Processing Procedures

Given the data obtained from suppliers, there may be exceptions to each of the procedures noted below. If so, they will be indicated in the documentation.

As a preliminary step and in order to maintain the precision of the data, a pressure offset may be removed. For example, for the Drake Passage South deployment on 26/11/1993 at a depth of 1020m, an offset of 100 bars was subtracted from the data. Where such an offset has been removed, it will be described in the accompanying deployment metadata. It should be noted that the datum of pressure measurements is not maintained from one deployment to the next, since sensors generally are not redeployed at precisely the same location (Vassie et al., 1994).

For tsunameter data from the National Data Buoy Center (NDBC) (largely from the Deep-Ocean and Reporting of Tsunamis network), information regarding deployment and recovery dates is limited. Therefore, annual files of quality controlled data are initially concatenated for each station and plotted in order to identify the start and end times of each deployment. The data are segmented into individual deployment time series and processed in the same manner as other time series (described below). It should be noted that NDBC data have been processed to the end of 2013. Consequently, time series that end on 31/12/2013 should not be considered to have been recovered and relate to OBP recorders that remain in situ. For these sensors, time series will be updated annually with the latest 12 months' data.

Each record is initially quality controlled to check for outliers and possible timing problems. Quality control is undertaken using the BODC in-house screening software Edserplo, which allows the user to perform a preliminary tidal analysis, generating non-tidal residuals which are displayed graphically alongside temperature and pressure data, so that suspect data become more easily identifiable. Segments of suspect data or gaps of less than one hour's duration are interpolated, but longer durations are simply flagged as suspect. In regard to timing corrections, where the OBPR clock is known to have drifted, a time correction is applied linearly across the record. Alternatively, data may be time stamped at the end of an averaging period rather than at its centre or tidal analysis may reveal a potential timing error. In the latter two cases, the entire record is shifted in time by an appropriate amount. Once this initial quality control procedure has been passed, we generate "ACC" files (see file formats page) that contain the quality-controlled data at the original sampling. In these files, suspect or missing data are replaced by '-999.99'. These are typically only distributed if the data were collected by the National Oceanography Centre (or its predecessors) or the data are not available elsewhere.

To compute hourly values from data sets with disparate sampling, we first perform a least-squares tidal fit (tides at diurnal and shorter period only), and subtract the tide, before interpolating and averaging the residuals as necessary. We then restore the tide reconstructed at the hourly sampling points. Values are hourly averages, centred on 30 minutes past the hour.

Using time-averaged observations, as opposed to instantaneous measurements, can have an effect on the estimated tidal amplitudes. Thus, we correct for this effect where appropriate, and particularly in creating the hourly averages. Assume that a tide is a sine wave of period T, and our observation is a running average over period P, then the amplitude is reduced by a factor of sin(phi)/phi where phi=pi*P/T. As an example, if tide with a period of 6 hours is measured using 15 minute averages, then the amplitude from the tidal analysis should be multiplied by 1./[sin(phi)/phi]=1.00286 where phi=pi/24 (24 lots of 15 minutes in 6 hours) to gain the true amplitude. To produce the hourly tidal amplitudes, the true amplitude should be multiplied sin(phi)/phi=0.9549297 where phi=pi/6 (6 hours per period). These adjustments are also represented in the tidal constituents file as observed amplitude, true amplitude, and new (hourly) amplitude. If the time series consists only spot (i.e. non-averaged) measurements, then the observed amplitude and true amplitude will be identical.

Since OBPRs commonly undergo sensor drift and adjustment after deployment, a trend is removed for each deployment time series following Watts and Kontoyiannis (exponential plus linear trend, see reference below). Data files of hourly mean pressures (see file formats page) are then produced containing 1) the hourly data, including tides and drift, 2) the residual after removing tide and drift, 3) the tide that was removed, 4) the drift that was removed, plus a flag to indicate whether the residual pressure for that hour is produced by interpolation (no good data in that hour) and a time stamp.

Daily mean values are constructed from the hourly residual time series after removal of diurnal and shorter period tides by averaging of 24 hourly values, from 00:30 to 23:30 on each day. They are supplied both inclusive and exclusive of sensor drift, together with the number of hourly values used to calculate the mean pressure for each hour, plus an interpolation flag and a time stamp. While this choice of a simple arithmetic average of the residuals differs from the normal usage of a "daily" value in tidal studies, where some tidal filter would be applied, we believe that this will make it simpler to compare model results that have not been similarly filtered. For both hourly and daily mean values, suspect or missing data are replaced by '-999.999'.

Reference:

Watts, D. R., and Kontoyiannis, H. Deep-ocean bottom pressure measurement: Drift removal and performance. J. Atm. Oceanic Tech. 7, 296-306 (1990).
Foreman, M.G.G, Manual for Tidal Heights Analysis and Prediction, IOS (Canada), 1977.
Vassie, J.M., Harrison, A.J., Woodworth, P.L., Harangozo, S.A., Smithson, M.J., On the temporal variability of the transport between Amsterdam and Kerguelen Islands, JGR, 99(C1). 937-949 (1994).