Maintaining stable yet contemporary archives:

The National River Flow & Groundwater Level Archives

Andrew McKenzie
National Groundwater Level Archive, BGS
Harry Dixon
National River Flow Archive, CEH

Hydrometric Data: the long view 22 October 2013

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A tradition of measurement

?

Chilgrove Well - 1835

Wendover springs - 1841

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Different ways of measuring ……

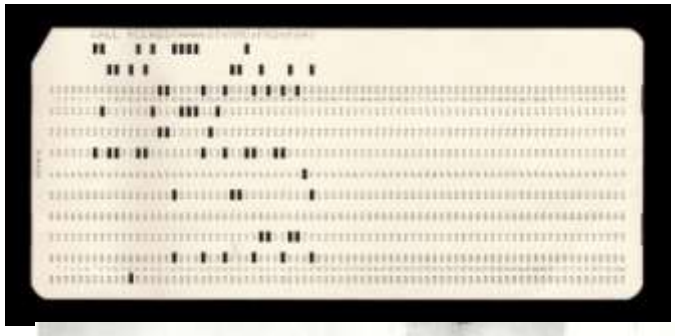
Manual dips

Chart recorders

Loggers and telemetry

Different data storage……

Paper records



Mainframes

Clustered SAN

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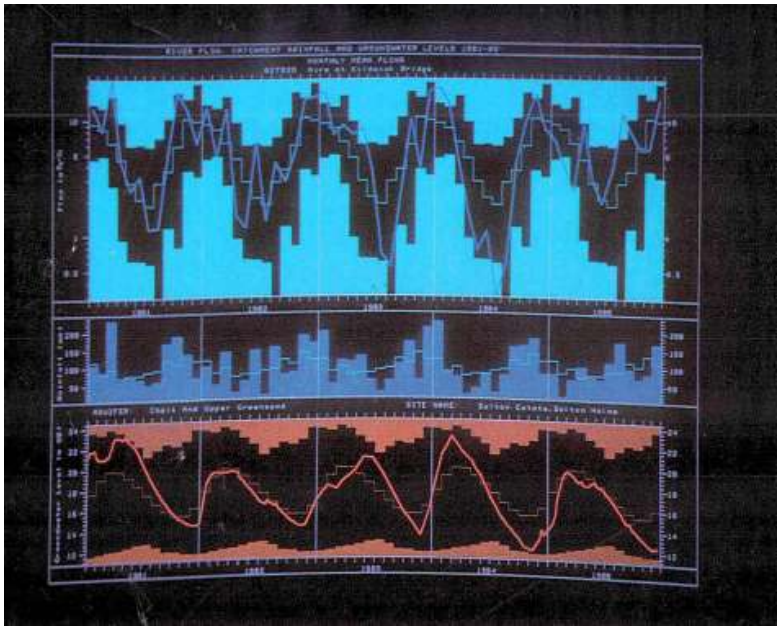
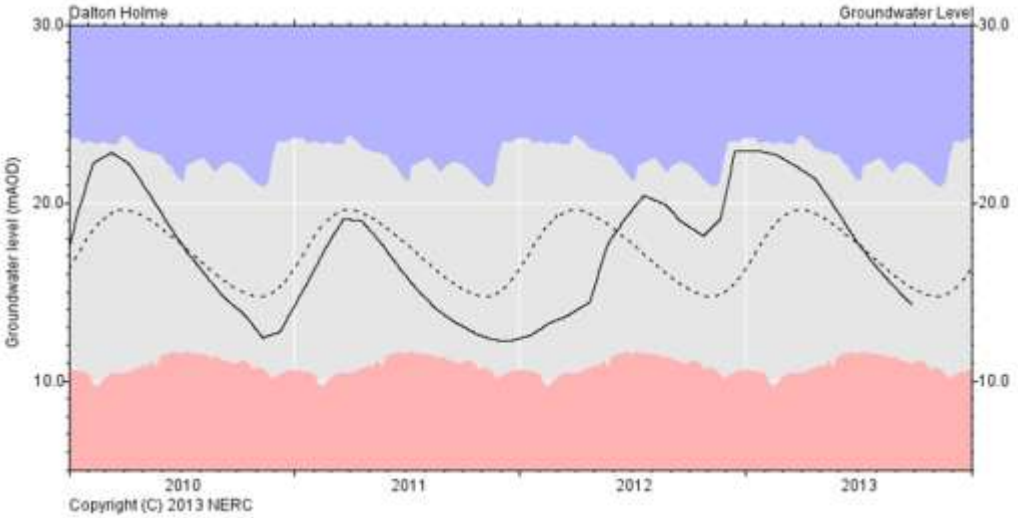
Different graphics ……

