



MAXIMISING THE UTILITY OF HYDROMETRIC INFORMATION FOR THE USER COMMUNITY: a national perspective

Harry Dixon

Data Acquisition and Retrievals Manager
National River Flow Archive

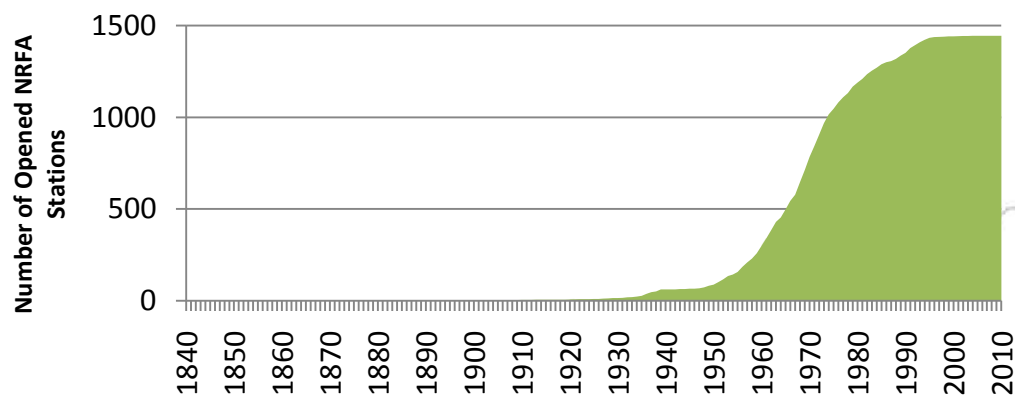
Presentation Outline

- History of the National River Flow Archive
- Hydrometric Information Lifecycle
 1. Monitoring and Network Design
 2. Data Sensing and Recording
 3. Data Validation and Archival
 4. Data Synthesis and Analysis
 5. Information Dissemination
 6. Information Usage and Decision Making
- Conclusions
 - How can we improve national hydrometric data for the end user?
 - Do we still need a National Archive?

History of the National Archive

- Primary national hydrometric archive for water resources

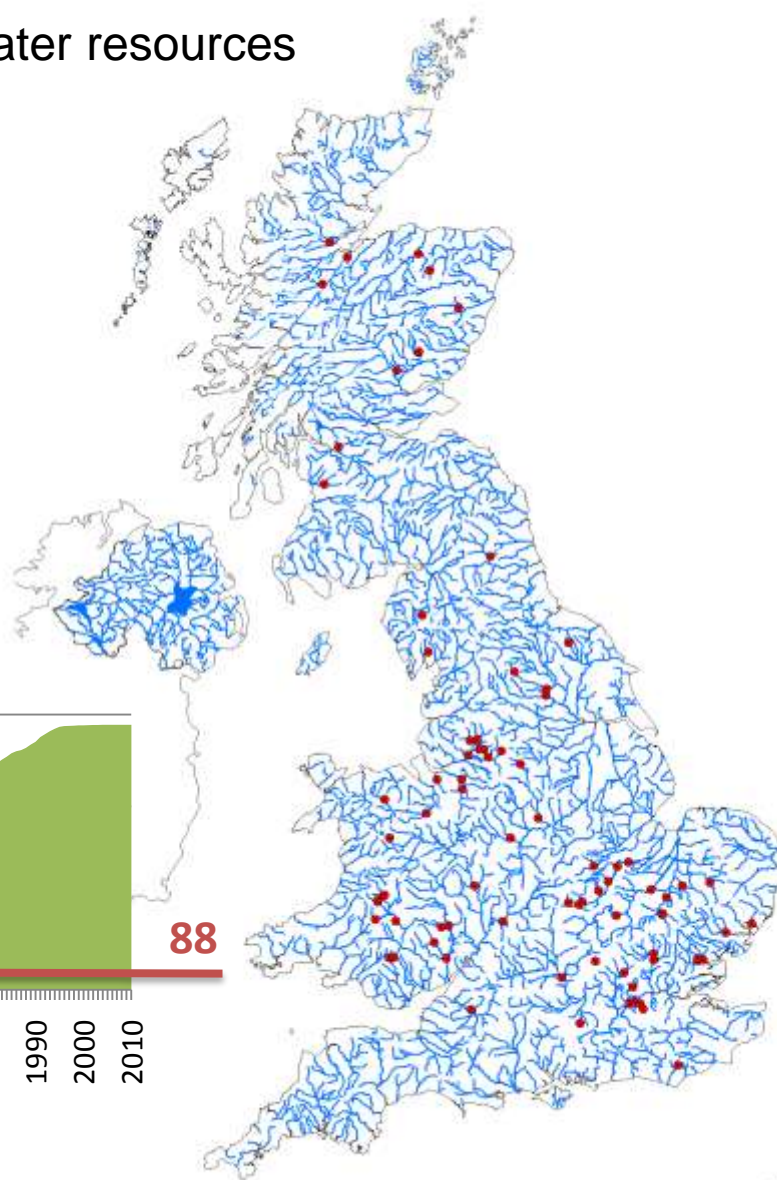
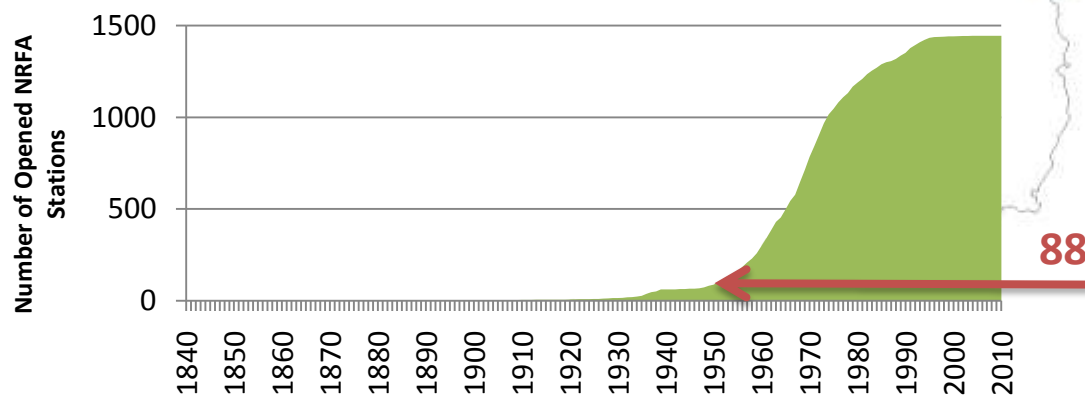
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1935-1952	Inland Water Survey
1955-1964	Surface Water Survey
1964-1974	Water Resources Board
1974-1982	Water Data Unit
1982 -	National River Flow Archive (Institute of Hydrology > CEH)



