

Metadata for *Response of a fringing reef coastline to the direct impact of a tropical cyclone*

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Table 1. Description of the fields needed to describe the creation of your dataset.

Title of dataset	Response of a fringing reef coastline to the direct impact of a tropical cyclone
URL of dataset	The data will be provided at https://doi.org/10.5281/zenodo.1162945
Abstract	<p>Tropical cyclones generate extreme hazards along coastlines, often leading to losses of life and property. Although coral reefs exist in cyclone-prone regions globally, few studies have measured the hydrodynamic conditions and morphological responses of reef-fringed coastlines to tropical cyclones. Here we examine the impact of Tropical Cyclone Olwyn on a section of Australia's largest fringing reef (Ningaloo Reef) using <i>in situ</i> wave and water level observations, topographic surveys, and numerical modeling. Despite forereef significant wave heights reaching 6 m and local winds of 140 km hr^{-1}, average beach volume change was only $-3 \text{ m}^3 \text{ m}^{-1}$. The results indicate that this erosion was due to locally-generated wind waves within the lagoon rather than the offshore waves that were dissipated on the reef crest. A comparison of these volume changes to observations of tropical cyclone impacts along exposed sandy beaches quantitatively demonstrates the substantial coastal protection reefs can provide against extreme storms.</p>
Keywords	tropical cyclone, fringing reef, numerical model, beach morphodynamics, Ningaloo Reef
Dataset lead author	Michael Cuttler (corresponding author)
Position of data author	Research Associate
Address of data author	UWA Oceans Institute and School of Earth Sciences The University of Western Australia, M004 35 Stirling Highway, Crawley, WA, 6009.
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Primary contact person for dataset	Same as author
Position of primary contact person	Same as author
Address of primary contact person	Same as author
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Organization associated with the data	The University of Western Australia
Usage Rights	Publicly available and free to use
Geographic region	The dataset was collected at Point Jurabi, Western Australia. Point Jurabi is part of Ningaloo Reef, Australia's largest fringing reef, located in the northwest of Western Australia.
Geographic coverage	Coordinates of instrument locations are included in the dataset
Temporal coverage - Begin date	Pressure data was collected from December 2014 Beach survey data was collected in July 2014, March 2015, October 2015, and June 2016
Temporal coverage - End date	Pressure data was collected until March 2015 Beach survey data was collected in July 2014, March 2015, October 2015, and June 2016
General study design	A field and numerical study of the effects of a tropical cyclone impact on beach morphology in a fringing reef environment.
Methods description	<p>A cross-shore transect of pressure sensors (RBRVirtuoso) were deployed from the forereef (18 m depth) to near the shoreline. These sensors logged continuously at 1Hz until recovery following the passage of TC Olwyn. Pressure records were downloaded using the Ruskin software available from RBR. Atmospheric pressure and tidal elevation were removed; spectral analysis was then conducted on the pressure time series to determine wave parameters (wave height, period, etc).</p> <p>Beach morphology was measured using a backpack-mounted differential GPS receiver. Measurements were downloaded and imported to GrafNav software. GrafNav was then used to convert the GPS measurements from ellipsoid height to heights relative to the Australian Height Datum (AHD) using the AusGeoid09 model. Elevation measurements were then organized into triangulated irregular networks and converted to a grid to produce a 1 m cell-size topographic surface of the surveyed beach using ArcGIS v.10.3. Successive surfaces were differenced to determine volume change between surveys.</p>
Laboratory, field, or other analytical methods	The pressure sensor observations were used to validate a coupled wave-circulation numerical model (Delft3D-SWAN). Three circulation domains were used ('outer', 'inner', and 'shore') and ranged from 50x50 m to 5x5 m resolution, respectively. These domains were two-way coupled using domain decomposition. Two wave domains were used, with resolutions corresponding to the 'outer' and 'inner' circulation domains (i.e. 50x50 and 17x17 m, respectively). Simulations were run for 31 hours which captured the approach, peak, and passage (relative to the cross-shore pressure sensor array) of TC Olwyn. The same model set up was run using wave observations from August 2013 to compare TC Olwyn conditions to typical incident conditions at the study site. Model settings are included in the dataset below and the supporting information of the manuscript.
Quality control	<p>Pressure readings from when instruments were out of water were removed prior to analysis.</p> <p>Low quality (e.g. too few satellites) GPS measurements were removed from the dataset prior to analysis.</p>
Additional information	N/A