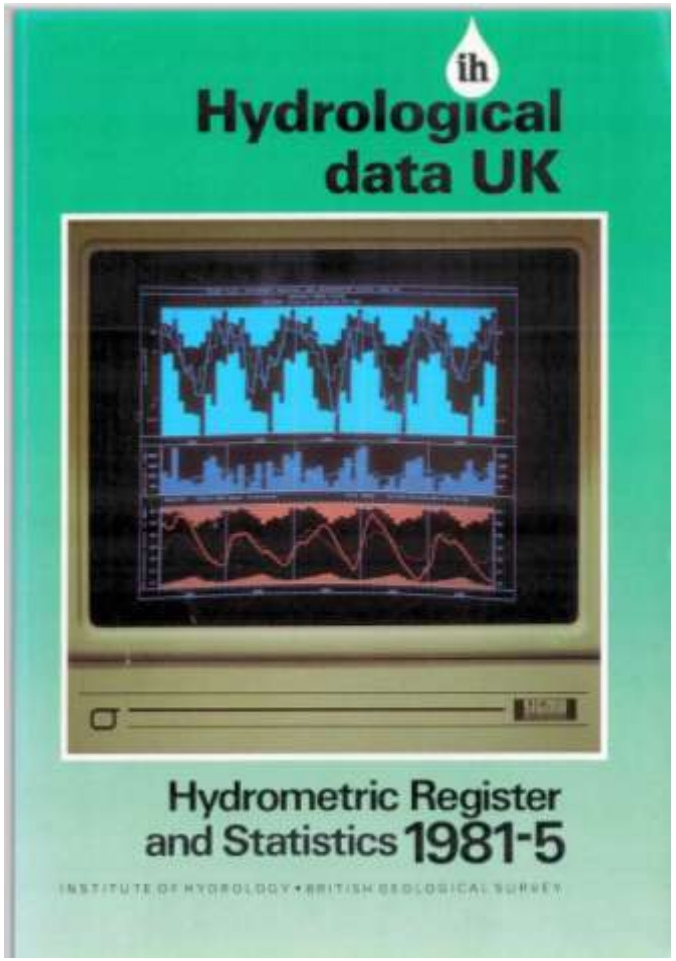


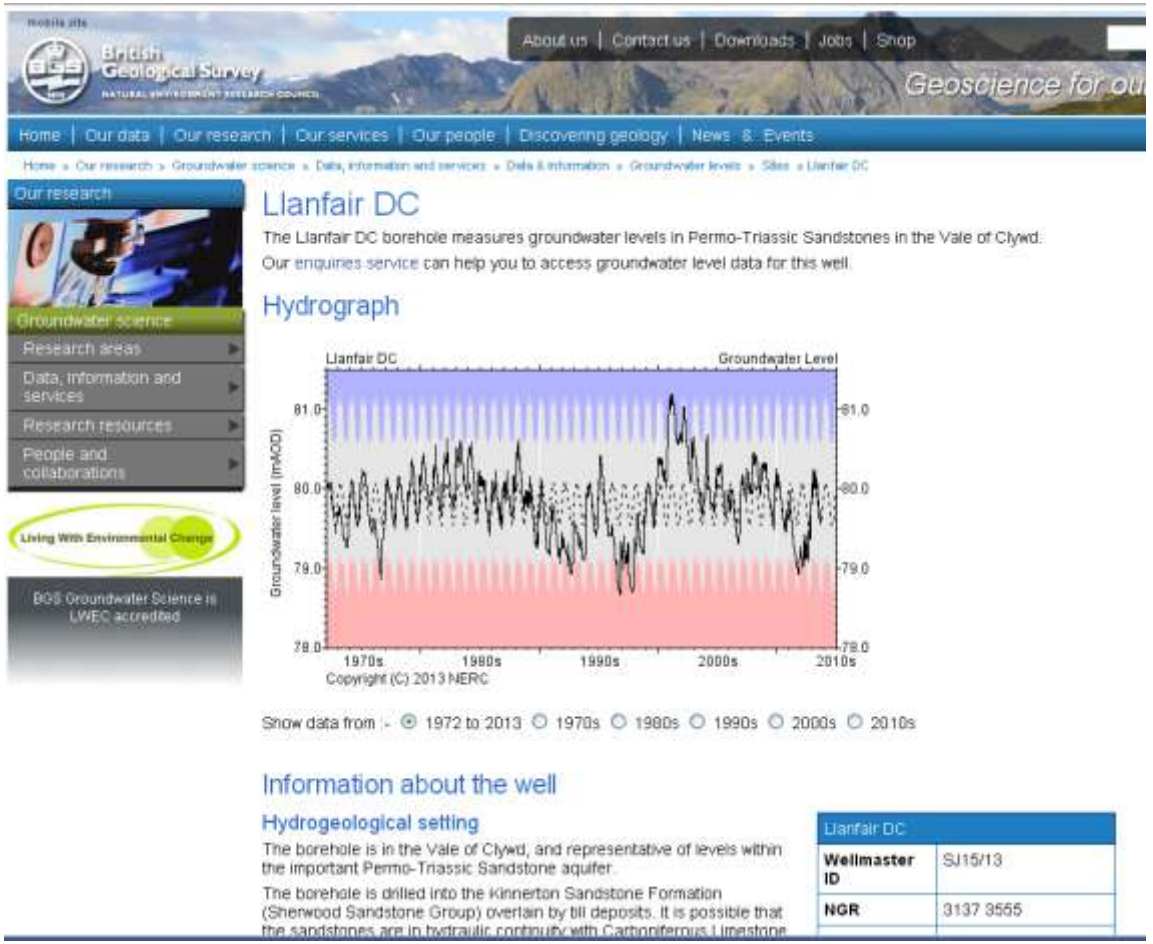


1986
-Computing
in colour

2013 - on the web

Different ways to publish….





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Getting the data out……

ENGLAND AND WALES WATER SITUATION REVIEW 1988/89 - December

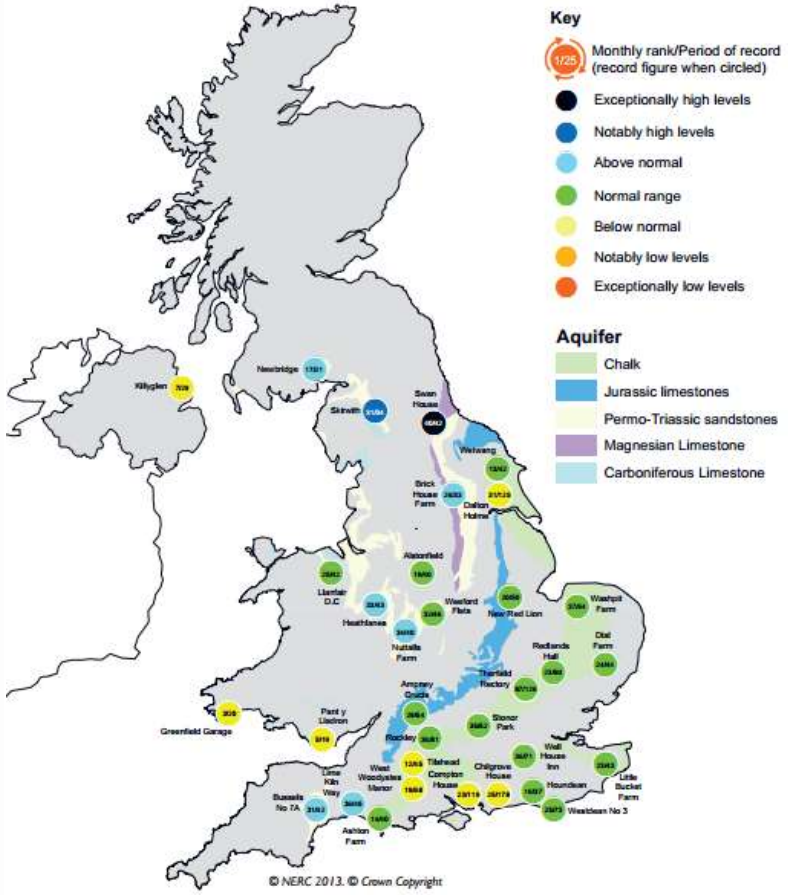
This report has been compiled in response to the request for information made by the Department of the Environment on the 19th January 1989. It is intended as a preliminary briefing note only.

RAINFALL

Table 1 gives the monthly rainfall totals for 1988 - as a percentage of the 1941-70 average - for England and Wales and the ten water authority areas; the data from July are provisional. Also shown are the rainfall totals for the year plus the accumulated totals from April to December and from August to December.

Annual precipitation in 1988, for England and Wales, was marginally above average with most regions registering totals within 5 per cent of their respective means. Some tendency for the higher percentage rainfall totals to favour the important reservoir gathering grounds in the west and north may also be recognised.