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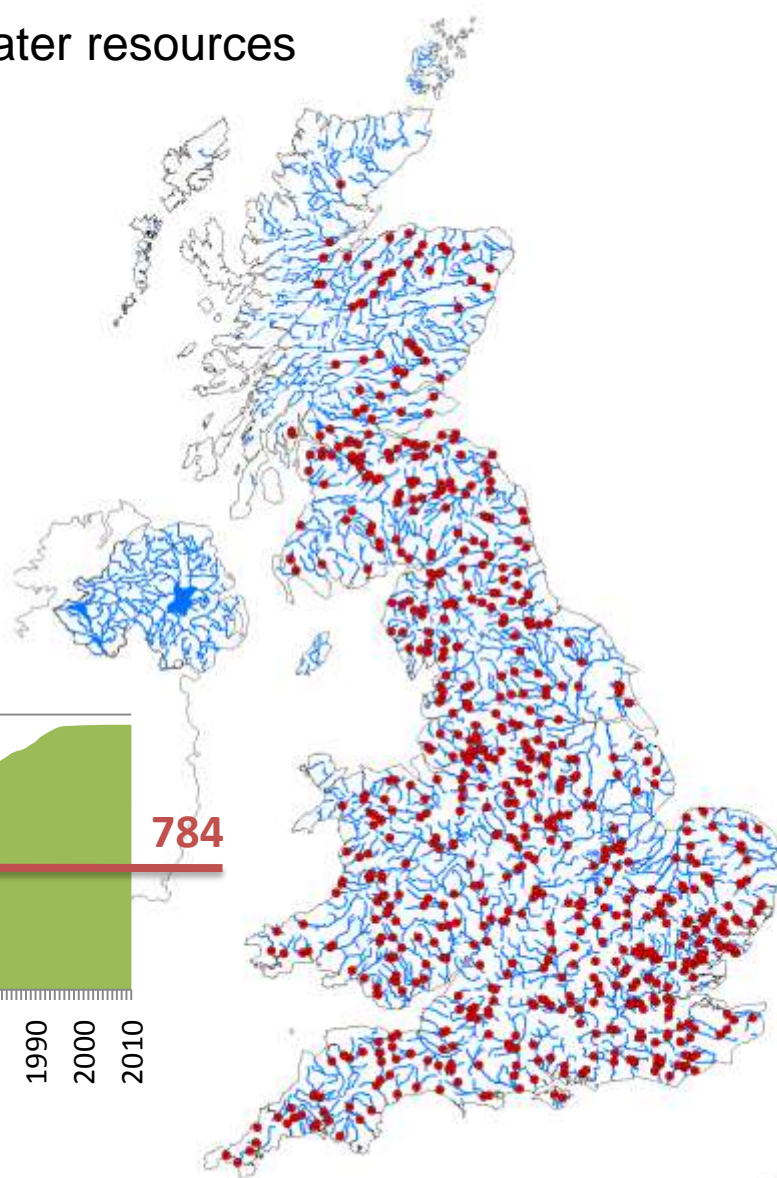
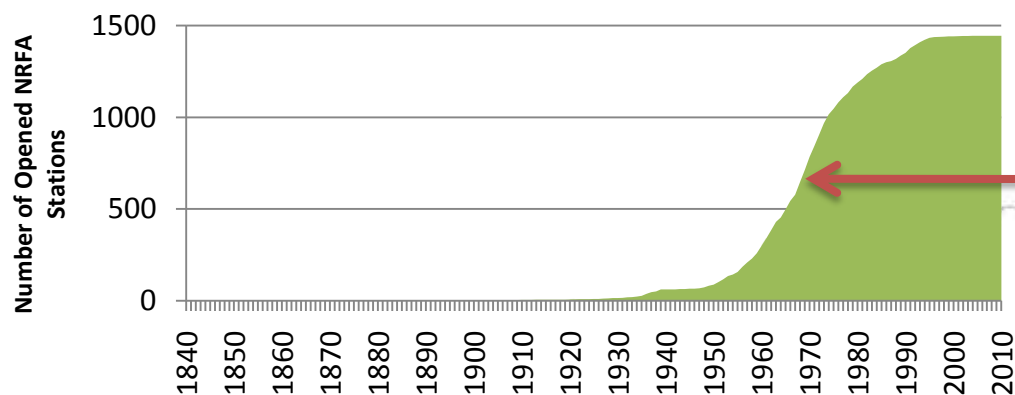
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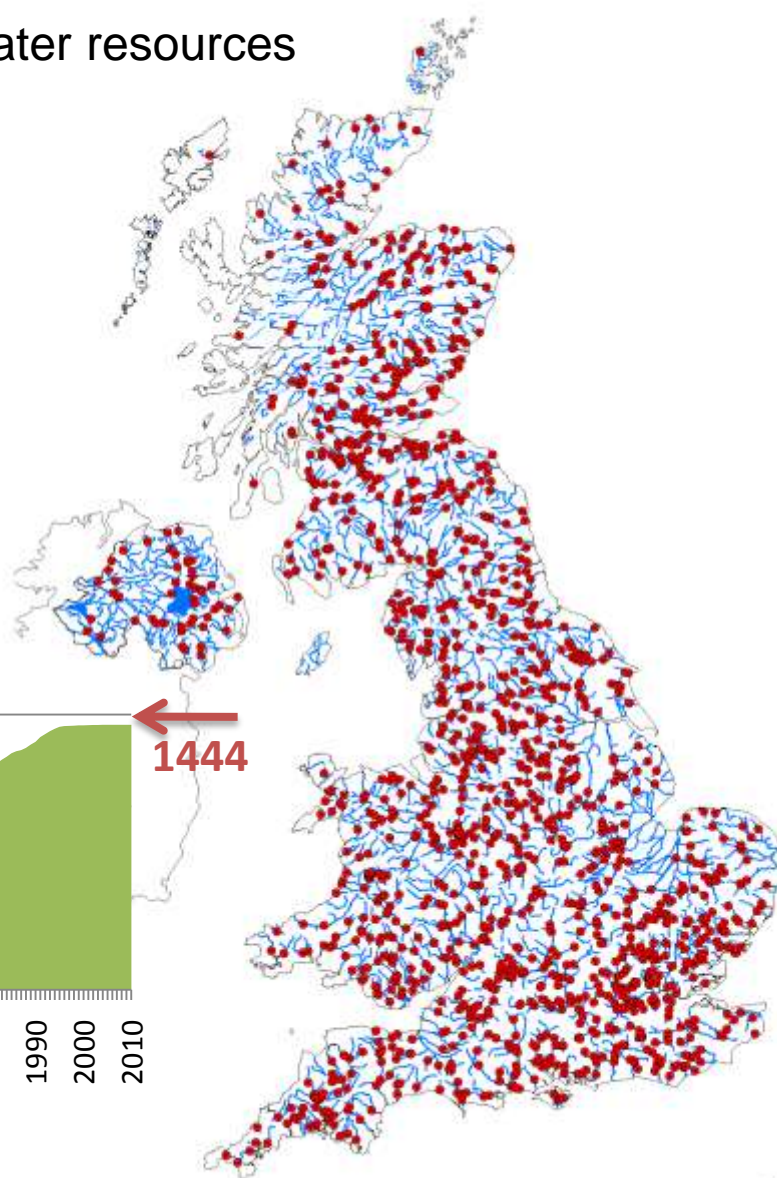
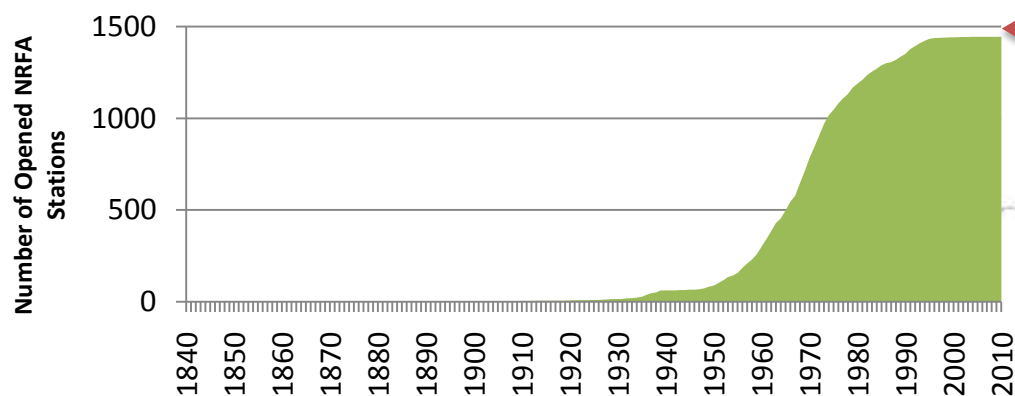
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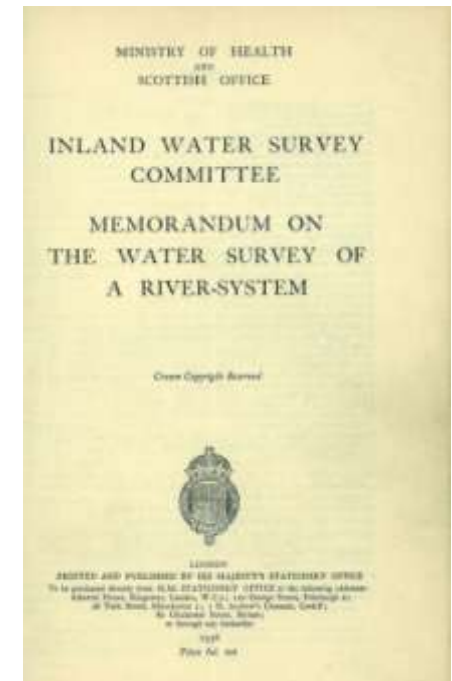
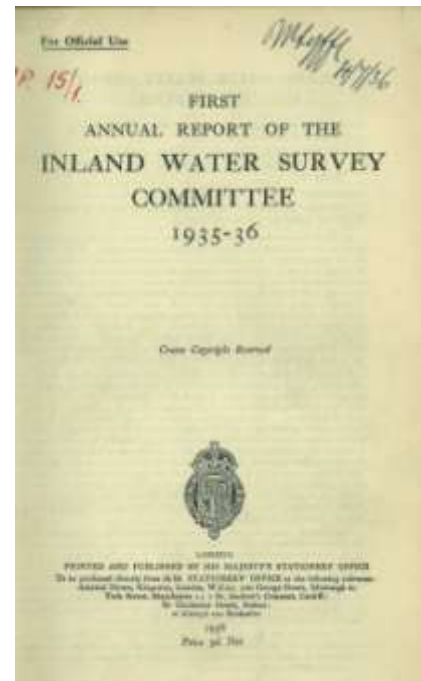
A National Archive by collaboration....

- “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



A National Archive by collaboration....

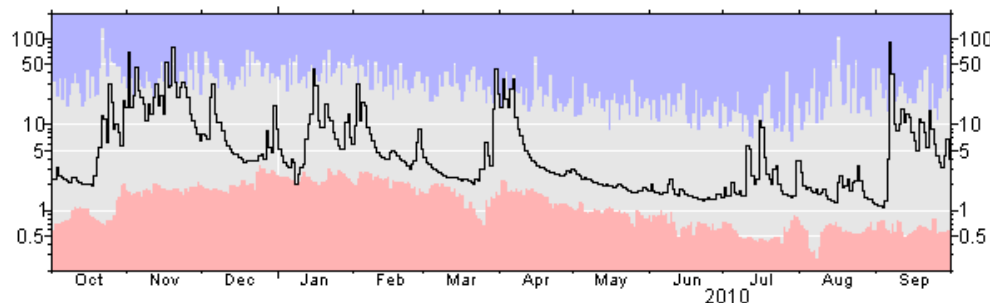
- UK Surface and Groundwater Archives Committee



The National Archive Today

- National hydrometric archive
 - Primarily **Daily Mean Flow** Data
 - 53,000 Station years of data
 - ~1500 Gauging Stations
 - Earliest data from 1841 (Wendover Springs)
 - Metadata, archive of station history material, microfilmed level charts, etc...

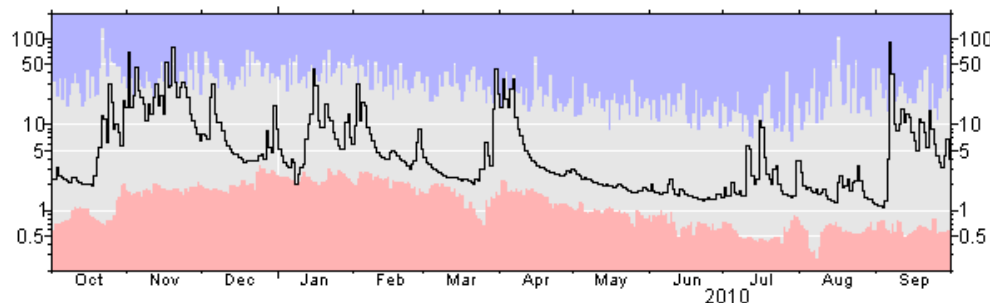
201005 Camowen at Camowen Terrace, Gauged Daily Flow



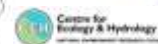
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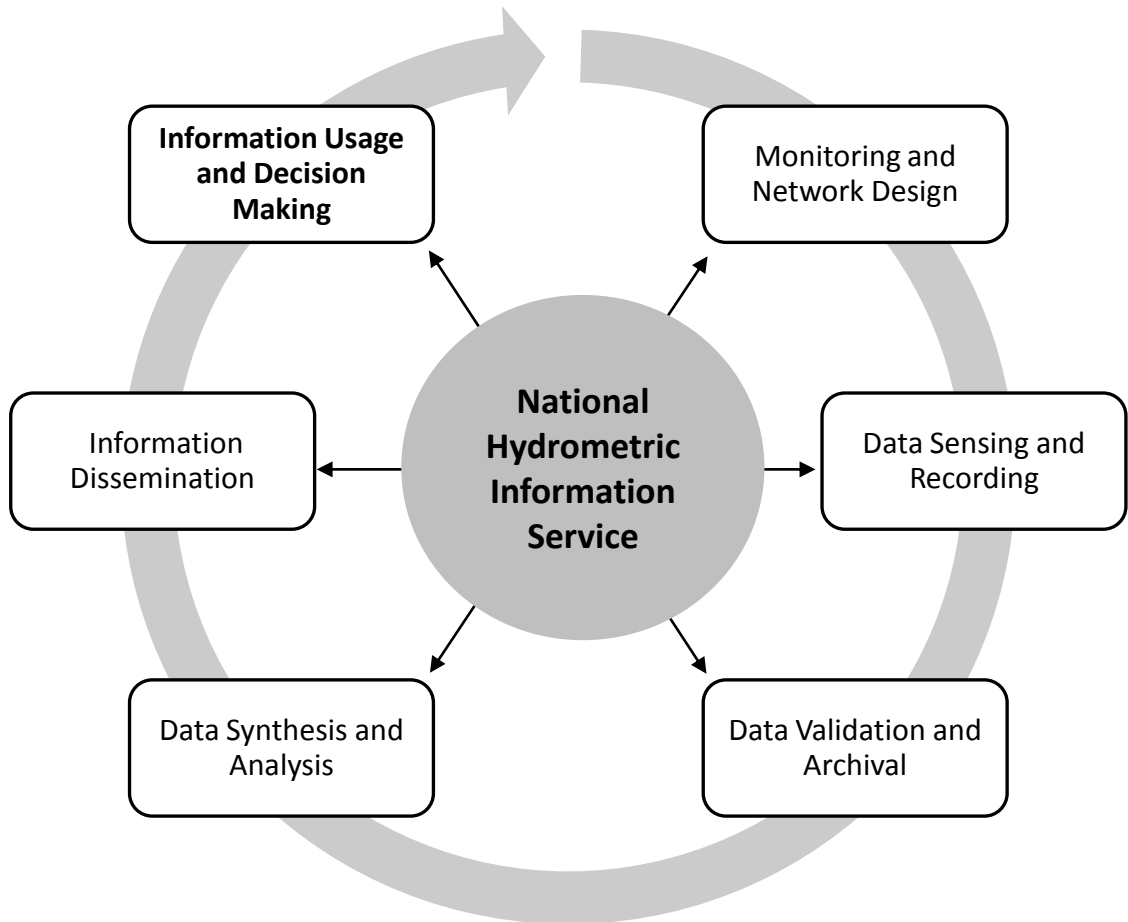


