

**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 **mbopts**. 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

**mbssystem(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.