Department of Science, Information Technology, Innovation and the Arts

Beach Surveys and Data Assessment, Gold Coast Region

COPE Data – Coolangatta Beach

Coastal Impacts Unit

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1. Introduction

1.1 Preamble

The Coastal Observation Program Engineering (COPE) data collection system was designed to collect data at selected sites along the Queensland coast to assist in the understanding of coastal processes and the way these processes affect the coast line. COPE was managed for the Beach Protection Authority (BPA) (now disbanded) by the Department of Harbours and Marine up until 1989 and then by the Coastal Management Branch in what is now the Department of Environment and Heritage Protection (DEHP). COPE data was progressively analysed and reports at selected sites were compiled up to mid 1996[1] when the program was abandoned. After that date very little further analysis was carried out, however all data was archived for possible future use. Guardianship of this data rests with the Coastal Impacts Unit of the Department of Science, Information Technology, Innovation and the Arts (DSITIA).

For this report, raw data was provided by DSITIA for Coolangatta Beach – COPE Site 107. This data had not been pre-processed to identify errors in the recordings and/or errors from the transfer of the data from the recording sheets to the computer data file.

In December 2013, the Coastal Impacts Unit of DSITIA commissioned GHD to compile a report on the COPE data from the Coolangatta Beach site, located approximately halfway between Dutton St and Warner St. The report is modelled on the Mooloolaba 2 site report compiled in 2010 by GHD for the Sunshine Coast Regional Council (SCRC).

DSITIA provided the following data:

1. Recorded raw data in the form of a text file – this was data compiled directly from the recording sheets;
2. Sieve data from the analysis of the sand samples collected by the observers at the site;
3. Beach profile data collected by the observers at the site and subsequent data collected by staff from DSITIA at Deagon; and
4. Photographs and other relevant information about the Coolangatta Beach COPE Station extracted from the BPA files.

GHD, through its Principal Coastal Engineer, Paul O'Keeffe, a former engineer to the BPA, was able to source other background information on the COPE program and make assessments of the data analysis based on first-hand experience with the COPE program.

In addition, the BPA's Beach Conservation newsletters were reviewed for any articles on the COPE program relating to the Coolangatta Beach site. Articles specific to the Coolangatta Beach site are reproduced in Appendix B.

Reference documents and technical papers that have been used to assist in the preparation of this report are listed in Section 4.

[1] This date concurs with the recollection of Paul O'Keeffe (GHD) and Sel Sultmann (DEHP), Coastal Engineer and Dune Conservationist respectively for the BPA at the time that the COPE program was finalised.

1.2 The Program

The BPA required basic data on the behaviour of Queensland's beaches in order to provide evidence based coastal management advice to Local Authorities. The COPE project aimed to collect information on wind, waves and beach behaviour in areas where extensive investigations were not practical and where otherwise little or no data existed.

The project was based on the recruitment of volunteer observers who were prepared to record a series of basic parameters daily for at least a three year period. The COPE project was operational from late in 1971 to about mid-1996[2] .

1.3 Site Selection

In selecting a site for a COPE station, consideration was given to:

1. The general shoreline configuration and the possibility of extrapolation of data to other adjacent beaches;
2. The distribution of stations along Queensland's coastline; and
3. The need to correlate the COPE data with planned or existing data collection programs.

1.4 Instrument

The COPE observers were supplied with a basic kit of recording instruments including:

- 30 m tape measure;
- Wind meter;
- Stop watch;
- 2.0 m measuring sticks;
- Recording forms;
- Fluorescent dye;
- 1.5 m support pole for level (as suggested by Instructions for filling out COPE recording form); and
- Hand level (as suggested by Instructions for filling out COPE recording form)

A graduated reference pole was usually installed on the beach to serve as the base point for all measurements in plan and the control for vertical levelling.

1.5 Observers

The majority of COPE observers were volunteers. Some stations were also operated by Government and Local Authority employees who carried out the observations as part of their official duties.

[2] Refer previous footnote

1.6 Accuracy

Individual observers differed in their subjective assessment of the various parameters recorded as part of the COPE program. Wave parameters such as height, and angle of approach together with surf zone width and the location of vegetation line all required visual assessment. The accuracy of recorded details varied from observer to observer and possibly from recording to recording. Although the BPA was confident that all observers made their observations to the best of their ability and accepted these observations without adjustment, the existence of random and non-random errors in the recorded data was to be expected.

Problems associated with the use of data containing these errors are minimised in a number of ways as follows:

1. Regular visits were made to the COPE stations by the BPA's COPE Field Officer to provide a check on any bias introduced into the recordings by incorrect observation procedures.
2. It was determined that, with a large number of observations taken on a regular basis, a reasonable assessment can be made of the average values of the observed parameters provided the observation errors are random. A minimum recording period of three years was adopted for the analysis and publication of the data, in order to minimise the effects of random errors.
3. Five day moving averages are applied to observations of the various beach width and foreshore slope parameters to filter out random errors.
4. Pre-processing of the raw data was undertaken to remove obvious errors from either recording errors and/or or errors from the transfer of the data from the recording sheets to the computer data file. For this report, these errors and how they were corrected have been documented in the Data Presentation section.

For these reasons, the BPA concluded that published COPE data can be used with confidence provided the above inherent limitations are recognised.

1.7 Presentation of Data

The purpose of this report is to present COPE data for Coolangatta Beach for the 15 year period from 1981 to 1995, and the continued profile data supplied by DSITIA from 1995 – 2010 in a useful statistical form.

The 15 year period can be considered to be representative of the long term average meteorological condition and the statistics presented on wind, wave and beach movements can be regarded as typical of the ambient conditions. However, this recording period is too short to be representative in terms of the average occurrence of extreme events such as cyclones and floods, and this should be taken into account when consideration is given to the influence of such events on trends of long term beach behaviour.

2. Station Particulars

2.1 Location

Coolangatta Beach is located on the Gold Coast and is situated approximately 100 km south of Brisbane on the South East Queensland coastline. The beach is approximately 700 m long extending from west of Snapper Rocks to east of Kirra. The location of the Coolangatta Beach COPE station is roughly halfway between Warner and Dutton Street, 200 m south of the groin, as shown on Figure 1a and Figure 1b.

2.2 Observers

The observers for the Coolangatta Beach site were students and teachers from the local Coolangatta Special School, led by Principal Ken Lindley. Their retirement from the program occurred on 19 May 1995 due to a reduction in staff employed at the school.

Coolangatta Special School has recorded COPE observations at Coolangatta Beach since September 1981. Students are shown measuring the foreshore slope, under the guidance of teacher Mr Phil Adams.

2.3 Reports from Beach Conservation

Beach Conservation was the title of the newsletter of the Beach Protection Authority of Queensland and was published quarterly between September 1970 and June 1990. Various aspects of the COPE program were frequently featured in the newsletter including two main articles on the operation of the program in April 1977 (Issue No 27) and June 1990 (Issue No 69). Relevant articles that are related to the Coolangatta Beach COPE station site have been extracted and are reproduced in Appendix B.

2.4 Site History

Listed below is information compiled from the BPA files for this site, including details of the installation and maintenance of the COPE pole.

- 1 September 1981 – Observations commenced;

- 20 April 1982 - COPE pole installed; and
- 19 May 1995 – Observations ceased.

Photo 1: Coolangatta Beach COPE Pole, 10 August 1995

2.5 Observed Parameters

The observers at this station recorded the majority of observations in the middle part of the day between 9am and 3pm at the beginning of the recording period, and earlier in the day between 6am and 11am in the last half of the recording period.

From the commencement of the program on 1 September 1981 until 12 March 1986, the old format recording sheet in Figure 2a (refer Section 6) was used with the following information being recorded:

- Wave period (s);
- Wave height (m);
- Wave angle at breaker (degrees);
- Wave type;
- Surf zone width (m);
- Presence of offshore bar;
- Wind speed (kn);
- Wind direction (cardinal direction);
- State of tide;
- Berm elevation (m);
- Distance to berm (m);
- Berm elevation (m);

- Distance to vegetation (m);
- Foreshore slope (degrees);
- Longshore current speed (m/min);
- Longshore current direction; and
- Sand level at COPE reference pole (m).

From 13 March 1986 onwards, data was recorded on the new format recording sheet shown in Figure 2c, with the following parameters being recorded:

- Wave height (average) (m);
- Wave height (maximum) (m);
- Wave height method;
- Wave period (s);
- Wave direction (degrees);
- Surf zone width (s);
- Longshore current speed (m/min);
- Longshore current direction;
- Distance from shore (m);
- Presence of offshore bar;
- Wind speed (mph);
- Wind direction (degrees);
- Fixed contour elevation (m);
- Distance to fixed contour (m);
- Distance to vegetation line (m);
- Sand level at COPE reference pole (m); and
- Sand sample.

Surf zone width was measured as the time (in seconds) it took for a wave to transgress the surf zone from its break point until its final run-up position.

All directions in this report are magnetic. Sector bearings derived from True North were converted to magnetic bearings using the magnetic variation shown on marine charts.

The first recorded sand sample was taken in September 1981, and from then on, samples were taken every month for the first three years, and every few months for the remainder of the recording period.

A profile of the beach was recorded monthly throughout the recording period (starting in April 1982) with additional profiles recorded within the month depending on the state of the beach and the occurrence of storm events. In addition, staff from DSITIA recorded beach profiles at the COPE site periodically from 1996 to 2010.

2.6 Tidal Information

Tidal information from the 1993 Official Tide Tables (DoT 1993) for Snapper Rocks (Coolangatta) is presented in Table 1. The levels have been adjusted to a Lowest Astronomical Tide (LAT) datum of zero.

It should be noted that in 2010, the tidal plane levels were updated for the current Tidal Datum Epoch 1992 - 2011, using the latest available tidal observations, prediction information and allowance for sea level rise. The current tidal plane levels are provided in the 2013 Official Tide Tables (MSQ 2013) and the levels for Snapper Rocks (Coolangatta) are presented in Table 1. The datum is LAT.

Table 1: Tidal Planes

Tidal Plane	1993 (m LAT)	2013 (m LAT)
Highest Astronomical Tide (HAT)	2.09	2.11
Mean High Water Springs (MHWS)	1.63	1.64
Mean High Water Neaps (MHWN)	1.34	1.32
Australian Height Datum (AHD)	0.98	0.98
Mean Sea Level (MSL)	0.97	0.97
Mean Low Water Neaps (MLWN)	0.61	0.49
Mean Low Water Springs (MLWS)	0.31	0.20

The tidal plane levels have changed slightly, however, the value of the AHD relative to the tidal planes has remained constant.

2.7 Beach Description

The beach at the Coolangatta Beach COPE station exhibited the following characteristics:

- Typical beach slopes: Foreshore slope was measured from 1 September 1981 until 12 March 1986 and was in the range of 1 to 11 degrees with an average slope of 4 degrees (by inspection of Figure 51 to Figure 60). Foreshore slope in subsequent years can be inferred from the beach width measurements and the monthly profiles. The beach slope oscillated between 1 to 7 degrees, with an average of 4 degrees between 1982 and 1996 (Figure 58 to Figure 72);
- Beach width: Varied from 10 to 75 m measured from the seaward toe of the frontal dune to the Low Water Mark over the 15 year period (1981 - 1995) (by inspection of the monthly beach profiles Figure 58 to Figure 75);
- D_{50} grain size: 0.31 mm averaged over 67 samples collected over the 15 years (1981 – 1995); and
- Adjoining landform: Vegetated sand dunes seaward of parkland.

Images of the beach are provided in Photos 2a and 2b.

Photo 2a: Coolangatta Beach, 10 August 1995 – Looking north:

Photo 2b: Coolangatta Beach, 10 August 1995 – Looking south:

2.8 Meteorological Events

The following cyclones were recorded by the Brisbane Bureau of Meteorology as having tracks within 400 km of Coolangatta Beach between January 1981 and December 2006. It is considered that these meteorological events may have had some effect on the condition of Coolangatta Beach.

- Cyclone ABIGAIL: 22 January – 1 February 1982;
- Cyclone GRACE: 11 – 20 January 1984;
- Cyclone LANCE: 3 – 7 April 1984;
- Cyclone PIERRE: 17 – 24 February 1985;
- Cyclone NANCY: 28 January – 8 February 1990;
- Cyclone DAMAN: 15 – 18 February 1992;
- Cyclone FRAN: 5 – 16 March 1992;
- Cyclone REWA: 28 December 1993 – 21 January 1994;
- Cyclone VIOLET: 3 – 6 March 1995;
- Cyclone GERTIE: 17 – 22 December 1995; and
- Cyclone KERRY: 8 – 18 January 2005.

In addition, Cyclone ROGER, 12 – 21 March 1993, seemed to have an impact on the beach conditions which can be observed in Figure 76. This cyclone was outside the 400 km zone. Other cyclones that also occurred outside the 400 km radius to Coolangatta Beach were Cyclone BETSY 10 – 14 January 1992, Cyclone YALI 17 – 27 March 1998 and Cyclone HAMISH 5 – 12 March 2009. See Figure 77 for the cyclone tracks for a 400 km radius centred just east of Coolangatta Beach (so as to include the aforementioned cyclones) over the recording period of 1981 – 2006. More recent records were unavailable for plotting in this format at the time of compiling the report.

2.9 Station Supervision

The observers were instructed in the recording program by the BPA COPE Field Officer and the initial instruction period was followed by regular visits to the station during the period of recordings presented in this report.

Installation of the reference pole for this station was carried out by the GCCC. Maintenance of the pole was carried out by the BPA COPE Field Officer.

3. Data

3.1 General

COPE data at this station for the 15 year period, September 1981 to May 1995, is presented in the tables in Section 5 Tabular Results and the figures in Section 6 Data Presentation. The data has been analysed statistically and/or smoothed to reveal long term averages or trends. A brief description of each of the observed parameters is given below with the relevant figure references.

3.2 Wind

The observer recorded the wind speed at the beach using a hand held wind meter at 1.5 m above beach level. Prior to 12 March 1986, the wind direction was recorded as a cardinal direction, and the speed was recorded in knots (kn). From 13 March 1986, wind direction was recorded in degrees by compass, and the speed was recorded in miles per hour (mph). Wind speed data in this report is presented in metres per second (m/s).

A summary of annual wind speed direction percentage occurrences is shown as a wind rose in Figure 3.

3.3 Waves

The average and maximum breaker height (trough to crest) was usually estimated to the nearest 0.1 m. Previous studies (Patterson and Blair, 1983) have shown that the estimate of average breaker height is comparable with the equivalent deep water significant wave height. The wave height was measured using one of the methods described on page two of the new format recording sheet (Figure 2d), the method chosen being dependent on the wave height.

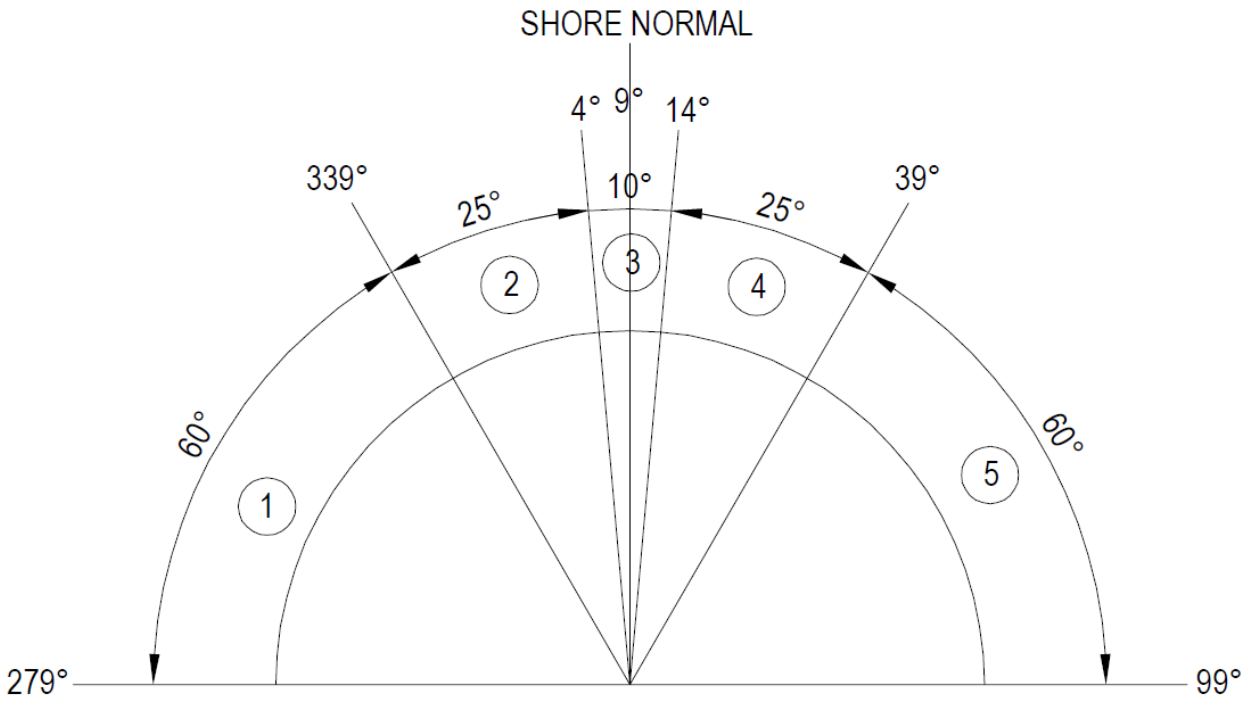
The observers estimated the wave period by recording the time taken for eleven wave crests (the duration of 10 waves) to pass a point.

Prior to 12 March 1986, wave direction was recorded using the protractor in Figure 2b placed parallel to the shore. Post 13 March 1986, wave direction was recorded as a compass bearing (refer Figure 2d). The direction recorded was then converted to a sector, as shown in the following paragraph.

Wave direction is estimated as one of five direction sectors in relation to the shore normal direction from which the waves were approaching the beach. The compass bearings for the sectors are displayed in Table 2 and in the diagram below:

Table 2: Sector Directions

Sector	Direction
1	279^{o} to 338^{o}
2	339^{o} to 3^{o}
3	4^{o} to 14^{o}
4	15^{o} to 39^{o}
5	40^{o} to 99^{o}



Note: At the Coolangatta Beach COPE station, the shore normal direction is approximately 9 degrees east of magnetic north.

Statistical representations of the observed wave data include:

- The percentage of wave height recordings which exceed any given wave height for all directions combined (Figure 4);
- The percentage occurrence of various combinations of wave heights, periods and directions (Figure 5 and Figure 6);
- Surf zone width with an indication of existence or otherwise of an offshore bar (Figure 7 to Figure 21); and
- Tabulation of the occurrence of various wave heights, periods, types and directions (Table 1 to Table 15).

3.4 Longshore Currents

The observer measured the distance parallel to the shoreline that a float or dye patch in the surf zone moved in one minute. Current direction is either upcoast (positive) or downcoast (negative), with the upcoast direction being to the left when facing the sea from the beach.

The readings were then converted to a velocity which was plotted on a daily basis (Figure 22 to Figure 36). A summary table for the mean upcoast and downcoast components and overall annual averages are provided on each of these yearly figures.

3.5 Beach Profile Parameters

Fixed contour elevation was measured by using the supplied level and the 1.5 m support pole. The observer would stand the pole on the top of the fixed contour, and by using the level, would site and record the elevation from the graduated COPE pole. The distance to the fixed contour was recorded using a tape measure. The fixed contour has been interpreted as being on top of a berm.

Sand level at the reference pole and the distance to the vegetation line was also recorded.

Changes in these parameters with time indicate how the beach moves in response to varying wave conditions. Plots of these parameters are shown in Figure 37 to Figure 50.

Foreshore slope was also recorded from 1981 – 1986 by placing the support pole on the sand, and by using the level, a slope was recorded. Refer to Figure 51 to Figure 56 for the results.

Figure 57 shows a summary of monthly averages of the distance to berm and the distance to vegetation line for the full recording period.

3.6 Monthly Beach Profiles

Measurements of beach profiles were usually taken monthly. However, if the beach experienced appreciable erosion or accretion during the month, the observer was requested to take an additional beach profile. Monthly beach profiles are shown in Figure 58 to Figure 71. Further profiles are also available in Figure 72 to Figure 75. These profiles were not recorded as part of the COPE data collection program, but were recorded by staff from DSITIA. It should be noted that the profile taken on 29 April 1982 has been repeated in each graph so comparisons between profiles can be easily made.

3.7 Sand Sample Particle Size Distribution

A total of 67 sand samples were collected over the 15 years (1981 to 1995) when the station was operational. The data indicates that each sample underwent a standard sieve analysis to determine the particle size distribution and the average D_{50} size of 0.31 mm was derived from the data.

4. References

1. BC No 27 – Jones, C.M., *COPE (Coastal Observation Programme Engineering)*, Beach Conservation newsletter No 21, October 1975.
2. BC No 69 – Andrews, M.J. and Blair, R.J., *Coastal Observation Programme – Engineering (COPE)*, Beach Conservation newsletter No. 69, June 1990.
3. DoT 1993 - 1993 *Official Tide Tables*, Queensland Department of Transport, 1993.
4. Mooloolaba 2 COPE Report 2010 – GHD Pty Ltd, *COPE Data Mooloolaba 2*, for Sunshine Coast Regional Council, August 2010.
5. MSQ 2013 – 2013 *Official Tide Tables*, Maritime Safety Queensland, 2013.
6. Patterson & Blair 1983 - Patterson, D.C. and Blair, R.J., *Visually Determined Wave Parameters*, 6th Australian Conference on Coastal and Ocean Engineering, Gold Coast, July 1983.
7. Robinson & Jones 1977 – Robinson, D.A. and Jones, C.M., *Queensland Volunteer Coastal Observation Programme – Engineering (COPE)*, 3rd Australian Conference on Coastal and Ocean Engineering, Melbourne, April 1977.

5. Tabular Results

Table 3: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1981

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave type %						Wave direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan																
Feb																
Mar																
Apr																
May																
Jun																
Jul																
Aug																
Sep	17	7.4	0.6	17	52.9	41.2	5.9	0.0	0.0	17	0.0	11.8	82.4	5.9	0.0	0
Oct	20	6.9	0.7	20	55.0	20.0	25.0	0.0	0.0	20	0.0	10.0	80.0	10.0	0.0	0
Nov	21	7.0	0.6	21	33.3	33.3	33.3	0.0	0.0	21	0.0	4.8	81.0	14.3	0.0	0
Dec	9	7.5	0.4	9	66.7	22.2	11.1	0.0	0.0	9	0.0	11.1	77.8	11.1	0.0	0
Whole Year	67	7.2	0.6	67	49.3	29.9	20.9	0.0	0.0	67	0.0	9.0	80.6	10.4	0.0	0

Table 4: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1982

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave type %						Wave direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan	5	7.9	0.8	5	20.0	40.0	40.0	0.0	0.0	5	0.0	0.0	100.0	0.0	0.0	0.0
Feb	19	8.1	0.5	19	52.6	31.6	15.8	0.0	0.0	19	0.0	10.5	89.5	0.0	0.0	0.0
Mar	23	8.2	0.7	23	21.7	43.5	34.8	0.0	0.0	23	0.0	0.0	95.7	4.3	0.0	0.0
Apr	15	8.7	0.8	15	40.0	33.3	20.0	0.0	0.0	15	0.0	6.7	93.3	0.0	0.0	0.0
May	19	7.8	0.7	19	26.3	47.4	21.1	0.0	0.0	19	0.0	0.0	84.2	5.3	0.0	0.0
Jun	17	9.0	0.7	17	41.2	58.8	0.0	0.0	0.0	17	0.0	5.9	94.1	0.0	0.0	0.0
Jul	15	8.9	0.5	15	46.7	20.0	33.3	0.0	0.0	15	0.0	6.7	93.3	0.0	0.0	0.0
Aug	20	7.1	0.6	20	15.0	65.0	20.0	0.0	0.0	20	0.0	0.0	100.0	0.0	0.0	0.0
Sep	17	7.7	0.5	17	35.3	29.4	35.3	0.0	0.0	17	0.0	17.6	76.5	5.9	0.0	0.0
Oct	15	7.3	0.6	15	40.0	26.7	33.3	0.0	0.0	15	0.0	6.7	86.7	6.7	0.0	0.0
Nov	22	7.4	0.6	22	54.5	27.3	18.2	0.0	0.0	22	0.0	13.6	86.4	0.0	0.0	0.0
Dec	16	7.7	0.7	16	75.0	12.5	12.5	0.0	0.0	16	0.0	12.5	75.0	12.5	0.0	0.0
Whole Year	203	203	8.0	0.6	203	39.4	36.9	22.7	0.0	0.0	0	6.9	89.2	3.0	0.0	0.0

Table 5: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1983

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave type %						Wave direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan	5	8.7	0.7	5	60.0	20.0	20.0	0.0	0.0	5	0.0	0.0	100.0	0.0	0.0	0.0
Feb	20	7.9	0.6	20	50.0	25.0	20.0	0.0	0.0	20	0.0	0.0	100.0	0.0	0.0	0.0
Mar	20	9.1	0.6	20	65.0	35.0	0.0	0.0	0.0	20	0.0	5.0	95.0	0.0	0.0	0.0
Apr	12	9.1	0.6	12	50.0	25.0	25.0	0.0	0.0	12	0.0	33.3	66.7	0.0	0.0	0.0
May	17	8.1	0.7	17	70.6	23.5	0.0	0.0	0.0	17	0.0	0.0	100.0	0.0	0.0	0.0
Jun	13	9.3	0.8	13	38.5	23.1	38.5	0.0	0.0	13	0.0	0.0	61.5	38.5	0.0	0.0
Jul	14	9.4	0.7	14	78.6	14.3	7.1	0.0	0.0	14	0.0	14.3	64.3	21.4	0.0	0.0
Aug	21	9.2	0.5	21	19.0	52.4	19.0	4.8	0.0	21	0.0	4.8	76.2	19.0	0.0	0.0
Sep	13	6.8	0.5	13	46.2	38.5	15.4	0.0	0.0	13	0.0	7.7	92.3	0.0	0.0	0.0
Oct	21	7.7	0.5	21	38.1	47.6	14.3	0.0	0.0	21	0.0	4.8	90.5	4.8	0.0	0.0
Nov	22	8.6	0.5	22	40.9	59.1	0.0	0.0	0.0	22	0.0	0.0	90.9	9.1	0.0	0.0
Dec	5	6.9	0.7	5	20.0	80.0	0.0	0.0	0.0	5	0.0	0.0	100.0	0.0	0.0	0.0
Whole Year	183	8.4	0.6	183	48.1	37.2	12.6	0.5	0.0	183	0.0	5.5	86.3	8.2	0.0	0.0

Table 6: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1984

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave type %						Wave direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan	5	6.9	0.4	5	100.0	0.0	0.0	0.0	0.0	5	0.0	0.0	100.0	0.0	0.0	0.0
Feb	20	7.0	0.6	20	70.0	30.0	0.0	0.0	0.0	20	0.0	10.0	85.0	5.0	0.0	0.0
Mar	21	8.7	0.5	21	61.9	19.0	19.0	0.0	0.0	21	0.0	4.8	85.7	9.5	0.0	0.0
Apr	12	9.8	0.8	12	25.0	33.3	33.3	0.0	0.0	12	0.0	8.3	83.3	8.3	0.0	0.0
May	18	8.9	0.7	18	38.9	33.3	27.8	0.0	0.0	18	0.0	0.0	94.4	5.6	0.0	0.0
Jun	16	8.4	0.6	16	12.5	81.3	6.3	0.0	0.0	16	0.0	0.0	75.0	25.0	0.0	0.0
Jul	16	8.9	0.3	16	18.8	62.5	18.8	0.0	0.0	16	0.0	6.3	81.3	12.5	0.0	0.0
Aug	16	11.0	0.5	16	6.3	62.5	31.3	0.0	0.0	16	0.0	0.0	81.3	18.8	0.0	0.0
Sep	8	8.2	0.3	8	0.0	87.5	12.5	0.0	0.0	8	0.0	0.0	87.5	12.5	0.0	0.0
Oct	20	7.6	0.6	20	30.0	60.0	10.0	0.0	0.0	20	0.0	0.0	70.0	30.0	0.0	0.0
Nov	19	8.3	0.5	19	26.3	73.7	0.0	0.0	0.0	19	0.0	0.0	73.7	26.3	0.0	0.0
Dec	7	7.8	0.4	7	14.3	85.7	0.0	0.0	0.0	7	0.0	0.0	85.7	14.3	0.0	0.0
Whole Year	178	8.5	0.5	178	33.7	51.7	14.0	0.0	0.0	178	0.0	2.8	82.0	15.2	0.0	0.0

Table 7: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1985

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave type %						Wave direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan	2	6.5	0.4	2	0.0	100.0	0.0	0.0	0.0	2	0.0	0.0	100.0	0.0	0.0	0.0
Feb	19	8.4	0.6	19	0.0	100.0	0.0	0.0	0.0	19	0.0	0.0	73.7	26.3	0.0	0.0
Mar	5	7.1	0.5	5	20.0	80.0	0.0	0.0	0.0	5	0.0	0.0	100.0	0.0	0.0	0.0
Apr	10	8.2	0.6	10	0.0	100.0	0.0	0.0	0.0	10	0.0	0.0	100.0	0.0	0.0	0.0
May	15	8.6	0.7	15	0.0	93.3	6.7	0.0	0.0	15	0.0	0.0	86.7	13.3	0.0	0.0
Jun	8	7.8	0.4	8	0.0	87.5	12.5	0.0	0.0	8	0.0	0.0	100.0	0.0	0.0	0.0
Jul	12	8.9	0.4	12	0.0	100.0	0.0	0.0	0.0	12	0.0	16.7	75.0	8.3	0.0	0.0
Aug	17	7.1	0.4	17	5.9	76.5	17.6	0.0	0.0	17	0.0	5.9	88.2	5.9	0.0	0.0
Sep	7	7.4	0.4	7	28.6	57.1	14.3	0.0	0.0	7	0.0	0.0	100.0	0.0	0.0	0.0
Oct	10	7.4	0.6	10	10.0	70.0	20.0	0.0	0.0	10	0.0	10.0	80.0	0.0	0.0	0.0
Nov	16	8.1	0.6	16	6.3	56.3	37.5	0.0	0.0	16	0.0	12.5	81.3	6.3	0.0	0.0
Dec	7	7.5	0.5	7	14.3	42.9	42.9	0.0	0.0	7	0.0	0.0	100.0	0.0	0.0	0.0
Whole Year	128	7.8	0.5	128	5.5	81.3	13.3	0.0	0.0	128	0.0	4.7	86.7	7.8	0.0	0.0

Table 8: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1986

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave type %						Wave direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan	1	8.0	0.8	1	0.0	100.0	0.0	0.0	0.0	1	0.0	0.0	100.0	0.0	0.0	0.0
Feb	17	7.3	0.4	17	47.1	11.8	41.2	0.0	0.0	17	0.0	0.0	94.1	5.9	0.0	0.0
Mar	13	8.4	0.7	4	0.0	100.0	0.0	0.0	0.0	13	7.7	38.5	15.4	30.8	7.7	0.0
Apr	6	9.0	0.8							6	0.0	16.7	0.0	50.0	16.7	0.0
May	16	8.5	0.5							16	0.0	75.0	6.3	18.8	0.0	0.0
Jun	8	8.7	0.5							8	0.0	37.5	0.0	62.5	0.0	0.0
Jul	12	8.9	0.6							12	0.0	83.3	0.0	16.7	0.0	0.0
Aug	13	7.9	0.4							13	0.0	61.5	0.0	38.5	0.0	0.0
Sep	11	8.2	0.4							11	0.0	72.7	0.0	27.3	0.0	0.0
Oct	18	6.7	0.4							18	0.0	72.2	11.1	5.6	0.0	11.0
Nov	16	7.2	0.5							16	0.0	93.8	0.0	6.3	0.0	0.0
Dec	7	6.8	0.6							7	0.0	85.7	0.0	14.3	0.0	0.0
Whole Year	138	8.0	0.5	22	36.4	31.8	31.8	0.0	0.0	138	0.7	58.7	15.9	21.0	1.4	0.0

Table 9: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1987

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	1	12.0	0.1	1	100.0	0.0	0.0	0.0	0.0	0.0
Feb	6	6.6	0.3	6	33.3	50.0	16.7	0.0	0.0	0.0
Mar	4	9.7	0.7	4	0.0	100.0	0.0	0.0	0.0	0.0
Apr	11	8.2	0.3	11	0.0	100.0	0.0	0.0	0.0	0.0
May	12	8.1	0.9	12	16.7	83.3	0.0	0.0	0.0	0.0
Jun	12	6.9	0.8	12	8.3	91.7	0.0	0.0	0.0	0.0
Jul	12	8.5	0.4	12	0.0	33.3	66.7	0.0	0.0	0.0
Aug	15	9.0	0.4	15	0.0	13.3	80.0	6.7	0.0	0.0
Sep	14	9.0	0.3	14	0.0	0.0	64.3	35.7	0.0	0.0
Oct	16	6.2	0.5	16	0.0	12.5	81.3	6.3	0.0	0.0
Nov	5	6.5	0.3	5	0.0	0.0	100.0	0.0	0.0	0.0
Dec				No data recorded						
Whole Year	108	8.2	0.5	108	5.6	43.5	44.4	6.5	0.0	0.0

Table 10: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1988

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan				No Data recorded						
Feb				No data recorded						
Mar	5	7.4	0.4	5	0.0	80.0	20.0	0.0	0.0	0.0
Apr	6	7.4	3.0	6	0.0	83.3	16.7	0.0	0.0	0.0
May	4	6.8	0.3	4	0.0	100.0	0.0	0.0	0.0	0.0
Jun				No data recorded						
Jul				No data recorded						
Aug				No data recorded						
Sep				No data recorded						
Oct				No data recorded						
Nov	5	7.8	0.4	5	0.0	60.0	40.0	0.0	0.0	0.0
Dec	28	9.0	0.8	28	0.0	42.9	28.6	28.6	0.0	0.0
Whole Year	48	7.7	1.0	48	0.0	58.3	25.0	16.7	0.0	0.0

Table 11: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1989

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	29	9.6	0.7	29	0.0	20.7	48.3	31.0	0.0	0.0
Feb	26	10.0	0.9	26	0.0	15.4	65.4	19.2	0.0	0.0
Mar	25	10.3	0.6	25	0.0	60.0	20.0	20.0	0.0	0.0
Apr	25	10.8	1.1	25	0.0	28.0	44.0	28.0	0.0	0.0
May	19	12.3	0.8	19	0.0	36.8	36.8	26.3	0.0	0.0
Jun	20	11.2	0.5	20	0.0	70.0	15.0	15.0	0.0	0.0
Jul	24	10.7	0.5	24	0.0	75.0	20.8	4.2	0.0	0.0
Aug	24	10.6	0.6	24	0.0	58.3	33.3	4.2	0.0	0.0
Sep	23	9.0	0.4	23	0.0	95.7	4.3	0.0	0.0	0.0
Oct	15	9.5	0.5	15	0.0	100.0	0.0	0.0	0.0	0.0
Nov	22	9.7	0.5	22	0.0	77.3	22.7	0.0	0.0	0.0
Dec	18	10.2	0.6	18	0.0	66.7	27.8	5.6	0.0	0.0
Whole Year	270	10.3	0.6	270	0.0	55.9	30.0	13.7	0.0	0.0

Table 12: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1990

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	27	9.3	0.6	27	0.0	55.6	33.3	11.1	0.0	0.0
Feb	17	10.9	1.1	17	0.0	35.3	52.9	11.8	0.0	0.0
Mar	11	10.2	0.7	11	0.0	45.5	36.4	18.2	0.0	0.0
Apr	23	9.8	0.5	23	0.0	43.5	39.1	8.7	0.0	8.7
May	21	9.9	0.5	21	0.0	57.1	33.3	9.5	0.0	0.0
Jun	11	11.8	0.4	11	0.0	36.4	63.6	0.0	0.0	0.0
Jul	25	9.1	0.4	25	0.0	48.0	52.0	0.0	0.0	0.0
Aug	18	10.6	0.4	18	0.0	66.7	33.3	0.0	0.0	0.0
Sep	17	9.9	0.4	17	0.0	52.9	47.1	0.0	0.0	0.0
Oct	26	9.8	0.5	26	0.0	50.0	46.2	3.8	0.0	0.0
Nov	21	9.7	0.6	21	0.0	66.7	14.3	19.0	0.0	0.0
Dec	17	9.6	0.4	17	0.0	64.7	35.3	0.0	0.0	0.0
Whole Year	234	10.0	0.5	234	0.0	52.6	39.7	6.8	0.0	0.0

Table 13: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1991

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	23	9.3	0.6	23	0.0	21.7	78.3	0.0	0.0	0.0
Feb	20	8.6	0.6	20	0.0	25.0	60.0	15.0	0.0	0.0
Mar	21	8.2	0.6	21	0.0	14.3	66.7	19.0	0.0	0.0
Apr	19	7.8	0.4	19	0.0	36.8	47.4	15.8	0.0	0.0
May	22	8.2	0.5	22	0.0	9.1	59.1	31.8	0.0	0.0
Jun	20	7.5	0.5	20	0.0	35.0	50.0	15.0	0.0	0.0
Jul	21	7.0	0.4	21	0.0	61.9	38.1	0.0	0.0	0.0
Aug	23	7.8	0.5	23	0.0	69.6	13.0	17.4	0.0	0.0
Sep	15	7.0	0.5	15	0.0	53.3	46.7	0.0	0.0	0.0
Oct	24	8.1	0.5	24	0.0	70.8	20.8	8.3	0.0	0.0
Nov	21	7.5	0.4	21	0.0	47.6	47.6	4.8	0.0	0.0
Dec	15	7.9	0.5	15	0.0	66.7	26.7	6.7	0.0	0.0
Whole Year	244	7.9	0.5	244	0.0	42.2	46.3	11.5	0.0	0.0

Table 14: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1992

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	13	7.7	0.5	13	0.0	46.2	38.5	15.4	0.0	0.0
Feb	23	8.2	0.7	23	0.0	21.7	60.9	17.4	0.0	0.0
Mar	15	10.4	0.8	15	0.0	20.0	73.3	6.7	0.0	0.0
Apr	20	9.3	0.6	20	0.0	30.0	40.0	30.0	0.0	0.0
May	10	9.8	0.6	10	0.0	30.0	70.0	0.0	0.0	0.0
Jun	19	10.7	0.6	19	0.0	21.1	57.9	21.1	0.0	0.0
Jul	21	8.8	0.4	21	0.0	23.8	61.9	14.3	0.0	0.0
Aug	22	8.7	0.5	22	0.0	50.0	27.3	22.7	0.0	0.0
Sep	16	7.8	0.5	16	0.0	31.3	68.8	0.0	0.0	0.0
Oct	17	8.4	0.6	17	0.0	35.3	64.7	0.0	0.0	0.0
Nov	22	7.5	0.5	22	0.0	27.3	68.2	4.5	0.0	0.0
Dec	9	8.6	0.5	9	0.0	0.0	88.9	11.1	0.0	0.0
Whole Year	207	8.8	0.6	207	0.0	29.0	58.0	13.0	0.0	0.0

Table 15: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1993

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	19	7.2	0.5	19	0.0	15.8	78.9	5.3	0.0	0.0
Feb	16	7.4	0.5	16	0.0	0.0	93.8	6.3	0.0	0.0
Mar	12	9.0	1.1	12	0.0	16.7	50.0	33.3	0.0	0.0
Apr	15	7.2	0.5	15	0.0	40.0	60.0	0.0	0.0	0.0
May				No data recorded						
Jun	16	10.0	0.5	16	0.0	6.3	62.5	31.3	0.0	0.0
Jul	16	9.0	0.6	16	0.0	0.0	81.3	18.8	0.0	0.0
Aug	16	8.1	0.5	16	0.0	18.8	81.3	0.0	0.0	0.0
Sep	15	8.1	0.5	15	0.0	6.7	73.3	20.0	0.0	0.0
Oct	13	7.6	0.6	13	0.0	23.1	76.9	0.0	0.0	0.0
Nov	19	6.8	0.5	19	0.0	21.1	57.9	21.1	0.0	0.0
Dec	15	6.8	0.7	15	0.0	26.7	33.3	40.0	0.0	0.0
Whole Year	172	7.9	0.6	172	0.0	15.7	68.6	15.7	0.0	0.0

Table 16: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1994

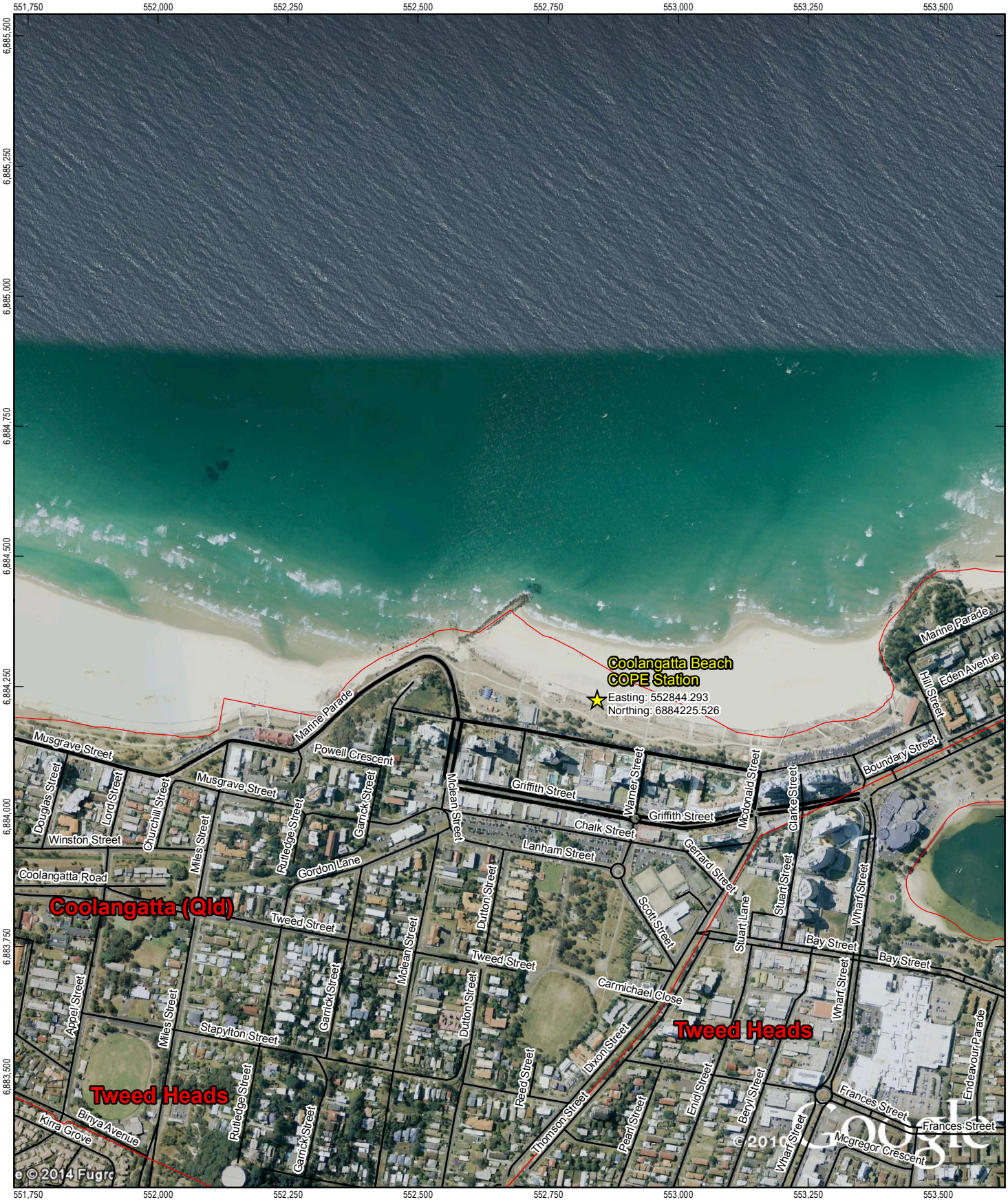
Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	19	8.2	0.8	19	0.0	10.5	84.2	5.3	0.0	0.0
Feb	12	7.6	0.6	12	0.0	0.0	100.0	0.0	0.0	0.0
Mar	14	9.1	0.9	14	0.0	0.0	42.9	57.1	0.0	0.0
Apr	13	7.9	0.6	13	0.0	0.0	61.5	38.5	0.0	0.0
May	15	7.6	0.4	15	0.0	13.3	53.3	33.3	0.0	0.0
Jun	12	9.6	0.5	12	0.0	8.3	75.0	16.7	0.0	0.0
Jul				No data recorded						
Aug	5	9.6	0.6	5	0.0	20.0	80.0	0.0	0.0	0.0
Sep				No data recorded						
Oct				No data recorded						
Nov				No data recorded						
Dec				No data recorded						
Whole Year	90	8.5	0.6	90	0.0	6.7	70.0	23.3	0.0	0.0

Table 17: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Coolangatta Beach. Year 1995

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan				No data recorded						
Feb				No data recorded						
Mar				No data recorded						
Apr				No data recorded						
May	9	9.7	0.8	9	0.0	0.0	22.2	77.8	0.0	0.0
Jun				Recording ceased						
Jul										
Aug										
Sep										
Oct										
Nov										
Dec										
Whole Year	9	9.7	0.8	9	0.0	0.0	22.2	77.8	0.0	0.0

6. Data Presentation

The data analysis for Coolangatta Beach COPE station is presented in the following figures.



LEGEND

COPE Station

Highway

Road

Rail

Watercourse

Suburb

1:10,000 @ A4

0 125 250

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

Job Number 41-27255
Revision A
Date 13 Mar 2014

Site Plan

Figure 1a

G:\41\27255\GIS\Maps\MXD\41_27255_004_Coolangatta_SitePlan_rev_a.mxd

145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM - Road/2010; GA - Watercourse/2007; ABS - Loclality/2011; Google Earth Pro - Imagery (Extracted 12/12/13). Created by: LS

LEGEND

COPE Station

Road

Locality

Rail

Watercourse

1:100,000 @ A4

0 1 2

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

Job Number 41-27255
Revision A
Date 13 Mar 2014

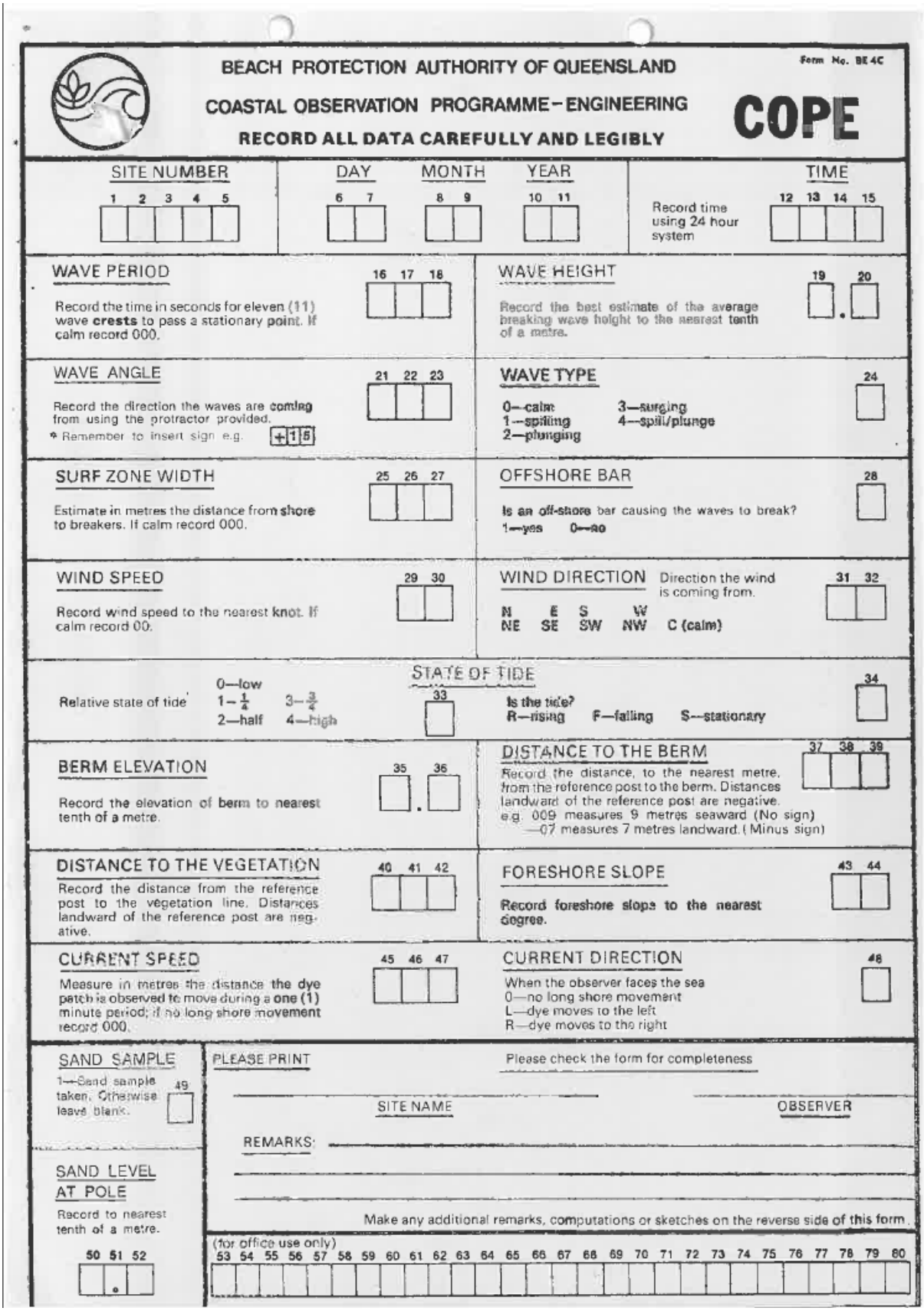
Locality Plan

Figure 1b

G:\41\27255\GIS\Maps\MXD\41_27255_003_CoolangattaLocalityPlan_rev_a.mxd

145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Rail/2007, GA - Road, Watercourse/2007; ABS - Locality/2011; Google Earth Pro - Imagery (Extracted 12/12/13). Created by: LS



BEACH PROTECTION AUTHORITY OF QUEENSLAND

Form No. BE 4C

COASTAL OBSERVATION PROGRAMME – ENGINEERING

COPE

RECORD ALL DATA CAREFULLY AND LEGIBLY

SITE NUMBER (1 2 3 4 5) | DAY (6 7) | MONTH (8 9) | YEAR (10 11) | TIME (12 13 14 15) — Record time using 24 hour system

WAVE PERIOD (16 17 18) — Record the time in seconds for eleven (11) wave **crests** to pass a stationary point. If calm record 000.

