Department of Science, Information Technology, Innovation and the Arts

Beach Surveys and Data Assessment, Gold Coast Region

COPE Data – Tallebudgera

Coastal Impacts Unit

February 2014

Great state. Great opportunity.

Queensland Government

Prepared by

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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 Tallebudgera – COPE Site 108. 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 Tallebudgera site, located 200 m south of the rock wall at Tallebudgera Creek. 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 the DSITIA at Deagon; and
4. Photographs and other relevant information about the Tallebudgera 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 newsletter was reviewed for any articles on the COPE program relating to the Tallebudgera site. However, no articles specific to Tallebudgera were identified.

Reference documents and technical papers that have been used to assist in the preparation of this report are listed in Section 4 and include the Mooloolaba 2 report compiled in 2010 by GHD for the Sunshine Coast Regional Council (SCRC).

[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 stick (as suggested by Appendix A – Instructions for filling out COPE recording form); and
- Hand level (as suggested by Appendix A – 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 Tallebudgera for the ten year period from 1984 to 1993, and the continued profile data supplied by DSITIA from 1993 – 2010 in a useful statistical form.

The ten 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

Tallebudgera is located on the Gold Coast and is situated approximately 90 km south of Brisbane on the South East Queensland coastline. The beach is approximately 1.5 km long extending from Tallebudgera Creek to the northern end of Palm Beach. The location of the Tallebudgera COPE station is about 200 m south of the rock wall at the entrance to Tallebudgera Creek, behind the Tallebudgera Recreation Camp, as shown on Figure 1a and 1b.

2.2 Observers

From information available from the BPA file for this station and the BPA Beach Conservation Newsletter No 57, the observers for the Tallebudgera site were staff from the local Tallebudgera Camp School operated by the Queensland Education Department. The main observers were two teachers; Mr Phil Muller and Mr Peter Duke, and the camp's groundsman Mr Ron Cox. The school was visited for six day periods by groups of about 150 Queensland school children. The recording of COPE observations formed part of their daily activities and helped foster interest in and an understanding of beach processes as well as providing data for the Authority. The station closed on 15 February 1993 as the resources and interest were no longer present.

Phil Muller and Peter Duke collecting a sand sample as part of the COPE observation procedure

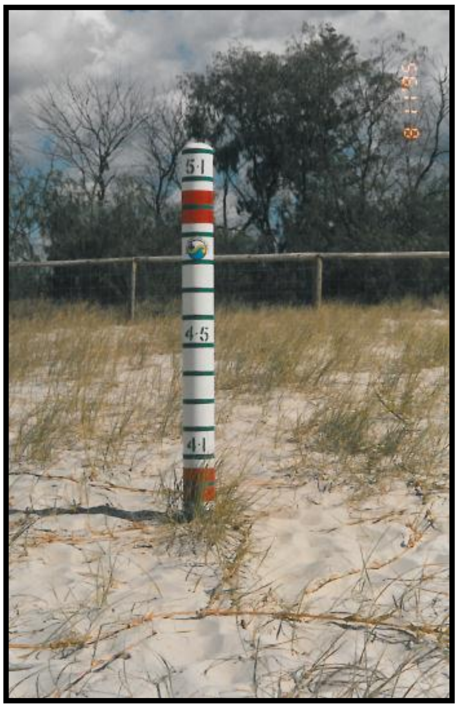
2.3 Site History

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

- 31 August 1984 – Observations commenced;
- 6 December 1984 – COPE pole installed by Frank Geotsch from Gold Coast City Council (GCCC);
- 6 December 1985 – Wind meter was determined to be faulty;

- 12 December 1985 – New wind meter received;
- 28 November 1990 – Top section of COPE pole was replaced; and
- 15 February 1993 – Observations ceased.

Photo 1: Tallebudgera COPE Pole, 11 August 1995



2.4 Observed Parameters

The observers at this station recorded the majority of observations in the morning between 6am and 10am at the beginning of the recording period, and later in the day towards the end of the recording period.

From the commencement of the program on 31 August 1984 until 14 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 17 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 1984, and from then on, samples were taken every month in the first two years, and every few months for the remainder of the recording period.

A profile of the beach was recorded monthly throughout the recording period 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.

2.5 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.

2.6 Beach Description

The beach at the Tallebudgera COPE station exhibited the following characteristics:

- Typical beach slopes: Foreshore slope was measured from 31 August 1984 until 14 March 1986 and was in the range of 1 to 11 degrees with an average slope of 4 degrees (by inspection of Figure 37 to Figure 39). Foreshore slope in subsequent years can be inferred from the beach width measurements and the monthly profiles. The beach slope oscillated between 1 to 5 degrees, with an average of 3 degrees between 1984 – 1996 (Figure 41 to Figure 51);
- Beach width: Varied from 25 to 80 m measured from the seaward toe of the frontal dune to the Low Water Mark over the 17 year period (1984 - 2010) (by inspection of the monthly beach profiles Figure 41 to Figure 54);
- D_{50} grain size: 0.26 mm averaged over 32 samples collected over the ten years (1984 – 1993); and
- Adjoining landform: Vegetated sand dunes seaward of parkland.

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

Photo 2a: Tallebudgera, August 1990 – Looking north

Photo 2b: Tallebudgera, August 1990 – Looking south

2.7 Meteorological Events

The following cyclones were recorded by the Brisbane Bureau of Meteorology as having tracks within 400 km of Tallebudgera between January 1984 and December 2006. It is considered that these meteorological events may have had some effect on the condition of Tallebudgera.

- 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.

Cyclones that occurred outside the 400 km radius to Tallebudgera were Cyclone ROGER 12 – 21 March 1993, Cyclone BETSY 10 – 14 January 1992, Cyclone YALI 17 – 27 March 1998 and Cyclone HAMISH 5 – 12 March 2009. See Figure 56 for the cyclone tracks for a 400 km radius centred just east of Tallebudgera over the recording period of 1984 – 2006. More recent records were unavailable for plotting in this format at the time of compiling the report.

2.8 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 for this station for the ten year period August 1984 to February 1993 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 14 March 1986, the wind direction was recorded as a cardinal direction, and the speed was recorded in knots (kn). From 17 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 metre. 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.

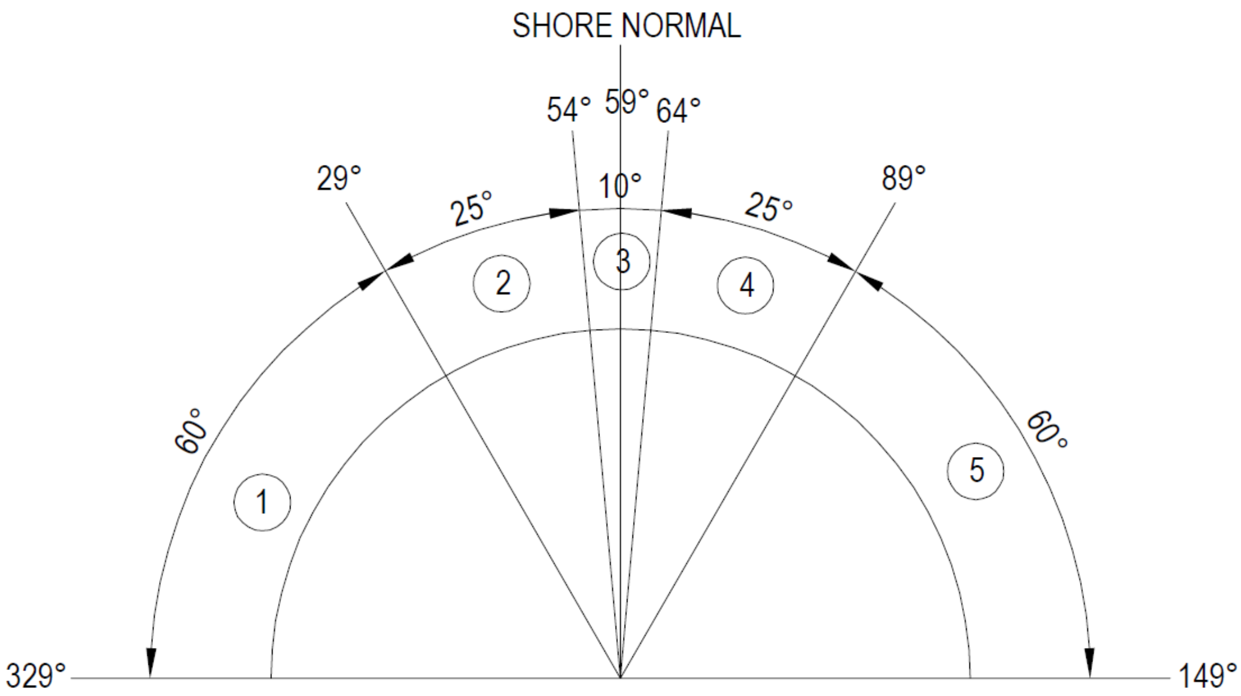
The observers estimated the wave period by recording the time taken for eleven wave crests (the duration of 10 waves) to pass a point.

Prior to 14 March 1986, wave direction was recorded using the protractor in Figure 2b placed parallel to the shore. Post 17 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	329° to 28°
2	29° to 53°
3	54° to 64°
4	65° to 89°
5	90° to 149°



Note: At the Tallebudgera COPE station, the shore normal direction is approximately 59 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 16); and
- Tabulation of the occurrence of various wave heights, periods, types and directions (Table 3 to Table 12).

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 17 to Figure 26). 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 in the top of the berm, 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 were 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 27 to Figure 36.

Foreshore slope was also recorded from 1984 – 1986 by placing the support pole on the sand, and by using the level, a slope was recorded. Refer to Figure 37 to Figure 39 for the results.

Figure 40 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 41 to Figure 50. Further profiles are also available in Figure 51 to Figure 54. 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 7 December 1984 has been repeated in each graph so comparisons between profiles can be easily made.

3.7 Sand Sample Particle Size Distribution

A total of 32 sand samples were collected over the ten years (1984 to 1993) 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 0.26 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. Tallebudgera. 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																
Feb																
Mar																
Apr																
May																
Jun																
Jul																
Aug	1	7.3	0.9	1	0.0	100.0	0.0	0.0	0.0	1	0.0	0.0	0.0	100.0	0.0	0.0
Sep	29	7.6	0.6	29	51.7	41.4	6.9	0.0	0.0	29	0.0	17.2	65.5	17.2	0.0	0.0
Oct	30	7.5	0.9	30	36.7	40.0	23.3	0.0	0.0	30	0.0	16.7	53.3	30.0	0.0	0.0
Nov	30	7.2	0.7	30	66.7	10.0	23.3	0.0	0.0	30	0.0	26.7	56.7	16.7	0.0	0.0
Dec	28	8.4	0.9	28	32.1	35.7	32.1	0.0	0.0	28	0.0	28.6	32.1	39.3	0.0	0.0
Whole Year	118	7.6	0.8	118	46.6	32.2	21.2	0.0	0.0	118	0.0	22.0	51.7	26.3	0.0	0.0

Table 4: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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	27	7.4	0.6	27	14.8	29.6	55.6	0.0	0.0	27	0.0	37.0	33.3	29.6	0.0	0.0
Feb	28	9.5	1.0	28	14.3	50.0	35.7	0.0	0.0	28	0.0	3.6	42.9	53.6	0.0	0.0
Mar	25	9.4	1.0	25	8.0	40.0	52.0	0.0	0.0	25	0.0	4.0	44.0	52.0	0.0	0.0
Apr	30	10.1	1.0	30	16.7	53.3	30.0	0.0	0.0	30	0.0	0.0	36.7	63.3	0.0	0.0
May	28	10.4	1.0	28	10.7	53.6	35.7	0.0	0.0	28	0.0	0.0	46.4	53.6	0.0	0.0
Jun	25	10.2	0.6	25	44.0	36.0	20.0	0.0	0.0	25	0.0	0.0	96.0	4.0	0.0	0.0
Jul	23	10.1	0.8	23	8.7	47.8	43.5	0.0	0.0	23	0.0	13.0	39.1	47.8	0.0	0.0
Aug	26	9.7	0.7	26	42.3	19.2	38.5	0.0	0.0	26	0.0	19.2	46.2	34.6	0.0	0.0
Sep	27	10.7	1.0	27	11.1	37.0	51.9	0.0	0.0	27	0.0	18.5	59.3	22.2	0.0	0.0
Oct	20	10.3	0.9	20	25.0	25.0	50.0	0.0	0.0	20	0.0	25.0	55.0	20.0	0.0	0.0
Nov	26	9.1	0.9	26	42.3	19.2	38.5	0.0	0.0	26	0.0	26.9	38.5	34.6	0.0	0.0
Dec	24	6.7	0.7	24	62.5	8.3	29.2	0.0	0.0	24	0.0	25.0	66.7	8.3	0.0	0.0
Whole Year	309	9.5	0.8	309	24.6	35.6	39.8	0.0	0.0	309	0.0	13.9	49.8	36.2	0.0	0.0

Table 5: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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	19	8.2	1.0	19	26.3	63.2	10.5	0.0	0.0	19	0.0	0.0	42.1	57.9	0.0	0.0
Feb	18	6.6	0.6	18	83.3	0.0	16.7	0.0	0.0	18	0.0	22.2	55.6	22.2	0.0	0.0
Mar	18	6.7	1.2	9	55.6	33.3	11.1	0.0	0.0	9	0.0	0.0	27.8	72.2	0.0	0.0
Apr	15	7.1	1.1							15	0.0	13.3	26.7	60.0	0.0	0.0
May	21	6.6	0.9							21	0.0	4.8	57.1	38.1	0.0	0.0
Jun	18	6.5	1.1							18	5.6	5.6	27.8	55.6	5.6	0.0
Jul	23	7.6	0.6							23	21.7	30.4	26.1	21.7	0.0	0.0
Aug	14	7.7	0.8							14	0.0	14.3	50.0	21.4	14.3	0.0
Sep	19	7.9	0.5							19	5.3	52.6	21.1	15.8	5.3	0.0
Oct	18	6.4	0.6							18	16.7	38.9	11.1	22.2	11.1	0.0
Nov	19	6.0	0.7							19	10.5	26.3	15.8	26.3	21.1	0.0
Dec	15	7.2	1.1							15	6.7	60.0	0.0	33.3	0.0	0.0
Whole Year	217	7.0	0.9	46	54.3	32.6	13.0	0.0	0.0	208	6.0	22.1	30.4	36.9	4.6	0.0

Table 6: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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	8	7.1	0.9	8	0.0	62.5	25.0	12.5	0.0	0.0
Feb	18	7.9	0.8	18	0.0	16.7	33.3	27.8	22.2	0.0
Mar	14	7.9	0.8	14	0.0	14.3	42.9	21.4	21.4	0.0
Apr	10	7.5	0.7	10	0.0	40.0	30.0	20.0	10.0	0.0
May	14	7.4	1.0	14	0.0	7.1	14.3	57.1	21.4	0.0
Jun	18	8.6	0.8	18	0.0	22.2	22.2	38.9	11.1	0.0
Jul	22	8.0	0.9	22	0.0	18.2	40.9	40.9	0.0	0.0
Aug	17	7.1	0.8	17	0.0	11.8	29.4	58.8	0.0	0.0
Sep	9	7.1	0.5	9	0.0	11.1	55.6	33.3	0.0	0.0
Oct	15	8.9	0.8	15	13.3	33.3	26.7	20.0	6.7	0.0
Nov	18	7.6	0.7	18	0.0	44.4	27.8	27.8	0.0	0.0
Dec	3	6.4	1.1	3	33.3	33.3	0.0	0.0	33.3	0.0
Whole Year	166	7.6	0.8	166	1.8	24.1	30.7	33.7	9.0	0.0

Table 7: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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	12	6.7	0.9	12	0.0	8.3	25.0	58.3	8.3	0.0
Mar	13	9.1	1.0	13	0.0	15.4	23.1	53.8	7.7	0.0
Apr	8	9.4	3.0	8	0.0	0.0	37.5	50.0	12.5	0.0
May	8	7.6	0.7	8	0.0	37.5	50.0	12.5	0.0	0.0
Jun	5	10.3	0.5	5	0.0	0.0	80.0	20.0	0.0	0.0
Jul	17	8.1	0.8	17	5.9	35.3	23.5	35.3	0.0	0.0
Aug	22	7.1	0.8	22	0.0	40.9	22.7	31.8	4.5	0.0
Sep	17	6.7	0.9	17	0.0	17.6	35.3	47.1	0.0	0.0
Oct	19	5.5	0.5	19	0.0	47.4	31.6	21.1	0.0	0.0
Nov	16	7.0	1.2	16	0.0	25.0	37.5	12.5	25.0	0.0
Dec	7	6.8	0.9	7	0.0	14.3	14.3	71.4	0.0	0.0
Whole Year	144	7.7	1.0	144	0.7	26.4	31.3	36.1	5.6	0.0

Table 8: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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	1	6.2	0.9	1	0.0	0.0	100.0	0.0	0.0	0.0
Feb	18	6.8	1.1	18	0.0	5.6	11.1	77.8	5.6	0.0
Mar	11	7.4	1.1	11	0.0	0.0	45.5	54.5	0.0	0.0
Apr	15	7.3	1.4	15	0.0	0.0	40.0	60.0	0.0	0.0
May	18	6.3	1.1	18	0.0	0.0	77.8	22.2	0.0	0.0
Jun	20	7.0	0.9	20	0.0	5.0	40.0	55.0	0.0	0.0
Jul	19	6.8	0.7	19	0.0	26.3	63.2	10.5	0.0	0.0
Aug	18	8.0	0.8	18	0.0	33.3	66.7	0.0	0.0	0.0
Sep	11	6.3	0.6	11	18.2	9.1	0.0	36.4	36.4	0.0
Oct	18	5.6	0.5	18	5.6	50.0	27.8	5.6	11.1	0.0
Nov	17	7.8	0.5	17	5.9	11.8	41.2	29.4	11.8	0.0
Dec	6	8.1	0.7	6	0.0	0.0	16.7	66.7	16.7	0.0
Whole Year	172	6.9	0.9	172	2.3	14.5	42.4	34.9	5.8	0.0

Table 9: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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				No data recorded						
Feb	10	8.8	1.4	10	0.0	20.0	30.0	30.0	20.0	0.0
Mar	3	6.8	0.9	3	0.0	66.7	33.3	0.0	0.0	0.0
Apr				No data recorded						
May				No data recorded						
Jun				No data recorded						
Jul				No data recorded						
Aug				No data recorded						
Sep				No data recorded						
Oct				No data recorded						
Nov				No data recorded						
Dec				No data recorded						
Whole Year	13	7.8	1.2	13	0.0	30.8	30.8	23.1	15.4	0.0

Table 10: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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	3	8.1	0.7	3	0.0	33.3	33.3	0.0	33.3	0.0
Feb	15	6.8	1.1	15	0.0	33.3	53.3	13.3	0.0	0.0
Mar	11	7.6	1.1	11	0.0	54.5	45.5	0.0	0.0	0.0
Apr	15	7.3	0.9	15	0.0	6.7	66.7	26.7	0.0	0.0
May	15	7.8	1.0	15	0.0	0.0	73.3	26.7	0.0	0.0
Jun	4	8.3	1.3	4	0.0	25.0	75.0	0.0	0.0	0.0
Jul				No data recorded						
Aug	4	8.8	0.5	4	25.0	50.0	25.0	0.0	0.0	0.0
Sep	4	10.1	0.6	4	0.0	25.0	25.0	50.0	0.0	0.0
Oct				No data recorded						
Nov				No data recorded						
Dec				No data recorded						
Whole Year	71	8.1	0.9	71	1.4	23.9	56.3	16.9	1.4	0.0

Table 11: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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	6	7.6	0.9	6	0	50	0.0	33.3	16.6667	0
Feb	13	6.4	1.0	13	7.7	38.5	38.5	7.7	0.0	0.0
Mar	20	7.7	1.0	20	0.0	40.0	20.0	25.0	15.0	0.0
Apr	5	6.6	0.8	5	0.0	0.0	40.0	60.0	0.0	0.0
May				No data recorded						
Jun	1	4.8	0.4	1	0.0	100.0	0.0	0.0	0.0	0.0
Jul	4	6.4	0.5	4	0.0	25.0	50.0	0.0	25.0	0.0
Aug				No data recorded						
Sep				No data recorded						
Oct	9	5.9	0.6	9	0.0	33.3	33.3	33.3	0.0	0.0
Nov	10	6.0	0.6	10	20.0	20.0	20.0	40.0	0.0	0.0
Dec				No data recorded						
Whole Year	68	6.4	0.7	68	4.4	33.8	26.5	26.5	7.4	0.0

Table 12: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Tallebudgera. 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				No data recorded						
Feb	9	6.8	0.7	9	11.1	44.4	22.2	22.2	0.0	0.0
Mar				Recording ceased						
Apr										
May										
Jun										
Jul										
Aug										
Sep										
Oct										
Nov										
Dec										
Whole Year	9	6.8	0.7	9	11.1	44.4	22.2	22.2	0.0	0.0

6. Data Presentation

The data analysis for Tallebudgera 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

GHD

QUEENSLAND GOVERNMENT

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

Job Number	41-27255
Revision	A
Date	13 Mar 2014

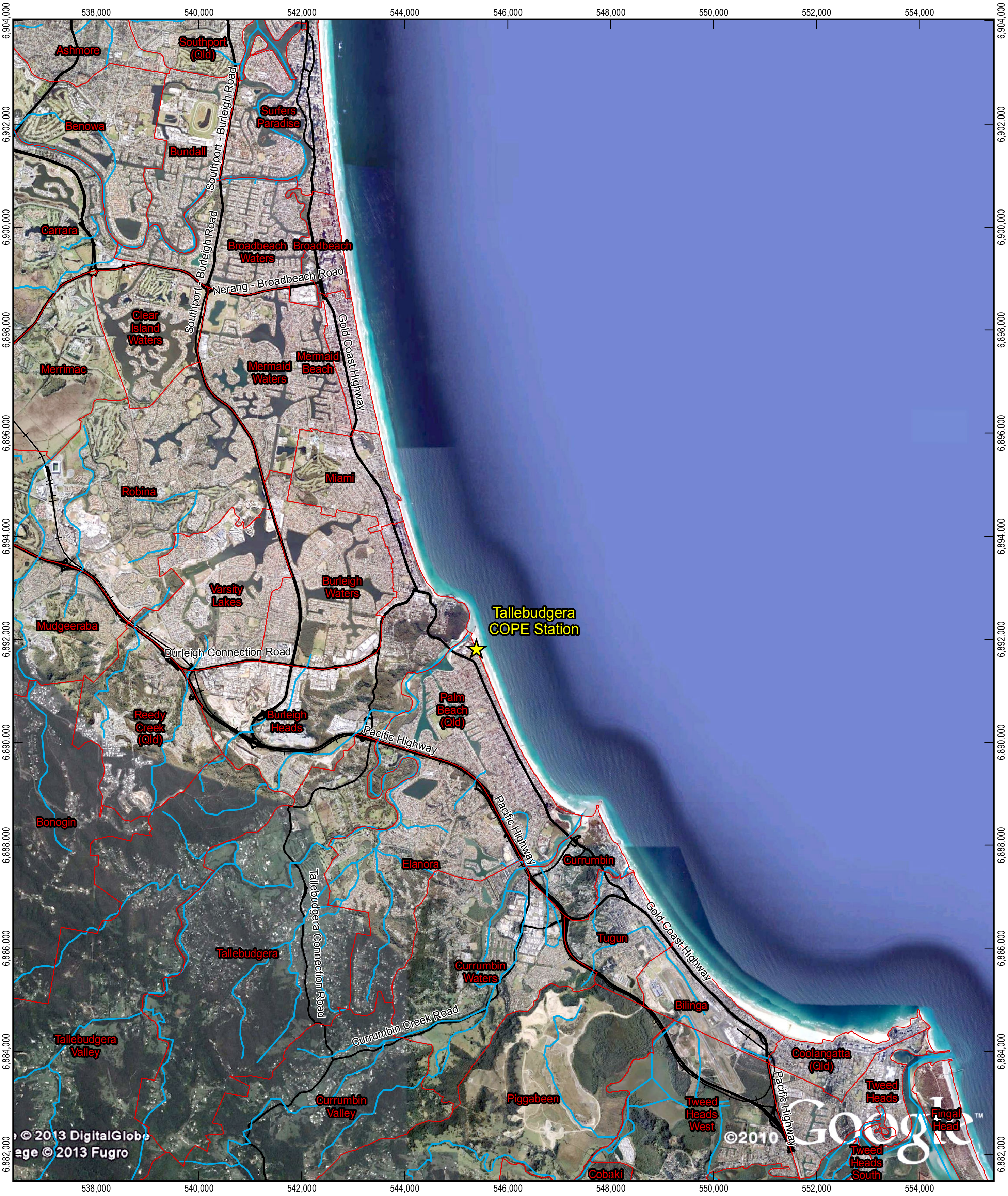
Site Plan

Figure 1a

G:\41\27255\GIS\Maps\MXD\41_27255_008_Tallebudgera_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 - Locality/2011; Google Earth Pro - Imagery (Extracted 12/12/13). Created by: LS



LEGEND

- ☆ COPE Station
- Road
- Rail
- Watercourse
- Locality

Department of Natural Resources and Mines and Department of Transport and Main Roads (DNRM, DTMR) makes no representations or warranties about the accuracy, reliability, completeness, or suitability for any particular purpose of the data. By using the data you agree that DNRM and DTMR is under no liability for any loss or damage (including consequential damage) that you may suffer from use of data. Further, you agree to continually indemnify the State of Queensland, DNRM, DTMR and their officers and employees against any loss, cost, expense, damage and liability of any kind (including consequential damage) arising directly or indirectly from or related to any claim relating to your use of the data or any product made from the data. Department of Natural Resources and Mines, Department of Transport and Main Roads © State of Queensland 2013

The Commonwealth gives no warranty regarding the Data's accuracy, completeness, currency or suitability for any particular purpose. Geoscience Australia © Commonwealth of Australia 2013

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
Tallebudgera COPE Data Compilation

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Locality Plan

Figure 1b

G:\41\27255\GIS\Maps\MXD\41_27255_007_Tallebudgera_LocalityPlan_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: GA - Watercourse/2007; DTMR - State Road/2012; ABS - Loclality/2011; Google Earth Pro - Imagery (Extracted 12/12/13). Created by: LS

Form No. BE 4C

BEACH PROTECTION AUTHORITY OF QUEENSLAND

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 E S W NE SE SW 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.

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

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
Tallebudgera Beach COPE Data Compilation

Job Number	41-27255
Revision	A
Date	16 Jan 2014

Figure 2a

COPE Recording Sheet – Old Format, Page 1

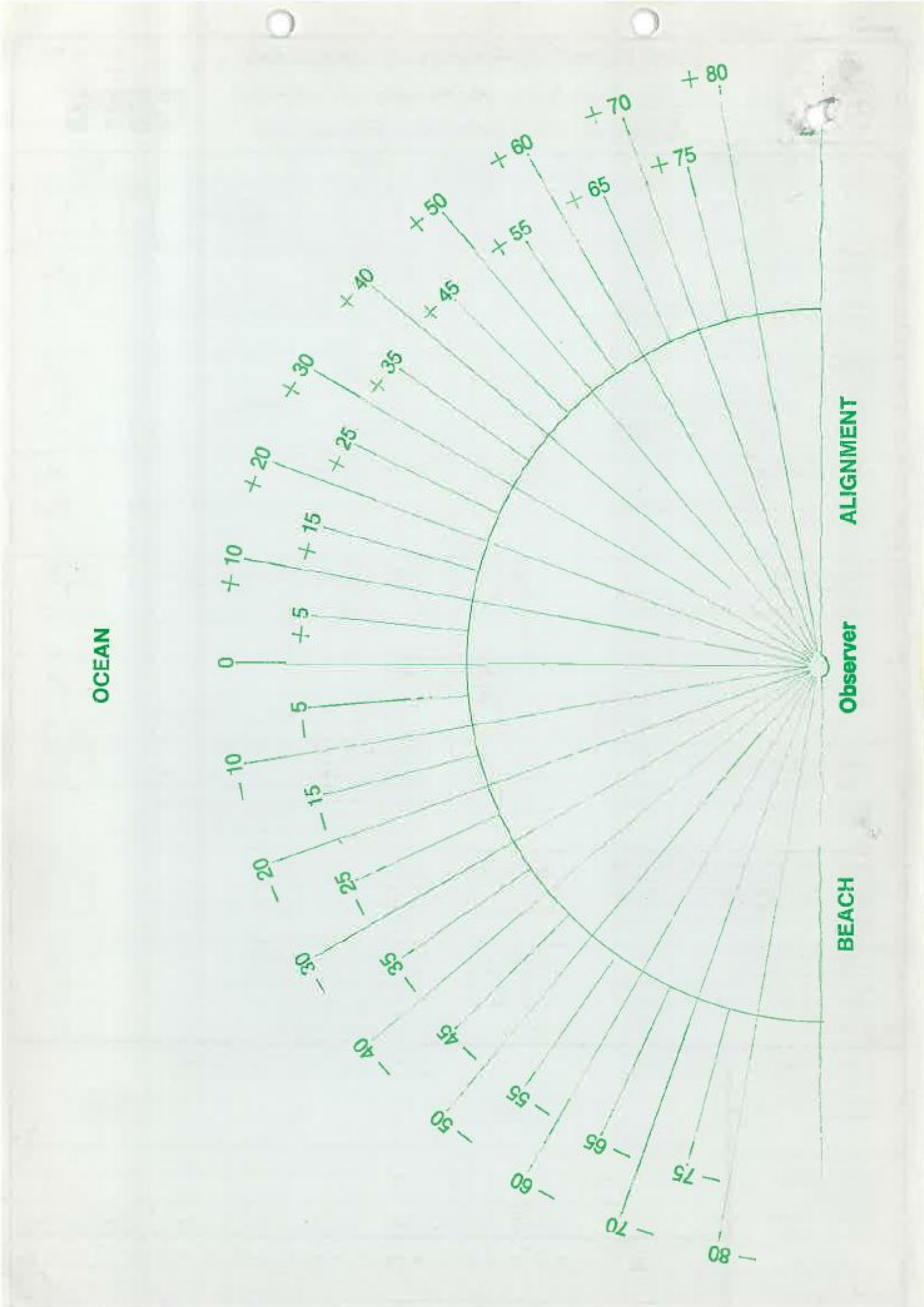

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Figure 2b

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

(i) WAVE HEIGHT (AVERAGE) [16] [17]
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).**

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

WAVE HEIGHT METHOD [20]
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

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

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

SURF ZONE WIDTH [27 28 29]
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.

(ii) CURRENT SPEED [30 31 32]
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.

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

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

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

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

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

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

DISTANCE TO FIXED CONTOUR [44 45 46]
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)

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

SAND LEVEL AT POLE [50] [51]
Record to nearest tenth of a metre.

(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

QUEENSLAND GOVERNMENT

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

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Figure 2c

COPE Recording Sheet – New Format, Page 1

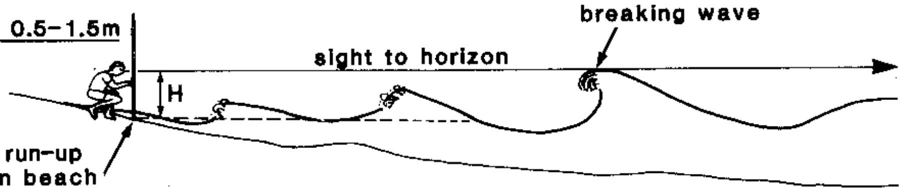
WAVE HEIGHT AND DIRECTION INSTRUCTIONS

METHOD 1 VISUAL ESTIMATION

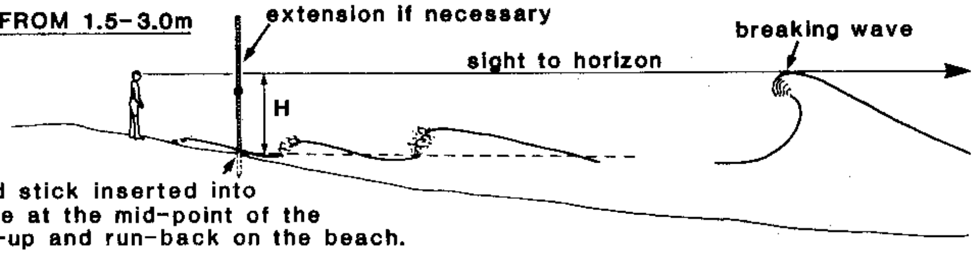
This method should only be used where the waveheights are below 0.5 and it is not practicable to use the preferred Method 2.

