Scarborough Tide Gauge

Location

OS: 504898E 488622N

WGS84: *Latitude:* 54° 16.950' N *Longitude:* 00° 23.417' W

Instrument

Valeport 740 (Druck Pressure Transducer)

Benchmarks

Benchmark	Description

Benchmark *Description*

TGBM = 4.18m above Ordnance Datum Newlyn

Port BM on western slipway of inner harbour

504750.75E 488754.385N

TGZ = -2.52m above Ordnance Datum Newlyn

TGZ = 0.73m above Chart Datum

TGZ = 6.70m below TGBM

Datum

All data are to Ordnance Datum Newlyn. The height of Chart Datum relative to Ordnance Datum at Scarborough is -3.25m (Admiralty Tide Tables, Supplementary Table III).

Survey information

The site was surveyed on 13 June 2013, where the tide gauge offset was found to be 0.195m higher than on the previous survey in 2003. The datum appeared to have changed during the period 2006-2011.

Site characteristics

The pressure transducer is mounted in a stilling well in Scarborough harbour.

Data quality

Recovery rate (%)	Sample interval
47	10 minutes

Service history

The gauge was first deployed on 28 April 2003 and maintained until December 2005. Measurements continued, and full maintenance was resumed in 2011. The instrument is serviced at 9-month intervals.

Measurements

The pressure transducer samples at 4 Hz. Tidal elevations are derived, every 10 minutes, as the 40 second average of the 4 Hz readings. The time stamp is the start of the measuring burst. Although the time stamp is accurate, the instrument has to be started manually after servicing and it is not always possible to start exactly on a 10 minute integer. Measurements are interpolated to the hour and 10 minute intervals, if the original time series is not on the hour. Missing data exceeding 2 hours are not interpolated. All data measured prior to the gauge being fully surveyed were adjusted to the correct elevations, but it has proven difficult to establish where the datum changed occurred between 2006 and 2011. The highest values during these years are included in the Amax tables, since the date/times are valid, but the elevations should be used with caution.

Residuals and Elevations (OD and CD) for the whole year are shown in Figures 1 to 3 respectively.

Statistics   *All times GMT*

Month	Extreme maxima		Extreme minima	
	Elevation (OD)	Date/Time	Elevation (OD)	Date/Time
January	-	-	-	-
February	-	-	-	-
March	-	-	-	-
April	-	-	-	-
May	-	-	-	-
June	1.88	30-Jun-2019 14:10:00	-1.54	30-Jun-2019 20:40:00
July	2.83	06-Jul-2019 06:20:00	-2.18	04-Jul-2019 10:50:00
August	2.99	31-Aug-2019 04:10:00	-2.15	01-Aug-2019 10:30:00
September	3.40	29-Sep-2019 16:30:00	-2.20	14-Sep-2019 10:50:00
October	3.34	02-Oct-2019 06:10:00	-2.17	27-Oct-2019 09:00:00
November	2.76	14-Nov-2019 04:50:00	-1.96	30-Nov-2019 00:00:00
December	2.90	11-Dec-2019 03:00:00	-2.21	10-Dec-2019 09:20:00

Month	Surge maxima		Surge minima	
	Value (m)	Date/Time	Value (m)	Date/Time
January	-	-	-	-
February	-	-	-	-
March	-	-	-	-
April	-	-	-	-
May	-	-	-	-
June	0.15	30-Jun-2019 16:20:00	-0.36	27-Jun-2019 21:50:00
July	0.38	01-Jul-2019 17:30:00	-0.26	03-Jul-2019 00:10:00
August	0.34	17-Aug-2019 06:20:00	-0.25	16-Aug-2019 12:50:00
September	0.74	15-Sep-2019 13:20:00	-0.35	14-Sep-2019 11:50:00
October	0.47	08-Oct-2019 01:40:00	-0.56	07-Oct-2019 12:50:00
November	0.35	08-Nov-2019 00:10:00	-0.28	15-Nov-2019 13:30:00
December	1.00	09-Dec-2019 06:30:00	-1.12	10-Dec-2019 13:20:00

Month	Mean Level	
	No. of days	Elevation (OD)
January	-	-
February	-	-
March	-	-
April	-	-
May	-	-
June	5	0.091
July	30	0.307
August	31	0.393
September	30	0.465
October	27	0.530
November	25	0.431
December	30	0.503

