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Climate-driven changes in tropical cyclone intensity shape dune activity on Earth's largest sand island

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I use historical aerial photos and detailed climatic time series to show the geomorphological consequences of a dramatic decrease in tropical cyclone frequency and intensity in eastern Australia since the early 1980s, leading to rapid dune stabilization on the Earth's largest sand island and a World Heritage Site, Fraser Island, Australia. Climate warming is generally expected to increase the intensity of tropical cyclones. However, some models predict that tropical cyclones' frequency will decrease in a warmer world. Here, I show that tropical cyclone frequency and intensity significantly declined in eastern Australia (south of 20°S) since the early 1980s, corresponding with the shift to a positive phase of the Inter-decadal Pacific Oscillation (in 1977) and an increased frequency of El-Niño events since 1982-83. Using remote sensing techniques I show that most of Fraser Island's sand blows were advancing inland in the period between 1948-1982, and that tropical cyclones in that period were strong enough to initiate small sand blows (< 1 ha). However, the decline in wind power since 1982 resulted in the contraction of Fraser Island's sand blows' area size, at an average rate of 0.5% of their area per year. This study demonstrates the importance of global changes in wind power, in addition to studied effects of changes in temperature, rainfall and sea level. In areas where tropical cyclones frequency and intensity are increasing, dune activation may be expected.