**NATIONAL RIVER
FLOW ARCHIVE**



Hydrometric Information Lifecycle

- Importance of links between all aspects of hydrometric data production and analysis
- Encompassing different organisations and users
- Internationally National Hydrological Services vary greatly in organisation setup.
- The NRFA tries to engage around the cycle



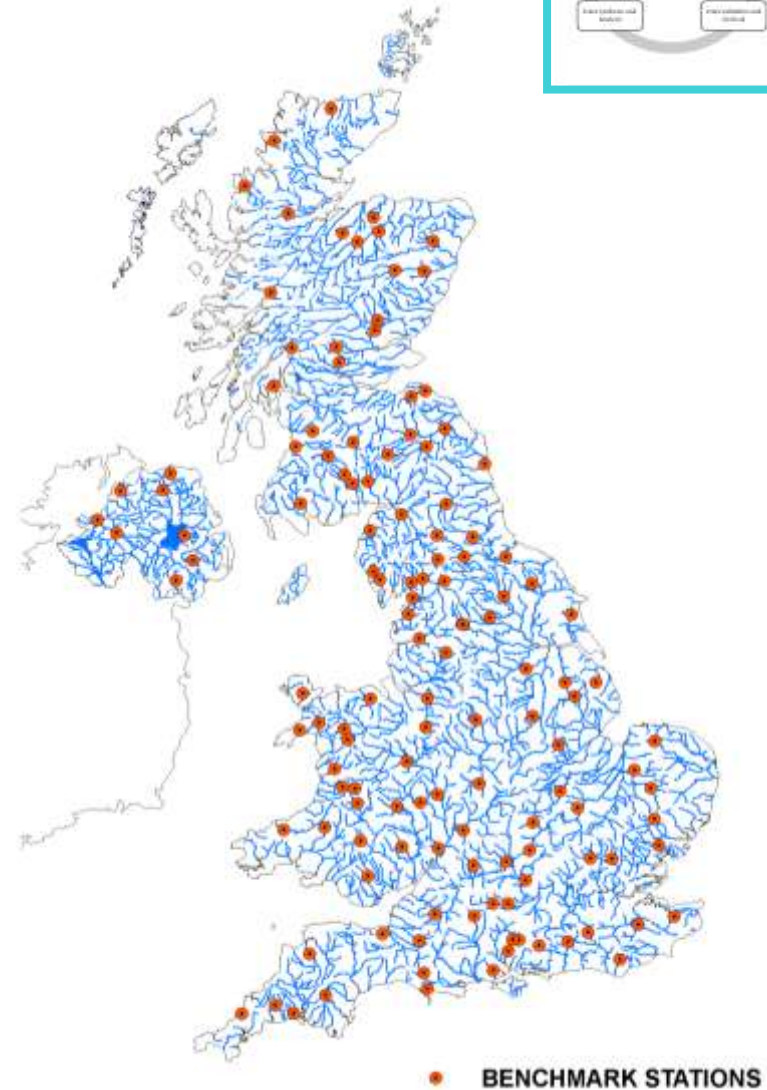
Monitoring and Network Design



National sub-networks:

Recent:

- Benchmark Network
 - 130+ 'Near natural' catchments



Benchmark Network: Bradford & Marsh (2003)

Burn et al (2011 – Submitted)

Monitoring and Network Design



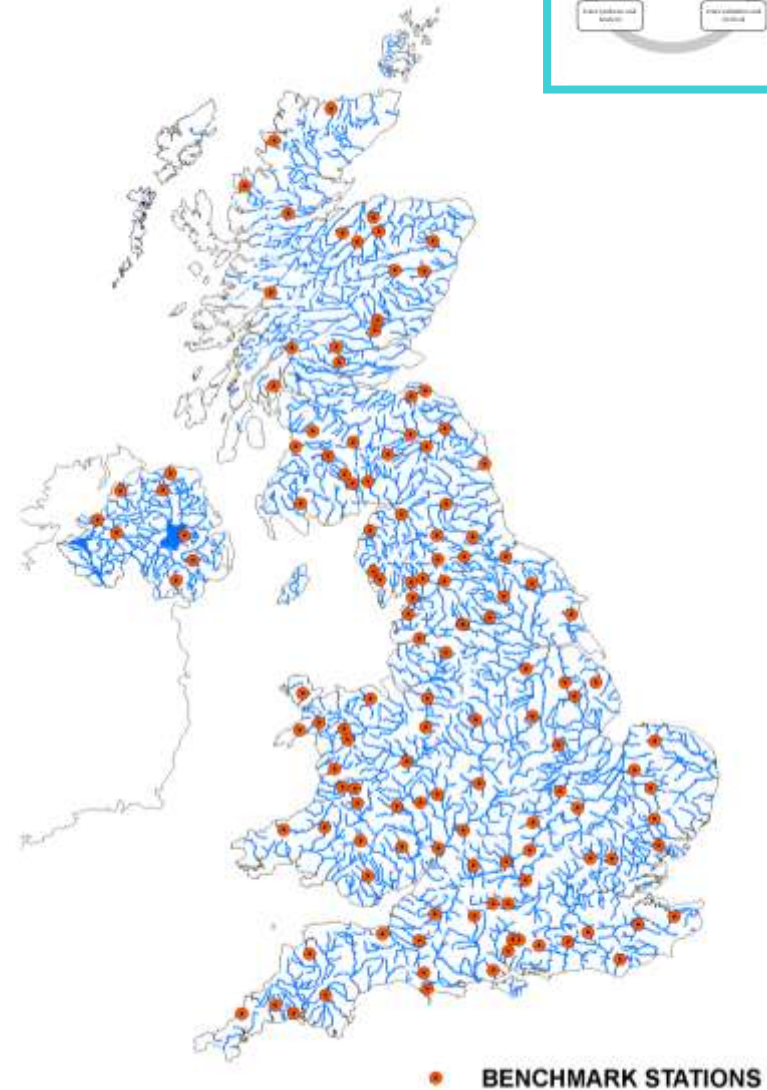
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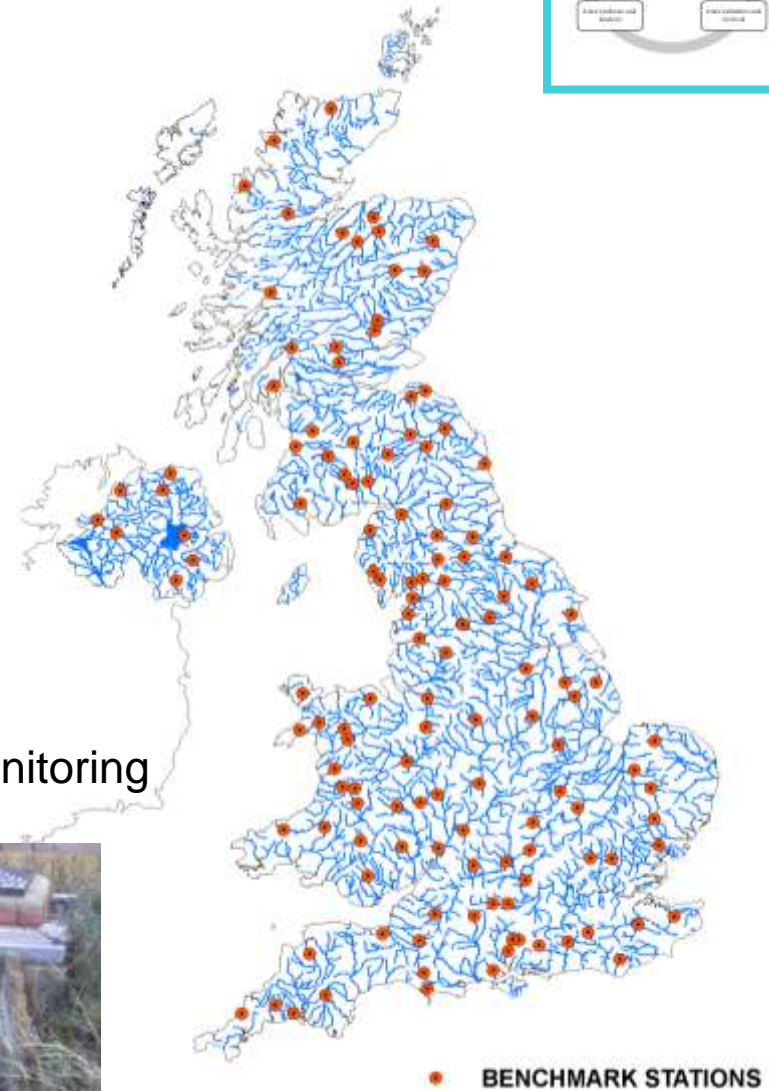
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Future:

- More integrated monitoring at national scale
 - Added information delivery from co-located monitoring



