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Figure 1: Location of UK tide gauges

The UK Tide Gauge Network (UKTGN) was set up as a result of severe flooding along the east coast of England in 1953 and is funded by the Environment Agency (EA). The UKTGN is part of the National Tidal & Sea Level Facility (NTSLF). The NTSLF is hosted by the Proudman Oceanographic Laboratory (POL) and is a consortium consisting of:

- POL science groups
- British Oceanographic Data Centre (BODC)
- UK Tide Gauge Inspectorate
- POL Applications Group

The network comprises 45 gauges (see Figure 1). Most are related through the national levelling network to Ordnance Datum Newlyn. Data are collected, processed and banked centrally to provide long time series of reliable and accurate sea levels. The data are used for tidal analysis and prediction, oceanographic research, coastal defence and storm surge warning systems.

Part of BODC's remit is to quality control and make available to users, the historical digital data we hold for the UK Tide Gauge Network. Between October 2002 and July 2004, over 700 site years of tide gauge data, from January 1980 to April 2004, were screened and made available to download from the NTSLF website.

The data were converted into the modern BODC internal format and then screened using our in-house developed software, Edteva. Each site year was screened alongside a tidal analysis, which was used to calculate a residual, also displayed on screen. Any spikes, unreasonable data values and timing errors were flagged with a 'bad data' flag. In some cases, where adequate information was available, the timing errors were corrected (see Figure 2).

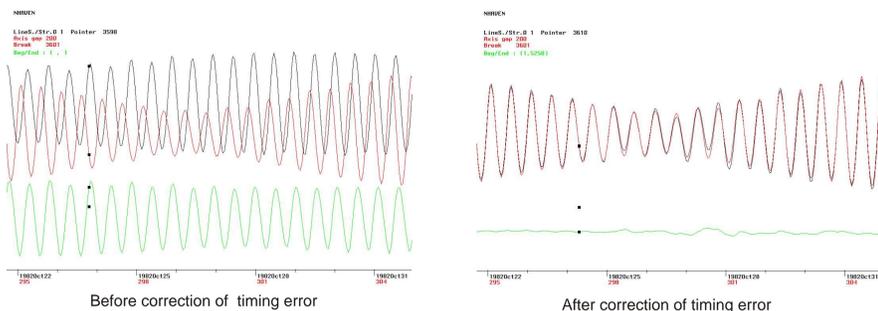


Figure 2 Timing error shown for the port of Newhaven, Wales, 1982.

Key
— Observed values
— Tidal analysis
— Calculated residuals

The data were also screened with data from neighbouring sites, where available, in order to confirm if unusual data were actually bad data or real events. If there was documentation available from when the data were collected, this was consulted to see if there were any mention of instrument failure or processing problems.

All the data were required to be measured relative to Admiralty Chart Datum (ACD), which is approximately the level of Lowest Astronomical Tide (LAT). The older data were often measured relative to Ordnance Datum Newlyn (ODN), or a local tide gauge benchmark. A datum shift was applied to those time series in order to correct to ACD (Figure 3). The value to apply for the shift was obtained from written records and datum diagrams (Figure 4), that displayed the benchmark and datum relationships.

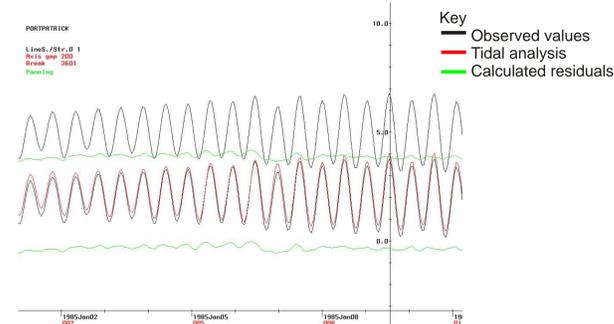


Figure 3: Datum shift applied to data from Portpatrick, 1985.

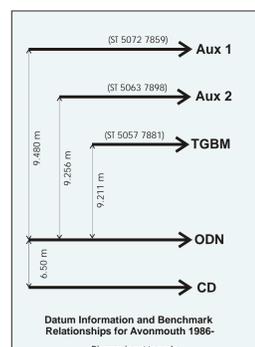


Figure 4: Example of a datum diagram, for Avonmouth, 1986

In the past, the location of tide gauges has changed, for instance when a pier has been demolished. Different benchmarks may have been used, and as new technology became available, the tide gauge instrumentation and data loggers have altered. All this information had to be recorded in the documentation that accompanies the data (see Figure 5). There was close liaison between BODC and the Tide Gauge Inspectorate to go through the records we both held, in order to ensure that the right metadata i.e. latitude and longitude of the tide gauge and type of gauge, was stored with the data.

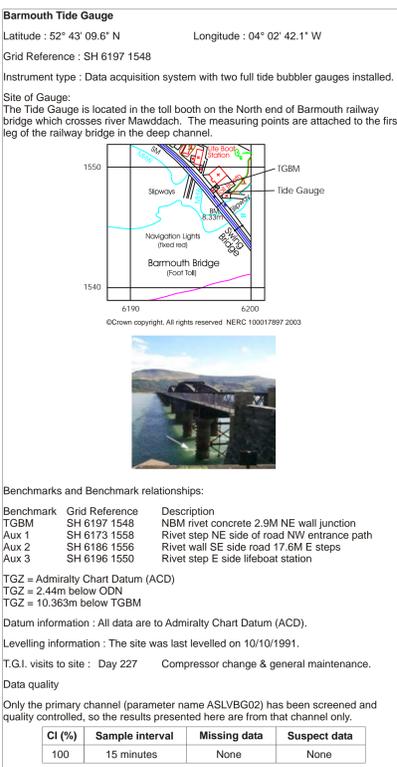


Figure 5: Example of the documentation that accompanies tide gauge data.