WAVE HEIGHT (19 . 20) — Record the best estimate of the average breaking wave height to the nearest tenth of a metre.

WAVE ANGLE (21 22 23) — Record the direction the waves are coming from using the protractor provided. * Remember to insert sign e.g. +15

WAVE TYPE (24) — 0—calm; 1—spilling; 2—plunging; 3—surging; 4—spill/plunge

SURF ZONE WIDTH (25 26 27) — Estimate in metres the distance from shore to breakers. If calm record 000.

OFFSHORE BAR (28) — Is an off-shore bar causing the waves to break? 1—yes 0—no

WIND SPEED (29 30) — Record wind speed to the nearest knot. If calm record 00.

WIND DIRECTION (31 32) — Direction the wind is coming from. N NE E SE S SW W NW C (calm)

STATE OF TIDE

Relative state of tide (33): 0—low; 1—¼; 2—half; 3—¾; 4—high

Is the tide? (34) R—rising F—falling S—stationary

BERM ELEVATION (35 . 36) — Record the elevation of berm to nearest tenth of a metre.

DISTANCE TO THE BERM (37 38 39) — Record the distance, to the nearest metre, from the reference post to the berm. Distances landward of the reference post are negative. e.g. 009 measures 9 metres seaward (No sign) —07 measures 7 metres landward. (Minus sign)

DISTANCE TO THE VEGETATION (40 41 42) — Record the distance from the reference post to the vegetation line. Distances landward of the reference post are negative.

FORESHORE SLOPE (43 44) — Record foreshore slope to the nearest degree.

CURRENT SPEED (45 46 47) — Measure in metres the distance the dye patch is observed to move during a one (1) minute period; if no long shore movement record 000.

CURRENT DIRECTION (48) — When the observer faces the sea 0—no long shore movement L—dye moves to the left R—dye moves to the right

SAND SAMPLE (49) — 1—Sand sample taken. Otherwise leave blank.

PLEASE PRINT — Please check the form for completeness

SITE NAME _____ OBSERVER _____

REMARKS: _____

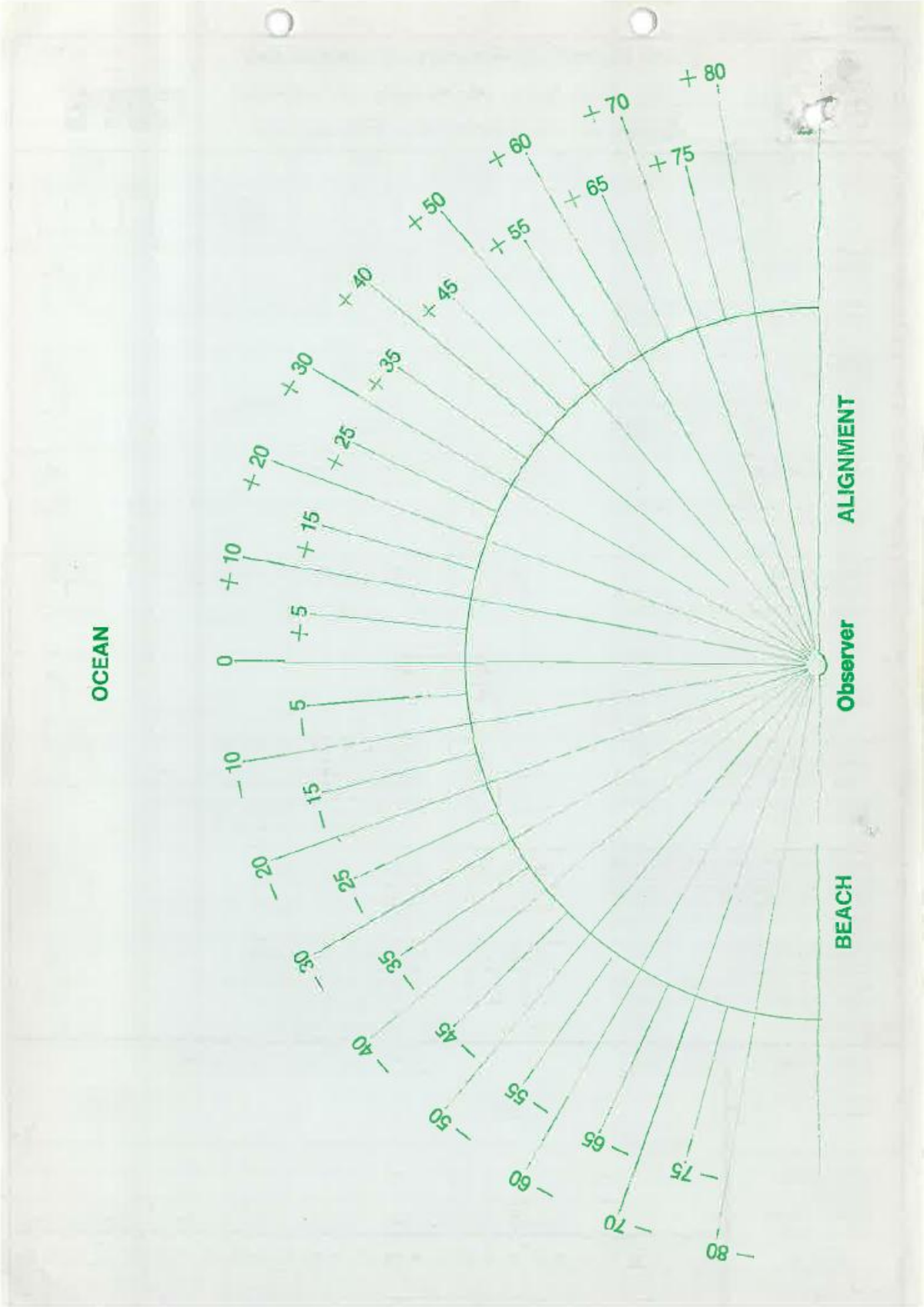
Make any additional remarks, computations or sketches on the reverse side of this form.

SAND LEVEL AT POLE (50 51 52) — Record to nearest tenth of a metre.

(for office use only) 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Figure 2a

COPE Recording Sheet – Old Format, Page 1



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Tallebudgera Beach COPE Data Compilation

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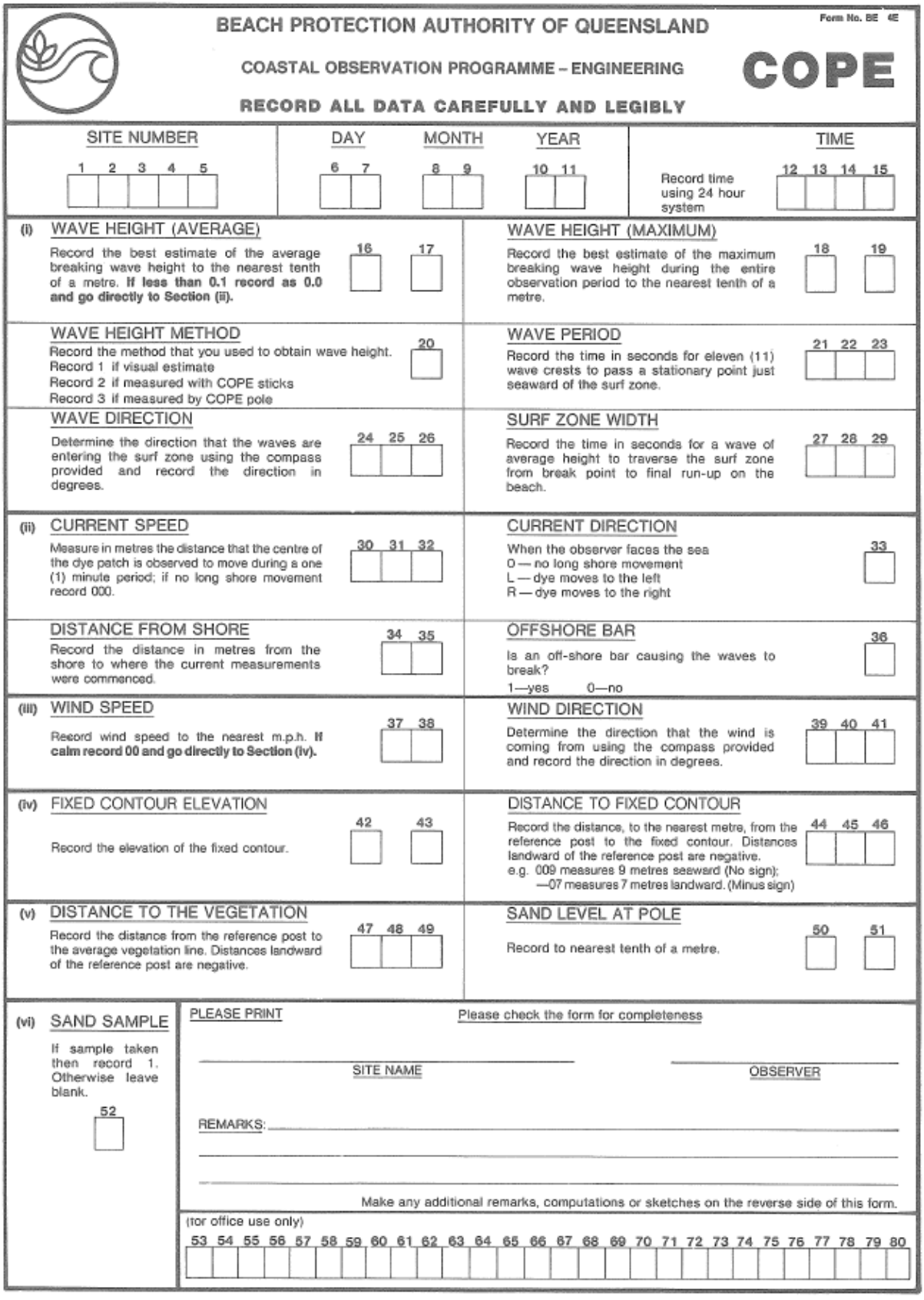
Revision	A
Date	16 Jan 2014

Figure 2b

COPE Recording Sheet – Old Format, Page 2



BEACH PROTECTION AUTHORITY OF QUEENSLAND

Form No. BE 4E

COASTAL OBSERVATION PROGRAMME – ENGINEERING

COPE

RECORD ALL DATA CAREFULLY AND LEGIBLY

SITE NUMBER (1 2 3 4 5) | DAY (6 7) | MONTH (8 9) | YEAR (10 11) | TIME (Record time using 24 hour system) (12 13 14 15)

(i) WAVE HEIGHT (AVERAGE)
Record the best estimate of the average breaking wave height to the nearest tenth of a metre. **If less than 0.1 record as 0.0 and go directly to Section (ii).** (16 17)

WAVE HEIGHT (MAXIMUM)
Record the best estimate of the maximum breaking wave height during the entire observation period to the nearest tenth of a metre. (18 19)

WAVE HEIGHT METHOD
Record the method that you used to obtain wave height.
Record 1 if visual estimate
Record 2 if measured with COPE sticks
Record 3 if measured by COPE pole (20)

WAVE PERIOD
Record the time in seconds for eleven (11) wave crests to pass a stationary point just seaward of the surf zone. (21 22 23)

WAVE DIRECTION
Determine the direction that the waves are entering the surf zone using the compass provided and record the direction in degrees. (24 25 26)

SURF ZONE WIDTH
Record the time in seconds for a wave of average height to traverse the surf zone from break point to final run-up on the beach. (27 28 29)

(ii) CURRENT SPEED
Measure in metres the distance that the centre of the dye patch is observed to move during a one (1) minute period; if no long shore movement record 000. (30 31 32)

CURRENT DIRECTION
When the observer faces the sea
0 — no long shore movement
L — dye moves to the left
R — dye moves to the right (33)

DISTANCE FROM SHORE
Record the distance in metres from the shore to where the current measurements were commenced. (34 35)

OFFSHORE BAR
Is an off-shore bar causing the waves to break?
1—yes 0—no (36)

(iii) WIND SPEED
Record wind speed to the nearest m.p.h. **If calm record 00 and go directly to Section (iv).** (37 38)

WIND DIRECTION
Determine the direction that the wind is coming from using the compass provided and record the direction in degrees. (39 40 41)

(iv) FIXED CONTOUR ELEVATION
Record the elevation of the fixed contour. (42 43)

DISTANCE TO FIXED CONTOUR
Record the distance, to the nearest metre, from the reference post to the fixed contour. Distances landward of the reference post are negative.
e.g. 009 measures 9 metres seaward (No sign);
—07 measures 7 metres landward. (Minus sign) (44 45 46)

(v) DISTANCE TO THE VEGETATION
Record the distance from the reference post to the average vegetation line. Distances landward of the reference post are negative. (47 48 49)

SAND LEVEL AT POLE
Record to nearest tenth of a metre. (50 51)

(vi) SAND SAMPLE
If sample taken then record 1. Otherwise leave blank. (52)

PLEASE PRINT — Please check the form for completeness

SITE NAME _____ OBSERVER _____

REMARKS: _____

Make any additional remarks, computations or sketches on the reverse side of this form.

(for office use only) (53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80)

Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

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Figure 2c

COPE Recording Sheet – New Format, Page 1

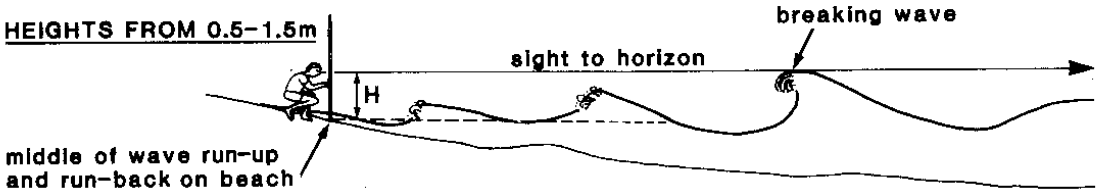
WAVE HEIGHT AND DIRECTION INSTRUCTIONS

METHOD 1 VISUAL ESTIMATION

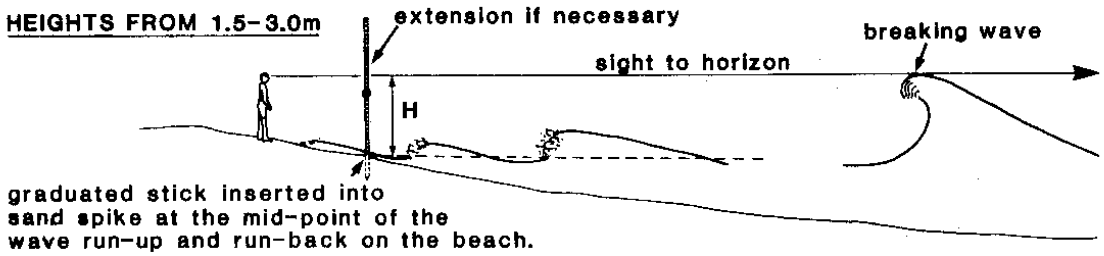
This method should only be used where the waveheights are below 0.5 and it is not practicable to use the preferred Method 2.

METHOD 2

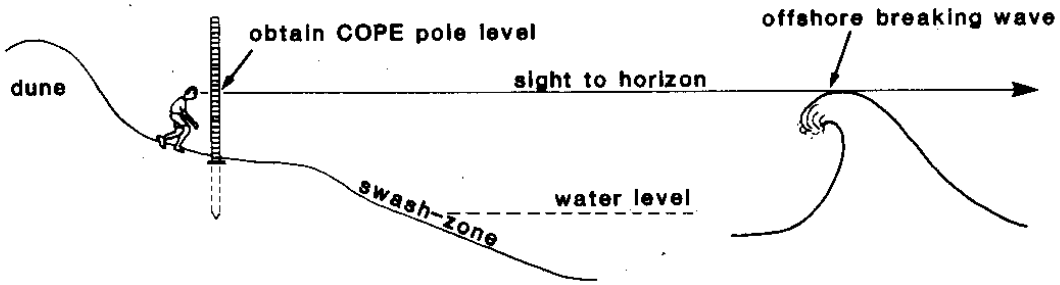
HEIGHTS FROM 0.5–1.5m



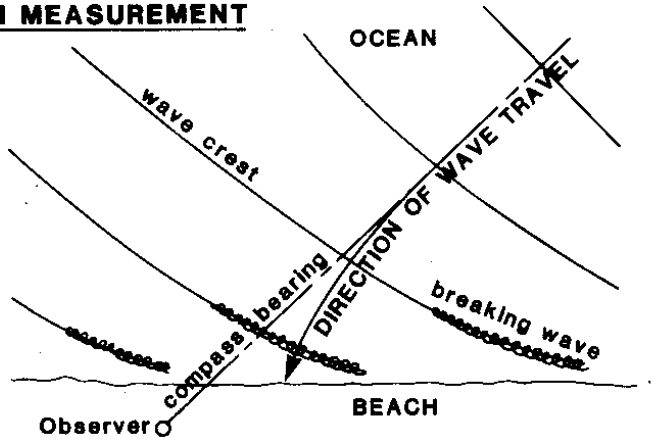
HEIGHTS FROM 1.5–3.0m



METHOD 3 FOR WAVES OVER 3m



WAVE DIRECTION MEASUREMENT



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

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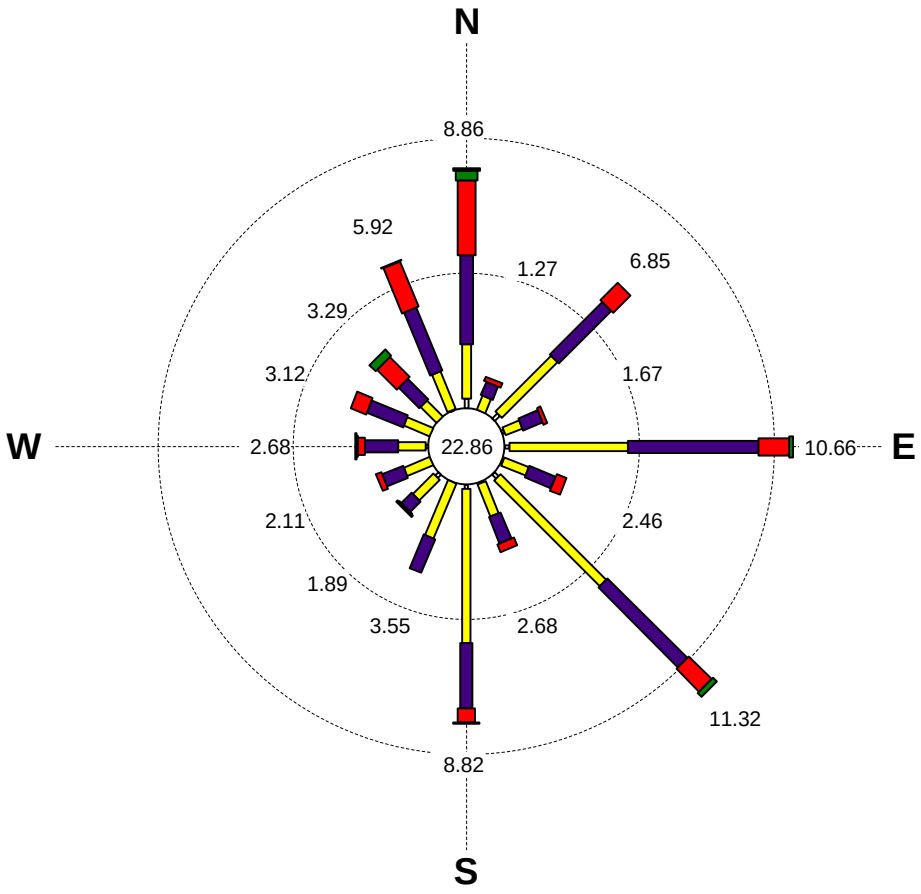
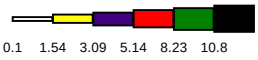
Figure 2d

COPE Recording Sheet – New Format, Page 2

Wind Data - All Observations
Figure 3
Coolangatta Beach: September 1981 - May 1995





Wind Speed (Meters Per Second)

Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Meters Per Second)
LOWER BOUND OF CATEGORY

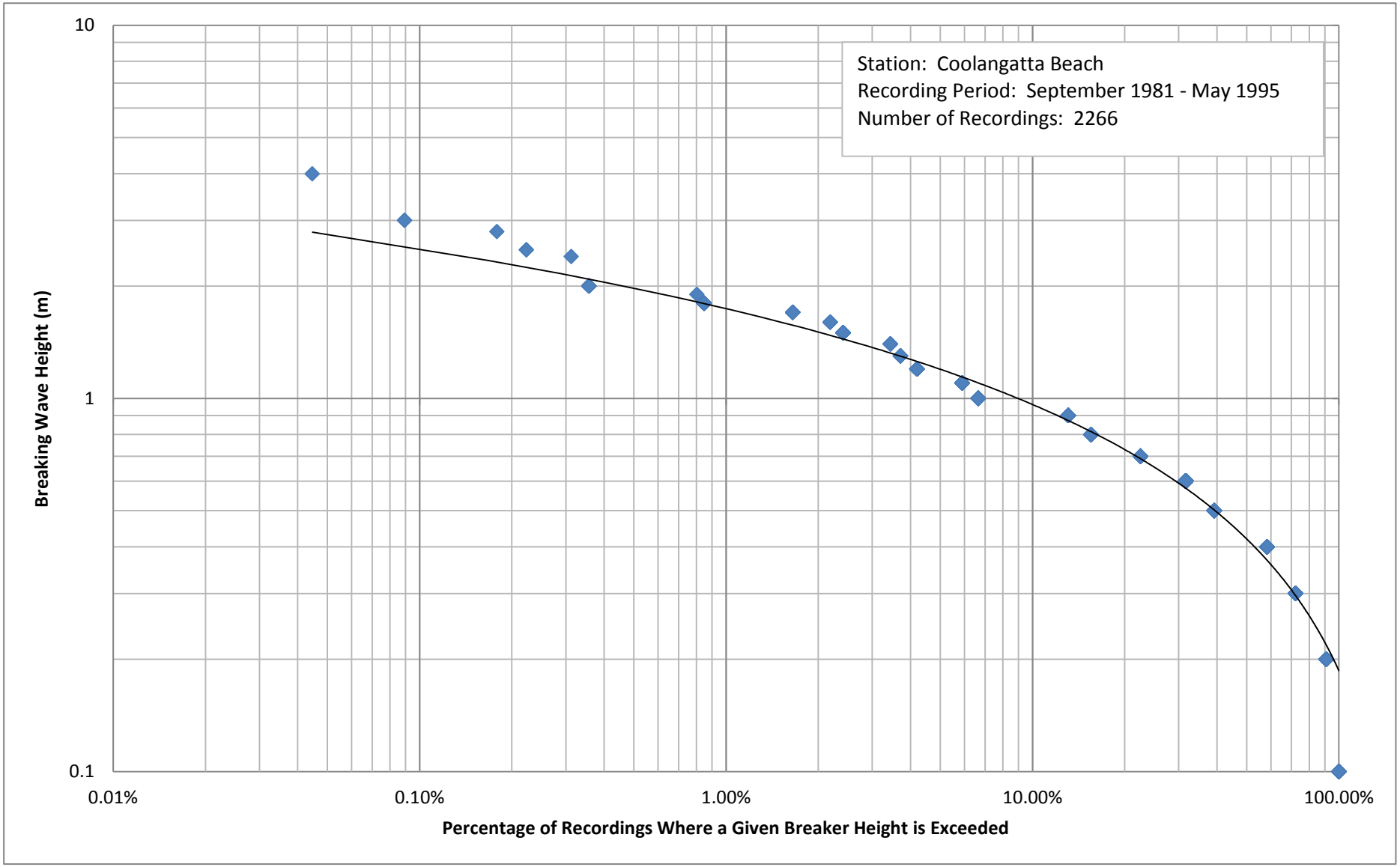
DIR	0.1	1.54	3.09	5.14	8.23	10.8
N	0.35	2.02	3.29	2.76	0.35	0.09
NNE	0.00	0.57	0.53	0.18	0.00	0.00
NE	0.26	2.94	2.72	0.92	0.00	0.00
ENE	0.09	0.66	0.79	0.13	0.00	0.00
E	0.18	4.39	4.83	1.14	0.13	0.00
ESE	0.04	0.97	1.05	0.39	0.00	0.00
SE	0.22	5.53	4.17	1.18	0.22	0.00
SSE	0.04	1.27	1.05	0.31	0.00	0.00

TOTAL OBS = 2279 MISSING OBS = 0

PERCENT OCCURRENCE: Wind Speed (Meters Per Second)
LOWER BOUND OF CATEGORY

DIR	0.1	1.54	3.09	5.14	8.23	10.8
S	0.13	5.70	2.41	0.53	0.00	0.04
SSW	0.00	2.19	1.36	0.00	0.00	0.00
SW	0.18	1.10	0.53	0.04	0.04	0.00
WSW	0.00	1.05	0.83	0.22	0.00	0.00
W	0.09	1.01	1.23	0.26	0.04	0.04
WNW	0.00	1.05	1.45	0.61	0.00	0.00
NW	0.00	0.83	1.10	1.05	0.31	0.00
NNW	0.04	1.49	2.55	1.80	0.04	0.00

CALM OBS = 521 PERCENT CALM = 22.86



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Coolangatta Beach COPE Data Compilation

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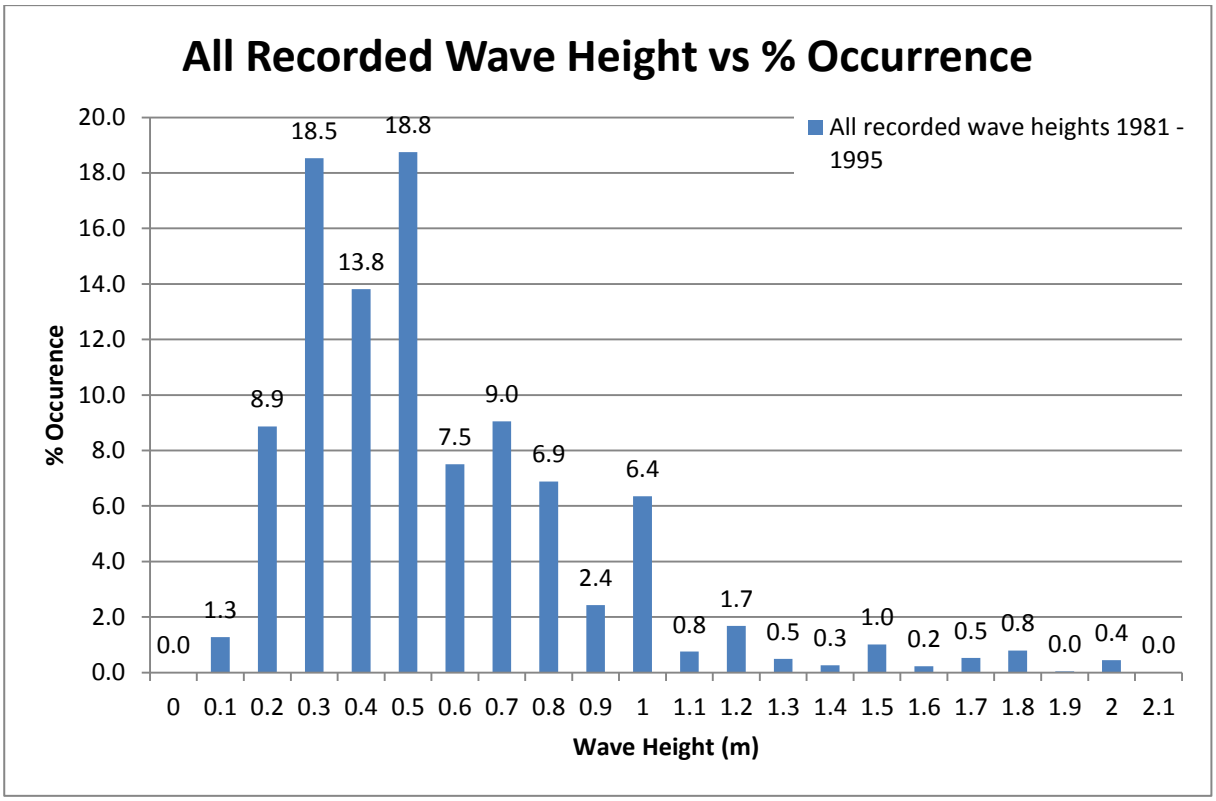
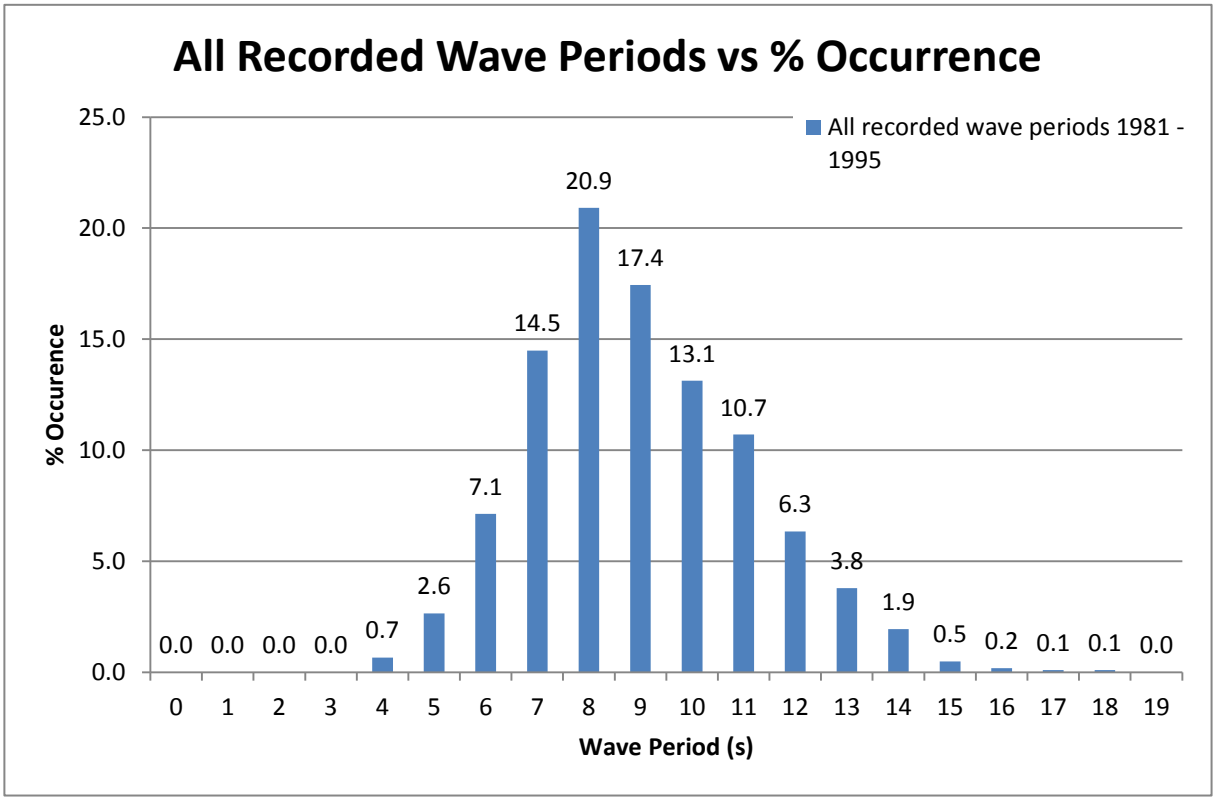
Wave Height Percentage Exceedance

Figure 4





Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

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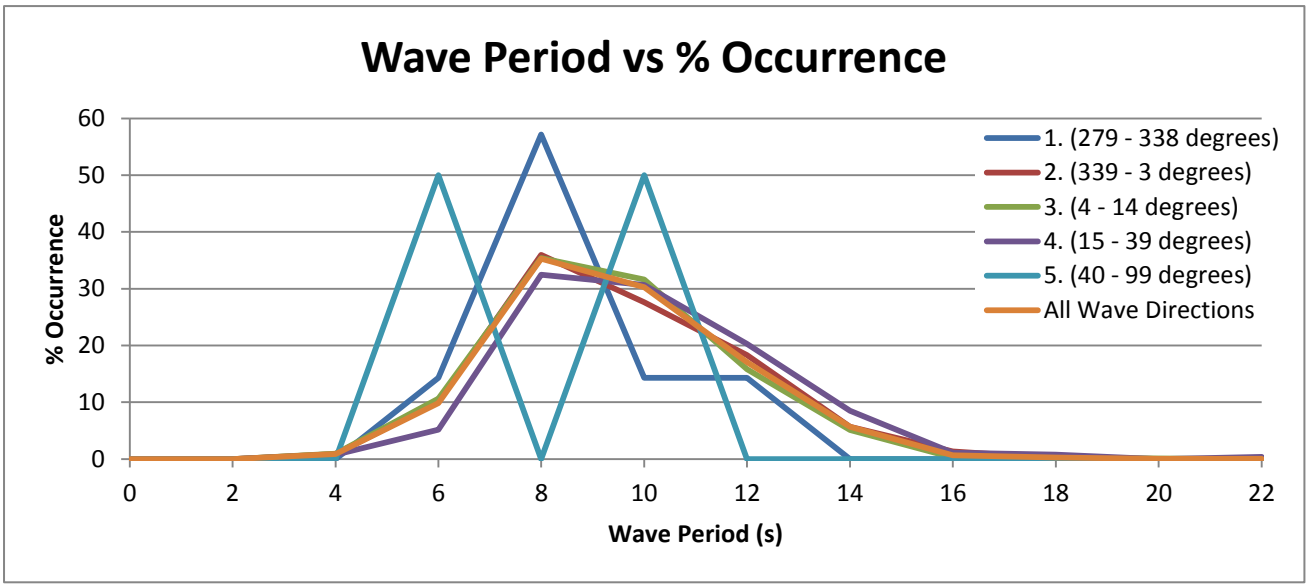
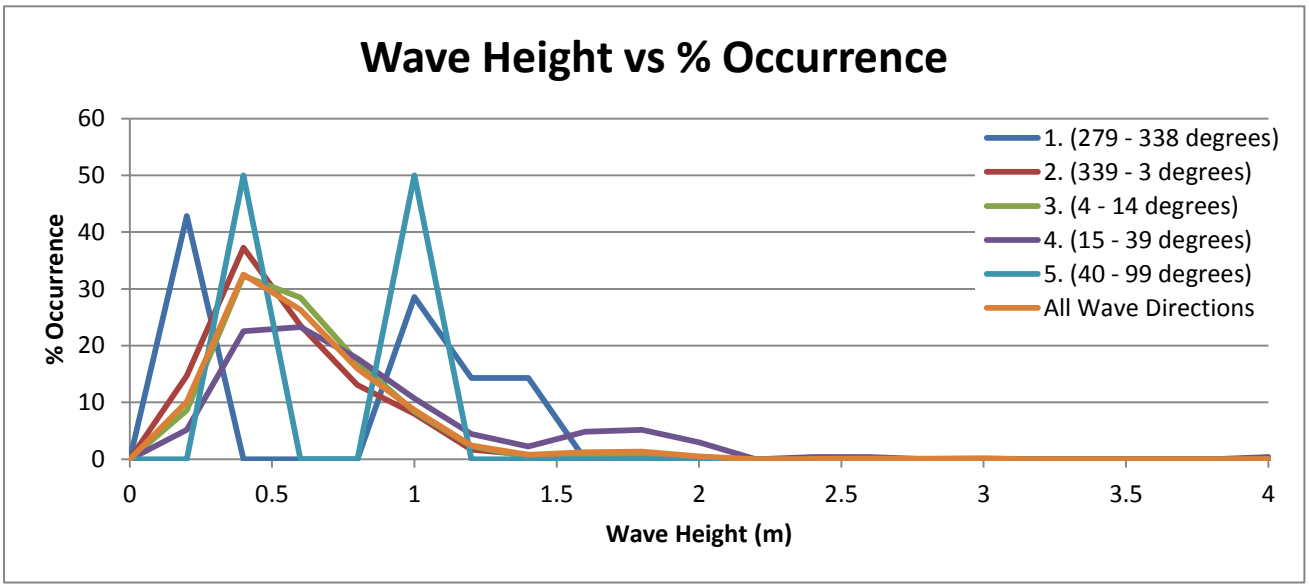
Figure 5

Percentage Occurrence of Wave Height and Wave Period





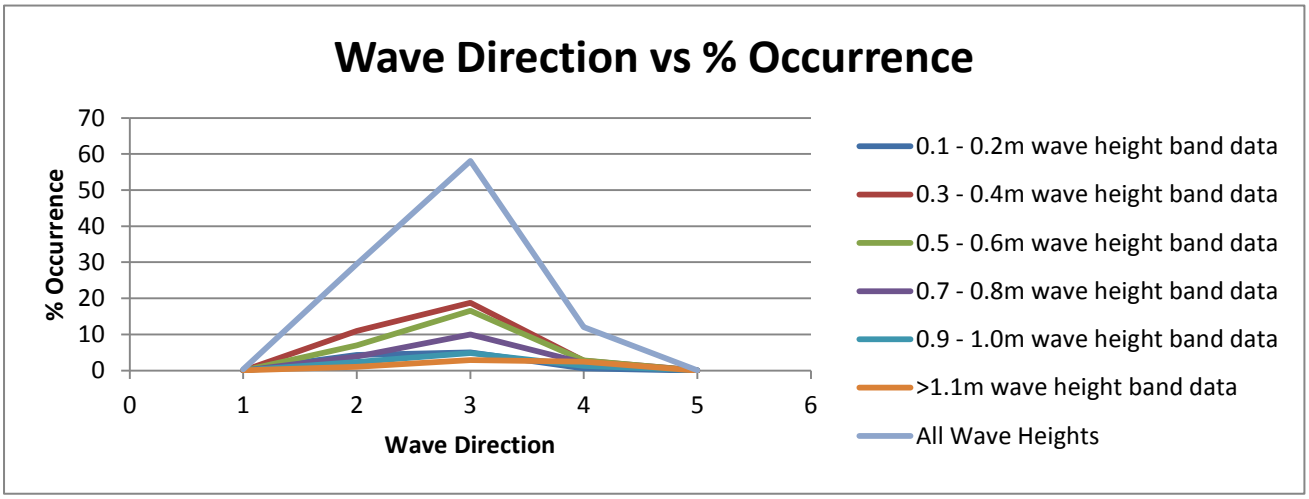


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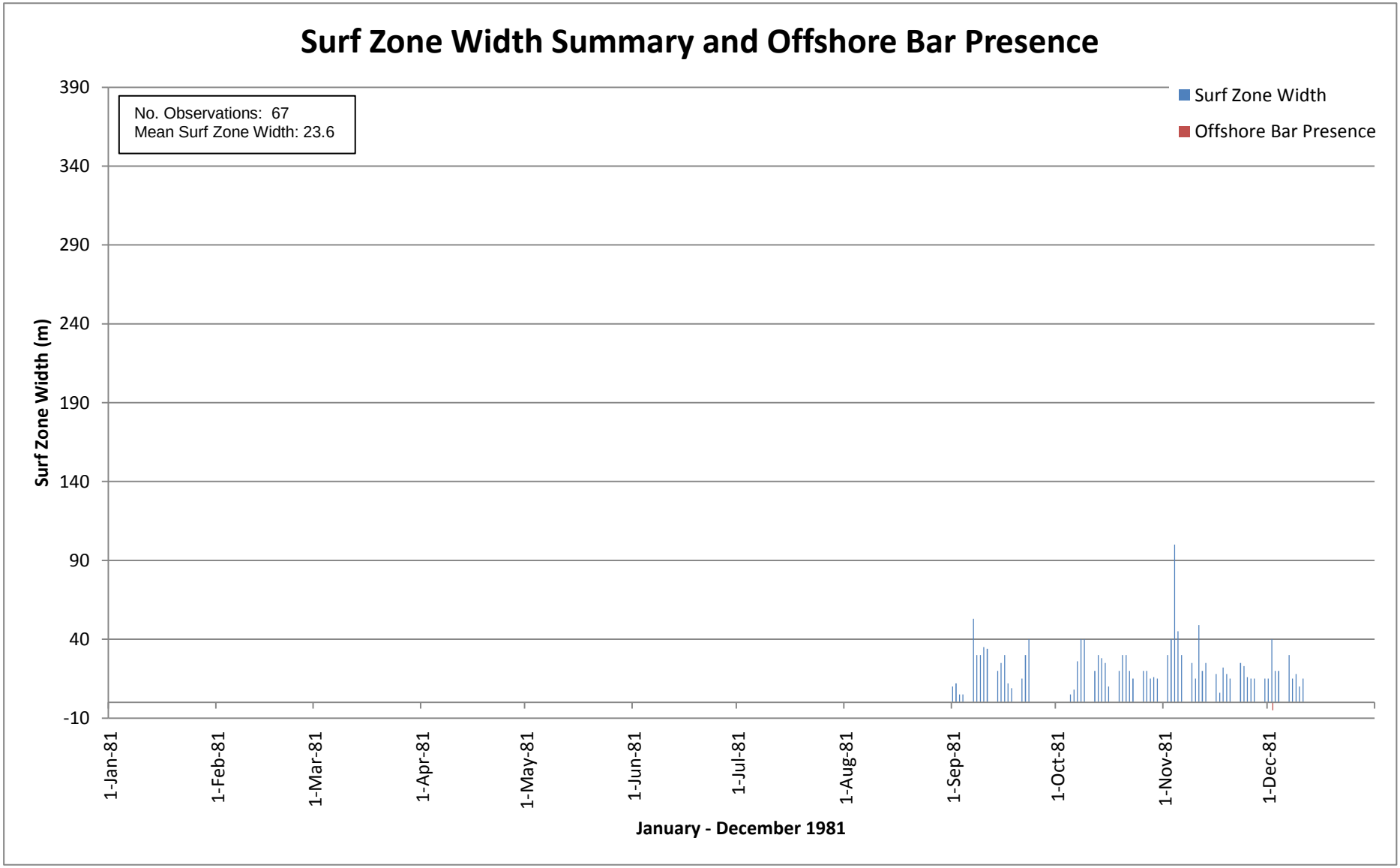
Figure 6

Wave Direction Analysis



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Surf Zone Width - 1981

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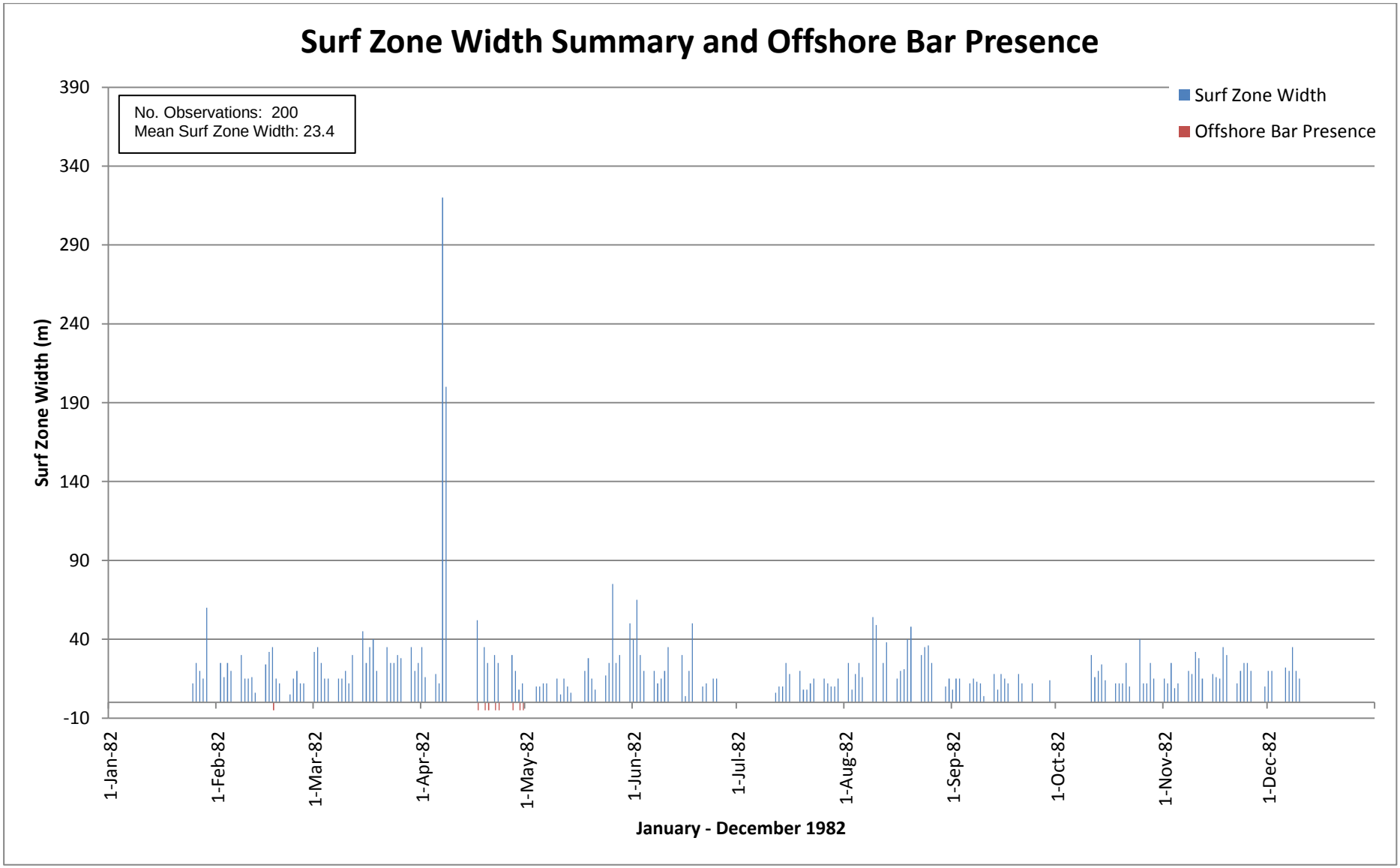
Figure 7