METHOD 2

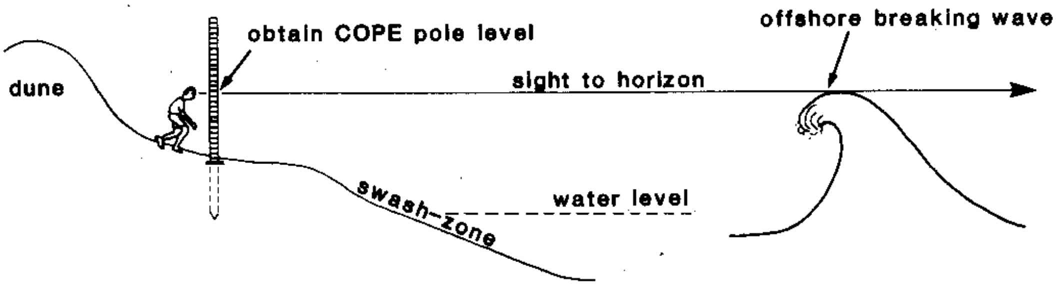
HEIGHTS FROM 0.5–1.5m



HEIGHTS FROM 1.5–3.0m



METHOD 3 FOR WAVES OVER 3m



WAVE DIRECTION MEASUREMENT

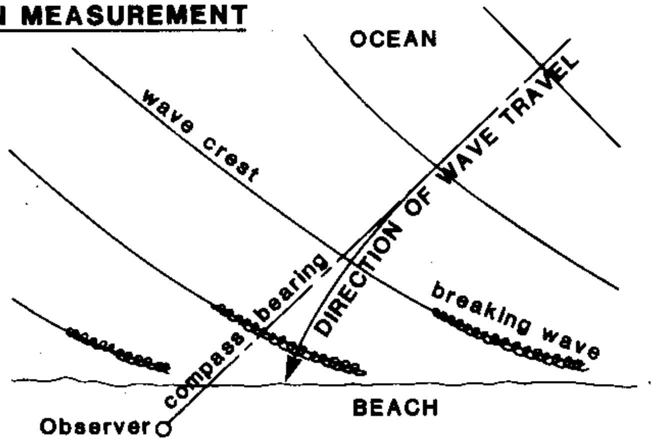


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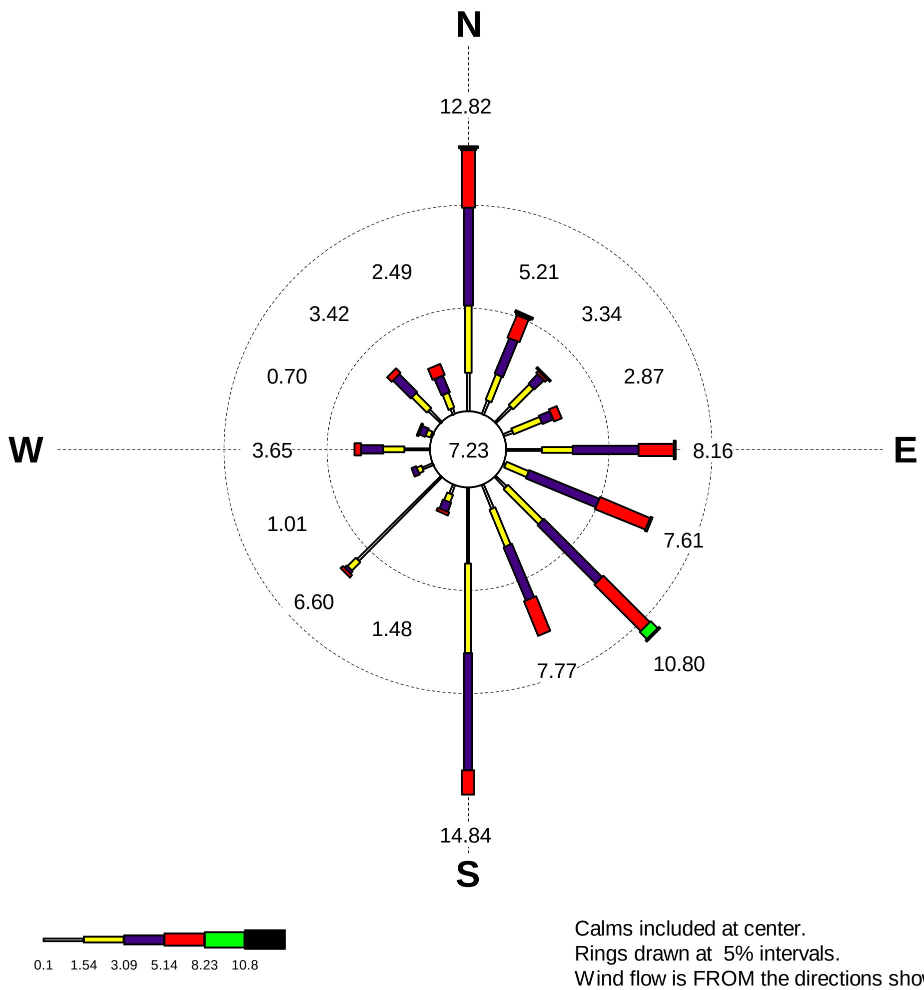
Figure 2d

COPE Recording Sheet – New Format, Page 2

Wind Data - All Observations
Figure 3
Tallebudgera: August 1984 - February 1993



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

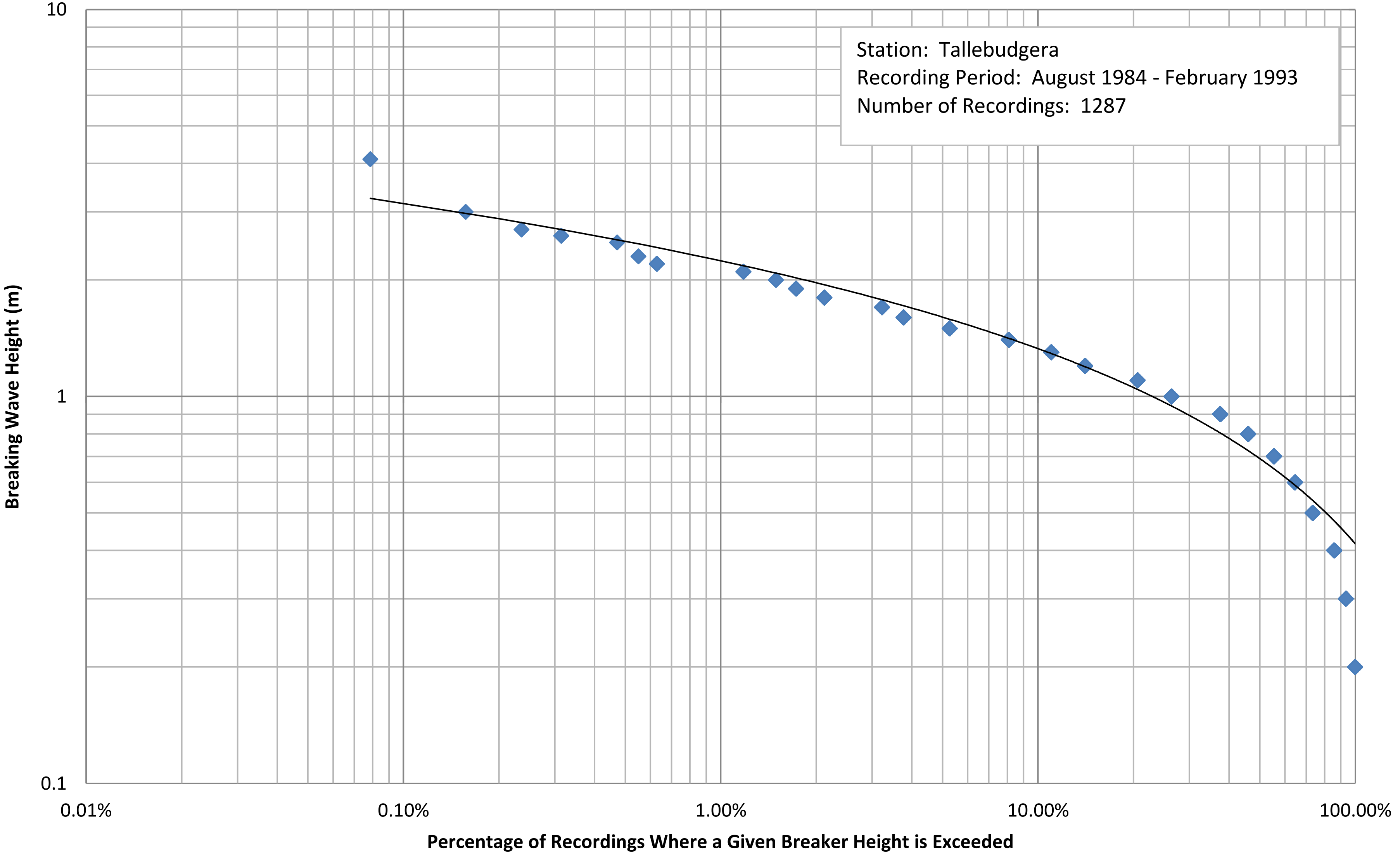
DIR	0.1	1.54	3.09	5.14	8.23	10.8
N	1.86	3.26	4.74	2.80	0.08	0.08
NNE	0.70	1.32	1.86	1.17	0.08	0.08
NE	1.09	1.40	0.62	0.16	0.00	0.08
ENE	0.47	1.48	0.54	0.39	0.00	0.00
E	1.71	1.48	3.19	1.71	0.00	0.08
ESE	0.08	1.17	3.65	2.64	0.08	0.00
SE	0.70	2.41	3.96	3.19	0.47	0.08
SSE	1.24	1.94	2.80	1.79	0.00	0.00

TOTAL OBS = 1287   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	3.65	4.35	5.67	1.17	0.00	0.00
SSW	0.47	0.39	0.47	0.16	0.00	0.00
SW	5.75	0.54	0.16	0.16	0.00	0.00
WSW	0.54	0.23	0.23	0.00	0.00	0.00
W	1.24	1.01	1.09	0.31	0.00	0.00
WNW	0.08	0.23	0.31	0.08	0.00	0.00
NW	0.85	1.01	1.24	0.31	0.00	0.00
NNW	0.31	0.78	0.85	0.54	0.00	0.00

CALM OBS =   93   PERCENT CALM = 7.23



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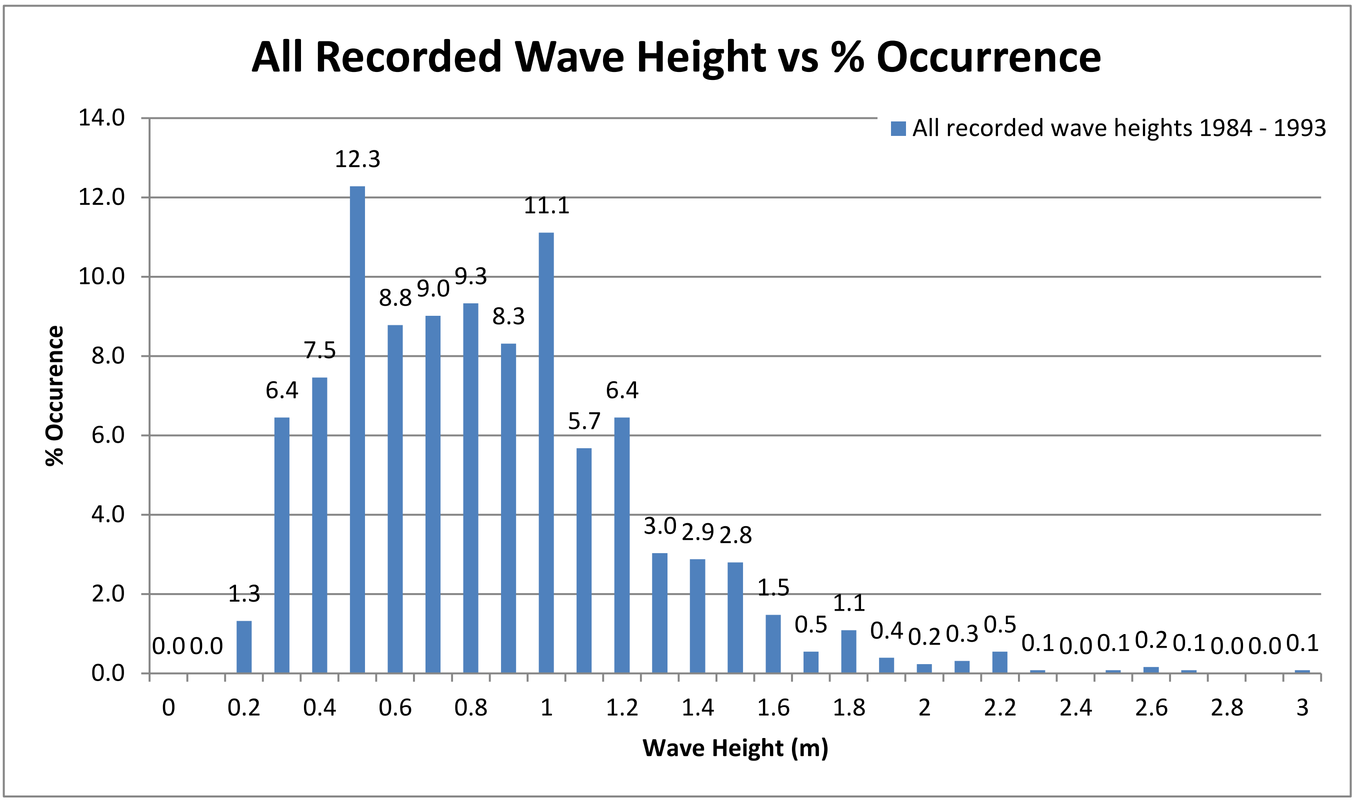
Wave Height Percentage Exceedance

Figure 4



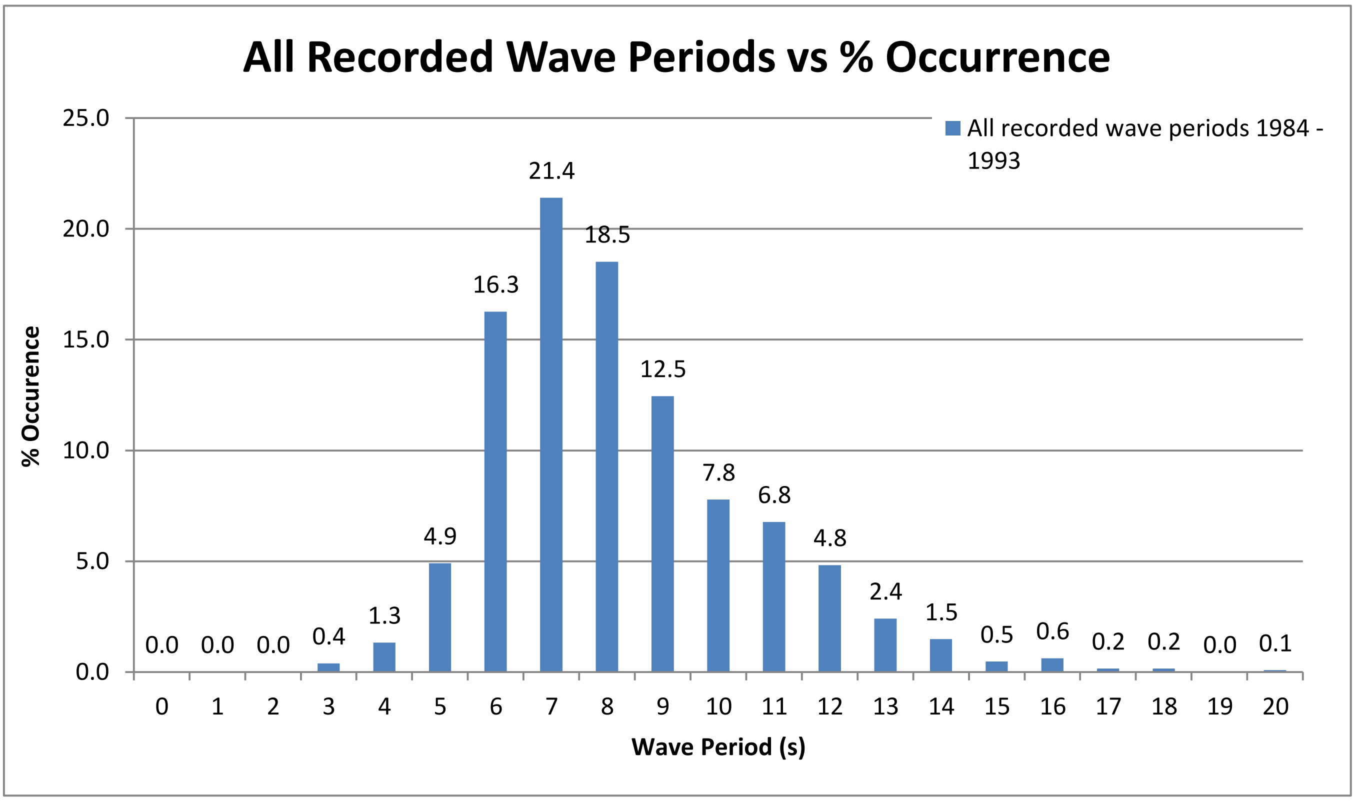


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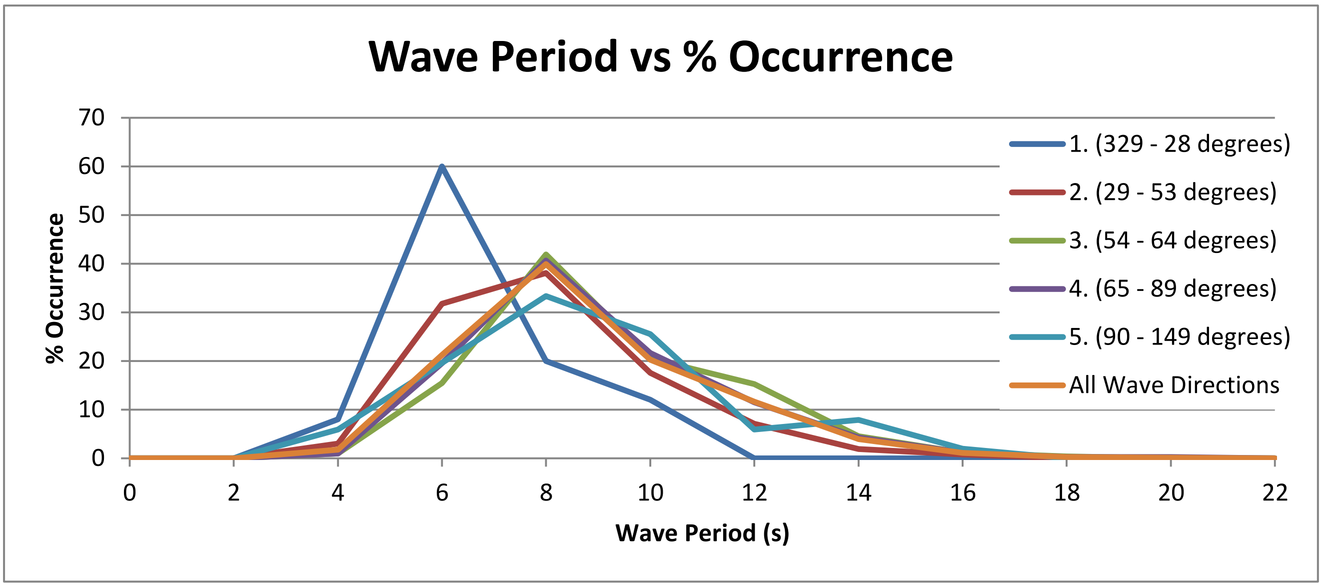
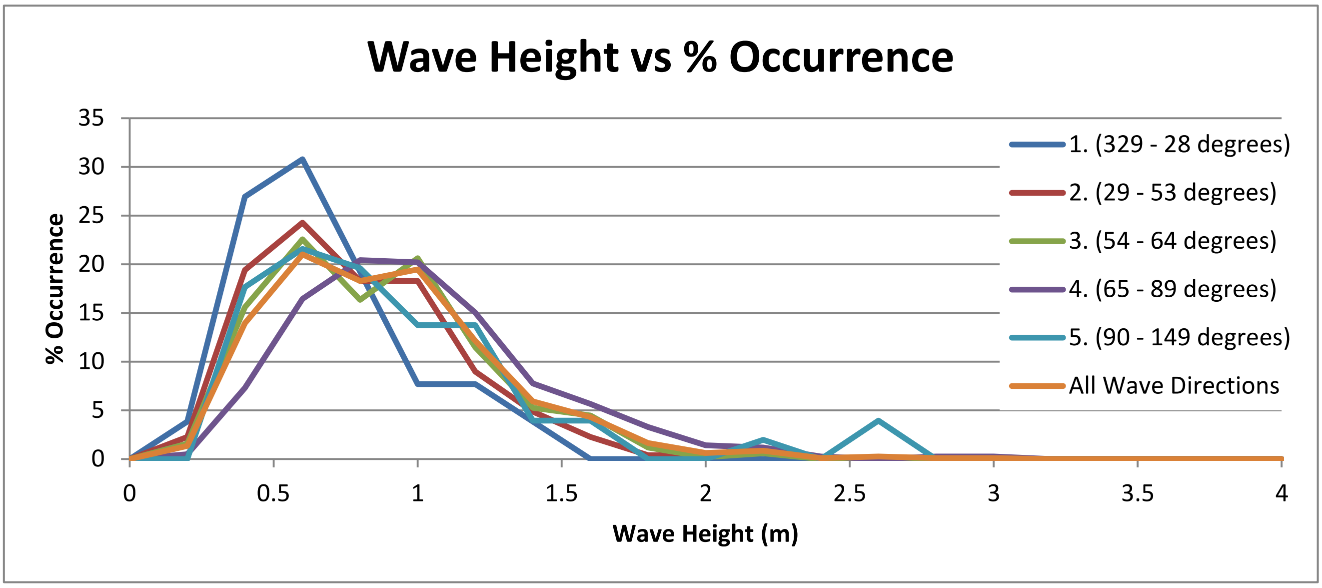
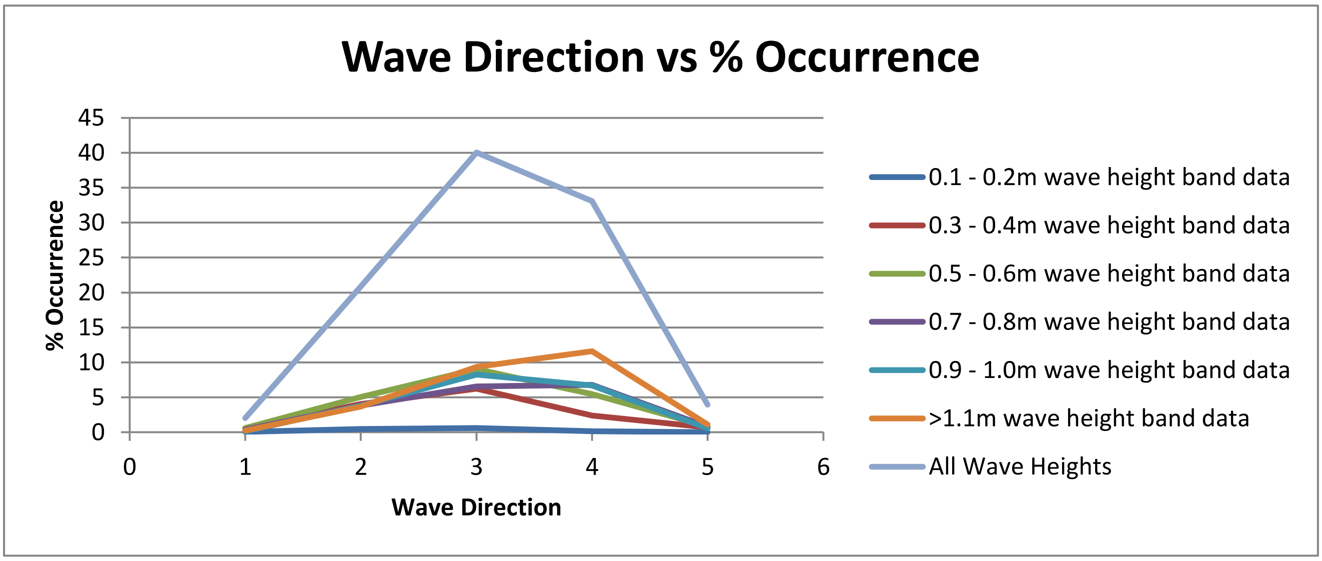
Figure 5

Percentage Occurrence of Wave Height and Wave Period







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Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Revision	A
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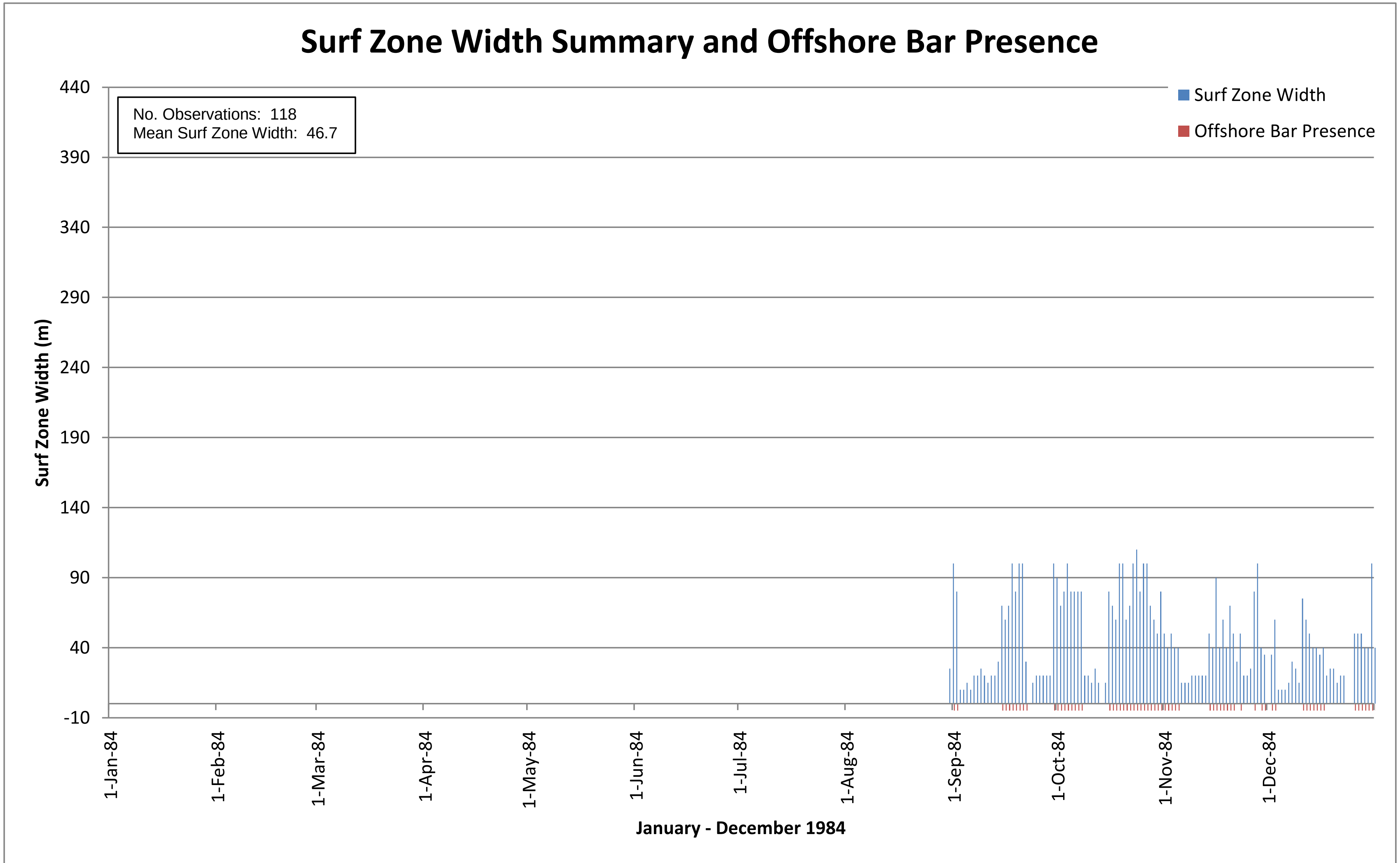
Figure 6

Wave Direction Analysis



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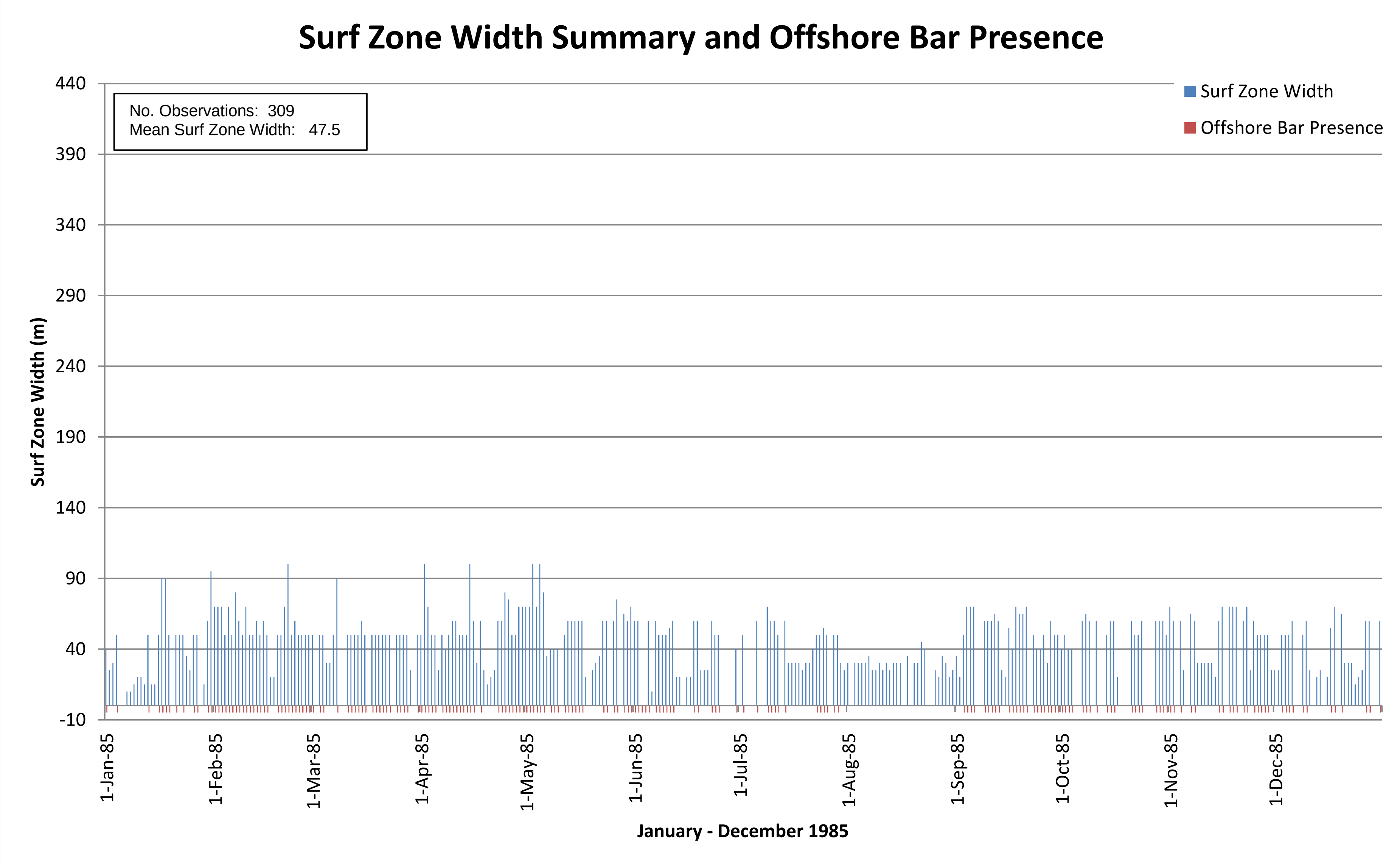
Surf Zone Width - 1984

