

# A twice-daily barometric pressure record from Durham Observatory in north-east England, 1843-1960

Stephen D. Burt

Department of Meteorology  
University of Reading, UK

ORCID 0000-0002-5125-6546

## Background

A twice-daily record of barometric pressure exists for Durham Observatory (54.768 °N, 1.584 °W, barometer cistern 107.3 m above mean sea level, MSL) from 23 July 1843 to 31 December 1960. The Durham record, which is 98.7% complete, is by far the longest digital barometric pressure series in northern England, and fills a very large temporal and spatial gap in the International Surface Pressure Database (ISPD: Cram et al, 2015). In what is believed to be the first study of its kind, the record has been independently quality-controlled against the NOAA–CIRES–DOE Twentieth Century Reanalysis version 3 (20CRv3; Slivinski et al, 2019, 2020), which did not include the Durham records in its assimilation set.

## Digitisation of the record

Most of the original manuscript meteorological records from Durham Observatory have been retained, either in the Department of Geography or in the Durham University library. An initiative funded by the Leverhulme Trust saw many of the manuscript instrumental records from 1850 to 1997 digitised (Kenworthy et al, 1997), including the barometric pressure records which terminated after December 1960, although until recently knowledge of this dataset remained almost entirely limited to Durham University. The remaining early records, from July 1843 to December 1849, were digitised by the author and Tim Burt in 2021.

The digital dataset is available online at <http://dx.doi.org/10.17864/1947.328>

Details of the dataset follow. This dataset is made available under **Creative Commons Attribution 4.0 licence** <https://creativecommons.org/licenses/by/4.0/>. If you use the data, please include a citation as follows:

Burt, Stephen (2021): A twice-daily barometric pressure record from Durham Observatory in north-east England, 1843-1960. University of Reading.  
Dataset. <http://dx.doi.org/10.17864/1947.328>

A full description of the instruments used and their exposure, the sources of the record, digitisation work undertaken to generate the digital time series (including quality control methods), and reduction to mean sea level pressure from station level observations can be found in either of the two following publications:

Burt, Stephen, *Accepted paper*: Twice-daily barometric pressure observations from Durham Observatory in north-east England, 1843-1960. *Geoscience Data Journal*, Special Issue on Locating, Imaging and Digitizing Historic Geoscience Data, expected to be published in October 2021

Appendix 5 in *Durham Weather and Climate since 1841*, by Tim Burt and Stephen Burt, to be published by Oxford University Press in Spring 2022.

**Key words:** Durham Observatory, barometric pressure series, reanalysis, quality control, 20CRv3

## References

Cram, T. A., G. P. Compo, X. Yin *et al*, 2015: The International Surface Pressure Databank version 2. *Geoscience Data Journal*, **2**, 31-46.

Kenworthy, J. M., N. J. Cox and A. N. Joyce, 1997: *Computerisation and analysis of the Durham Observatory meteorological record: Final Report to the Leverhulme Trust, Reference F/128/Q*. Durham University.

## The Durham observatory digital pressure record

The entire Durham twice-daily pressure dataset 1843-1960 is available as a Comma Separated Variable (.csv) format file at the doi listed above. The file size is 8 MB.

The contents of the file are listed below, with this file as a ReadMe document (txt or PDF) within the same folder.

Three options are available for the Durham MSLP series – the ‘raw’ (as observed) record, including gaps where they occur; the corrected (post QC) record, including gaps; and a corrected (post QC) record, where gaps have been filled using the 20CRv3 gridpoint data +0.5 hPa to provide an unbroken series. Gaps in the record amount to 1.3% of the record and corrections to just 0.4%. Full details are given in the GDJ paper.

## Dataset details of the twice-daily Durham Observatory digital pressure series 1843-1960.

Column header Cell contents

**YYYY MM DD** Date as YYYY MM DD character string (two entries per day)

**YYYY MM DD HHmm** Date and time as YYYY MM DD HHmm character string (one entry per observation)

**DD** Date in month (1-31)

**MM** Month (1-12)

**YYYY** Year (1843-1960)

**HHmm** Observation hour HHmm – mostly 0900 or 2100, GMT from Oct 1885

**Missing** Flag: Barometer ‘as Read’ reading missing = 1, else 0

**AsRead\_inHg** Barometer ‘as read’ in inches of mercury (inHg) to November 1948, blank thereafter. This is the barometer reading as observed and digitised and includes numerous errors

**AsRead\_hPa** Barometer ‘as read’ in millibars (mbar or hPa) throughout – inHg converted by x 33.86388. This is the barometer reading as observed and digitised and includes numerous errors

**AttTherm\_C** Barometer ‘attached thermometer’ in degrees Celsius – converted from °F as necessary. This is the thermometer reading as observed and digitised and includes some errors, particularly from 1949-60

**SLP\_hPa** Station level pressure – barometer as read reduced to 0 °C using the attached thermometer reading (see text for details) corrected for known or suspected errors

**Tdry\_C** Observed external air temperature (dry bulb in screen) in degrees Celsius. Some are missing; estimates were made using neighbouring values or, occasionally, monthly means over several years

**MSLP\_RAW\_hPa** Calculated MSL pressure in millibars (hPa). For MSL calculation details, see GDJ paper. This is the RAW value calculated from the observed As Read and Attached Thermometer with dry bulb temperature, prior to quality control

**MSLP\_QC\_hPa** Calculated MSL pressure in millibars (hPa). This is the CORRECTED value, post quality control (see text for QC details), based upon the SLP\_hPa value

**MSLP\_QC\_hPa\_gapfilled** Calculated MSL pressure in millibars (hPa). This is the CORRECTED value, post quality control (see text for QC details) with gaps filled by using the 20CRv3 reanalysis ensemble mean gridpoint value for 55 °N, 2 °W for the observation date/time +0.5 hPa; this provides for a complete series without any gaps.

**MSLP\_20CRv3\_hPa** Reanalysis 20CRv3 ensemble mean gridpoint value for 55 °N, 2 °W for the observation date/time, or nearest available 3h point. See text for sources. On average, this is about 0.5 hPa lower than the value expected in Durham as a result of the climatological decrease in pressure northwards, but obviously this will vary with pressure gradient and isobar orientation.

Missing data are shown blank (empty cell), but note that there are no missing cells in the date/time headers, for the 20CRv3 ensemble mean gridpoint value or for the gapfilled pressure series.