Highest values in 2019				
Extreme			**Surge**	
Elevation (OD) *(Surge component)*	Date/Time	Value (m)	Date/Time	
3.40 *(0.50)*	29-Sep-2019 16:30:00	1.00	09-Dec-2019 06:30:00	
3.36 *(0.20)*	30-Sep-2019 04:50:00	0.85	09-Dec-2019 10:50:00	
3.34 *(0.35)*	02-Oct-2019 06:10:00	0.81	11-Dec-2019 00:30:00	
3.33 *(0.18)*	01-Oct-2019 05:30:00	0.74	15-Sep-2019 13:20:00	
3.33 *(0.30)*	29-Sep-2019 04:00:00	0.68	15-Sep-2019 14:00:00	
3.23 *(0.26)*	03-Sep-2019 06:40:00	0.67	20-Dec-2019 00:20:00	
3.22 *(0.34)*	30-Sep-2019 17:10:00	0.61	10-Dec-2019 23:30:00	
3.20 *(0.16)*	01-Sep-2019 05:00:00	0.60	15-Sep-2019 01:00:00	
3.19 *(0.71)*	15-Sep-2019 04:50:00	0.60	08-Dec-2019 20:00:00	
3.16 *(0.41)*	01-Oct-2019 18:00:00	0.55	21-Dec-2019 21:00:00	

Year	Annual extreme maxima		Annual surge maxima		Z_0 (OD)	Annual recovery rate
	Elevation (OD) *(Surge)*	Date/Time	Value (m)	Date/Time		
2003	3.05 *(-0.03)*	28-Sep-2003 05:10	1.13	21-Dec-2003 09:40	-	76%
2004	3.09 *(0.34)*	22-Feb-2004 17:10	0.96	18-Nov-2004 04:00	0.292	99%
2005	3.66 *(0.86)*	12-Jan-2005 17:20	1.18	20-Jan-2005 08:20	0.287	99%
2006*	3.30 *(0.17)*	30-Mar-2006 16:30	1.29	31-Oct-2006 15:40	-	77%
2007*	3.40 *(0.71)*	25-Nov-2007 04:00	1.60	08-Nov-2007 21:30	0.221	97%
2008*	3.05 *(0.16)*	09-Mar-2008 17:20	0.90	22-Feb-2008 02:10	-	65%
2009*	3.19 *(0.44)*	12-Jan-2009 16:50	1.15	18-Jan-2009 16:30	-	84%
2010*	3.21 *(0.05)*	11-Sep-2010 05:30	0.81	12-Nov-2010 04:20	-	82%
2011*	3.03 *(-0.14)*	21-Mar-2011 17:10	1.33	04-Feb-2011 11:00	-	80%
2012	2.94 *(0.06)*	17-Oct-2012 04:40	0.92	05-Jan-2012 16:40	-	70%
2013	4.39 *(1.66)*	05-Dec-2013 17:20	1.75	05-Dec-2013 15:50	0.186	98%
2014	3.40 *(0.51)*	04-Jan-2014 18:00	1.16	21-Oct-2014 20:20	-	88%
2015	3.29 *(0.29)*	21-Feb-2015 17:40	1.23	10-Jan-2015 17:30	-	98%
2016	3.13 *(0.17)*	17-Sep-2016 04:00	1.54	26-Dec-2016 21:20	-	100%
2017	3.43 *(0.79)*	13-Jan-2017 16:20	1.22	13-Jan-2017 10:50	-	100%
2018	3.27 *(0.26)*	12-Sep-2018 05:40	0.80	28-Jan-2018 05:20	-	82%
2019	3.40 *(0.50)*	29-Sep-2019 16:30	1.00	09-Dec-2019 06:30	-	47%

* Possible datum shift by up to -0.195m

Tidal levels		
Observation period	January 2013 – October 2014	
Tide Level	Elevation (OD)	Elevation (CD)
HAT	3.34	6.59
MHWS	2.52	5.77
MHWN	1.38	4.63
MLWN	-0.86	2.39
MLWS	-2.00	1.25
LAT	-3.02	0.23

General

The time series of 10 minute tidal elevations for one year is quality-checked in accordance with ESEAS guidelines, flagged and archived. The archived time series is continuous and monotonic, with missing data given as 9999. The missing data shown are days where the entire 24 hours of data are missing.