Figure 7



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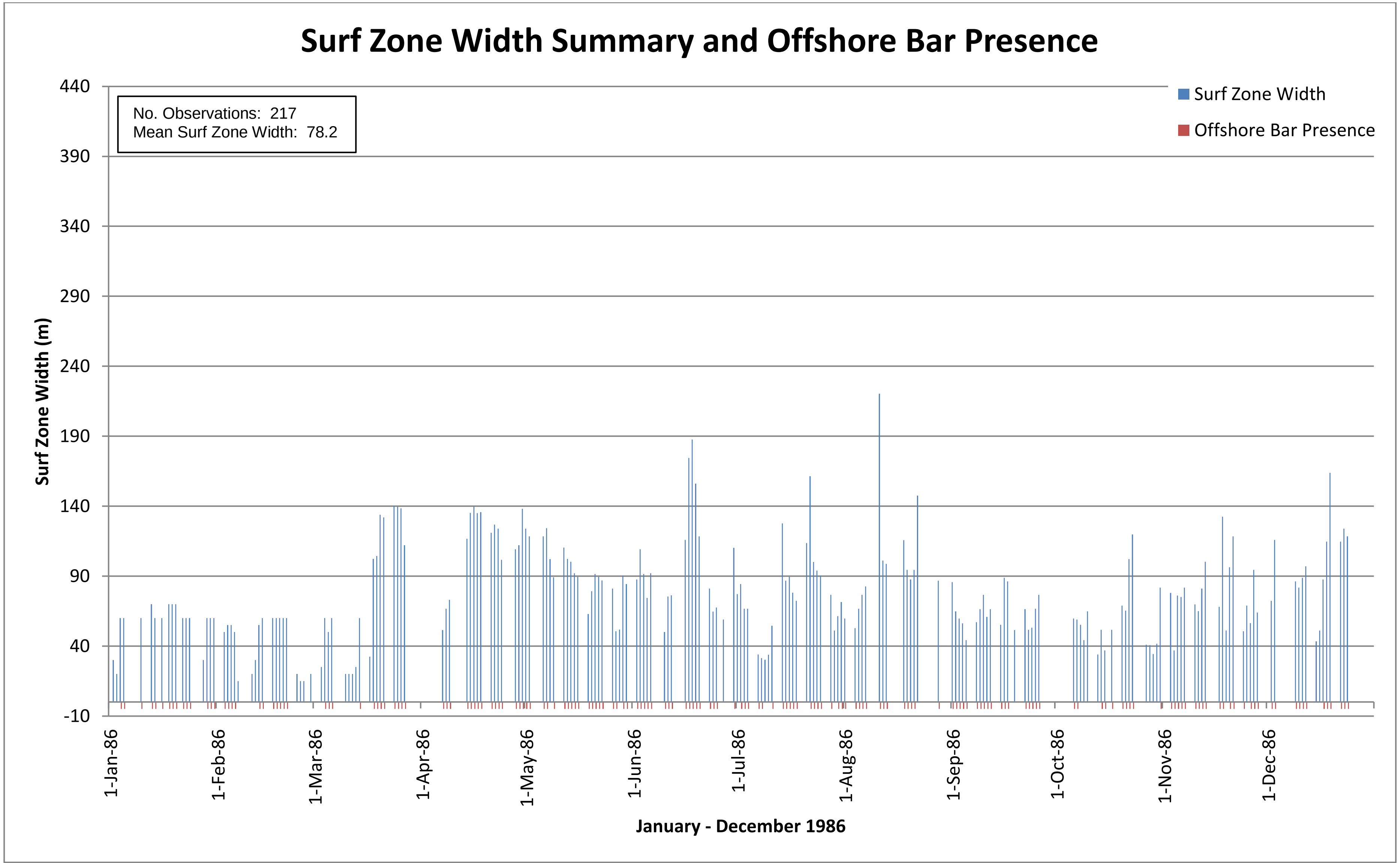
Surf Zone Width - 1985

Figure 8



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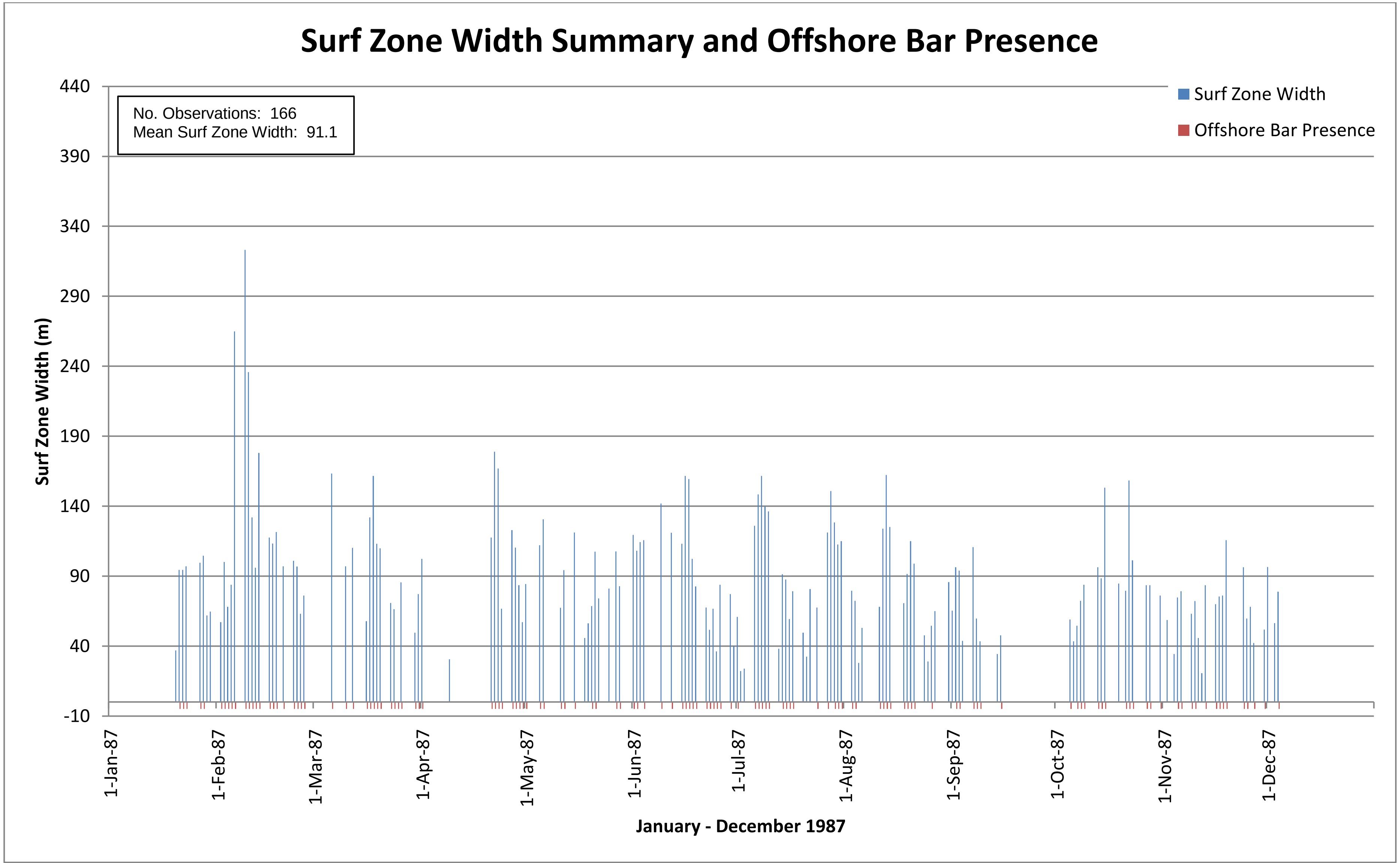
Surf Zone Width - 1986

Figure 9



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Surf Zone Width - 1987

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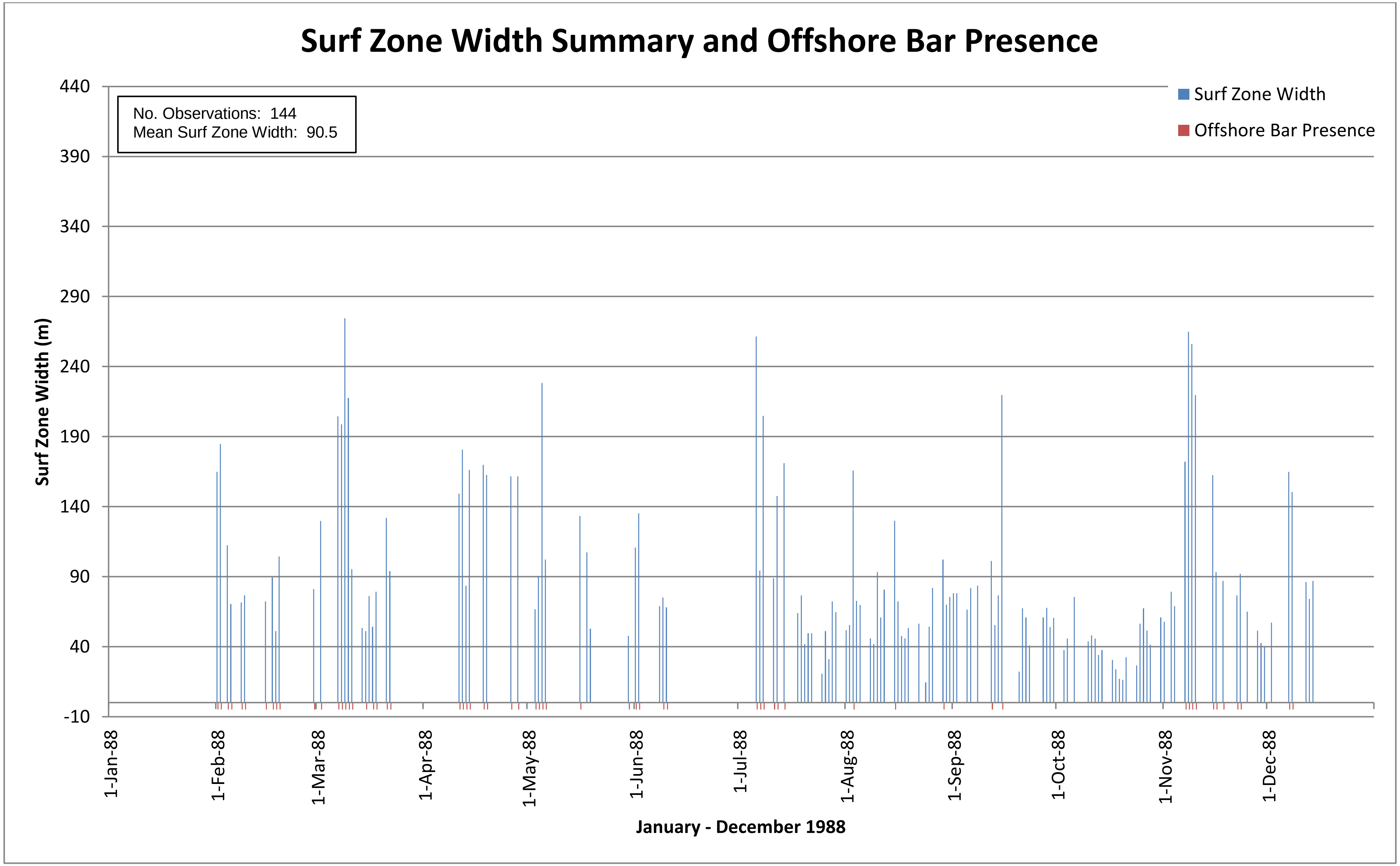
Figure 10



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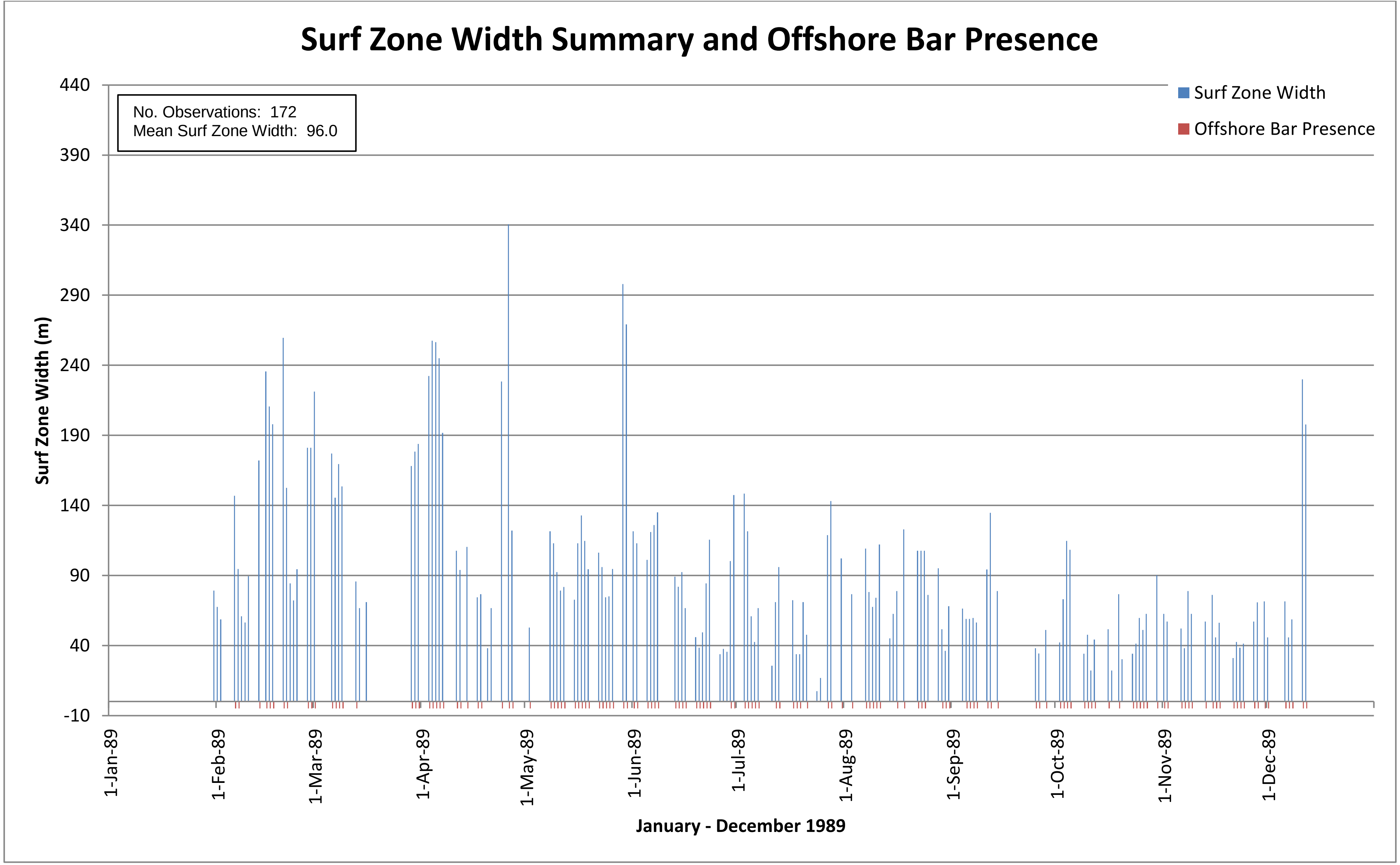
Surf Zone Width - 1988

Figure 11



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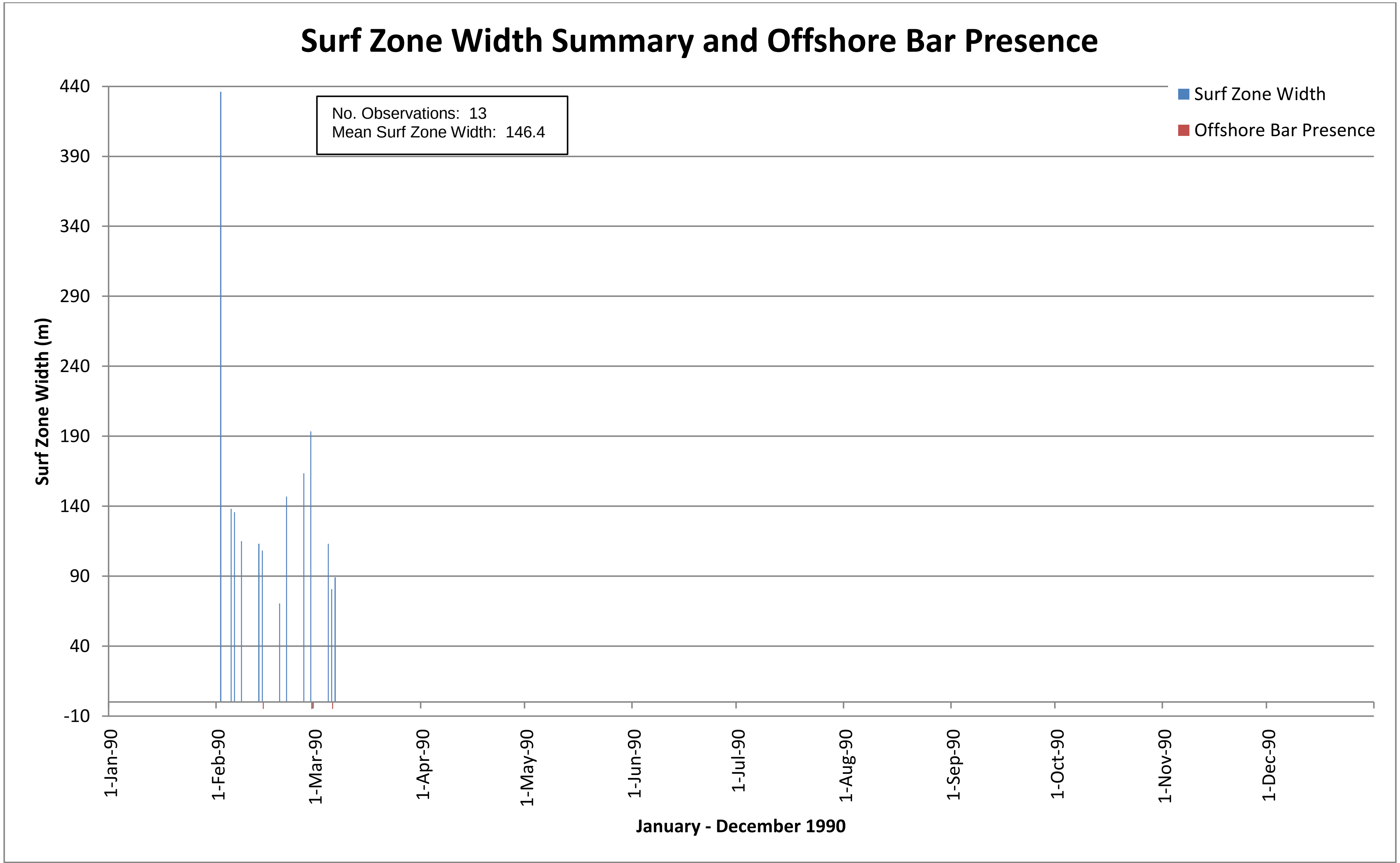
Surf Zone Width - 1989

Figure 12



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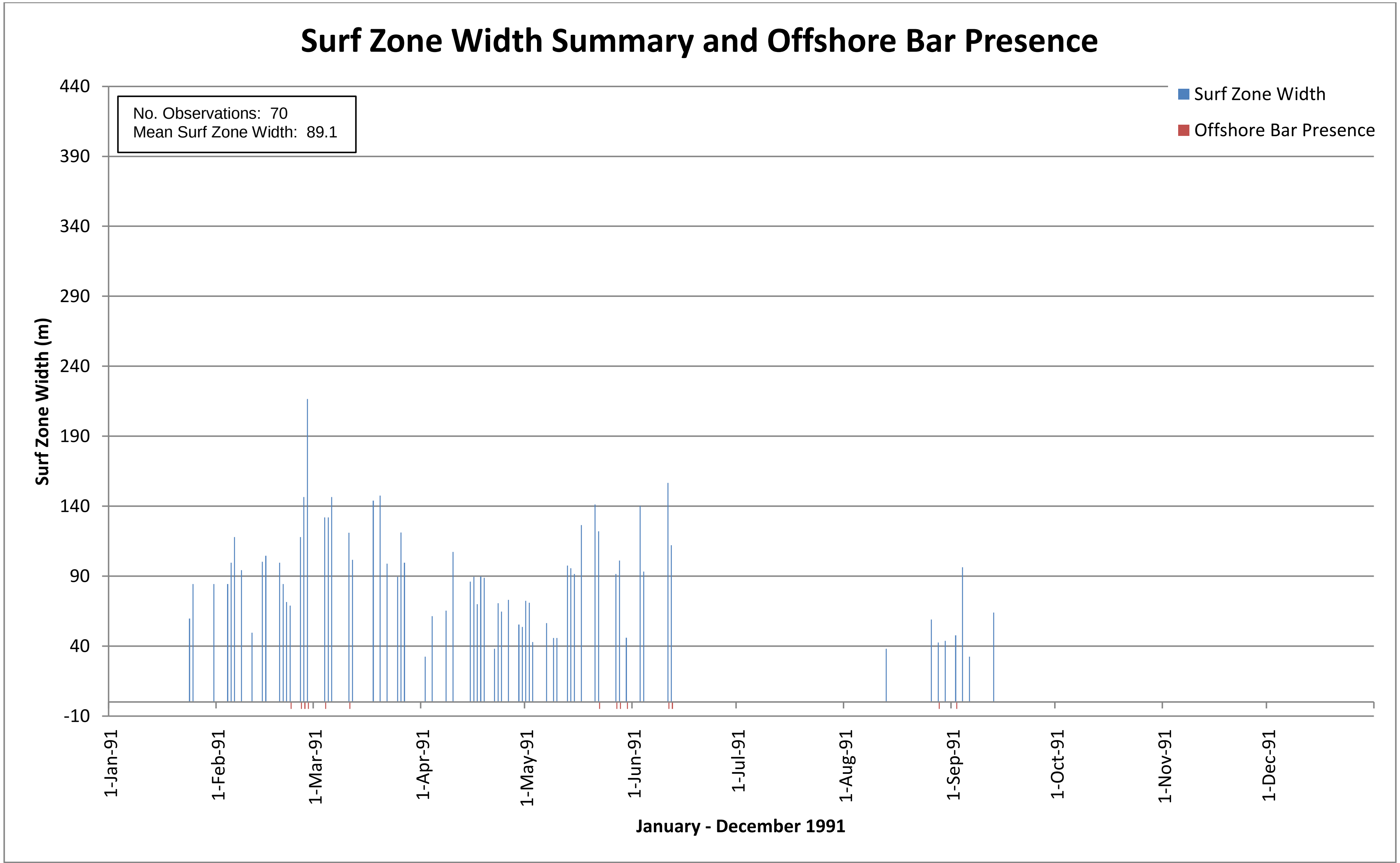
Surf Zone Width - 1990

Figure 13



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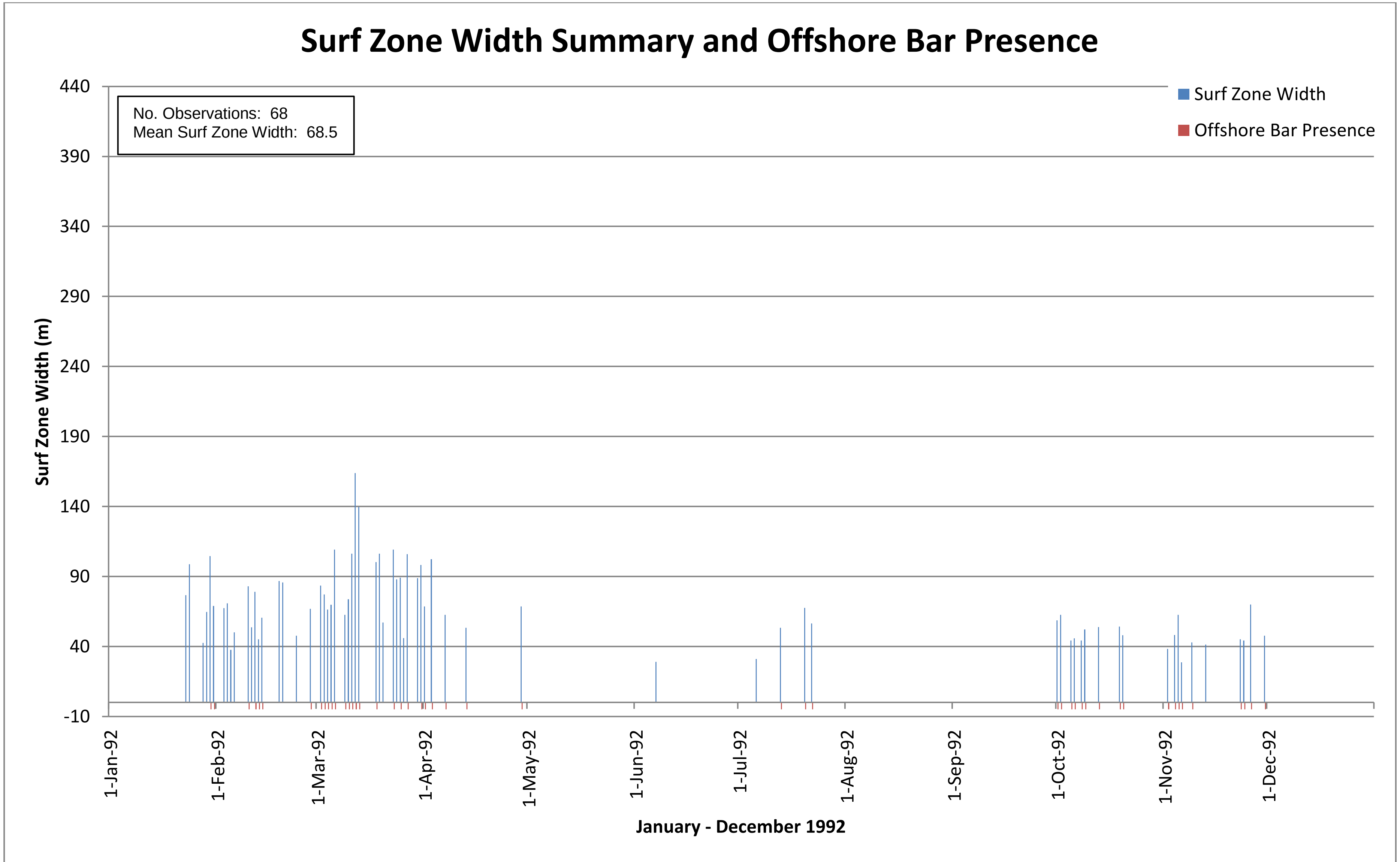
Surf Zone Width - 1991

Figure 14



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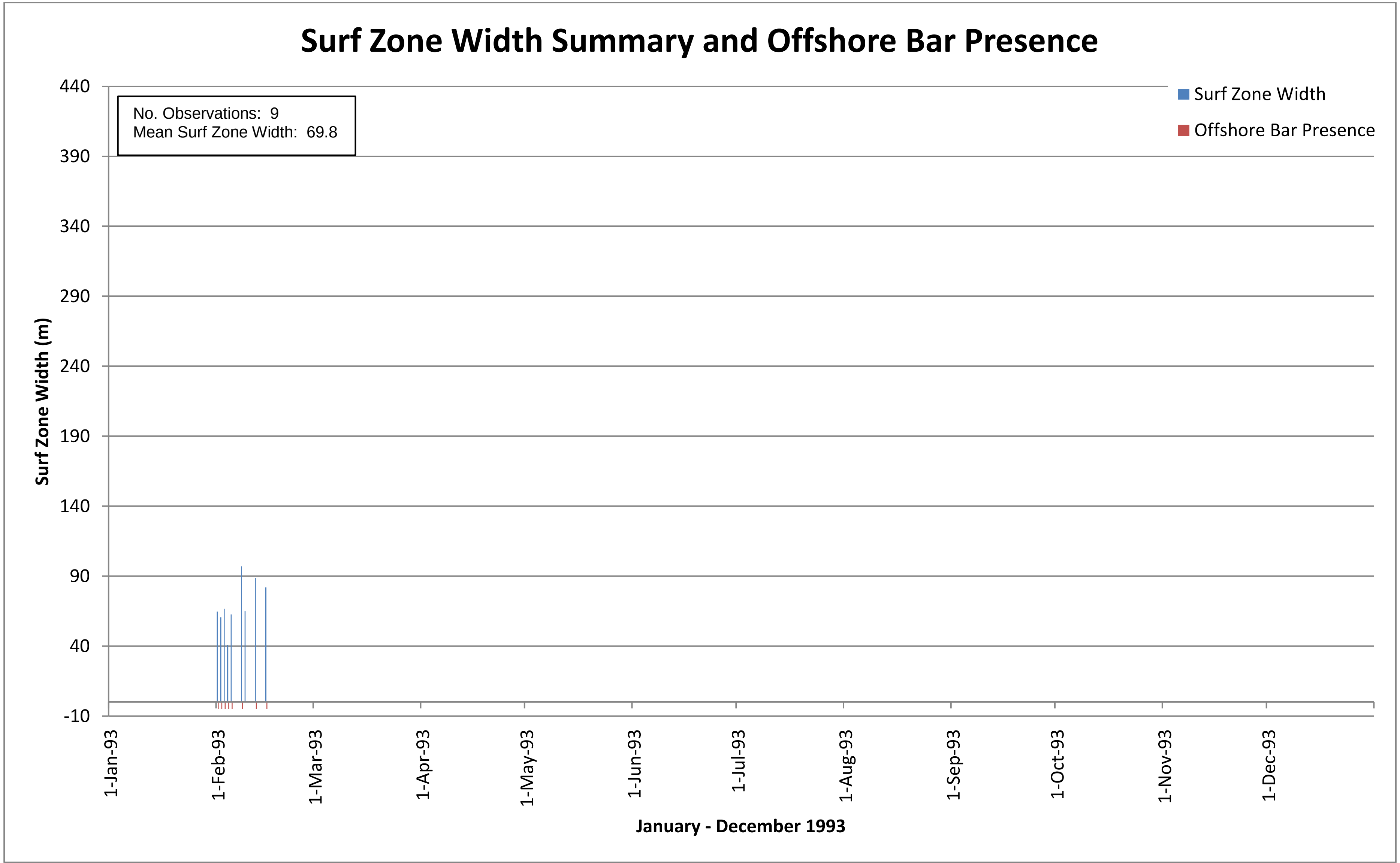
Surf Zone Width - 1992

Figure 15



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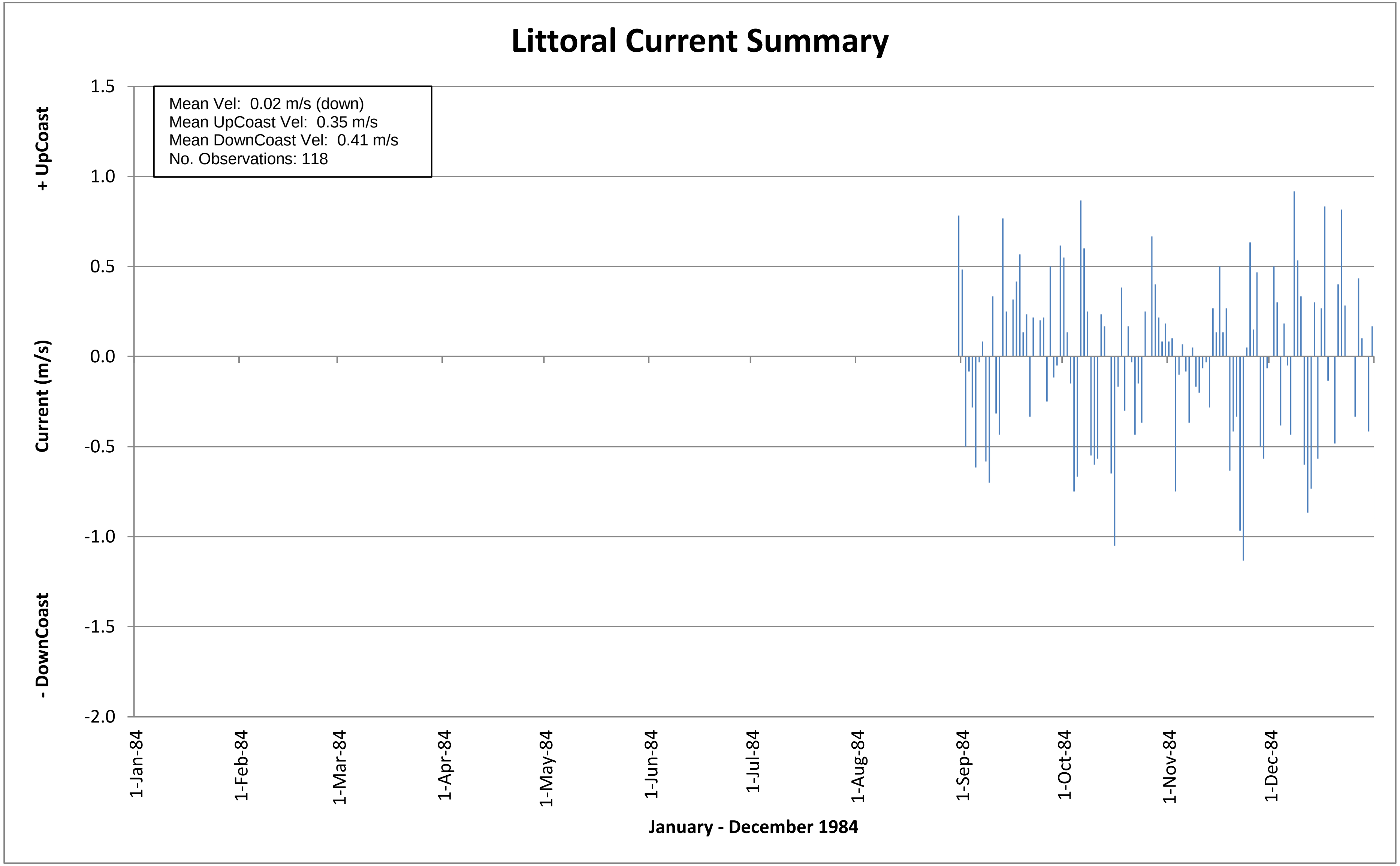
Surf Zone Width - 1993