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

Surf Zone Width - 1982

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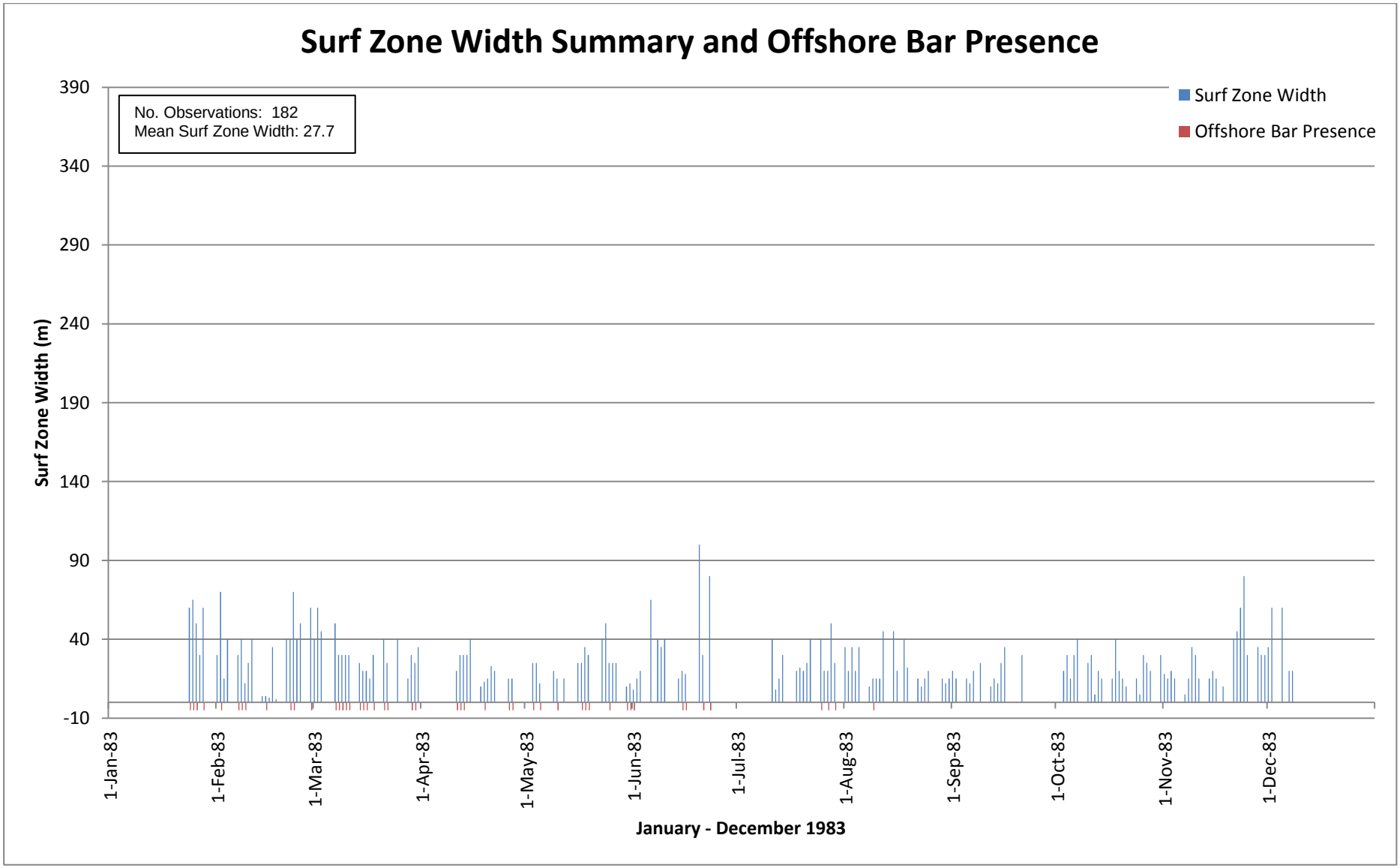
Figure 8



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Surf Zone Width - 1983

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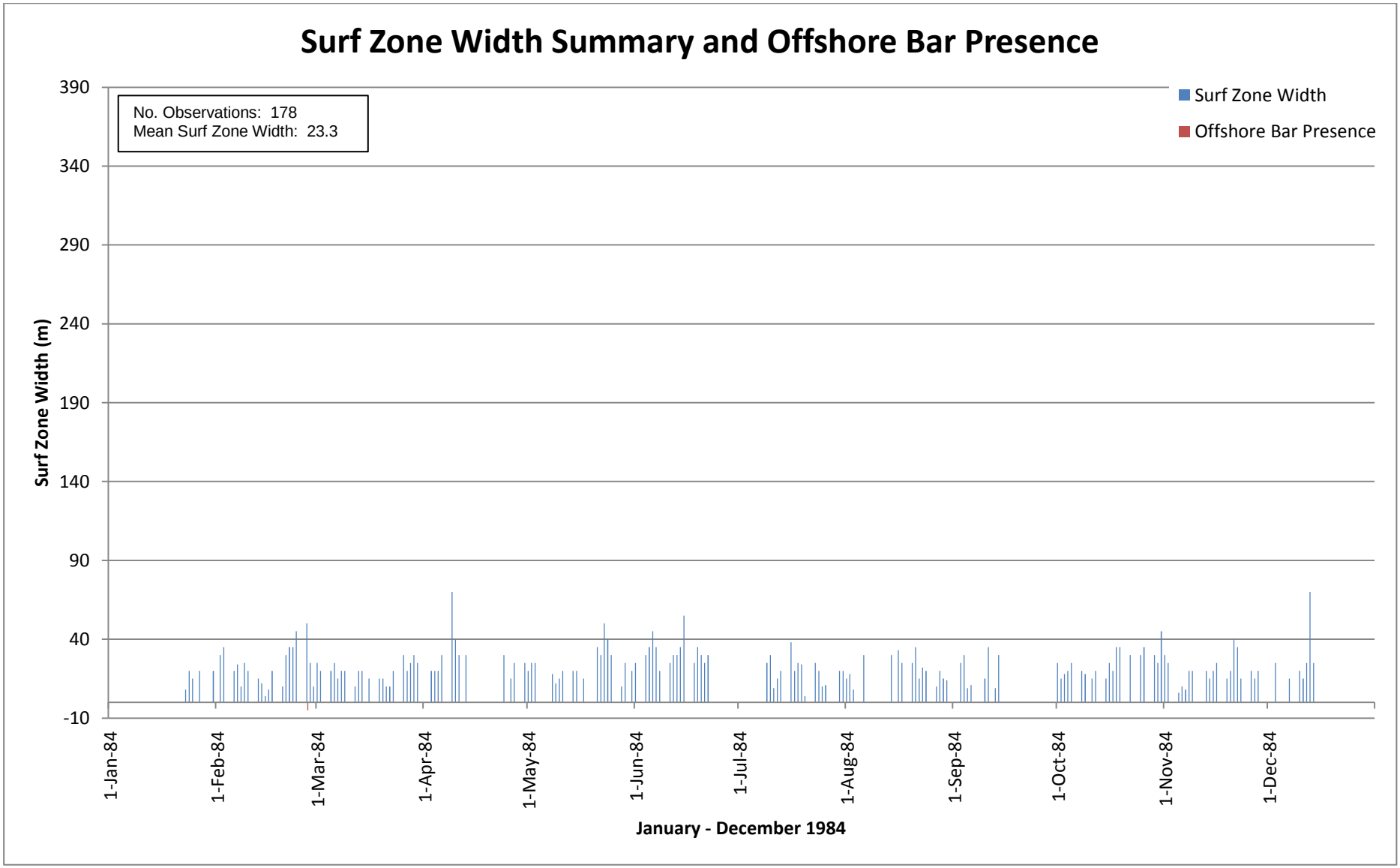
Figure 9



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

Surf Zone Width - 1984

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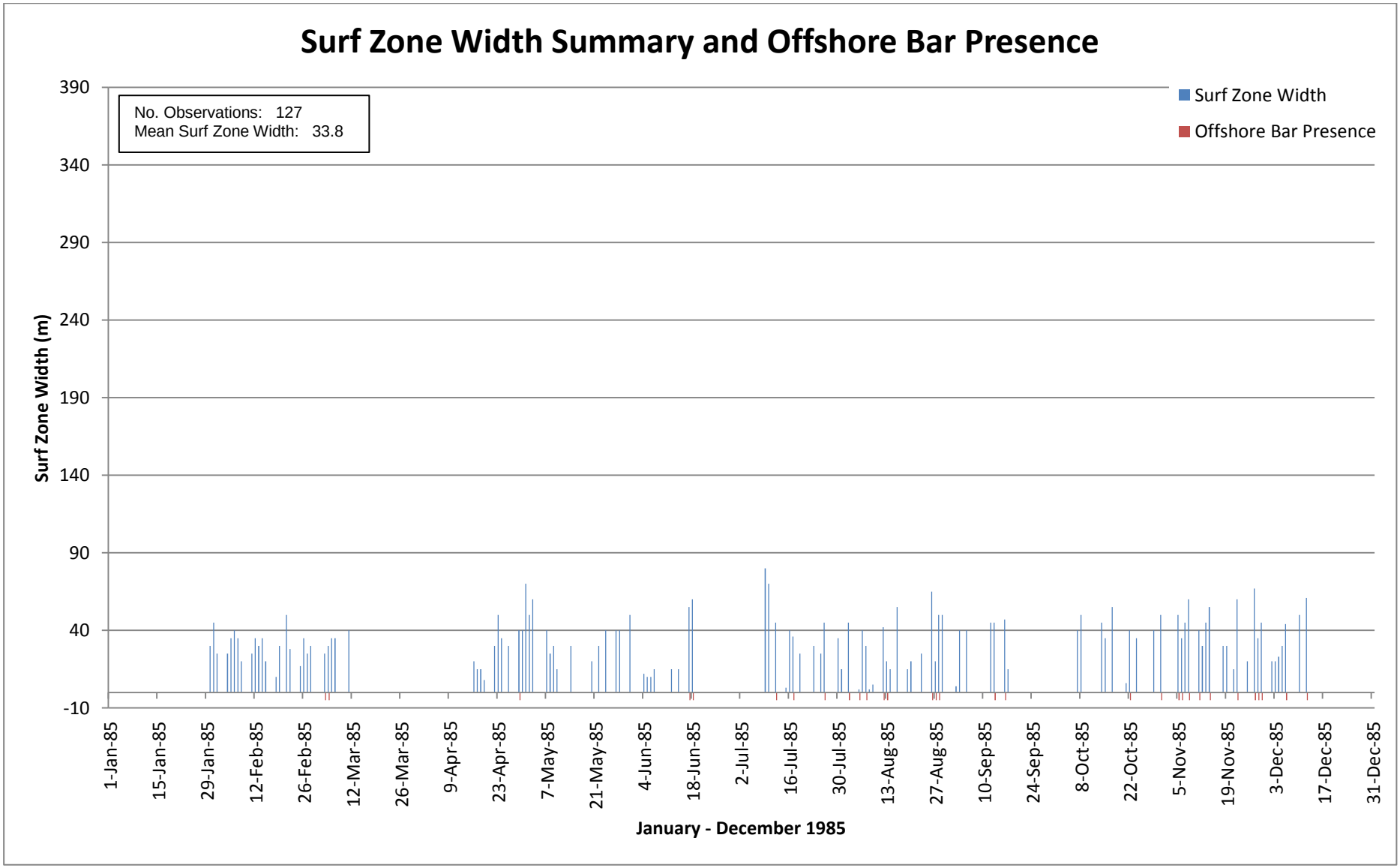
Figure 10



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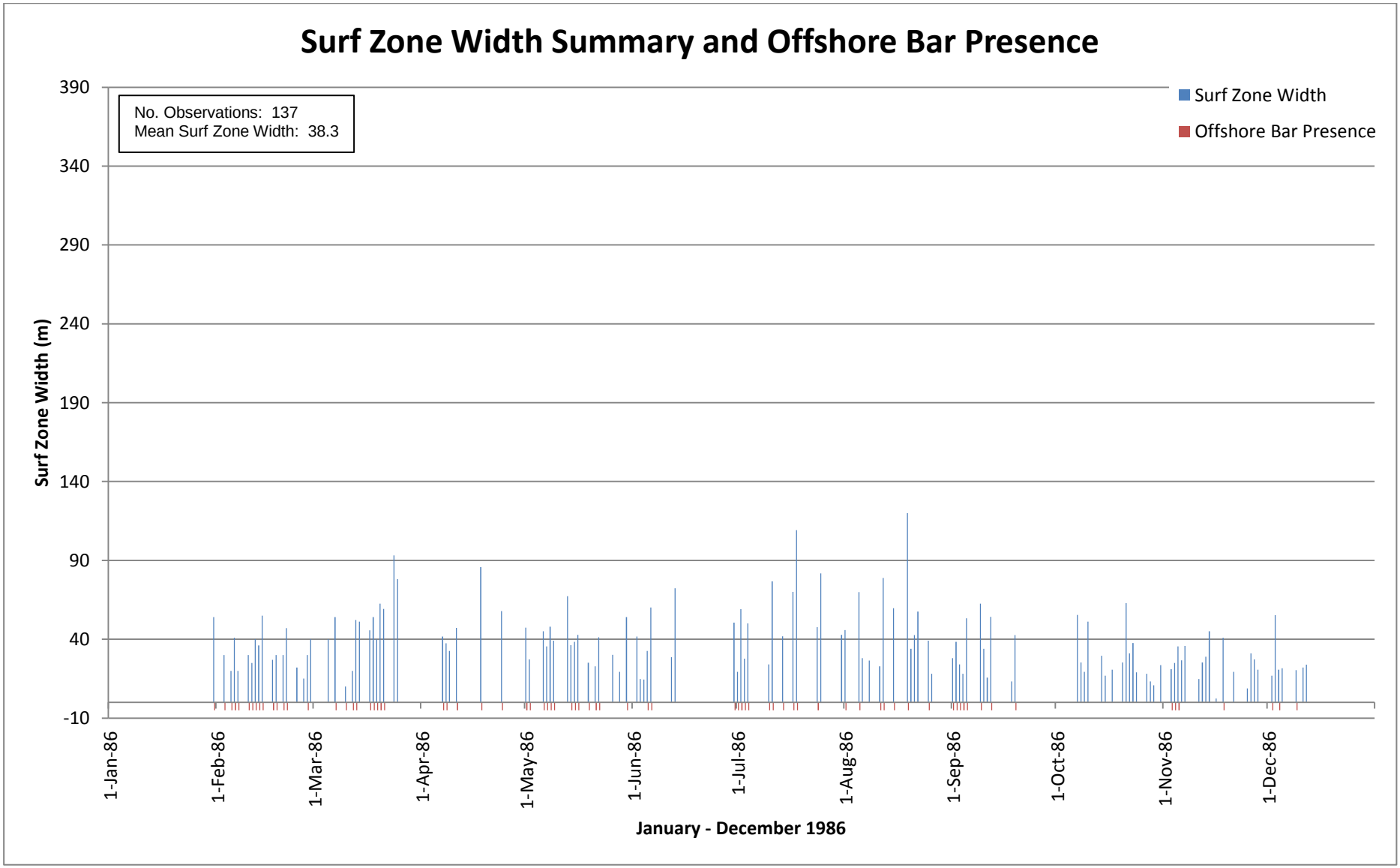
Surf Zone Width - 1985

Figure 11



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Surf Zone Width - 1986

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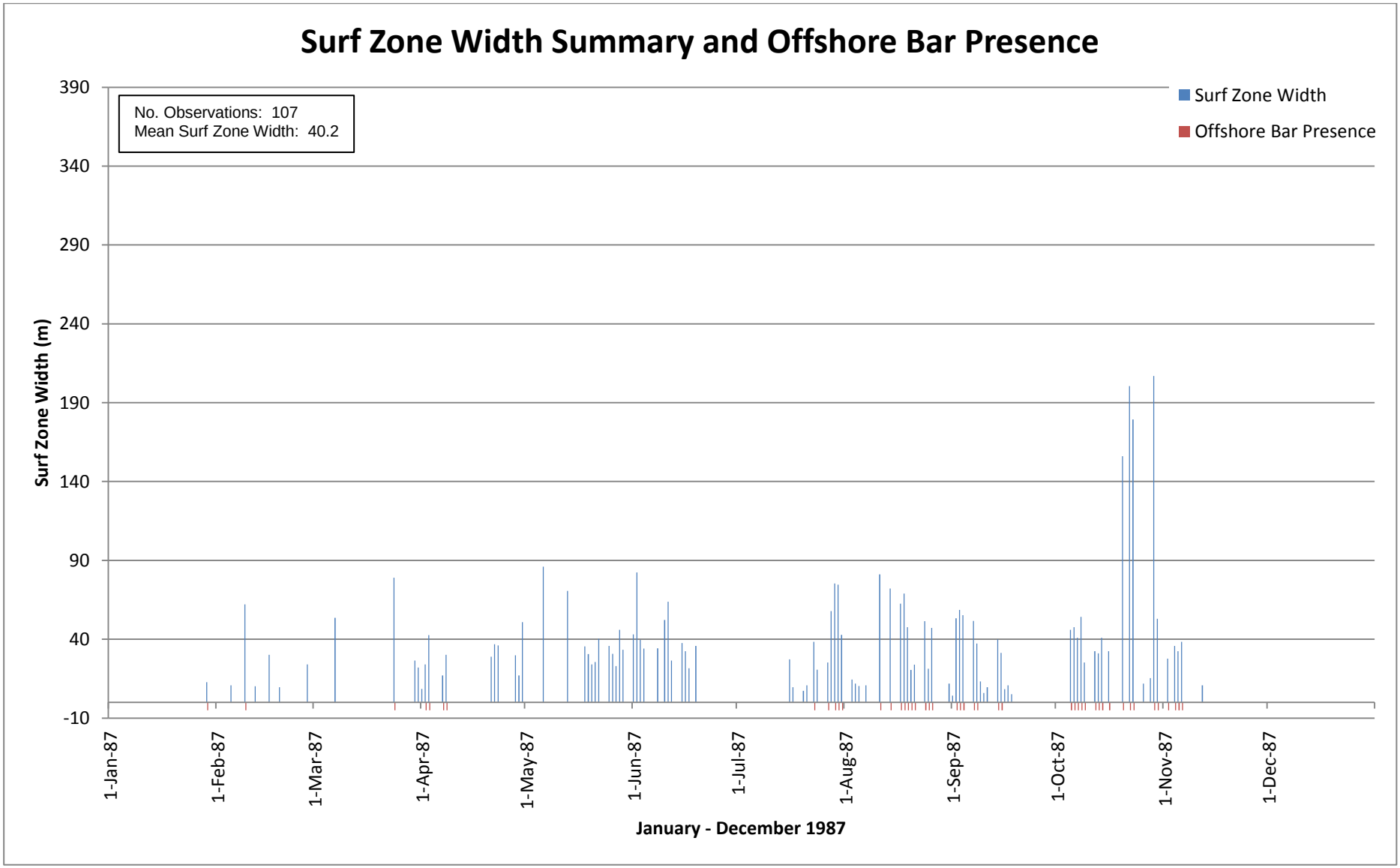
Figure 12



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Surf Zone Width - 1987

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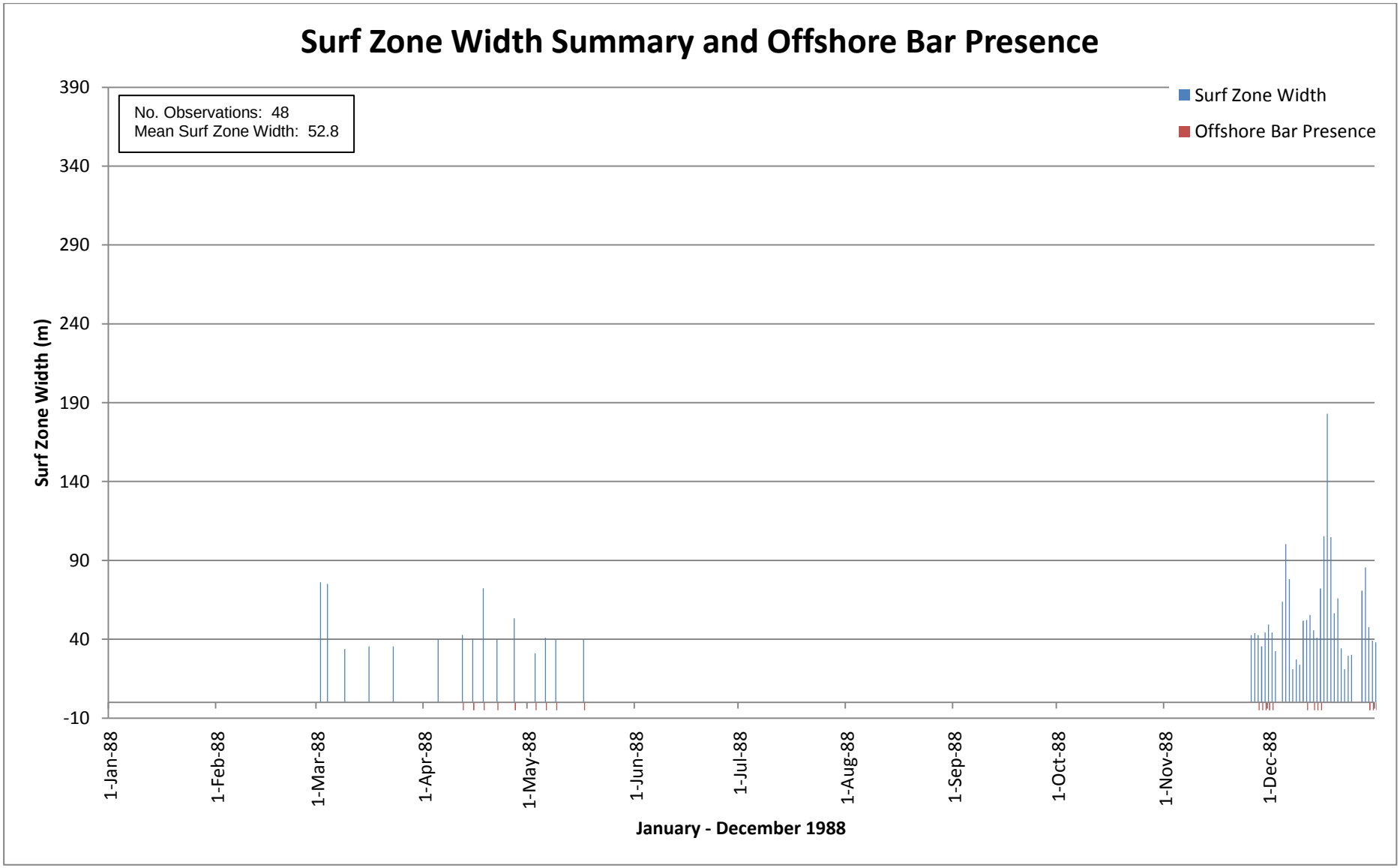
Figure 13



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Surf Zone Width - 1988

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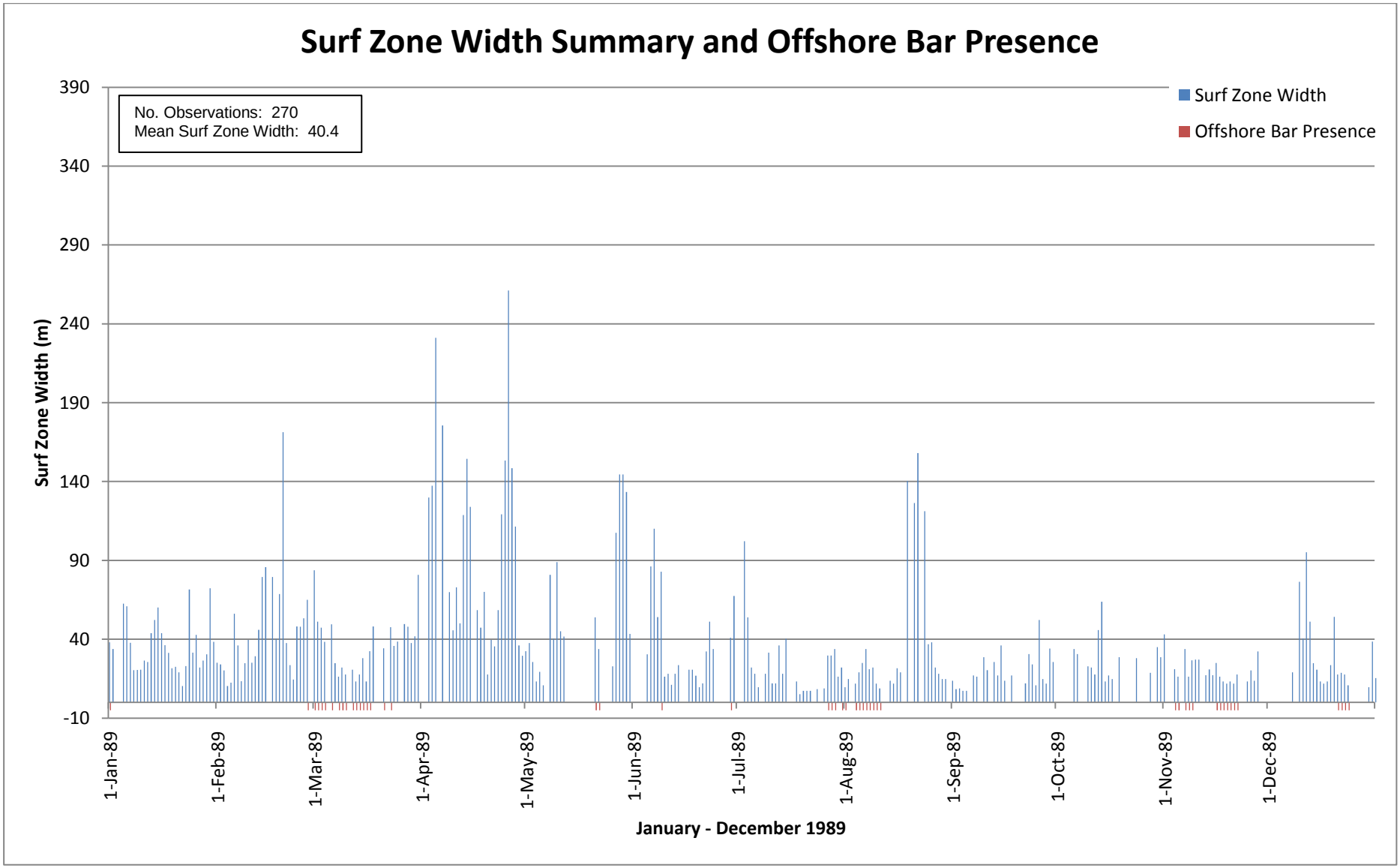
Figure 14



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Surf Zone Width - 1989

Job Number	41-27255
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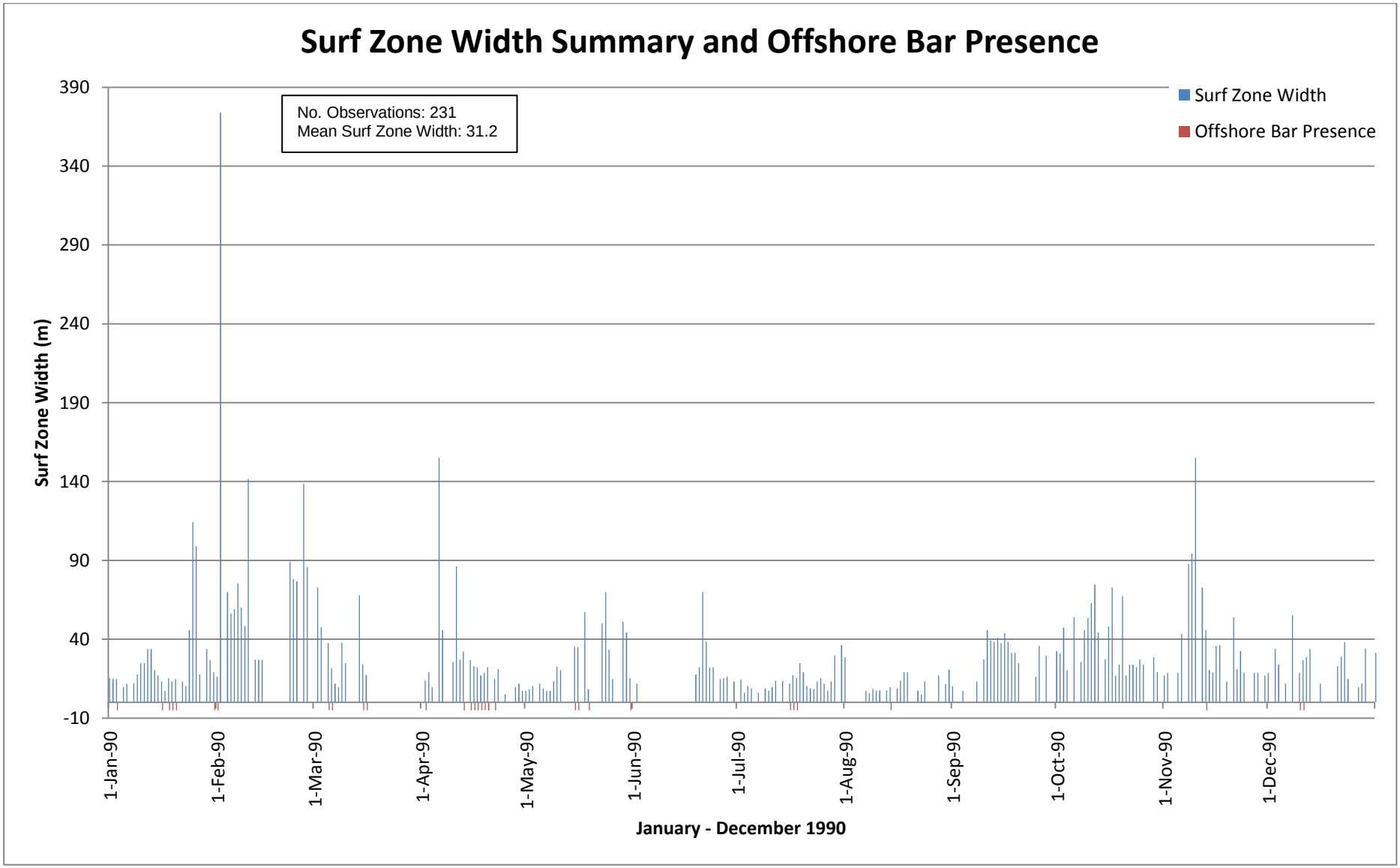
Figure 15



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Surf Zone Width - 1990

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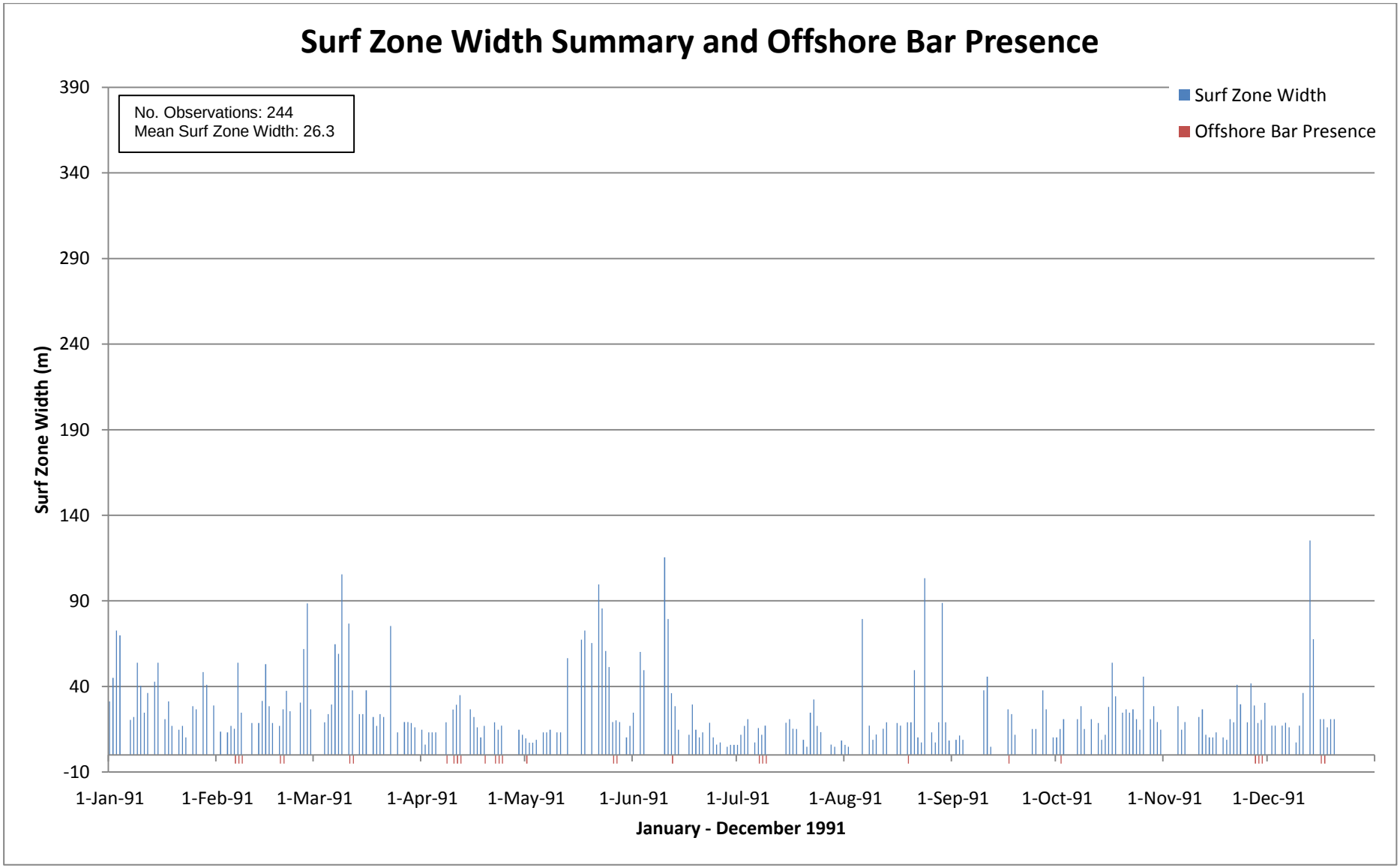
Figure 16



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Surf Zone Width - 1991

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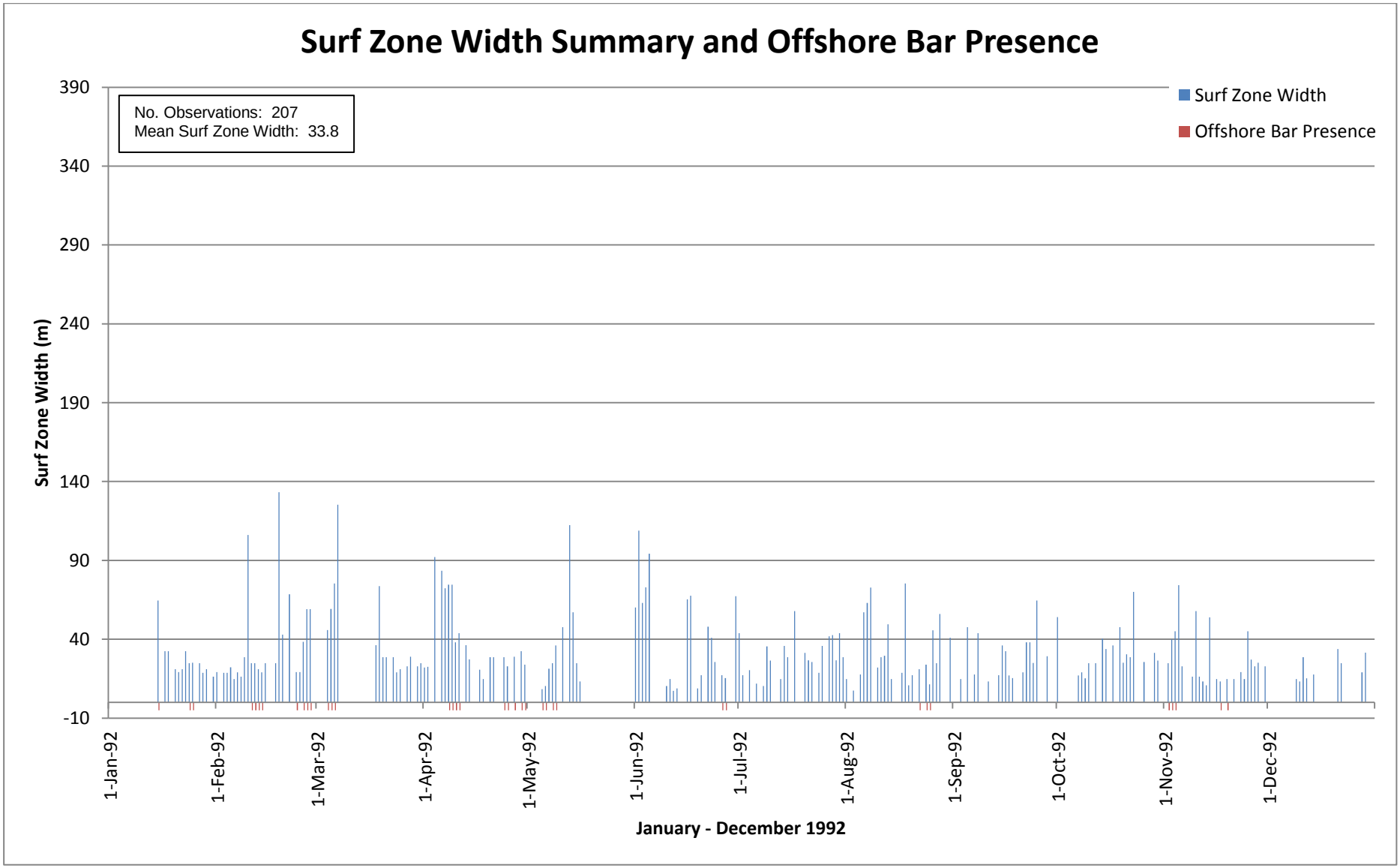
Figure 17



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

Surf Zone Width - 1992

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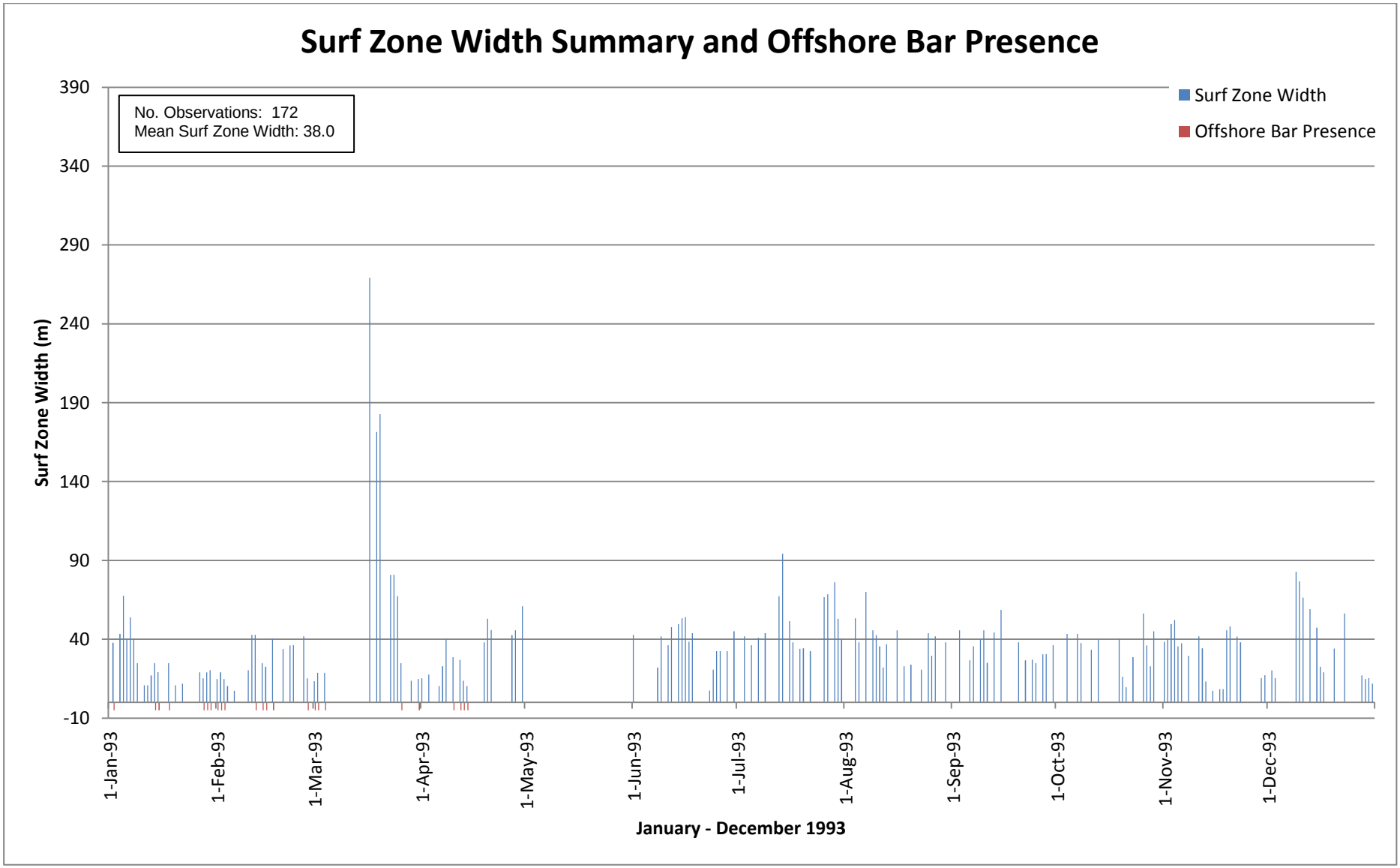
Figure 18



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Surf Zone Width - 1993

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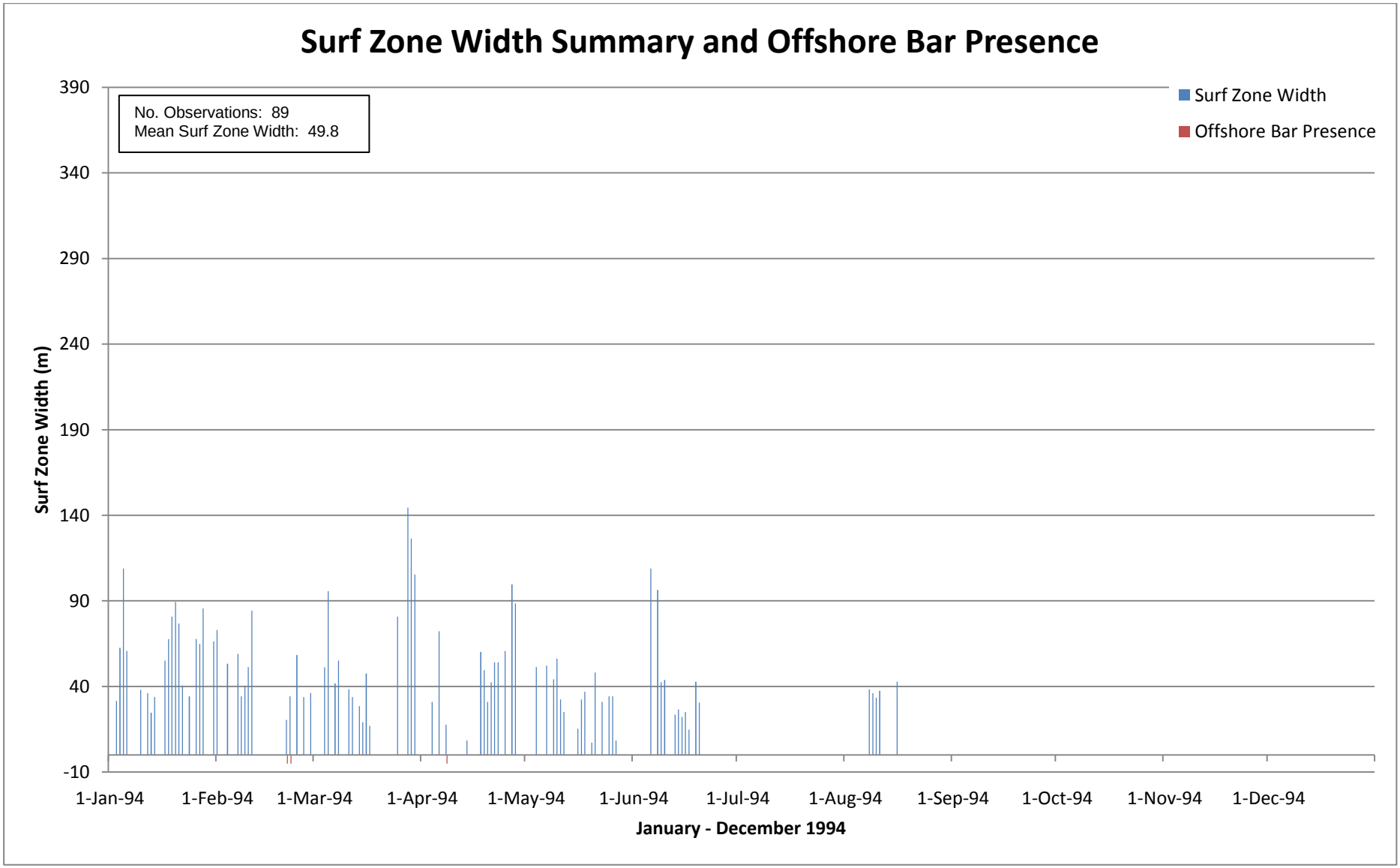
Figure 19



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

Surf Zone Width - 1994

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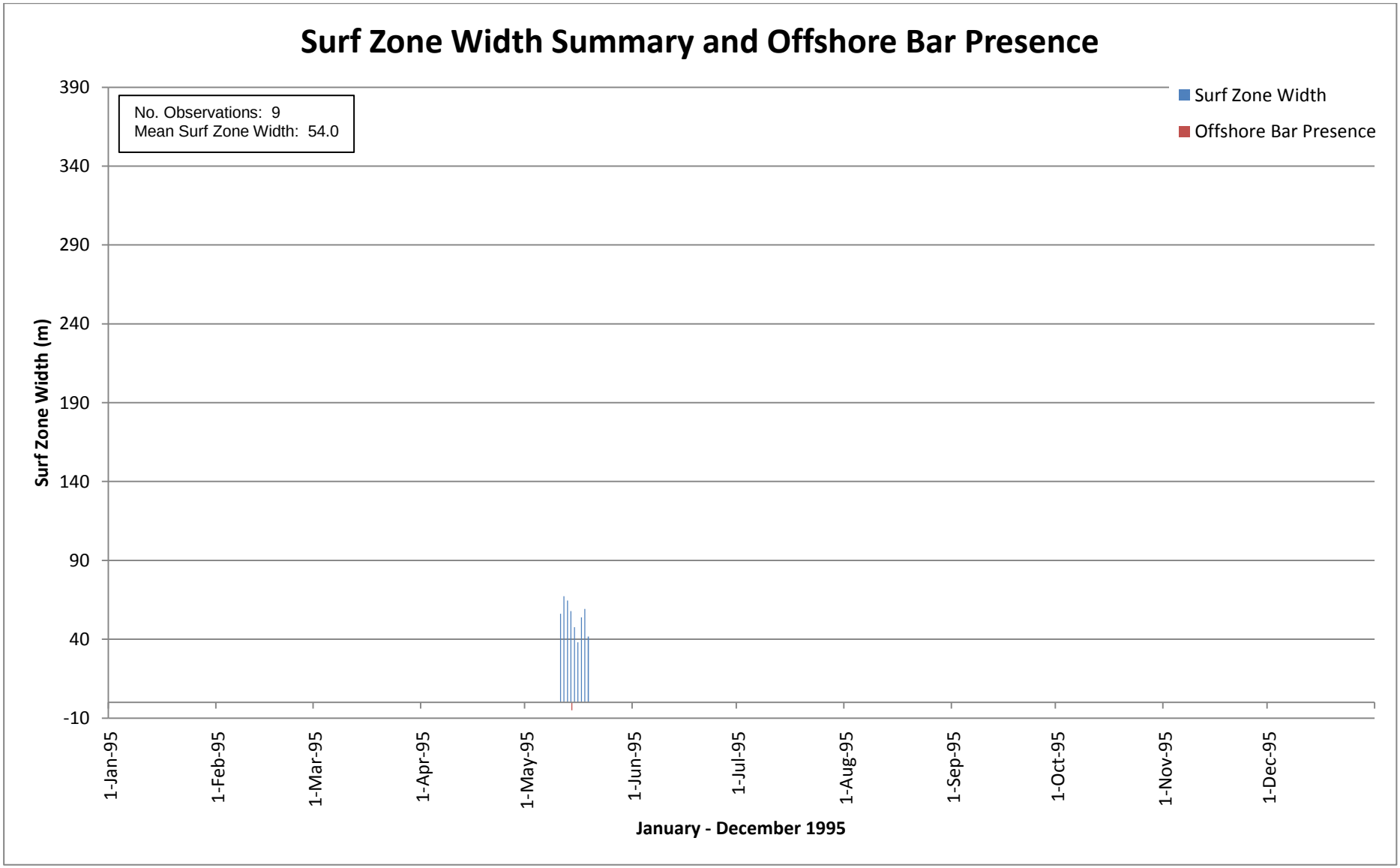
Figure 20



