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Giant reef-top coral boulder deposits as evidence for palaeo-extreme wave events on Makemo Atoll, Tuamotu Archipelago, French Polynesia

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The history of extreme wave events in the Tuamotu Archipelago of French Polynesia in the central South Pacific remains poorly understood, even though giant wave-deposited coastal boulders were identified in the region decades ago. Numerous large coral boulders deposited on the reef flats of Makemo Atoll (16.56˚S, 143.73˚W) were investigated in this study in an attempt to understand the characteristics of extreme palaeo-events in the region. The positions, dimensions and orientations of 286 boulders were recorded along over 15 km of the northern coastline of the atoll. The biggest clast measures >130 m^3 in size and weighs >340 tonnes. The size-distribution of the Makemo boulders suggests that these huge clasts were transported by extreme storm waves. The long-axes orientations of boulders are mostly aligned parallel to sub-parallel to the shoreline. However, a relationship between boulder size and orientation was not found, suggesting that the orientation of boulders is not representative of transport mode. By using previously developed hydrodynamic equations, it is estimated that a flow velocity of at least 6.6 m/s is needed to slide the largest boulder on a flat surface, while a minimum of 21.5 m/s is required to lift this boulder onto the platform from a lower offshore position. This data set therefore provides clues on the power of unrecorded pre-historical wave events, which should assist in improving hazard assessment for exposed coastlines in the central Pacific Islands.