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Hurricanes in the South Pacific Ocean; Characteristics and Consequences for Island Environments

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The most extreme meteorological conditions in the tropical South Pacific occur during hurricanes (severe tropical cyclones) and small islands are vulnerable to their effects. Hurricanes are relatively infrequent in the south west Pacific averaging 9.4 events per season, but in optimal conditions they form quickly and bring violent winds, torrential precipitation, destructive waves, dangerous storm surges and river flooding. This paper outlines the climatology of South Pacific hurricanes, especially their formation, origin and storm characteristics (e.g. frequency, size, structure, track movements and longevity). The behaviour and impacts of recent catastrophic hurricanes are illustrated, such as *Zoe* in the outer Solomon Islands in December 2002, *Ami* which struck northern Fiji in January 2003, and *Heta* which devastated the tiny Pacific nation of Niue in January 2004.

Different types of Pacific islands, e.g. volcanic, limestone and coral islands, suffer a range of environmental effects during hurricanes. If a storm makes landfall on a high volcanic island, the mountainous terrain causes orographic uplift of the rain bands, delivering exceptional and widespread precipitation. The normal arrangement of rain clouds is in a spiral pattern with gaps of clear weather between heavy downpours, but vertical shearing may distort the cloud pattern, distributing moisture unevenly and making localized rainfall prediction difficult. Several hurricane examples demonstrate the magnitude of storm surges and coastal inundation, shoreline erosion, destruction of coral reefs, landslides and denudation, and large river floods. All of these physical impacts cause human hardship, especially for the poor, and place difficult economic burdens on developing Pacific island states with limited resources.

Since hurricanes are often associated with the ENSO phenomenon, this link is discussed. During the developmental phase of El Niños, hurricanes affecting South Pacific islands are generated as the eastward-migrating pool of warm ocean water passes across the north. Regarding future climate change in the South Pacific, many uncertainties remain. However, the region is likely to experience more sustained El Niño-like conditions, owing to global atmospheric and ocean warming. Implications for hurricane characteristics include the potential for increased intensities, greater storm numbers, changes to the present spatial distribution of storm origins and farther poleward travel after vortex formation. Such changes will only worsen the vulnerability of island nations to hurricane impacts, so it is important for climate scientists to investigate evolving hurricane behaviour in the South Pacific, in order to advance appropriate strategies for adaptation.