Rainfall distribution throughout the year was far from typical (see Figure 1). January and March were both very wet, the former especially so in the South East. The total precipitation over the January-March period ranks as the fourth wettest in the general England and Wales series which extends back to 1766. Hence, early in the year, the replenishment of reservoirs and aquifers was plentiful and the water resources outlook reassuring. Subsequently, rainfall



Groundwater levels - September 2013

The calculation of ranking has been modified from that used in summaries published prior to October 2012. It is now based on a comparison between the most recent level and levels for the same date during previous years of record. Where appropriate, levels for earlier years may have been interpolated. The rankings are designed as a qualitative indicator, and ranks at extreme levels, and when levels are changing rapidly, need to be interpreted with caution.

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The same concerns……

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The same issues……

‘From the groundwater standpoint, 1981 appears to have been a near average year in England and Wales, with groundwater levels near to, or above average. Only at dalton Holme in the Chalk of Yorkshire were groundwater levels below average at the end of the year’

‘….., across the majority of the Chalk, groundwater levels are currently still close to their seasonal average levels, and would have been lower were it not for the continued influence of the high recharge throughout much of last year. The exception to this pattern is in the south of England, where responsive Chalk aquifers are now below their normal range, and at Dalton Holme (Yorkshire), where a faster than expected recession has brought levels below their normal range’

The same challenges……

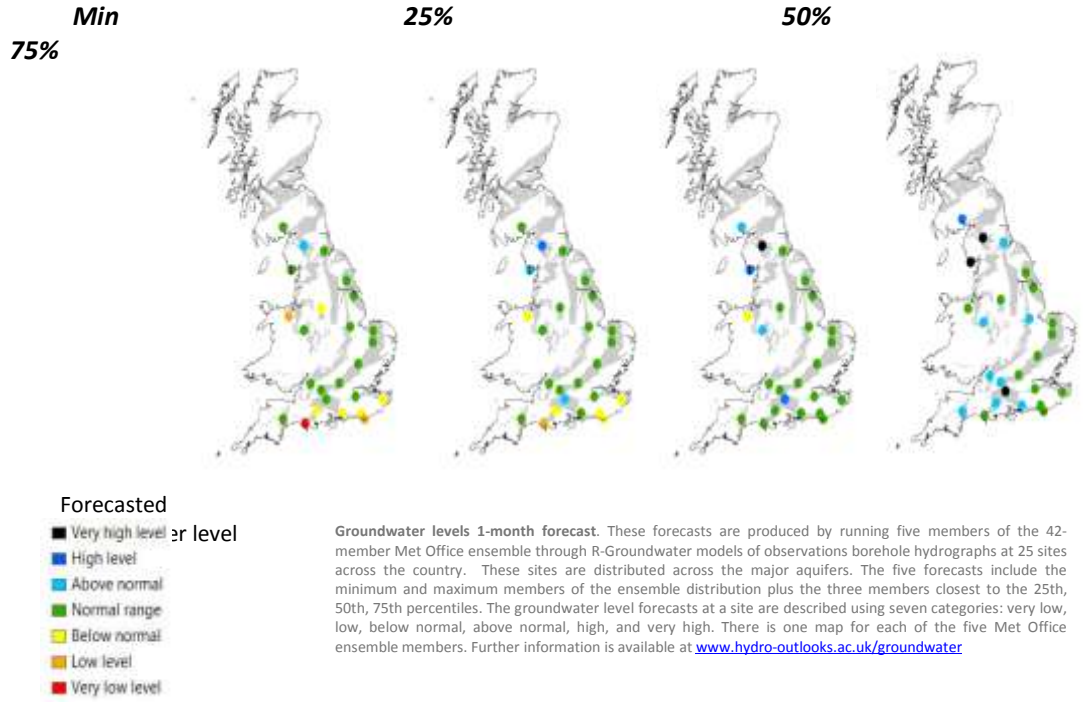
Prediction of Groundwater Levels

Issue 21 of Technical note - Central Water Planning Unit, Technical note - Central Water Planning Unit
S. Phillips

Central Water Planning Unit, 1978

Projections: The three month outlook is not certain, as the timing and intensity of autumn rainfall can cause large variations in groundwater recharge, although the effect of these variations will be muted over many aquifers as it takes time for recharge to cause levels to change. However under a majority of ensemble forecasts levels in the Chalk and other aquifers in Southern England are likely to fall further below normal.

3 months ahead (end of December)



Groundwater levels 1-month forecast. These forecasts are produced by running five members of the 42-member Met Office ensemble through R-Groundwater models of observations borehole hydrographs at 25 sites across the country. These sites are distributed across the major aquifers. The five forecasts include the minimum and maximum members of the ensemble distribution plus the three members closest to the 25th, 50th, 75th percentiles. The groundwater level forecasts at a site are described using seven categories: very low, low, below normal, above normal, high, and very high. There is one map for each of the five Met Office ensemble members. Further information is available at www.hydro-outlooks.ac.uk/groundwater


19 May 1983 Stage: 850mm
10 Oct 2013 Stage: 838mm

The UK Hydrometric Archives Today

- Primary national archives of hydrometric data
- Collate data from public bodies tasked with hydrometric monitoring (and others)
- River flow & groundwater level data:
  - 1400 + gauging stations / 180 + boreholes
  - 54,000+ station years of river flow data
  - 9000 station years of groundwater level data, with observations from another 55,000 wells and boreholes
- Single source of UK wide hydrometric information
- Data made freely and openly available to all