Monthly extreme maxima/minima are the maximum and minimum water levels from all measured data for that month. Monthly surge maxima/minima (residuals) are calculated in a similar manner from the time series of residuals. Residuals are derived as the measured tidal elevation minus the predicted tidal elevation.

The monthly Mean Level is calculated as the average of all readings for the given month. The annual Z_0 is the value of Mean Sea Level derived by the harmonic analysis of the year's data. These values should not be used for any purpose without consideration of the recovery rate.

Acknowledgements

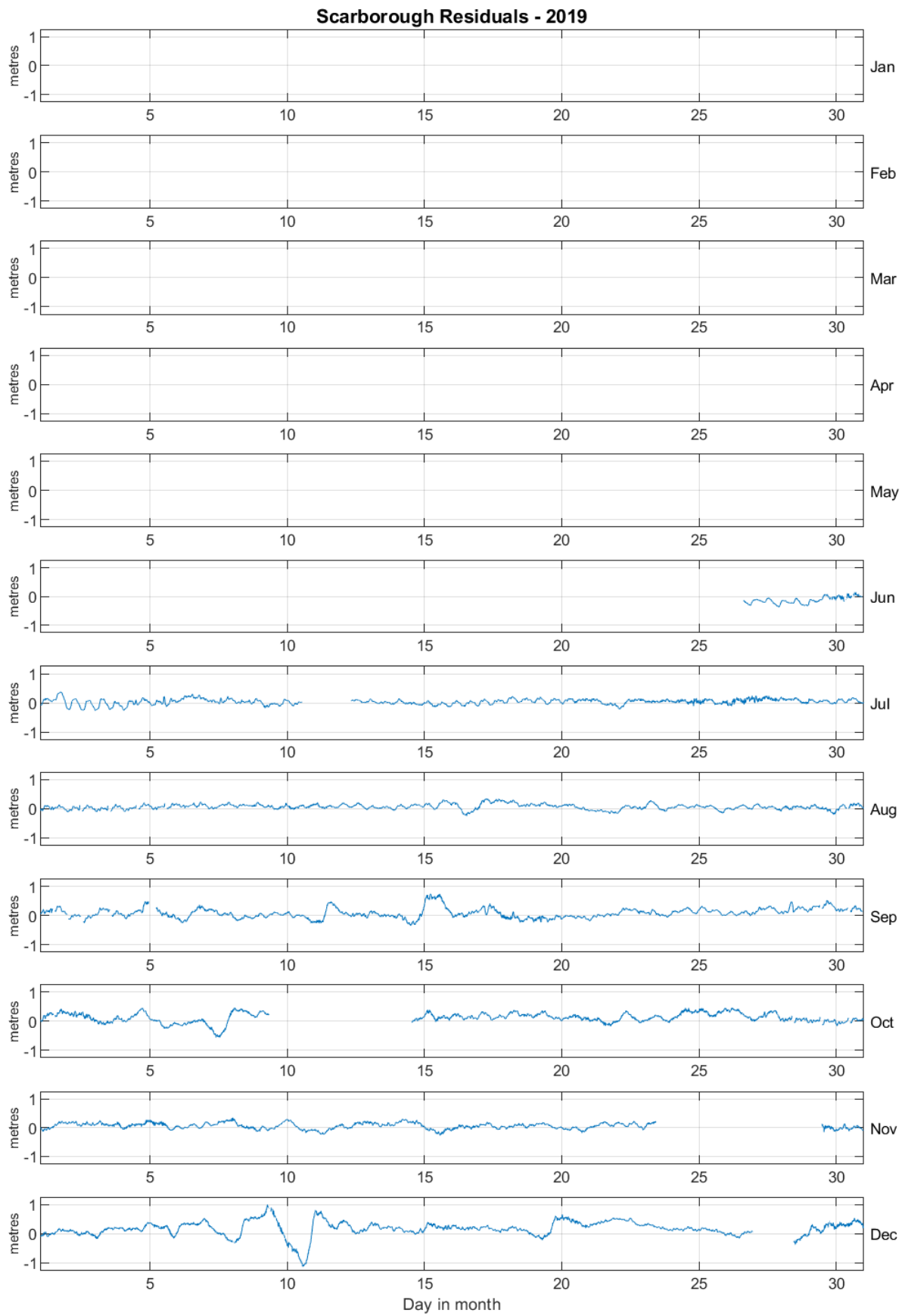Tidal predictions and tide levels were produced by Fugro GB Marine Limited.
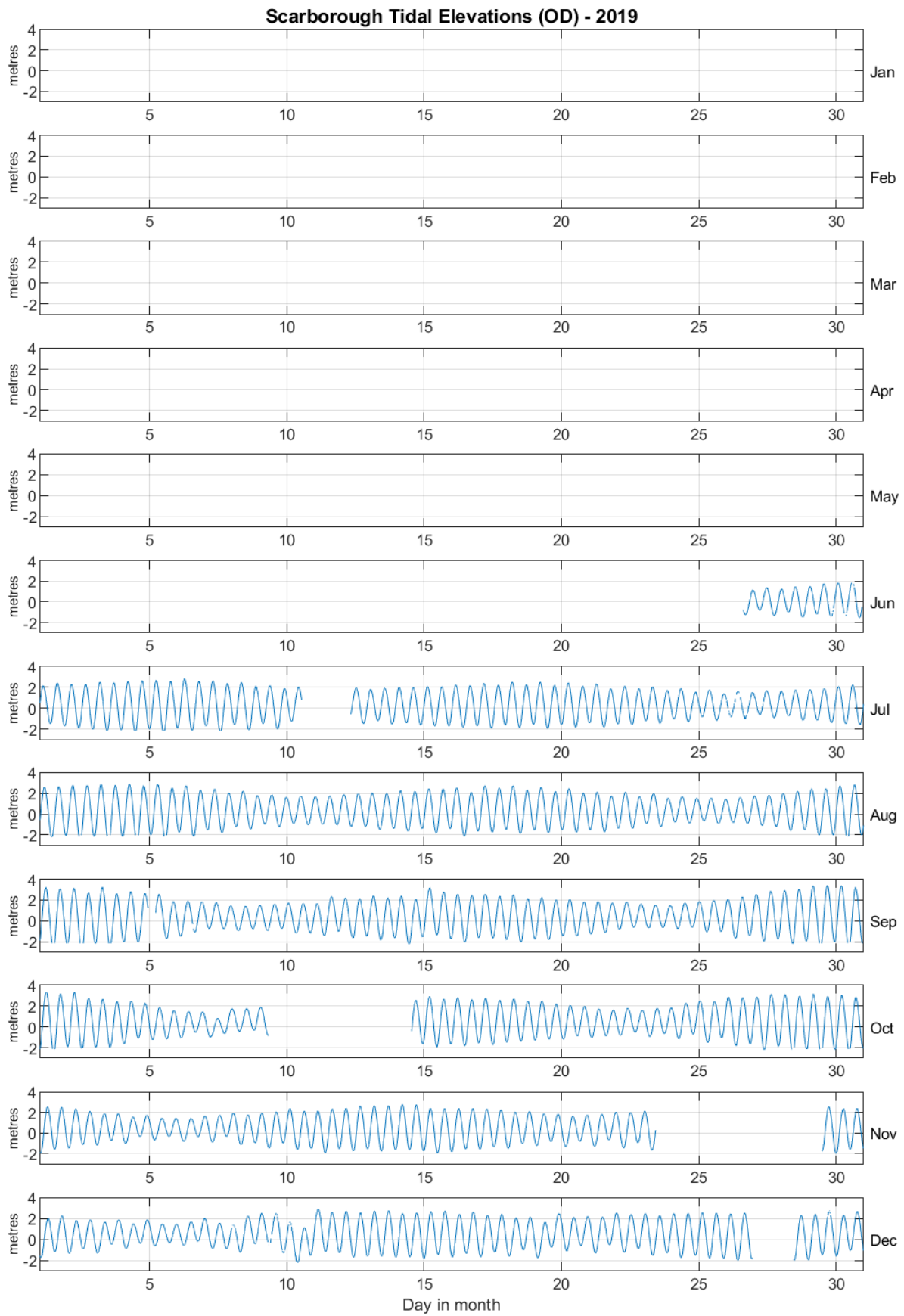
Figure 1: Scarborough residuals for 2019