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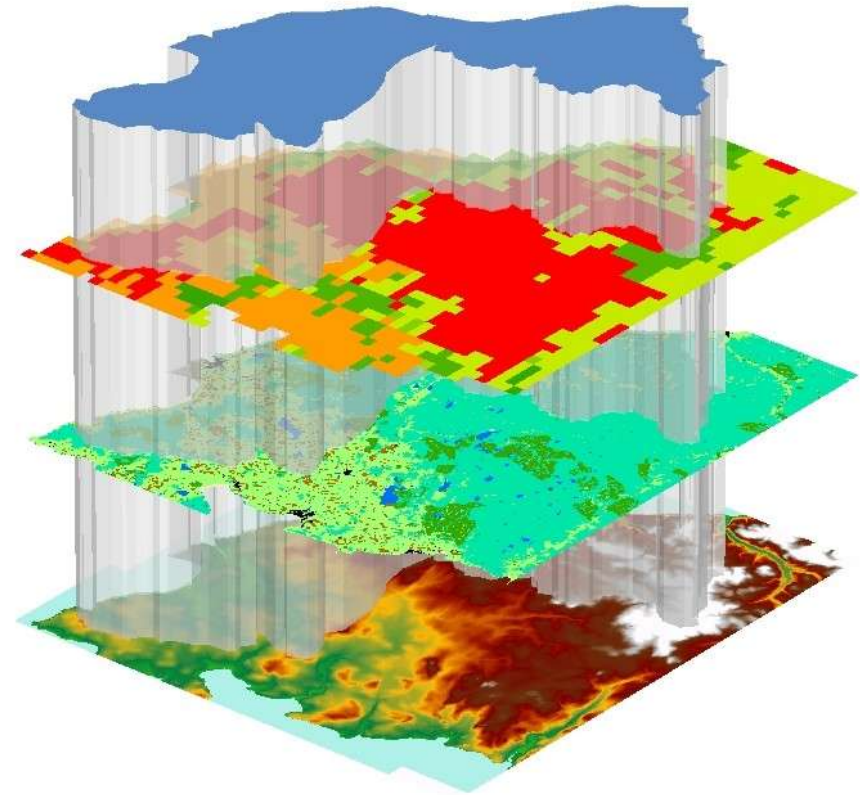
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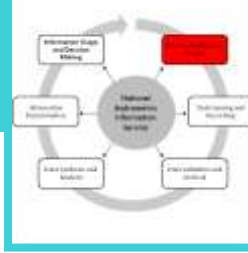
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 - Representative Catchment Index
 - Catchment Utility Index



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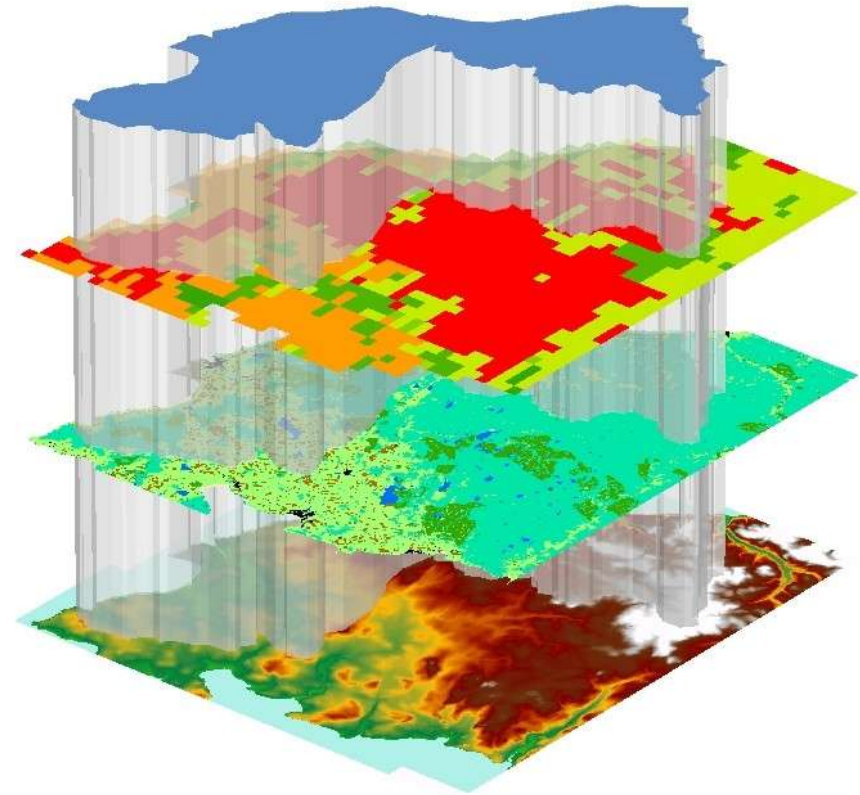
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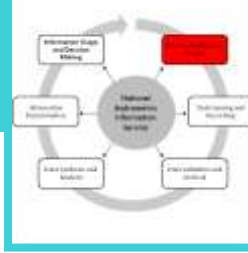
Current:

- Network review
 - Pressure on monitoring globally
 - Important that all user needs are considered
 - Operational AND strategic needs



Assessment tools: Laizé et al (2008)
Network Review: Hannaford et al (2011)

Monitoring and Network Design



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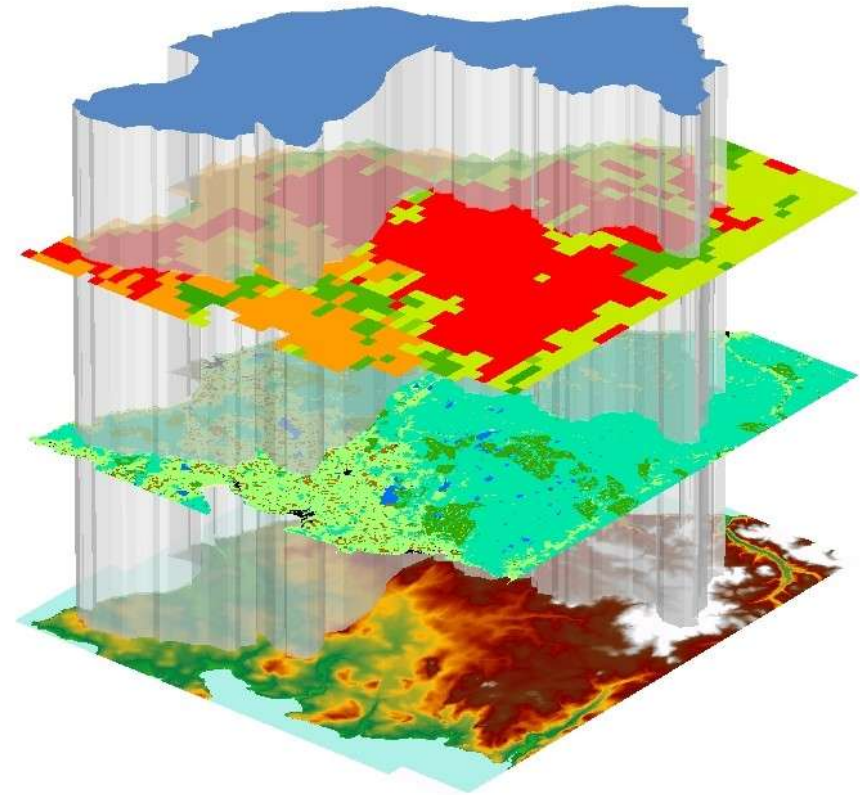
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Future:

- Web-based user tools for catchment assessment



Data Sensing and Recording

Recent :

- Understanding and communicating hydrometric issues through the cycle:
 - NRFA regional hydrometric data specialists
 - Concentration on overall utility of datasets
 - Information for a range of scales:
National/International **vs.** Regional/Local



Data Sensing and Recording



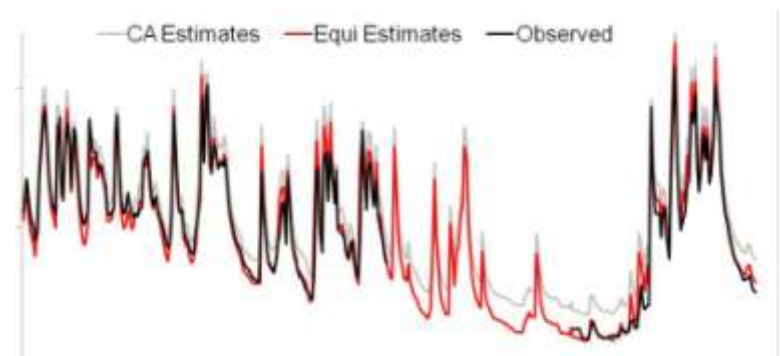
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 - Small gaps in flow series remain a problem
 - Research into infilling techniques
 - Guidance to promote consistency & auditability



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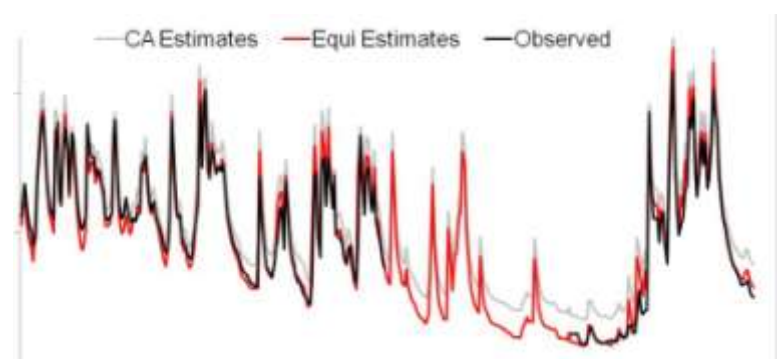
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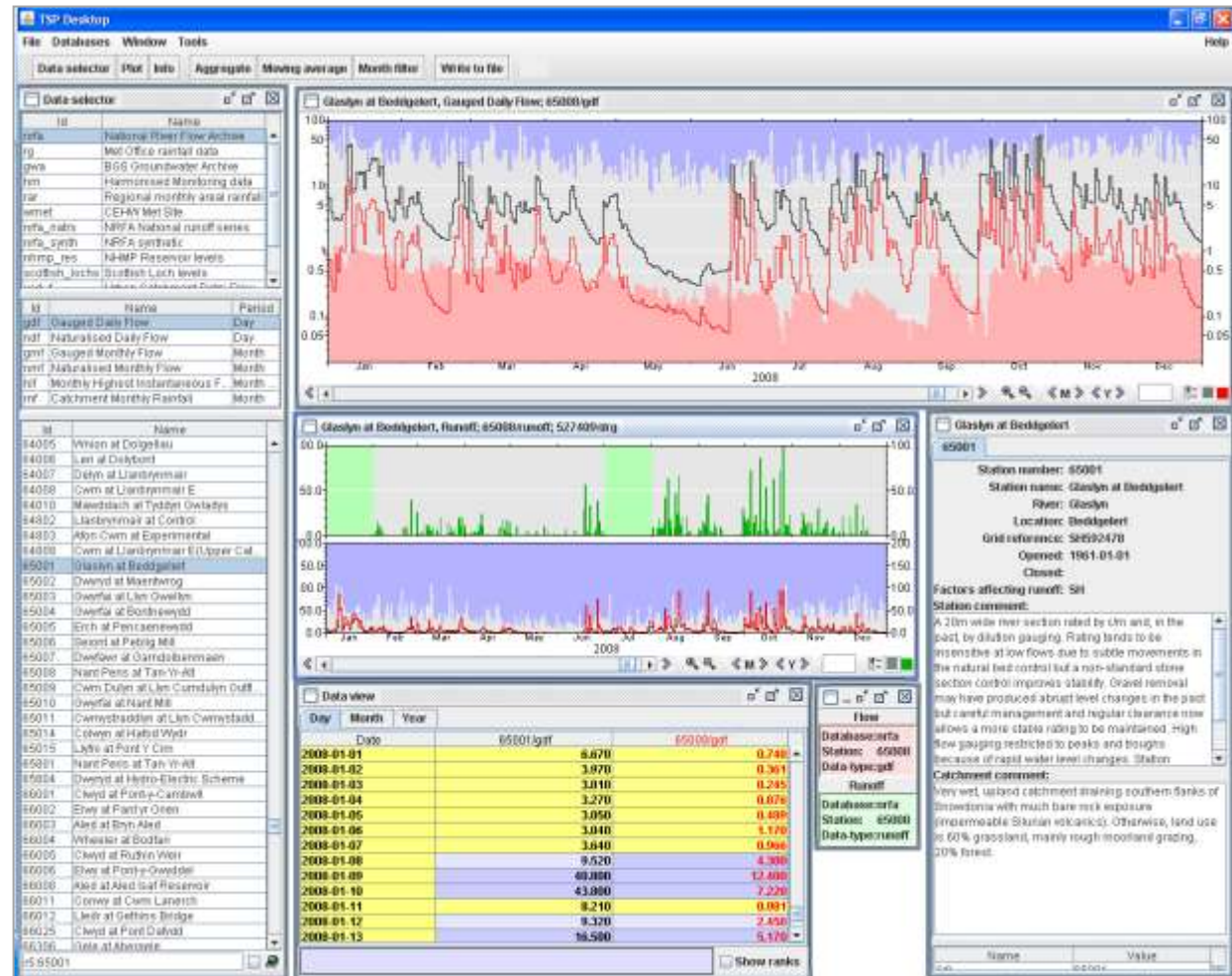
Future:

- Communicating uncertainty!