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Surf Zone Width - 1995

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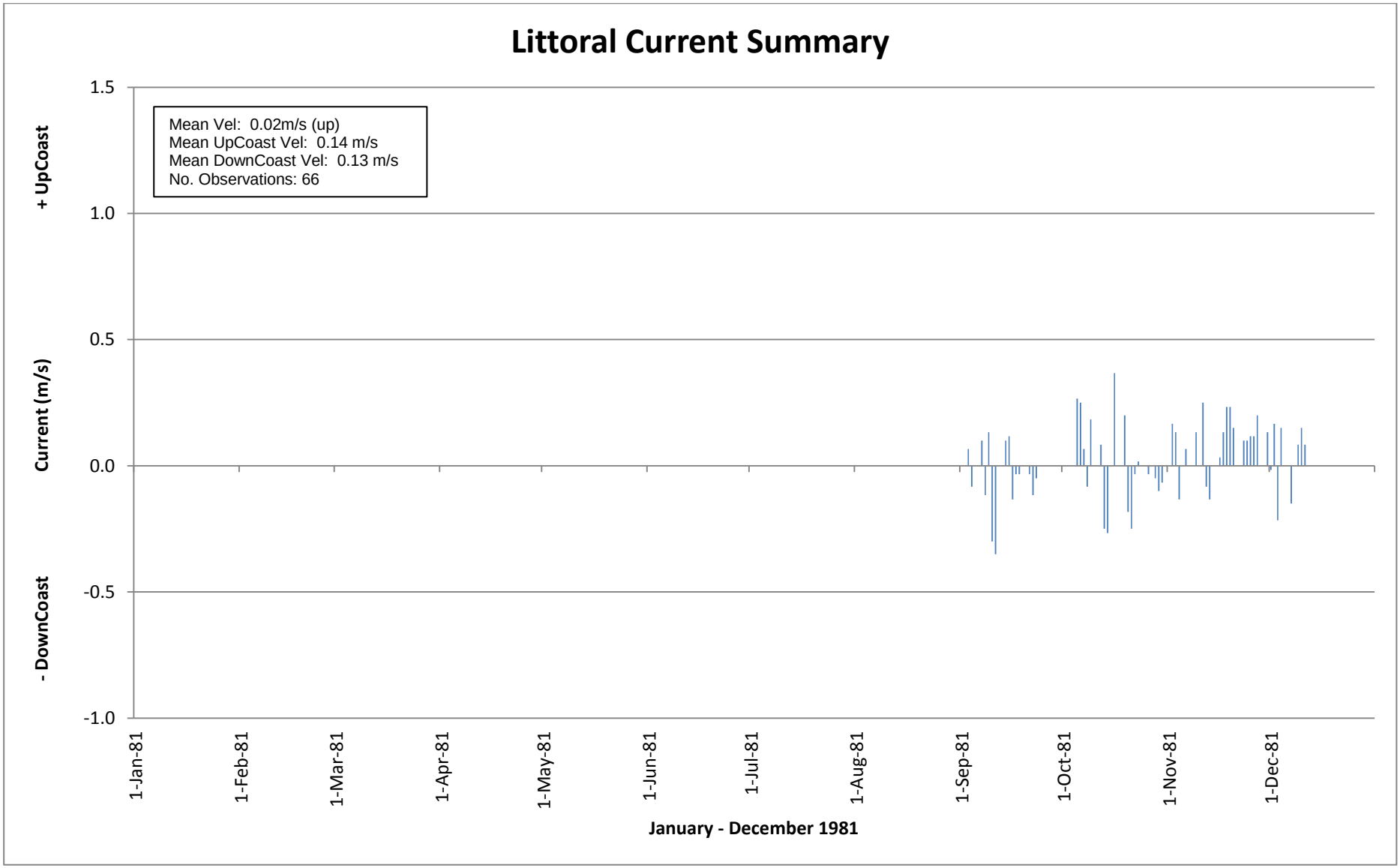
Figure 21



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

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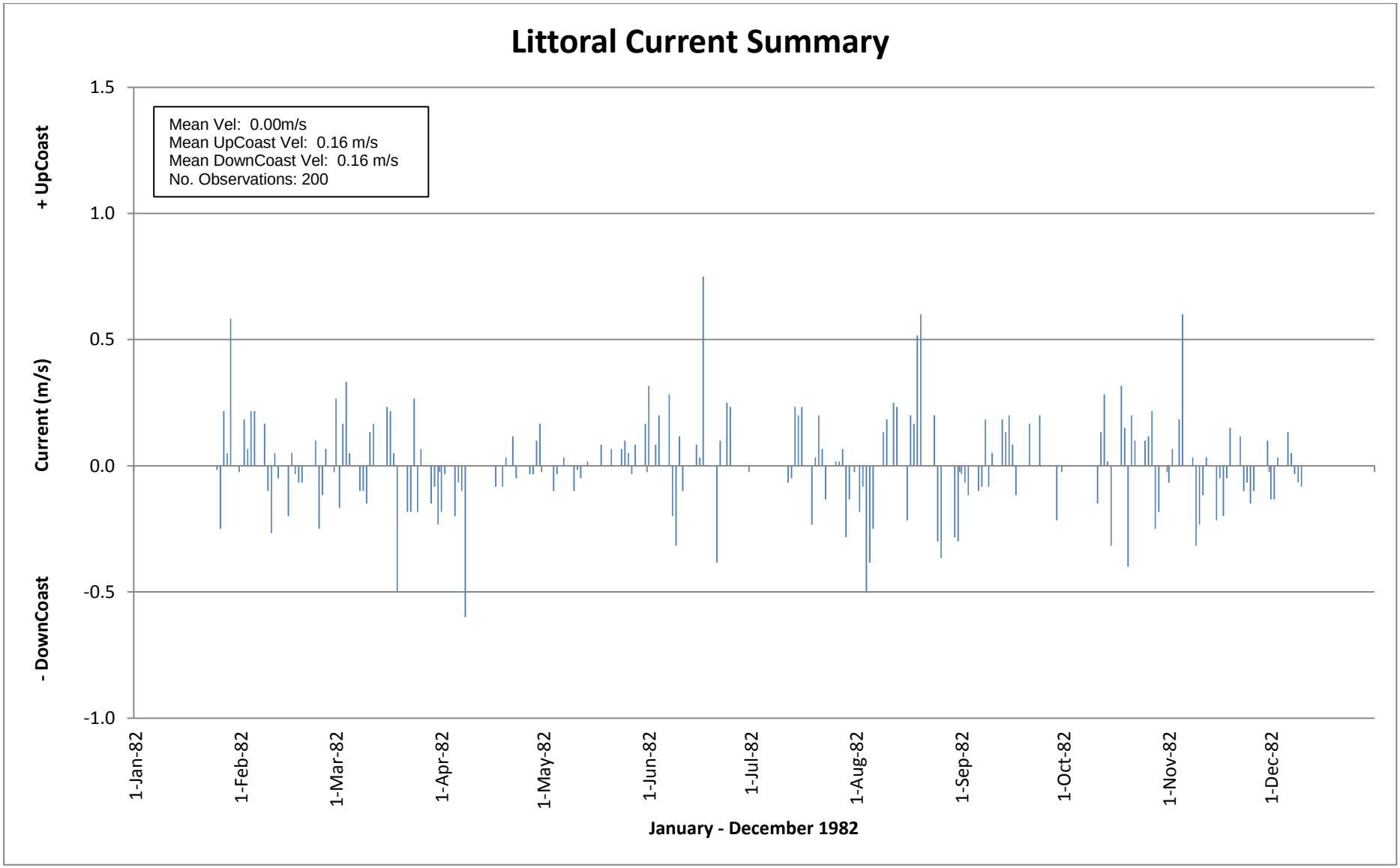
Littoral Current Summary – 1981

Figure 22



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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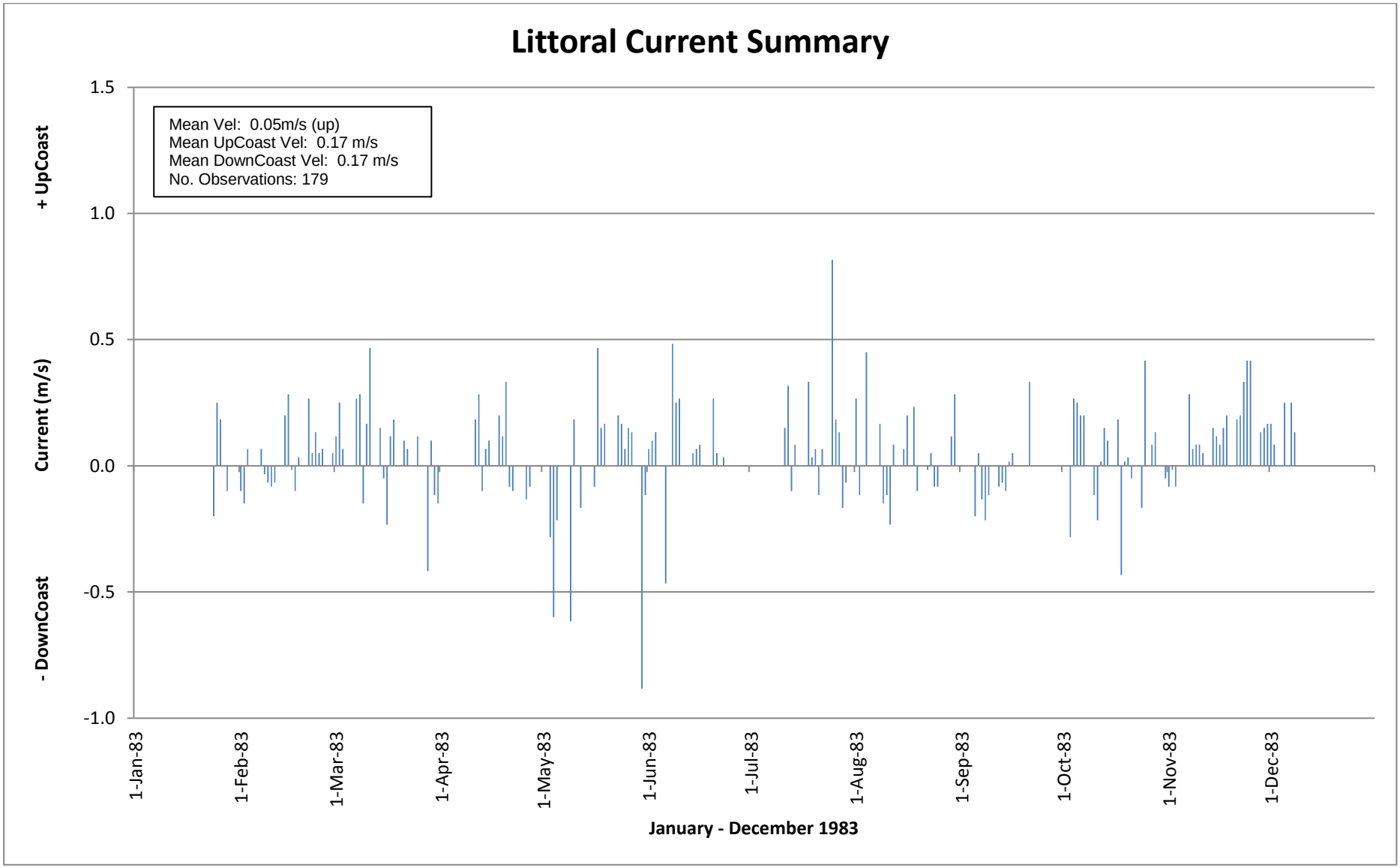
Littoral Current Summary – 1982

Figure 23



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

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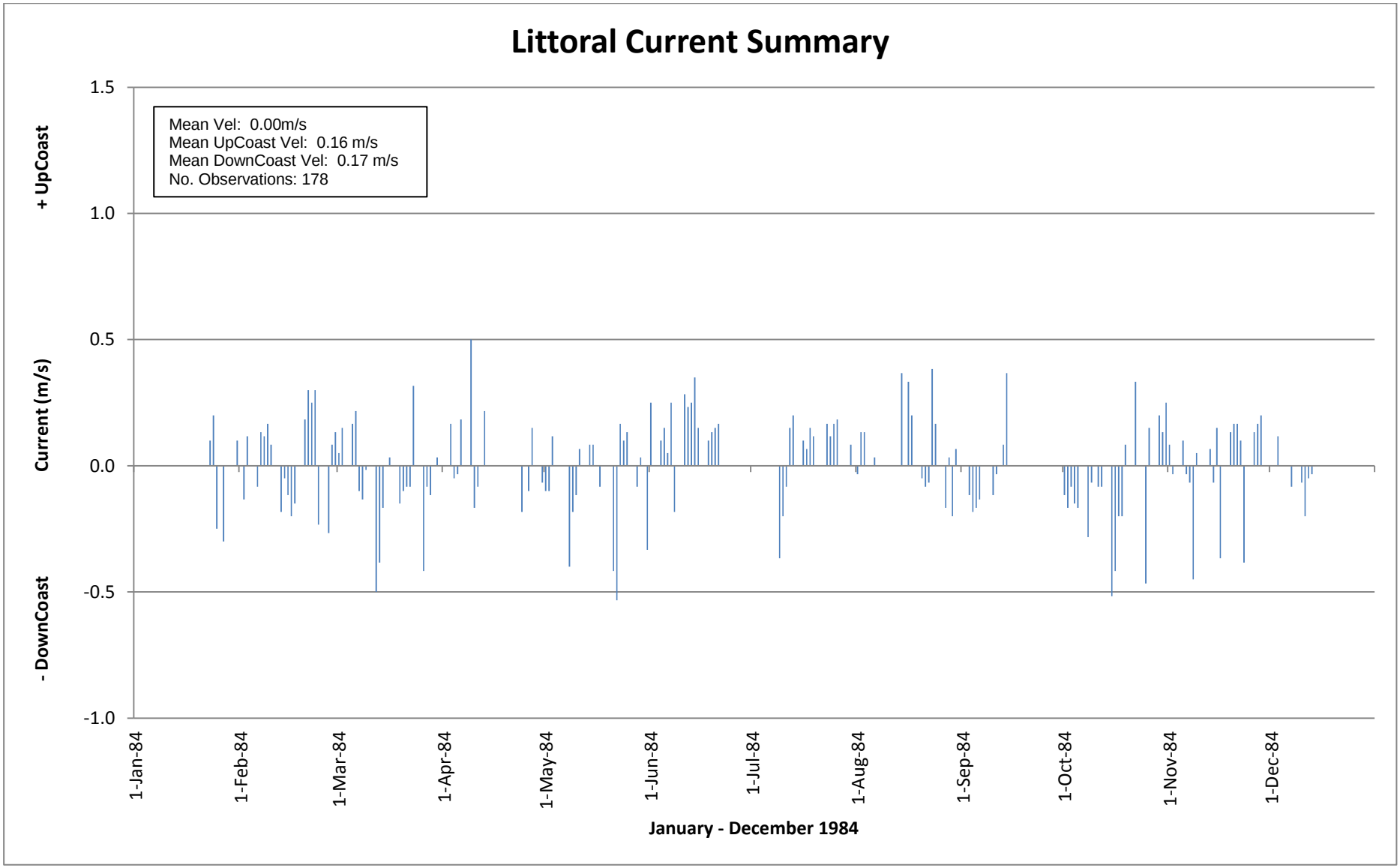
Littoral Current Summary – 1983

Figure 24



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

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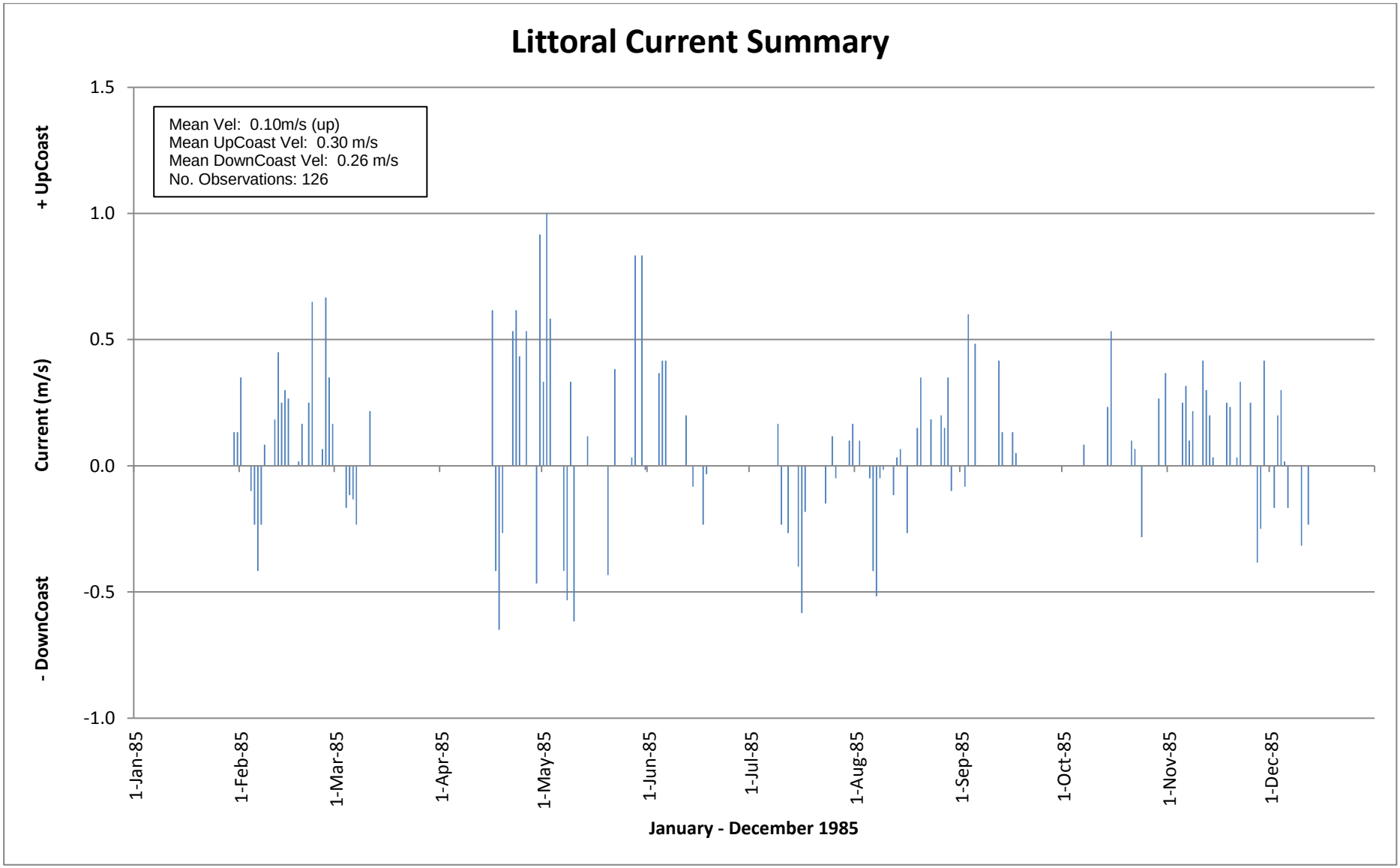
Littoral Current Summary – 1984

Figure 25



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Coolangatta Beach COPE Data Compilation

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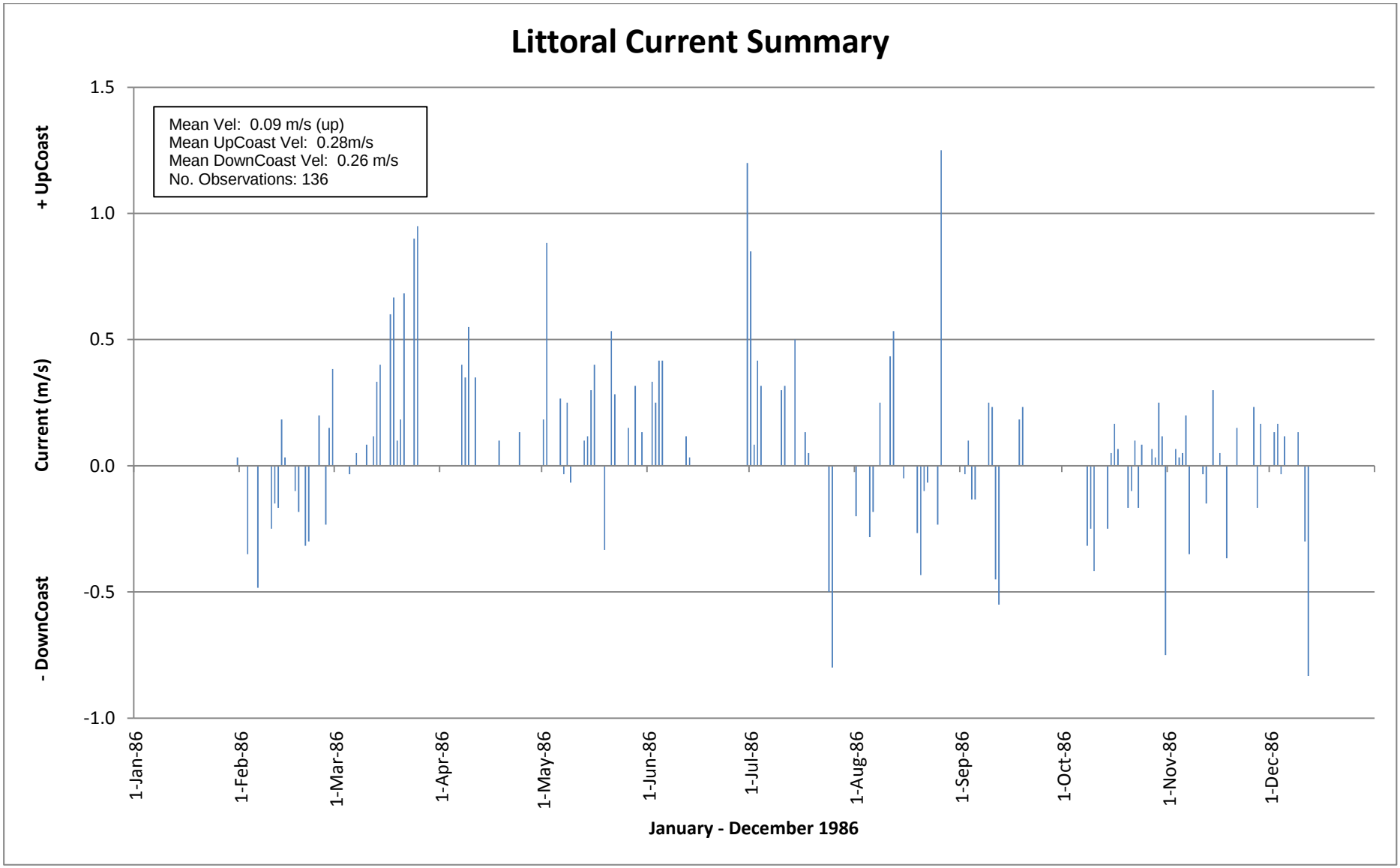
Littoral Current Summary – 1985

Figure 26



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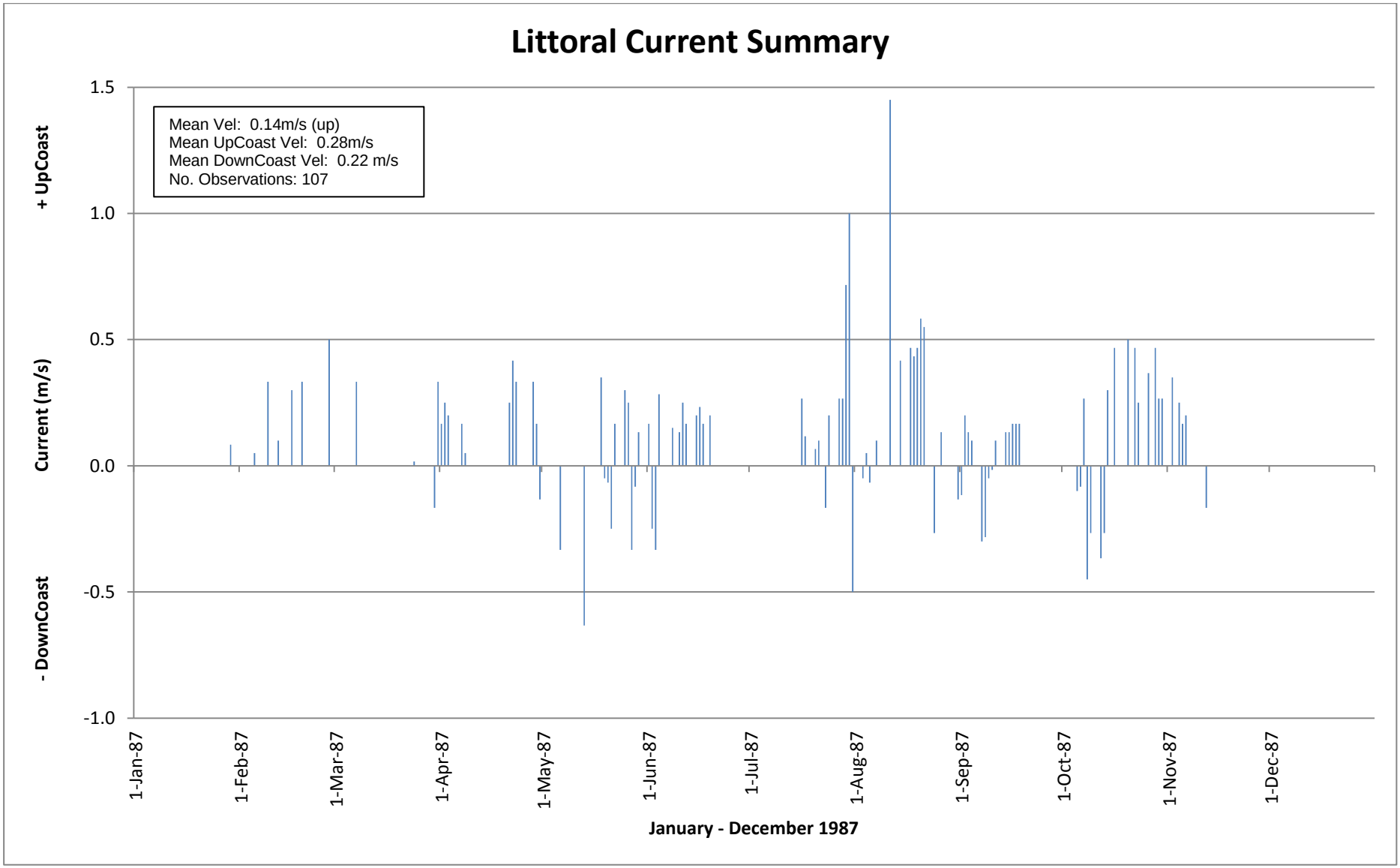
Littoral Current Summary – 1986

Figure 27



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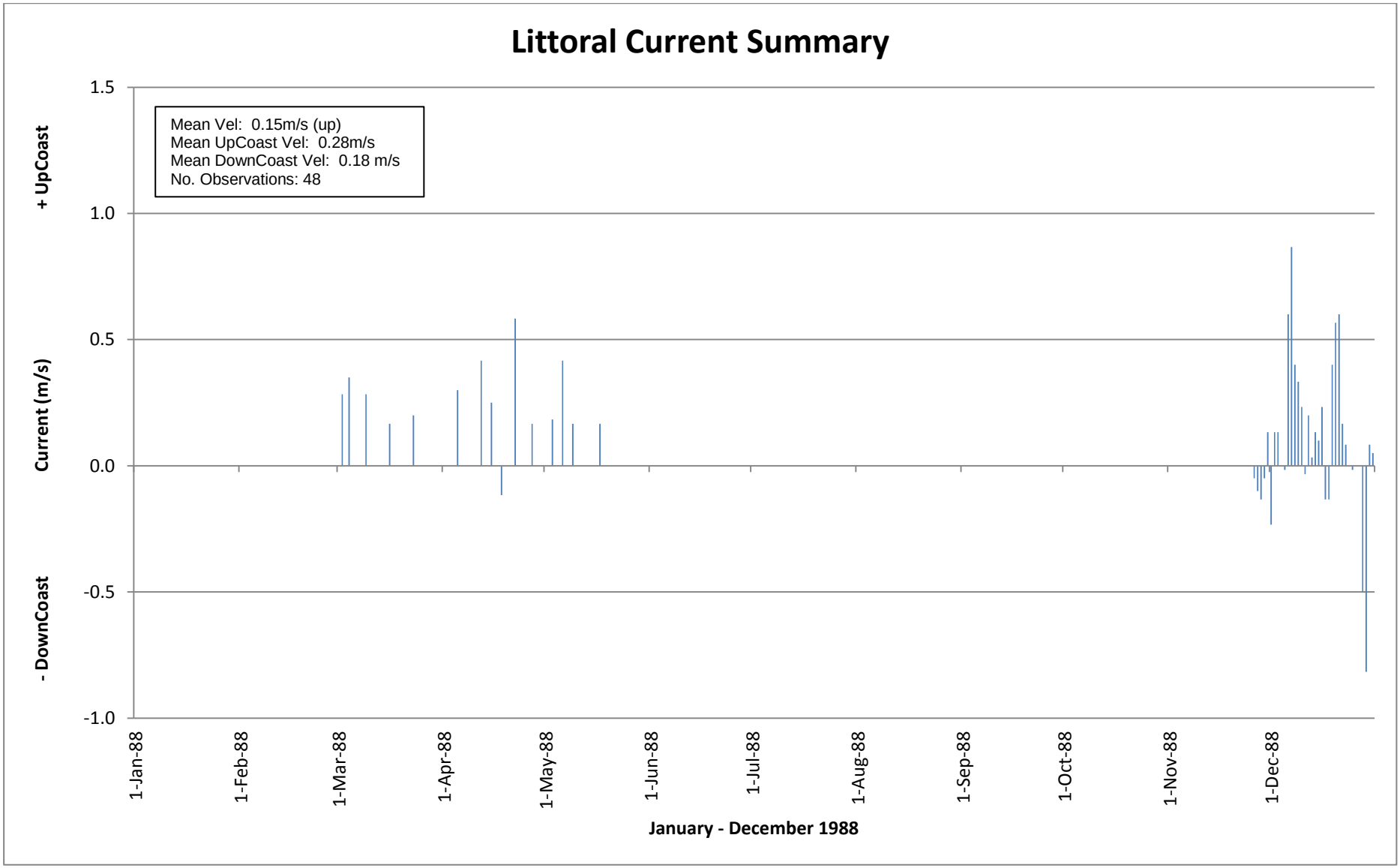
Littoral Current Summary – 1987

Figure 28



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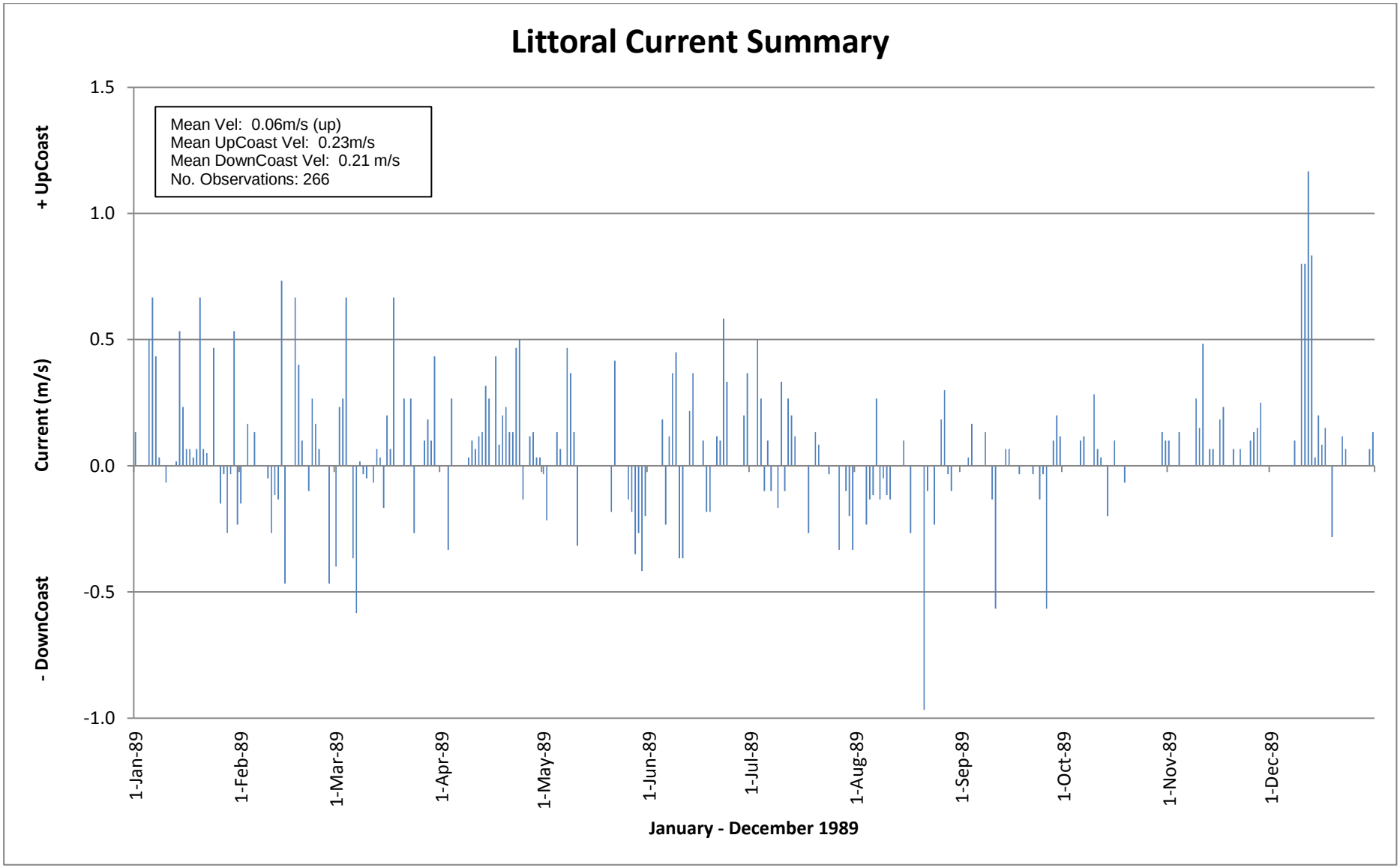
Littoral Current Summary – 1988

Figure 29



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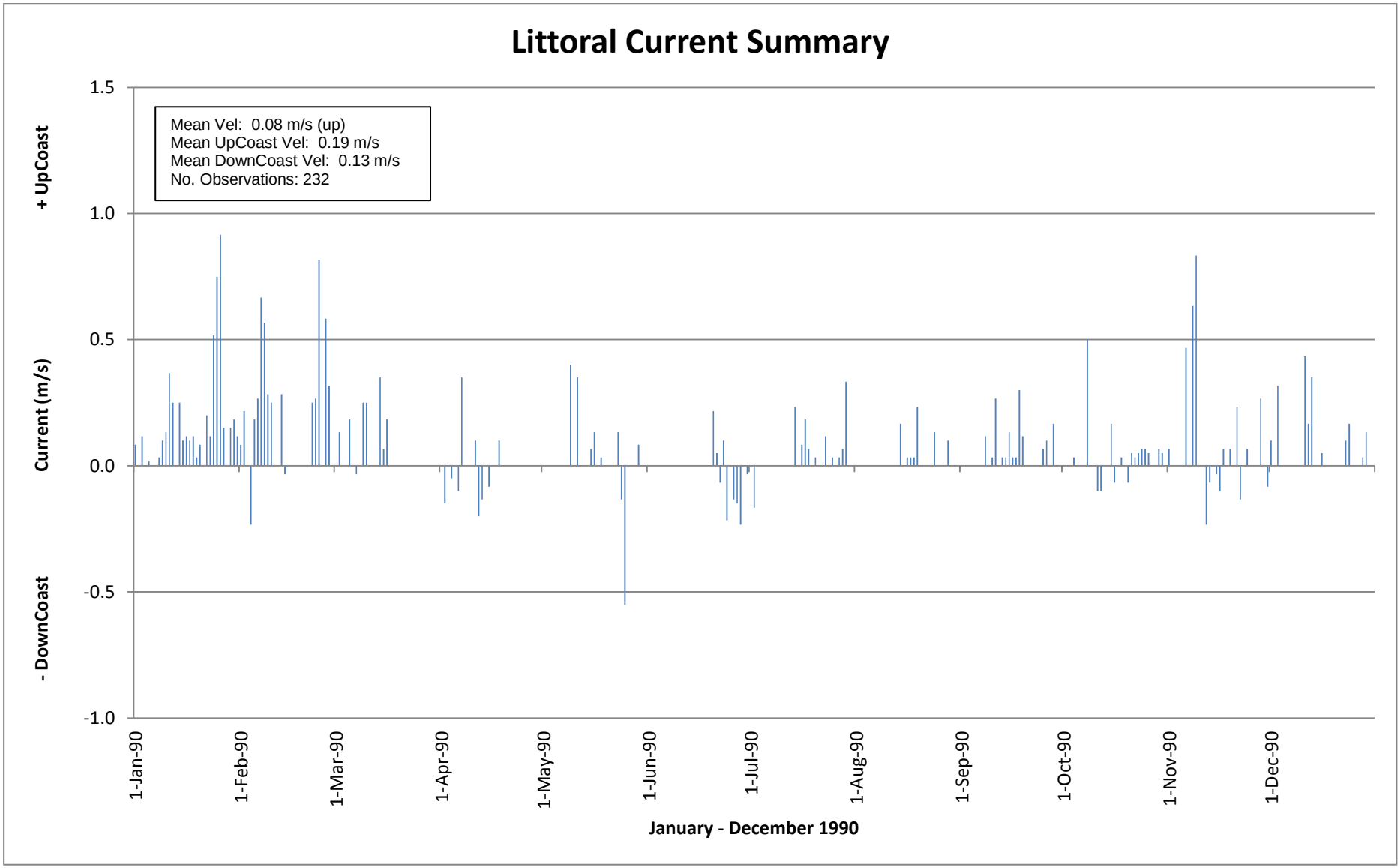
Littoral Current Summary – 1989

Figure 30



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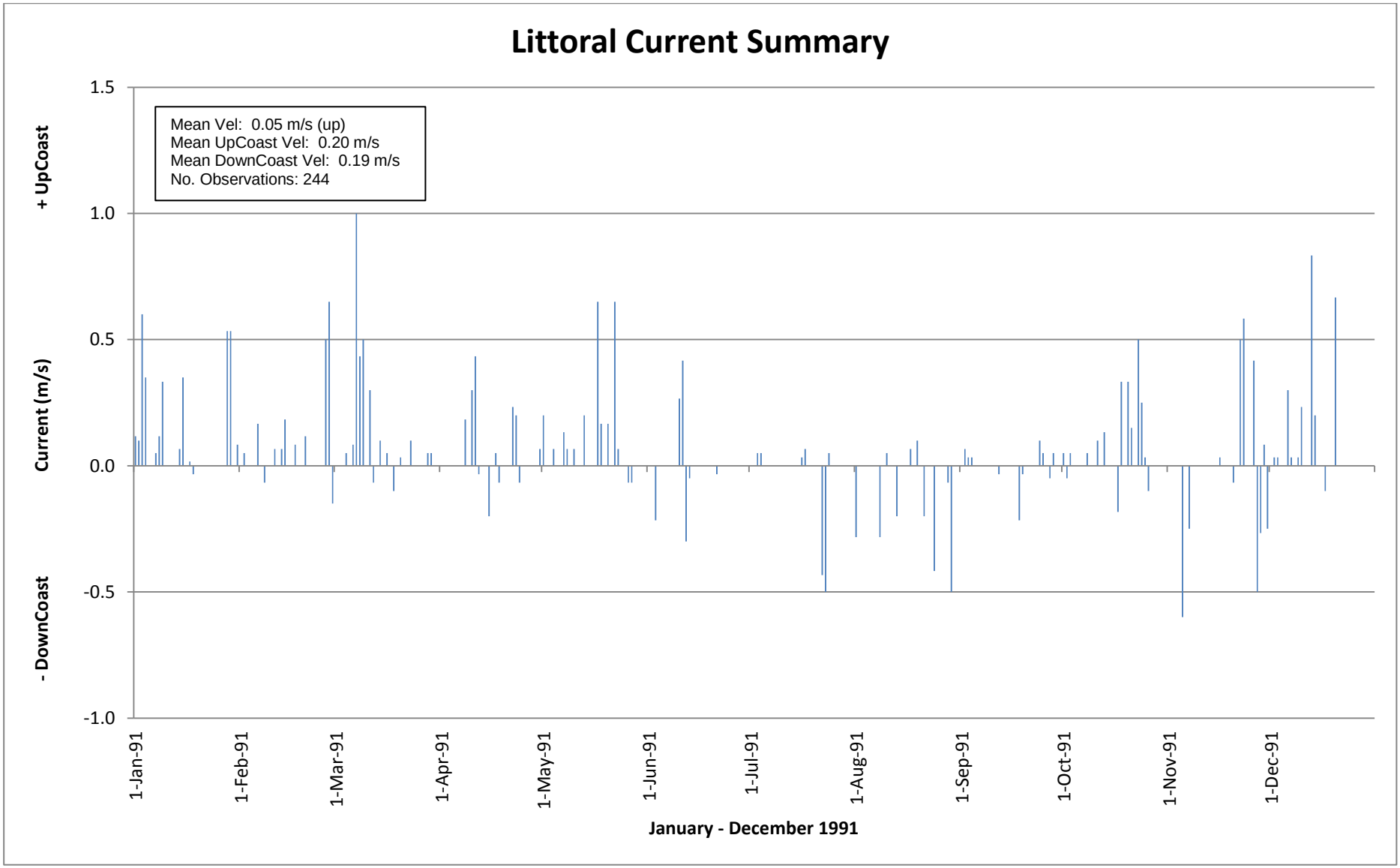
Littoral Current Summary – 1990

Figure 31



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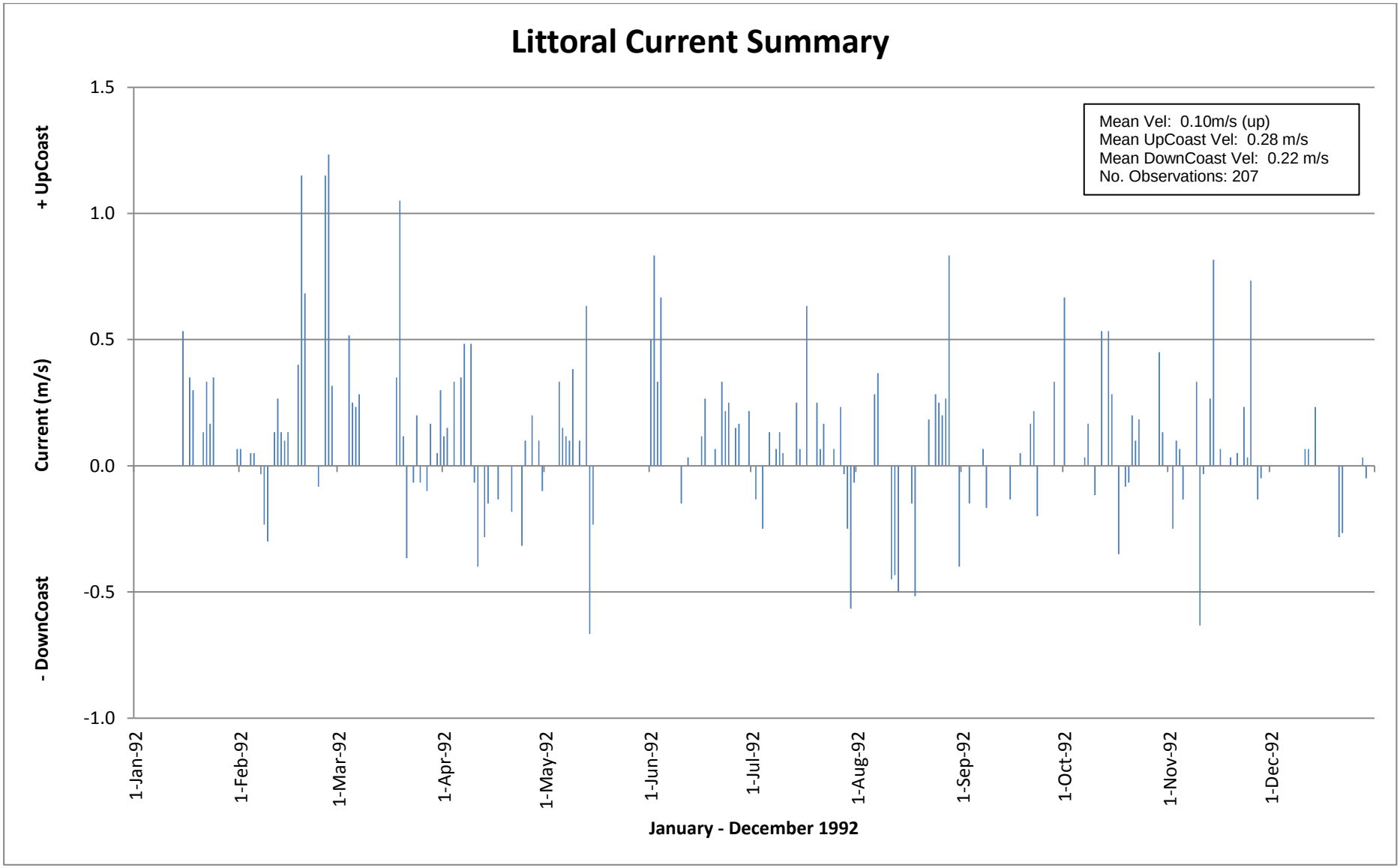
Littoral Current Summary – 1991