Figure 16



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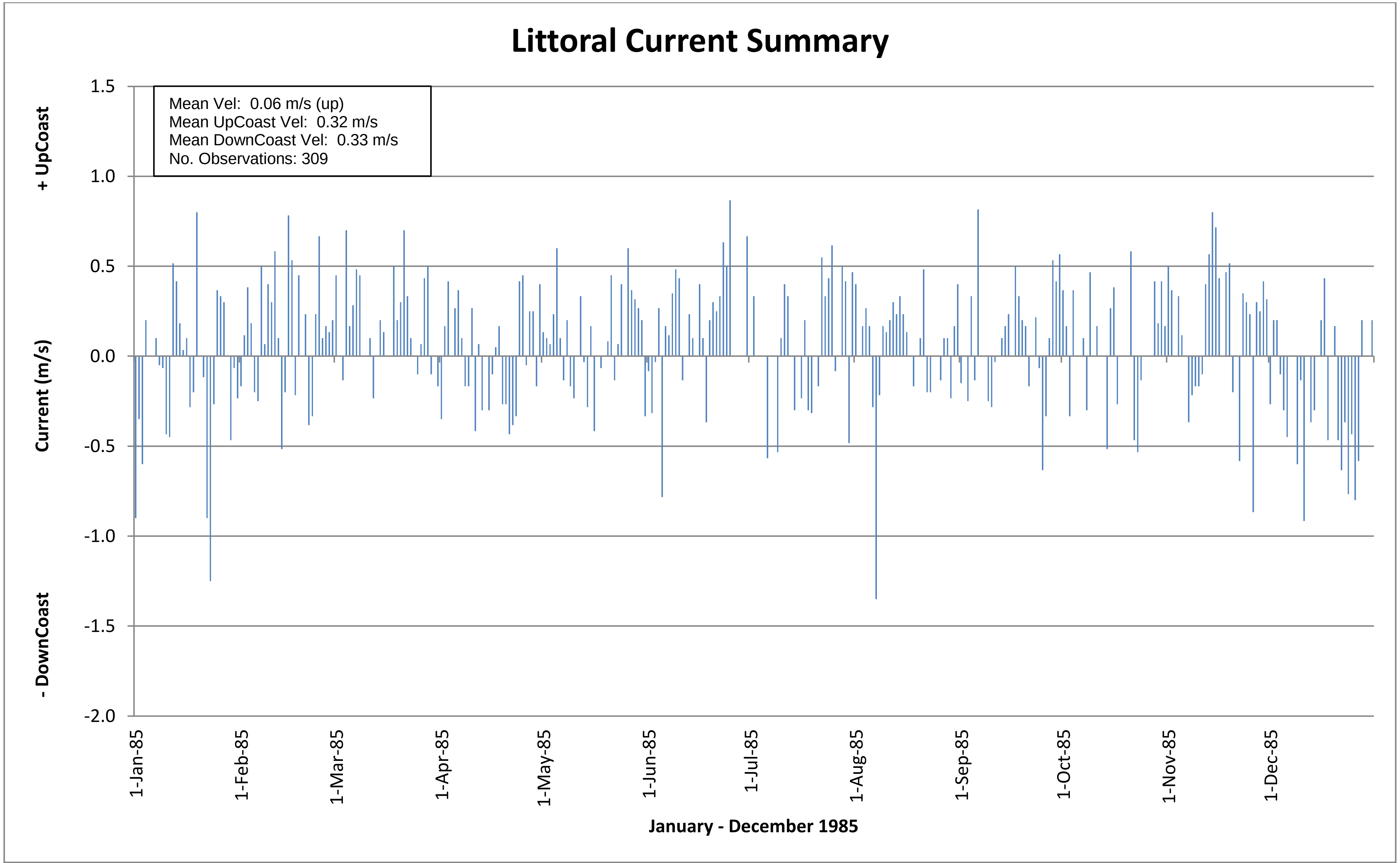
Littoral Current Summary – 1984

Figure 17



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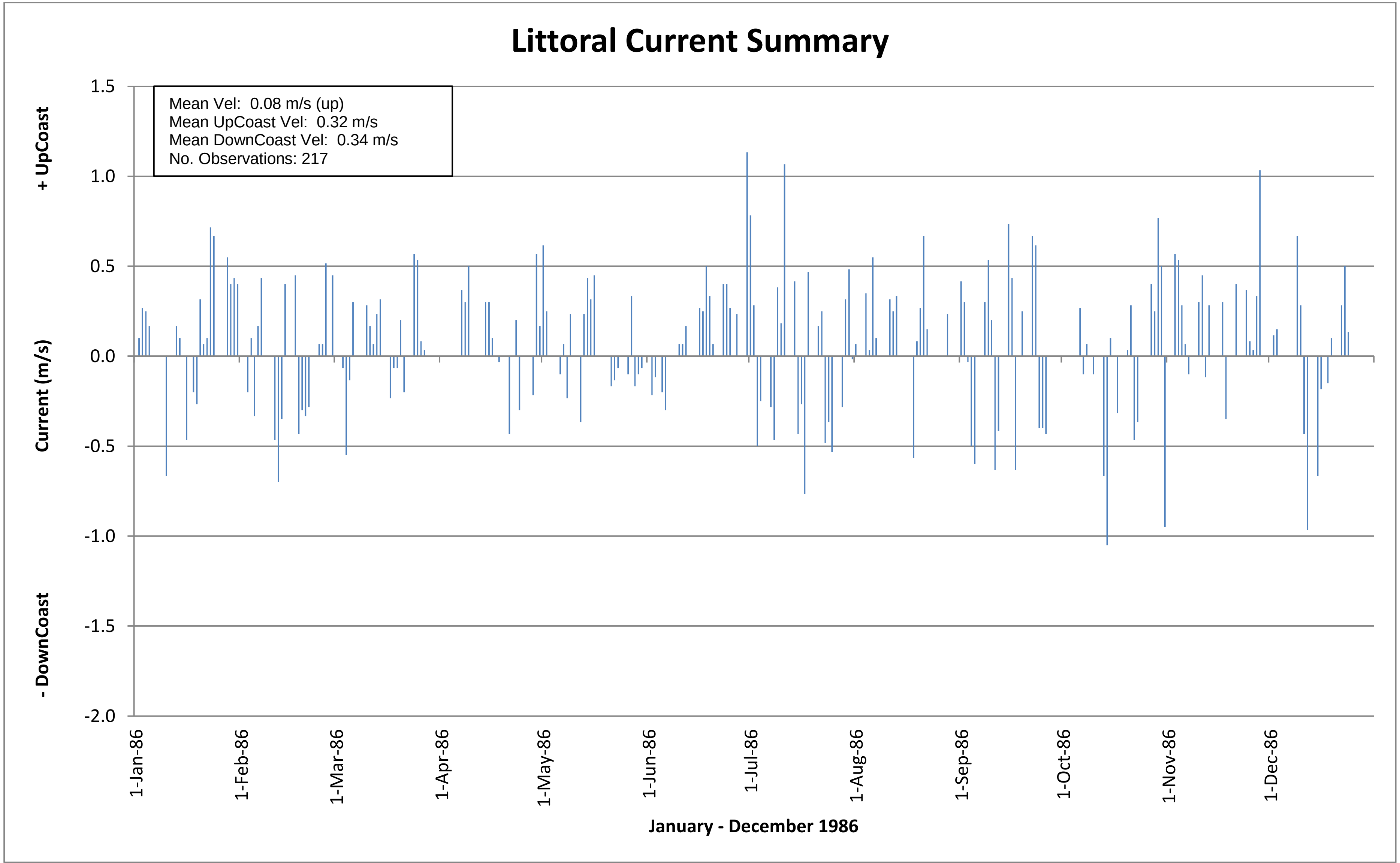
Littoral Current Summary – 1985

Figure 18



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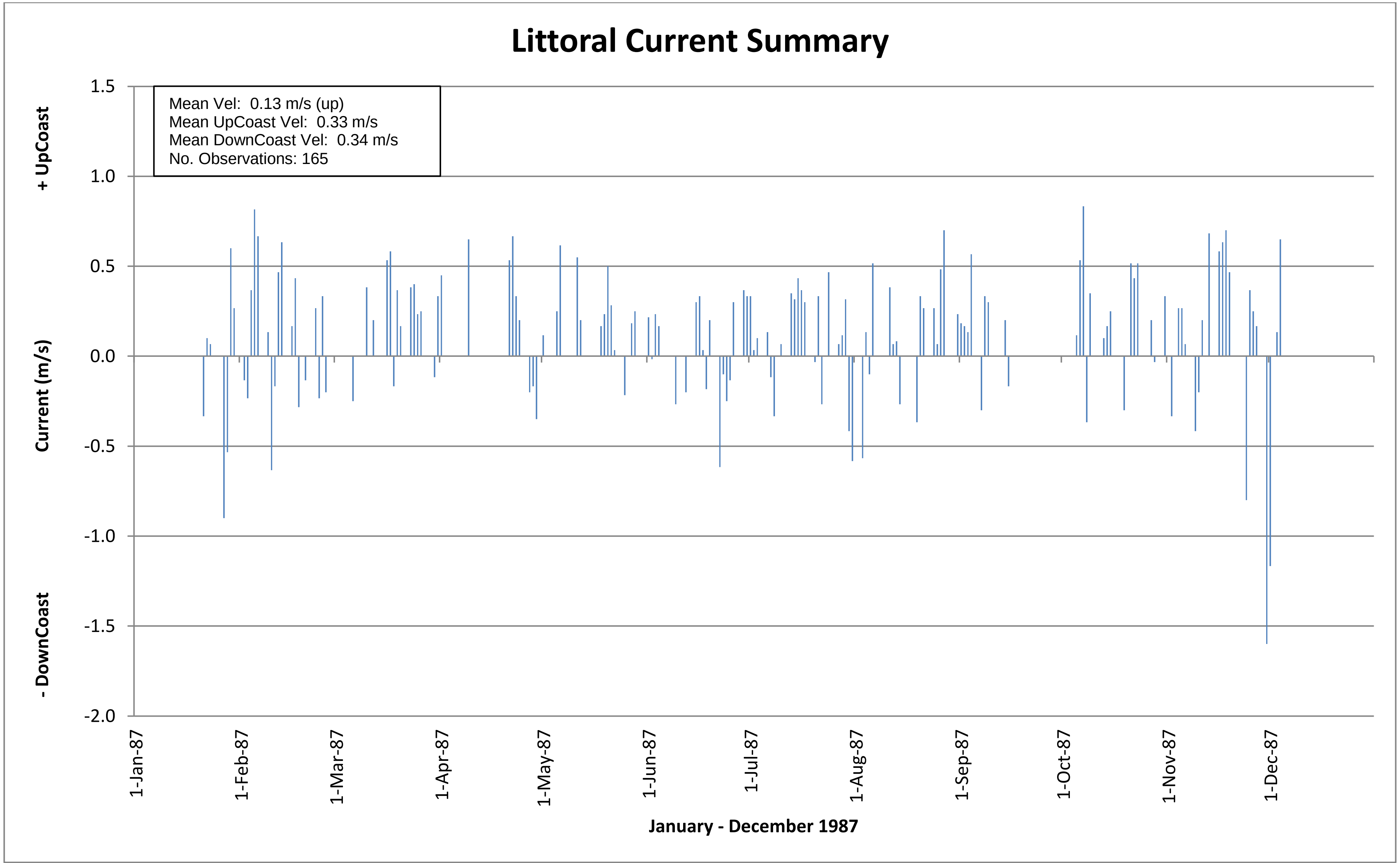
Littoral Current Summary – 1986

Figure 19



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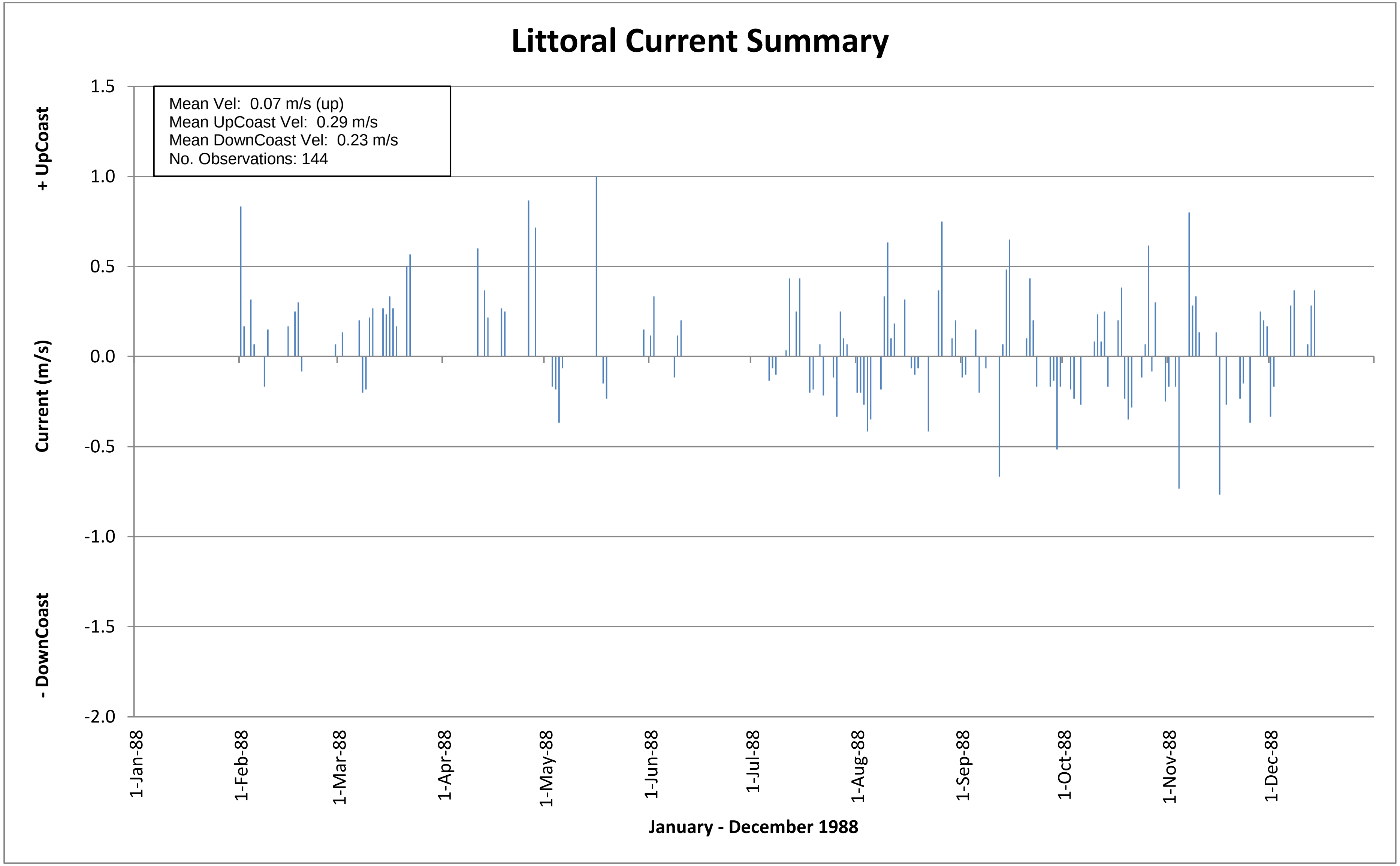
Littoral Current Summary – 1987

Figure 20



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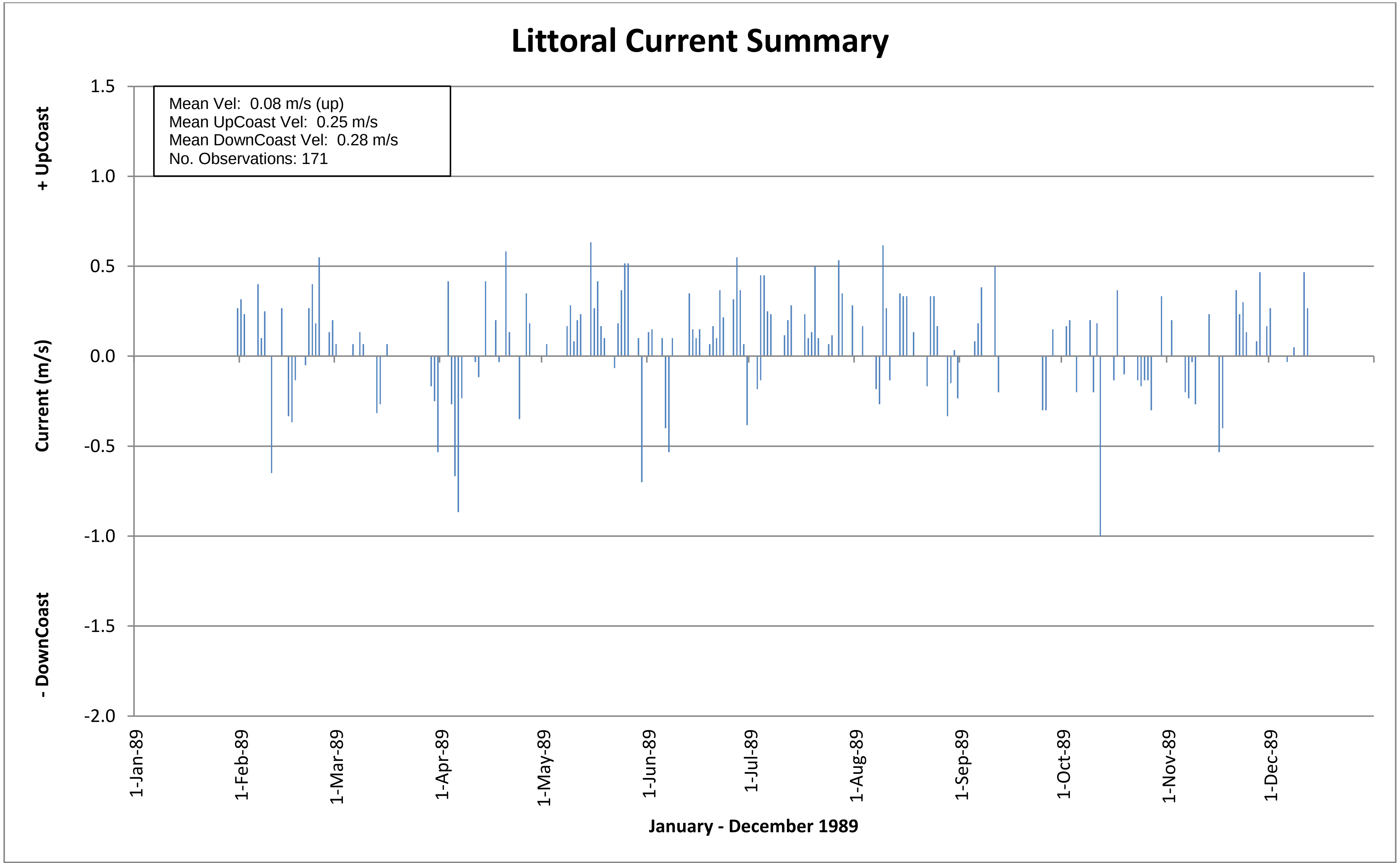
Littoral Current Summary – 1988

Figure 21



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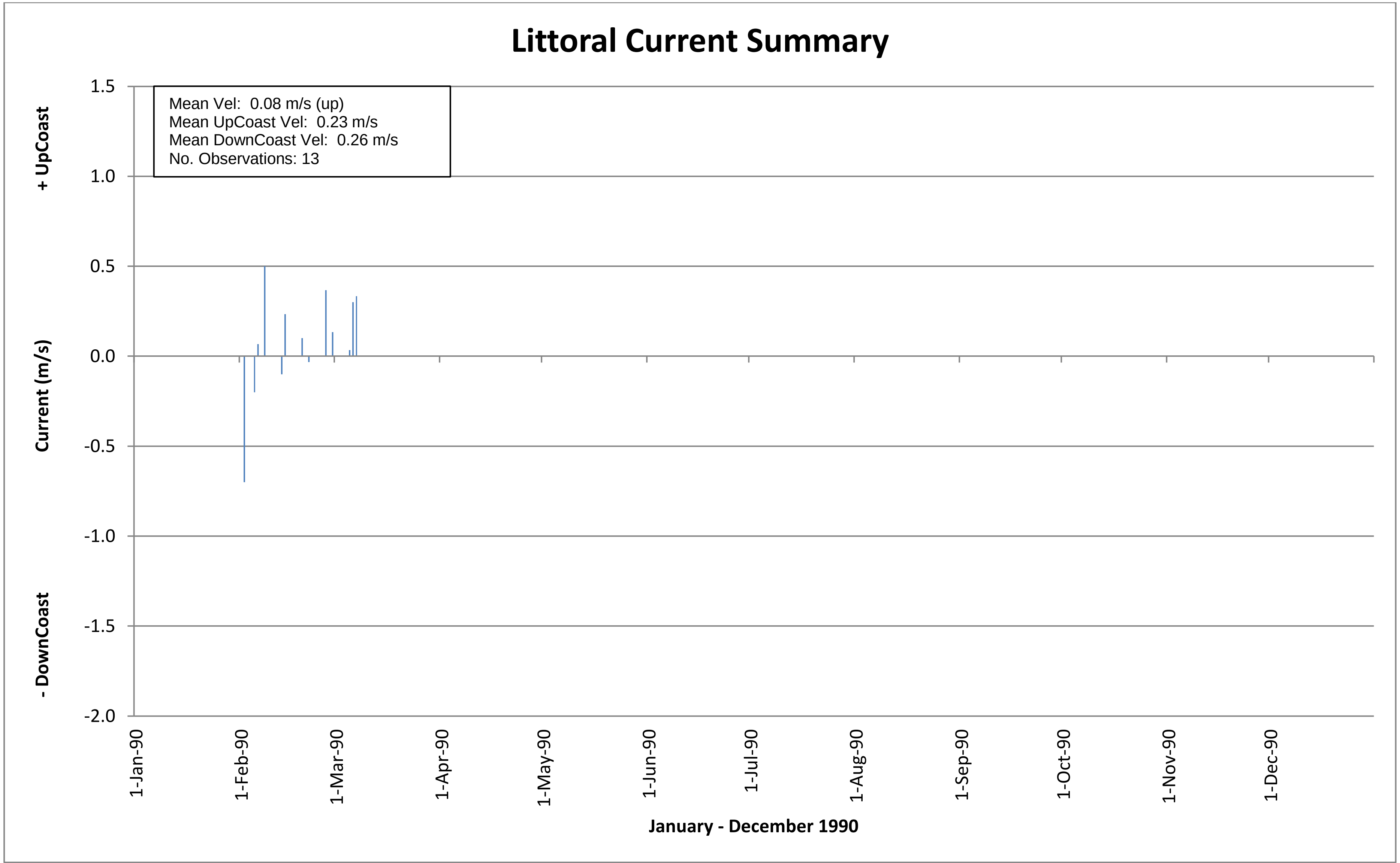
Littoral Current Summary – 1989

Figure 22



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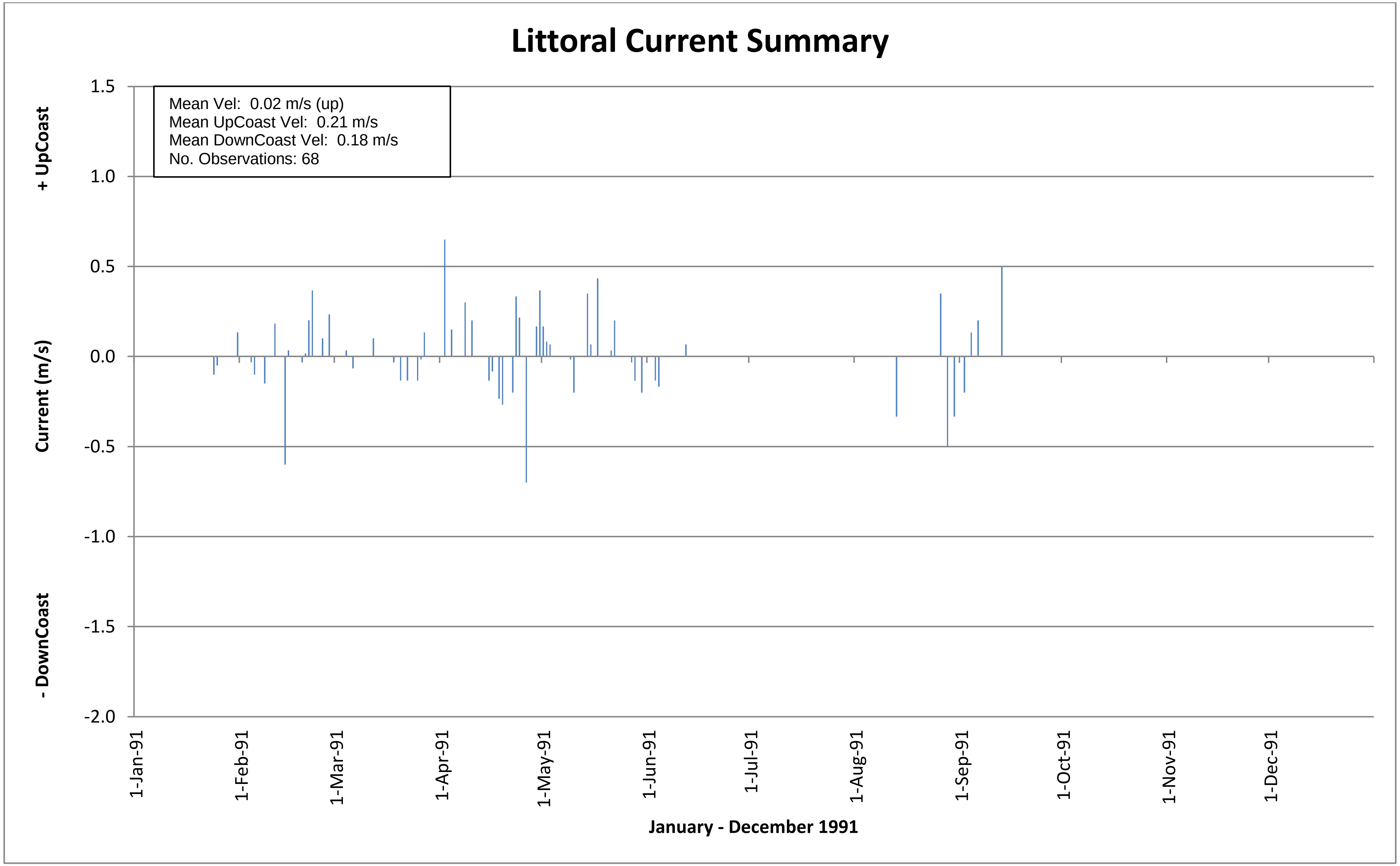
Littoral Current Summary – 1990

Figure 23



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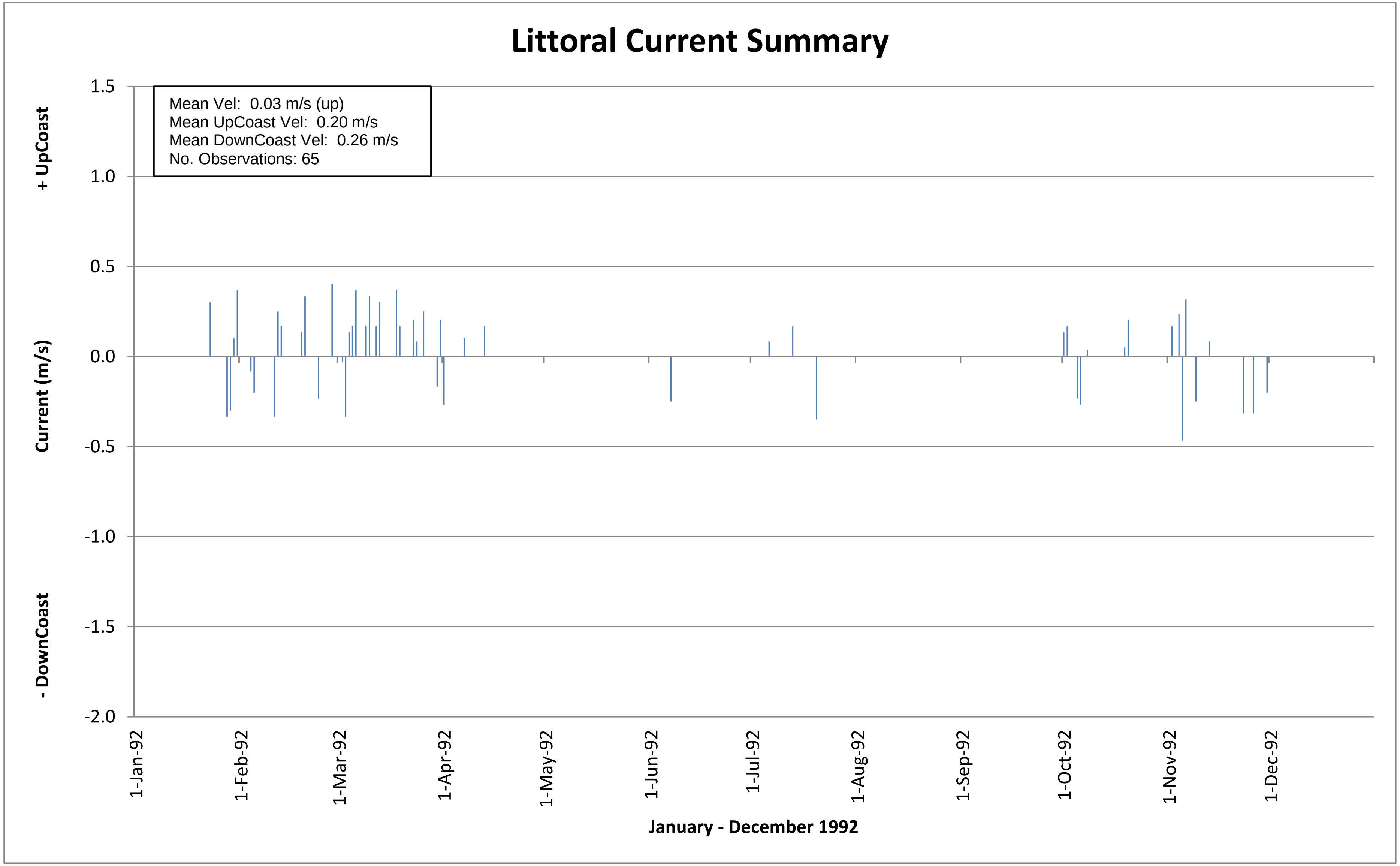
Littoral Current Summary – 1991