The diagram illustrates the Entrepreneurial Mindset Framework. At the center is a circle labeled "Entrepreneurial Mindset Framework". Surrounding this central circle are six rectangular boxes, each representing a component of the framework. The boxes are arranged in a circular pattern, and arrows indicate a clockwise flow from one box to the next. The components are: "Interchangeable Skills and Capabilities", "Learning Mindset", "Thriving and Flourishing", "Entrepreneurial Mindset", "Entrepreneurial Mindset", and "Entrepreneurial Mindset".

- Data validation by regional NRFA specialists before data is added to the national archive
- Data queries lead to improved data for all parties
- Bespoke data handling systems developed for visual and automated checking:

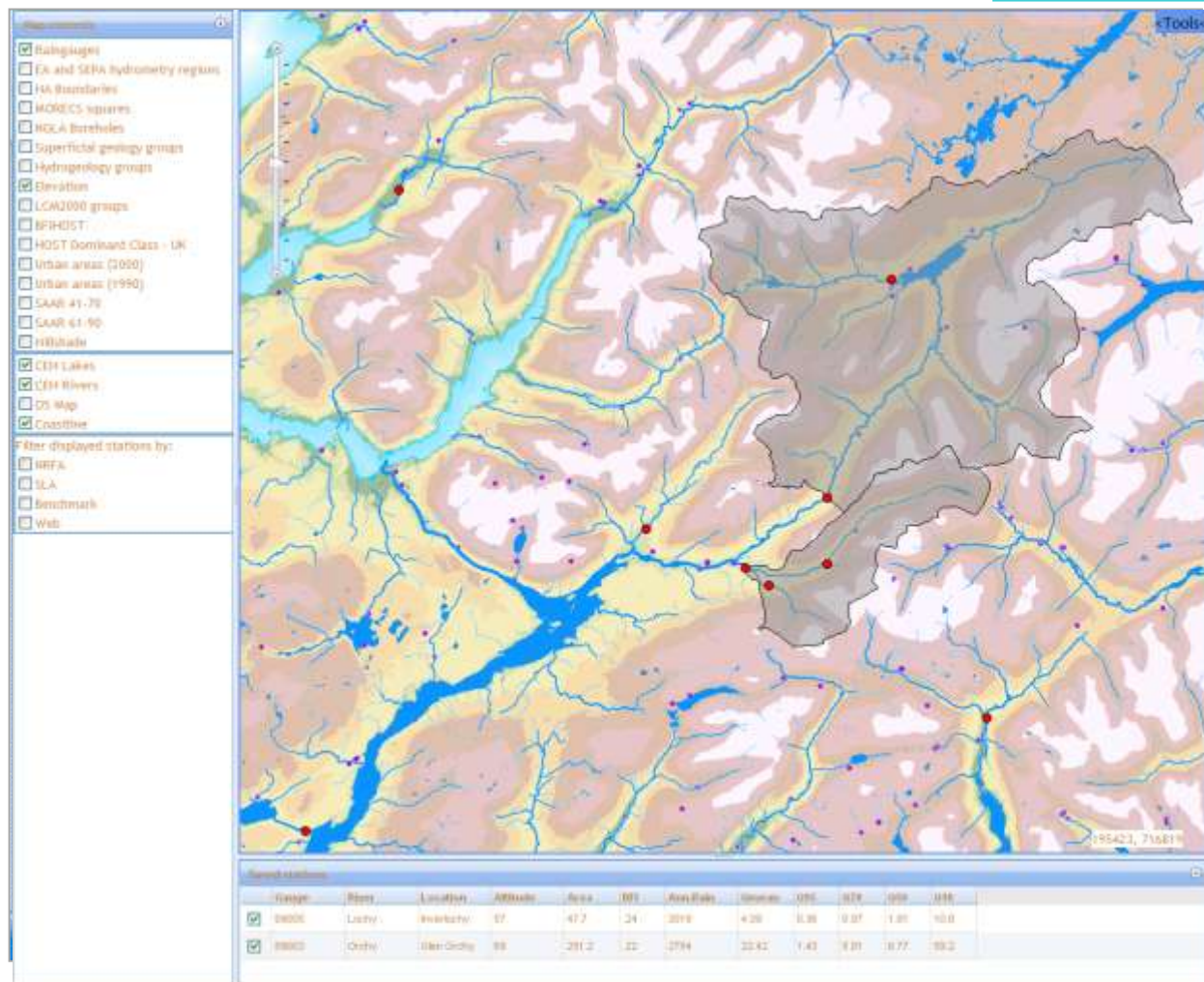


Data Validation and Archival



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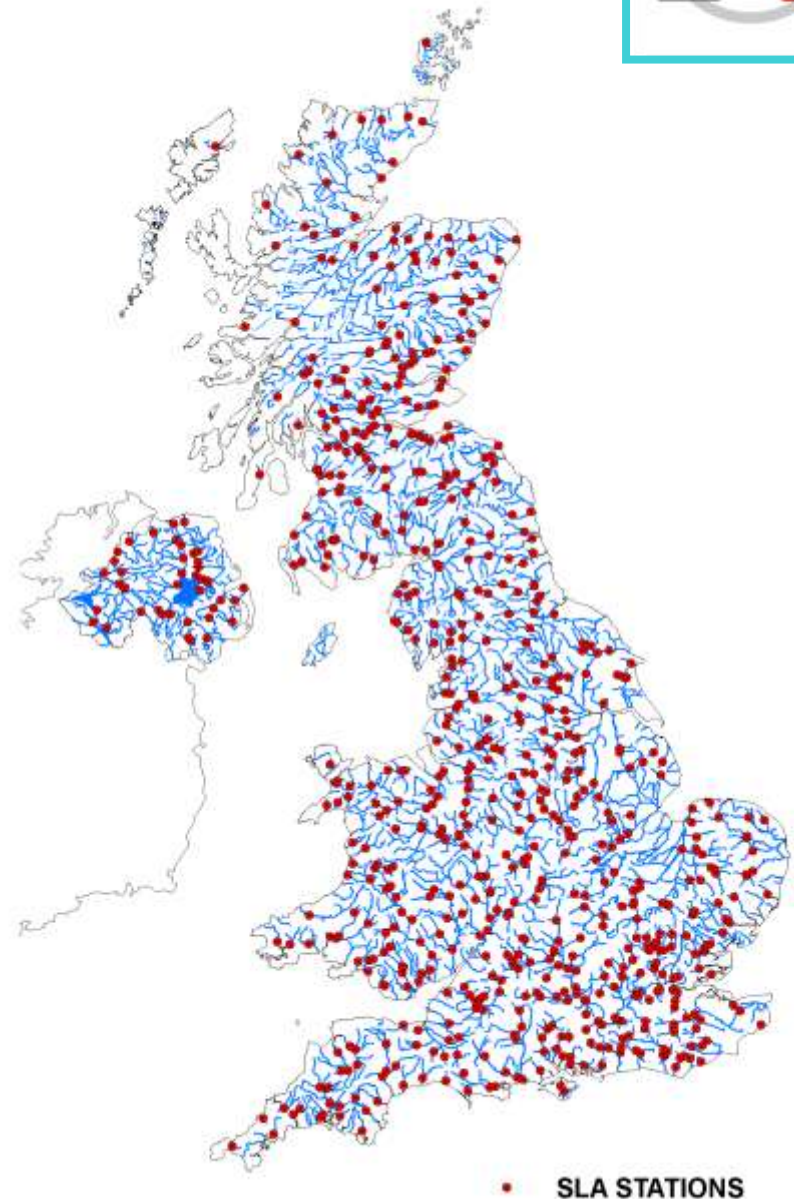


Data Validation and Archival



Controlling data provision to the national archive:

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

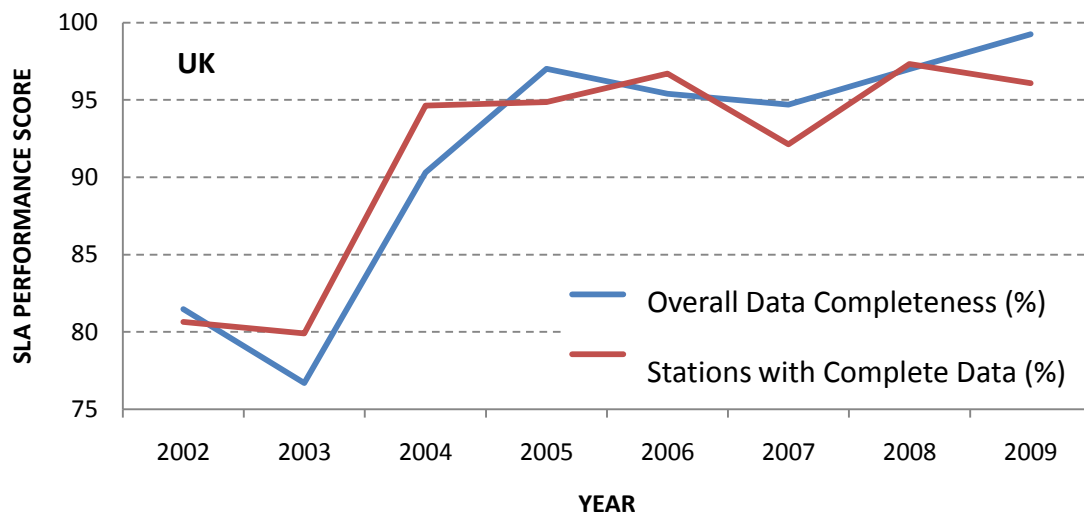
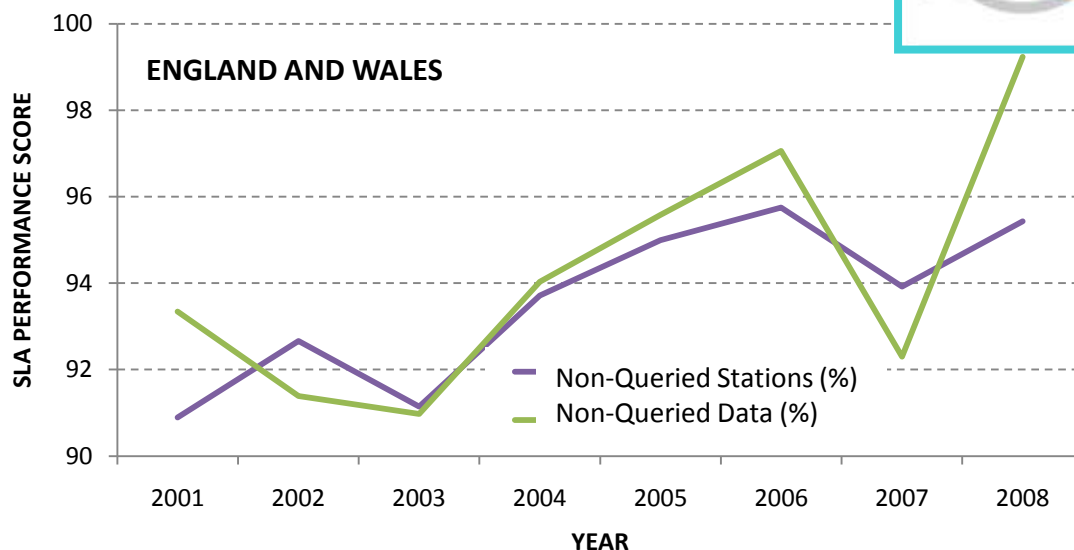


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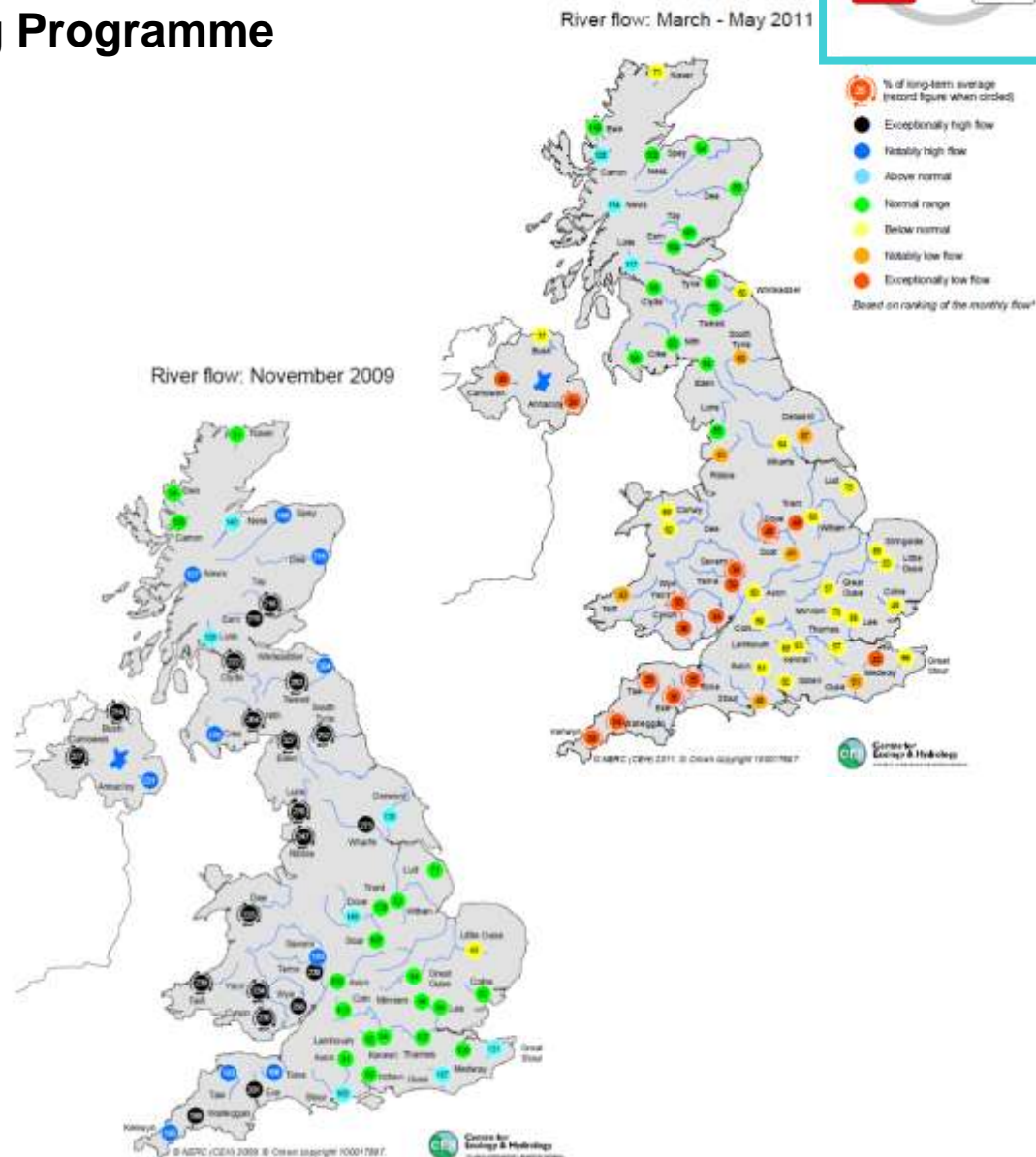
- Service Level Agreement since 2002
- Aims:
 - Promote **stability** in national network
 - Improve data **quality**
 - Increase data **completeness**
- Subset of network monitored through Performance Indicators
 1. Data provision timeliness
 2. Data completeness
 3. Data queries



Data Synthesis and Analysis

National Hydrological Monitoring Programme

- Started in 1988
- Monthly situation reporting
- Hydrological review of major events



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Recent :

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- Back catalogue of 300+ publications available on the NRFA website
- Media engagement to promote scientific understanding



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Future:

- Ecological impacts
- International context



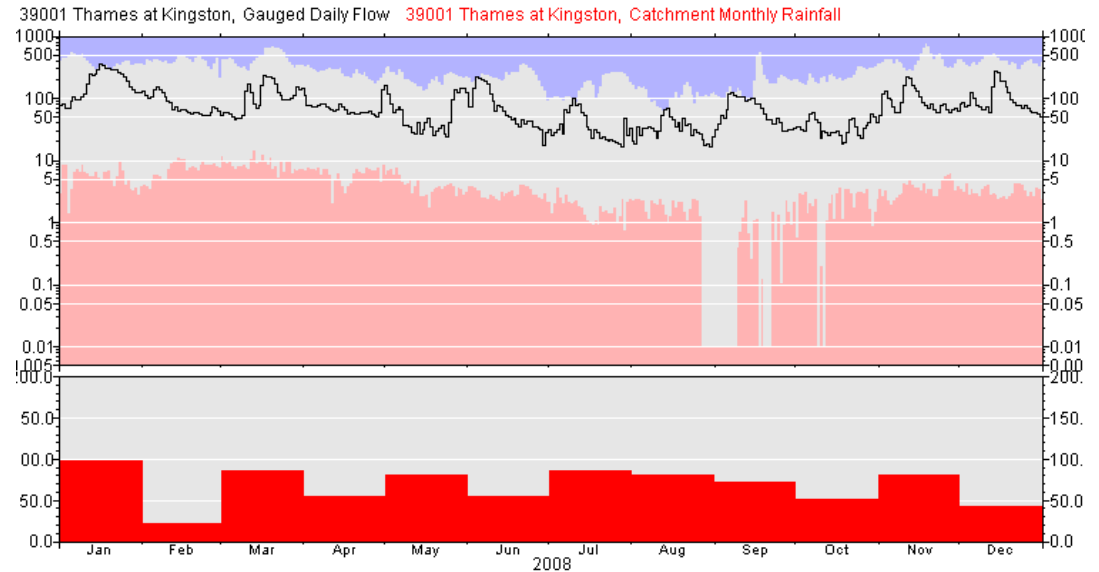
Information Dissemination



Core datasets:

Time Series

- Gauged Daily Mean Flows
- Naturalised Flows (some)
- Catchment monthly rainfall



The diagram illustrates the Entrepreneurial Process as a continuous cycle. At the center is a grey circle labeled "Entrepreneurial Decision-making Process". Surrounding this central circle are six rectangular boxes, each representing a stage in the process, connected by a circular arrow indicating a clockwise flow. The stages are: 1. "Identifying Business Opportunity" (top right), 2. "Validating and Assessing Opportunity" (middle right), 3. "Formulating Business Plan" (bottom right), 4. "Securing Resources and Funding" (bottom left), 5. "Implementing and Managing Business" (middle left), and 6. "Evaluating and Adapting Business" (top left). A red rectangular box labeled "Entrepreneurial Process" is positioned to the left of the central circle, with an arrow pointing towards it.

The diagram illustrates the Design Thinking Process as a circular flow. At the center is a grey circle labeled "Design Thinking: Understanding Learning". Surrounding this central circle are five rectangular boxes, each representing a stage of the process, connected by a circular arrow indicating a clockwise flow. The stages are:

- Understanding the Problem** (top right)
- Defining the Problem** (right)
- Ideating Solutions** (bottom right)
- Prototyping and Testing** (bottom left)
- Evaluating and Refining** (left)

 A red rectangular box labeled "Design Thinking Process" is positioned to the left of the central circle, with an arrow pointing towards it. The entire process is enclosed within a larger, light grey circular arrow that also points clockwise.

Information Dissemination



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- Naturalised Flows (some)
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Basic Metadata

- Location, Catchment area, Station type
- Photos

User Guidance Information

- Station descriptions
- Catchment characteristics
- Factors affecting runoff

Catchment Metadata

- Elevation, Geology, Land use

Maintaining metadata is a vital part of data stewardship



Station and Catchment Description

Ultrasonic station commissioned in 1974; multi-path operation from 1986 and back-up ultrasonic installed in 1991. Full range. Lockages not allowed for and high water temperatures can effect gauge performance at low flows. No peak flows pre-1974 when dmfs derived from Teddington weir (a 70m wide complex of gates, sluices, weirs and locks); tailwater rating used with twice-daily levels (at low tide) to compute flows >85 cumecs. Significant structural improvements since 1883 but high hydrometric accuracy not achievable for pre-1951 record (leakage and lockages result in underestimation of early low flows; mill operation also evident on early hydrographs. Gauged flow fell to zero in August 1976. 1894 peak gdf re-assessed in 2002 (800 cumecs). Increased channel capacity means that bankfull now very rarely exceeded. Baseflow sustained mainly from the Chalk and the Oolites; flashfloods from tributaries draining the clay vales. Some runoff from outside the catchment but overall negligible.