Figure 32



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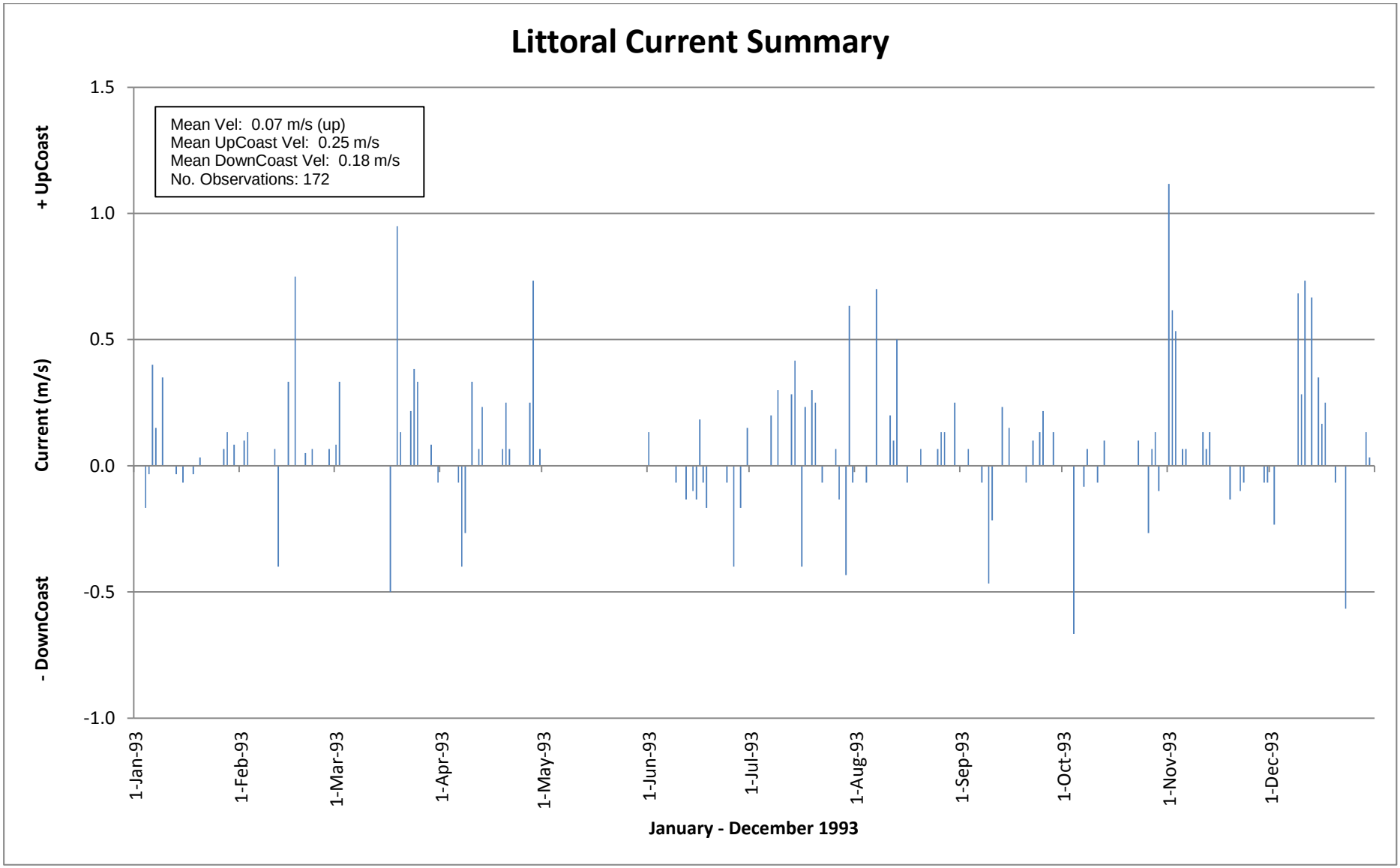
Littoral Current Summary – 1992

Figure 33



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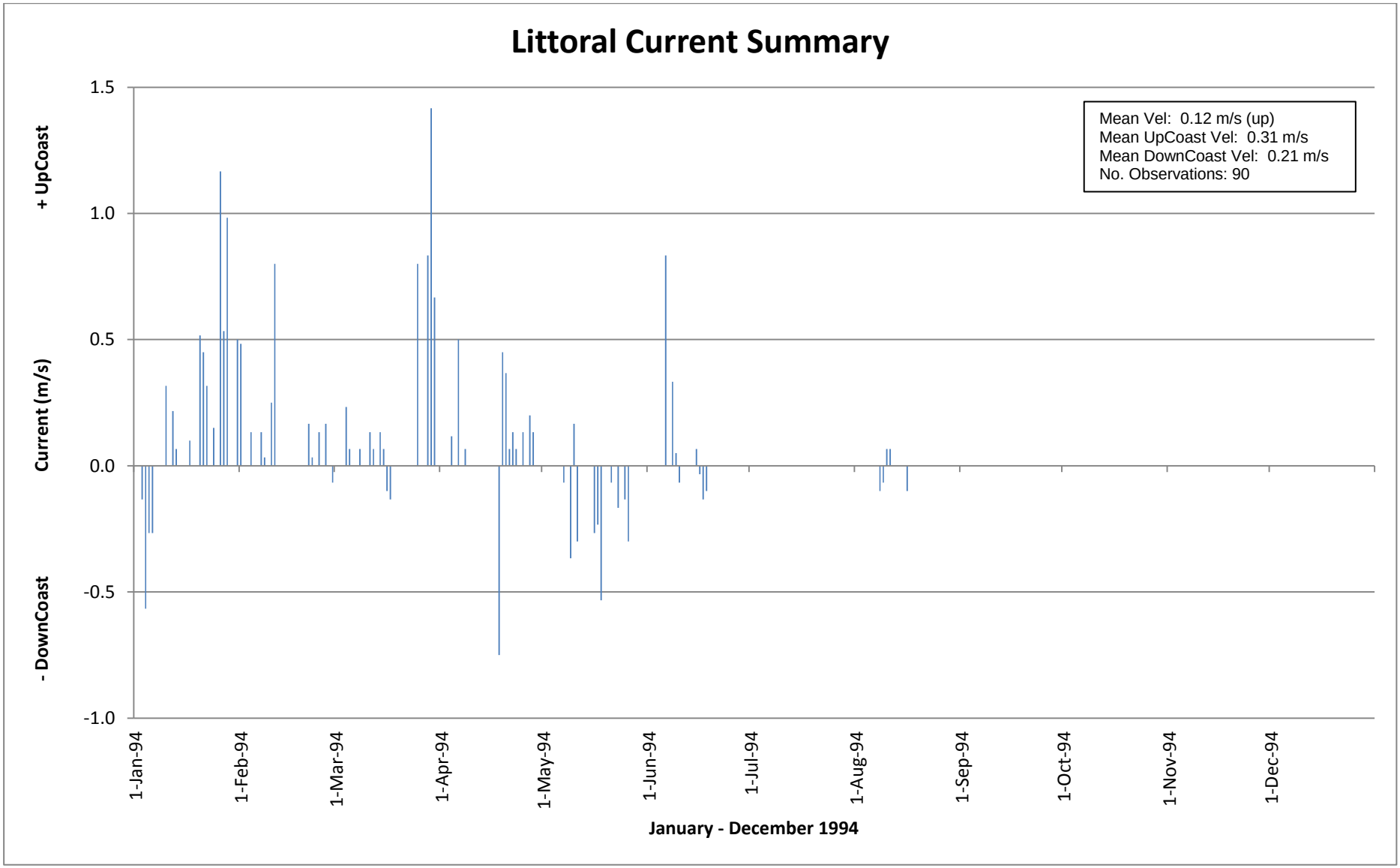
Littoral Current Summary – 1993

Figure 34



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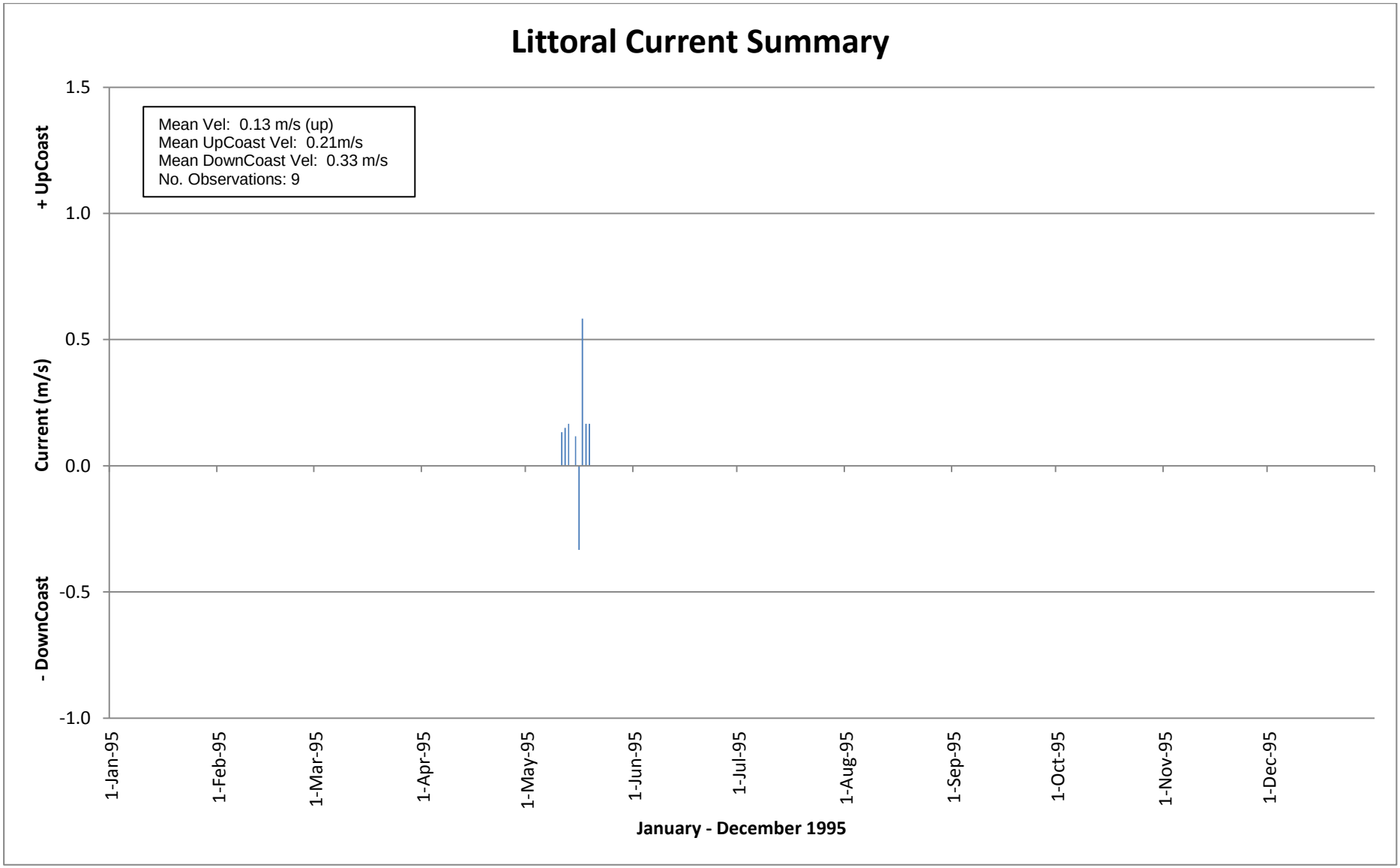
Littoral Current Summary – 1994

Figure 35



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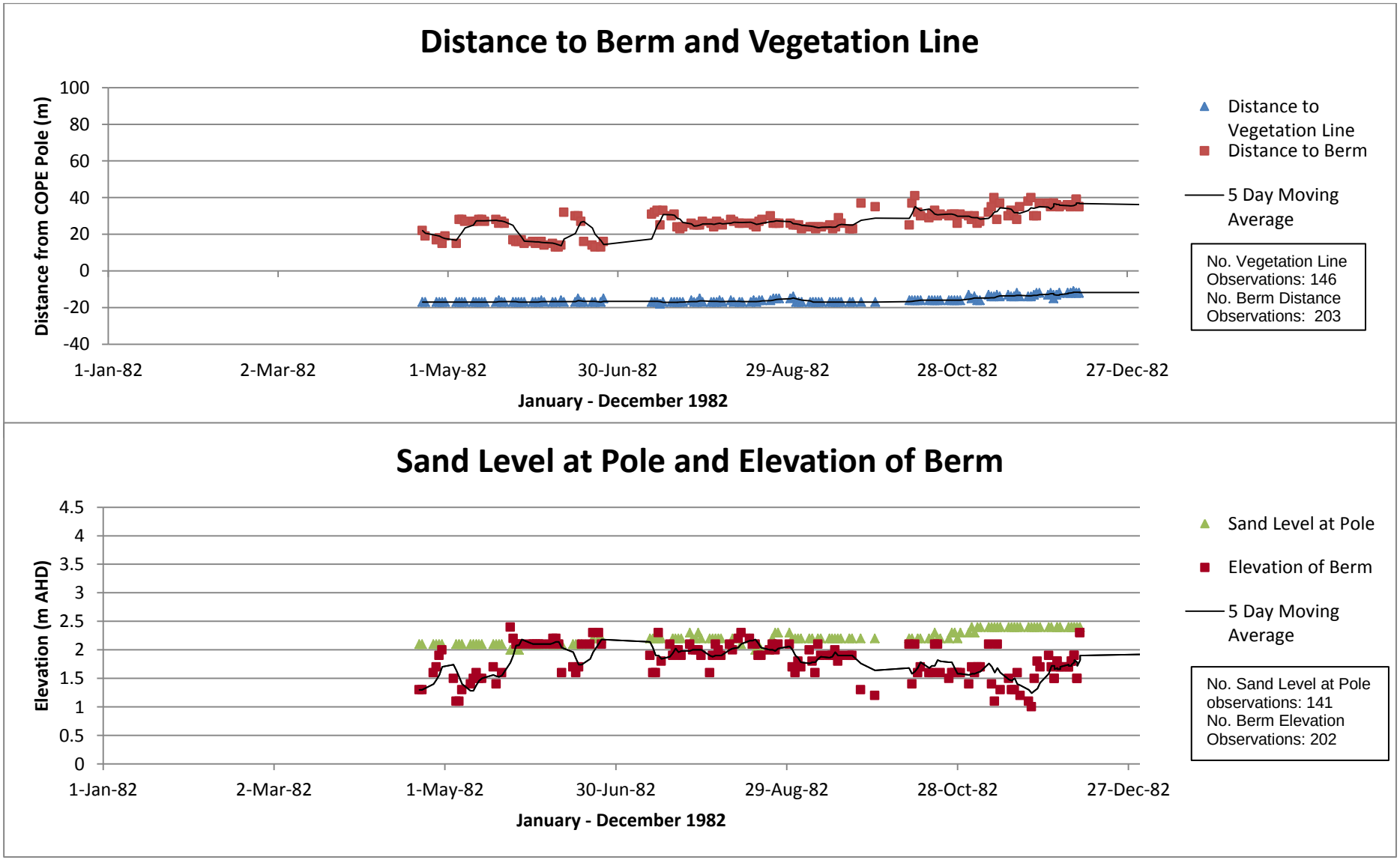
Littoral Current Summary – 1995

Figure 36



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Beach Profile Parameters – 1982

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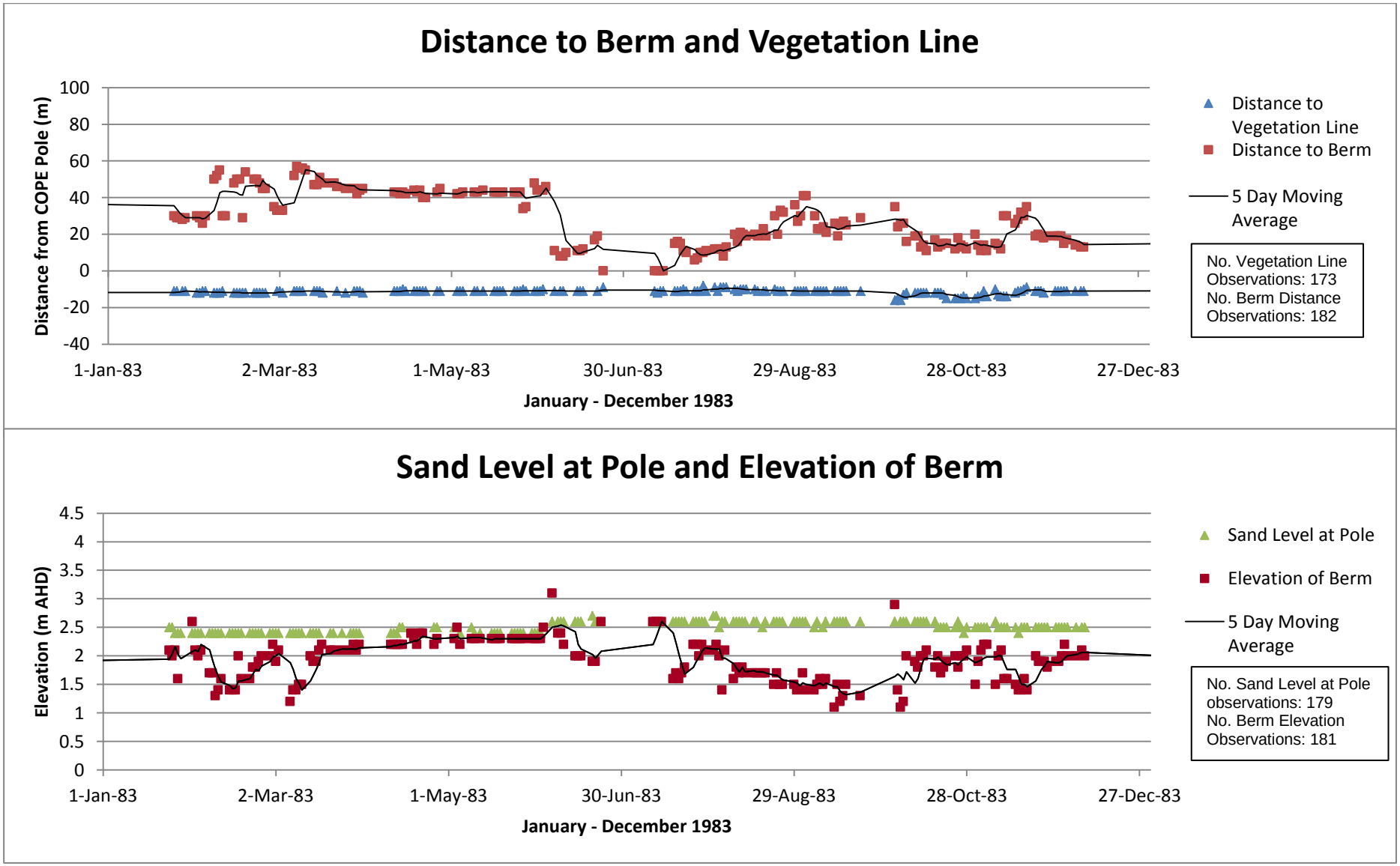
Figure 37



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Beach Profile Parameters – 1983

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Revision	A
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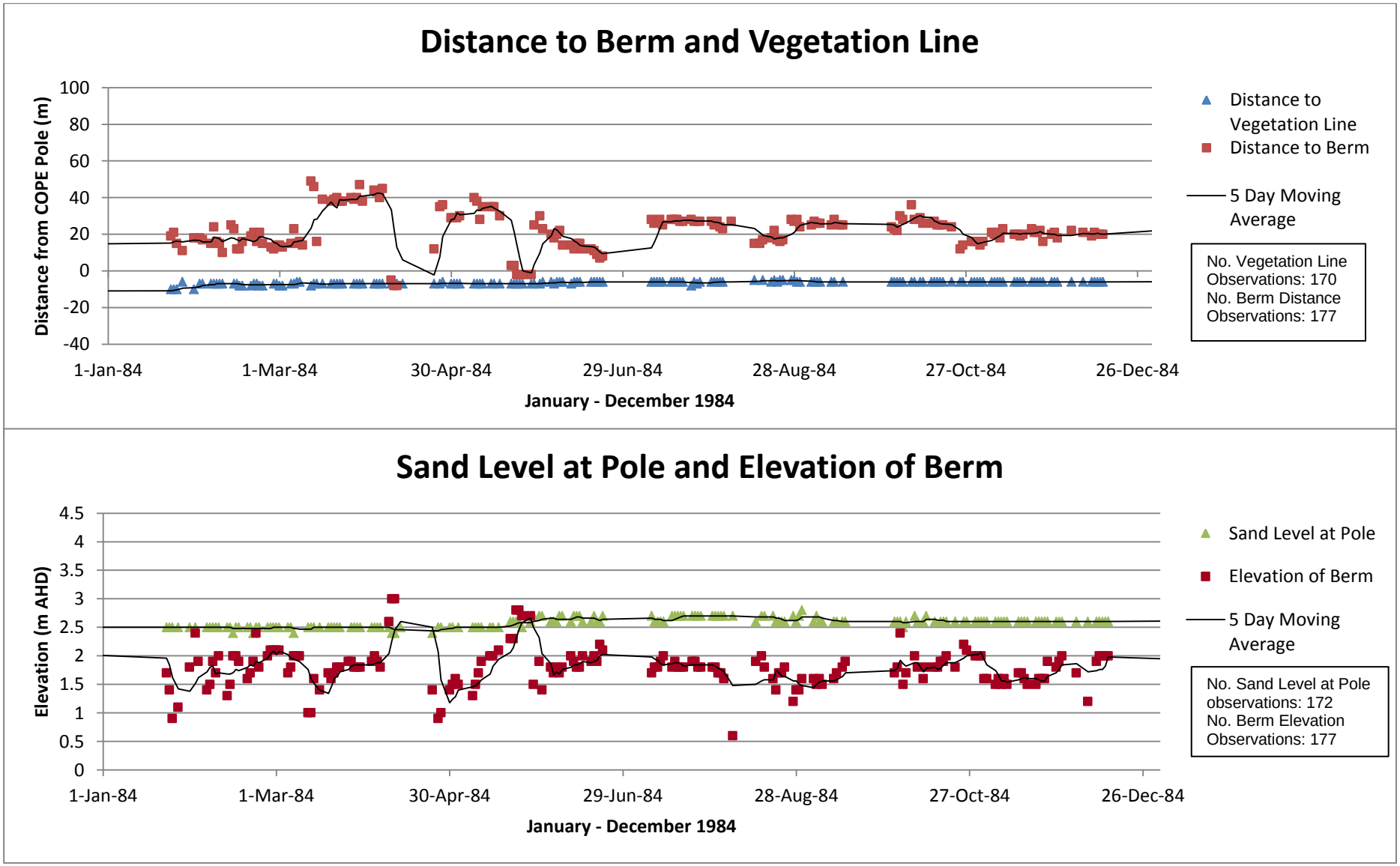
Figure 38



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Beach Profile Parameters – 1984

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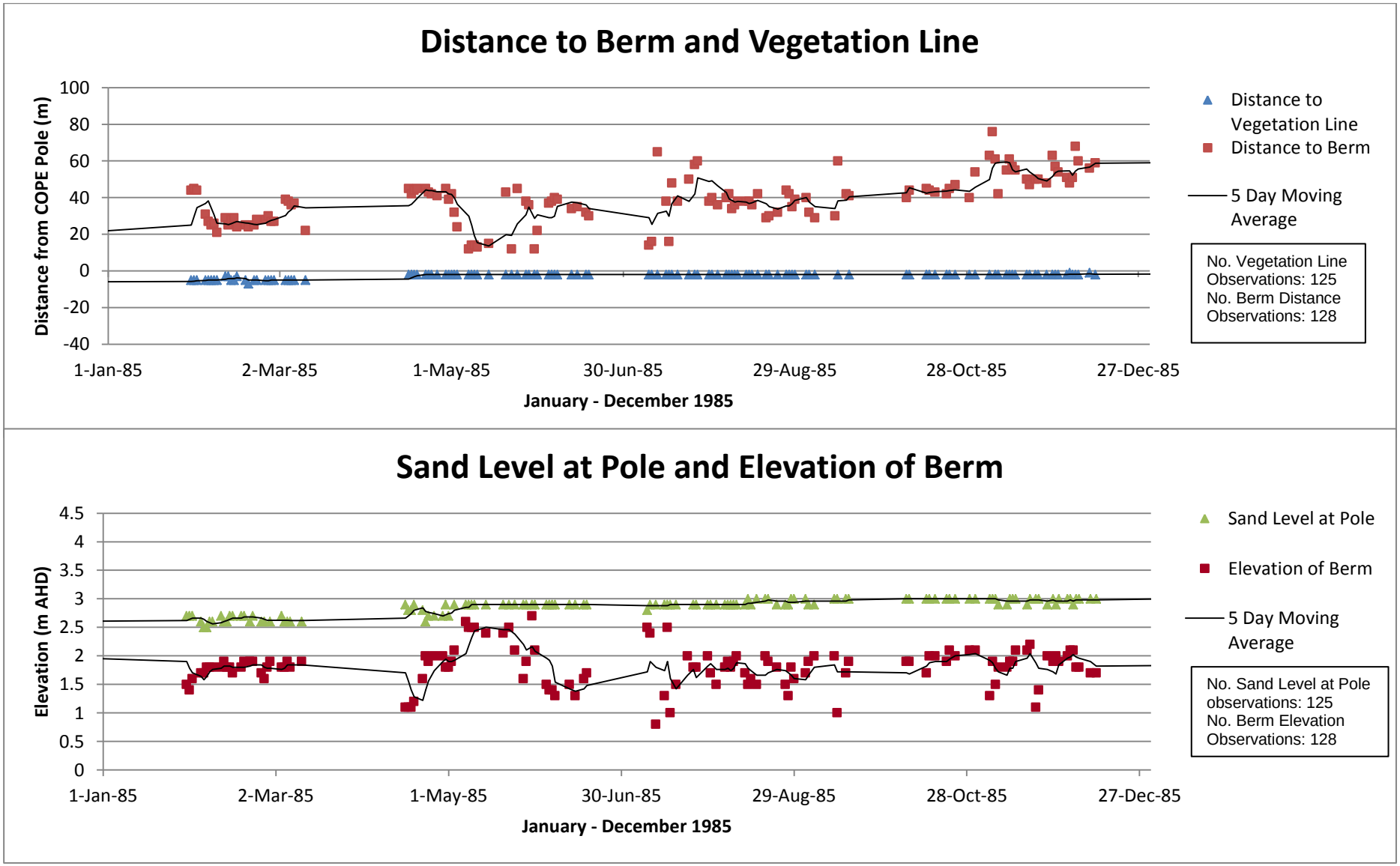
Figure 39



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Beach Profile Parameters – 1985

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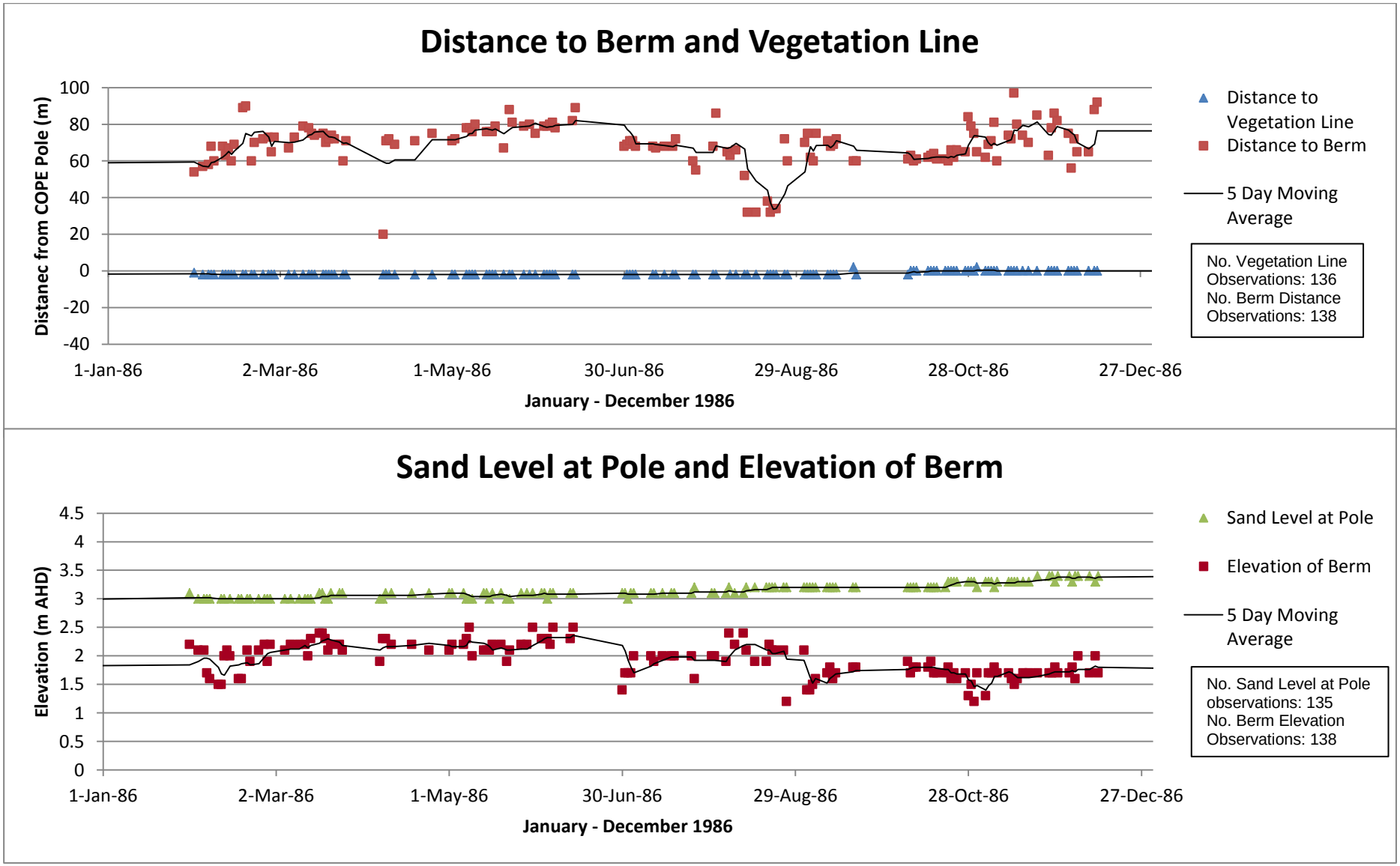
Figure 40



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Beach Profile Parameters – 1986

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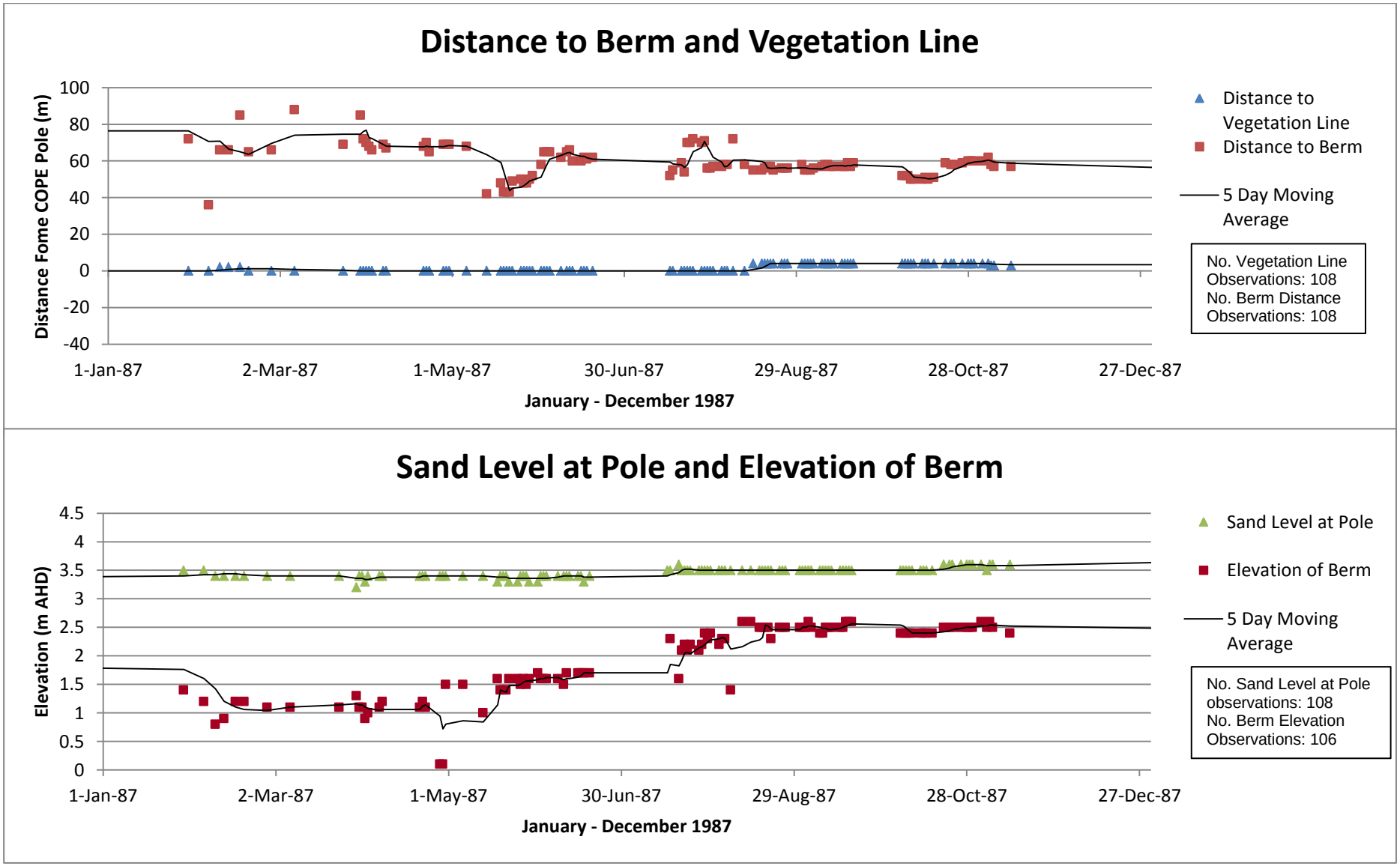
Figure 41



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Beach Profile Parameters – 1987

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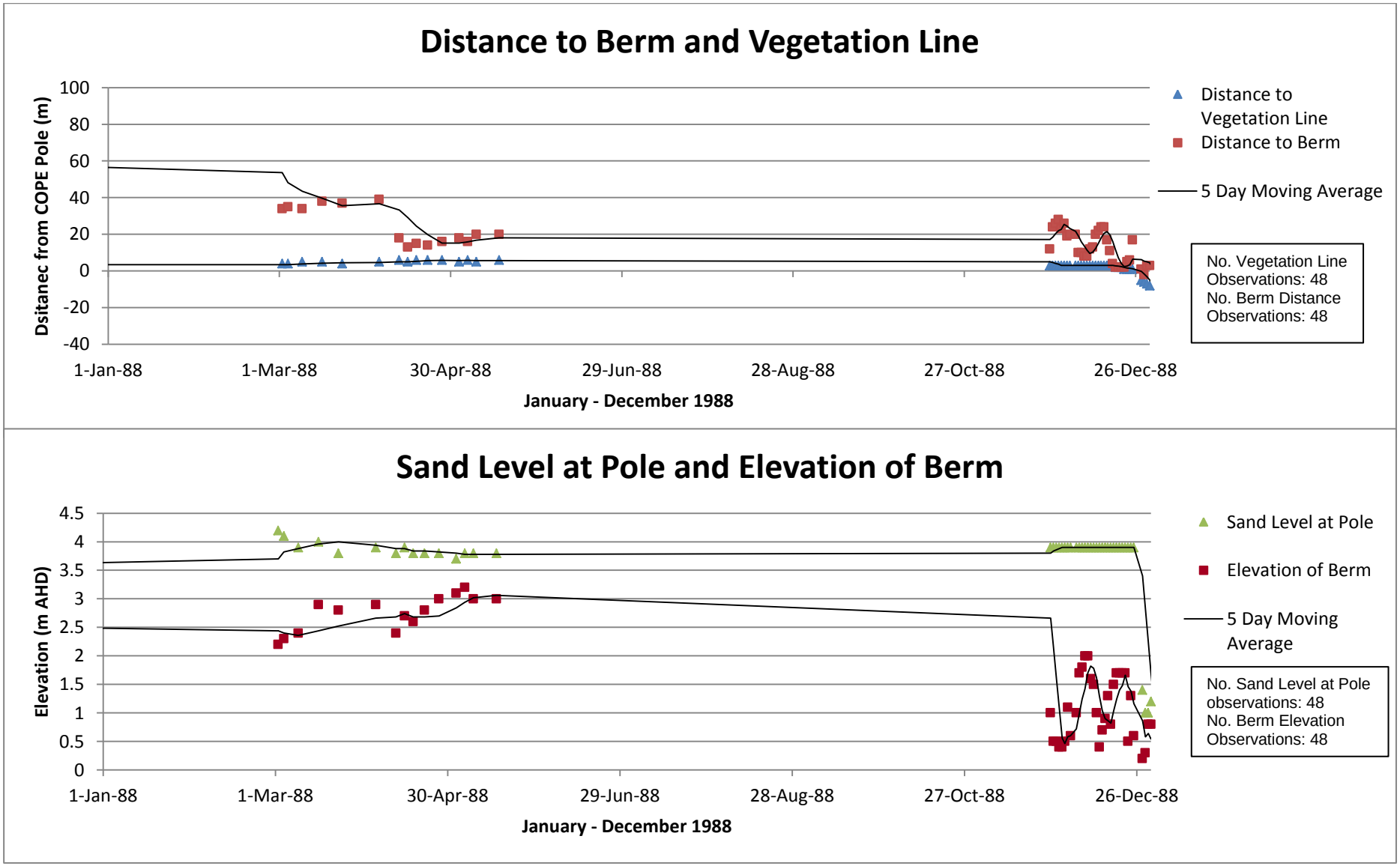
Figure 42



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Beach Profile Parameters – 1988

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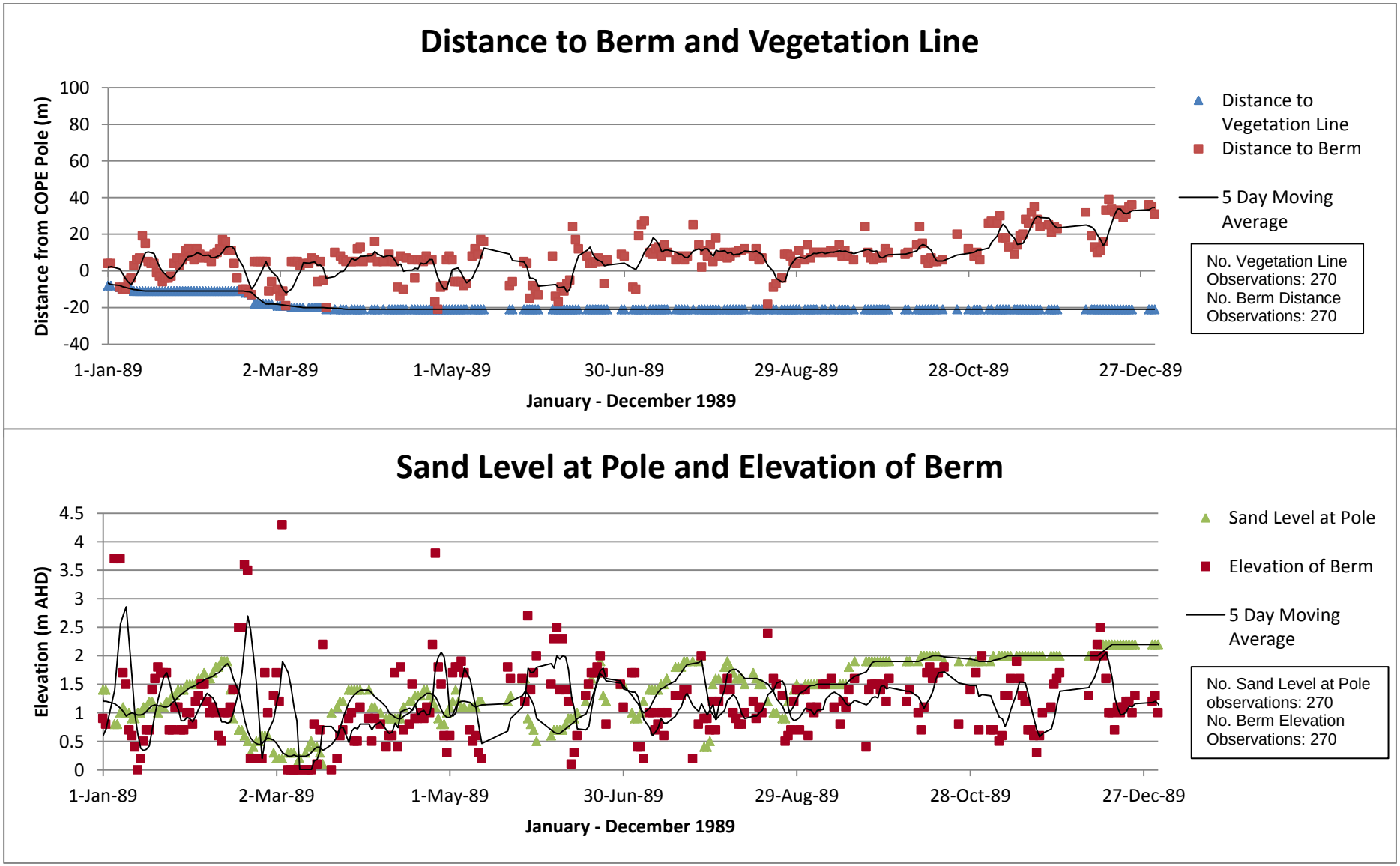
Figure 43



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Bilinga Beach COPE Data Compilation

Beach Profile Parameters – 1989

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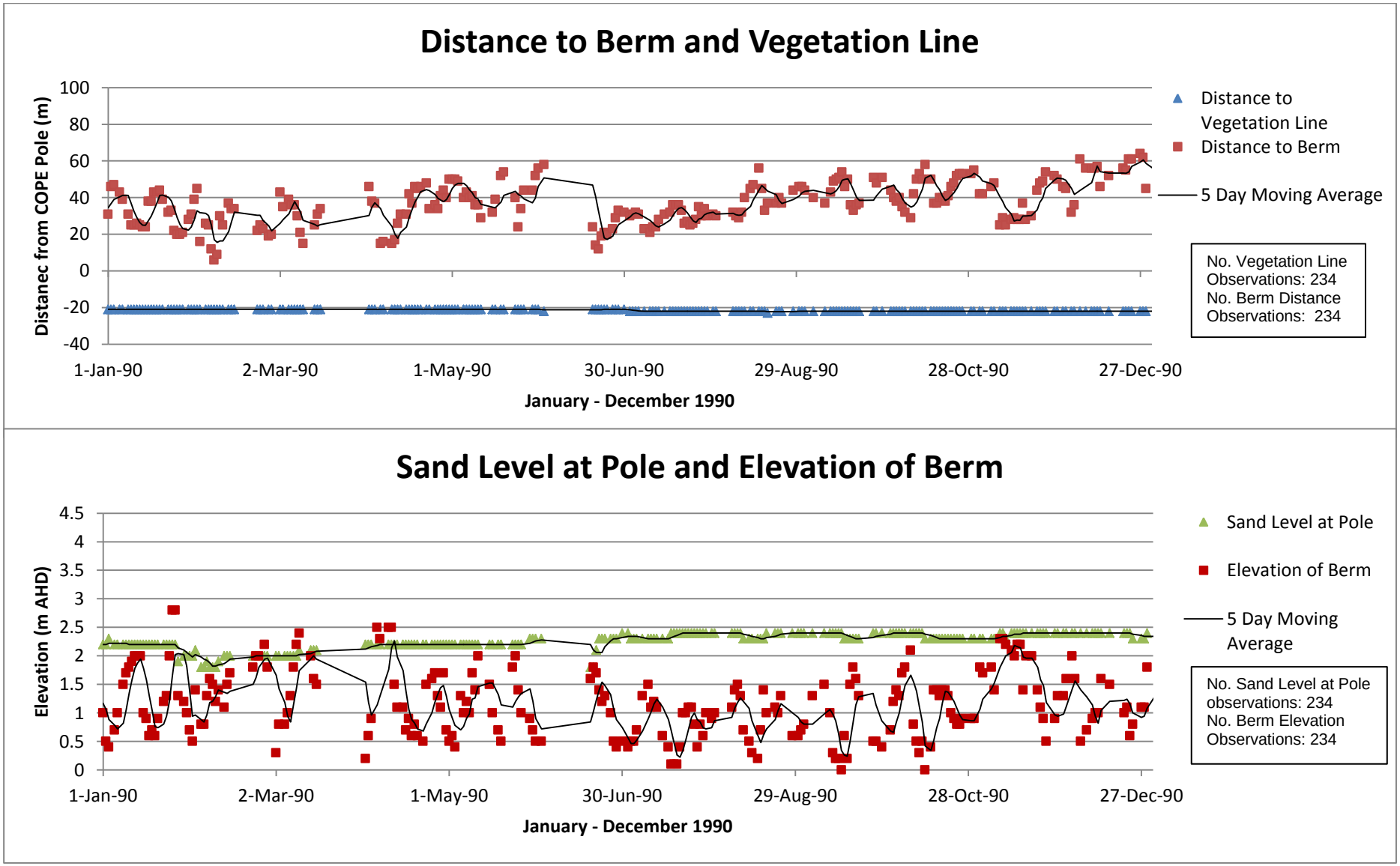
Revision	A
Date	10 Jan 2014

Figure 44



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Beach Profile Parameters – 1990

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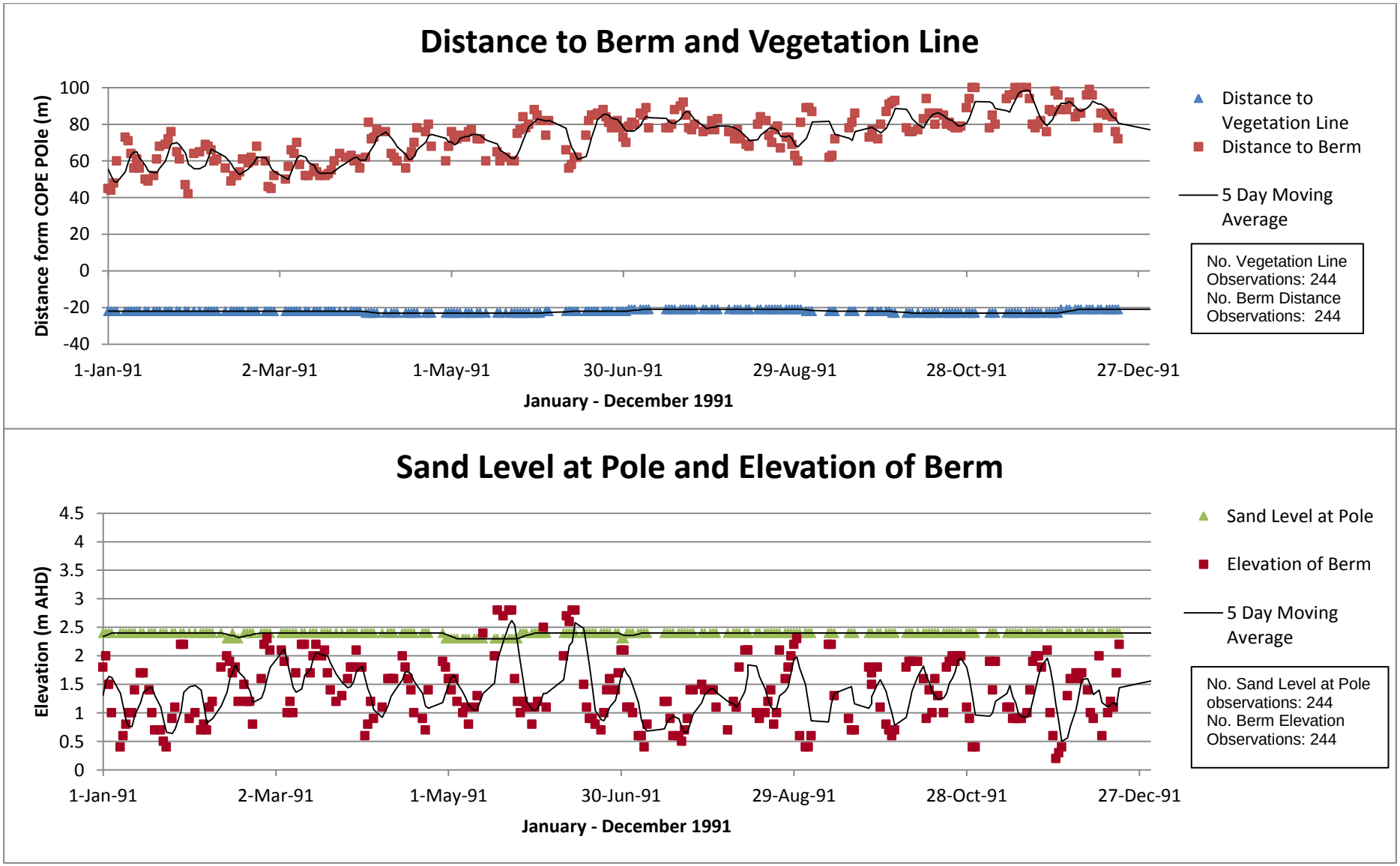
Figure 45



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Coolangatta Beach COPE Data Compilation