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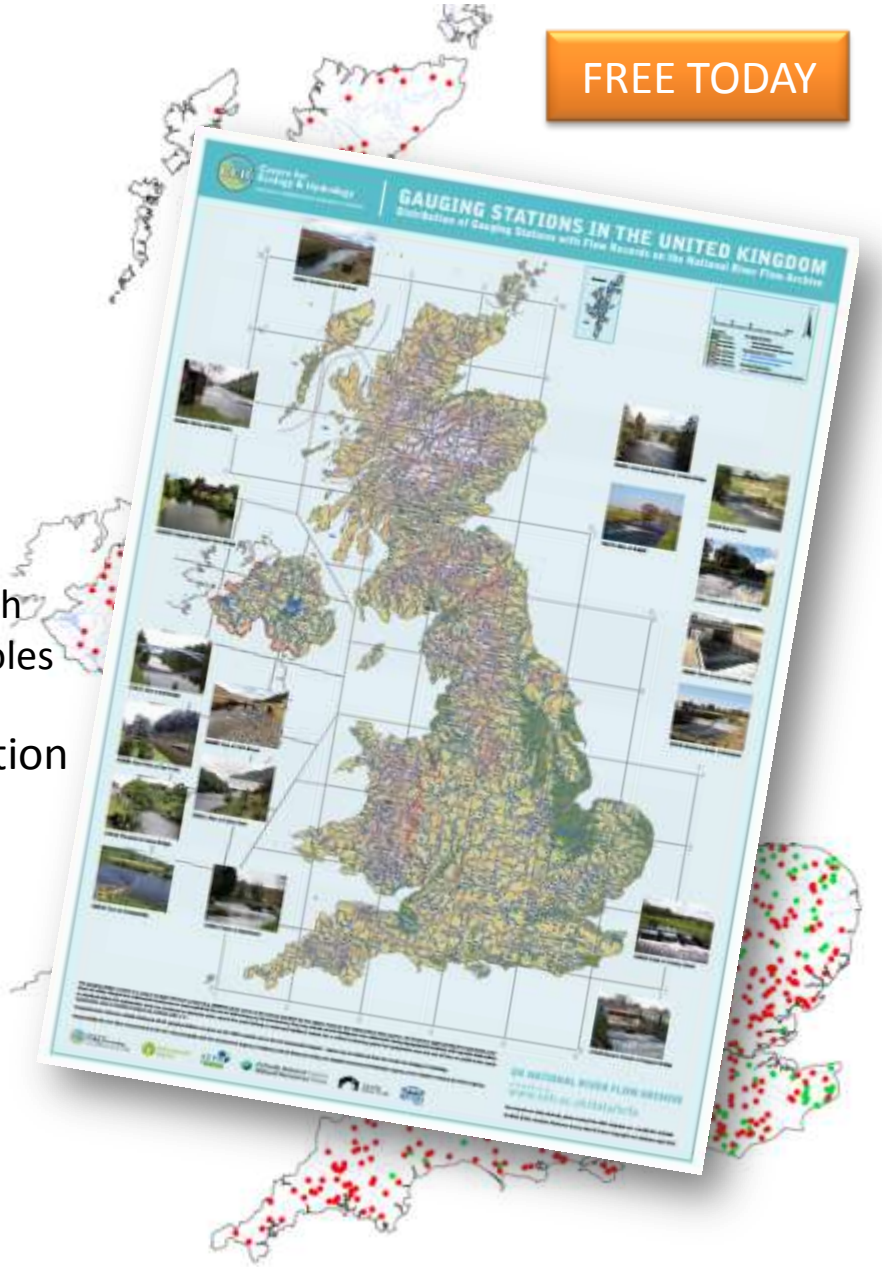
FREE TODAY



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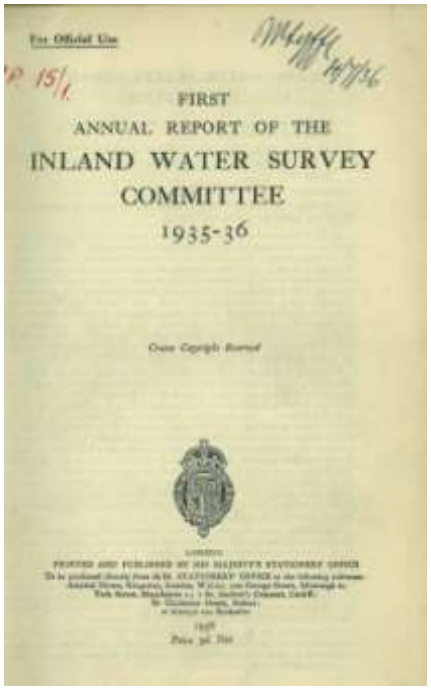
National Archives by Collaboration....

- “A water survey committee, composed of persons outside Government Departments, will be appointed to advise on the survey and on the progress of measures undertaken. In the constitution of the Committee attention will be paid to the inclusion of both scientific and practical experience.”

The Minister of Health (Sir Hilton Young) *House of Commons* *7 December 1934*


For Official Use

FIRST
ANNUAL REPORT OF THE
INLAND WATER SURVEY
COMMITTEE
1935-36

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National Archives by Collaboration....

- UK Surface and Groundwater Archives Committee

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SEPA
Scottish Environment Protection Agency

RIVERS Agency

Cyfoeth Naturiol Cymru
Natural Resources Wales

Environment Agency

Met Office

Department for Environment Food & Rural Affairs

The Scottish Government
Riaghaltas na h-Alba

Llywodraeth Cymru
Welsh Government

CIWEM

British Hydrological Society

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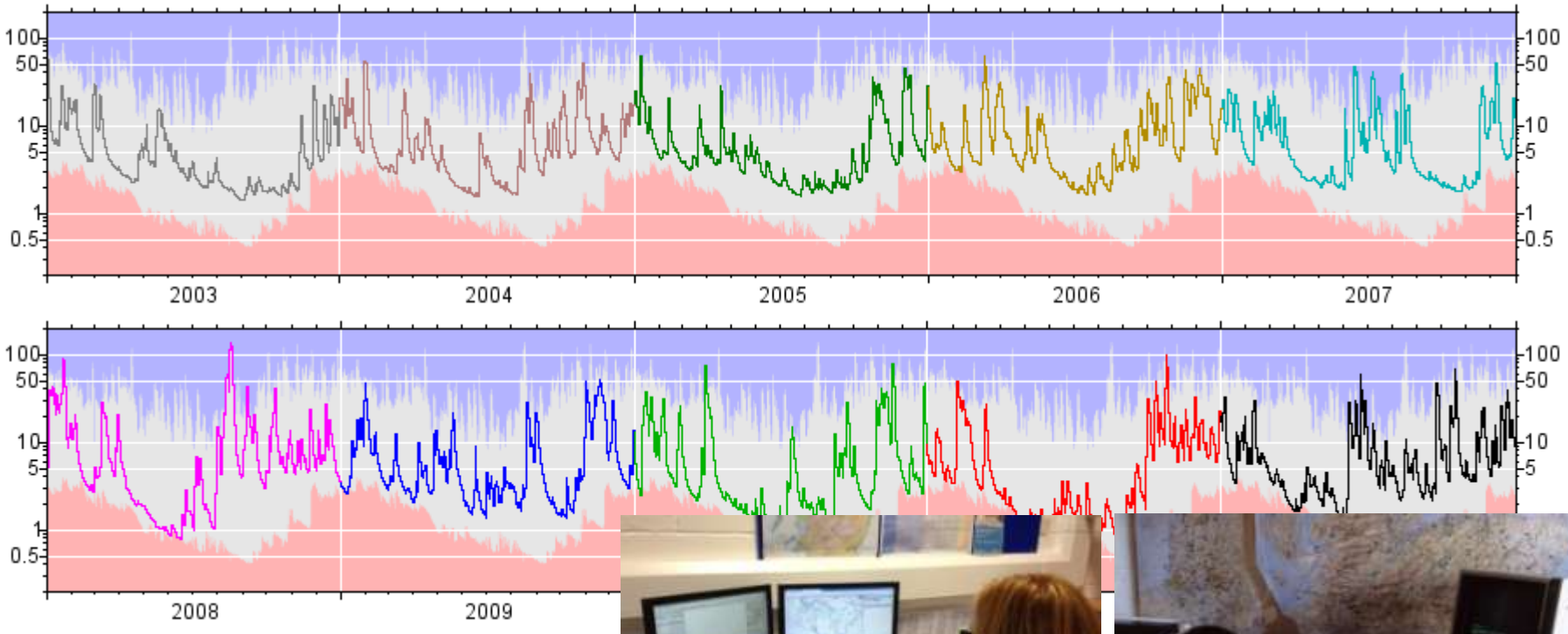
Data Validation and Archival