Thames at Kingston

Measuring Authority: Environment Agency
Data Reference: 21 (T2) 177 000
Station Type: Ultrasonic

Detailed Flow and Rainfall
BMPA Station Number: 2
Local Number: 3432

Daily Flow Hydrograph

Max. and min. flow mean from 1850 to 2010 excluding those for the National grid (2000-1999) flow: 30.25 m³/s

Flow Duration Curve

Flow Statistics

Flow Type	Mean	Median	Mode	Range
1 day	10.0	10.0	10.0	10.0
3 day	10.0	10.0	10.0	10.0
7 day	10.0	10.0	10.0	10.0
15 day	10.0	10.0	10.0	10.0
30 day	10.0	10.0	10.0	10.0
60 day	10.0	10.0	10.0	10.0
120 day	10.0	10.0	10.0	10.0
240 day	10.0	10.0	10.0	10.0
480 day	10.0	10.0	10.0	10.0
960 day	10.0	10.0	10.0	10.0
1920 day	10.0	10.0	10.0	10.0
3840 day	10.0	10.0	10.0	10.0
7680 day	10.0	10.0	10.0	10.0
15360 day	10.0	10.0	10.0	10.0
30720 day	10.0	10.0	10.0	10.0
61440 day	10.0	10.0	10.0	10.0
122880 day	10.0	10.0	10.0	10.0
245760 day	10.0	10.0	10.0	10.0
491520 day	10.0	10.0	10.0	10.0
983040 day	10.0	10.0	10.0	10.0
1966080 day	10.0	10.0	10.0	10.0
3932160 day	10.0	10.0	10.0	10.0
7864320 day	10.0	10.0	10.0	10.0
15728640 day	10.0	10.0	10.0	10.0
31457280 day	10.0	10.0	10.0	10.0
62914560 day	10.0	10.0	10.0	10.0
125829120 day	10.0	10.0	10.0	10.0
251658240 day	10.0	10.0	10.0	10.0
503316480 day	10.0	10.0	10.0	10.0
1006632960 day	10.0	10.0	10.0	10.0
2013265920 day	10.0	10.0	10.0	10.0
4026531840 day	10.0	10.0	10.0	10.0
8053063680 day	10.0	10.0	10.0	10.0
16106127360 day	10.0	10.0	10.0	10.0
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Information Dissemination

Main dissemination routes:

- **Publications:**
Yearbooks (1935-1995)
Hydrometric Register (Latest 2008)
- **Manual enquiry service:**
~ 400 p.a.
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OECD  OCDE

European Environment Agency  

 UK National Statistics

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European Environment Agency



• UK contributions to international data centres:

- WMO Global Runoff Data Centre
- UNESCO IHP-FRIEND European Water Archive

Archives at a national level make international collaboration easier



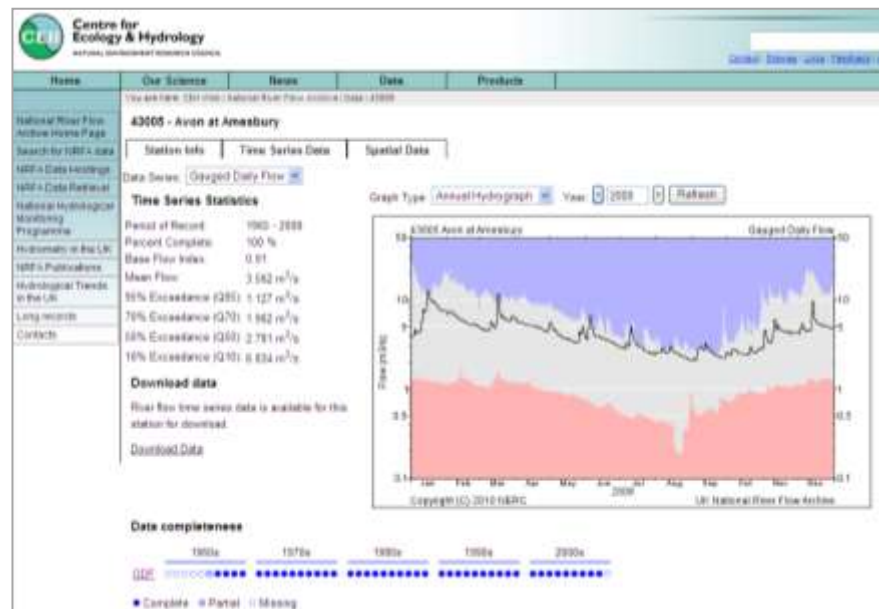
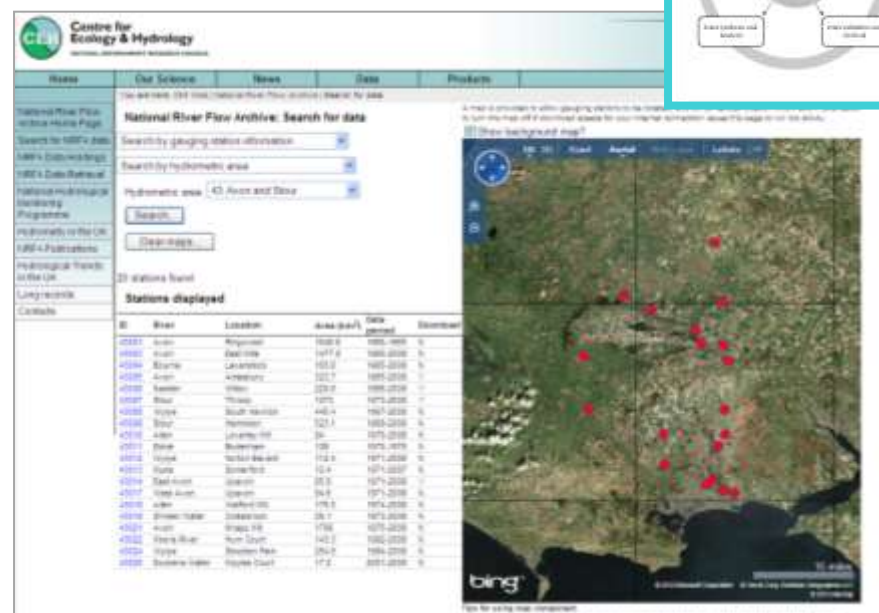
Information Dissemination



Recent:

Website developments:

- **Discovery:** map and metadata based searching
- **Viewing:** Dynamic time series graphing and metadata comparison
- **Download:** Currently ~ 200 stations



Information Dissemination



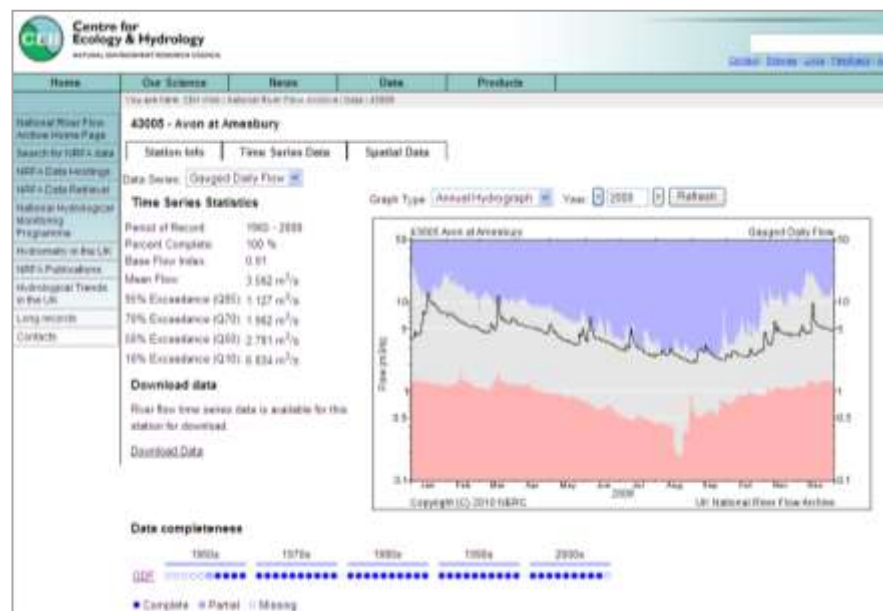
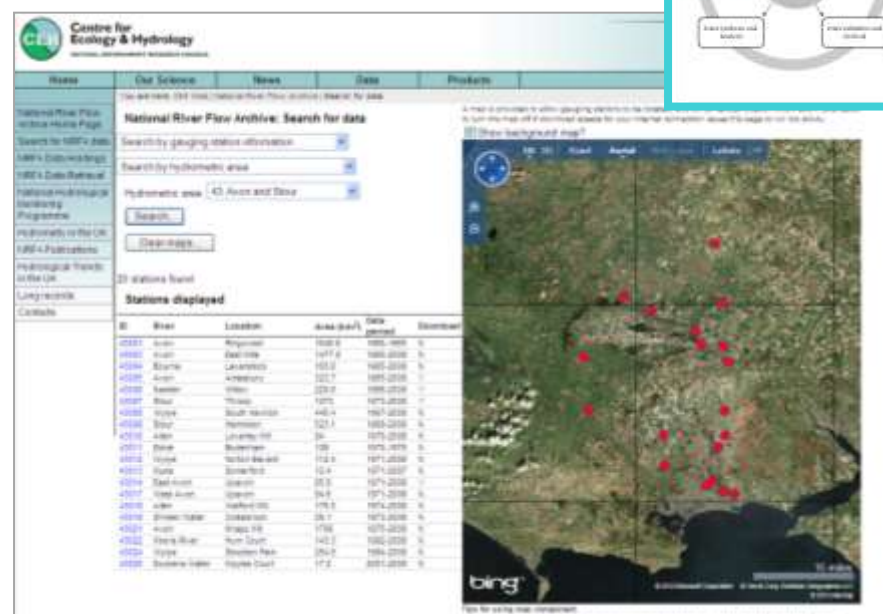
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Information Dissemination



