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TITLE: Widespread inundation of Pacific islands triggered by distant-source wind-waves

AUTHOR: ['Ron Hoeke', 'Kathleen L. McInnes', 'Jens C. Krüger', 'Rebecca McNaught', 'John Hunter', 'S Smithers']

ABSTRACT:

It is essential to understand the causes of sea level extremes in order to anticipate and respond to coastal flooding (inundation), and to adapt to sea level rise. We investigate a series of inundation events which occurred across the western Pacific over several consecutive days during December 2008, causing severe impacts to five Pacific Island nations. These events were not associated with commonly identified causes: tropical cyclones or unusually large astronomical tides. Instead, the dissipation of wind-waves generated by distant extra-tropical cyclones (swell) was the main cause, although regional sea level variability, including recent accelerated rise, significantly contributed to the severity of impact experienced at many locations. The implication of recent sea level rise in the severity of these events suggests that episodic swell will increasingly cause major impacts of the nature described herein, although such impacts will continue to be modulated by El Niño/Southern Oscillation (ENSO) variability in the region. Significantly, tide gauges recorded little evidence of extreme sea levels during the event, implying that causes of extreme sea levels inferred from tide gauge analysis are unlikely to include this important cause of inundation. Therefore, any assessment of inundation risk predicated on tide gauge information (as well as larger scale sea level information such as satellite altimetry) may fail at many locations in the Pacific. To be accurate, such efforts must include information on the relationship between wave climate, wave forecasts and local extreme water levels. Further development of related early warning systems will become more pertinent as modern SLR continues to add to the magnitude of extremes.

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