Beach Profile Parameters – 1991

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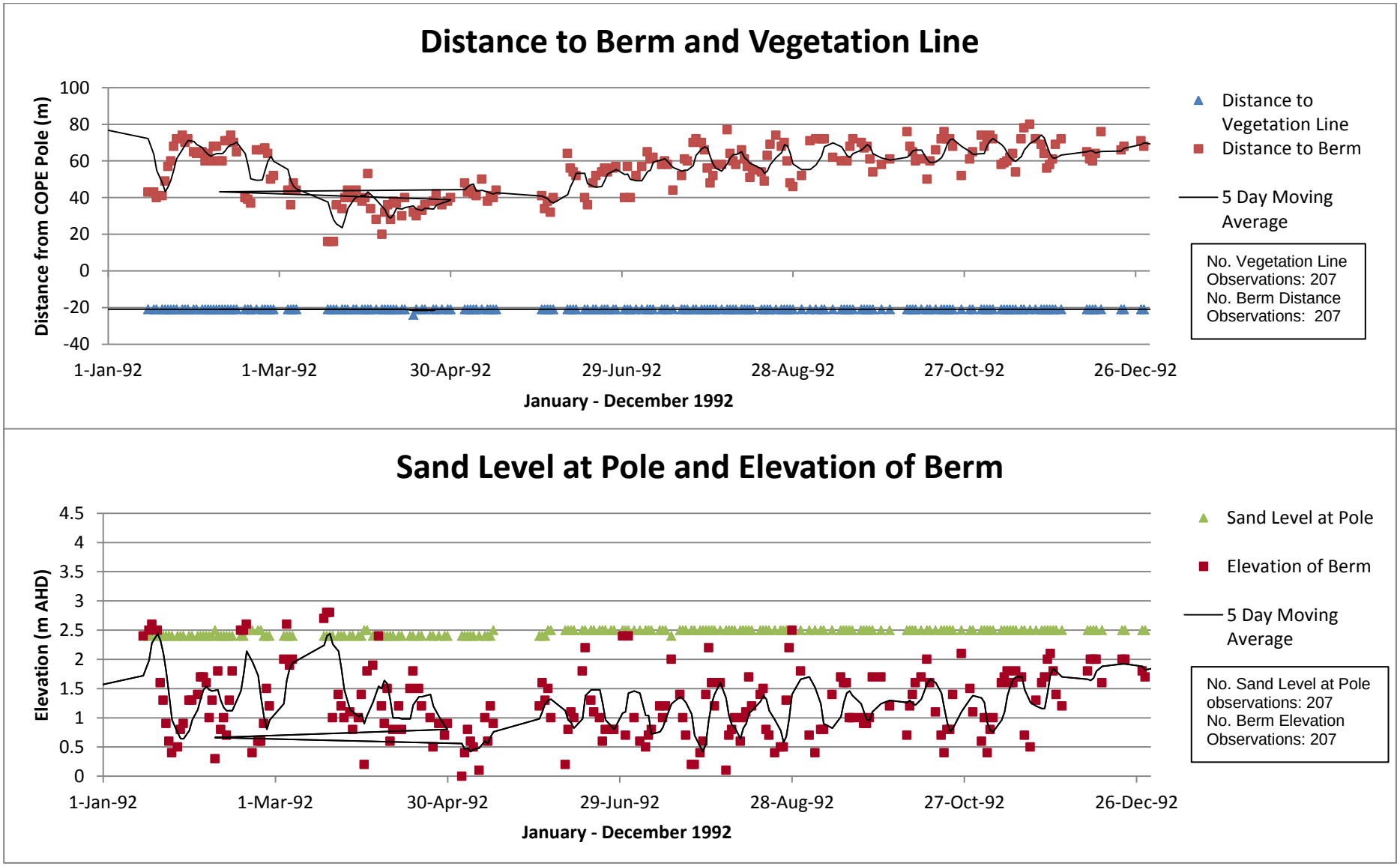
Figure 46



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Coolangatta Beach COPE Data Compilation

Beach Profile Parameters – 1992

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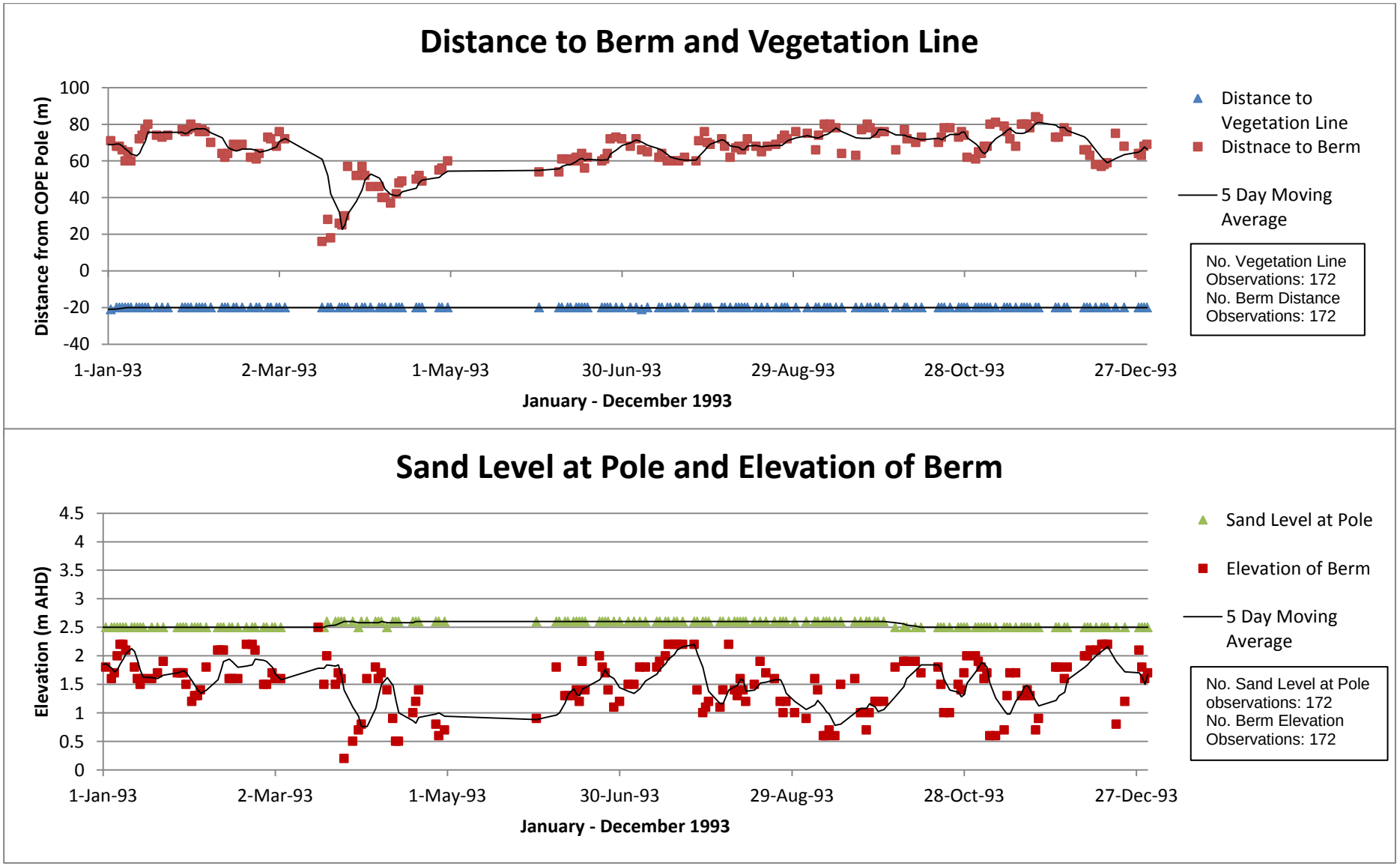
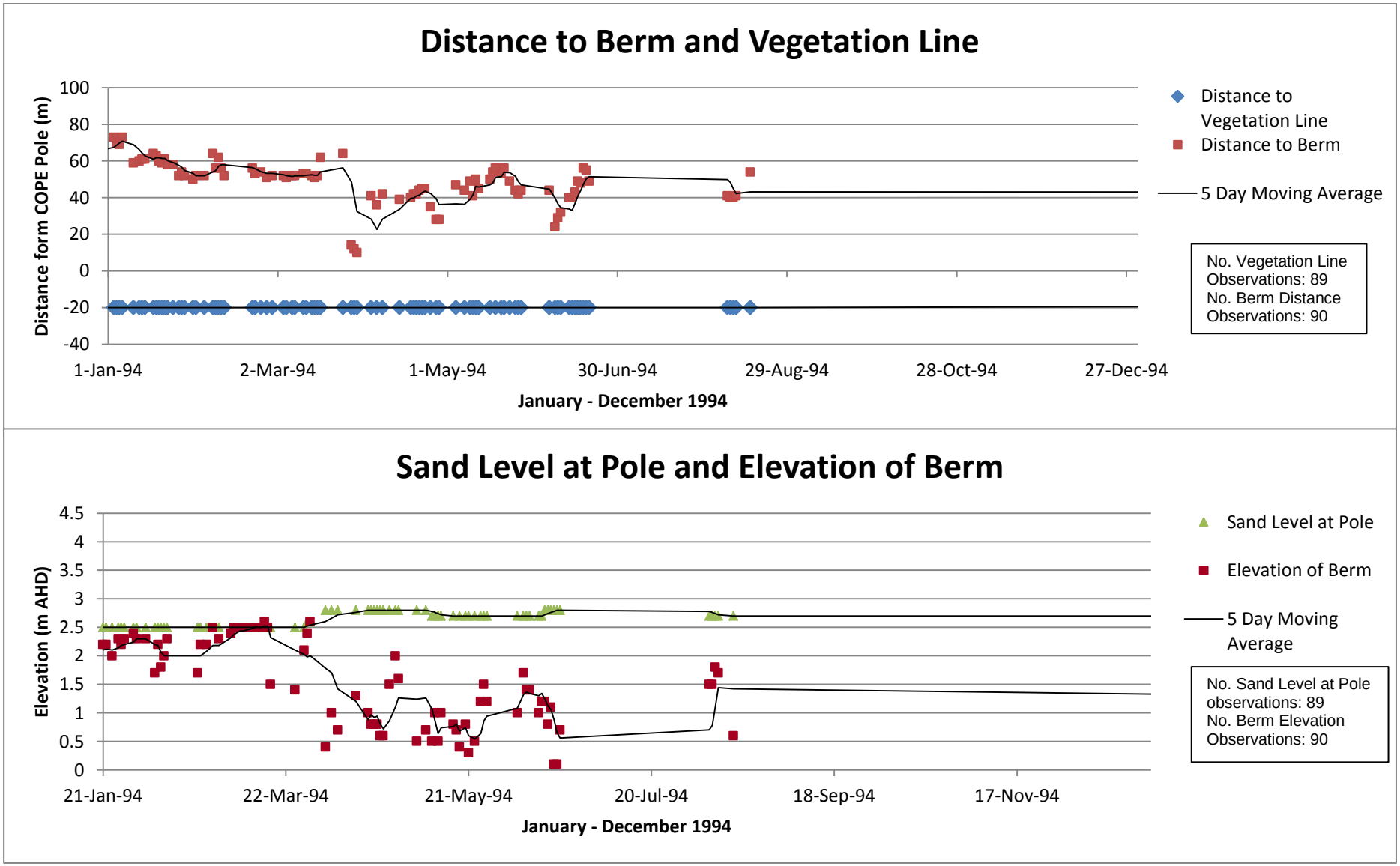
Figure 47


Distance to Berm and Vegetation Line
Distance from COPE Pole (m)
100
80
60
40
20
0
-20
-40
1-Jan-93
2-Mar-93
1-May-93
30-Jun-93
29-Aug-93
28-Oct-93
27-Dec-93
January - December 1993
Distance to Vegetation Line
Distnace to Berm
5 Day Moving Average
No. Vegetation Line Observations: 172
No. Berm Distance Observations: 172
Sand Level at Pole and Elevation of Berm
Elevation (m AHD)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Jan-93
2-Mar-93
1-May-93
30-Jun-93
29-Aug-93
28-Oct-93
27-Dec-93
January - December 1993
Sand Level at Pole
Elevation of Berm
5 Day Moving Average
No. Sand Level at Pole observations: 172
No. Berm Elevation Observations: 172



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Beach Profile Parameters – 1994

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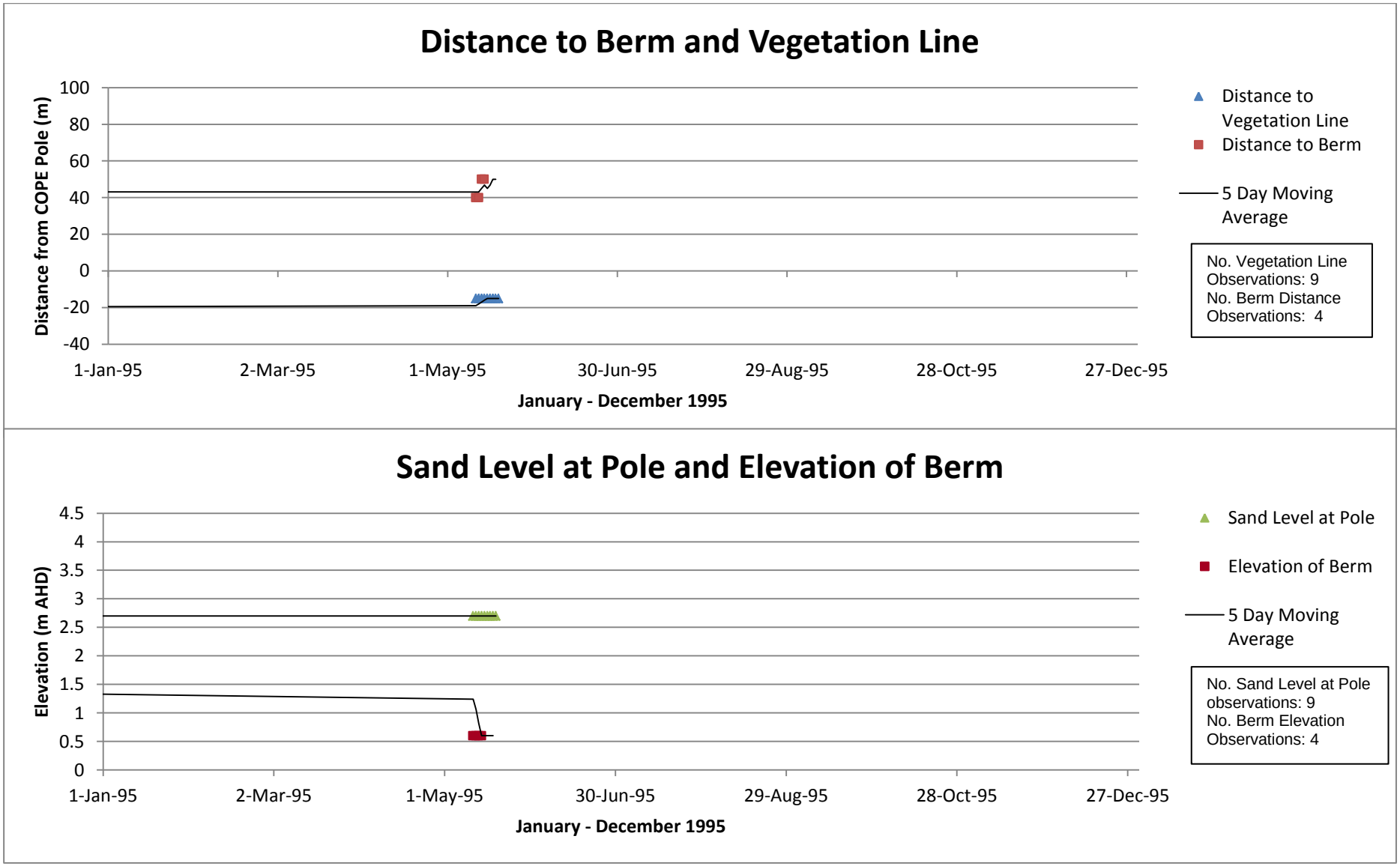
Figure 49



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Beach Profile Parameters – 1995

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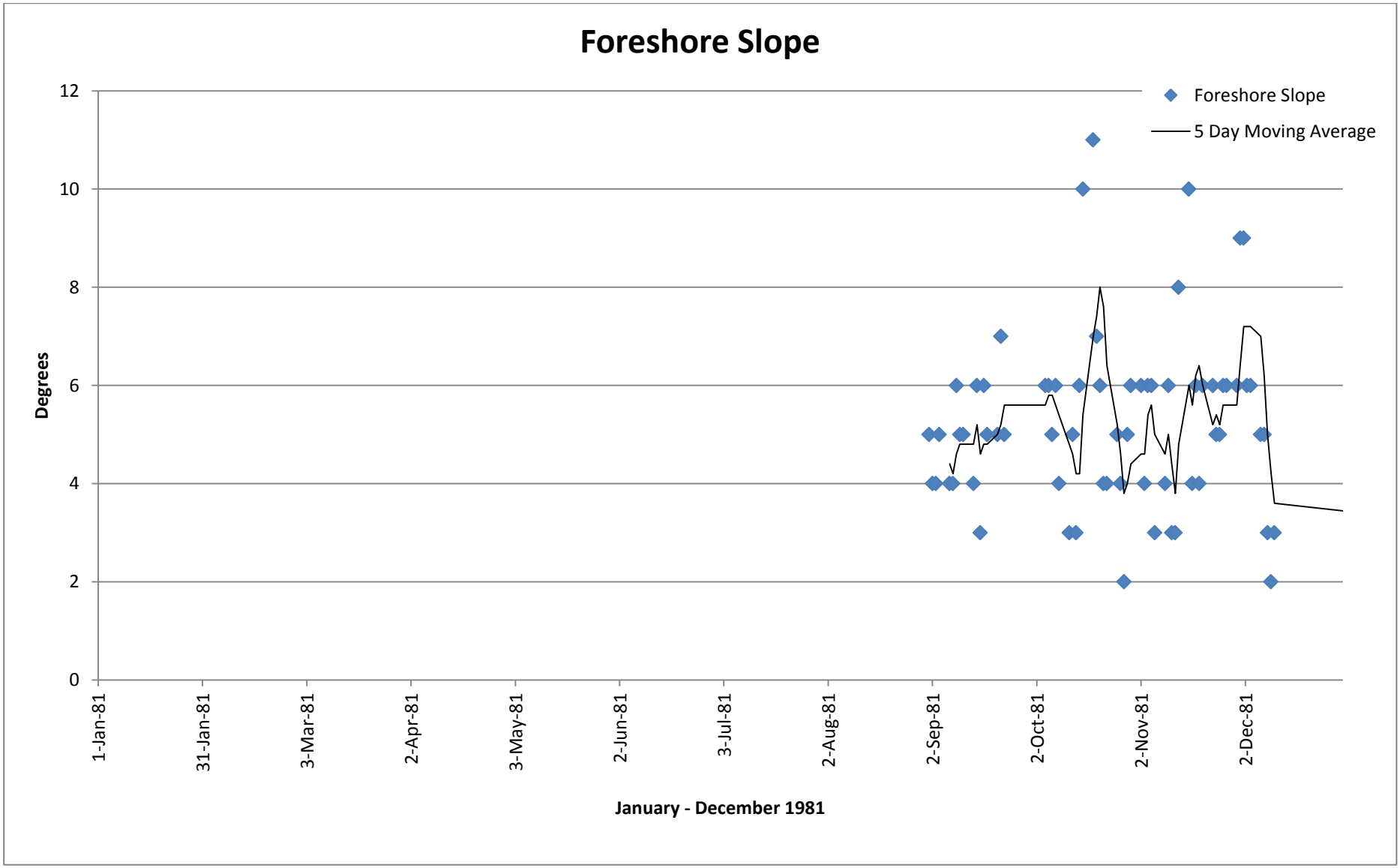
Figure 50



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Foreshore Slope – 1981

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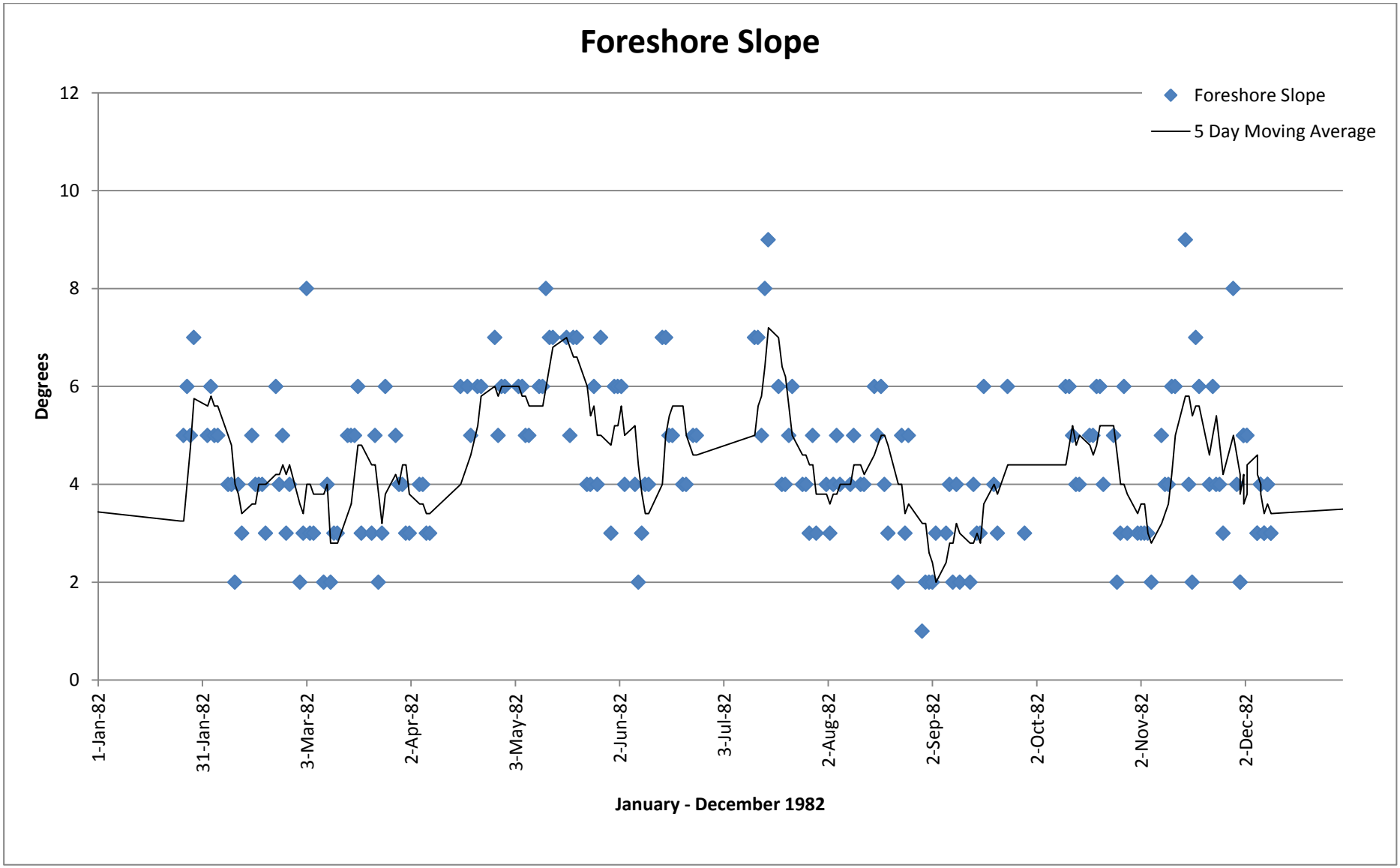
Figure 51



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Foreshore Slope – 1982

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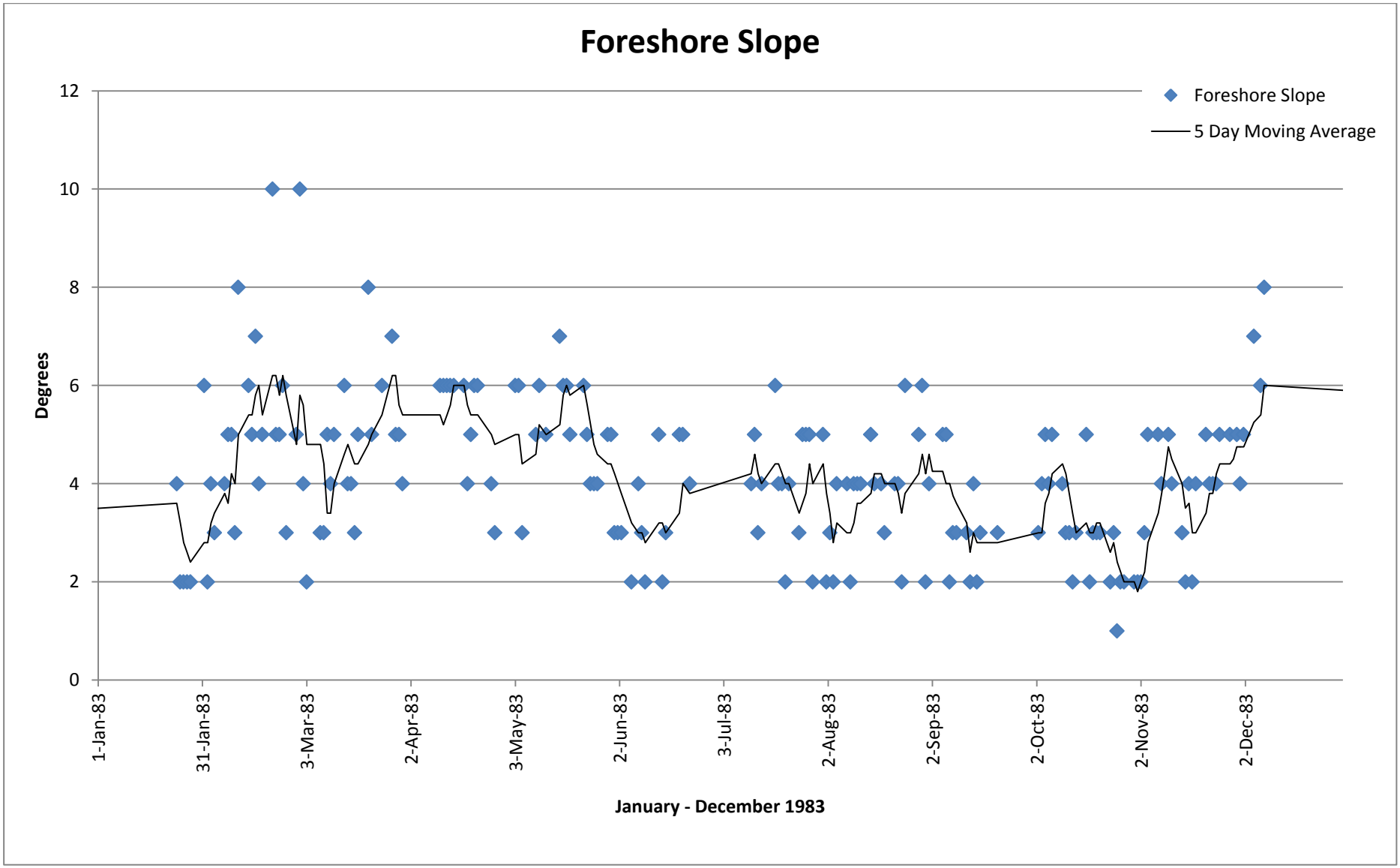
Figure 52



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Foreshore Slope – 1983

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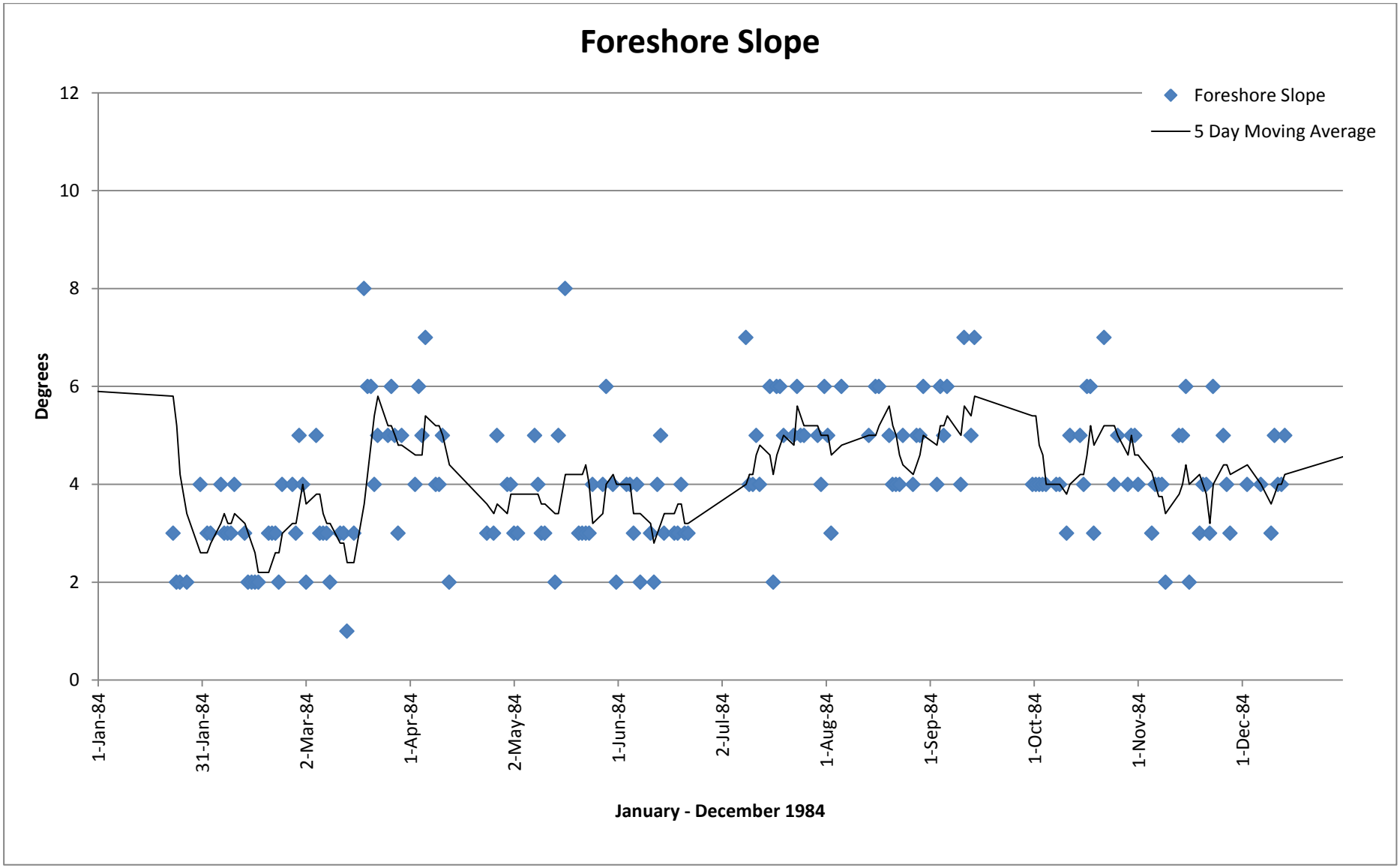
Figure 53



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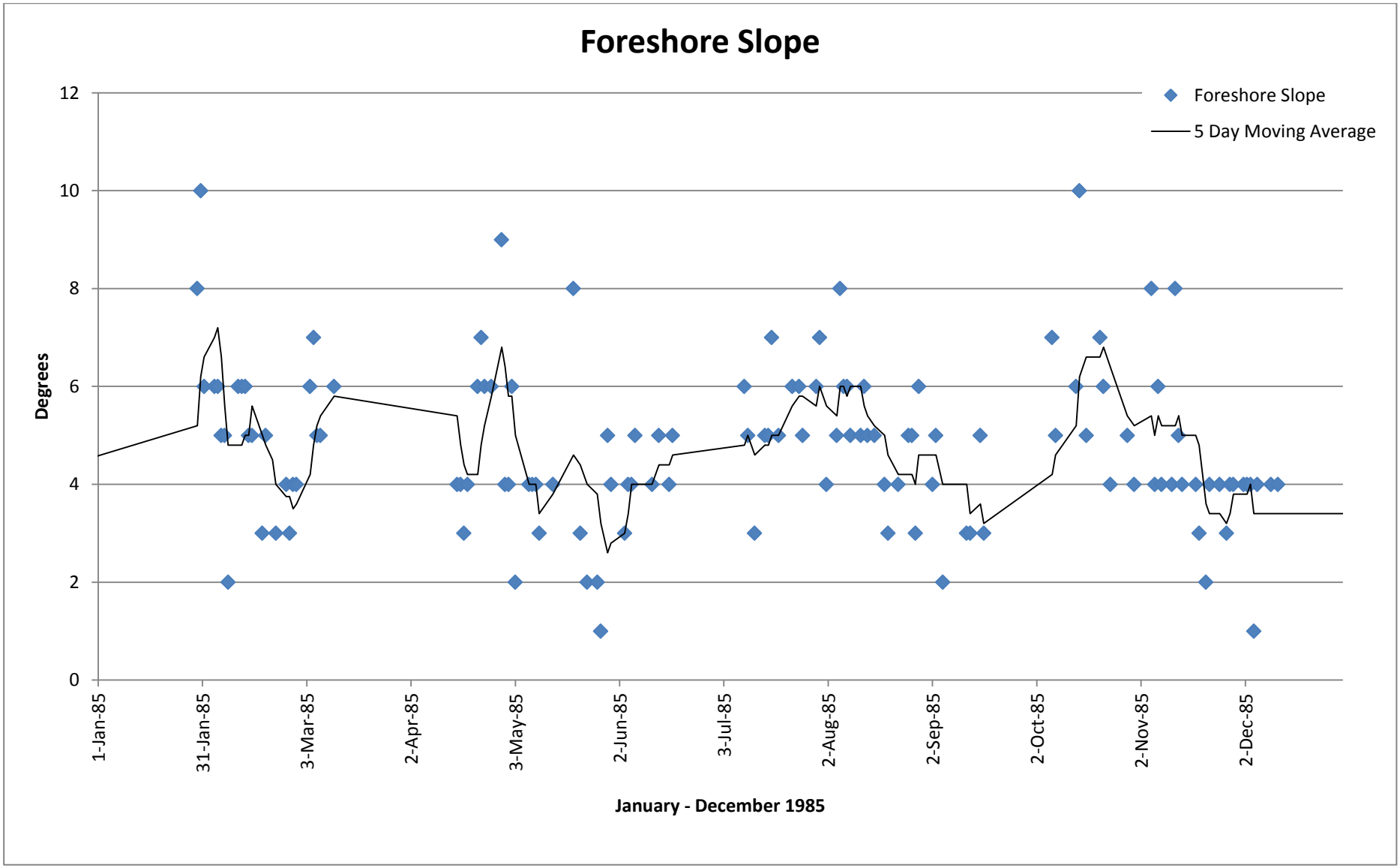
Foreshore Slope – 1984

Figure 54



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Foreshore Slope – 1985

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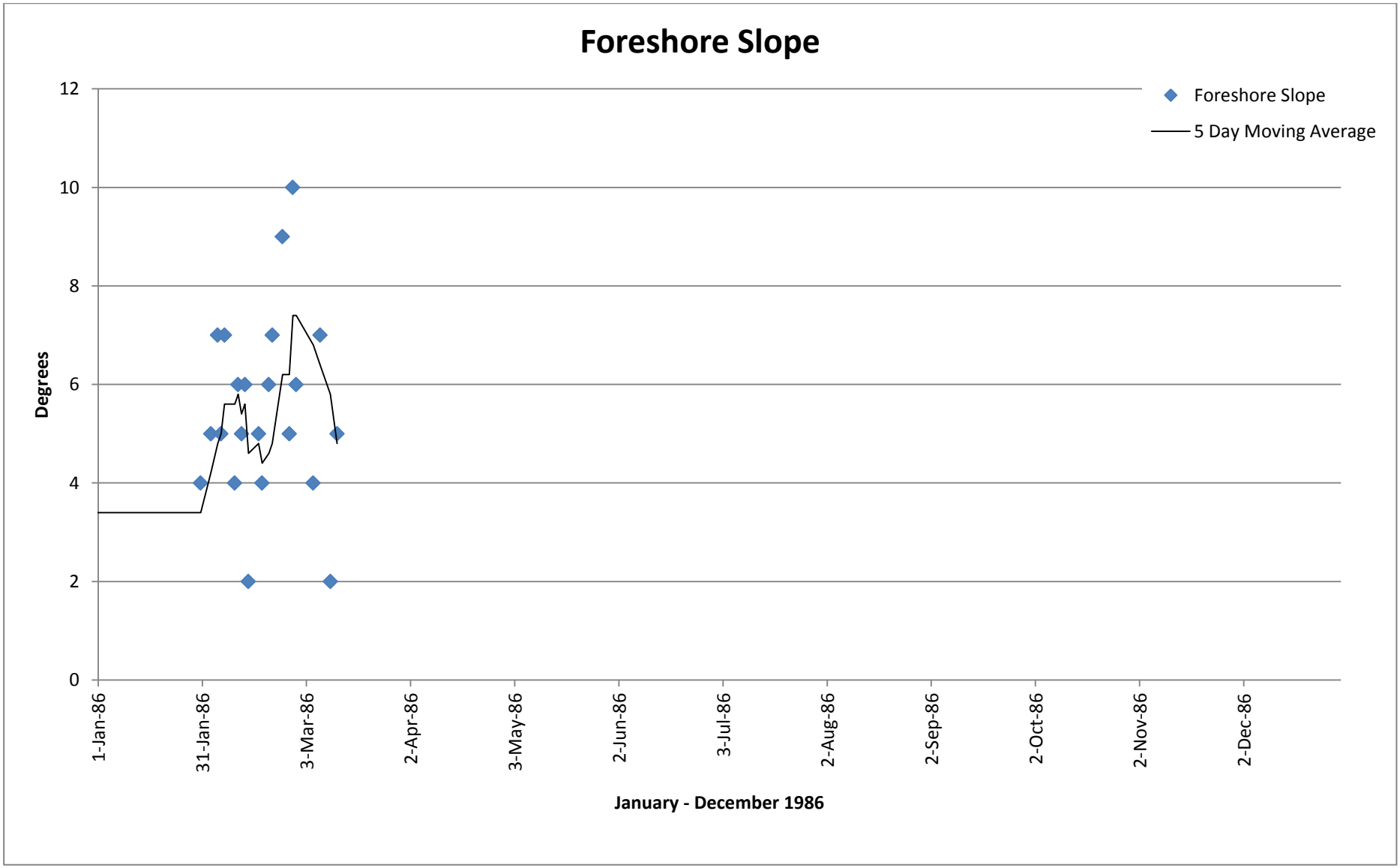
Figure 55



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Foreshore Slope – 1986

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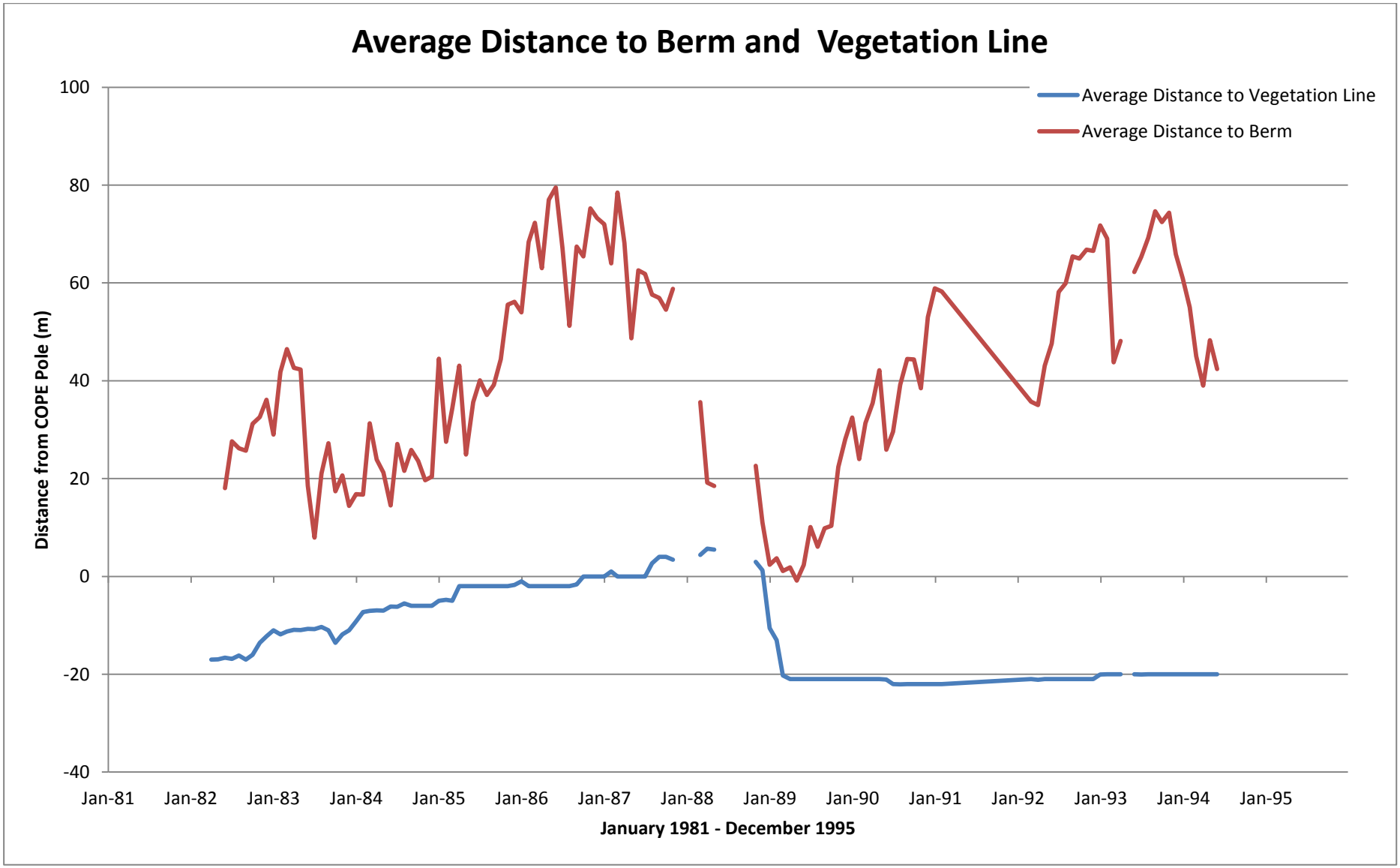
Figure 56



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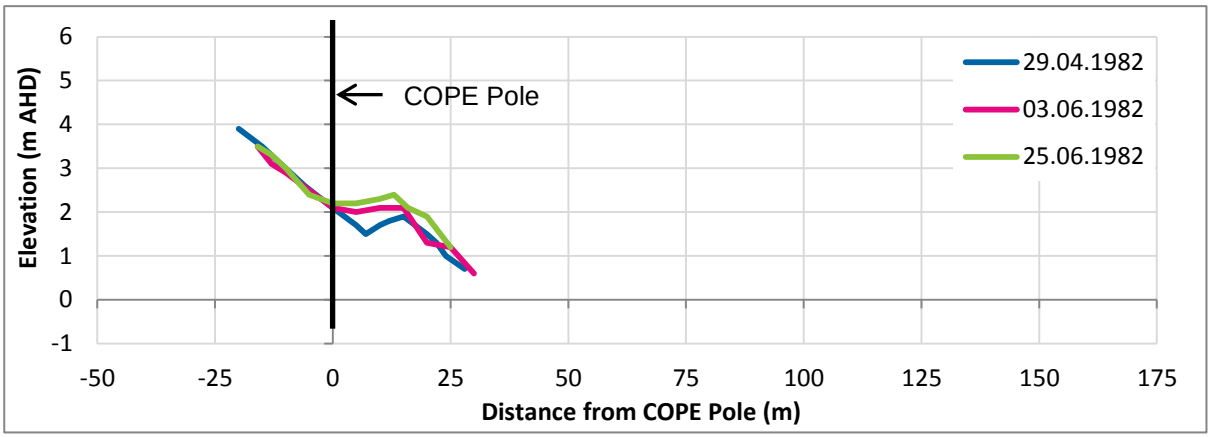
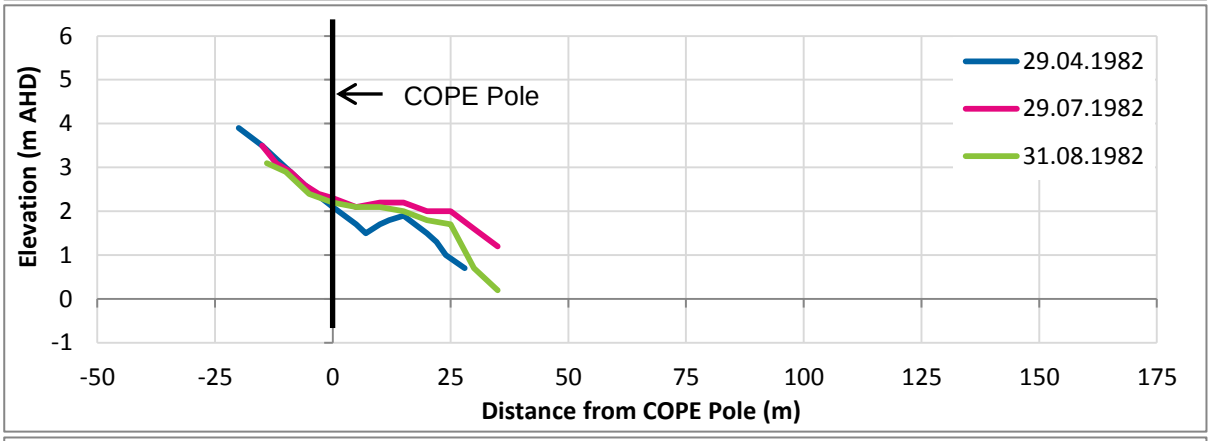
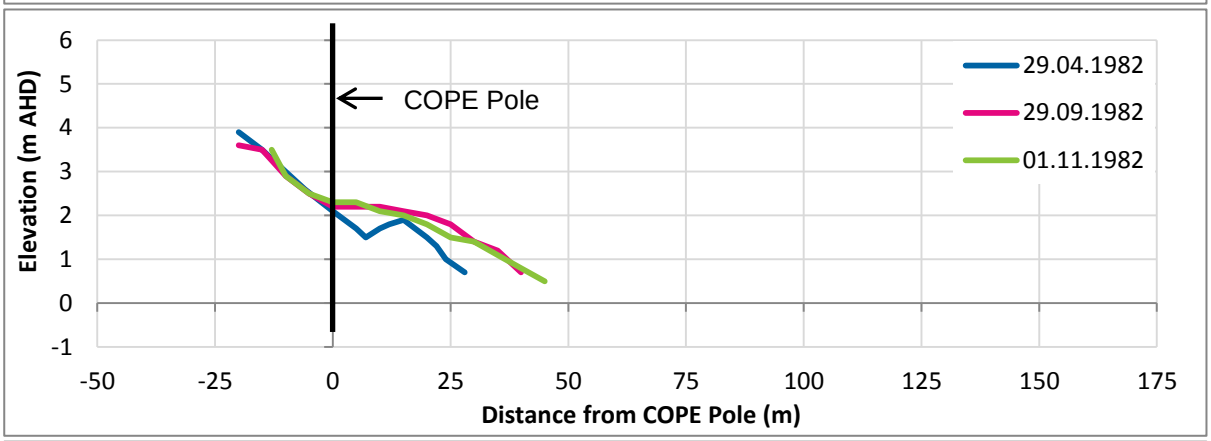
Average Distance to Berm and Vegetation Line