Annual data acquisition:

- Additional layer of data validation before data is added to the national archive



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Data Validation and Archival

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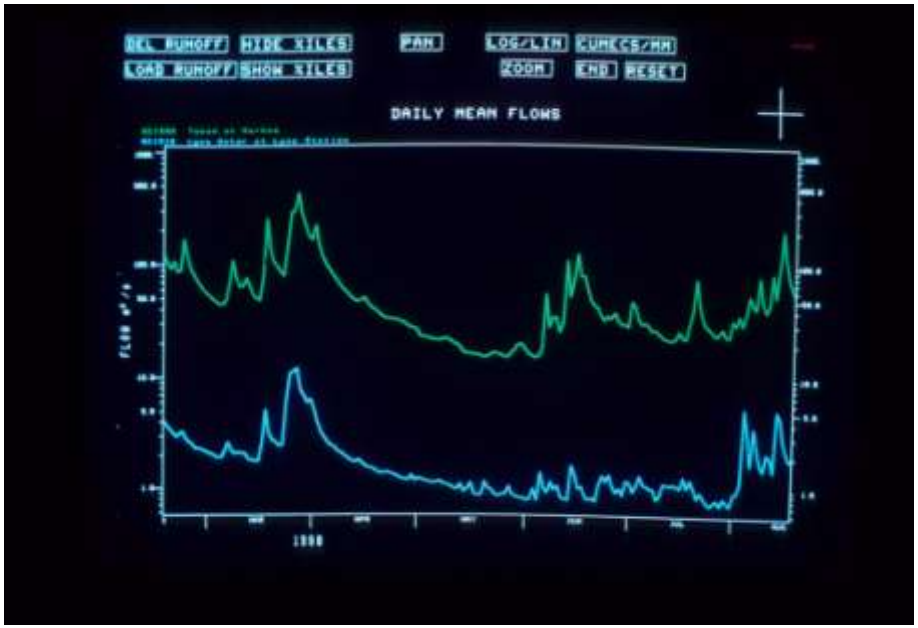
- Bespoke data handling systems developed for visual and automated checking



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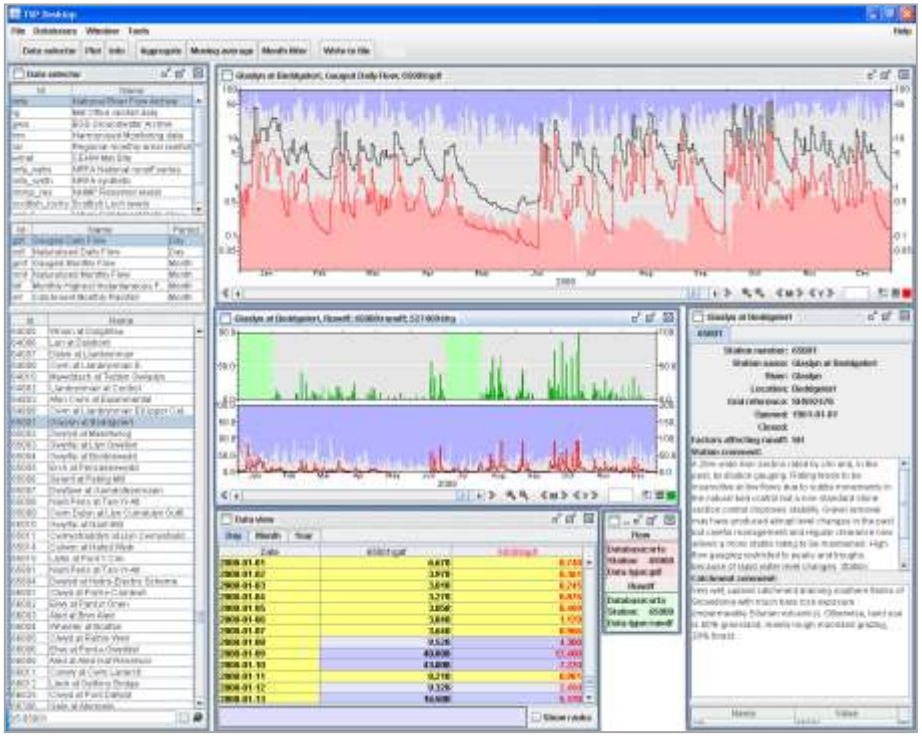