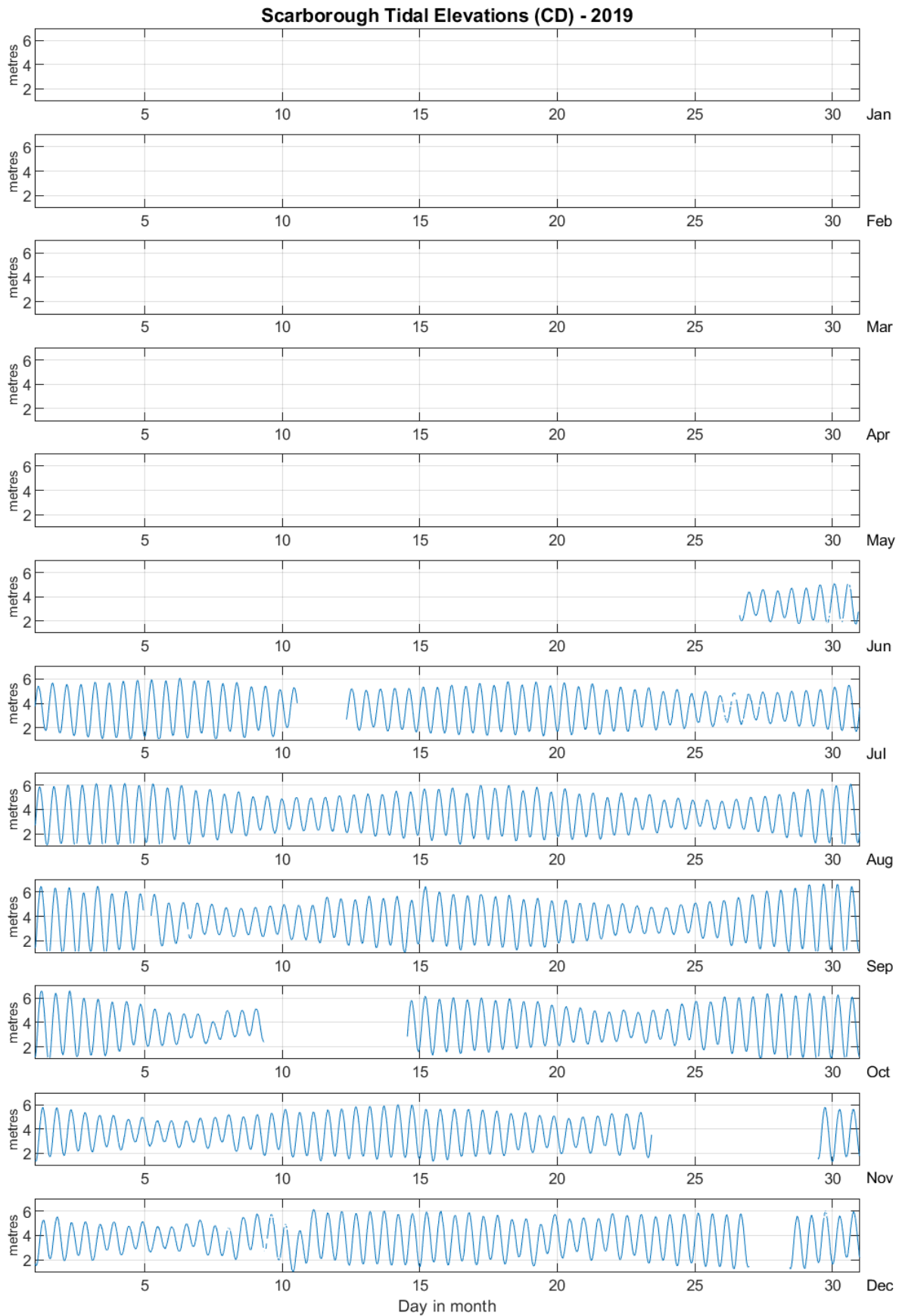**Figure 2:** Scarborough tidal elevations for 2019 relative to Ordnance Datum