Figure 57







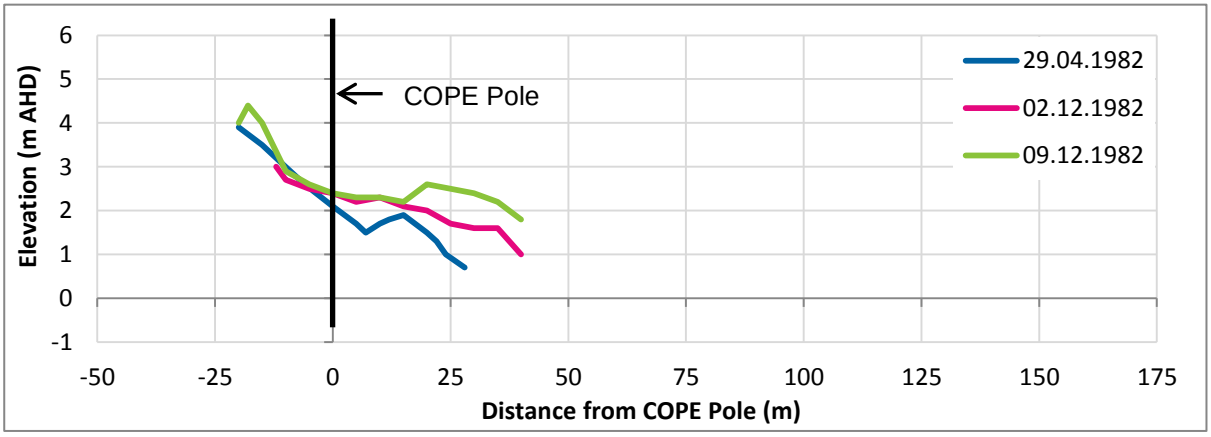


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Figure 58

Monthly Beach Profiles – 1982

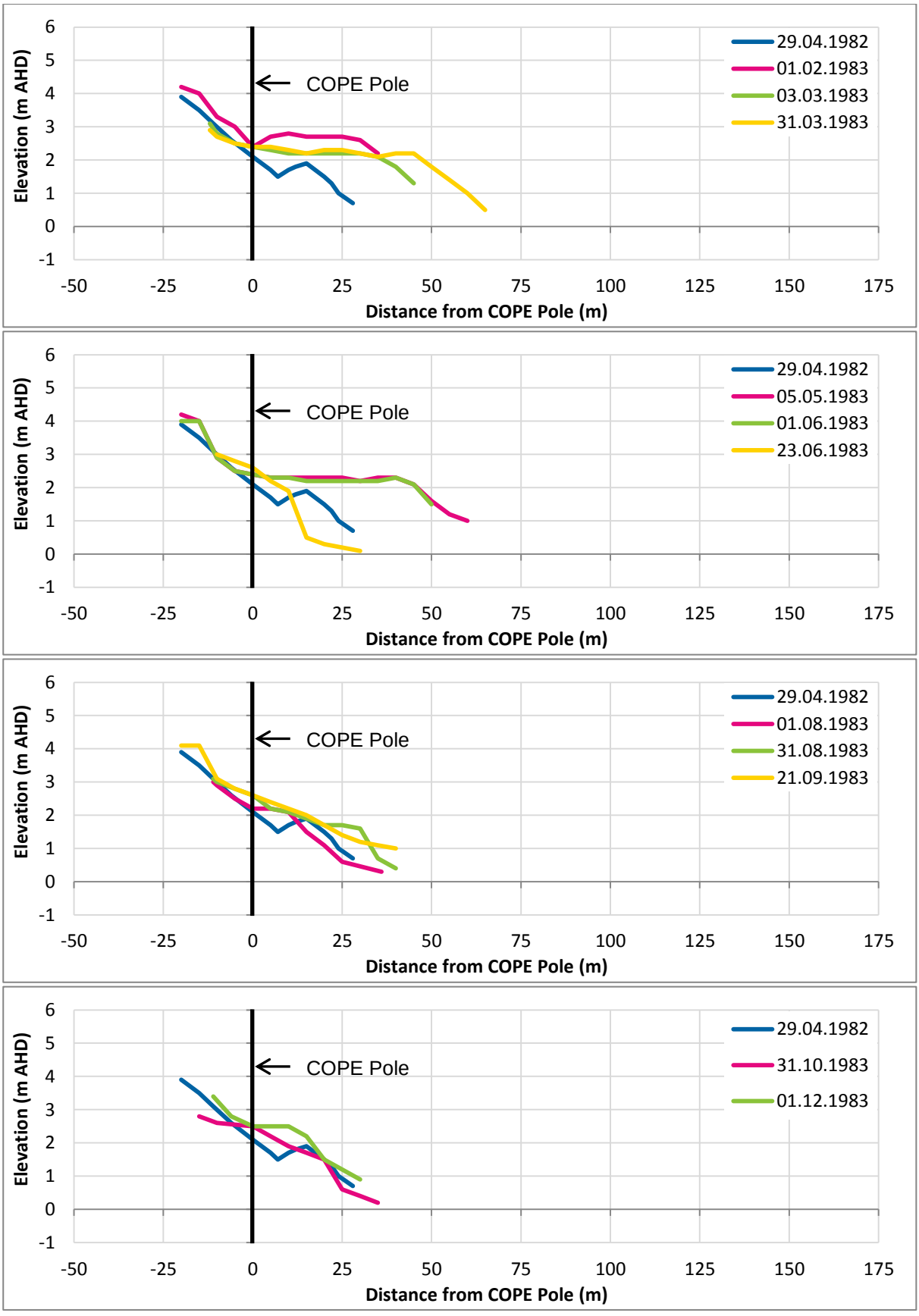

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Figure 59

Monthly Beach Profiles – 1983

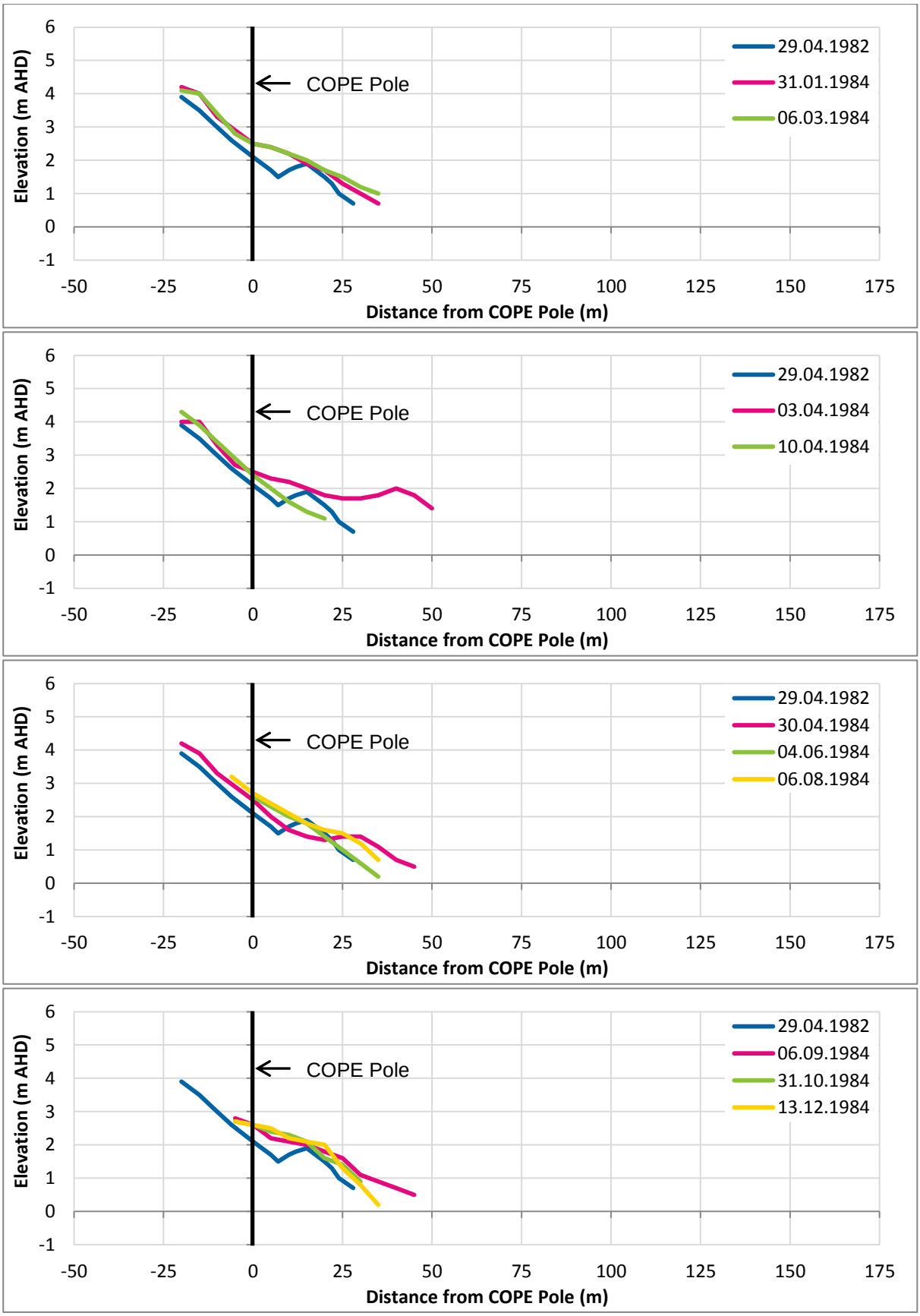

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Figure 60

Monthly Beach Profiles – 1984

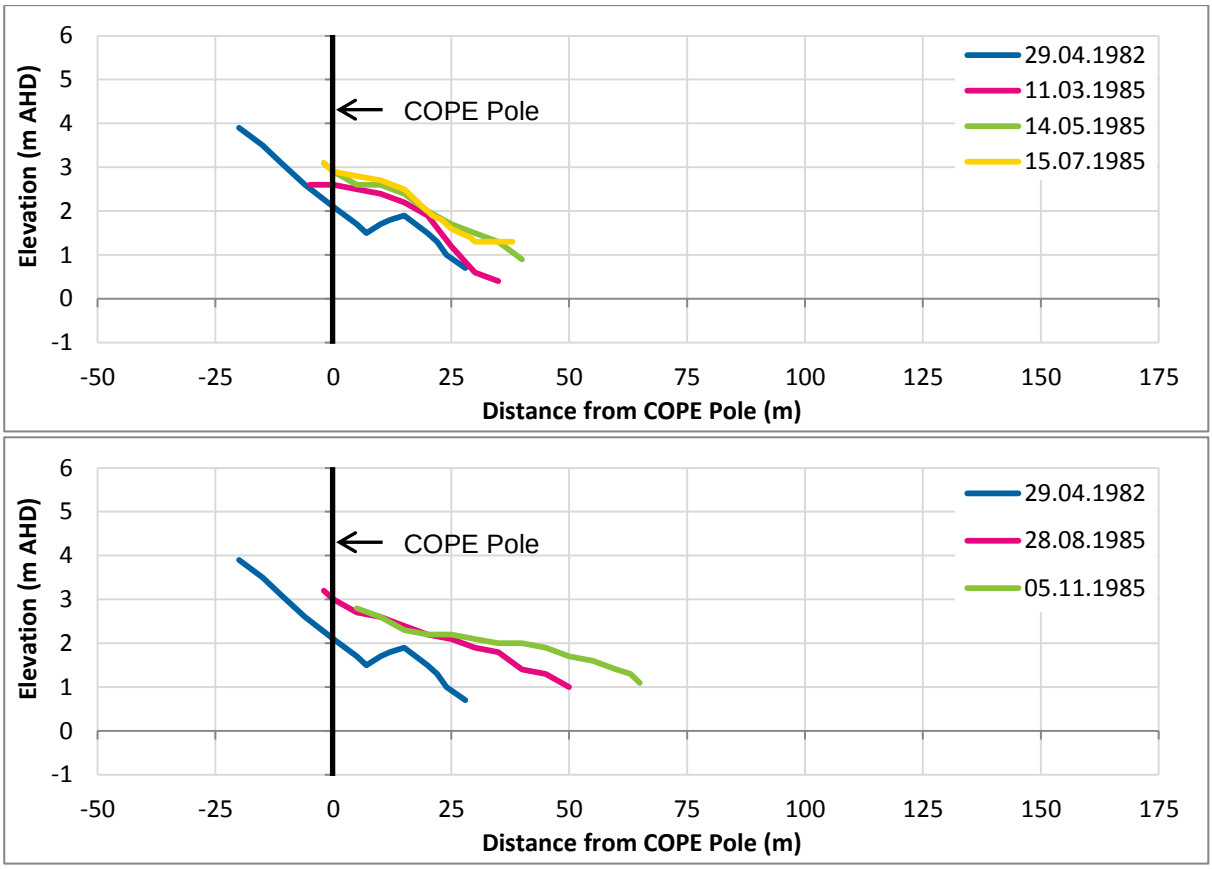

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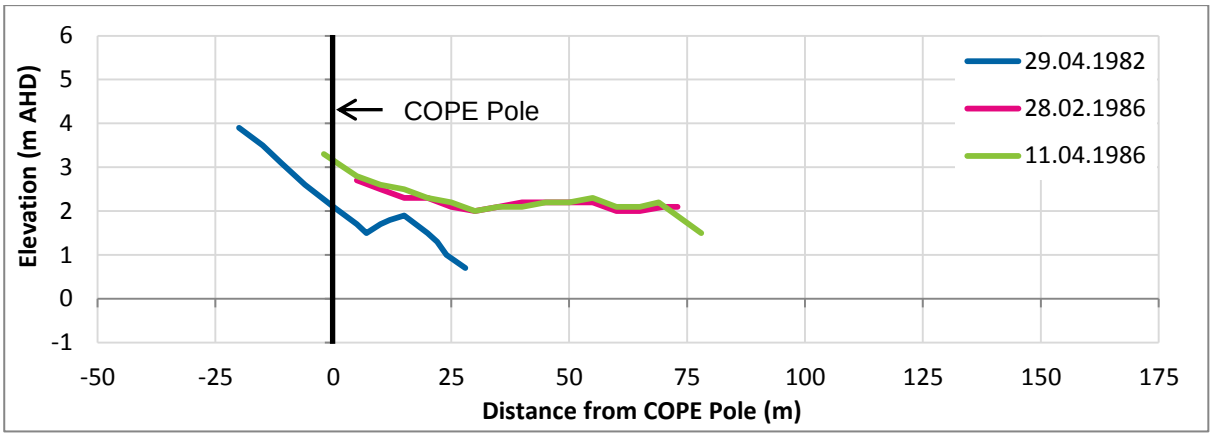
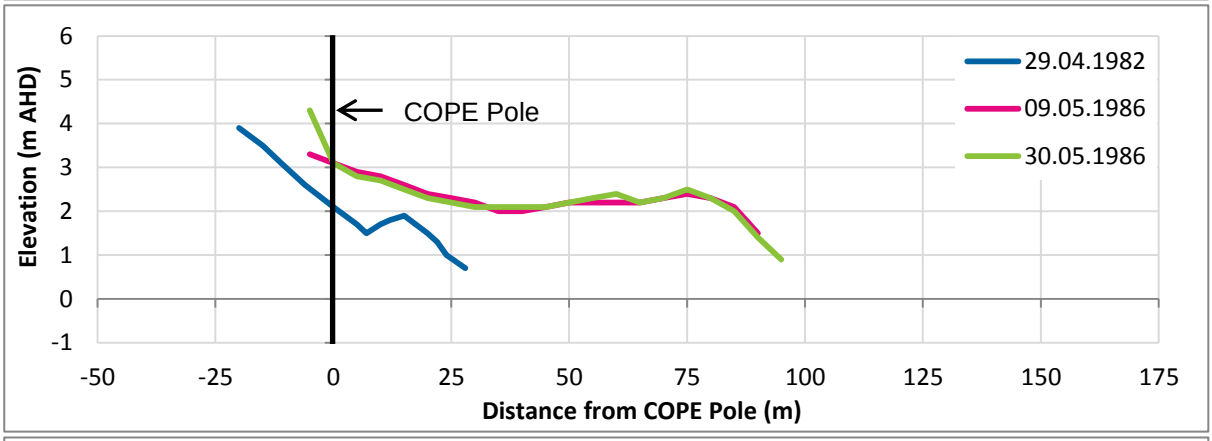
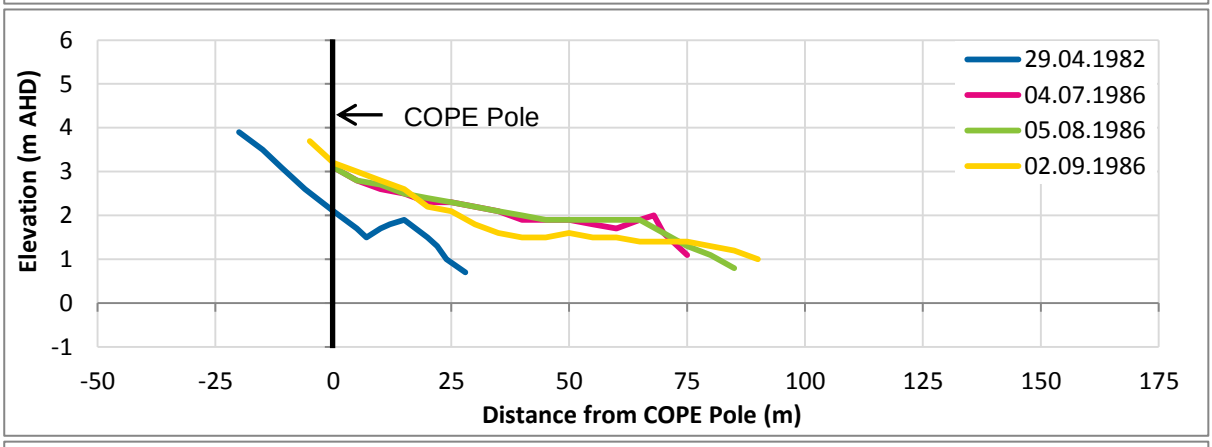
Figure 61

Monthly Beach Profiles – 1985







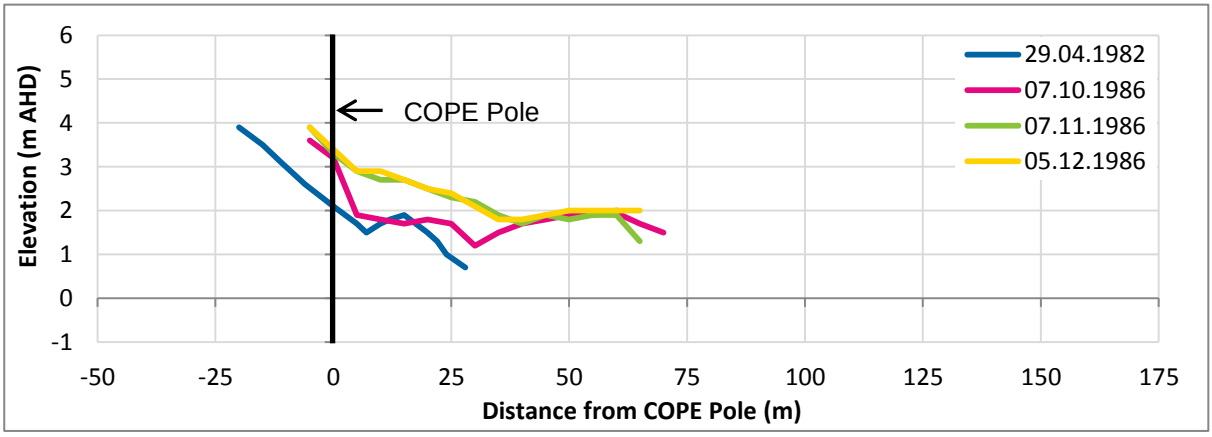


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Figure 62

Monthly Beach Profiles – 1986

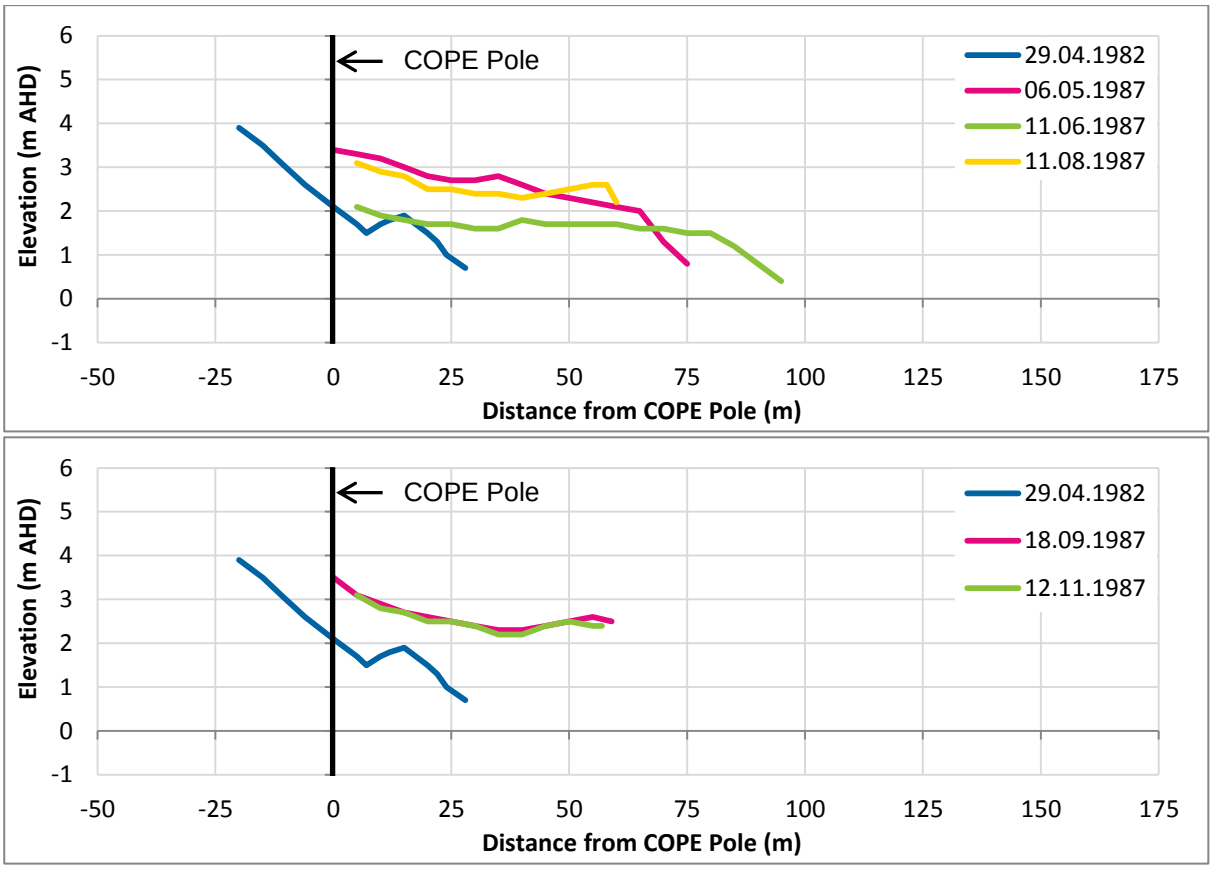

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Figure 63

Monthly Beach Profiles – 1987

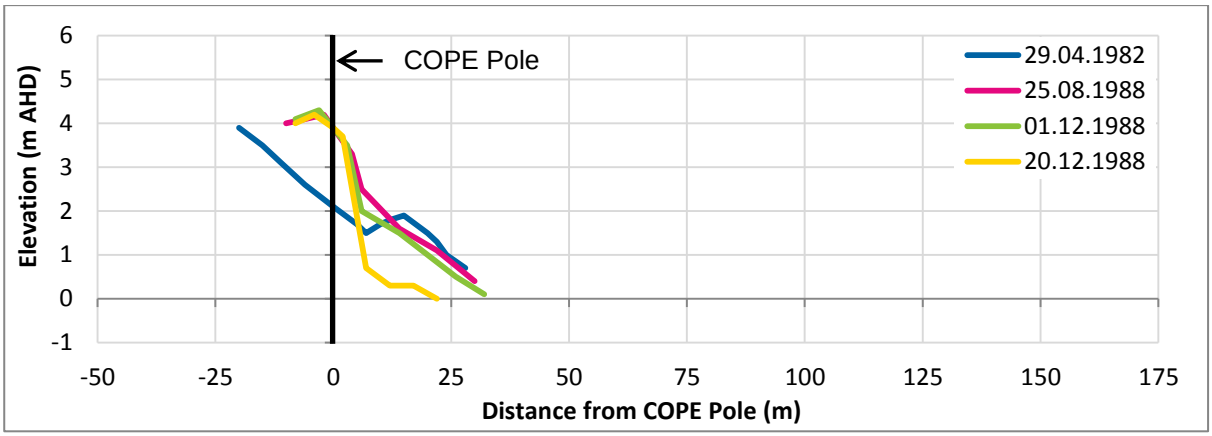

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Figure 64

Monthly Beach Profiles – 1988

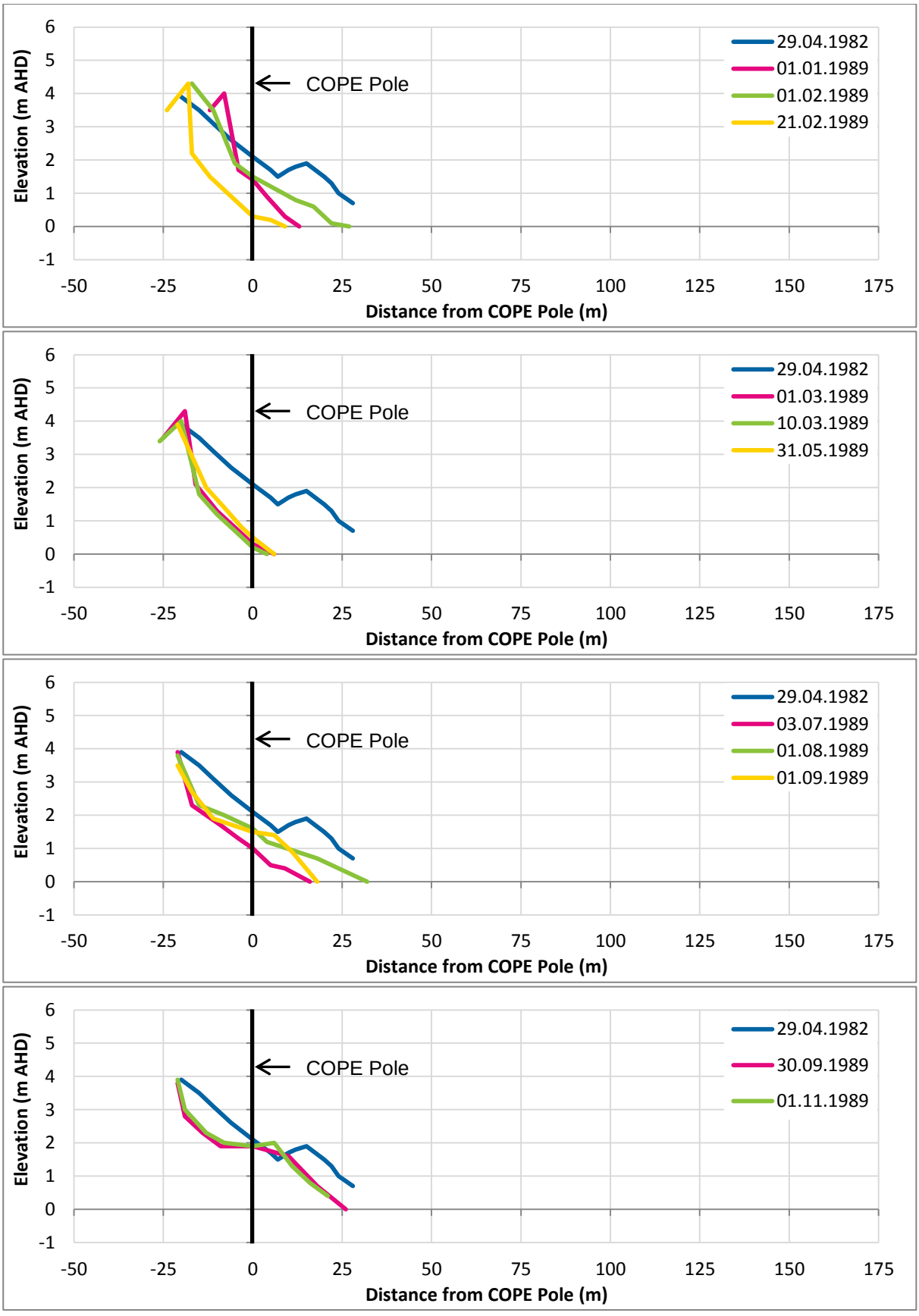

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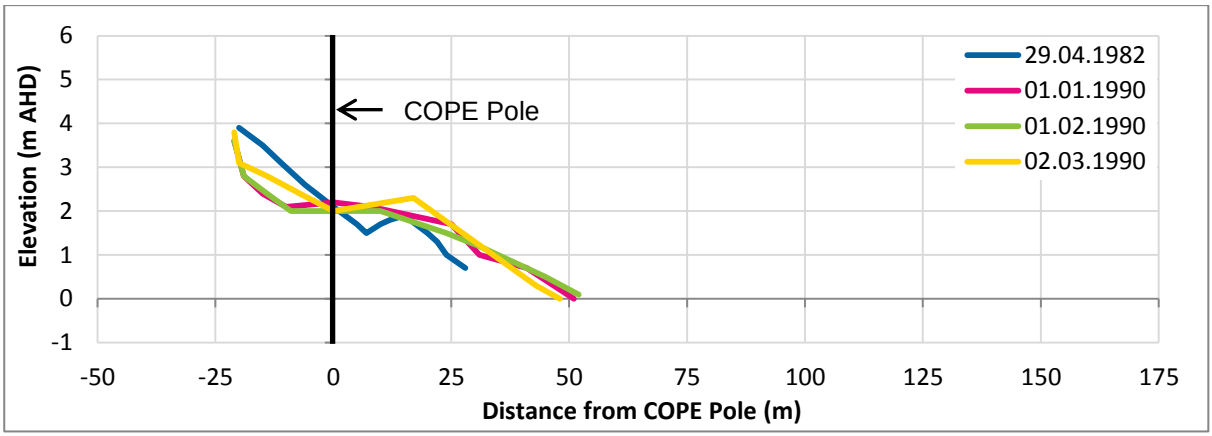
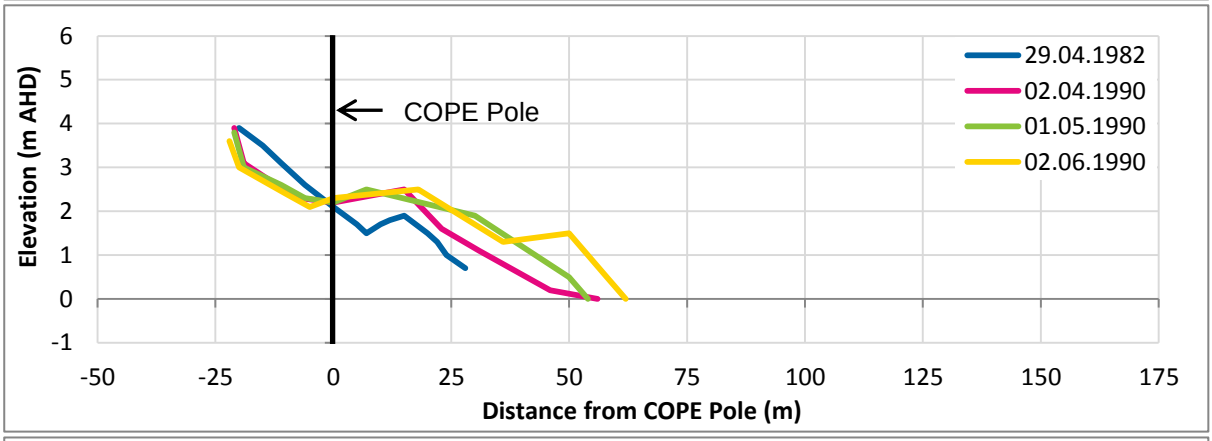
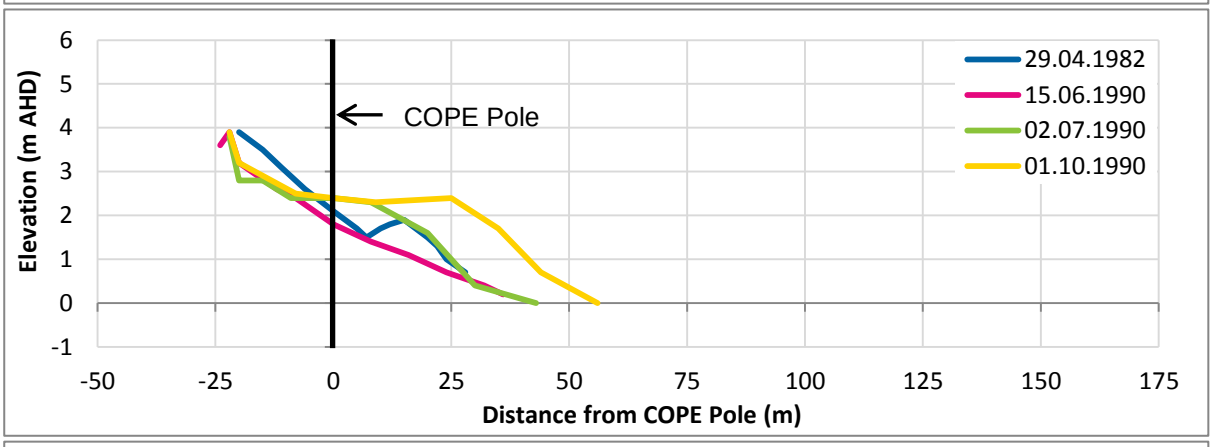
Figure 65

