

Guide to the acquisition and management of meteorological precipitation data

Part 2. Field practices and data management

Section 2.3 Data management

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee CPL/113, Flow measurement of surface and ground water, upon which the following bodies were represented:

- British Waterways Board
- Clyde River Purification Board
- Department of the Environment
- Institute of Measurement and Control
- Institution of Civil Engineers
- Institution of Water and Environmental Management
- National Rivers Authority
- Water Services Association of England and Wales

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Forth River Purification Board
- Imperial College, London
- Institute of Hydrology
- Meteorological Office

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Foreword

This Section of BS 7843 has been prepared by Technical Committee CPL/113. BS 7843 is a new publication and no other standard has been superseded or withdrawn.

This Section is one of a series of related publications on the acquisition and management of meteorological precipitation data, the overall structure of which is as follows:

Part 1. *Network design*

Section 1.1 *The user requirement for precipitation data*

Section 1.2 *Network design and monitoring*

Part 2. *Field practices and data management*

Section 2.1 *Technical aspects in the field*

Section 2.2 *Methods of observation and data tabulation*

Section 2.3 *Data management*

Section 2.4 *Areal rainfall*

This British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification, and particular care should be taken to ensure that claims of compliance are not misleading.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Guide

1 Scope

BS 7843 provides guidance on procedures for the observation and measurement of meteorological precipitation, and for the collection, quality control, archiving and exchange in the United Kingdom of the data obtained from the measurements.

Part 1 describes the data users' criteria, and the design of raingauge networks to enable the desired data to be obtained.

Part 2 of BS 7843 gives guidance on practical aspects of field work for the acquisition of the data, and for the subsequent transmission, quality control and archiving of the data obtained.

This Section explains the procedures whereby rainfall observations made by voluntary observers and by automatic gauges are collected and transferred to the National Rainfall Archive. The structure and function of regional and the national archives are explained and the methods used to effect quality control of the data are described.

2 Normative references

This Section of BS 7843 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies: any subsequent amendments to or revisions of the cited publication apply to this Section of BS 7843 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

3 Definitions

For the purposes of this Section of BS 7843, the definitions in BS 7843 : Section 1.1 apply.

4 Methods of data collection and transmission

4.1 Data collection networks

The collection of rainfall data has a three-layered pyramidal structure. The base of the pyramid contains the observers who may be volunteers or employees of various organizations. The observers send their rainfall data to the next layer which consists of collection agencies such as the National Rivers Authority (NRA), the Rivers Purification Boards (RPBs), water supply services or a wide variety of organizations interested in water management. Such bodies administer their own regional or local networks using both manual and automatic recording gauges. They collect the data and enter it to their own archive before transferring selected records to the National Rainfall Archive (see 6.1) which forms the apex of the pyramid.

Most observers send rainfall data in tabulated form to their local or regional collecting centre where it is checked and keyed into a regional rainfall database before being sent to the National Rainfall Archive by magnetic tape, floppy disk or by a direct data transmission link. Organizations that have no keying facilities or local archive should check the data returns and send them directly to the National Archive.

Any observer who is not a member of a local or regional collecting network may send records directly to the National Rainfall Archive, which also maintains a nationwide network of climate sites. Data from this combined network are supplied to the National Archive. Full responsibility for the administration of this network of observers is held by the Meteorological Office's sections at Bracknell (England and Wales), Edinburgh (Scotland) and Hillsborough (Northern Ireland).

4.2 Daily and monthly rainfall collection

Observers should maintain their own local record and also enter the rainfall totals onto rainfall data postcards (see clause 6 of BS 7843 : Section 2.2 : 1996). The size (203 mm by 127 mm) and printed format (see annex B of BS 7843 : Section 2.2 : 1996) are standardized to enable storage in the national archives. At the end of each month the postcards should be sent to the observer's local or regional collecting centre.

The collecting centre forwards the data from its regional archive to the national archive by one of the following means:

- a) a magnetic tape with encoded data in accordance with the magnetic tape transfer format given in annex A; or
- b) a floppy disk or by direct telemetry with encoded data in accordance with the general rainfall transfer format given in annex B; or
- c) a rainfall postcard.

4.3 Collection timescales

Daily rainfall data should be sent at monthly intervals to the National Rainfall Archive as soon after the end of the month as possible. Data arriving more than 20 days late delay the running of daily quality control programs and the provision of validated data before the start of the next month.

