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Wave-driven Circulation in a Coral Reef, Lagoon, and Pass System

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Wave driven circulation and fluxes through tropical lagoons can have significant effects on the transport, dispersal, retention, and fate of many coral reef biota. This study considers these physical mechanisms in Paopao Bay, on the north shore of Moorea, French Polynesia. This site is particularly well suited for isolating wave driven flow dynamics as it has a strong yet seasonally variable wave climate, and is nearly tideless due to small tidal prism and close proximity to major amphidromic points in the South Pacific. Year long time-series data were collected with an array of acoustic current meters and thermistor strings, spanning the forereef, reef crest, lagoon, and reef pass. Wave statistics were derived from upward-looking directional ADCP measurements just offshore of the reef complex. Fluxes onto the reef, through the lagoon, and out the pass were obtained from current profile data. Results show the strong coupling between incident wave forcing and lagoonal circulation, and that fluxes are strongly episodic, coinciding with large swell events.