. As per the Terms of Reference, the purpose of the PIMOS Panel is to provide technical advice to the PMC on matters related to marine and ocean services, with an emphasis on oceanography and marine meteorology, to strengthen coastal multi-hazard early warning systems (Coastal MHEWS), national preparedness and maritime safety support mechanisms at the national and regional level, as prescribed in the Pacific Islands Meteorological Strategy and other international and regional frameworks such as the Sendai Framework for Disaster Risk Reduction 2015-2030 and the S.A.M.O.A. Pathway.

2. Historically, many countries in the Pacific have been reactive to disasters such as tropical cyclones or tsunamis, often experiencing significant losses in lives and livelihoods. In recent years, the adoption of the Hyogo Framework for Action (HFA) has led to a paradigm shift in disaster risk management from disaster response to disaster preparedness. Risk assessment and early warning systems lay the foundation of disaster preparedness and are well-recognized as live-saving tools for floods, droughts, storms, and other hazards.

3. The primary drivers of inundation in small Pacific Islands and atolls are different than for large continental landmasses thus many of the storm surge models and forecast systems developed for other nations are not fit-for-purpose in the Pacific context.

4. Over the last decade, the Pacific Community (SPC) Geoscience, Energy and Maritime (GEM) Division and a consortium of partners have been at the forefront of the development and implementation of innovative inundation forecast systems and hazard assessments, specifically tailored to Pacific Island countries.

5. The PMC-4 recognised SPC's contributions and recommended that effective pilot studies, models, and decision-making tools be upscaled and further developed for other vulnerable coastal zones in the Pacific and tasked the PIMOS Panel to work with NMHSs to replicate and upscale implementation of MHEWS.

Update:

1. Since the PMC-4 in 2017, progress in system development operationalization, ocean monitoring, research and capacity building has been achieved through a number of pilot projects including:

    a. Recovery Support for Tropical Cyclone Pam project – Tuvalu (funded by German KfW bank)

    - High-resolution offshore wave forecast for all of Tuvalu's 9 atolls; Offshore tide predictions for all atolls; Mean sea level anomaly predictions for all 9 atolls; Defined threshold for inundation warning established;
    - Knowledge transfer: oceanography, wave modelling, wave forecasting, drone survey operation, hazard & impact survey, and coastal monitoring surveys.
    - Two heavy swell warnings have been issued between November 2018 and February 2019 based on forecast system.

    b. Coastal inundation forecasting demonstration project (CIFDP) – Fiji (funded by WMO and Government of Korea)

    - High-resolution offshore wave forecast, tide predictions, mean sea level anomaly forecast developed for Fiji's Coral Coast. Inundation forecast system developed at 1 location (3 more in progress). One Offshore wave buoy deployed to feed into inundation forecast system (1-2 more deployments over next 5 months).
    - Knowledge transfer: oceanography, wave modelling, wave forecasting.
    - Two impact based inundation warnings issued in 2018.

    c. The Pacific Resilience Project (PREP) II – Marshall Islands (funded by the World Bank)

    In progress: Development of an integrated multi-hazard (distant source swell & cyclone) inundation forecast based on the time varying emulator for short and long-term analysis of coastal flooding (TESLA-Flood; Anderson et al., 2018).

    d. Climate Risk and Early Warning Systems (CREWS) project – Tuvalu & Kiribati (funded by WMO)

    In progress: Development of wave, tide, and storm surge models for Tuvalu and Kiribati. Development of impact based inundation (from distant source swell events) forecast system for Tuvalu and Kiribati.

Deployment of 2 real-time wave buoys, one in each country, to support the forecast system.

2. **UFORIC and Research Partnerships**

SPC has been actively involved in the Working Group on Understanding Flooding on Reef-lined Island Coasts (UFORIC). The working group is developing action plans that can be used globally, regionally, and nationally to guide research and development activities related to understanding and predicting inundation along tropical coral reef-lined shorelines over the coming years. The next working group meeting will be hosted in 2020 by SPC GEM Division in Suva.

SPC also maintains active collaboration with a number of research partners and groups including but not limited to: the University of the South Pacific (USP); the French Institute for Research and Development (IRD); the University of Cantabria, Spain; the University of New South Wales, Australia; the University of Hawaii, USA; the Commonwealth Scientific and Industrial Research Organisation (CSIRO); United States Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the Australian Bureau of Meteorology (BoM), the National Institute of Water and Atmospheric Research (NIWA), Deltares, Remote Sensing Technology Center of Japan (RESTEC), etc.

In addition, the SPC Oceanographic Team is contributing to promoting and sharing the science through a number of publications (listed in References below).

3. Whilst a number of Green Climate Fund (GCF) proposals that would help address this priority issue are currently in the pipeline, to date the development of inundation forecast and early warning systems has been largely ad hoc, funded by short-term projects. These can be problematic as they lack coordination, are often not based upon rigorous country needs assessments, and may be challenging to sustain, particularly if they include installation of new equipment.

Recommendations:

The Meeting is invited to:

- **Note** the considerable progress and ongoing work to support early warning systems and coastal inundation impact-based forecasting in the region;

  Recognise the need for tailored coastal inundation forecasting and early warning systems and climate change projections for Pacific Island countries due to their unique bathymetry and hazard exposure;

- **Task** the PIMOS Panel to coordinate the development of coastal inundation forecasting and early warning systems in the region to ensure compatibility of services and best-practice methods tailored to reef-fronted island coastlines are employed;

  Recognise the urgent need for improved coastal inundation MHEWS and impact-based forecasting in an environment of increasing hazard and risk due to climate change;

- **Request** development partners to invest in the replication, upscaling and to further build upon the recent successes of operational models in Marshall Islands, Tuvalu and Fiji, thus improving the sustainability and compatibility of these services across the region.

Links

https://geoblueplanet.org/blue-planet-activities/uforic/

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