A MULTI-SCALE COASTAL STORM HAZARDS EARLY WARNING SYSTEM FOR AUSTRALIA

Christopher Leaman, University of New South Wales Sydney, c.leaman@unsw.edu.au
Mani Thran, Australian Government Bureau of Meteorology, mandi.thran@bom.gov.au
Daniel David, University of Western Australia, daniel.david@research.uwa.edu.au
Ian Turner, University of New South Wales Sydney, ian.turner@unsw.edu.au
Mitchell Harley, University of New South Wales Sydney, m.harley@unsw.edu.au
Nashwan Matheen, University of New South Wales Sydney, a.abdulmatheen@unsw.edu.au
Michael Cuttler, University of Western Australia, michael.cuttler@uwa.edu.au
Jeff Hanson, University of Western Australia, jeff.hansen@uwa.edu.au
Kristen Splinter, University of New South Wales Sydney, k.splinter@unsw.edu.au
Michael Kinsela, University of Newcastle, michael.kinsela@newcastle.edu.au
Ryan Lowe, University of Western Australia, ryan.lowe@uwa.edu.au
Diana Greenslade, Australian Government Bureau of Meteorology, diana.greenslade@bom.gov.au
Stefan Zieger, Australian Government Bureau of Meteorology, stefan.zieger@bom.gov.au
Andy Taylor, Australian Government Bureau of Meteorology, andy.taylor@bom.gov.au

INTRODUCTION

Coastal storms pose a threat to livelihoods and assets along Australia's coastlines. By delivering timely information about approaching coastal storms, early warning systems (EWSs) can enhance community preparedness and inform risk-reduction measures, with the goal of reducing potential impacts to property, critical infrastructure, and loss of life. Worldwide, existing coastal hazard EWSs primarily center around the forecasting of coastal flooding risks, which predominantly occur along surge-dominated coastlines. However, many of Australia's densely populated coastlines are wave-dominated, where erosion hazards feature more prominently. This pilot project has developed a multi-scale, coastal hazard EWS capability for Australia that uses state-of-the-art scientific methods for predicting both erosion and flooding impacts caused by coastal storms.

Development of the prototype system has been underpinned by consultation and guidance provided by potential end-users, to inform them of the nature and timing of erosion hazard predictions. It is envisaged that this prototype system will now operate in two test regions on the east and west coasts of Australia and will facilitate a future wide-scale deployment, with the goal of enhancing community preparedness to coastal storms.

METHODS AND RESULTS

The EWS operates simultaneously at two spatial scales: 1) a regional scale (~100km length of coastline) over which the type and intensity of coastal storm hazard(s) are predicted every 100 m alongshore; and 2) a local "hotspot" scale (e.g., a specific site) at which a range of quantitative indicators of open-coast erosion and flooding are predicted.

On a rolling 7-day forecast horizon, marine wave and water level forecasts are provided by the Australian Bureau of Meteorology (BoM). Wind-wave forecasts are generated using the AUSWAVE model, which is then enhanced using a refined nearshore mesh specific for each region and hotspot. Storm surge forecasts are produced using BoM's National Storm Surge (NSS) system.

Regional-scale beach erosion and coastal flooding hazard forecasts, with a 100 m alongshore resolution, are determined using a new Storm Hazard Matrix. This was identified as a key end-user need and has been developed for this project. This approach uses simple and readily available parameters to classify hazards into one of sixteen regimes of varying type and intensity, each likely to require different management responses.

It is anticipated that local-scale hazard forecasting can be implemented at pre-determined locations where the historic, present, or future risk of coastal hazards are high. At these locations, the process-based coastal erosion model *XBeach* (2DH, surf beat mode) is used to provide a quantitative assessment of the extent of erosion and total water level (surge + wave runup) during the forecast event. From this, a range of hazard thresholds and indicators can be locally defined to match local coastal managers' needs. Although computationally expensive, this approach provides coastal managers with a greater level of detail of potential hazards in high-risk locations.

The EWS workflow is managed using the Delft-FEWS platform, with Python packages used for pre- and post-processing tasks. The forecasts generated are available to coastal managers using the FEWS platform but are also imported into an online portal. An example of the forecast product provided to coastal managers is shown in Figure 1. Continued development of the system, along with the collection of validation data, is underway.

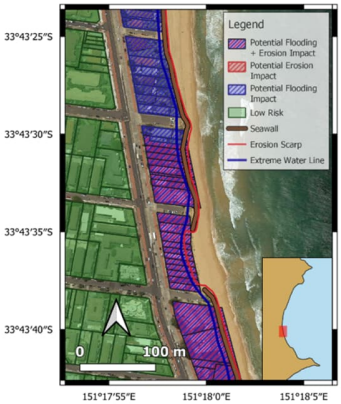

Figure 1. Local-scale component of the pilot EWS.