NAME

mbm_bpr − MB−System macro to process data from a Seabird SBE53 pressure sensor into a tidal model for use by mbprocess.

VERSION

Version 5.0

SYNOPSIS

mbm_bpr −I*bprfile* **−O***tidefile* [**−D***offset* **R***lon/lat* **−T −H −V***]*

DESCRIPTION

mbm_bpr is a perl shellscript used to translate pressure data from a Seabird SBE53 pressure sensor used as 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 in the *.tid format produced by Seabird software and the output path for the resulting tidefile.

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 the to 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 **−D***offset* option.

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.

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OPTIONS

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

−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.