4.4 Collection of sub-daily data

Event data from tipping bucket raingauges may be telemetered to a local collecting centre or recorded on site by a data logger and transferred at regular intervals to the collecting centre. Event data selected for transfer to the National Archive should be sent at monthly intervals in digital form encoded in accordance with the general rainfall transfer format given in annex B.

Tabulation or digitization of autographic records is dealt with in **6.3** of BS 7843 : Section 2.2 : 1996. Hourly rainfall tabulations obtained from autographic charts can be sent to the National Archive on Meteorological Office form 7113. Fine structure detail from autographic charts should be digitized in accordance with annex C of BS 7843 : Section 2.2 : 1996 and the general rainfall transfer format given in annex B should be used for data transfer between archives.

Sub-daily event type data being transferred between a regional archive and the national archive should be sent in complete monthly sections from 0900 UTC on the first day of the month to 0900 UTC on the first day of the following month. In order to achieve this, data from on site recording units should be captured within the first few days of each month. As with daily information the data should be sent to the national archive within 20 days, any data values remaining for the current month being stored for transmission in the following month.

4.5 Site documentation exchange format

A simple PC spreadsheet or data exchange format is described in annex C. This allows information covering raingauge sites (see **7.1** of BS 7843 : Section 2.1 : 1996) and raingauge records to be exchanged between regional and the national archives.

5 Quality control

5.1 General concepts

The objective of quality control is to identify rainfall measurements which are incorrect because of human or machine error. Errors are detected by comparing the measurements of one gauge with its neighbouring gauge or gauges, but intergauge comparisons depend on both the spatial and the temporal variation of rainfall in the local area. The validity of such comparisons increases when individual measurements from a site are added together to form a longer period total that is less affected by local variations. Thus an error of 10 % can be identified in an annual total that differs from its neighbours, but differences of 500 % or more may need to be accepted when gauges are compared in showery rainfall conditions.

Quality control procedures should, however, be applied quickly and are therefore applied to sub-daily data first, then proceeding through daily to monthly and annual totals with each stage providing higher levels of accuracy. If an annual quality control check shows a station's total to be suspect, a check should be made on monthly and daily totals to try to identify the error. The practical methods of quality control (both manual and by machine) first identify unlikely values then look for possible causes for the errors. If the value is judged to be exceptional by statistical tests and falls into a common error category, an estimate of the true measurement should be made and inserted in its place.

5.2 Annual average rainfall

Annual rainfall totals show considerable variation from year to year and even from decade to decade. As a result a period of 30 years is chosen as a reference and referred to as the Annual Average Rainfall (AAR). The Meteorological Office has produced maps and individual station values for the period 1941 to 1970 and 1961 to 1990. The maps are produced by data from stations open for the whole period. Stations open for only part of the period have their missing record estimated to ensure that their AAR fits in with that of their long term neighbours. The AAR map and individual station values are used extensively in daily and monthly quality control procedures. When a new station opens it is allocated an AAR by reference to its location on the master map.

5.3 Sub-daily data quality control

5.3.1 Event data

Spatial comparisons cannot normally be carried out using event data because of the relatively large distances between such gauges. Procedures are therefore limited to ensuring that gauge malfunctions are identified and that the daily totals from such gauges agree with a local on-site standard gauge or with values estimated by the use of daily quality control procedures (see **5.5**).

The daily total for each tipping bucket gauge should be presented for the normal daily quality control procedure; ideally daily values from a collocated standard gauge will enable accurate comparisons to be made. A short review of this topic is provided in annex E and in annex B of BS 7843 :

Section 2.1 : 1996. Where only intermittent daily or even weekly readings are made, comparisons with near-neighbour gauges will still provide useful results. When a daily total differs significantly from the collocated standard gauge or the quality control estimate, the short period record should be flagged as suspect. Alternatively, if the difference can be explained by equipment failure, maintenance or operator action, a suitable flag covering the action should be used. For example, the absence of tips on a wet day because the bucket was jammed could be confirmed by an equipment failure flag.

Malfunctions of a tipping bucket gauge may be identified by looking for unusual sequences in the tip-time sequence. Some examples to illustrate the problem are given in annex C of BS 7843 : Section 2.1 : 1996.

Special care is required when dealing with the reliability of snow measurements from tipping bucket gauges. Manual measurements ensure that snow is recorded on the day it falls. Automatic measurements may continue to show snow melt for some days afterwards depending on the performance of gauge heaters (if present) and the actual air temperature.