Description of files included in the dataset

NUMERICAL SIMULATIONS

Dataset filename	Description
FullModel.zip	This .zip file contains all model input files (including model setup files, boundary conditions, etc) and output files from the coupled Delft3D-SWAN model. This dataset is for the simulation of TC Olwyn with wind enabled in both modules (i.e. wind-driven currents in Delft3D-FLOW and wind growth enabled in SWAN).
FlowWindOnly.zip	This .zip file contains all model input files (including model setup files, boundary conditions, etc) and output files from the coupled Delft3D-SWAN model. This dataset is for the simulation of TC Olwyn with wind enabled in Delft3D-FLOW only (i.e. no wind growth in SWAN).
Tant2013.zip	This .zip file contains all model input files (including model setup files, boundary conditions, etc) and output files from the SWAN model. This dataset is for the simulation of a typical swell event incident to the study site. The conditions in this simulation are derived from <i>in situ</i> observations recorded in August 2013.

BEACH SURVEYS

Dataset filename	Description
july_clip2.txt	This text file is the gridded elevation data from the backpack-mounted differential GPS surveys for July 2014 (the pre-cyclone survey). Elevation data are measured in meters above the Australian Height Datum (AHD). The first six lines of the text file provide information about the size of the grid (e.g. number of columns and rows), the physical location of lower-left corner of the grid, and the no data value (-9999).
mar_julyclip.txt	This text file is the gridded elevation data from the backpack-mounted differential GPS surveys for March 2015 (the immediate post-cyclone survey). Elevation data are measured in meters above the Australian Height Datum (AHD). The first six lines of the text file provide information about the size of the grid (e.g. number of columns and rows), the physical location of lower-left corner of the grid, and the no data value (-9999). This grid has been clipped so that it covers the same spatial extent as the data in 'july_clip2.txt'.
oct_julyclip.txt	This text file is the gridded elevation data from the backpack-mounted differential GPS surveys for October 2015 (the first post-cyclone recovery survey). Elevation data are measured in meters above the Australian Height Datum (AHD). The first six lines of the text file provide information about the size of the grid (e.g. number of columns and rows), the physical location of lower-left corner of the grid, and the no data value (-9999). This grid has been clipped so that it covers the same spatial extent as the data in 'july_clip2.txt'.
june_julyclip.txt	This text file is the gridded elevation data from the backpack-mounted differential GPS surveys for June 2016 (the second post-cyclone recovery survey). Elevation data are measured in meters above the Australian Height Datum (AHD). The first six lines of the text file provide information about the size of the grid (e.g. number of columns and rows), the physical location of lower-left corner of the grid, and the no data value (-9999). This grid has been clipped so that it covers the same spatial extent as the data in 'july_clip2.txt'.

PRESSURE SENSORS

Dataset filename	Description
P1_TANT01S01.rsk	This is the raw pressure time series collected at the forereef pressure sensor. Pressure readings were collected at 1 Hz from 14 December 2014 to 19 March 2015. This file is able to read and opened by downloading Ruskin and/or RSKTools for Matlab – both are freely available from: https://rbr-global.com/products/software
P2_TANT01S02.rsk	This is the raw pressure time series collected at the reef flat pressure sensor. Pressure readings were collected at 1 Hz from 14 December 2014 to 19 March 2015. This file is able to read and opened by downloading Ruskin and/or RSKTools for Matlab – both are freely available from: https://rbr-global.com/products/software
P3_TANT01S03.rsk	This is the raw pressure time series collected at the outer lagoon/back reef pressure sensor. Pressure readings were collected at 1 Hz from 14 December 2014 to 19 March 2015. This file is able to read and opened by downloading Ruskin and/or RSKTools for Matlab – both are freely available from: https://rbr-global.com/products/software
P4_TANT01S04.rsk	This is the raw pressure time series collected at the lagoon pressure sensor. Pressure readings were collected at 1 Hz from 14 December 2014 to 19 March 2015. This file is able to read and opened by downloading Ruskin and/or RSKTools for Matlab – both are freely available from: https://rbr-global.com/products/software
P5_TANT01S05.rsk	This is the raw pressure time series collected at the inner lagoon (most shoreward) pressure sensor. Pressure readings were collected at 1 Hz from 14 December 2014 to 19 March 2015. This file is able to read and opened by downloading Ruskin and/or RSKTools for Matlab – both are freely available from: https://rbr-global.com/products/software
PressureSensors.xlsx	Coordinates of the cross-shore pressure sensor array; coordinates are Easting/Northing, relative to Geocentric Datum of Australia 1994 (GDA94)/Map Grid of Australia (MGA) zone 50. Units are meters.