

**NAME**

**mbm\_bpr** – MB-System macro to process data from a pressure sensor into a tidal model for use by **mbprocess**.

**VERSION**

Version 5.0

**SYNOPSIS**

```
mbm_bpr -Ibprfile -Otidefile [-Doffset -Fformat Rlon/lat Swindow -T -H -V]
```

**DESCRIPTION**

**mbm\_bpr** is a perl shellscript used to translate pressure data from a Bottom Pressure Recorder (BPR) into tidal data that can be used to correct swath bathymetry data. The user specifies an input BPR data file and the output path for the resulting tidefile.

The input data must be in a supported format. The \*.tid format produced by Seabird sensors such as the Seabird SBE53 is specified using **-F0**. The CSV files output by Sonardyne AMT units are specified using **-F1** if the AMT pressure data are in lines tagged with "PR2" and **-F1** if the AMT pressure data are in lines tagged with "PRS". Pressure data in the form of epoch time (seconds since the start of 1970) followed by pressure values in dbar can be processed by specifying **-F3**.

By default, the output tidefile will be in the form of a text file with two columns:

time\_d tide.

Here time\_d are time values in decimal epoch seconds (seconds since 1970 Jan 1 00:00:00) and the tide values are in meters. In this case, the tidefile is in format 1 as supported by **mbprocess**, so to make use of this tide data to correct swath bathymetry, use **mbset** as follows:

```
mbset -Idatalist.mb-1 -PTIDEFILE:tidefilename -PTIDEFORMAT:1
```

where datalist.mb-1 is the datalist referring to the data files to be processed. After using **mbset** to turn on tide correction, run **mbprocess**:

```
mbprocess -Idatalist.mb-1
```

If the **-T** option is specified, then the output file will have the form of:

year month day hour min sec tide

In this case, the tidefile is in format 2 as supported by **mbprocess**, so to make use of this tide data to correct swath bathymetry, use **mbset** as follows:

```
mbset -Idatalist.mb-1 -PTIDEFILE:tidefilename -PTIDEFORMAT:2
```

where datalist.mb-1 is the datalist referring to the data files to be processed. After using **mbset** to turn on tide correction, run **mbprocess**.

The macro **mbm\_bpr** calculates depth from pressure and latitude using the empirical formula for seawater in:

N. P. Fofonoff and R. C. Millard, Jr., Algorithms for computation of fundamental properties of seawater, Unesco Tech. Papers in Mar. Sci., No. 44 1983.

and then calculates tidal data as the difference between the observed depth and a vertical reference depth. If a location is supplied using the **-R** option, **mbm\_bpr** uses the latitude in the depth calculation and also extracts a tidal model corresponding to the BPR deployment site and timespan using the program **mbotps**. The vertical reference is then the average difference between the tidal model and the observed depths. If the user does not supply a location using the **-R** option, a location on the equator is assumed for the depth calculation and the vertical reference is the mean depth of the middle half of the depth time series (i.e. depths from 1/4 to 3/4 of the total time span). The user can specify an additional offset to apply to the tide data using the **-Doffset** option.

If the **-Swindow** option is used, then the calculated depth data will be smoothed using a boxcar window of

*window* seconds.

If the **-T** option is not used, then **mbm\_bpr** will also output a shellscript that will, if executed, generate a GMT postscript plot of the tide data output. If a location has been specified so that a tidal model was also generated, the model will be plotted with the tide data.

## MB-SYSTEM AUTHORSHIP

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## OPTIONS

**-D** *offset*

An offset to be added to the calculated tidal data, in meters. Default: *offset*=0.