Figure 24



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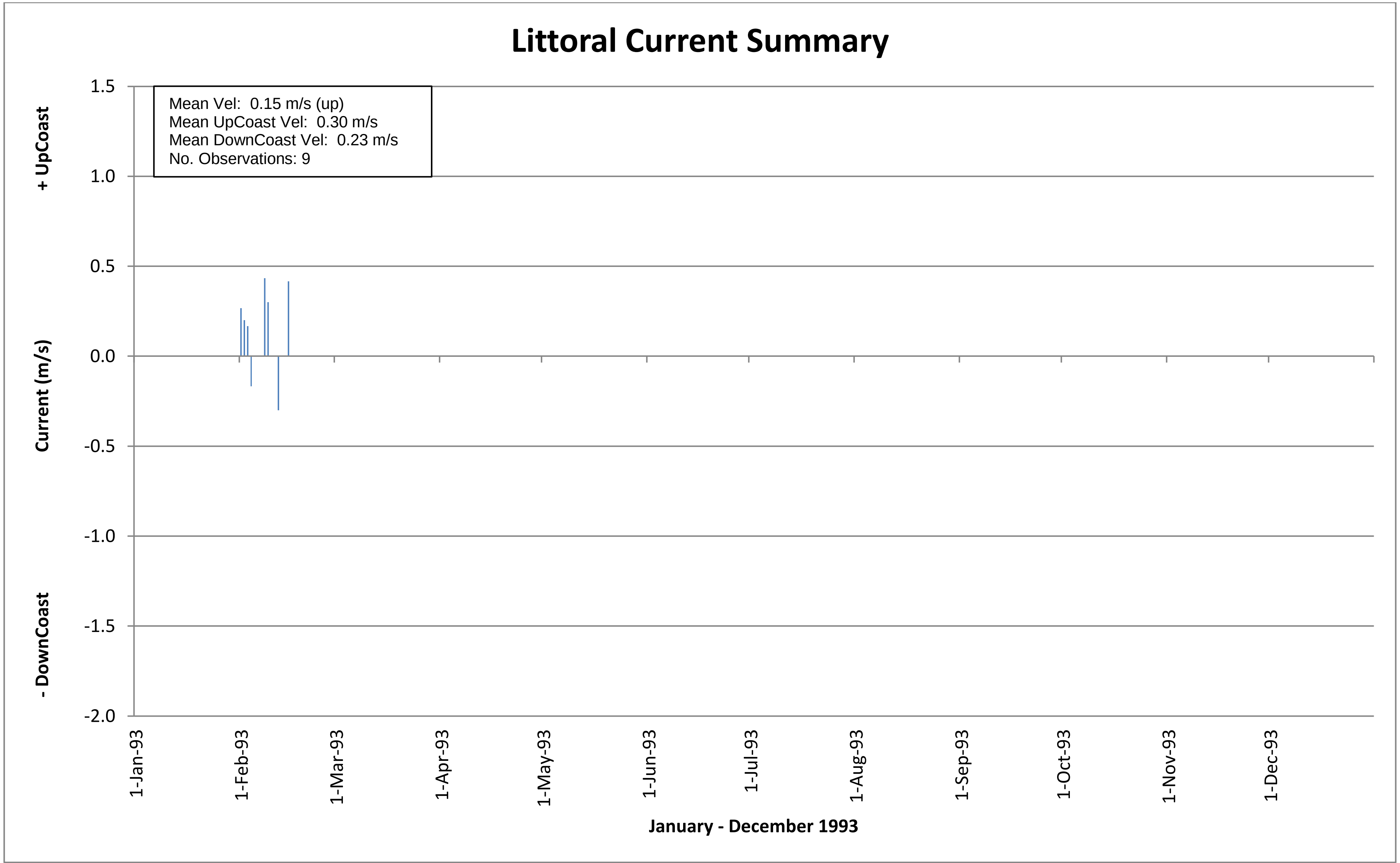
Littoral Current Summary – 1992

Figure 25



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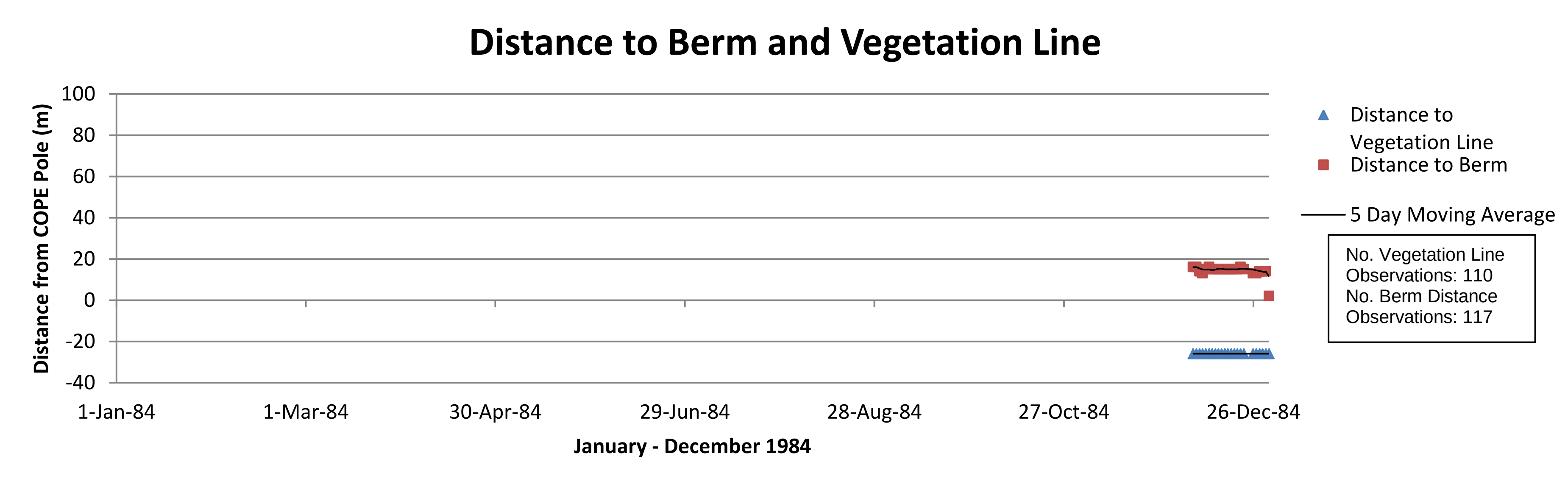
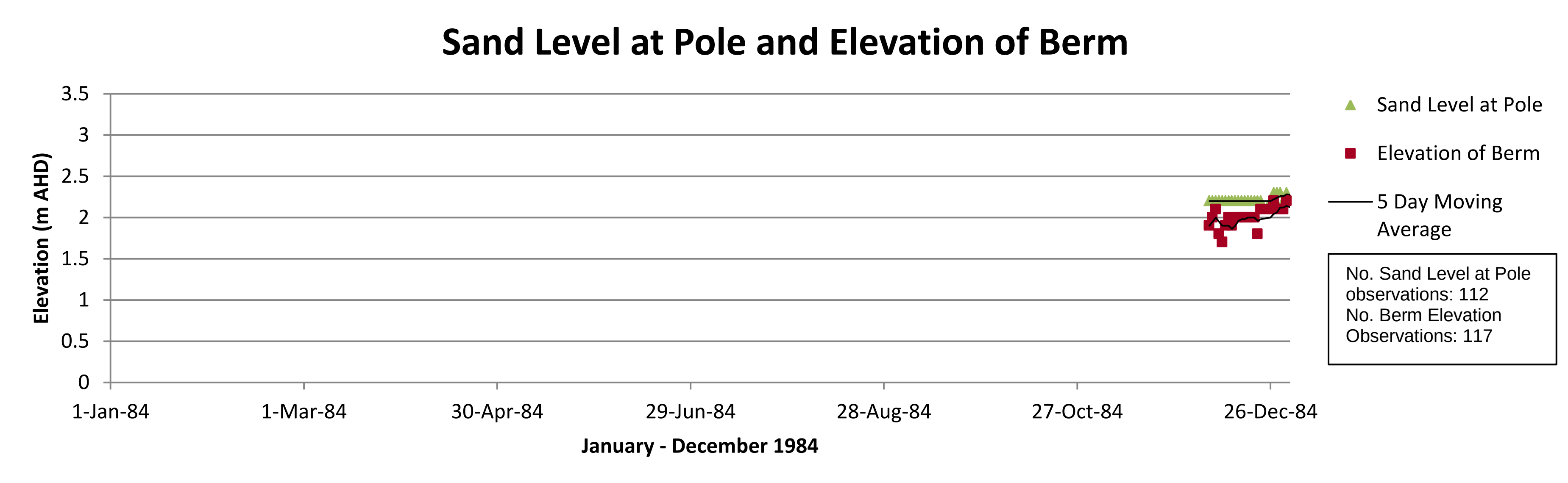
Littoral Current Summary – 1993

Figure 26





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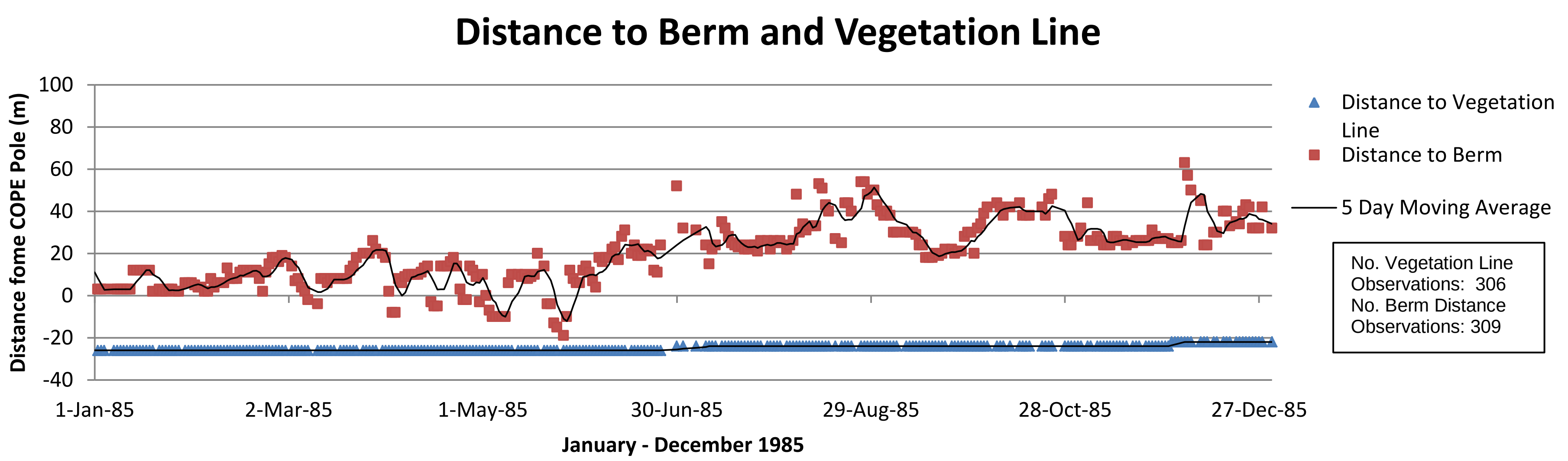
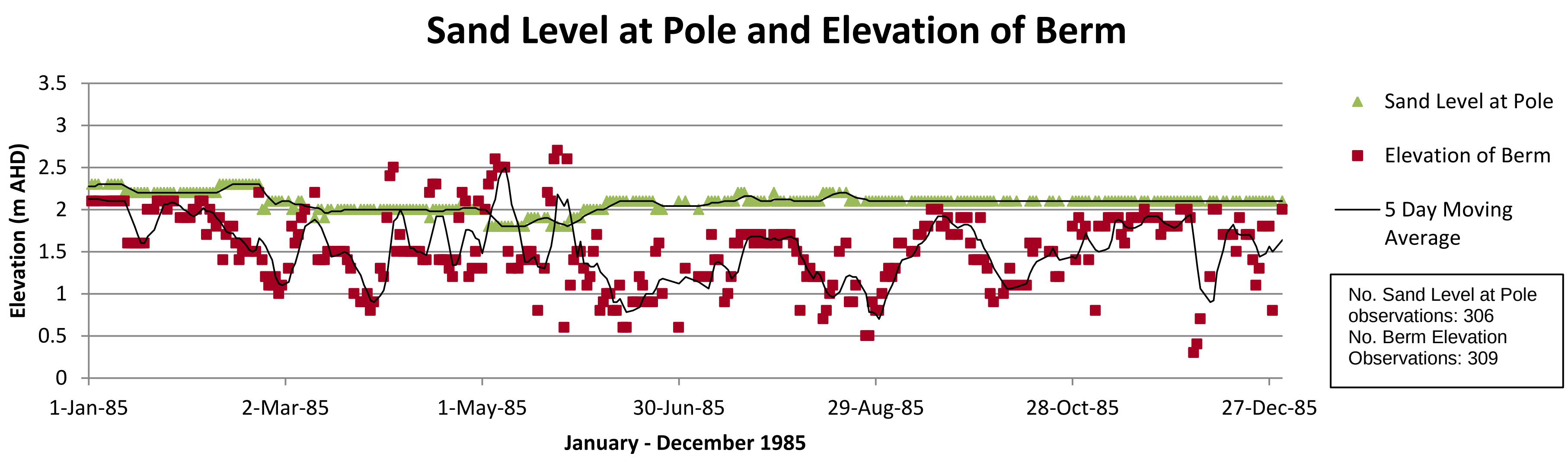
Beach Profile Parameters – 1984

Figure 27





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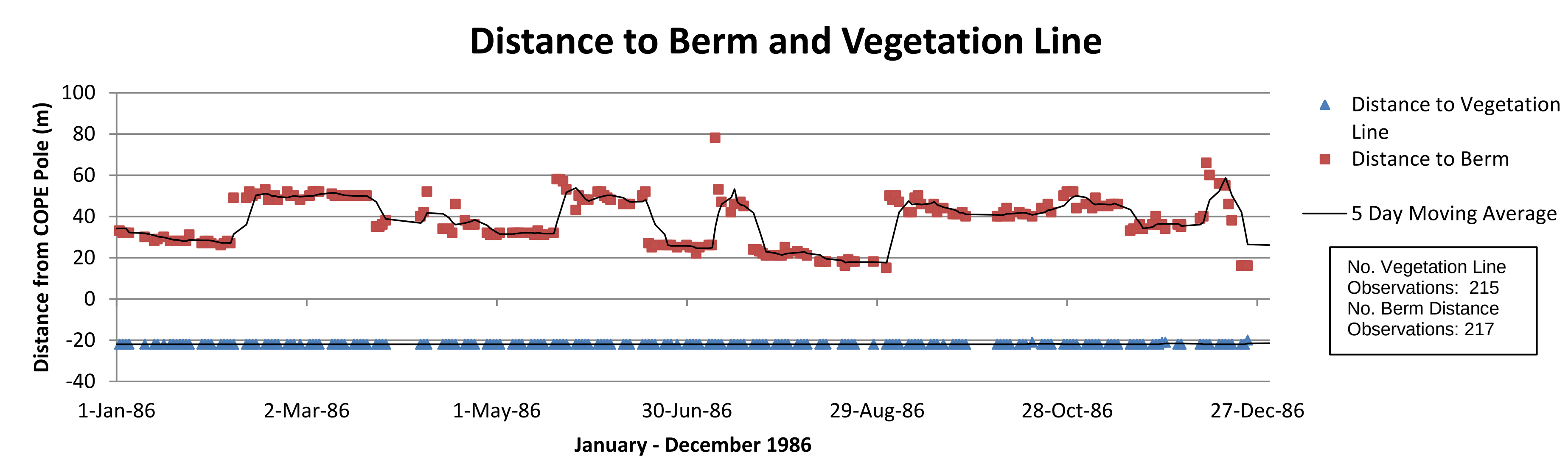
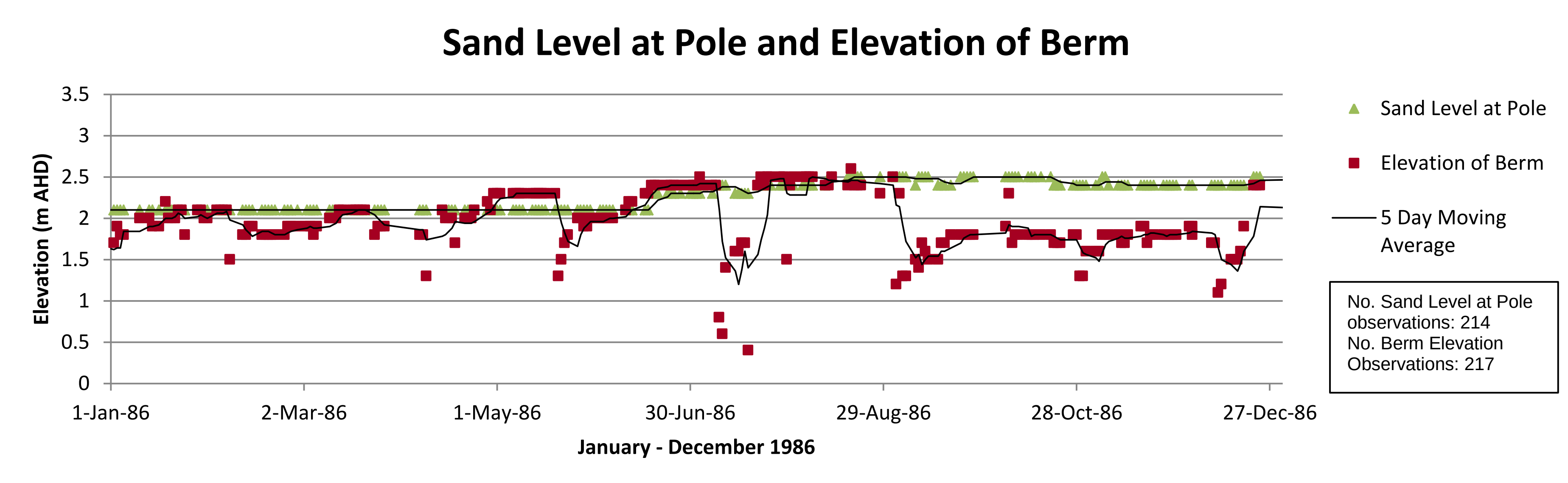
Beach Profile Parameters – 1985

Figure 28





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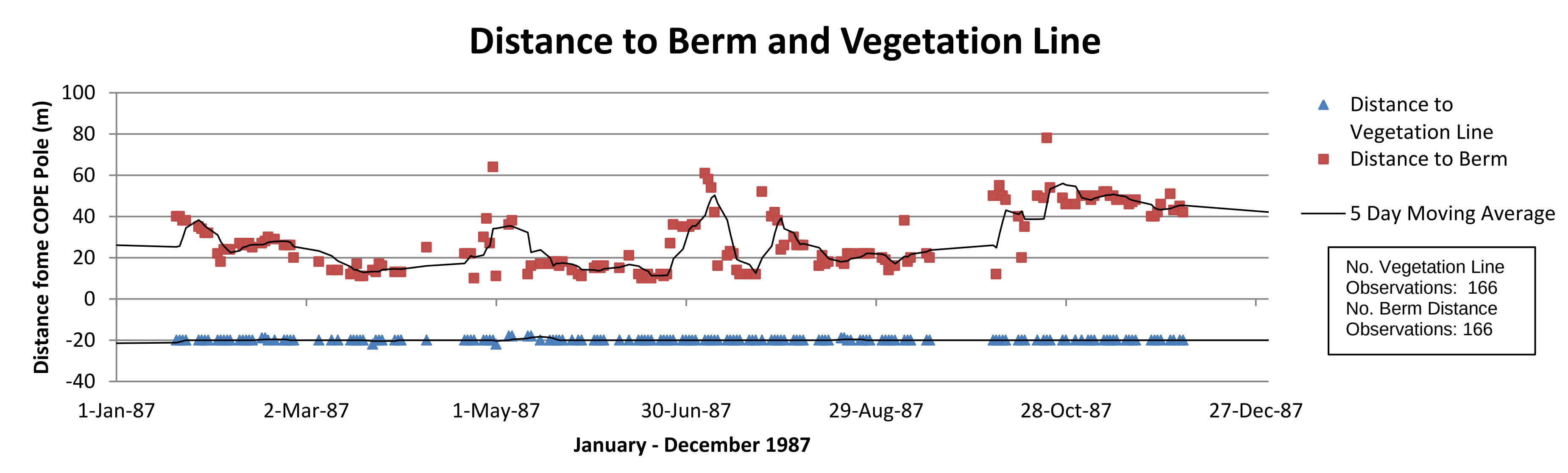
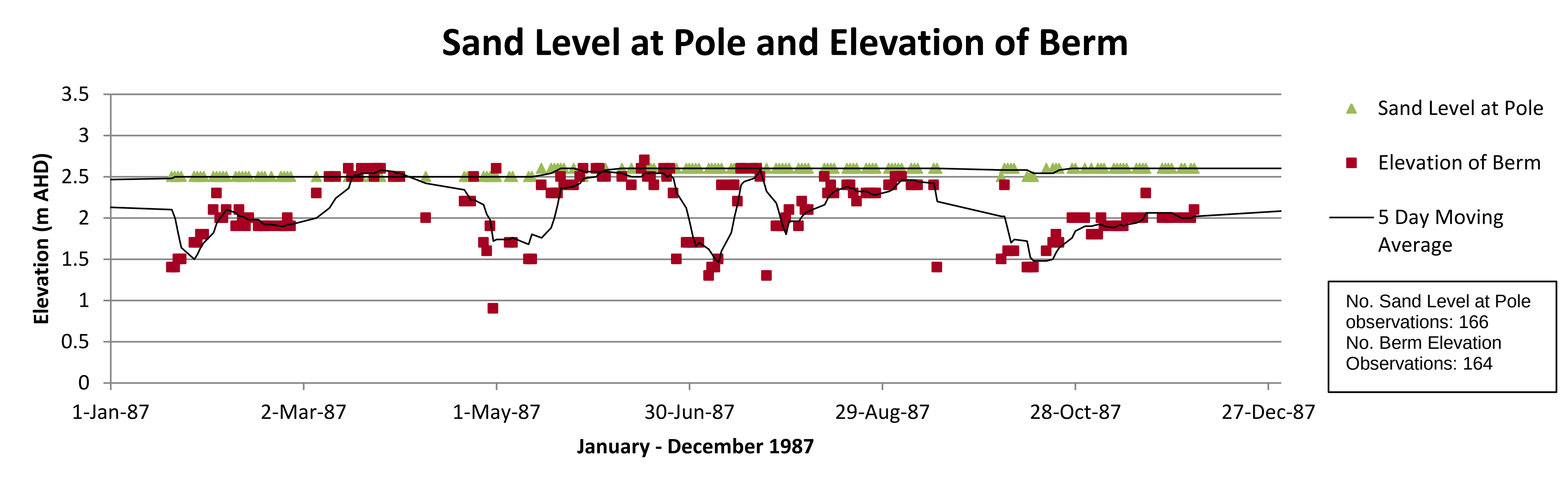
Beach Profile Parameters – 1986

Figure 29





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Beach Profile Parameters – 1987

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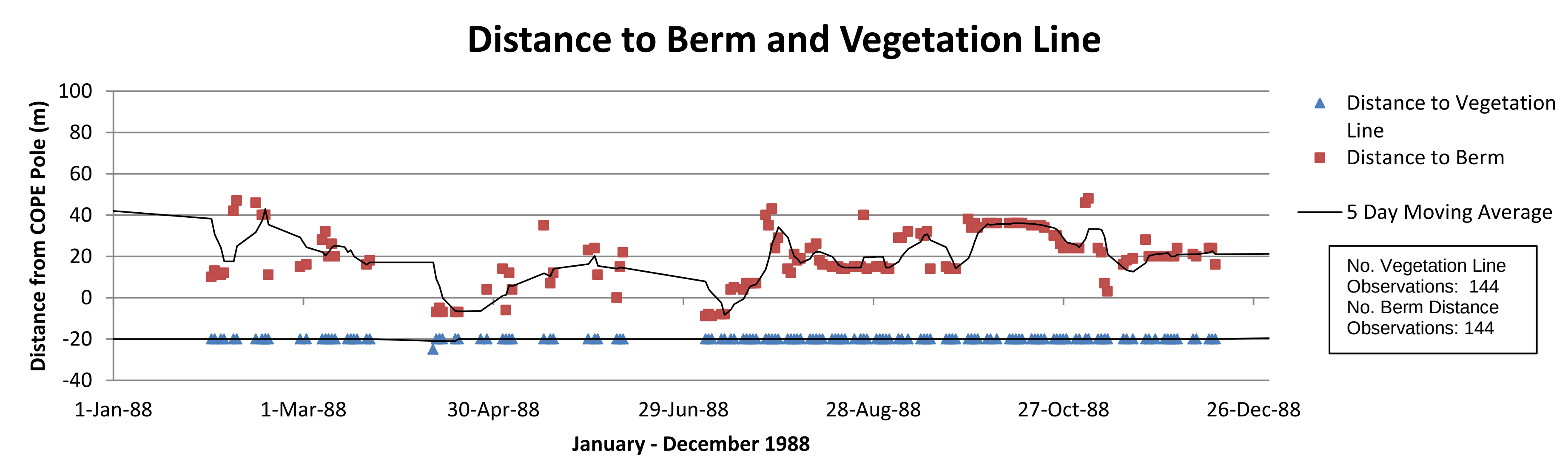
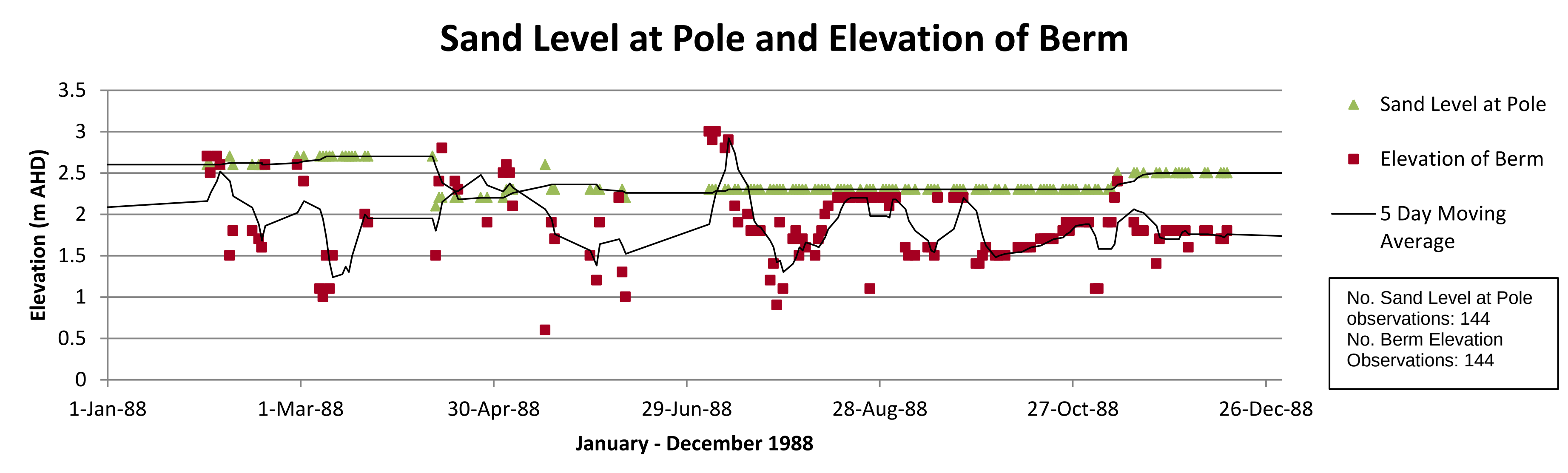
Figure 30





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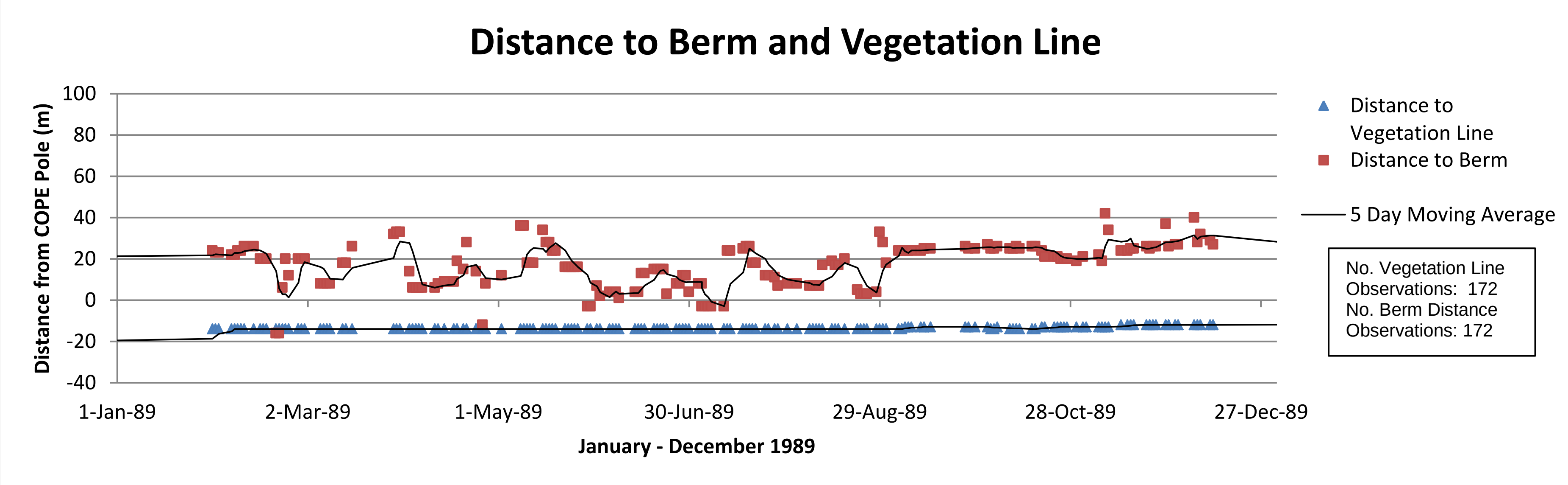
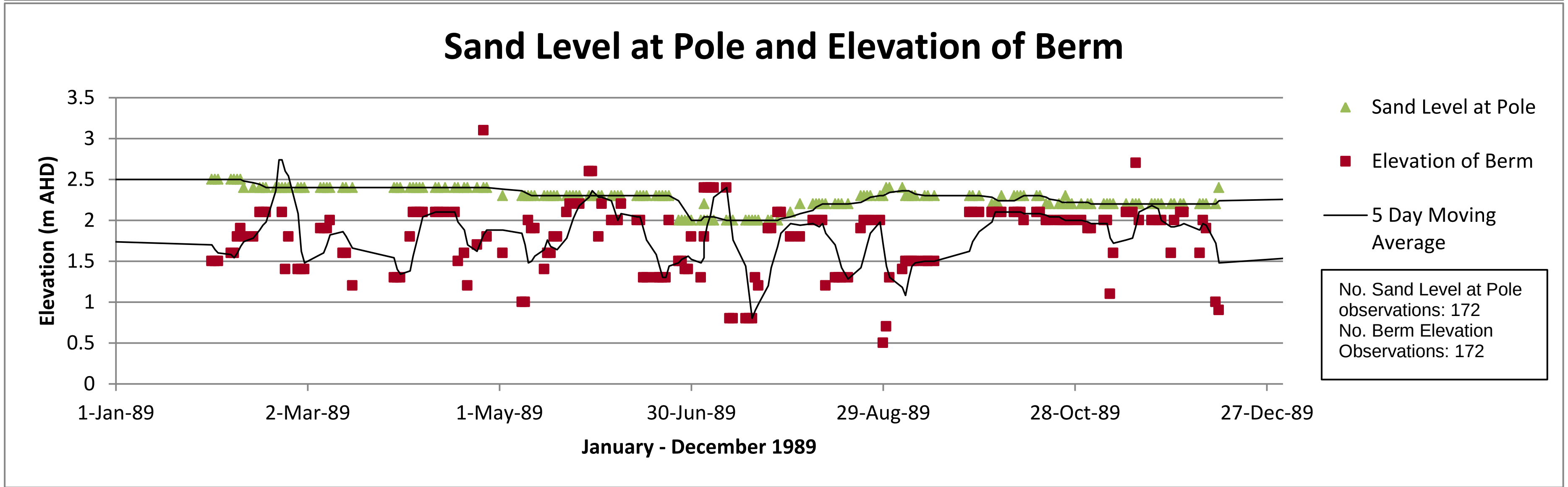
Beach Profile Parameters – 1988