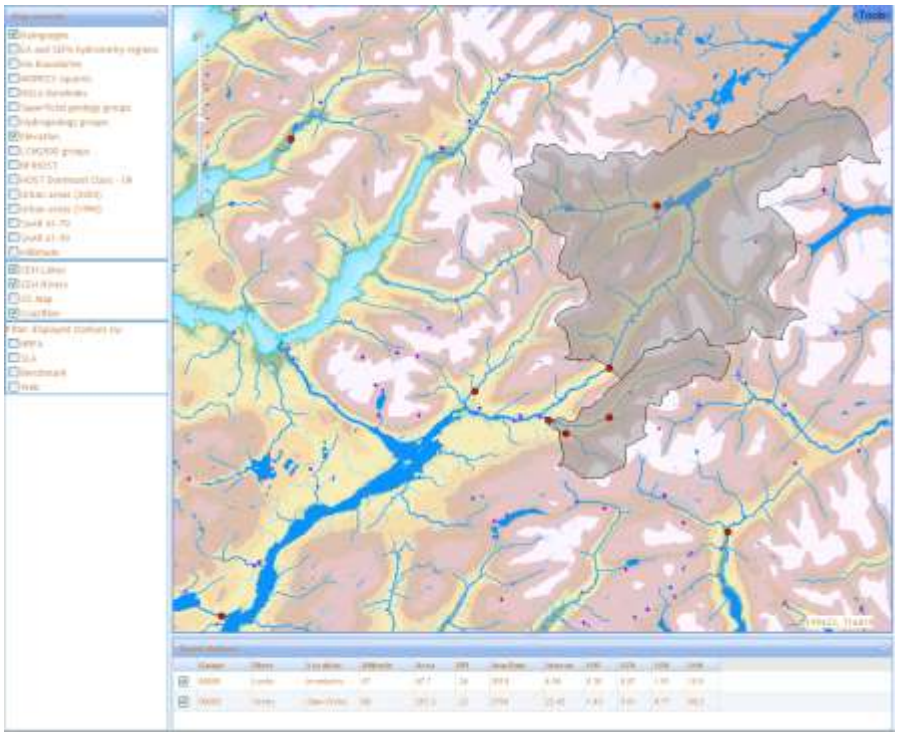

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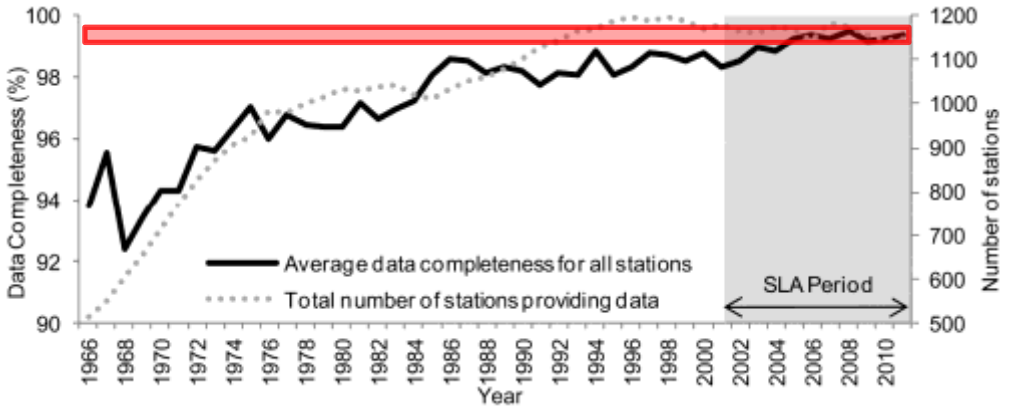
Maintaining high quality databases

Controlling data provision to the national archive:

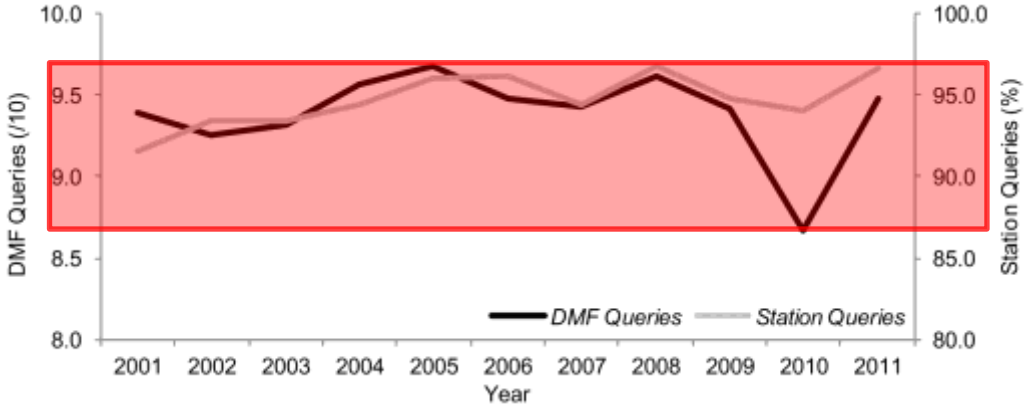
- Service Level Agreement since 2002
- Aims:
  - Promote **stability** in national network
  - Improve data **quality** and **completeness**

- Subset of network monitored through performance indicators
  1. Data provision timeliness
  2. Data completeness
  3. Data queries

For more information see: Muchan & Dixon (in press)



- 99% data completeness is common



- < 1.5 % of data queried in any year

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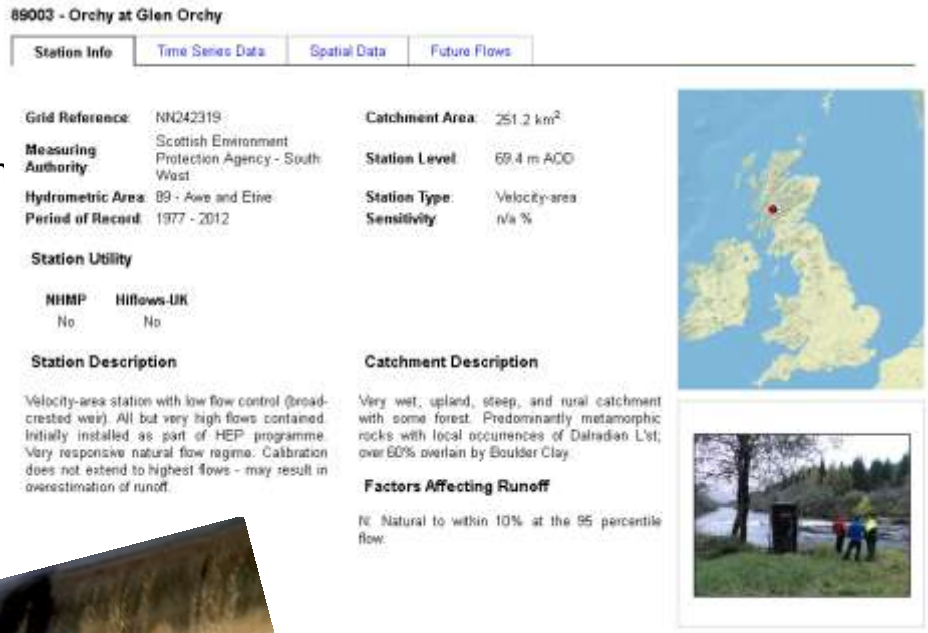
Turning Data into Information

- Collating and disseminating data alone is not enough!
- **Add value** by understanding and communicatir hydrometric issues
- Comprehensive metadata holdings stored in digital and physical archives


89003 - Orchy at Glen Orchy

Station Info | Time Series Data | Spatial Data | Future Flows

Grid Reference: NN242319
Catchment Area: 251.2 km²
Measuring Authority: Scottish Environment Protection Agency - South West
Station Level: 69.4 m AOD
Hydrometric Area: 89 - Awe and Etive
Station Type: Velocity-area
Period of Record: 1977 - 2012
Sensitivity: n/a %

Station Utility

NHMP: No
Hiflows-UK: No

Station Description

Velocity-area station with low flow control (broad-crested weir). All but very high flows contained. Initially installed as part of HEP programme. Very responsive natural flow regime. Calibration does not extend to highest flows - may result in overestimation of runoff.

Catchment Description

Very wet, upland, steep, and rural catchment with some forest. Predominantly metamorphic rocks with local occurrences of Dalradian Lst; over 60% overlain by Boulder Clay.

Factors Affecting Runoff

N: Natural to within 10% at the 95 percentile flow.

