

## **Storms in an Ocean of Islands: Understanding the Contribution of Tropical Cyclones on Island Landscape Evolution**

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Although uncertainties remain, many scientists now believe that tropical Pacific regional climates may experience more frequent or sustained El Niño-like conditions in the future, owing to global ocean warming. In consequence, there are potential implications for changes to the current spatial patterns of tropical cyclone activity, with the possibility of increased storm intensities, shifts in mean positions of storm genesis, and other potential variations in track behaviour, all of which may affect the vulnerability of South Pacific island communities to these extreme meteorological events. In this talk, focus is directed towards examining several recent tropical cyclones and the nature of their physical impacts on island landscapes. Fieldwork at selected locations in Vanuatu, the Cook Islands and Fiji presents a range of studies across different types of island settings (such as volcanic coasts, barrier reefs and low-lying atoll islets) to elucidate some of the principal environmental changes felt.

Landscape effects of the following tropical cyclones are investigated in detail: TC Ami which struck Vanua Levu Island in Fiji in January 2003, TC Percy that devastated Pukapuka Atoll in the Northern Cook Islands in March 2005 and TC Funa that traversed parts of northern Vanuatu in January 2008. Each of these storms has caused long-lasting physiographic effects through the action of powerful waves, storm surge, mass movements and river floods. Off Vanua Levu's northern coast, coral boulder fields were emplaced on barrier reefs 8-25 km offshore due to reef-edge damage. Examination of this coral detritus may provide clues on the site-selectivity of reef damage and the wave energy needed for clast production and entrainment. For the tiny coral islets of Pukapuka Atoll the major problem has been saltwater contamination of the very limited existing groundwater resources, which required approximately two years to recover. On Ambae Island in Vanuatu, wave-induced beach erosion has exacerbated shoreline retreat, threatening coastal forest, agriculture and infrastructure development.

Yet, island landscapes can also benefit from the changes brought about by cyclone-driven geomorphic processes. Thick alluvial sediments deposited by floods on valley floors provide rich soils for sugarcane production in Fiji, sustaining local

economies. Atoll islands are nourished by reef-derived debris during storms, increasing their longevity. Elsewhere, coastlines have experienced progradation rather than erosion, depending on local physiographic controls. A better understanding of these and similar landscape responses to geomorphic processes during storms therefore helps build up human resilience, which is an important form of adaptation to natural hazards for island communities.



Figure. Left: large coral boulder emplaced on the outer edge of the Great Sea Reef off the northern coast of Vanua Levu Island in Fiji by storm waves generated by cyclone Ami in January 2003. Right: vegetation damage and shoreline retreat on Ambae Island in Vanuatu, after sediment mobilisation during cyclone Funa in January 2008.