



*"Sustainable Weather, Climate, Oceans and Water Services for a Resilient Pacific"*

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## **Fourth Meeting of the Pacific Meteorological Council (PMC-4) Working Papers**

14-18 August 2017  
Honiara  
Solomon Islands

### **Agenda Item 16.3: Coastal Inundation in Fiji and Tuvalu: Operationalising Coastal Hazard and Inundation Information**

#### **Purpose:**

1. Call attention to the risks coastal inundation and storm surge pose to Pacific Island Countries and Territories (PICTs) in the absence of effective early warning systems (EWS);
2. Highlight the work the Pacific Community (SPC) and a consortium of partners have undertaken to operationalise hazard and asset information into impact and risk assessment tools that inform national planning and decision-making processes;
3. Recommend in-situ observations are enhanced and high-resolution models and impact assessment tools upscaled and replicated to strengthen EWS in other PICTs.

#### **Background:**

1. Development of the coastal zones of PICTs often takes place in the absence of evidence-based disaster and climate resilient planning. Communities, businesses, governments and public assets are therefore increasingly at risk from the impacts of coastal hazards such as inundation due to extreme wave, tidal, and storm surge events.
2. Since 2015, and during the 2015-16 El Niño, major inundation events were recorded in Tuvalu, Vanuatu, Kiritimati Island, Majuro, and Fiji. The Kiritimati Island inundation in early January 2016 resulted in the loss of four lives. In Fiji, during Tropical Cyclone Winston (Category 5) waves and sea flooding were responsible for 25% of the 44 casualties<sup>1</sup>. The casualties linked to coast inundation can be attributed to the lack of community awareness around storm surge impacts related to tropical cyclones. The Governments of Tuvalu, Kiribati, Vanuatu, Republic of the Marshall Islands and Fiji have all requested official assistance from SPC to assess the risk of such inundation hazards and recommend measures to reduce their vulnerability.
3. Given the likely climate change scenarios, it is expected that risk will increase as extreme events become more common in PICTs. The Intergovernmental Panel on

Climate Change (IPCC) 2013 report lists wave climate as one of the six major climate drivers for coastal systems<sup>ii</sup>.

4. In recent decades, our understanding of the physical processes causing marine inundation in our mid-ocean small islands has improved. Progress has been particularly evident in the development of computer models that are able to forecast inundation at reef-fringed coastlines. Moreover, technological advances in, for example, geographic information systems (GIS) are making impact-forecasting more accessible and meaningful.
5. PICTs have not benefited as much as they could have from this progress in EWS and associated impact tools, and significant gaps remain. Some key challenges include, (i) access to wave observations, (ii) availability of near-shore bathymetry/topography data, (iii) availability of post disaster / impact data, and (iv) building and maintaining the capacity of National Meteorological and Hydrological Services (NMHSs) to operate and utilise EWS.
6. The Pacific Islands Marine and Ocean Services (PIMOS) Panel aims to help NMHSs to bridge these gaps guided by advice from a consortium of regional partners and experts. This will also require improving access to data and introducing the appropriate tools with the benefit of technical backstopping services at the regional level where necessary.
7. Several small-scale inundation forecasting projects have been undertaken and are currently underway in the region. These pilot projects are providing important insights and lessons learned which can be upscaled and used to build regional forecasting capacity.

**Update:**

1. The European Union-funded *Changing Waves and Coasts in the Pacific* (WACOP) project (2012-2016) implemented by SPC, provided the first formal assessment of baseline wave climate and climate change effects on wind-waves at scales relevant to PICTs. In addition, it produced more than 200 reports, including Wave Climate Reports for more than 150 locations throughout the Pacific and wave atlases for five countries. The analysis also predicted wave parameter change associated with two greenhouse gases emissions scenarios in a number of locations.
2. Detailed morphology, bathymetry, and habitat data was collected to produce a wave model for Maui Bay fringing reef system on Fiji's Coral Coast. The high-resolution model provides detailed insight into how waves interact with the ocean bottom and with the shallow coral reefs surrounding the islands. Most existing models in the region, particularly those using satellite-derived bathymetric data, are too coarse to account for such reef systems.
3. Following on from WACOP, under the *Coastal Inundation Forecasting Demonstration Project-Fiji* (CIFDP-F), the World Meteorological Organisation (WMO) is working in partnership with SPC, the Fiji Meteorological Service (FMS) and Korean Meteorological Administration (KMA) to develop a suite of models that can provide EWS for Viti Levu in Fiji. SPC is currently testing and validating the models and planning a capacity building program to equip and train FMS to internalise this coastal inundation early warning system within the next year.
4. In addition, through the *Pacific Resilience Programme* (PREP), *Pacific Risk Tool for Resilience* (PARTneR) and *PacSAFE* projects in collaboration with the World Bank,

National Institute of Water and Atmospheric Research (NZ) and Geoscience Australia, respectively, SPC is using the data and hazard maps produced to develop risk assessment tools that contextualise risk information for planners. The tools are interactive and intuitive, allowing the user to consider different disaster scenarios to simulate potential damage and disruption to services. The tools provide the platform to introduce impact forecasting as an early warning service.

### Recommendations:

The Meeting is invited to:

- **Note** the urgent need to improve technical capacity and knowledge-base in order to build resilience against coastal hazards and marine inundation in the region;
- **Recognise** the significant contribution that SPC and numerous partners have made to develop tools supporting NMHSs to operationalise coastal hazard information for EWS, as well as impact assessment tools, strengthening preparedness and response;
- **Recommend** that effective pilot studies, models and decision-making tools be upscaled and further developed for other vulnerable coastal zones in the Pacific;
- **Request** the PIMOS panel to support the existing collaborative approach and to work with interested NMHSs to replicate and upscale the implementation of multi-hazard early warning systems and impact forecasting for coastal areas.

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### Attachment

- PacSAFE brochure.

### Links

- WACOP <http://wacop.gsd.spc.int/index.html>
- CIFDP-F <https://public.wmo.int/en/projects/coastal-inundation-forecasting-demonstration-project-fiji-cifdp-f-development-of-integrated>
- PacSafe <http://services.gsd.spc.int/pacsafe/index.html>

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<sup>i</sup> SPC, 2016. Tropical Cyclone Winston Coastal Inundation and challenges of forecasting wave/storm surge run-up.

<sup>ii</sup> IPCC, 2013. <http://www.ipcc.ch/report/ar5/wg1/>