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- Comprehensive metadata holdings stored in digital and physical archives
- Regular and effective liaison with measuring authorities
- Balance of national and regional knowledge

NRFA Regional Reps:

- Regional hydrometric data specialists
- Maintain links with regional measuring authorities

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- Maintain links with regional measuring authorities

+ Many ex-reps

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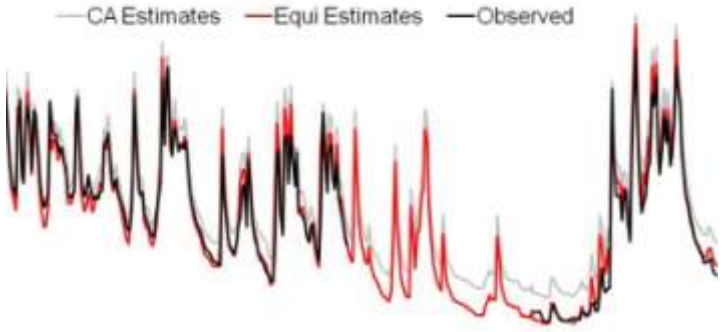
Helping Develop Best Practice

- Promotion of consistent and forward-looking practice in data management/ hydrometry:
  1. Research into infilling techniques
  2. Support development of best practice through hydrometric standards
  3. Active involvement in international initiatives to improve and harmonise hydrometric data management:
     - OGC Hydrology Domain Working Group
     - WMO Regional Hydrology Forum



Harvey et al (2012)

BSi British Standards

1997	BS 7898: Guide to Hydrometric Data Management
2013/14	BS 17898: Code of Practice for Hydrometric Data Management

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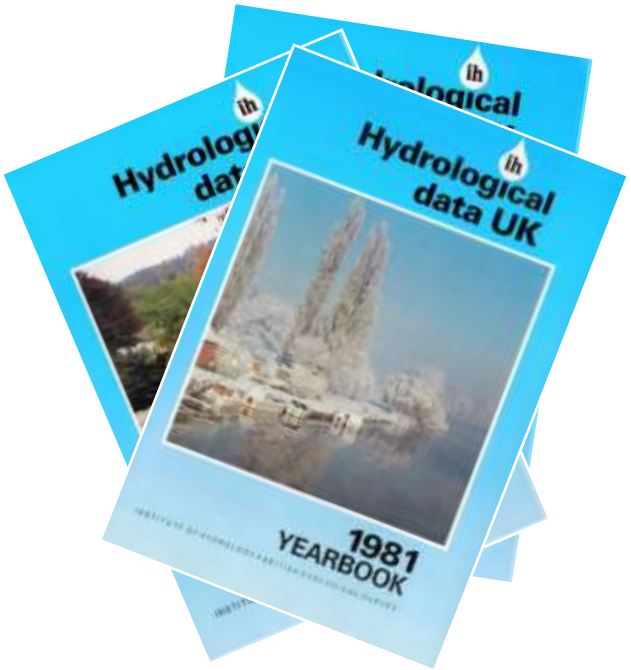
Delivering to the UK

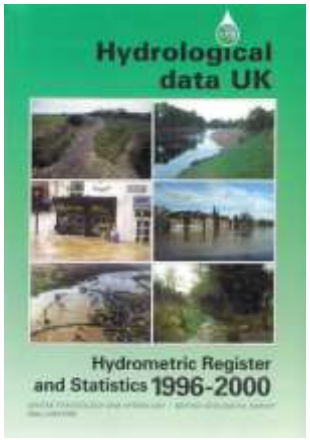
Main dissemination routes:

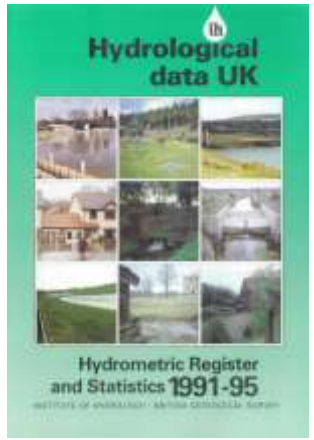
- **Publications:**

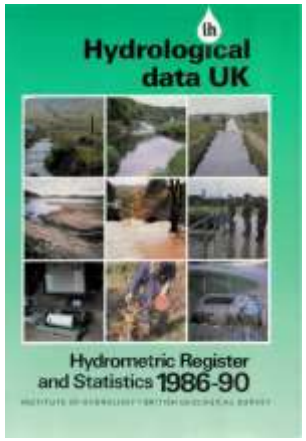
  1935-1995 Yearbooks

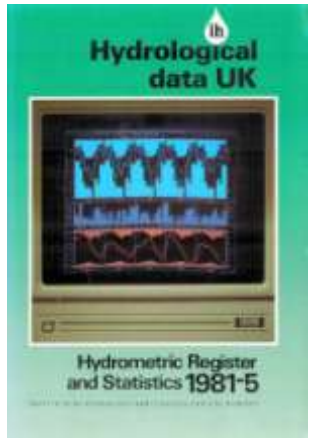
  Hydrometric Register (Latest 2008)











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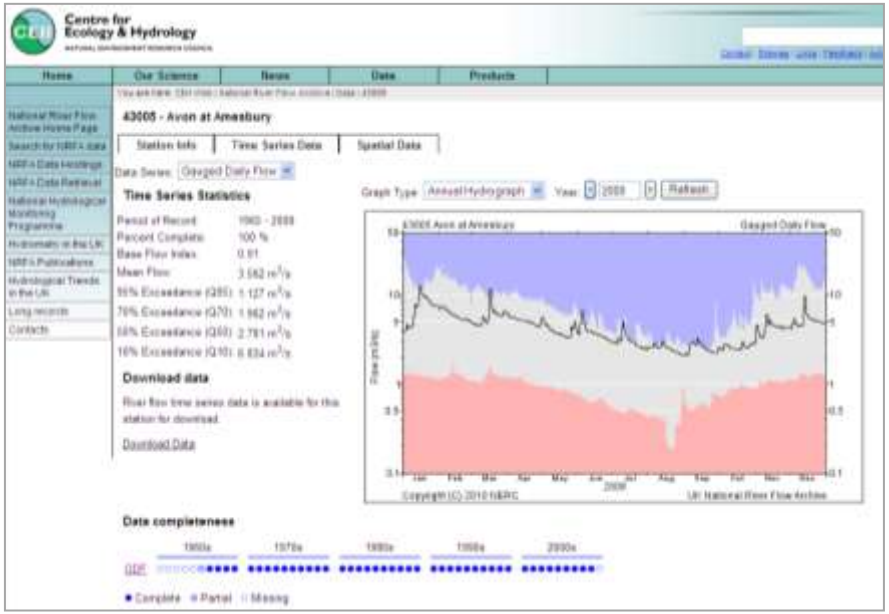
- **Manual enquiry service:**

