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Indirect Sensing of Equatorial Currents by Means of Island Pressure Measurements

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ABSTRACT

From November 1982 until March 1983, an experiment was conducted at Jarvis Island (0.4°S, 160°W) in order to study the energetics of swift currents encountering a small equatorial island, and to determine the relationship between the free stream zonal velocity and the pressure drop from the upstream stagnation point to the island wake. Vertical profiles of velocity and temperature show a conversion of kinetic to potential energy as water in the eastward flowing Equatorial Undercurrent approaches the upstream stagnation point. An energy deficit is observed in the wake region, and the energy drop from the upstream stagnation point to the downstream end of the island amounts to about 1.3 times the free stream kinetic energy. The measurements are consistent with laboratory studies of high Reynolds number flow and with a previous density survey at Jarvis Island.

Temperature–pressure recorders were set on the east and west sides of the island at nominal depths of 10 and 150 m. West-to-east pressure differences were converted to time series of free stream velocity using calibration data from the velocity-temperature profiles. These indirectly measured velocities agree reasonably well with a set of direct measurements made by E. Firing at 159°W on the equator. They show the relaxation of the anomalous oceanographic conditions of the 1982–83 El Niño event, including the reappearance of the South Equatorial Current and the Equatorial Undercurrent.

Pairs of sea level stations at small equatorial islands are suggested as a practical means of obtaining long time series of zonal velocity and also to provide improved estimates of open ocean sea level.

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