Figure 31





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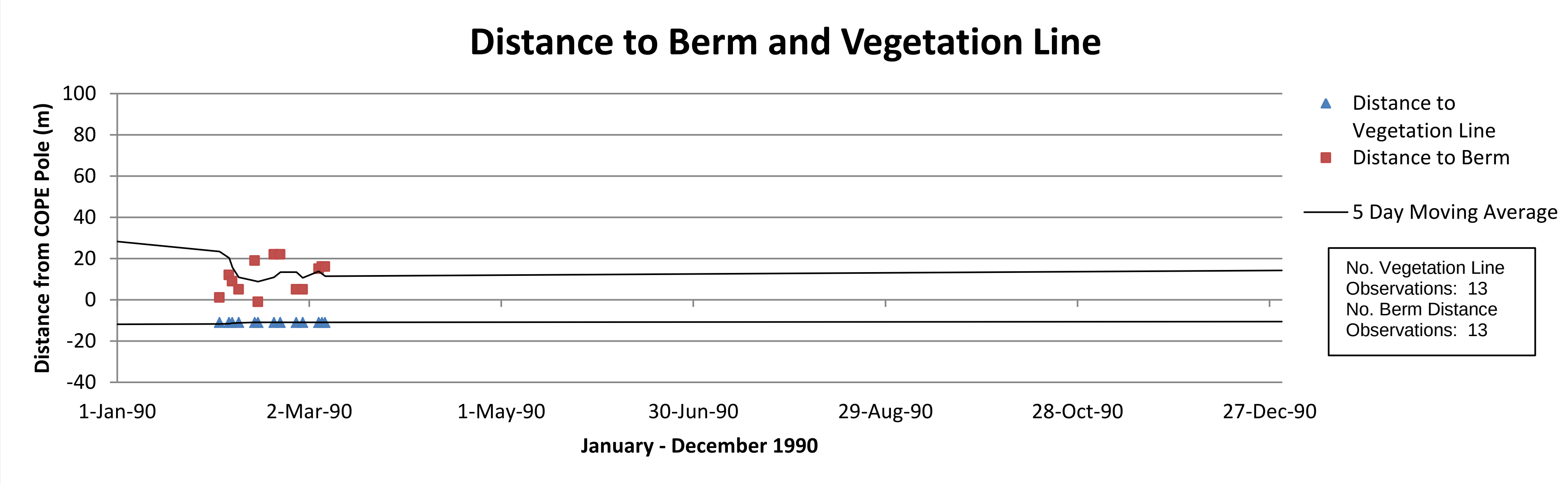
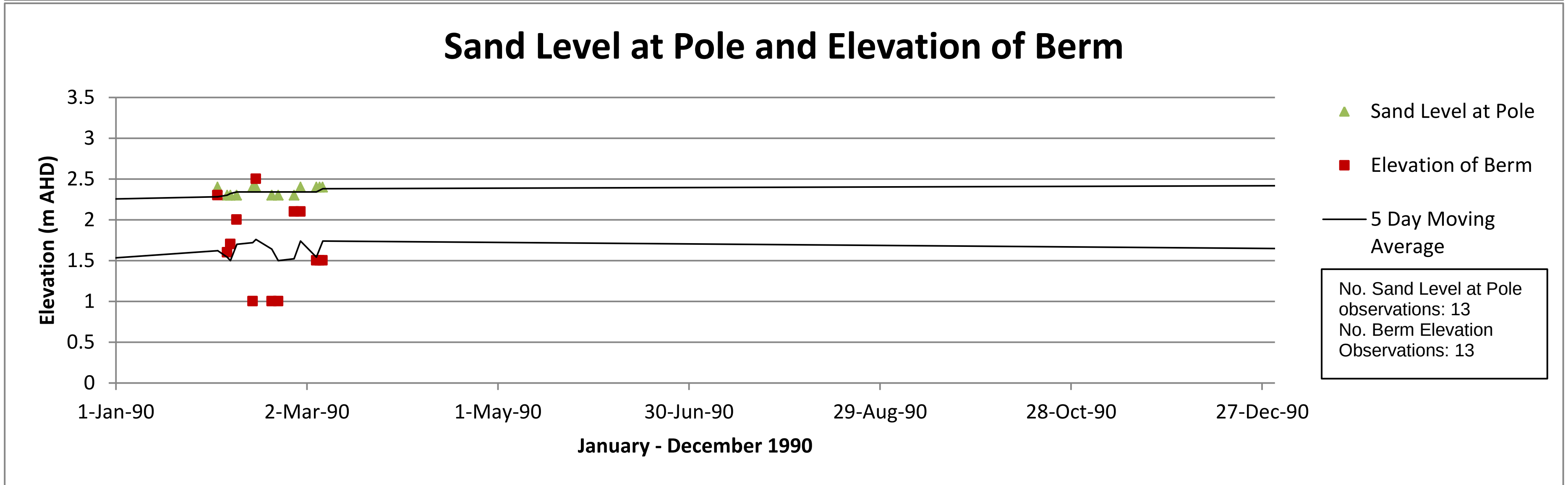
Beach Profile Parameters – 1989

Figure 32





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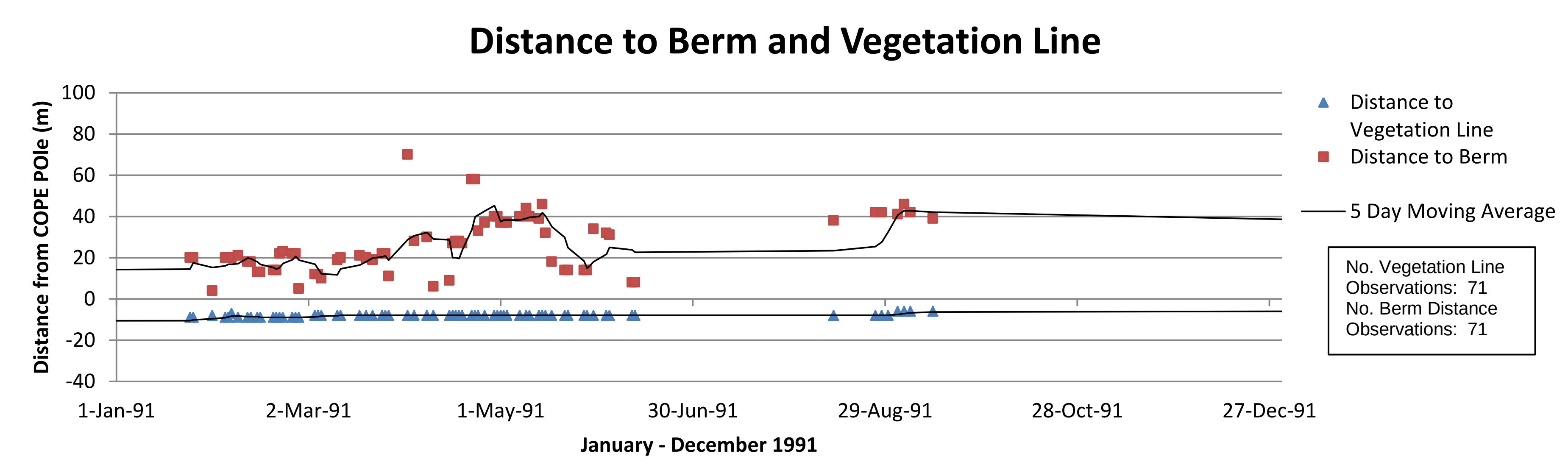
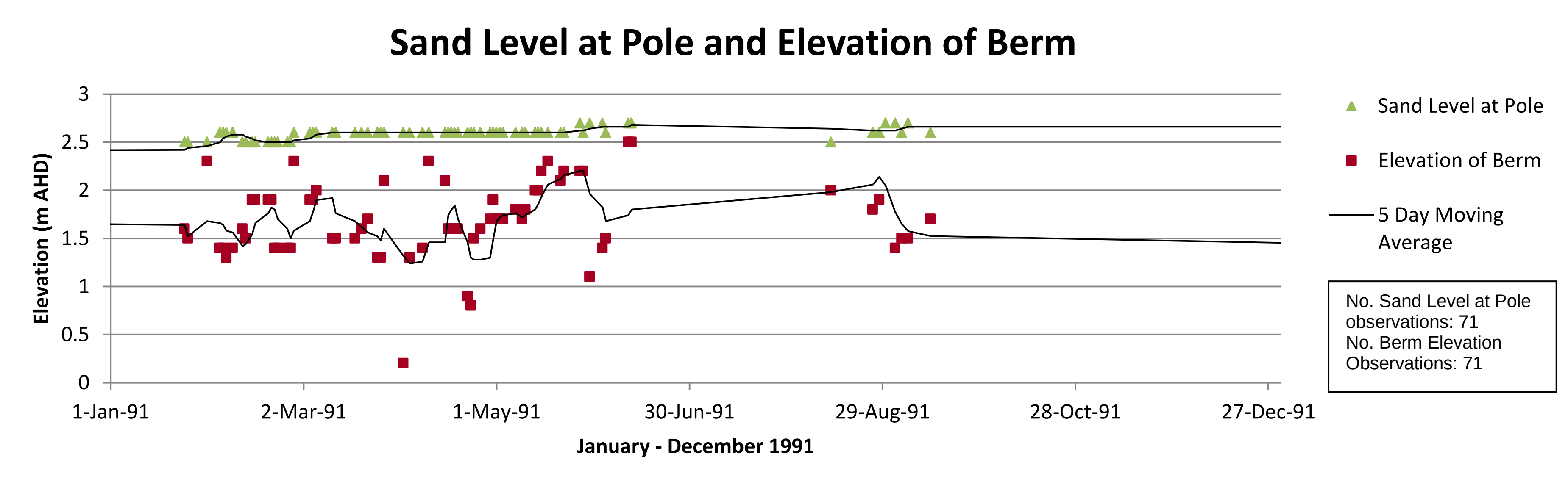
Beach Profile Parameters – 1990

Figure 33





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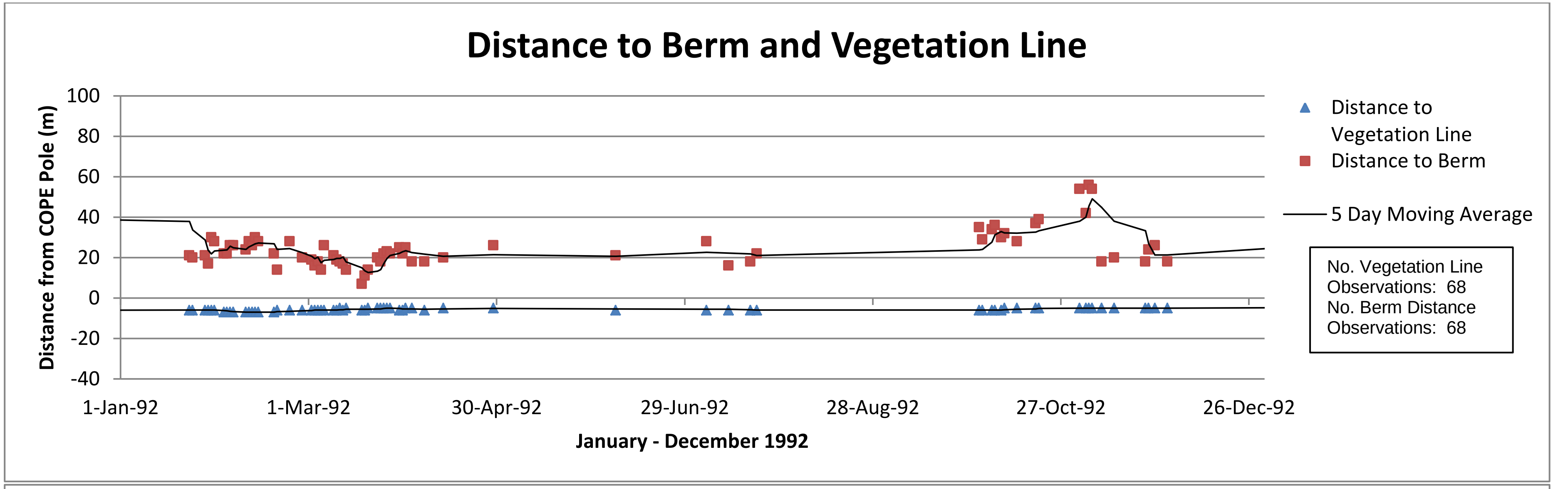
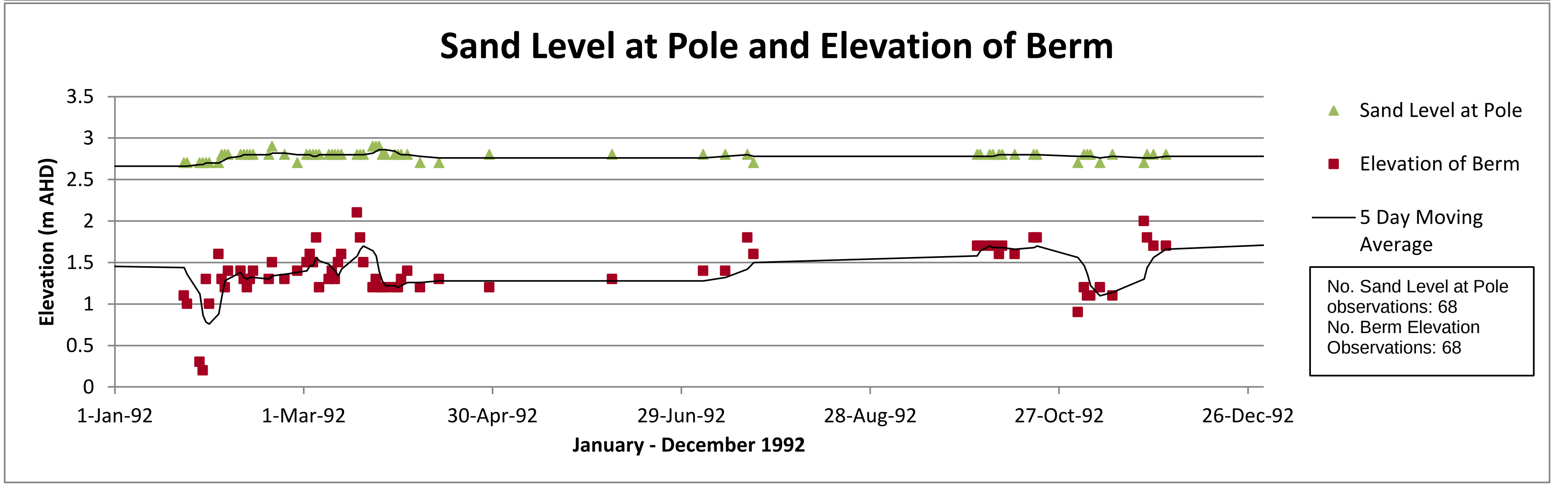
Beach Profile Parameters – 1991

Figure 34





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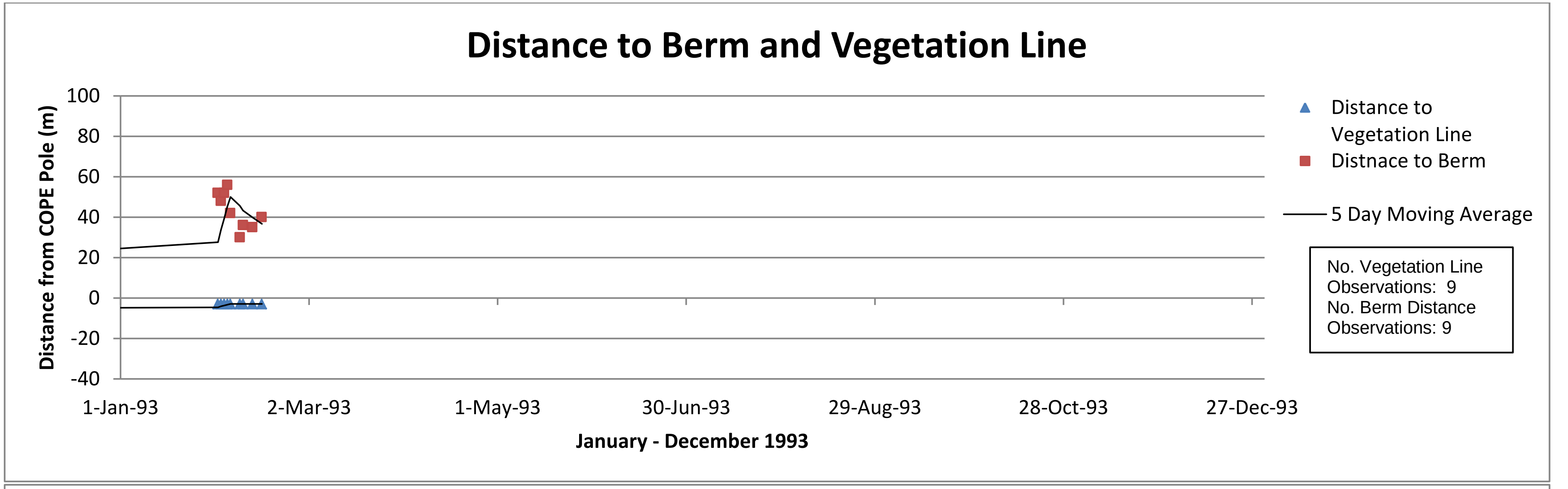
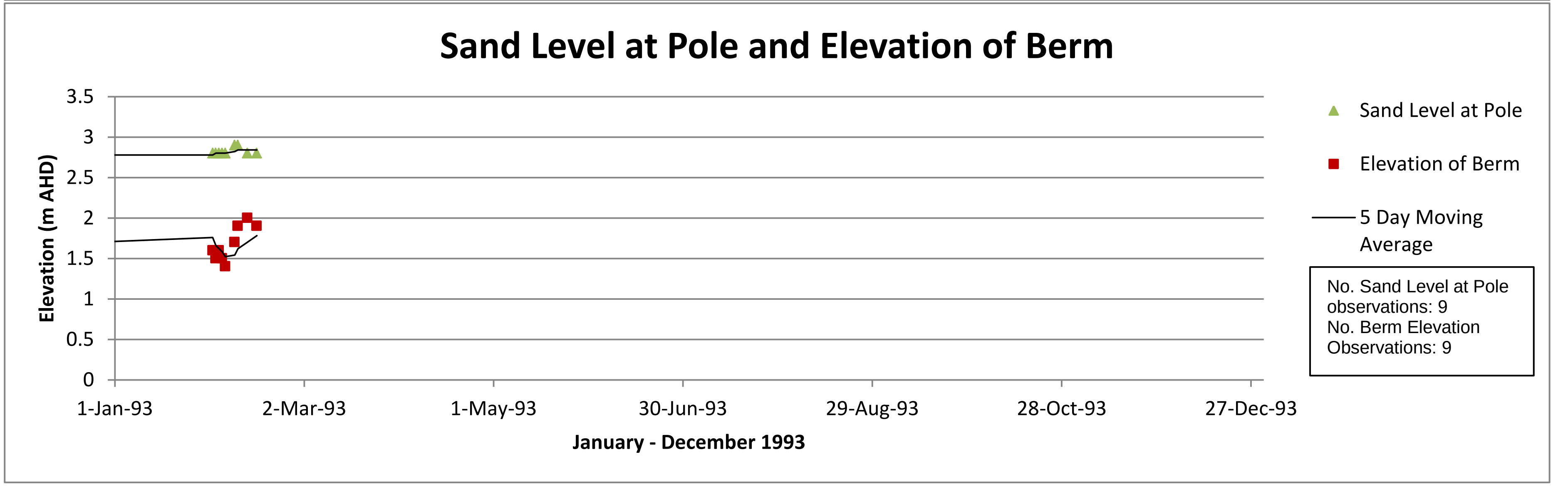
Beach Profile Parameters – 1992

Figure 35





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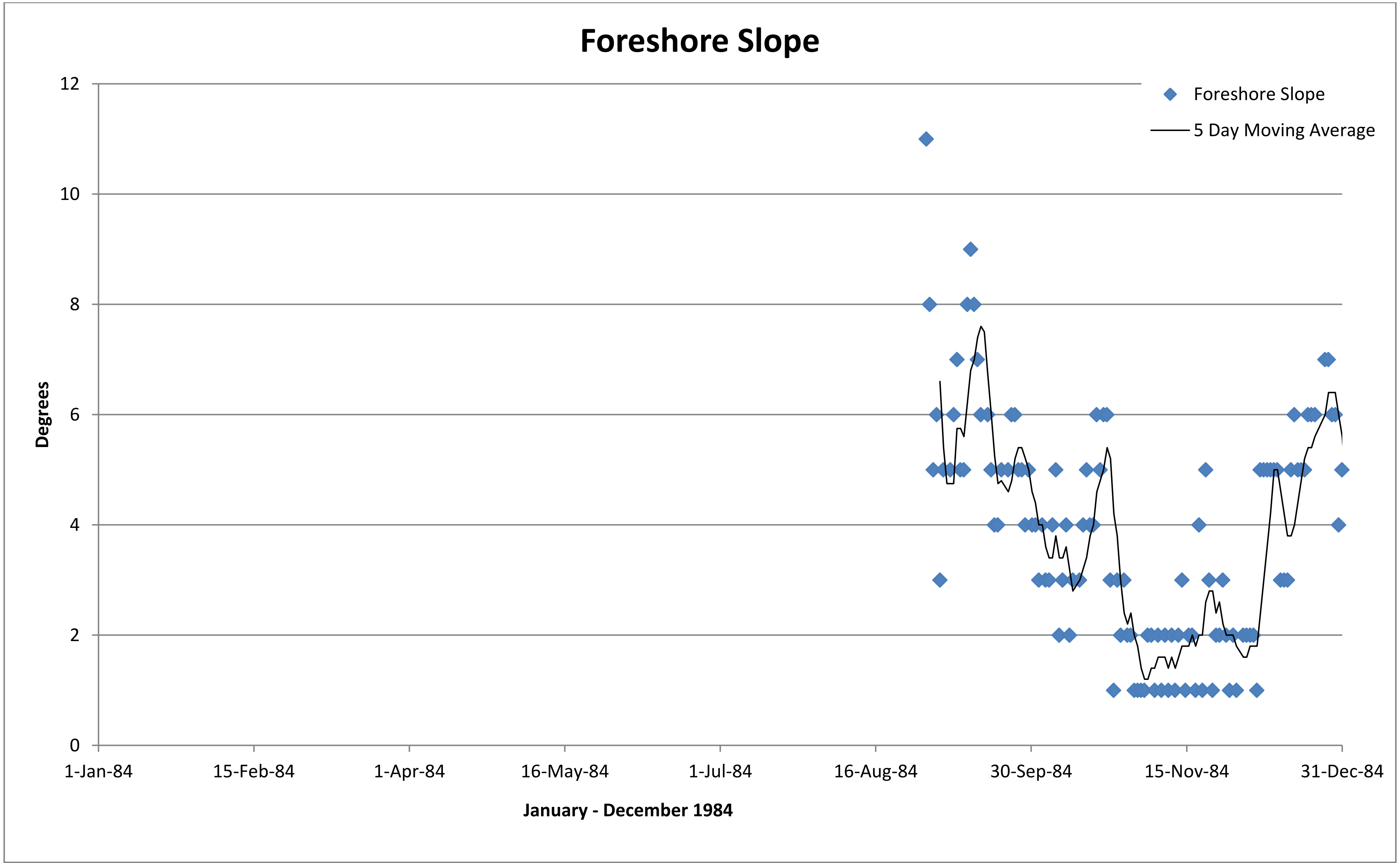
Beach Profile Parameters – 1993

Figure 36



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Foreshore Slope – 1984

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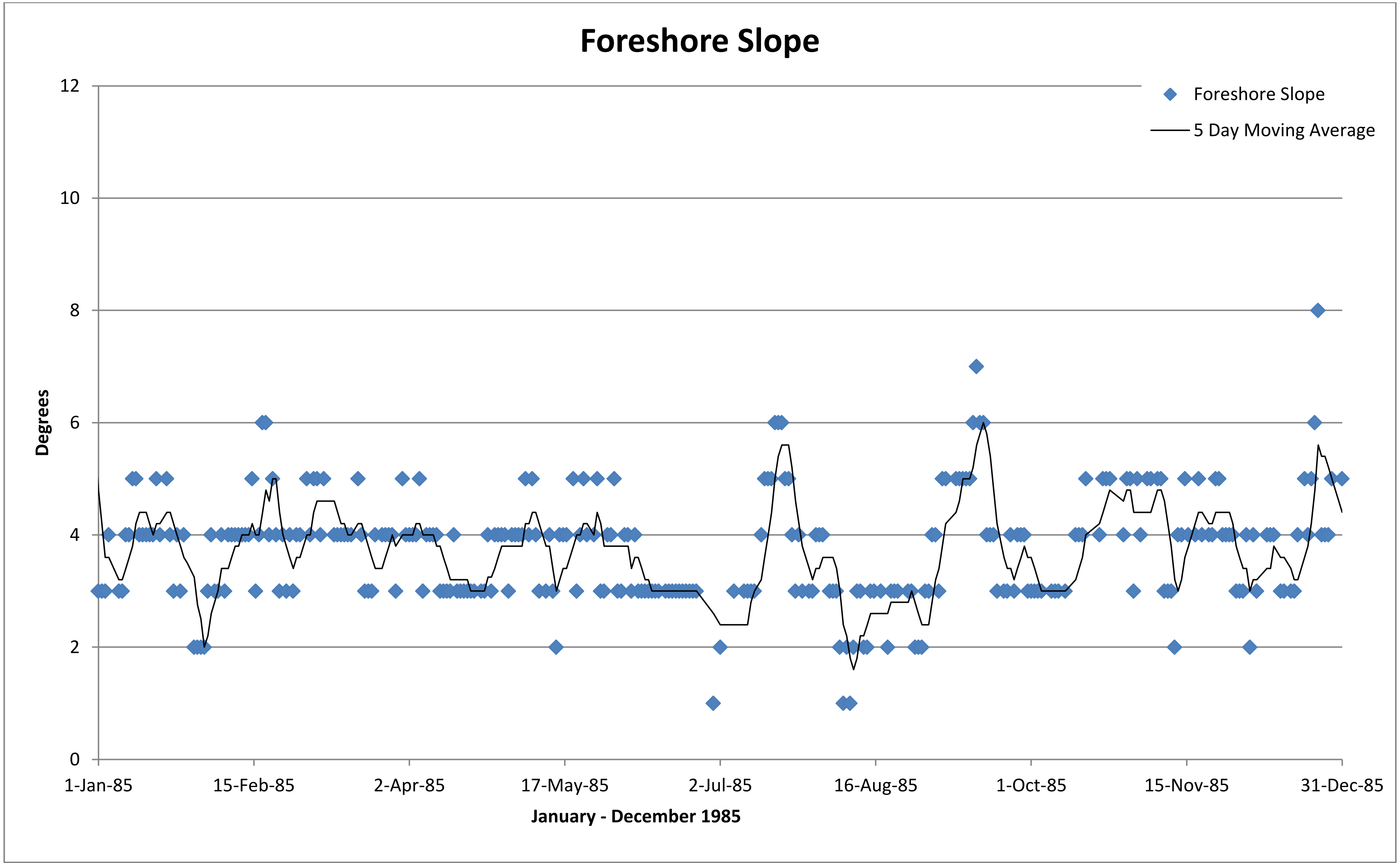
Figure 37



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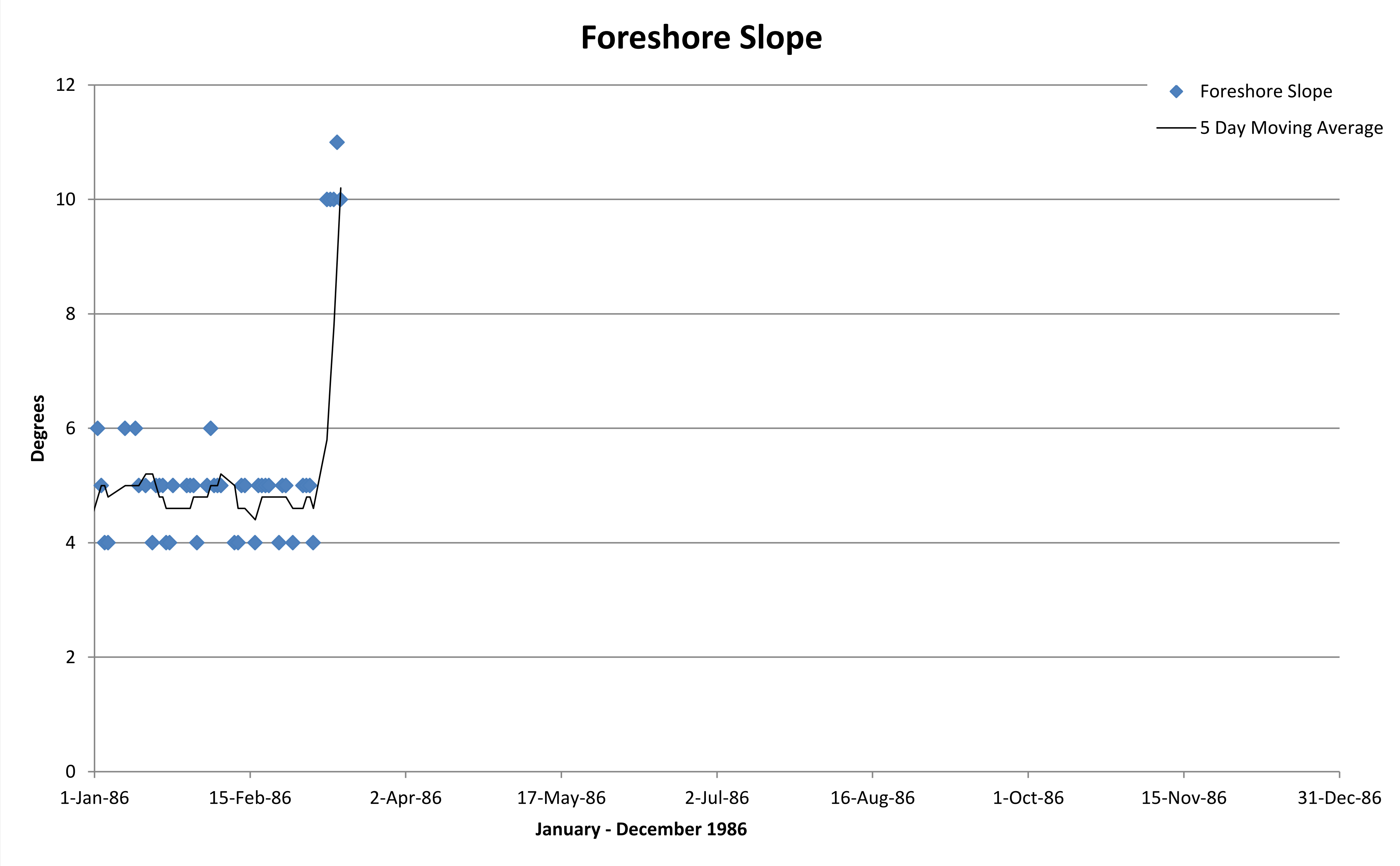
Foreshore Slope – 1985

Figure 38



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Foreshore Slope – 1986

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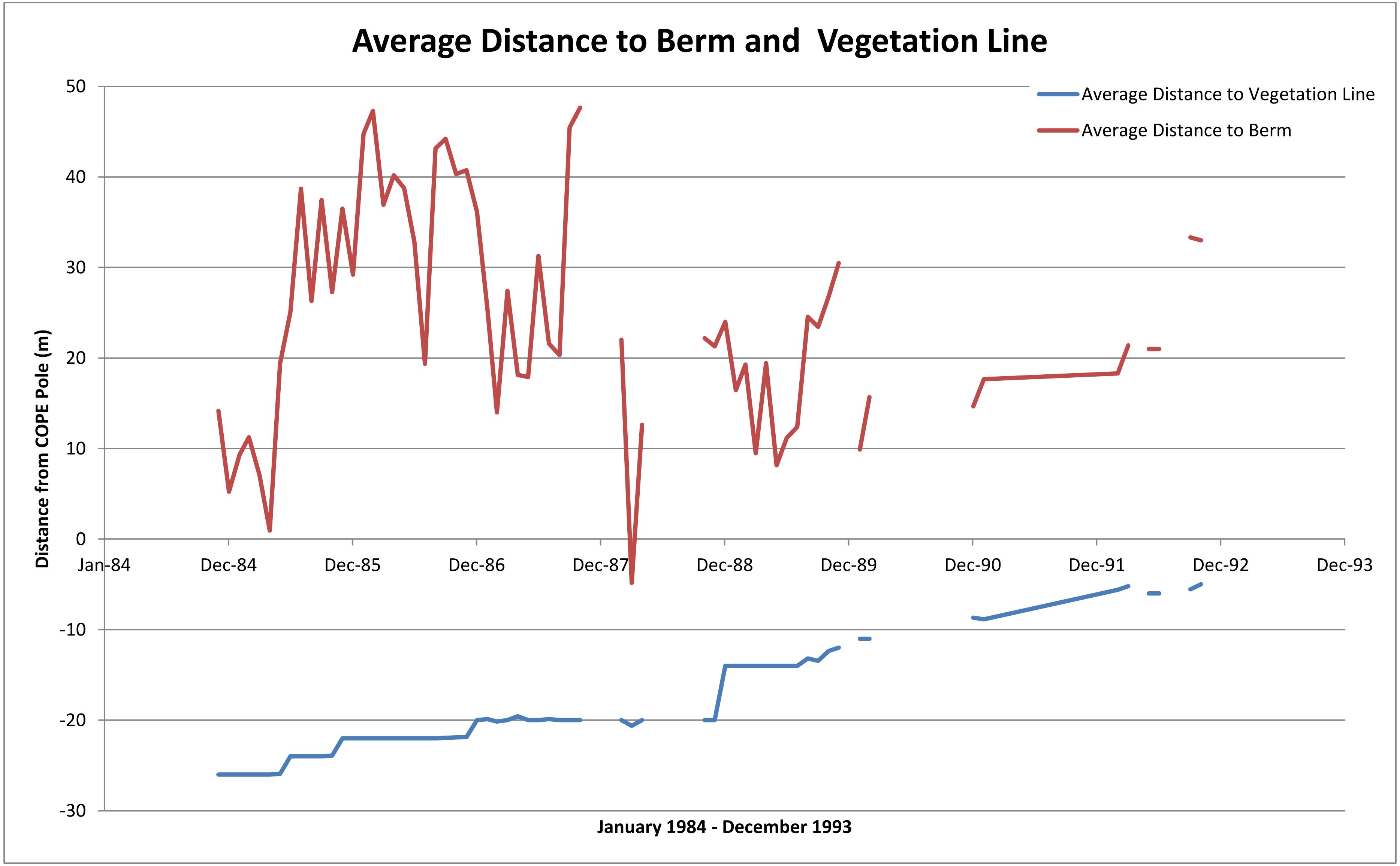
Figure 39