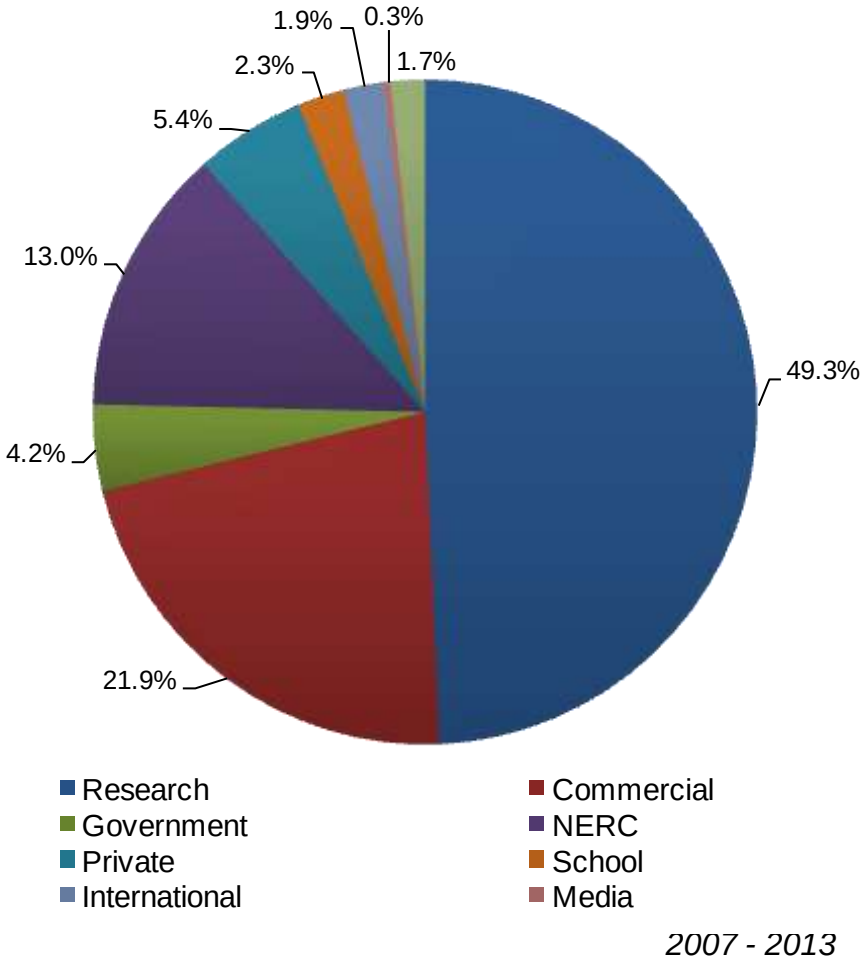
  ~ 480 p.a.

- **Internet:**

  55,000 views of gauging station information in 2012

  8,000 data downloads in 2012





2007 - 2013

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Delivering for the UK

National water balance reporting:

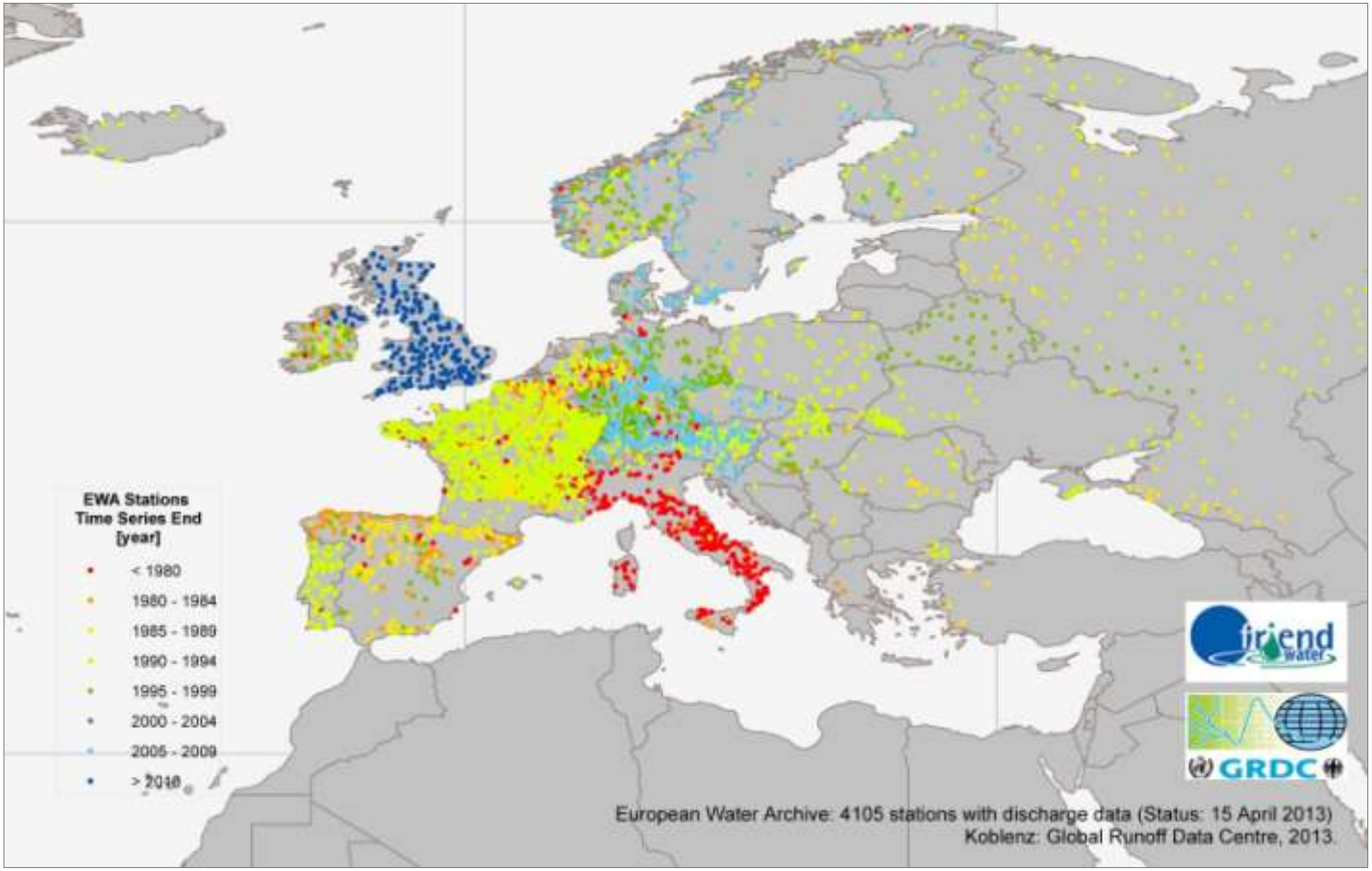
- UK Government (ONS/ Defra)
- EU / OECD

International data sharing:

- UNESCO European Water Archive
- WMO Global Runoff Data Centre
- GCOS/GTOS Baseline Global Terrestrial Network

World Meteorological Organization
Weather • Climate • Water

United Nations Educational, Scientific and Cultural Organization



Dixon et al. 2013 ***Sharing water observations: turning local data into global information***

The archives aim to:

- Provide a stable source of integrated national hydrometric information
- Develop, implement and promote contemporary approaches to hydrometric data management

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