1. **ABOUT THE DATASET**

**Title: Eskdalemuir Observatory monthly mean Potential Gradient 1911-1981**

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**Description:** Measurements of atmospheric electricity, specifically the Potential Gradient (PG), are relatively rare but have occasionally been made at some sites, such as meteorological or geomagnetic observatories. A long series of twentieth century PG measurements exists from Eskdalemuir Observatory in Scotland, which was obtained between 1911 and 1981. This archive provides the mean monthly values of the Eskdalemuir PG derived from hourly measurements.

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**Related publications:** Harrison (2007, 2003, 2004)

1. **TERMS OF USE**

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1. **PROJECT AND FUNDING INFORMATION**

This dataset contains atmospheric Potential Gradient (PG) data from Eskdalemuir Observatory, Scotland. The measurements were originally obtained by the Met Office.

These data were recovered and keyed as part of ongoing atmospheric electricity research by Prof Giles Harrison in the Department of Meteorology, University of Reading, during the past twenty years. No external project funding has been received.

Measured values were originally recorded on daily and monthly summary sheets, which were then published annually by the Met Office in *The Observatories’ Year Book* (OYB). The last year of the OYB’s publication was 1967, after which the data values continued to be published, by the Hydrological Service of the USSR. The observatory summary sheets from the post-OYB period are stored in the National Meteorological Library and Archive, which continued to 1981 when the measurements ceased. For long term preservation, these summary sheets were scanned by the Hadley Centre of the Met Office in 2003, with supervision from Prof Harrison: the scanning only generated images for preservation purposes, and the data values were not keyed. Scanned images of the OYB have subsequently also been made by the British Geological Survey (BGS) at <http://www.geomag.bgs.ac.uk/data_service/data/yearbooks/esk.html> .

Since then, data values from the OYB and electrograms have been keyed in from time to time by Prof Harrison with various collaborators and students, most notably Dr Keri Nicoll. This has been an entirely ad hoc activity. The scrutiny applied by different individuals at different times has helped identify erroneous values, which have been removed: other incorrect values will no doubt remain. Further, where possible, averages which were provided in the original tabulations have been recalculated as a check on the OYB tabulated values. Where discrepancies persisted after such checking, the final values as originally published in the relevant OYB have been retained in the data submission.

1. **CONTENTS**

This data submission contains monthly mean values of the Potential Gradient (PG) made in undisturbed and slightly disturbed conditions at Eskdalemuir Observatory. Eskdalemuir is in Dumfriesshire, Scotland, with the nearest towns Langholm and Lockerbie. Fig1 shows the location in the UK, with the positions marked of the other observatories where atmospheric electricity measurements were also made (Harrison, 2003).

A map of the united kingdom

Description automatically generated

Figure 1. Map showing the position of Eskdalemuir. (The two further atmospheric electricity monitoring sites at Lerwick and Kew are also marked).

At Eskdalemuir, the atmospheric Potential Gradient (PG) measurements began soon after the Observatory opened, using a Kelvin water dropper electrograph (Aplin and Harrison, 2013). The sensor was changed to a radioactive probe in Feb 1936.

The PG is a measure of the vertical fair weather electric field in the atmosphere. It is determined from the potential gradient at 1 m above the surface over open, flat ground, with units of volts per metre (Vm-1). In fair weather the PG is positive, and typically 100 Vm-1 to 150 Vm-1. If the measurements are not made in such well-exposed conditions, a suitable correction (sometimes known as the *reduction factor* or even just *factor*) is applied. Principles and methods of PG measurement are given in Harrison & Bennett, (2022). A discussion of the PG measurements at Eskdalemuir Observatory is given in (Harrison, 2004). Further electrical properties of the air at the site were also occasionally measured, notably in the early period of the data by one of the first superintendents, Lewis Fry Richardson (Harrison, 2007) .

The data provided were originally organised and classified by the “daily character method”, as 0a, 1a or 2a. These codes denoted: 0 - a day (midnight to midnight) with no negative PG recorded, 1 - a day with negative PG excursions totalling less than three hours, 2 - a day with negative PG totalling more than three hours. In any of the hourly periods of the day, the letter *a* signifies that the PG range did not exceed 1000 Vm‑1. In the earlier period, the mean monthly values were derived from measurements on days on which the data fulfilled the daily character criteria, and in the later period, from hours during which the meteorological conditions were either, those of no precipitation (i.e. without rain, snow or hail), described as “no hydrometeors”, or, more demandingly, entirely fair weather. In the early period, the mean monthly values were derived from measurements on days on which the data fulfilled the daily character criteria, and in the later period, from hours during which the meteorological conditions were either those of fair weather, or without rain, snow or hail (“no hydrometeors”). A discussion of the criteria for fair weather in atmospheric electricity is given in Harrison and Nicoll, (2018).

The monthly mean values transcribed from the original Eskdalemuir data tabulations are provided in the data submission. There are two data files:

|  |  |
| --- | --- |
| Filename | Contents |
| **EskMonthlyMeanPG\_0aFW.csv** | Monthly mean PG values from 1911 to 1981 obtained in undisturbed (1981 to 1963) and fair weather (1964-1981) conditions. |
| **EskMonthlyMeanPG\_1a2aNH.csv** | Monthly mean PG values from 1911 to 1981 obtained in slightly disturbed (1911 to 1956) and no hydrometeor (1957-1981) conditions. |

Both files are plain ascii text files, with each line of data values in columns running from left to right, comma separated. The files are organised as described in Table 1. Both have six header lines. Missing values are left blank.

**Table 1. Eskdalemuir monthly mean PG data**

|  |  |  |  |
| --- | --- | --- | --- |
| Column number | Quantity | Description | unit |
| 1 | Year | Time variable (value runs from 1911 to 1981) | GMT |
| 2:13 | PG | Monthly mean PG (using day classification) | Vm-1 |
| 14:25 | PG | Monthly mean PG (using hourly weather classification) | Vm-1 |

1. **DATA SOURCES**

Values were keyed from the OYB except for:

-1911 values. Obtained from Dobson, (1914).

-1922, 1967-1981. Electrogram monthly summary sheets.

1. **REFERENCES**

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