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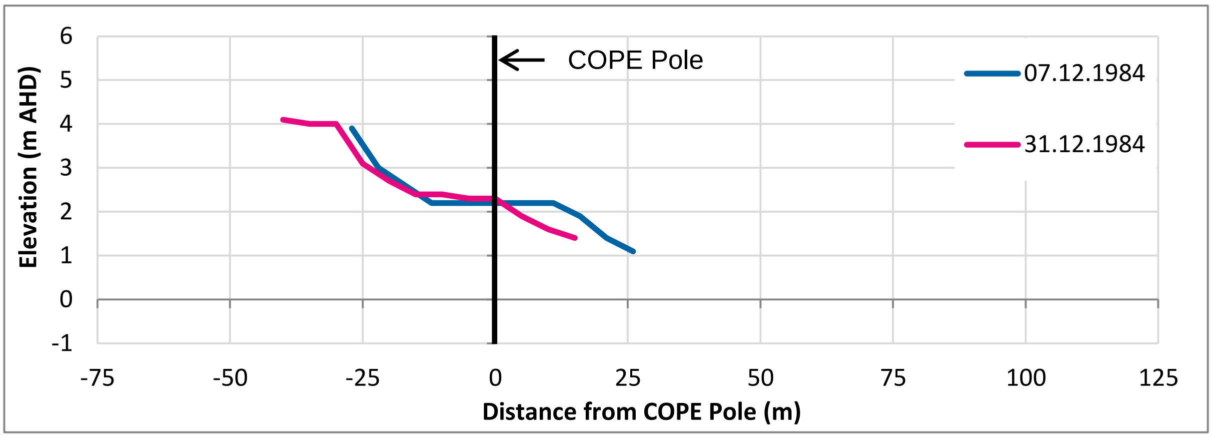
Average Distance to Berm and Vegetation Line

Figure 40



Monthly Beach Profiles – 1984

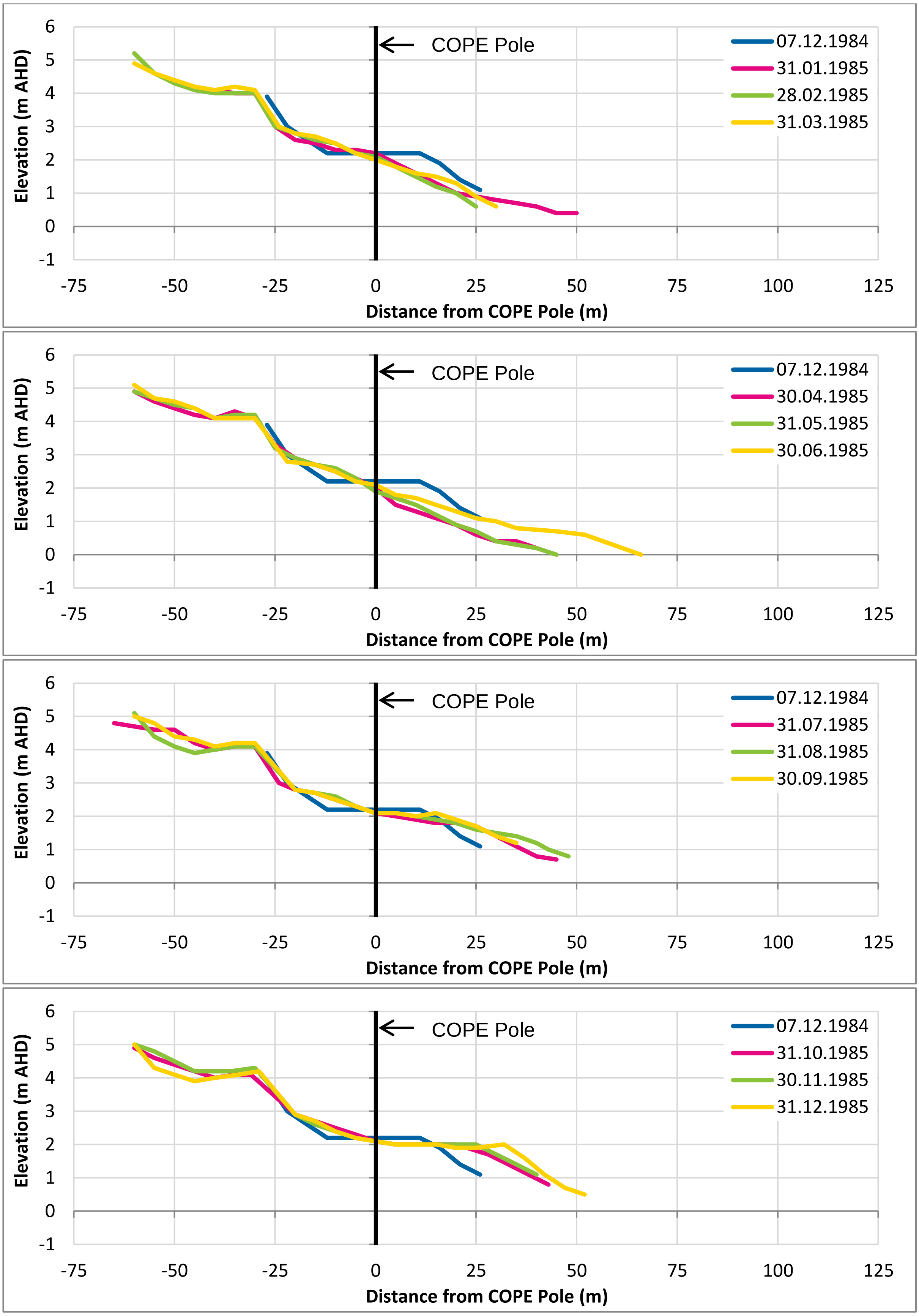


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Figure 42

Monthly Beach Profiles – 1985

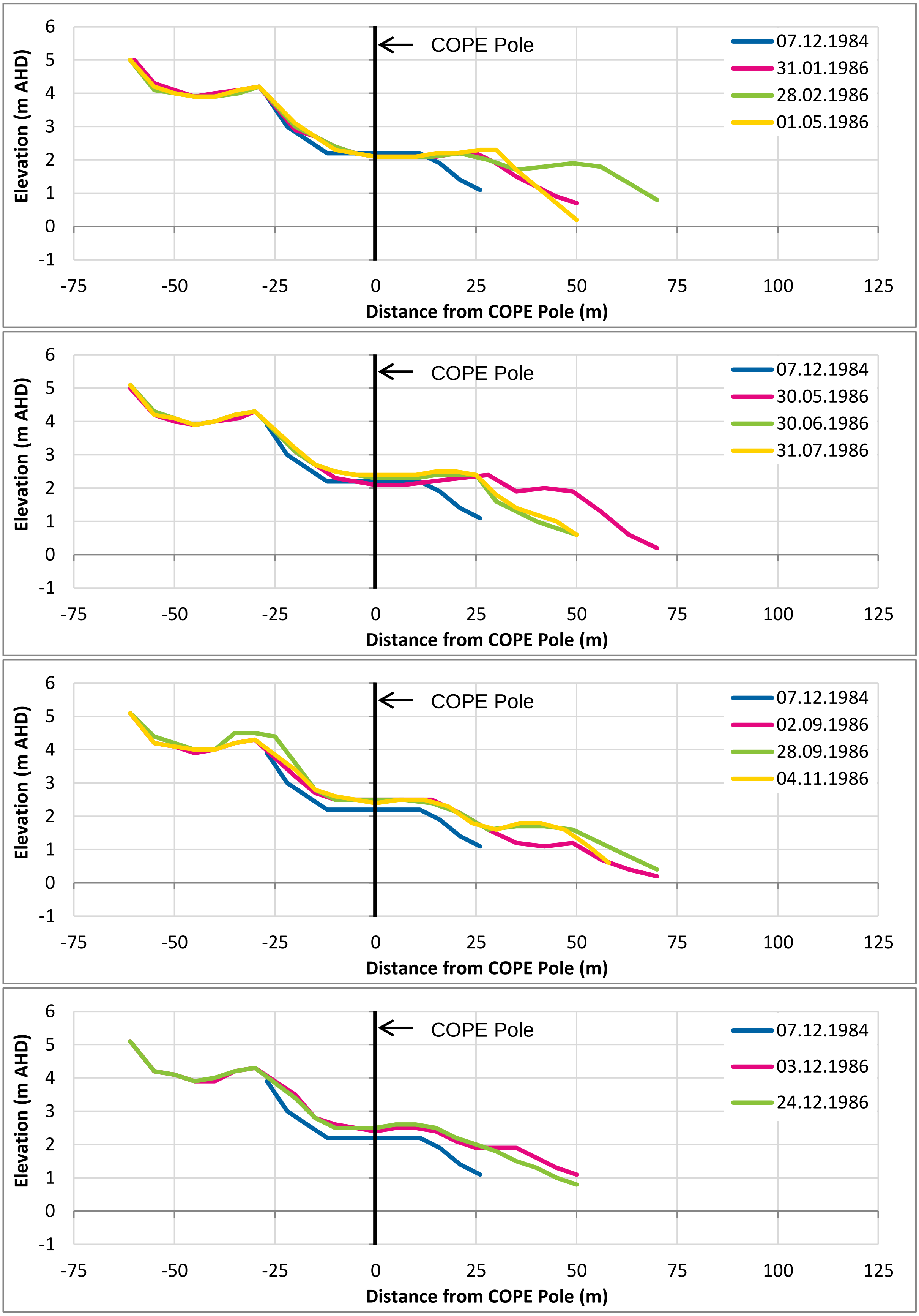

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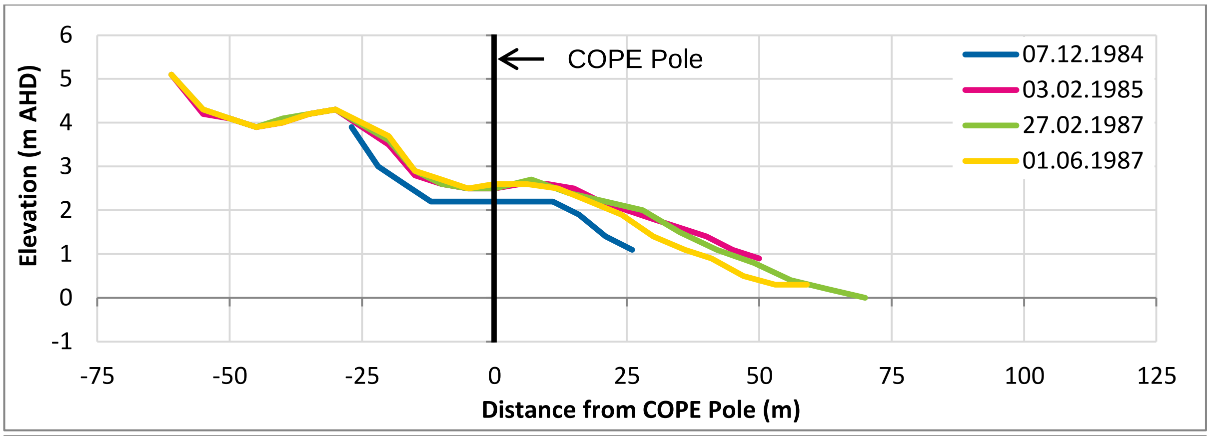
Figure 43

Monthly Beach Profiles – 1986



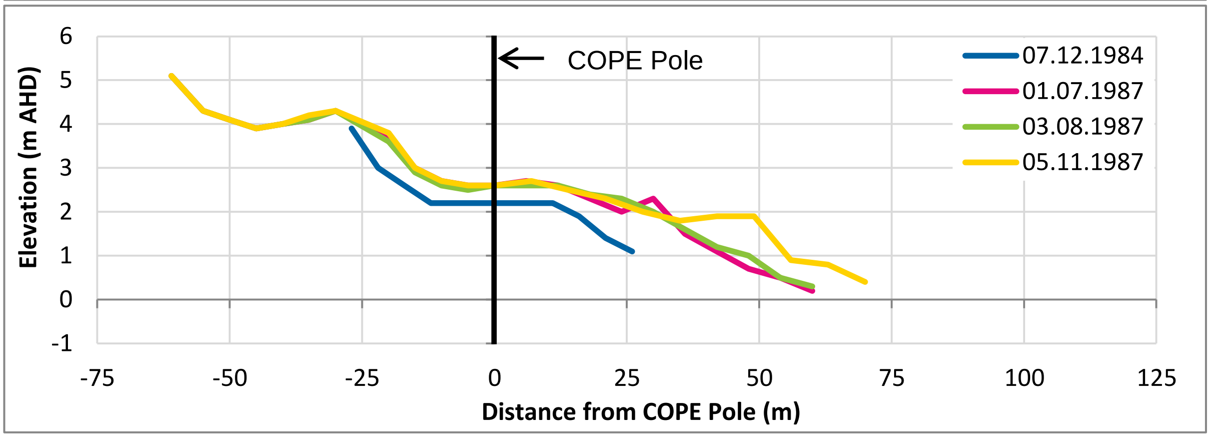


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Figure 44

Monthly Beach Profiles – 1987

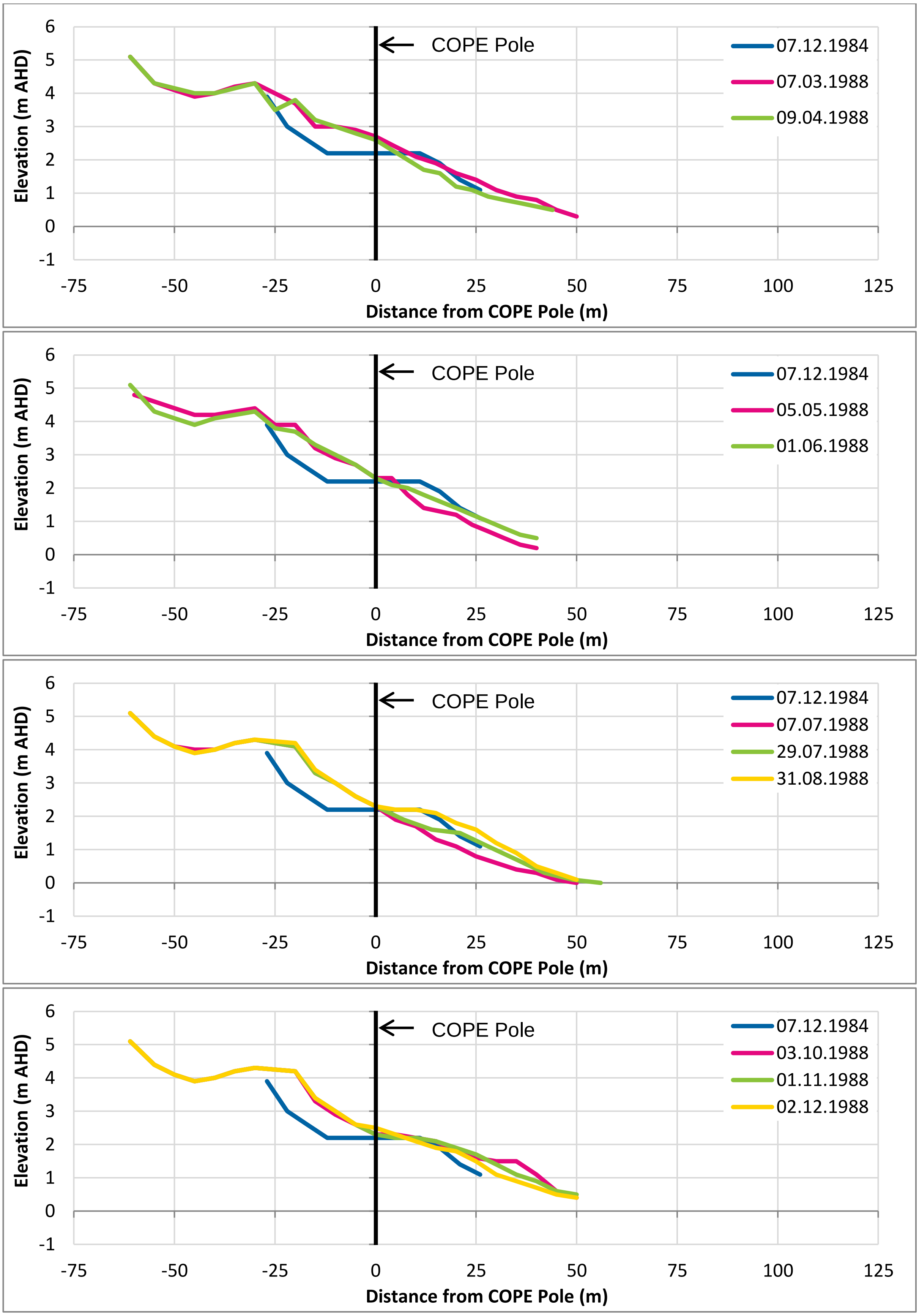

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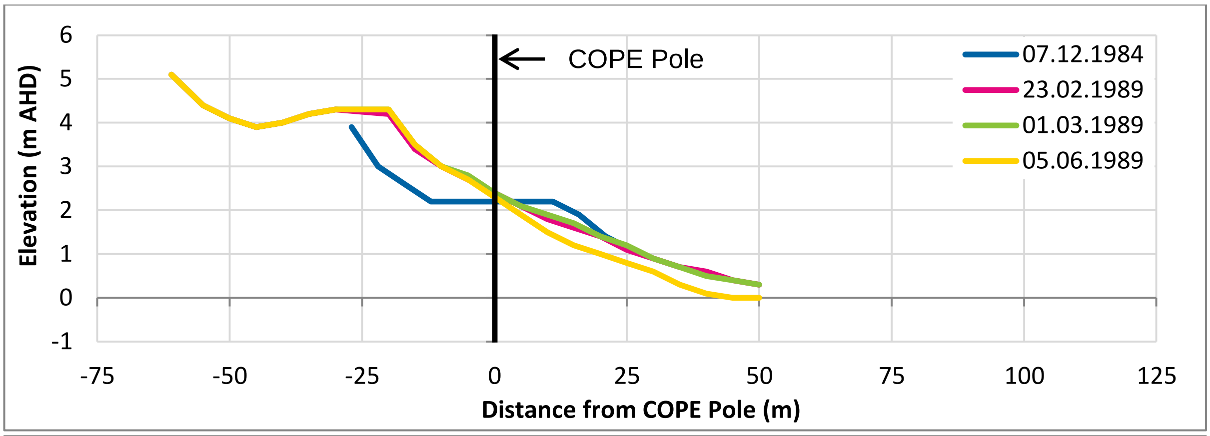
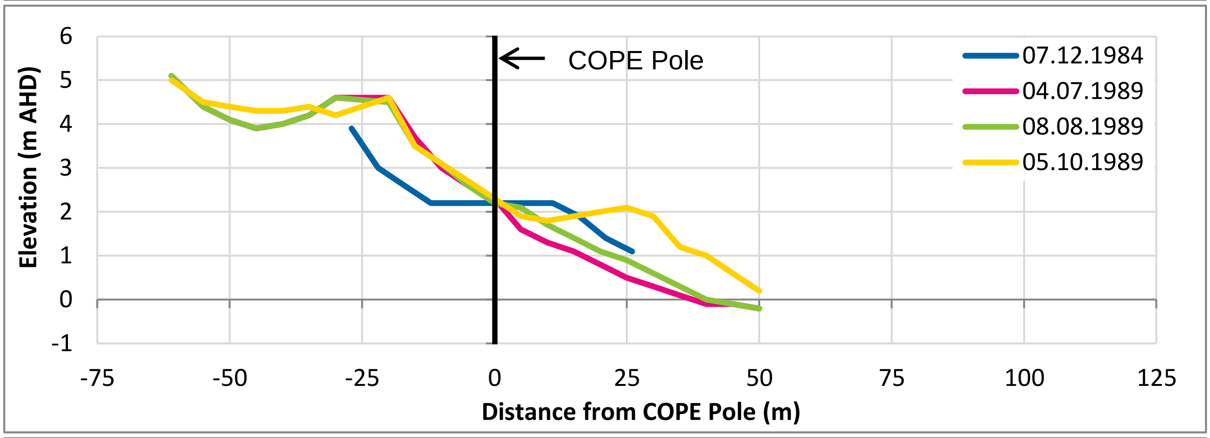
Figure 45

Monthly Beach Profiles – 1988





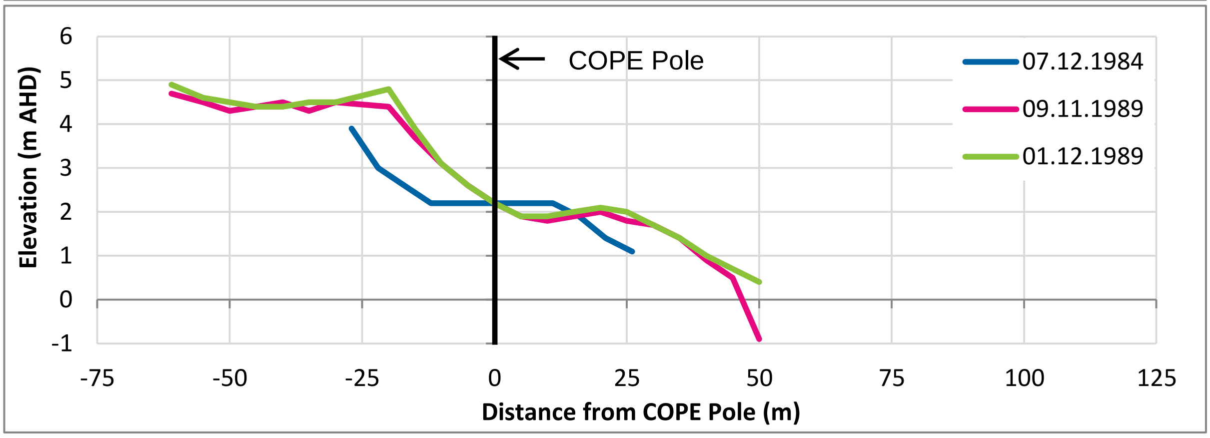


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Figure 46

Monthly Beach Profiles – 1989

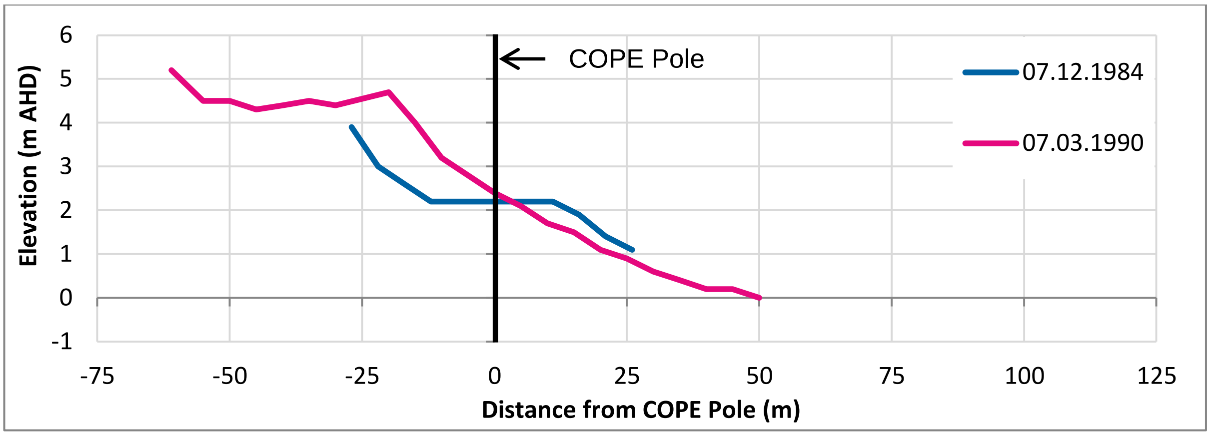
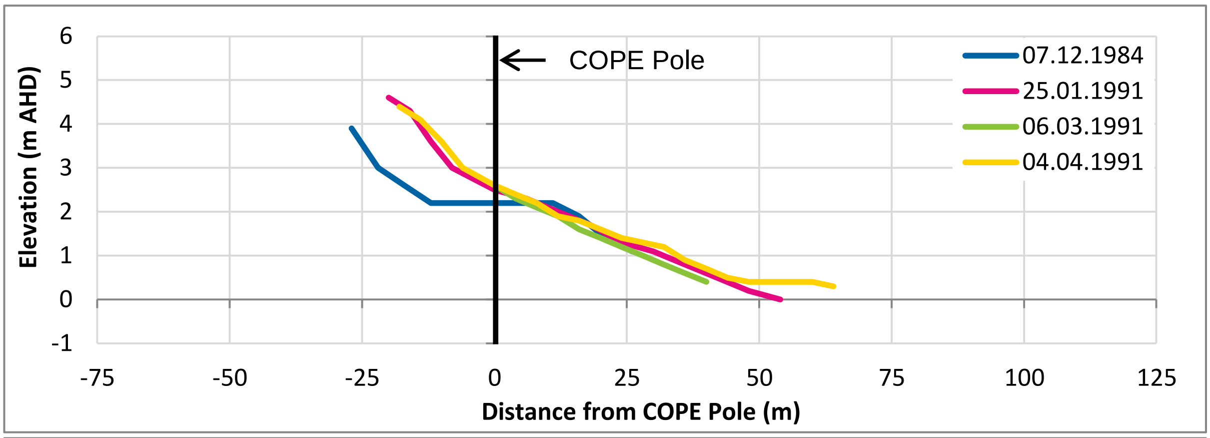