**-F** *format*

This option specifies the format of the input BPR data. If *format*=0 then input data are in the \*.tid format produced by Seabird software from sensors such as the Seabird SBE53. If *format*=1 then input data are in a CSV file output by Sonardyne AMT units, and the pressure values used are in lines with the "PR2" tag. If *format*=2 then input data are in a CSV file output by Sonardyne AMT units, and the pressure values used are in lines with the "PRS" tag. Depending on Sonardyne software configurations, the specifics of the output are variable, particularly with regard to the representation of time. Both of the following variants are supported:

PRS,2019/03/15 04:15:00,2019/03/19 17:26:43,1,10943.021,0.00

PRS,5/20/2018 17:15,5/23/2018 21:48,1,7844.870605,0,,,

If *format*=3 then the input pressure data consist of epoch time (seconds since the start of 1970) followed by pressure values in dbar. Default: *format*=0.

**-H** This "help" flag cause the program to print out a description of its operation and then exit immediately.

**-I** *bprfile*

Input pressure data from the SBE53 pressure sensor in the Sea-Bird \*.tid format.

**-O** *tidefile*

Output tide data file path. The format of the tide data controlled by the use (or not) of the **-T** option.

**-R** *longitude/latitude*

Sets the location of the BPR deployment. Here *longitude* and *latitude* are in decimal degrees.

**-S** *window*

This option enables smoothing of the depth values calculated from BPR pressure using a boxcar window of *window* seconds. The number of samples that are averaged to generate each smoothed value depends on both the size of the window and the sampling interval.

**-T** Changes the tide data format output. The format of the tide data are normally in the form of a text file with two columns:

time\_d tide

where *time\_d* are time values in decimal epoch seconds (seconds since 1970 Jan 1 00:00:00) and the tide values are in meters. If the **-T** option is specified, then the output file will instead have the form of:

year month day hour min sec tide

**-V** Causes **mbm\_bpr** to operate in "verbose" mode so that it outputs more information than usual.

## Examples

Suppose one has deployed an SBE53 at 110 deg 40.92220'W 26deg 27.18960'N at about 1200 m depth. The Sea-Bird processing software outputs data in \*.tid files with output something like:

1	03/14/2012 16:27:21	99999.9999	20.2731
2	03/14/2012 16:28:21	99999.9999	20.2696
3	03/14/2012 16:29:21	99999.9999	20.2589
4	03/14/2012 16:30:21	99999.9999	20.2537
5	03/14/2012 16:31:21	99999.9999	20.2448
6	03/14/2012 16:32:21	99999.9999	20.2322
7	03/14/2012 16:33:21	99999.9999	20.2188
8	03/14/2012 16:34:21	99999.9999	20.2656
9	03/14/2012 16:35:21	99999.9999	20.3567
10	03/14/2012 16:36:21	99999.9999	20.4316
11	03/14/2012 16:37:21	99999.9999	20.4929
12	03/14/2012 16:38:21	99999.9999	20.5661
13	03/14/2012 16:39:21	99999.9999	20.6242
14	03/14/2012 16:40:21	99999.9999	20.6891
15	03/14/2012 16:41:21	99999.9999	20.7590
16	03/14/2012 16:42:21	99999.9999	19.8901
17	03/14/2012 16:43:21	99999.9999	18.1037
18	03/14/2012 16:44:21	99999.9999	17.2487
19	03/14/2012 16:45:21	99999.9999	15.9275
20	03/14/2012 16:46:21	99999.9999	14.7406
21	03/14/2012 16:47:21	99999.9999	13.7798
22	03/14/2012 16:48:21	99999.9999	13.0540
23	03/14/2012 16:49:21	99999.9999	12.3869
24	03/14/2012 16:50:21	99999.9999	11.8464
25	03/14/2012 16:51:21	99999.9999	11.1999
26	03/14/2012 16:52:21	528.8065	10.5061
27	03/14/2012 16:53:21	583.2633	9.9686
28	03/14/2012 16:54:21	637.7951	9.3547
29	03/14/2012 16:55:21	693.5947	8.8287
30	03/14/2012 16:56:21	748.5921	8.3998
31	03/14/2012 16:57:21	804.0302	8.0251
32	03/14/2012 16:58:21	859.5471	7.6560
33	03/14/2012 16:59:21	914.8043	7.3006
34	03/14/2012 17:00:21	969.7692	7.0322
35	03/14/2012 17:01:21	1023.0636	6.6673
36	03/14/2012 17:02:21	1077.7238	6.3327
37	03/14/2012 17:03:21	1132.0991	6.0528
38	03/14/2012 17:04:21	1186.9391	5.8203
39	03/14/2012 17:05:21	1241.4040	5.6089
40	03/14/2012 17:06:21	1295.6002	5.4167
41	03/14/2012 17:07:21	1350.1353	5.2188
42	03/14/2012 17:08:21	1404.8882	5.0195
43	03/14/2012 17:09:21	1460.2095	4.9215
44	03/14/2012 17:10:21	1514.6683	4.7630
45	03/14/2012 17:11:21	1568.9270	4.5651
46	03/14/2012 17:12:21	1623.3903	4.4452
47	03/14/2012 17:13:21	1678.6771	4.3075
48	03/14/2012 17:14:21	1733.7411	4.1910
49	03/14/2012 17:15:21	1789.1549	4.0284

```

50 03/14/2012 17:16:21 1844.5557 3.8760
51 03/14/2012 17:17:21 1869.8892 3.7976
52 03/14/2012 17:18:21 1869.8176 3.7534
53 03/14/2012 17:19:21 1869.8197 3.7088
54 03/14/2012 17:20:21 1869.8224 3.6828
55 03/14/2012 17:21:21 1869.8241 3.6682

