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Tracing historical tropical cyclones and the 1883 Krakatoa tsunami in short-lived geological archives of the Ashburton Delta (NW Australia)

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Records of coastal geological archives are discontinuous. They store traces of both episodic and long-term processes as particular depositional landforms, deposits or erosional features. In particular the identification and interpretation of episodic high-energy coastal flooding due to tropical cyclones (TCs) and tsunamis is associated with a number of difficulties, including the spatial and temporal variability of geological records as well as the application of different dating techniques. In addition, the differentiation between tsunami and storm deposits remains challenging, notably where modern deposits and/or historical reports on the event are absent. Analysing modern (or historic) analogues for which documentation of process-specific parameters and/or geomorphic and sedimentary effects are available contributes to a better understanding of their sedimentary signatures and related depositional processes. These studies are key components to unravel the fossil record and the history of past events.

The NW coast of Western Australia (WA) is highly vulnerable to extreme wave events. On average 1–2 TCs impact the W Australian coast per year, and ten historically documented tsunami events are recorded since 1858, including the tsunami following the 1883 Krakatoa eruption. However, no sedimentary evidence on this particular event has been presented yet, and little is known about the geological imprint of both (pre)historic TCs and tsunamis in NW Australia in general. Here we present new data on the sedimentology and chronostratigraphy of historical washover events found in short-lived geological archives of the Ashburton River delta (NW part of Western Australia), where clearly distinguishable traces of both TCs and the 1883 Krakatoa tsunami are recorded. We aim at (i) establishing (at least locally valid) sedimentary criteria differentiating between TCs and tsunami deposits; (ii) presenting an OSL-based local chronostratigraphy with direct relation to historical events; and (iii) discussing the archive's overall significance for palaeoevent research. Our results show that the presented archive is discontinuous on different spatial and temporal levels, related to the episodic nature of extreme wave events and the general variability of geological archives.