Figure 47

Monthly Beach Profiles – 1990



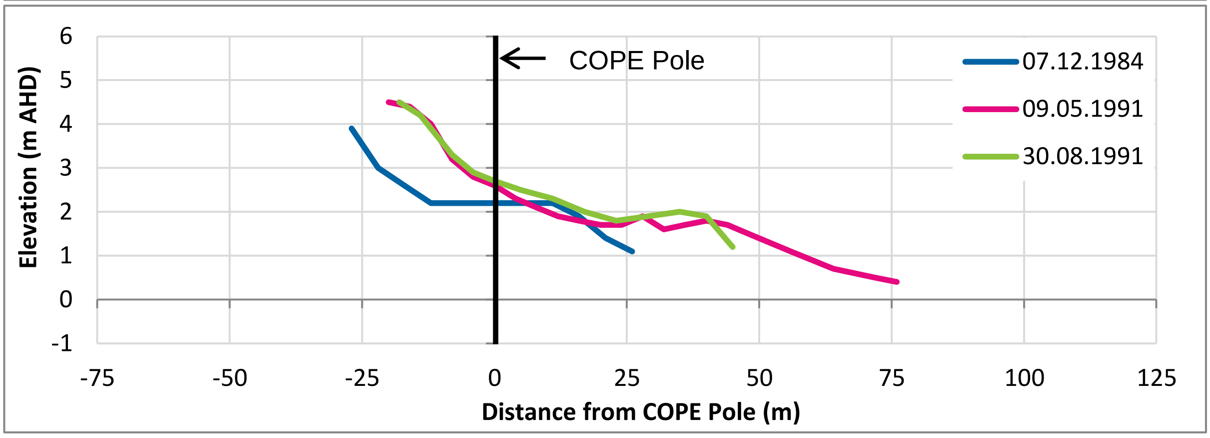


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Figure 48

Monthly Beach Profiles – 1991

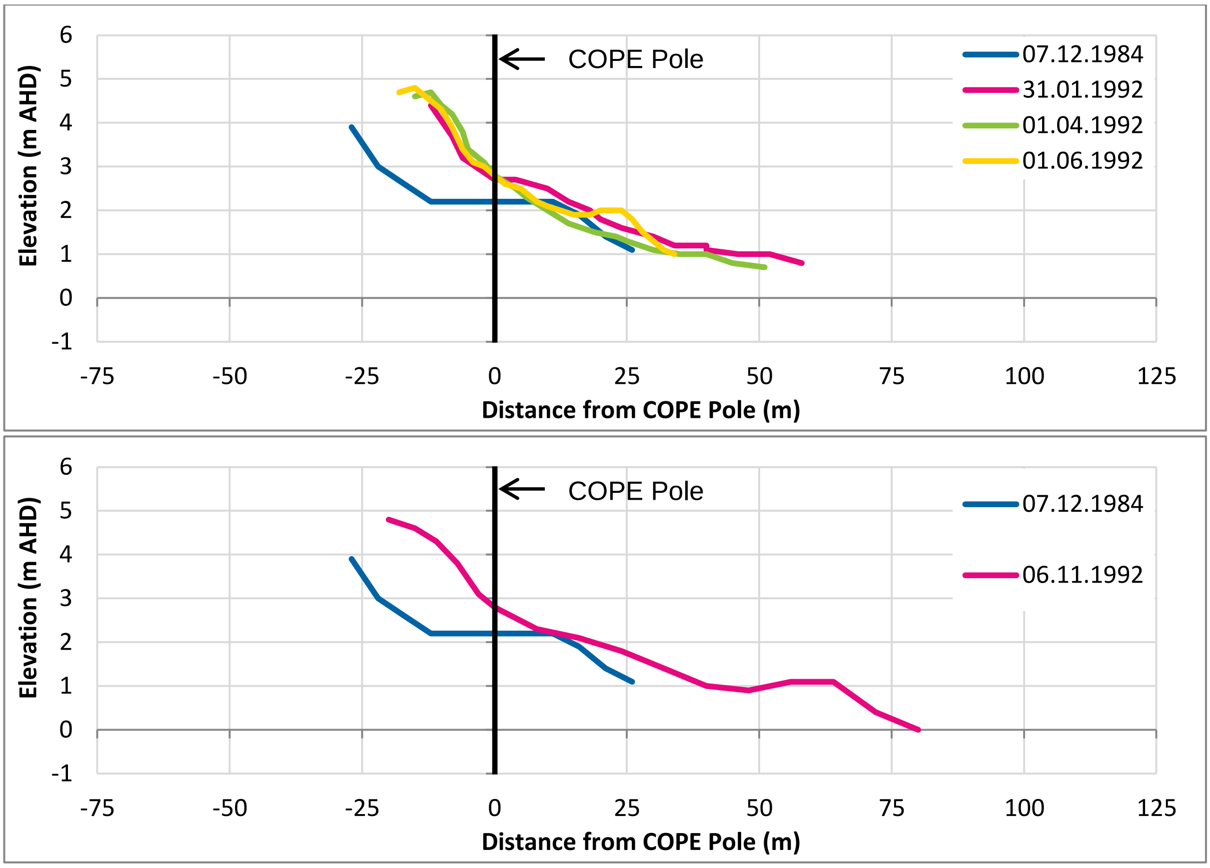

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Figure 49

Monthly Beach Profiles – 1992

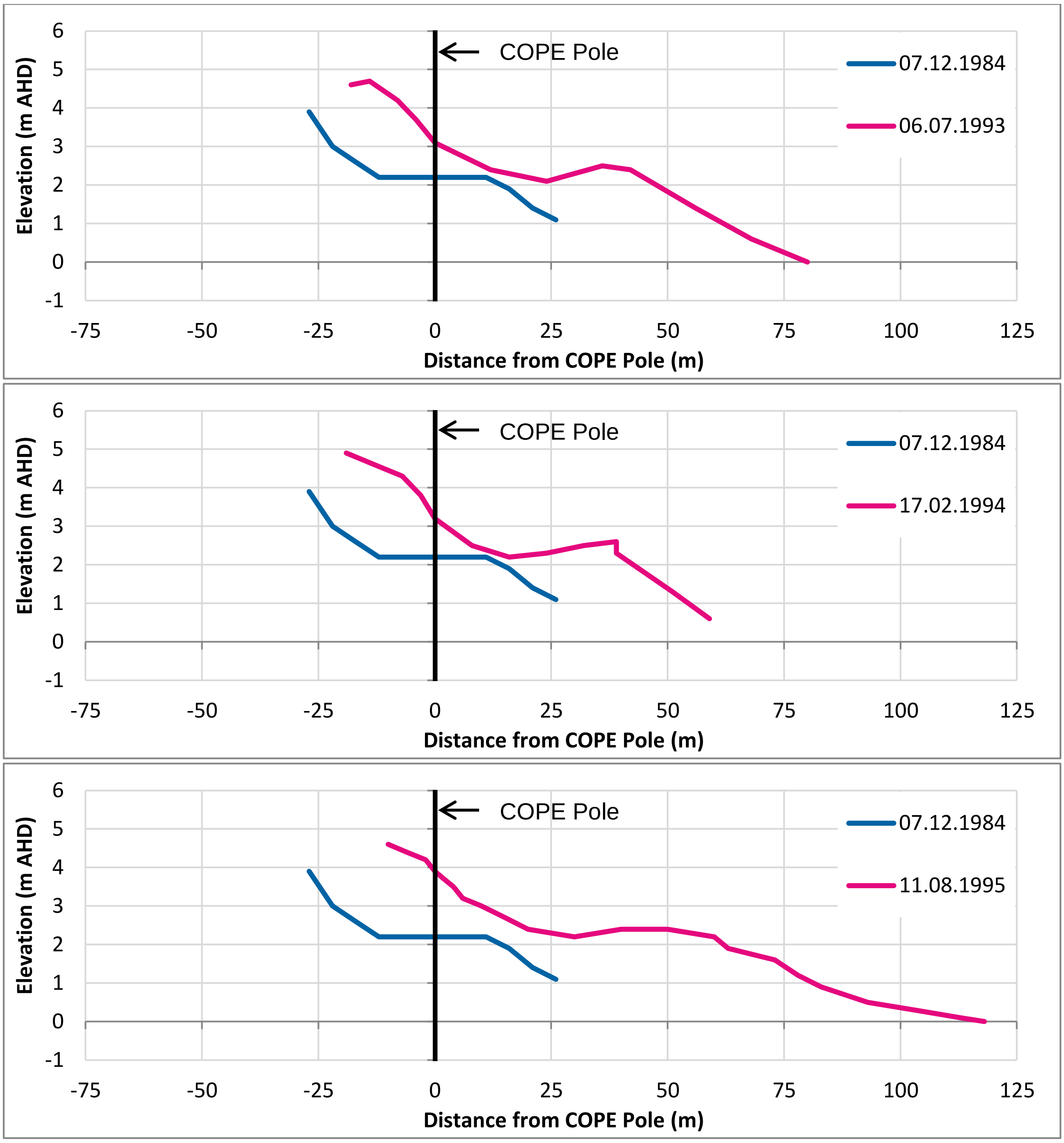

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Figure 50

Monthly Beach Profiles – 1993 – 1995

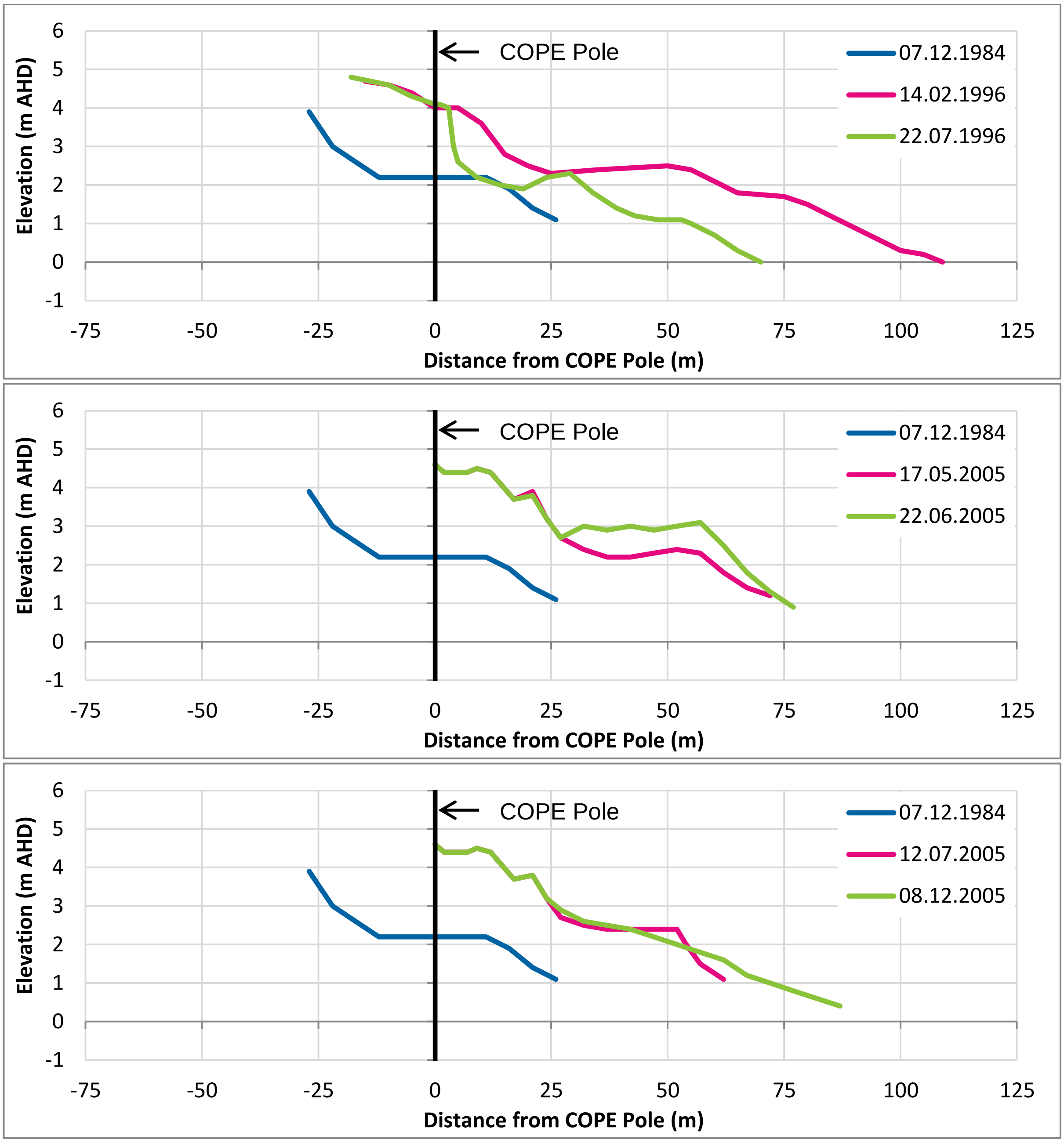

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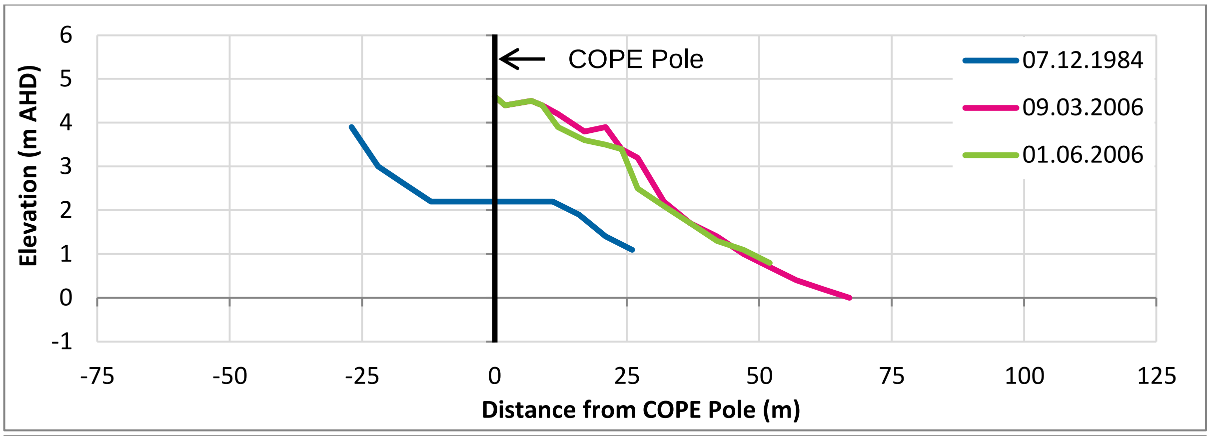
Figure 51

Monthly Beach Profiles – 1996, 2005



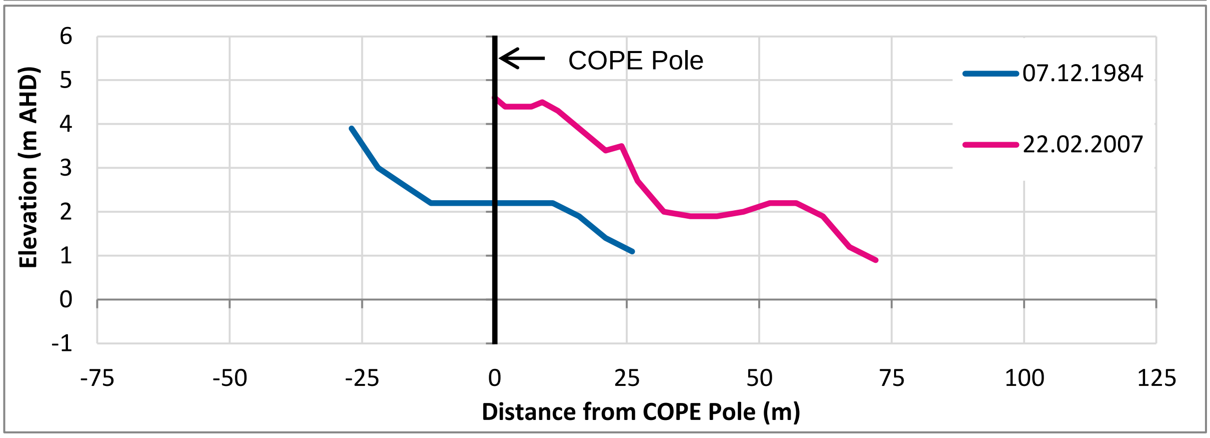
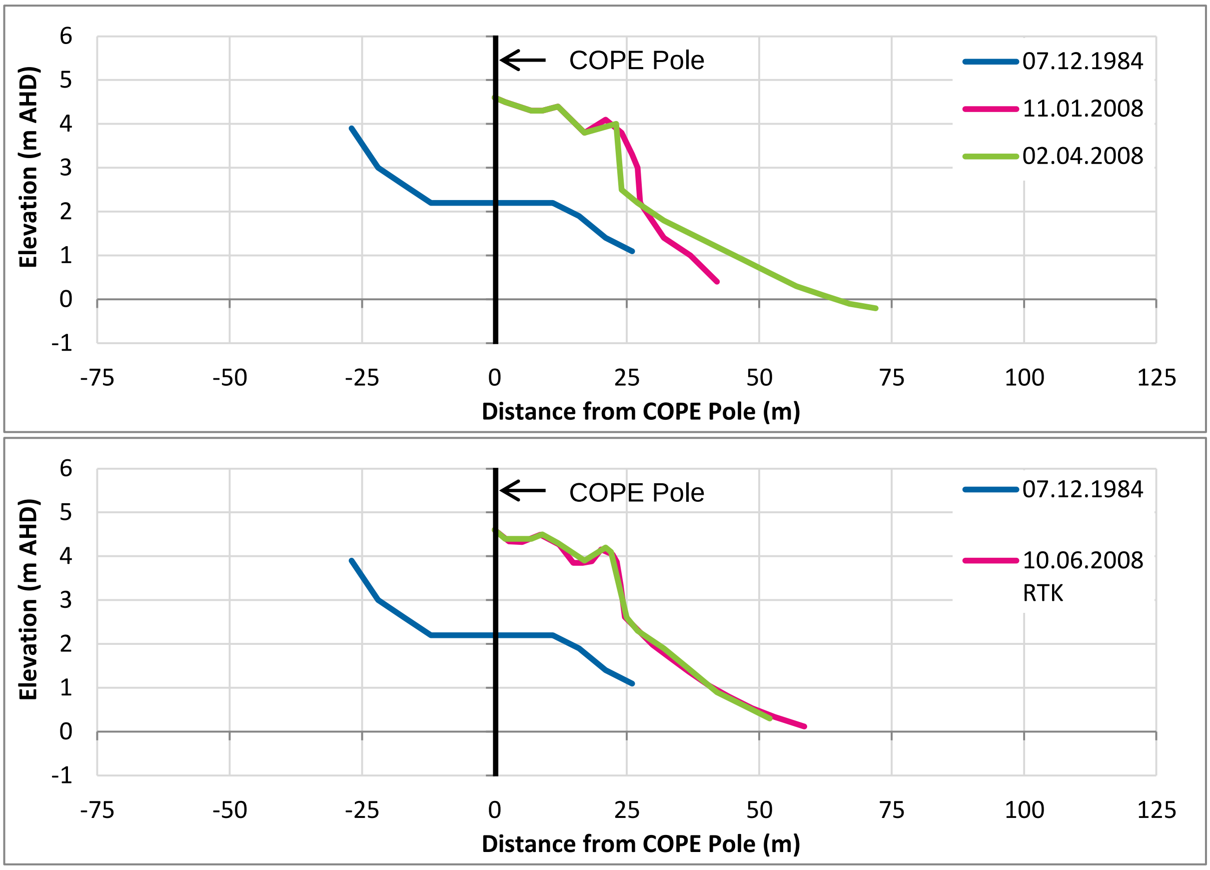
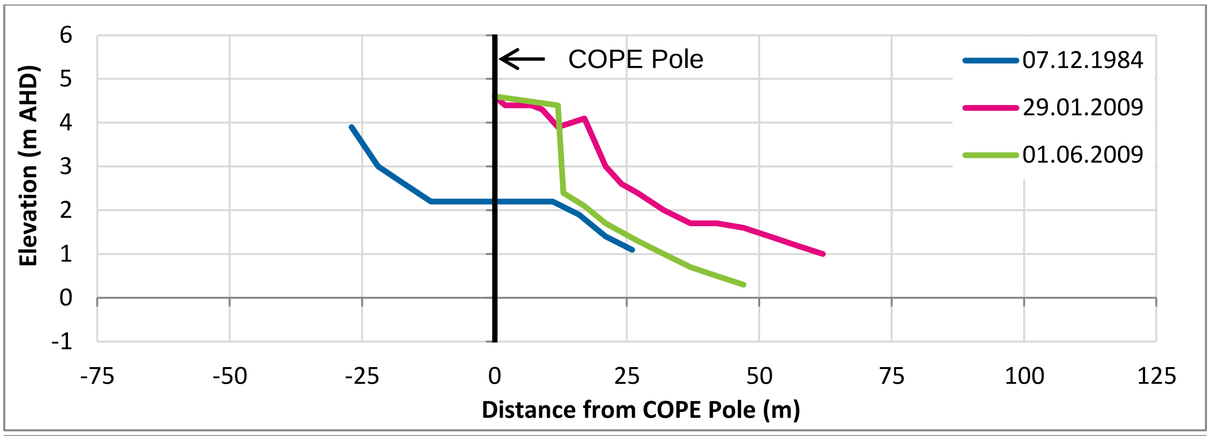


Figure 52

Monthly Beach Profiles – 2006 – 2007



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



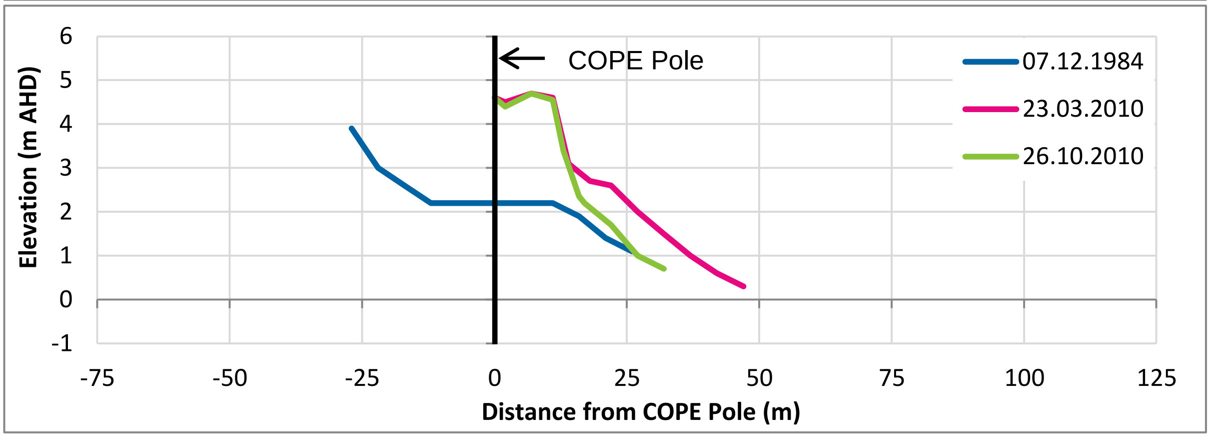


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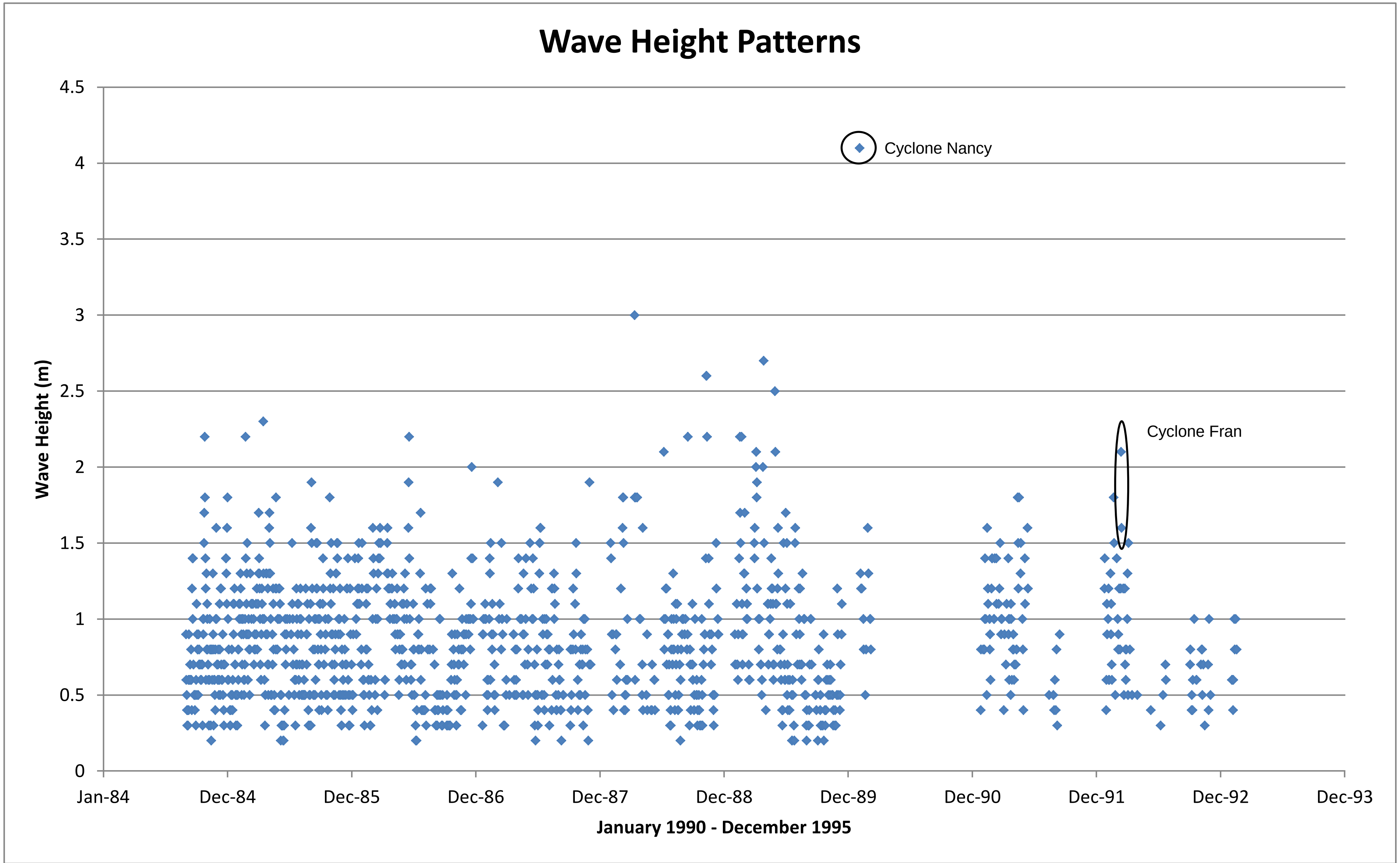
Figure 54

Monthly Beach Profiles – 2009 – 2010



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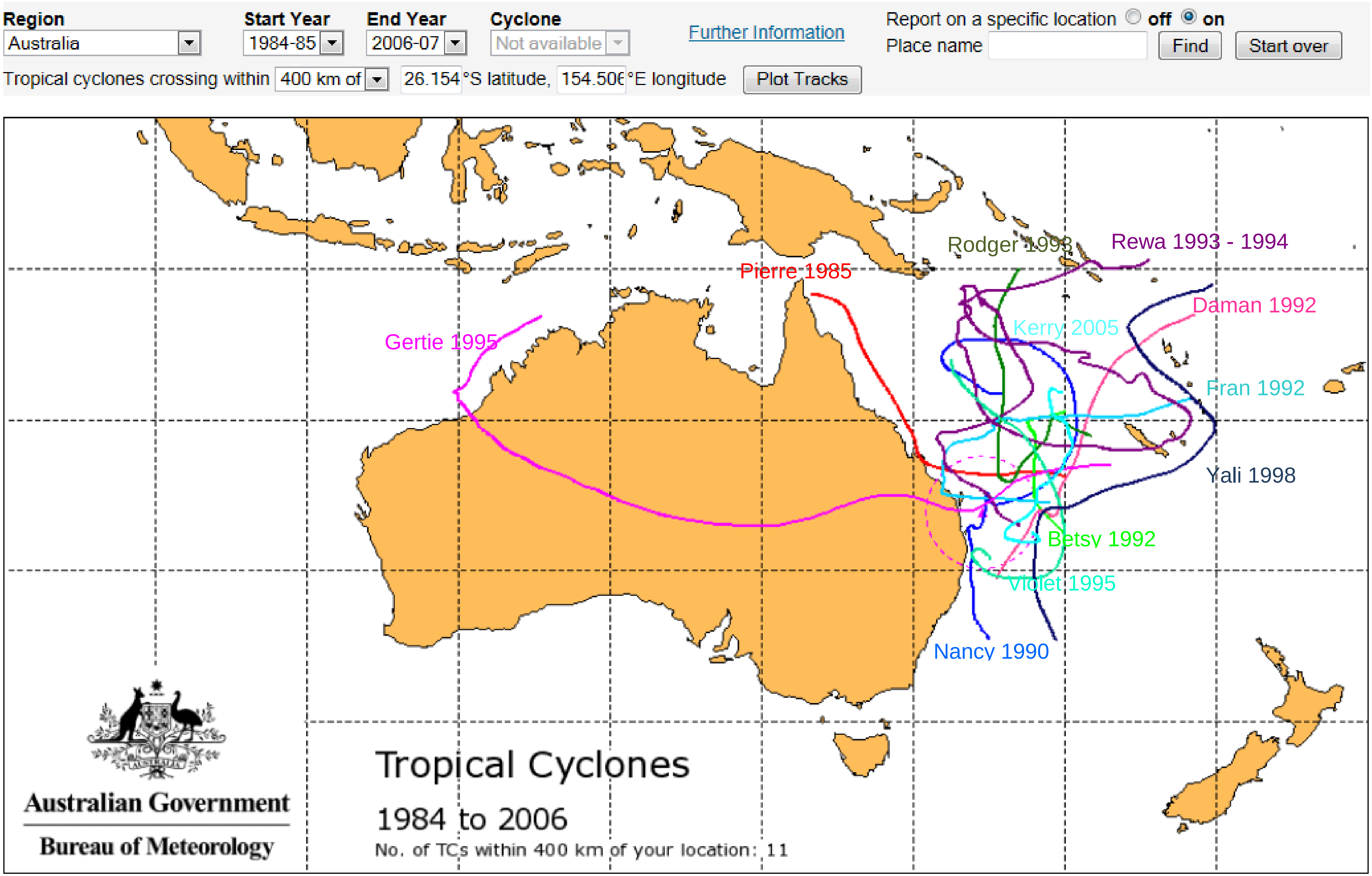
Wave Heights and Cyclone Influence

Figure 55



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Cyclone Tracks January 1984 – December 1993

Figure 56

Table 13: Amendments to Data:

Date	Parameter	Changed From	Changed To	Justification
24/11/1984	Foreshore Slope	0	2	A slope of 0 is unreasonable, new value was averaged from surrounding values
15/04/1985	Surf Zone Width	200	100	200 m surf zone seemed unreasonable
5/05/1985	Berm Distance	10	-10	Assume transcription error
26/05/1985	Berm Distance	19	-19	Assume transcription error
10/07/1986	Wave Period	23	12	23s period for waves with heights of 0.2m is unlikely, new value was averaged from waves with similar parameters
18/07/1986	Wave Direction	330	60	Wave direction of 330 degrees is just landward of parallel to the beach face
18/03/1987	Berm Distance	170	17	Surrounding data suggests that 170 is incorrect, assume transcription error
23/04/1987	Wind Speed	60	20	60 mph seemed unreasonable, new value was chosen from surrounding data
15/05/1987	Distance to Vegetation	-26	-20	Surrounding data is constant at -20, assume transcription error
14/07/1987	Wave Period	23.8	6.4	23.8s period seemed unreasonable, new value was averaged from waves with similar parameters
15/07/1987	Wave Period	21	6.4	21s period seemed unreasonable, new value was averaged from waves with similar parameters
04/08/1987	Wave Period	2.5	6.5	2.5s period seemed unreasonable,

				assume transcription error
07/09/1987	Wave Period	21	9	21s period seemed unreasonable, new value was averaged from waves with similar parameters
09/09/1987	Wave Period	19.3	9.3	19.3s period seemed unreasonable, assume transcription error
11/04/1988	Wave Period	2	20	2s period is unreasonable for waves with heights of 3m, assume transcription error
10/06/1988	Time	100	1000	Assume transcription error
13/03/1989	Distance to Vegetation	14	-14	Surrounding data is constant at -14, assume transcription error
15/02/1993	Wave Direction	180	80	Wave direction of 180 is just landward of parallel to the beach face, assume transcription error

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:

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

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.

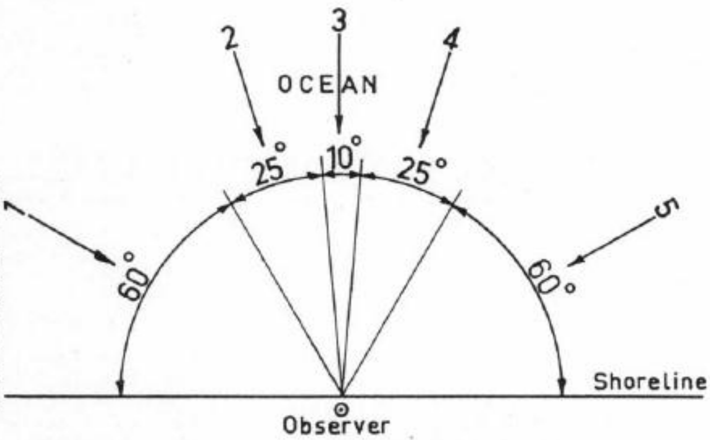
WAVE OBSERVATIONS:

(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

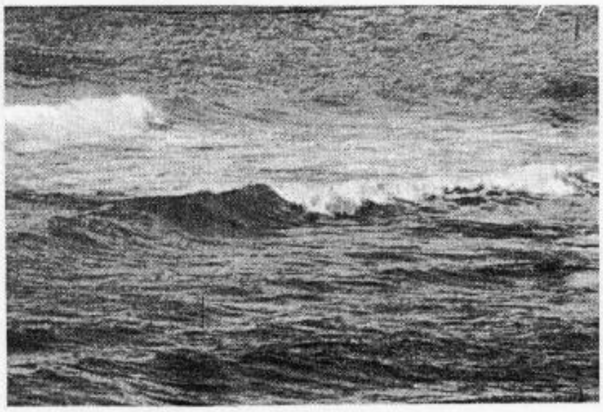


Fig. 3

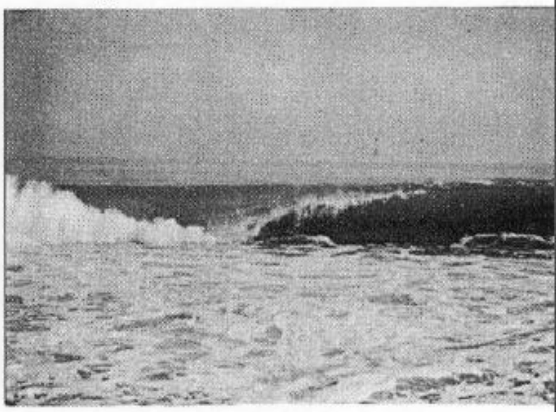


Fig. 4

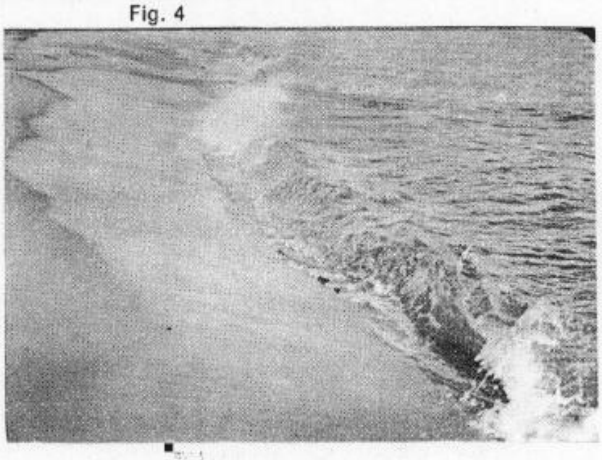
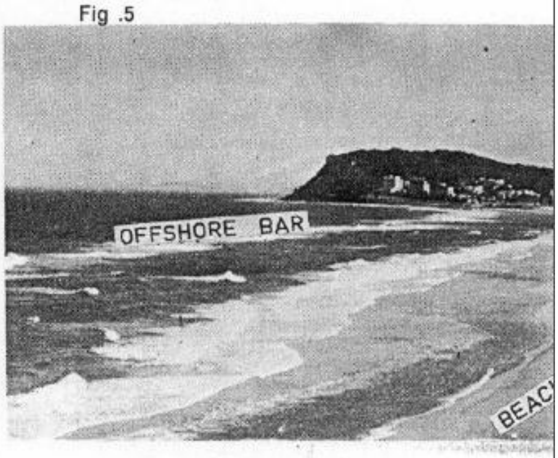


Fig .5



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.

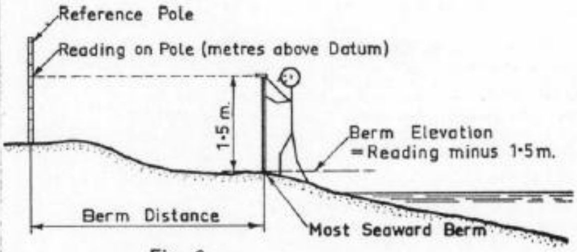


Fig. 6

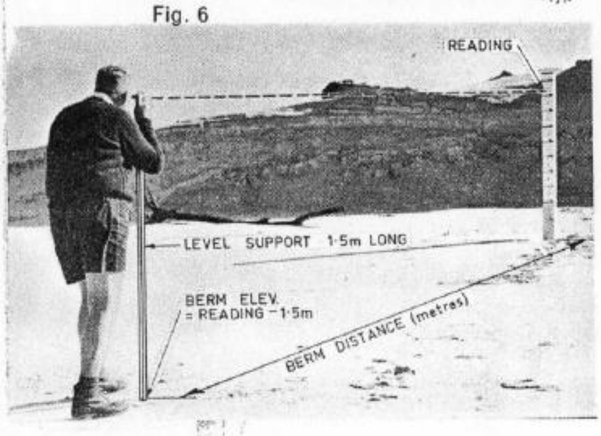


Fig. 7

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)