```

where the third column is the pressure in dbar and the fourth column is temperature in degrees C. The pressure increases and the temperature decreases as the sensor sinks to the seafloor following deployment off a ship. Once the sensor is on the seafloor, pressure variations reflect the tides.

To extract a tidal model, use **mbm\_bpr** as follows:

```
mbm_bpr -I BPR.tid -OBPR.tde -R-110.682037/27.453160 -V
```

The output to the shell looks like:

```

Program Status:
1771 pressure values read from BPR.tid
Vertical reference to tidal model for position -110.682037 27.453160
Tide will be output as <time_d tide> values
A plot will be generated
Executing: mbotps -A1 -D1200 -R-110.682037/27.453160 -B2012/03/14/16/52/21
-E2012/03/15/22/22/21 -OBPR.tid_tidemodel.txt
Results are really in BPR.tid_tidemodel.txt
1690 pressure values output to BPR.tde
Vertical reference: 1267.31678290355 m
Executing mbm_xyplot -R1331743941.000000/1331850141.000000/-0.5071/0.5071
-IW0/0:0:BPR.tde -IW255/0:0:BPR.tid_tidemodel.txt -OBPR.tde_tideplot -L"Tide Data from BPR
<BPR.tde> (black) & Tide Model (red):Seconds:Tide (meters)" -V
Executing <BPR.tde_tideplot.cmd> also invokes gv to view the plot on the screen.

```

The output tidal data file BPR.tde has the form:

```

1331745441.000000 -0.0803109226781089
1331745501.000000 -0.129052283649798
1331745561.000000 -0.127622718432121
1331745621.000000 -0.125784706023751
1331745681.000000 -0.124627438960488
1331745741.000000 -0.123334022838208
1331745801.000000 -0.12285750111073
1331745861.000000 -0.121768308595847

```

where the first column is time in seconds since January 1, 1970 (epoch seconds, aka unix seconds, aka time\_d values within **MB-System**), and the second column is the tidal signal in meters. In this case the reference tidal model is provided by **mbotps**, and the plot created by running the output shellscript BPR.tde\_tideplot.cmd plots both the tidal data calculated by **mbm\_bpr** and the tidal model extracted using **mbotps**.

## SEE ALSO

**mbsystem(1)**, **mbprocess(1)**, **mbset(1)**

## REFERENCES

N. P. Fofonoff and R. C. Millard, Jr., Algorithms for computation of fundamental properties of seawater, Unesco Tech. Papers in Mar. Sci., No. 44 1983.

## BUGS

Lobsters, really.