To make the data ready for the web, the files were converted into ASCII format (see Figure 6). The 15 minute interval data were interpolated so that the data values fell exactly on the quarter hour. All gaps were filled with null values and given associated null flags.

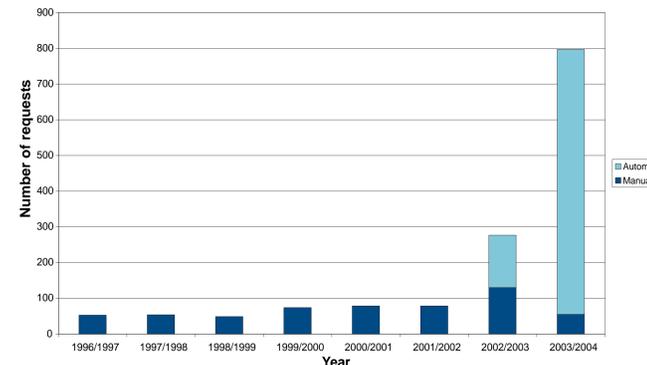
The header information was automatically taken from our database, then the files were placed on the NTSLF website, for users to download.

Figure 6: Example of downloaded ASCII data file

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Port: P024
Site: Lowestoft
Latitude: 52.4820
Longitude: 1.7516
Start Date: 01JUL2004-00.00.00
End Date: 31JUL2004-23.45.00
Contributor: Proudman Oceanographic Laboratory
Datum information: The data refer to Admiralty Chart Datum (ACD)
Parameter code: ASLVBG02 = Sea level, Bubbler tide gauge (second sensor)
Cycle Date Time ASLVBG02 Residual
Number yyyy mm dd hh mi ssf £ £
1) 2004/07/01 00:00:00 1.0470 0.0683
2) 2004/07/01 00:15:00 0.9790 0.0810
3) 2004/07/01 00:30:00 0.9250 0.1032
4) 2004/07/01 00:45:00 0.8750 0.1225
5) 2004/07/01 01:00:00 0.8300 0.1372
6) 2004/07/01 01:15:00 0.7980 0.1424
7) 2004/07/01 01:30:00 0.7670 0.1536
8) 2004/07/01 01:45:00 0.7530 0.1545
9) 2004/07/01 02:00:00 0.7660 0.1630
10) 2004/07/01 02:15:00 0.8060 0.1775
    
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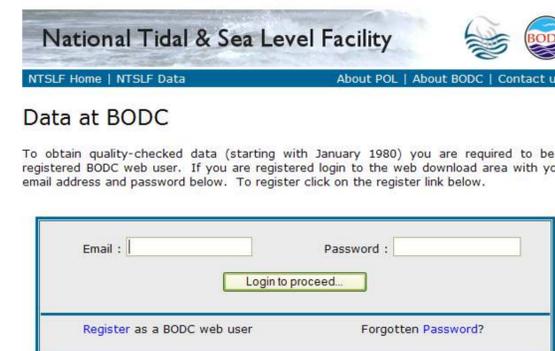
Figure 8: Tide gauge data requests serviced over the past 8 years



Commercial users (who make up 30% of the requests) are downloading the data to assimilate into and validate their models, and use in the planning and development of wind farms and harbours which contributes to wealth generation for the UK economy, university students (28% of requests) are incorporating the data into their BSc, MSc and PhD theses, local government workers (15%) have used the data in flood assessments and the design of sea defences, 13% of requests come from outside the UK, private individuals (10%) are downloading the data to see if their houses are at risk from flooding and 4% of the requests come from within NERC. It is important that we produce a high quality dataset.

Data from our gauges are used in the UK Met office storm surge model and results are transmitted to the Environment Agency to produce coastal flood warnings in England and Wales. Data from the tide gauges along the East coast of the UK are used in determining whether or not to close the Thames Barrier, when there is a storm surge, which provides flood defence for London and surrounding areas. There is great economic importance in us providing accurate data, as a lot of money is invested in areas where the data are used.

The historical datasets are an unprecedented resource of quality controlled UK sea level data and are valuable to climate change scientists looking for long records and modellers looking for large datasets.



Data prior to January 1980 or collected within the last 3 months may be requested elsewhere.

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Figure 7: Login screen to obtain data from the NTSLF

In order to access the data, users have to register with BODC. This helps us to keep track of who is downloading the data and how they are being used.

Since the NTSLF data became freely available to download from our web site in October 2002, UK tide gauge data requests have gone up from on average 70 requests per year to 800, in the period April 2003 to March 2004. There are over 600 users registered on the system.

The notional economic value (the revenue from the data had we charged for it) of tide gauge data distributed in 2001/2002 was £80k and in 2003/2004 when the data were available to download, the notional economic value of the data supplied had increased to £3.7 million.

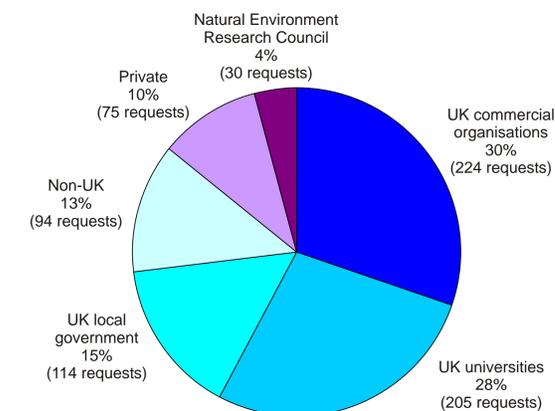


Figure 9: Source of requests for April 2003 to March 2004