Monthly Beach Profiles – 1989







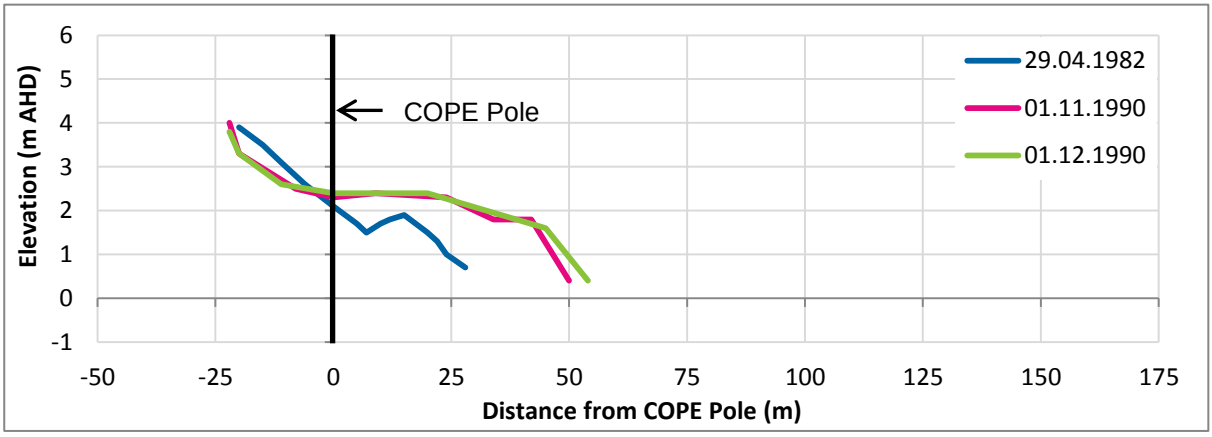


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Figure 66

Monthly Beach Profiles – 1990

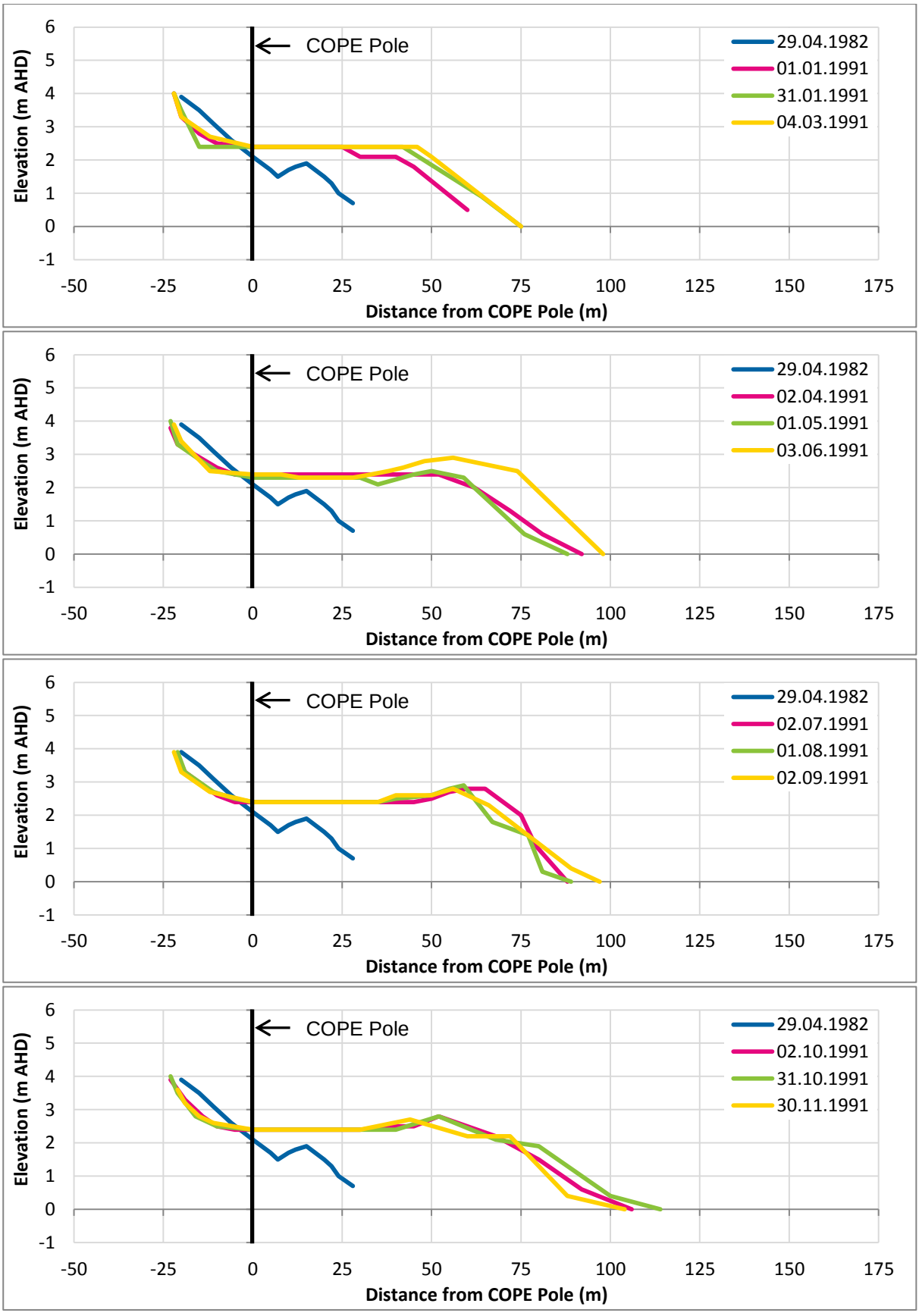

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Figure 67

Monthly Beach Profiles – 1991

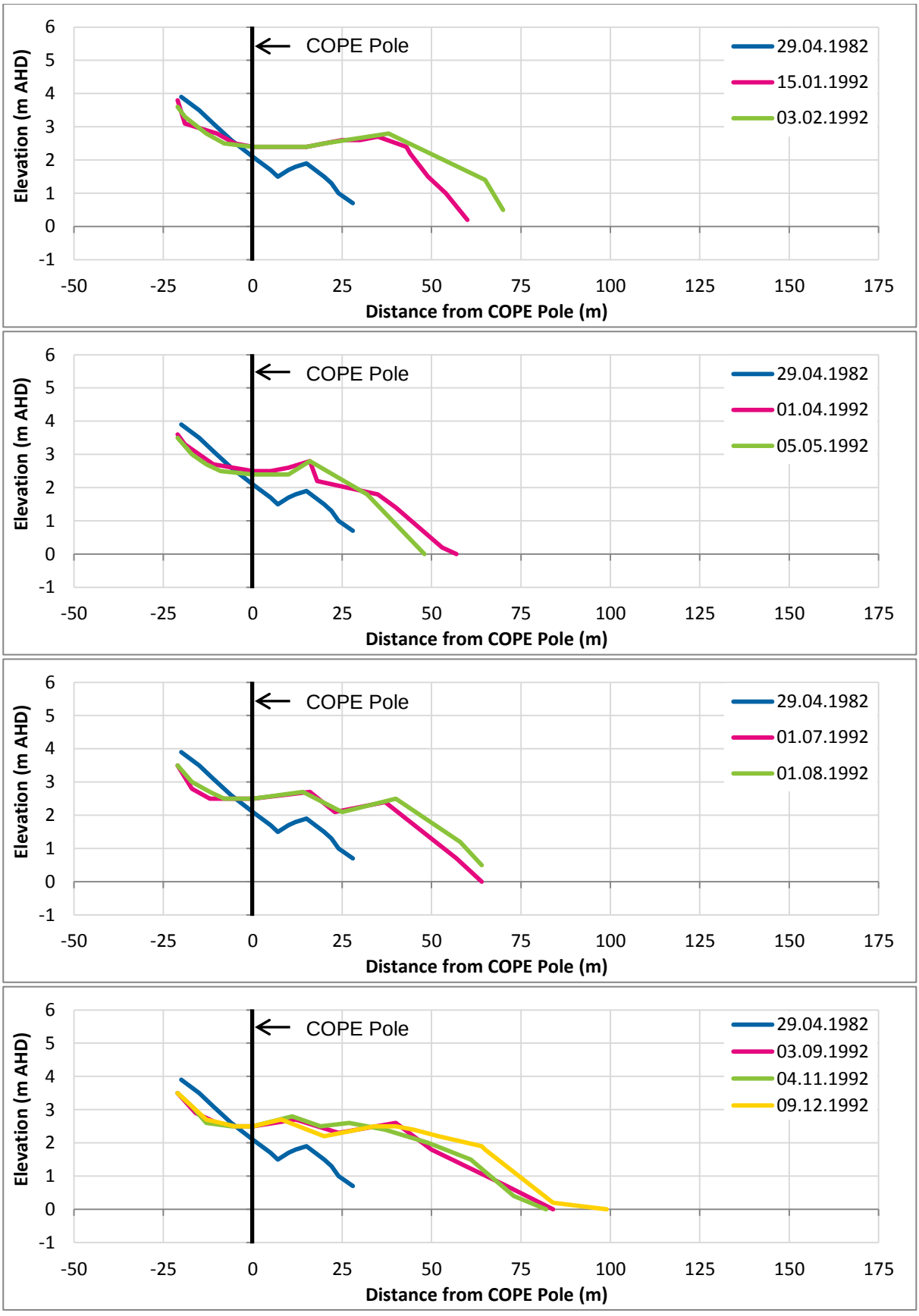

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Figure 68

Monthly Beach Profiles – 1992

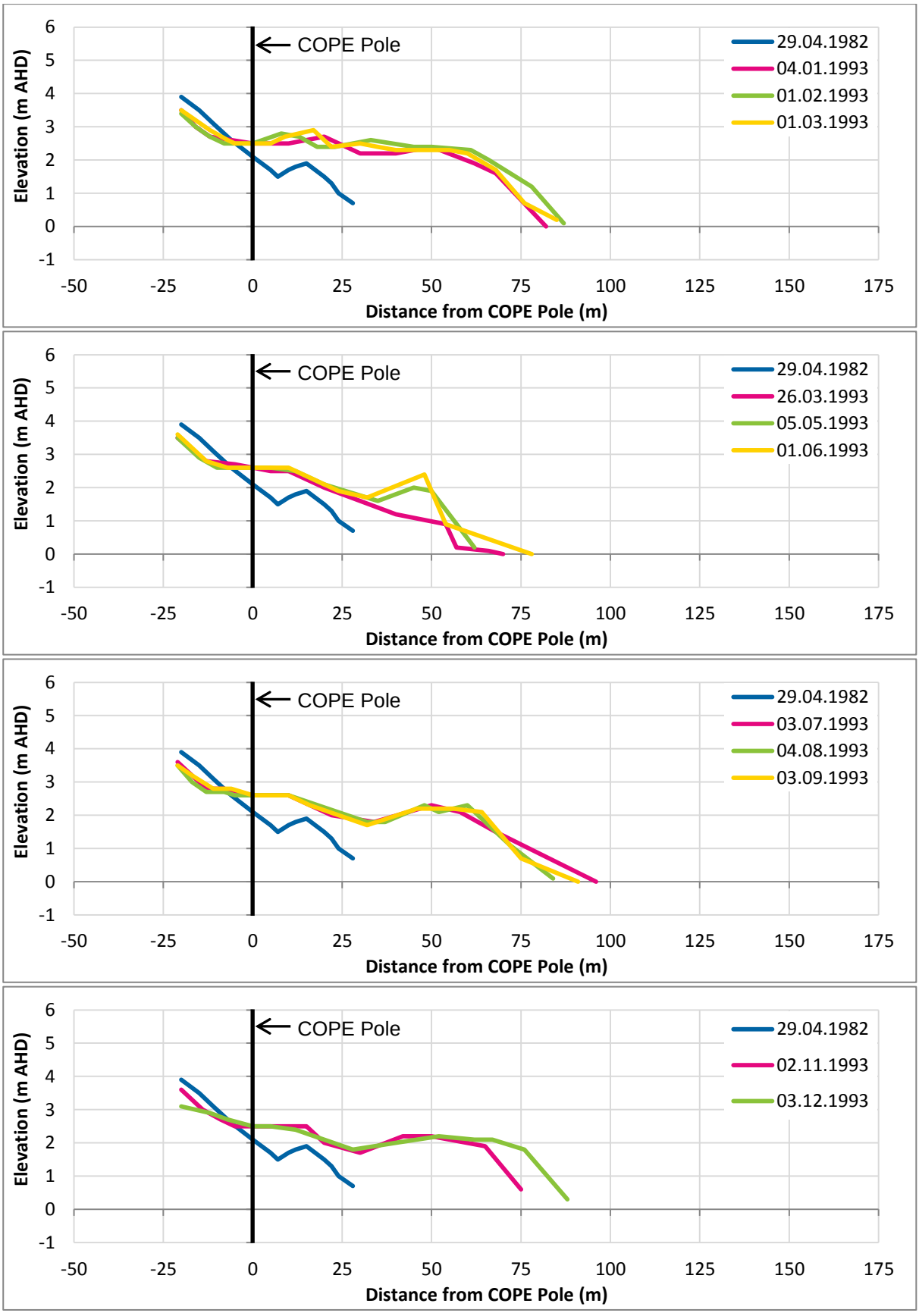

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Figure 69

Monthly Beach Profiles – 1993

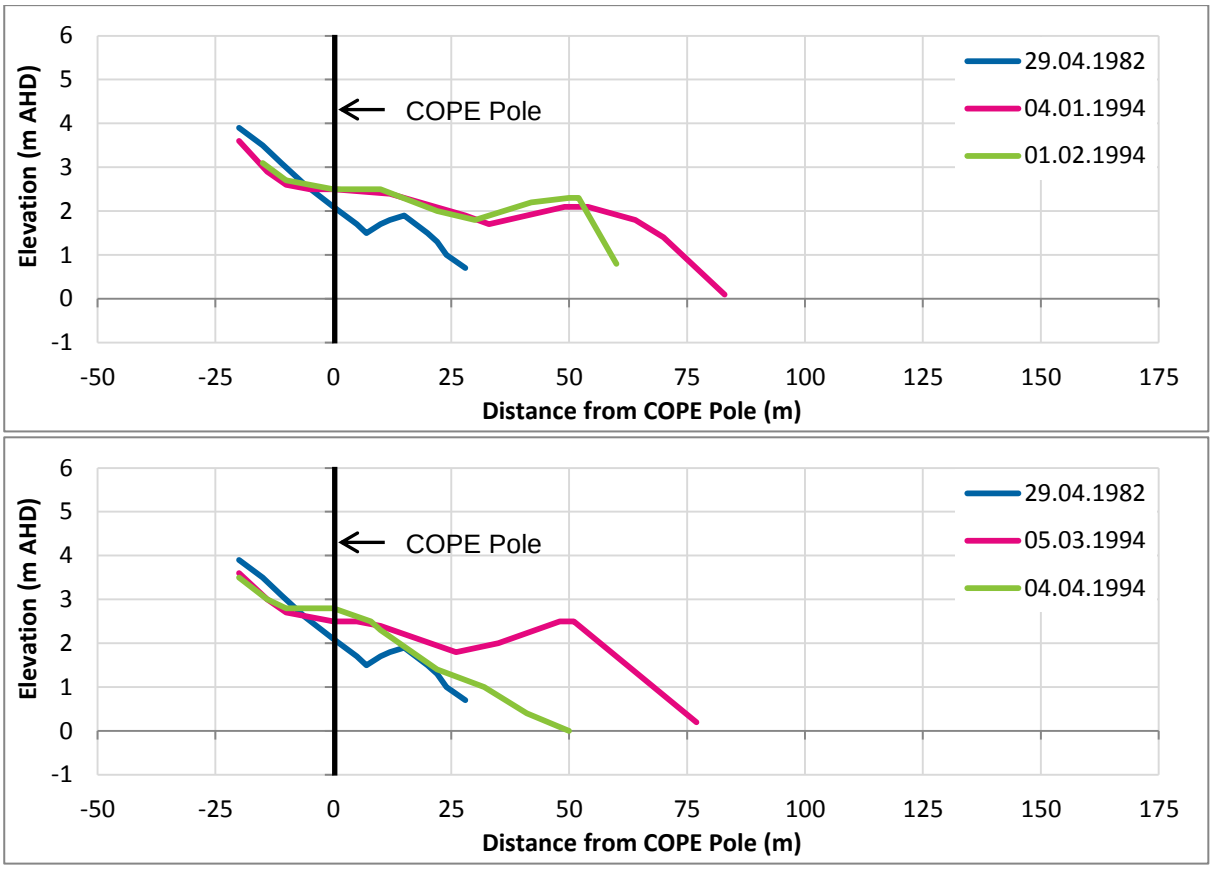

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Figure 70

Monthly Beach Profiles – 1994

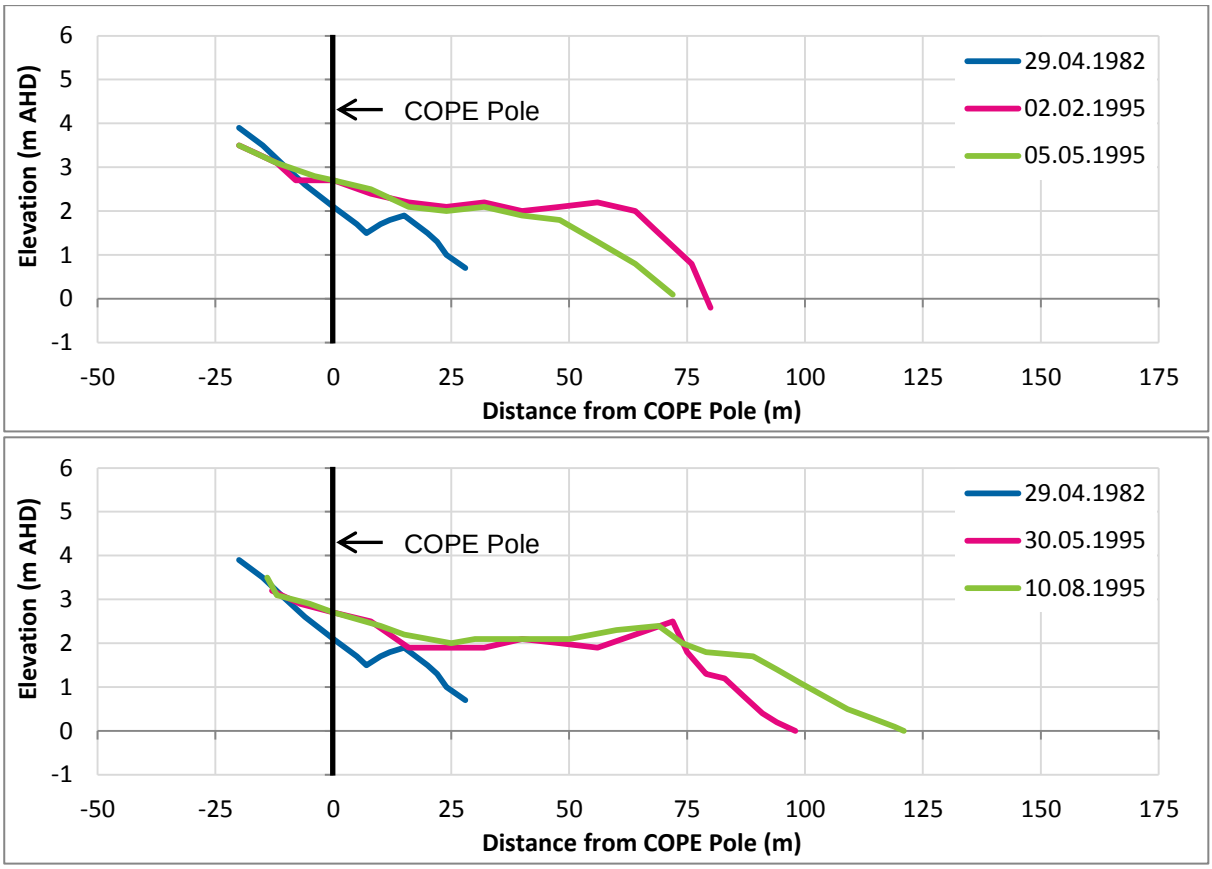

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Figure 71

Monthly Beach Profiles – 1995

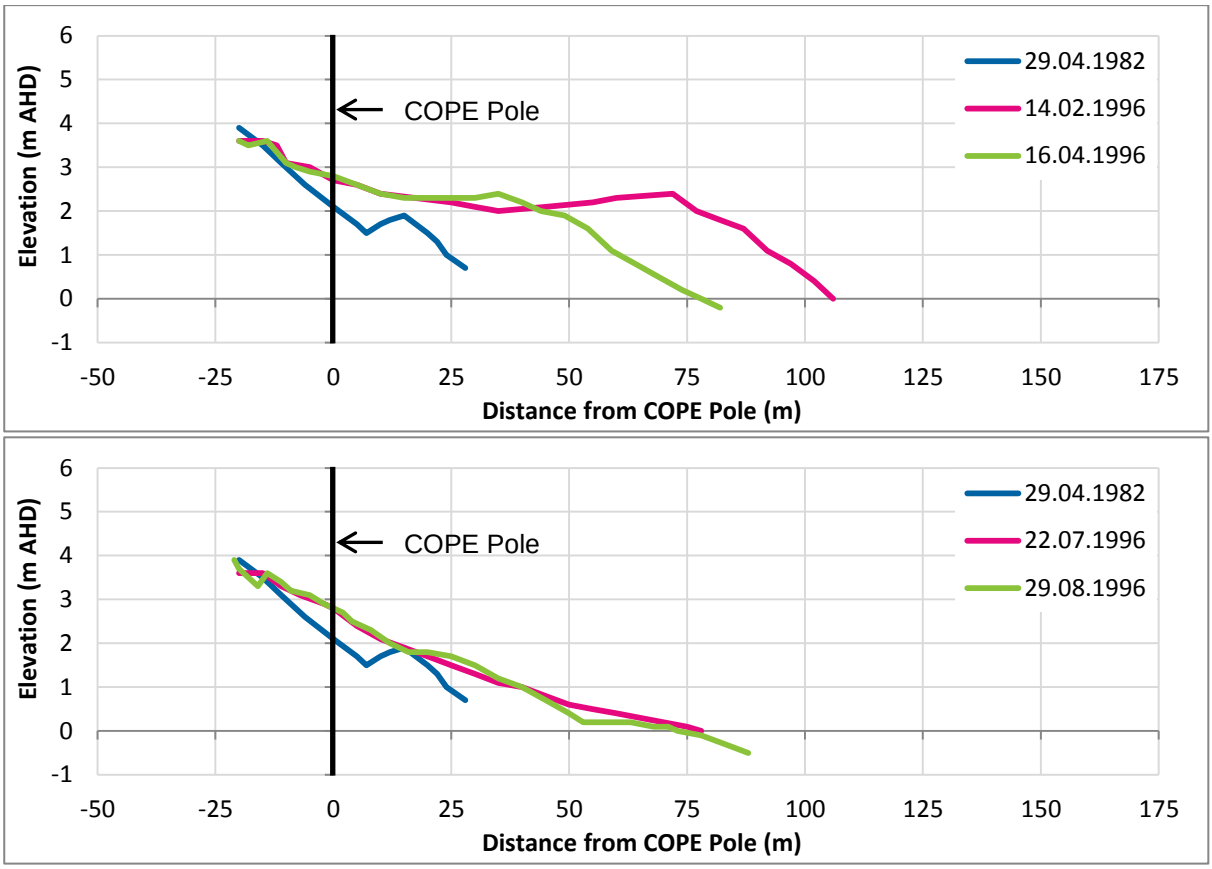

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Figure 72

Monthly Beach Profiles – 1996

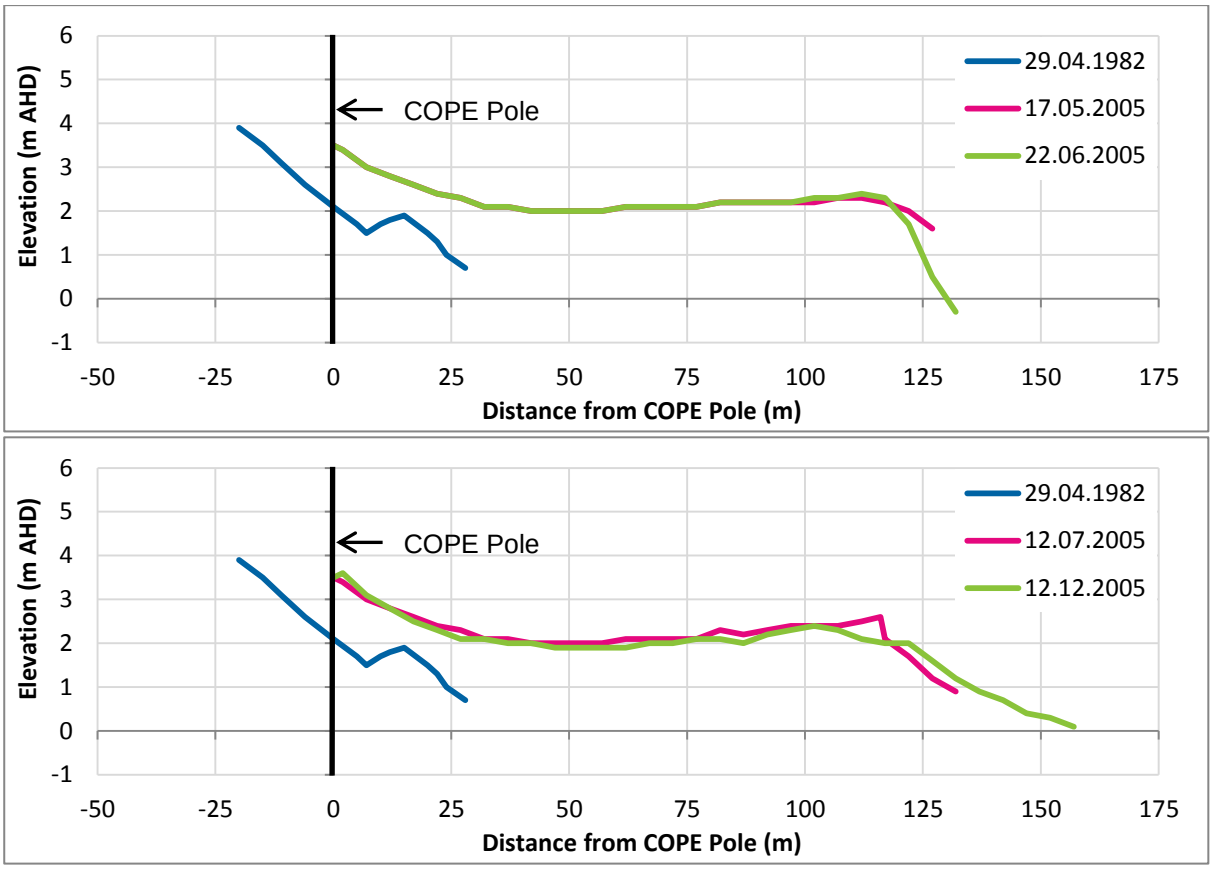

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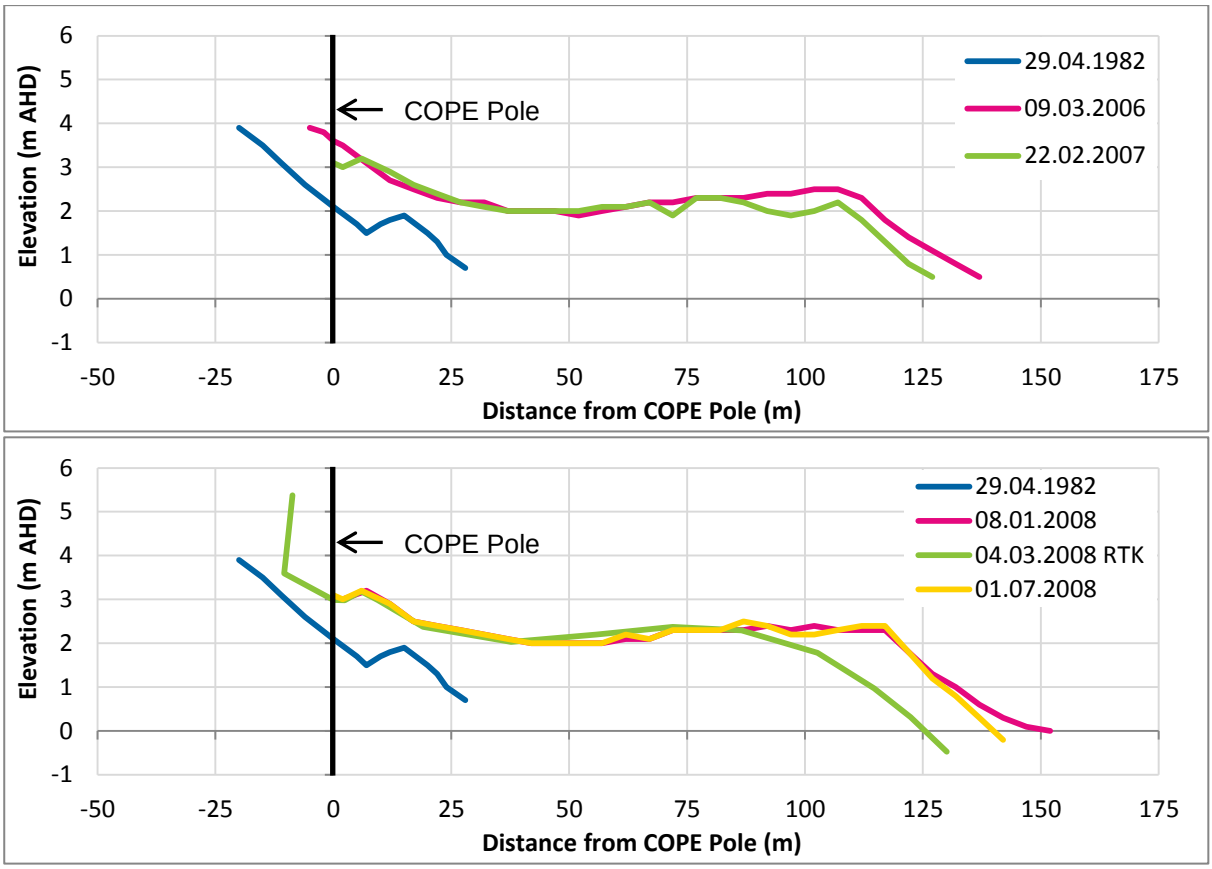
Figure 73

Monthly Beach Profiles – 2005



RTK – This profile measured using Sokkia Real Time Kinematic survey equipment

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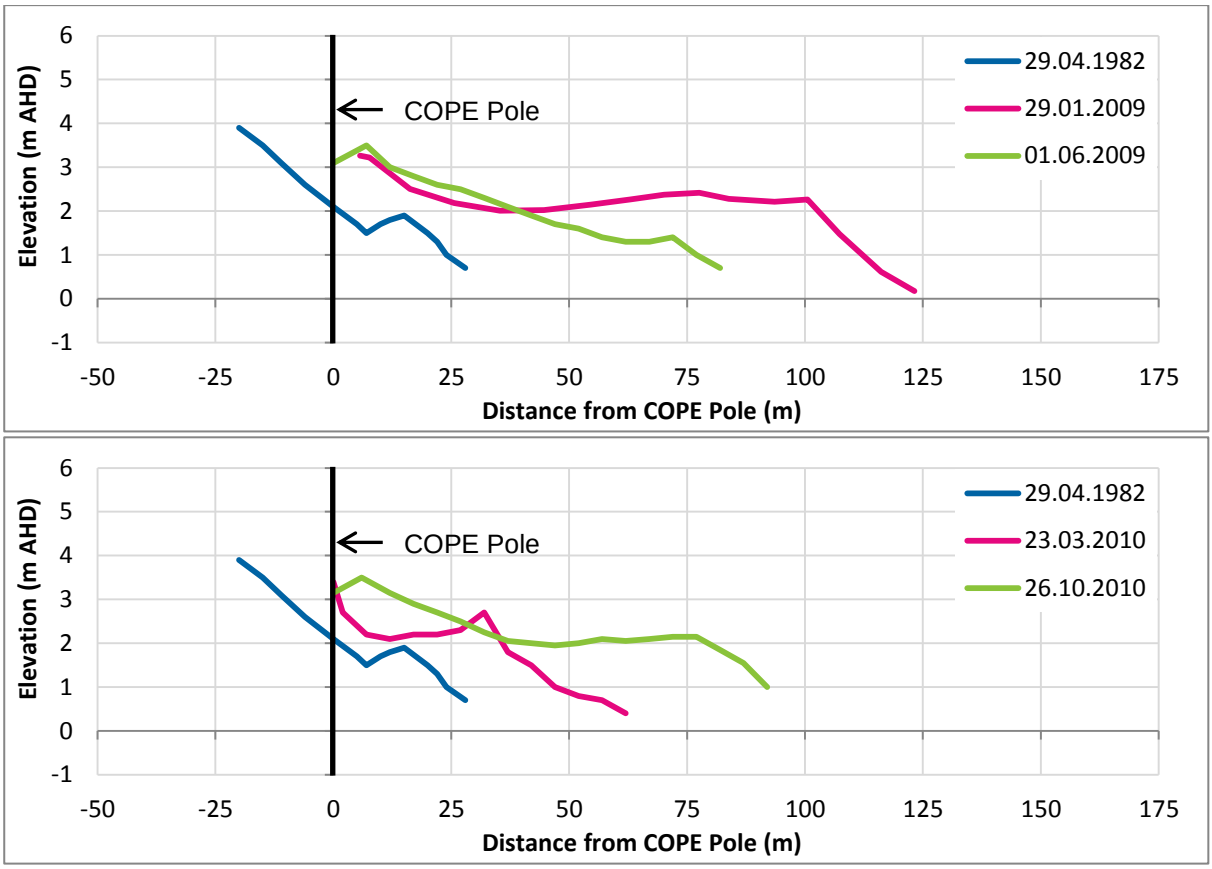
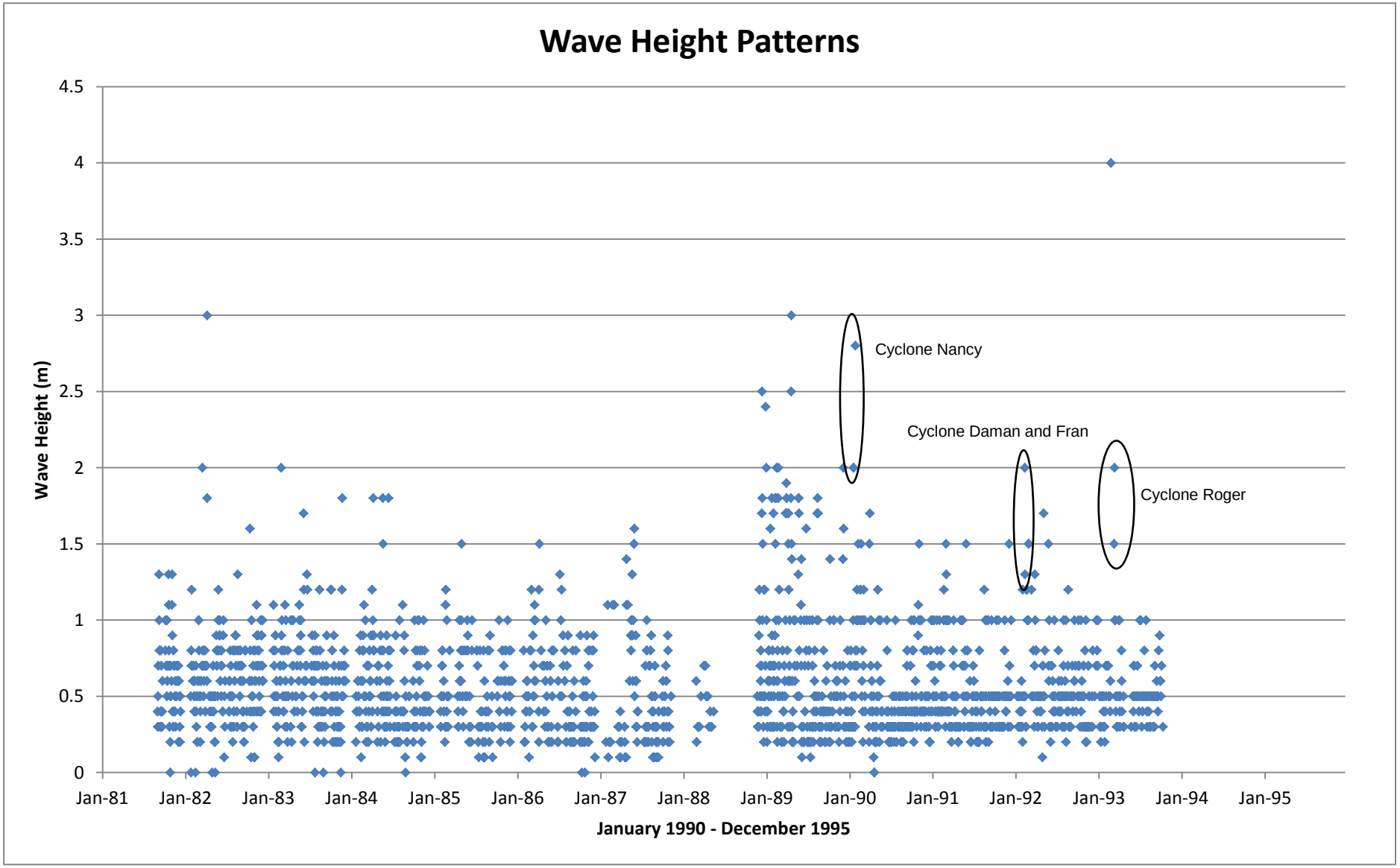
Figure 74

Monthly Beach Profiles – 2006 – 2008


Elevation (m AHD)
6
5
4
3
2
1
0
-1
-50
-25
0
25
50
75
100
125
150
175
Distance from COPE Pole (m)
COPE Pole
29.04.1982
29.01.2009
01.06.2009
Elevation (m AHD)
Distance from COPE Pole (m)
COPE Pole
29.04.1982
23.03.2010
26.10.2010



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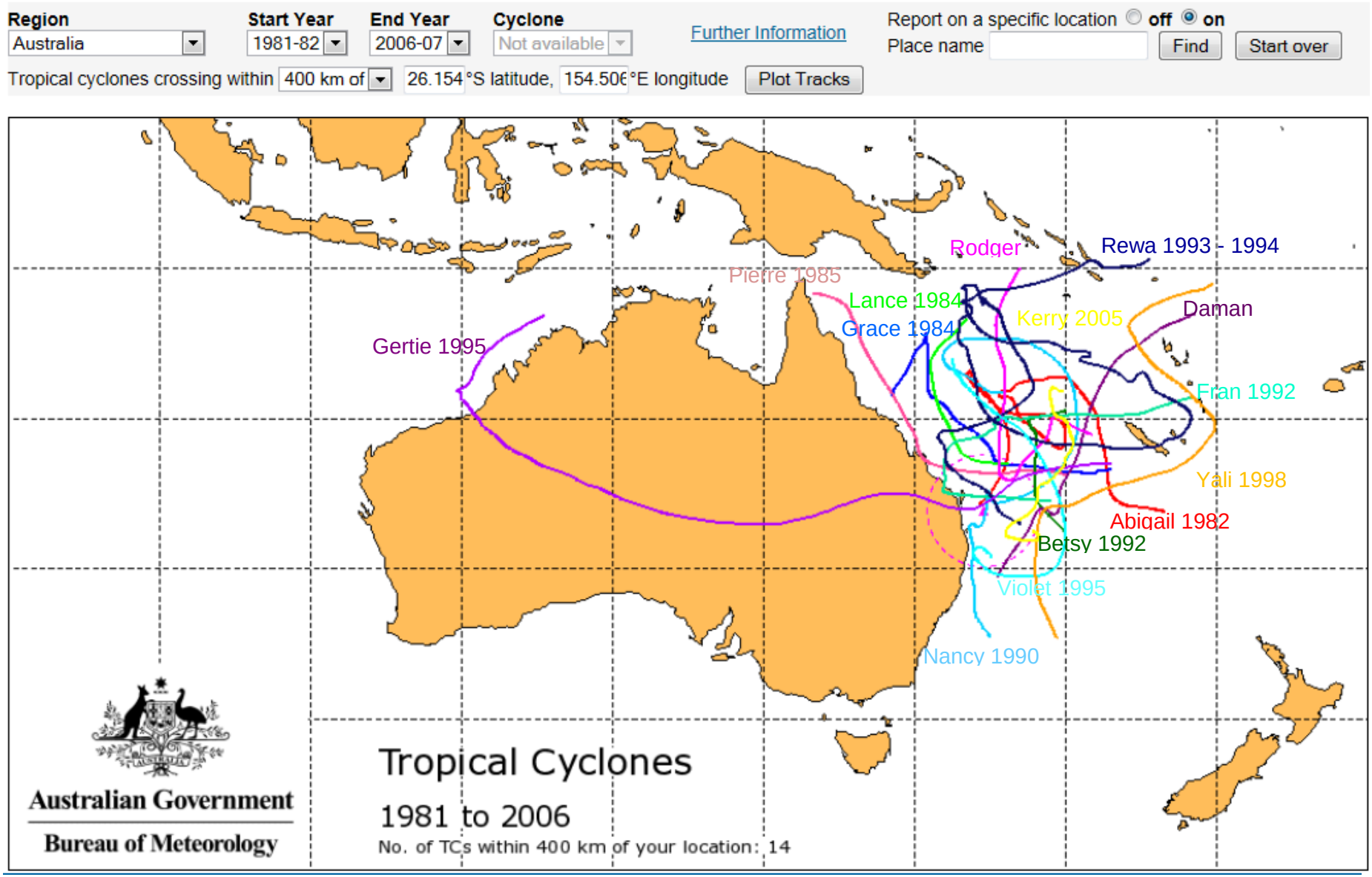
Cyclone Tracks January 1981 – December 1996

Figure 76



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Cyclone Tracks January 1981 – December 1996

Figure 77

Table 18: Amendments to Data:

Date	Parameter	Changed From	Changed To	Justification
15/10/1981	Current Direction	O	0	Only possible recording are L, R and 0, assume transcription error
27/10/81	Current Direction	O	0	Only possible recording are L, R and 0, assume transcription error
22/02/1982	Current Direction	O	0	Only possible recording are L, R and 0, assume transcription error
03/03/1982	Current Speed	89	10	Surrounding data is fairly consistent around 10 m/min, the wave height and direction do not suggest a large value
06/05/1982	Current Direction	O	0	Only possible recording are L, R and 0, assume transcription error
13/05/1982	Current Direction	O	0	Only possible recording are L, R and 0, assume transcription error
20/10/1982	Wave Direction	89	39	A wave that propagates at 89 degrees is virtually moving parallel to the shoreline
17/11/1982	Wave Period	3	6	Surrounding data is consistently larger than 3s, new value was averaged from

				waves with similar parameters
21/03/1983	Wave Direction	284	9	284 degree propagation is practically parallel to shoreline and current speed does not reflect this, new value was averaged from waves with similar parameters
01/06/1983	Wave Period	17	8.5	Corresponding wave height is quite small – 17s period is unrealistic, new value was averaged from waves with similar parameters
06/06/1983	Berm Distance	-11	11	Surrounding data suggests that the value is positive, assume transcription error
04/11/1983	Current Direction	O	0	Only possible recording are L, R and 0, assume transcription error
14/05/1984	Foreshore Slope	12	2	Surrounding data suggests that 12 degrees is an error, assume transcription error
14/06/1984	Distance to Vegetation	6	-6	Surrounding data is constant around -6, assume transcription error
22/08/1984	Wind Speed	36 knots	16 knots	Surrounding data is constantly smaller than 36 knots, new value was averaged from waves with

				similar parameters
02/11/1984	Offshore Bar	6	0	Only possible recordings are 0 and 1, assume transcription error
13/11/1984	Offshore Bar	6	0	Only possible recordings are 0 and 1, assume transcription error
19-20/11/1984	Distance to Vegetation	6	-6	Surrounding data is constant at 6, assume transcription error
09/07/1985	Current Speed	100	10	Wave conditions do not reflect such a high current (medium sized wave with little deviation from the perpendicular), assume transcription error
05/08/1985	Offshore Bar	2	1	Only possible recordings are 0 and 1, assume transcription error
05/12/1985	Wave Period	16	6	Wave height did not suggest such a large period, assume transcription error
24/03/1986	Wave Period	1	10	1s period is unreasonable, assume transcription error
22/05/1986	Wave Period	17.3	7.3	Small wave height does not suggest such a large period, assume transcription error

02/07/1986	Wave Period	1.7	6	1.7s period is unreasonable, new value was averaged from waves with similar parameters
10/07/1986	Wave Period	20.5	7	The corresponding small wave height does not suggest such a high period, new value was averaged from waves with similar parameters
31/07/1986	Current Speed	162	62	Wave height and angle do not suggest such a large current speed, assume transcription error
04/09/1986	Current Speed	238	8	Wave parameters do not suggest such a high current speed, assume transcription error
03/11/1986	Wave Direction	90	0	Current speed does not suggest wave direction near parallel to beach, assume transcription error
13/11/1986	Site No.	1.07	107	Assume transcription error
25/11/1986	Site No.	1.07	107	Assume transcription error
24/03/1987	Wave Direction	255	355	255 degree wave is impossible given beach location, assume transcription error
06/05/1987	Wave Direction	225	325	255 degree wave is

				impossible given beach location, assume transcription error
22/04/1988	Time	145	1450	Assume transcription error
19-21/12/1988	Berm Elevation	3.7	1.7	Surrounding data suggests that 1.7 is correct – a increase to 3.7m is unreasonable, assume transcription error
05/06/1989	Distance to Vegetation Line	21	-21	Surrounding data suggests is constant at -21m, assume transcription error
08/06/1989	Distance to Vegetation Line	21	-21	Surrounding data suggests is constant at -21m, assume transcription error
15/07/1989	Surf Zone Width	115	15	Surrounding data suggests that 15s is the correct number, assume transcription error
11/10/1989	Surf Zone Width	105	15	Surrounding data suggests that 15s is the correct number, assume transcription error
04/02/1990	Time	-100	1000	Assume transcription error
11/02/1991	Current Distance from Shore	50	30	50m seems unreasonable given the surf zone width, new value was averaged from waves with similar parameters

25/02/1991	Current Speed	10	0	Corresponding current direction is 0, assume transcription error
01/04/1992	Distance to Vegetation	121	-21	Surrounding data is constant at -21, assume transcription
11-19/05/1995	Distance to Vegetation	15	-15	Surrounding data is constant at -20, assume transcription error (-15 is still reasonable)

Note: On the new recording sheet, surf zone widths (m) were recorded as the time (s) it takes for an average wave to transgress the surf zone. Using the following equation from Patterson & Blair 1983, the value was converted into metres:

$$Surf\ Zone\ Width\ (metres) = 0.86 \times g^{1/2} \times H_{obs}^{1/2} \times t_w$$

where:

$g = acceleration\ due\ to\ gravity = 9.81 m/s^2$

$H_{obs} = observed\ wave\ height\ (m)$

$t_w = elapsed\ time\ for\ a\ wave\ of\ average\ height\ to\ transgress\ the\ surf\ zone\ from\ the\ break\ point\ to\ the\ final\ runup\ position\ on\ the\ beach\ (s)$

Where a correction to the surf zone width was required, a value was estimated by using a surf zone parameter for a wave with a similar height and period. This value was then converted from seconds to metres using the above formula.

Appendix A – COPE Instructions

The following text is an extract from BPA newsletter – Beach Conservation No. 69 in which the COPE program was the feature article. The extract describes how the recordings were performed for the **new format** recording sheet, which was introduced in March 1986.

OBSERVATIONS

The data is recorded on special forms which are suitable for computer processing. An example is shown in Figure 2. The wave parameters recorded are:

(i) estimate of wave heights (average and maximum):

(ii) wave period (average time interval between waves);

(iii) wave direction (as a compass bearing);

(iv) surf zone width (traverse time of surf zone by average wave).

The beach parameters recorded, using the installed reference pole are:

(i) elevation of the fixed contour or beach berm;

(ii) distance to the fixed contour or beach berm;

(iii) distance to the average vegetation line;

(iv) sand level at the pole.

Wind speed and compass direction are determined by the use of a hand held wind meter.

The longshore current in the surf zone causes the transportation of sand along the beach, and it is important that this current is measured. This is done by introducing a harmless dye into the water and measuring the distance that the dye patch travels along the beach in one minute. Wave action soon dissipates the dye.

The survey of a monthly beach profile, using the installed reference pole, provides information on beach movements. During periods of change, such as cyclonic wave attack, profiles are usually taken before and after the event. All reference poles are surveyed at the time of installation to allow replacement in the same position if they are destroyed or are washed out by erosion.

The average sand grain size is an element to be considered in the assessment of longshore sand transport rates. Therefore, a monthly sample is taken from a specified beach level and analysed to reveal any seasonal or long term changes.

The following document details the instructions on how to fill out the **old format** recording sheet which was discontinued in March 1986.

FORM No. BE3

BEACH PROTECTION AUTHORITY - QUEENSLAND

Instructions for filling out COPE recording form

COASTAL OBSERVATION PROGRAMME - ENGINEERING

(COPE)

STATION IDENTIFICATION:

Each site for COPE has been assigned a numerical code consisting of five digits. The first two digits define the Shire or City in which the site is located, and the remaining three digits define the particular beach and reference mark position within a particular Local Authority area. A space is provided to write in the name of the beach at which the observation is made.

DATE:

Record the year, month and day in the spaces provided on each page of the recording sheet.

TIME: (Column 2)

Record the time to the nearest quarter-hour **in Eastern Standard Time** (E.S.T.) at which the observation is made. (e.g. 10.00 a.m. Daylight Saving Time is 0900 E.S.T.). The 24-hour clock system of recording time is used to avoid any confusion between a.m. and p.m. (e.g. 0900 is 9.00 a.m. and 1500 is 3.00 p.m.).

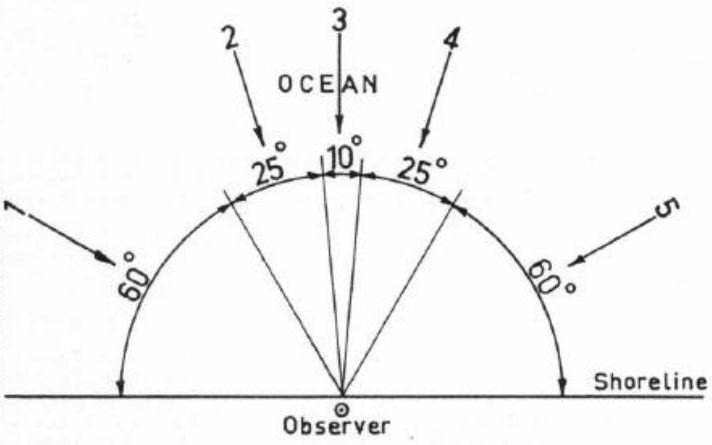
Daily observations should be made as close as possible to 0900 hours, and twice-daily observations should be made once in the morning and once in the afternoon and as close as possible to 0900 and 1500 hours. Observations should be made at the **same** time every day.

WAVE OBSERVATIONS:
(These observations are to be made twice daily.)

(a) **Wave Period:** (Column 3). Record the time in seconds for eleven wave "crests" to pass a stationary point. Eleven "crests" will include ten complete waves (crests and trough). Crest 1 is zero-time, crest 11 is cut time.

(b) **Wave Height:** (Column 4). This observation is based solely on the judgement of the observer. The observer's best estimate will be sufficient. Record the breaking wave height to the nearest one-fifth metre. If wave height is less than one-fifth metre (0.2), the wave height is "O". If no waves exist at all, mark "O" for **both** WAVE HEIGHT and WAVE PERIOD columns.

Fig. 1 WAVE DIRECTION CODE



(c) **Wave Direction:** (Column 5). Darken the space which best describes the direction of the approaching waves according to Fig. 1 above. If no waves exist at all, write the direction as "O".

(d) **Type of Breaking Waves:** (Column 6). If no waves exist, leave the item blank, otherwise choose only **ONE** of the following four types of waves:

Spilling – Spilling occurs when the wave crest becomes unstable at the top and the crest flows down the front face of the wave, producing an irregular, foamy water surface. This wave is sometimes referred to as a "roller" (see Fig. 2 below). Mark "SP" for spilling.

Plunging – Plunging occurs when the wave crest curls over the front face of the wave and falls into the base of the wave, producing a high splash and much foam. This wave is sometimes referred to as a "dumper" (see Fig. 3 below). Mark "PL" for plunging.

Plunging/Spilling – Darken this space only when there is a combination of spilling and plunging waves. Mark "PS" for plunging/spilling.

Surging – Surging occurs when the wave crest remains unbroken while the base of the front of the wave advances up the beach (see Fig. 4 below). Mark "S" for surging.

(e) **Surf Zone Width:** (Column 7). This observation is based on the judgement of the observer. The observer's best estimate is sufficient. Record the distance, to the nearest whole metre, from the water line at the time of observation to the line of the most seaward row of breakers, at the time of observation. If no waves exist at all, mark "O". If two or more breaker zones exist, record the distance to the most seaward row of breakers of the most seaward breaker zone.

(f) **Offshore Bar:** (Column 8). Record whether or not a significant offshore bar exists. This may be determined as "yes" if there is a distinct gutter between the initial breakpoint and the beach, allowing the wave to reform; and "no" if the wave continues in a broken state from the initial breakpoint to the beach (see Fig. 5).

Fig. 2

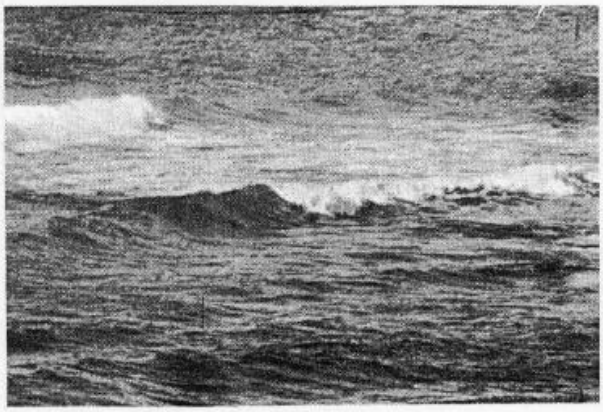


Fig. 3

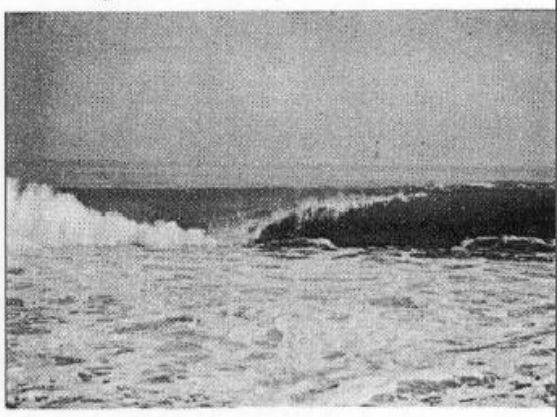


Fig. 4

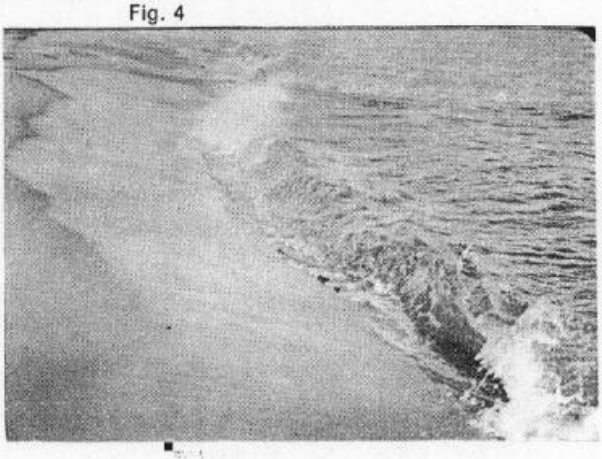
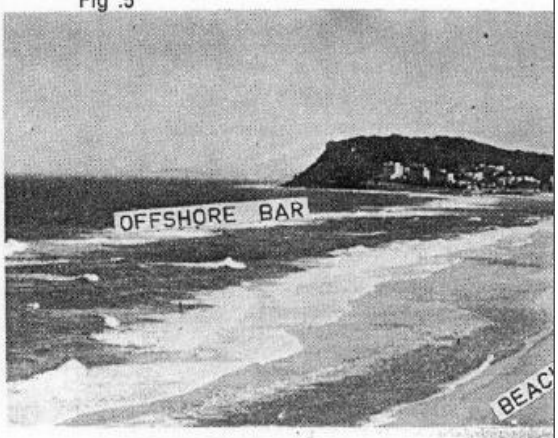


Fig .5



WIND OBSERVATIONS: (These observations are to be made twice daily).

(a) **Wind Velocity:** (Column 9). A wind meter is provided for each observer. The instructions provided with the meter should be followed to obtain wind velocity measurements.

(b) **Wind Direction:** (Column 10). Determine the orientation of the beach with respect to the compass directions, and record the direction **from which** the wind is coming. The direction of true north should be indicated on the reference mark or nearby.

STATE OF TIDE: (Column 11). (This observation is to be made twice daily).

Indicate the relative state of tide by marking one of the ranges: low tide "O/4", quarter tide "1/4", half tide "2/4", three-quarter tide "3/4", full tide "4/4", and mark whether the tide is rising "R", falling "F", or stationary "S" at the time of observation.

BEACH OBSERVATIONS: (These observations are to be made once daily.)

(a) **Elevation of the most seaward beach berm crest:** (Column 12). To obtain this, a graduated reference pole has been installed on the beach and the observer has been provided with a hand level. The observer should also have a 1.5 m-long support for the level. To use the Clinometer as a level, set the bubble lever to zero and sight through the instrument to the reference pole so that the bubble is centred on the cross hair. To obtain this measurement, the observer must place himself on the most seaward berm crest and take a reading of the reference pole (see Fig. 6 below). This reading minus 1.5 metres (length of support) is recorded on the form. If no berm can be easily recognised mark "NB" for no berm.

(b) **Distance to the most seaward berm crest from the reference pole:** (Column 13). Record the distance (to the nearest whole metre) between where the level reading is taken and the reference pole (see Fig. 6 below). If no berm exists, leave the distance **blank: DO NOT** mark the "O". If the distance is measured landward from the reference pole, the distance is a minus value. After erosion the berm may be at the erosion scarp.

(c) **Distance to the vegetation line from the reference pole:** (Column 14). Record the distance to the nearest whole metre between the reference pole and a line along the average seaward extent of the existing perennial vegetation. If the distance is measured landward from the reference pole, the distance is a minus value.

(d) **Angle of Foreshore Slope:** (Column 15). This observation can be made by placing the support pole for the level on the foreshore slope and laying the level on the support, as shown in Fig. 7 below. The foreshore is the uniform sloped section of the beach between H.W.M. and L.W.M. Next, adjust the bubble level so as to centre the bubble in the bubble tube, and then note reading on the DEGREE scale.

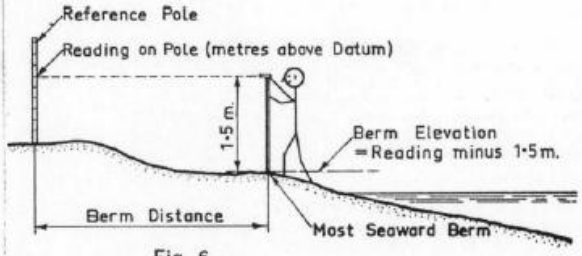


Fig. 6

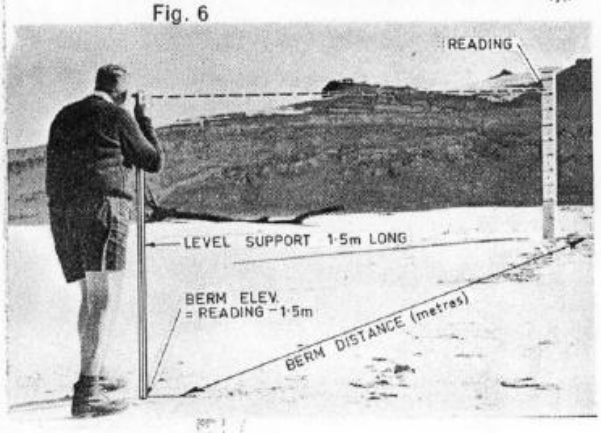


Fig. 7

Continued overleaf

LITTORAL CURRENT OBSERVATIONS: (These observations are to be made once daily.)

(a) **Current Velocity:** (Column 16). For this measurement the observer is provided with dye. The dye is **very** powerful, and care must be observed when handling it so as not to allow any dye to accidentally spill. The dye should be thrown as near as possible to the midpoint of the surf zone. The observer will note the position of the dye at entry to the breaker zone and the position of the dye after an elapsed time of one minute. The distance between these two positions is entered in the spaces provided on the form. If no current is evident, darken the "O" marks.

(b) **Current Direction:** (Column 17). If no current is evident, mark "C" for "calm". Otherwise indicate whether the dye patch moves downcoast or upcoast. In general, current that flows to the north is considered upcoast, and that which flows to the south is considered downcoast.

SAND SAMPLES:

Sand samples should be collected once a month in the special plastic bags provided. The sample should be obtained from the foreshore slope of the beach at about half tide level. Identify the sample with the name and code number of the beach, and record the date and time the sample was collected. Write this information directly on the outside of the specially provided padded envelope.

PHOTOGRAPHS: (Optional)

Photographs are to be taken once a month, preferably early each month and at low tide. General panoramic views of the beach in the up and down coast directions are desired. Photographs should be taken from the same location each time and view the same area with a recognisable landmark in the background. Each photo must be identified with the name and code number of the beach, and the date and time and tide level when it was taken.

COMMENTS:

Note any remarks or sketches or unusual events (e.g. erosion scarps, cyclone damage, surge etc.) in the comments column of the recording form.

Remember: There are about 50 COPE stations in Queensland.

Remember: To mark **all** recording sheets, sand samples and photographs with your code number, and time and date.

Issued by

BEACH PROTECTION AUTHORITY OF QUEENSLAND

Department of Harbours and Marine
Edward Street, Brisbane 4000
(G.P.O. Box 2195, Brisbane 4001)

Appendix B – Beach Conservation Extracts

Extracts from Beach Conservation newsletters that are related to the Coolangatta Beach COPE station site are reproduced below.

Beach Conservation No 45 October 1981

School Pupils man Coastal Observation Station at Coolangatta

Pupils from the Coolangatta Special School at Kirra Hill have recently joined the Beach Protection Authority's Coastal Observation Programme. The children became part of the volunteer team of observers operating a network of 41 stations which stretch from Port Douglas, near Mossman, south to Coolangatta.

The establishment of this station in the southern section of the Gold Coast will help in determining variations in the rate of longshore transport of sand along the Gold Coast. The site chosen is on Coolangatta Beach about 100 metres from the groyne.

COPE Field Officer, Bob Blair, and Engineer, Russell Murray, visited the school to instruct the teachers and pupils involved.

At least once a day, the children will be called upon to measure and record wind speed and direction, littoral currents, beach slope, surf zone width, and wave height, period and direction.

Data collected at this station will benefit the beaches of the Gold Coast by aiding the Authority's understanding of beach processes in the area.

School Principal Ken Lindley (left) and teacher Phil Adams (right) are shown receiving instruction in the measurement of foreshore slope from COPE Field Officer, Bob Blair.