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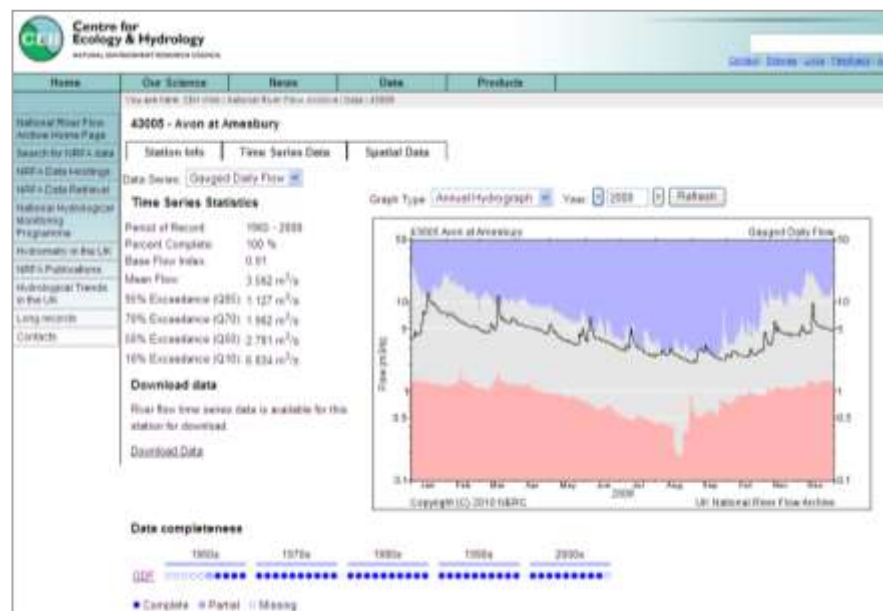
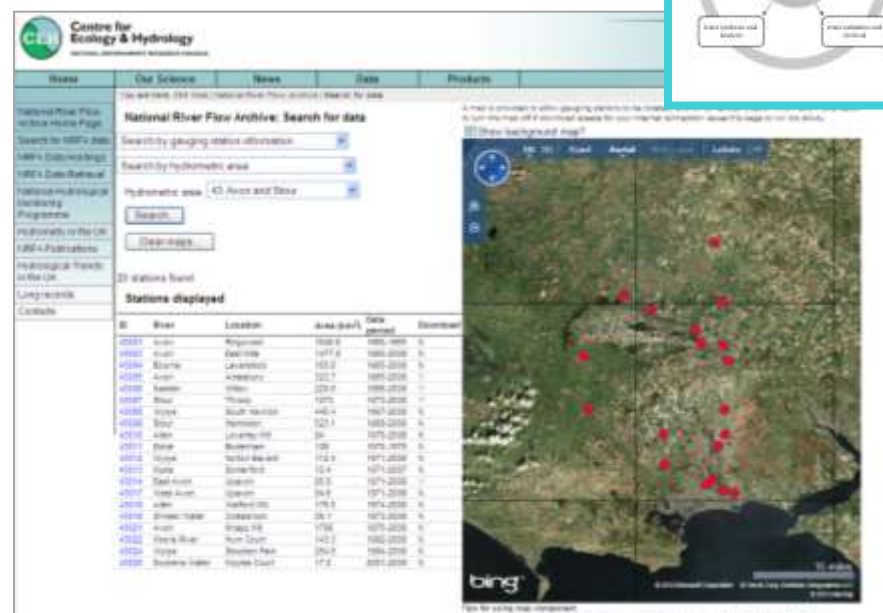
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Future:

- **Catchment 'explorer' tools**
- **'Trends' website**
- **Other technological opportunities**



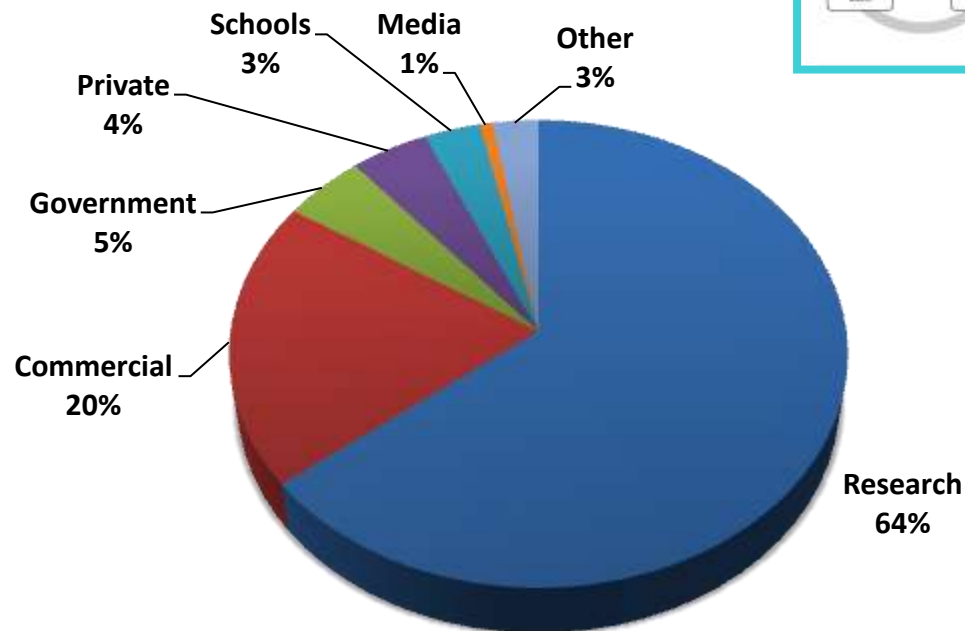
Information Use



User community:

Current:

- Direct Users
- Indirect users through:
 - Government reporting (ONS, Defra)
 - Media
 - Other data centres
- Measuring Authorities



Information Use



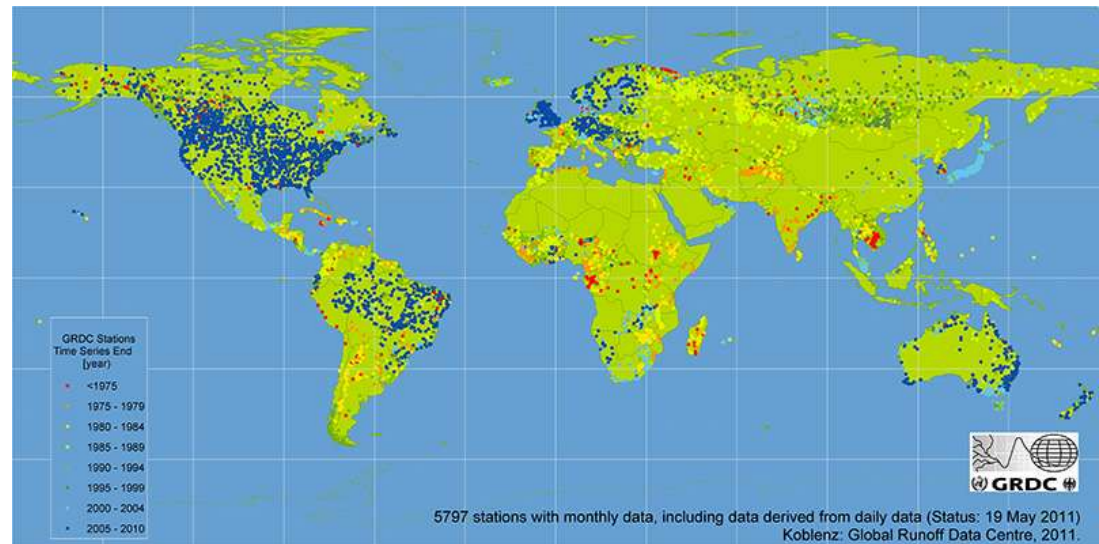
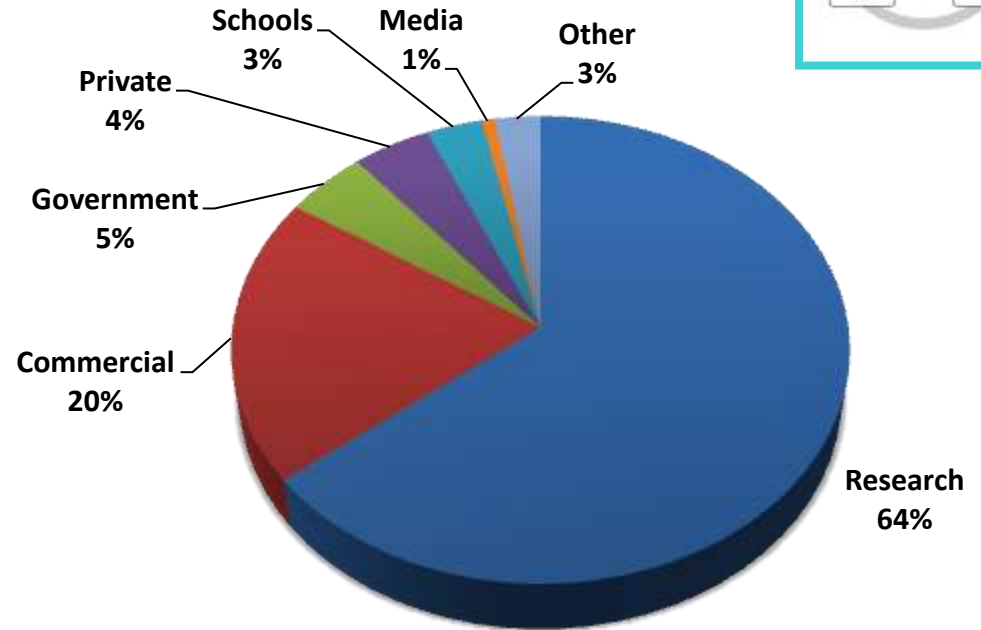
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Information Use



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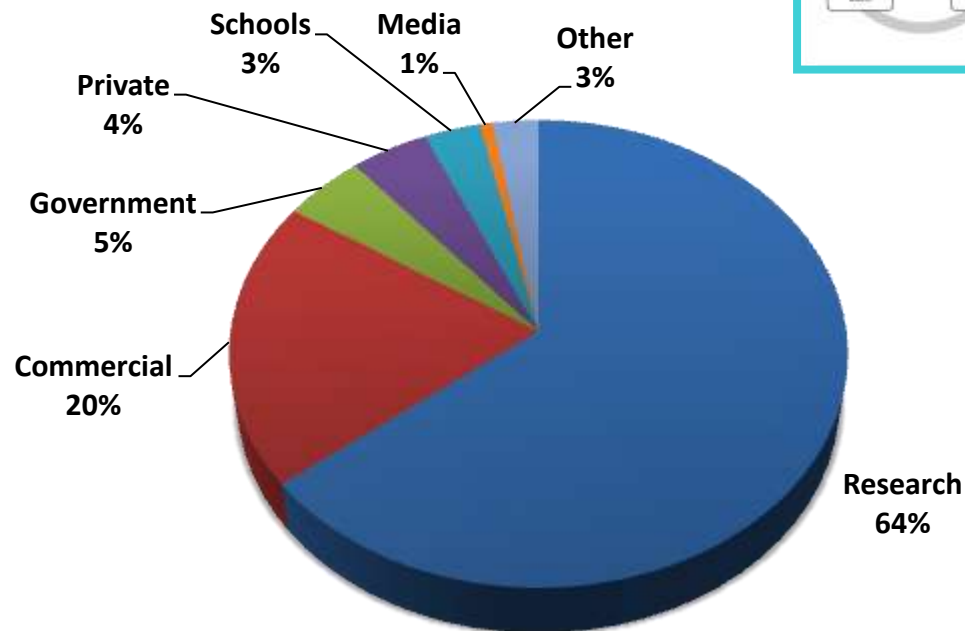
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Future:

- Increased international users
- Increased public awareness
- New user communities

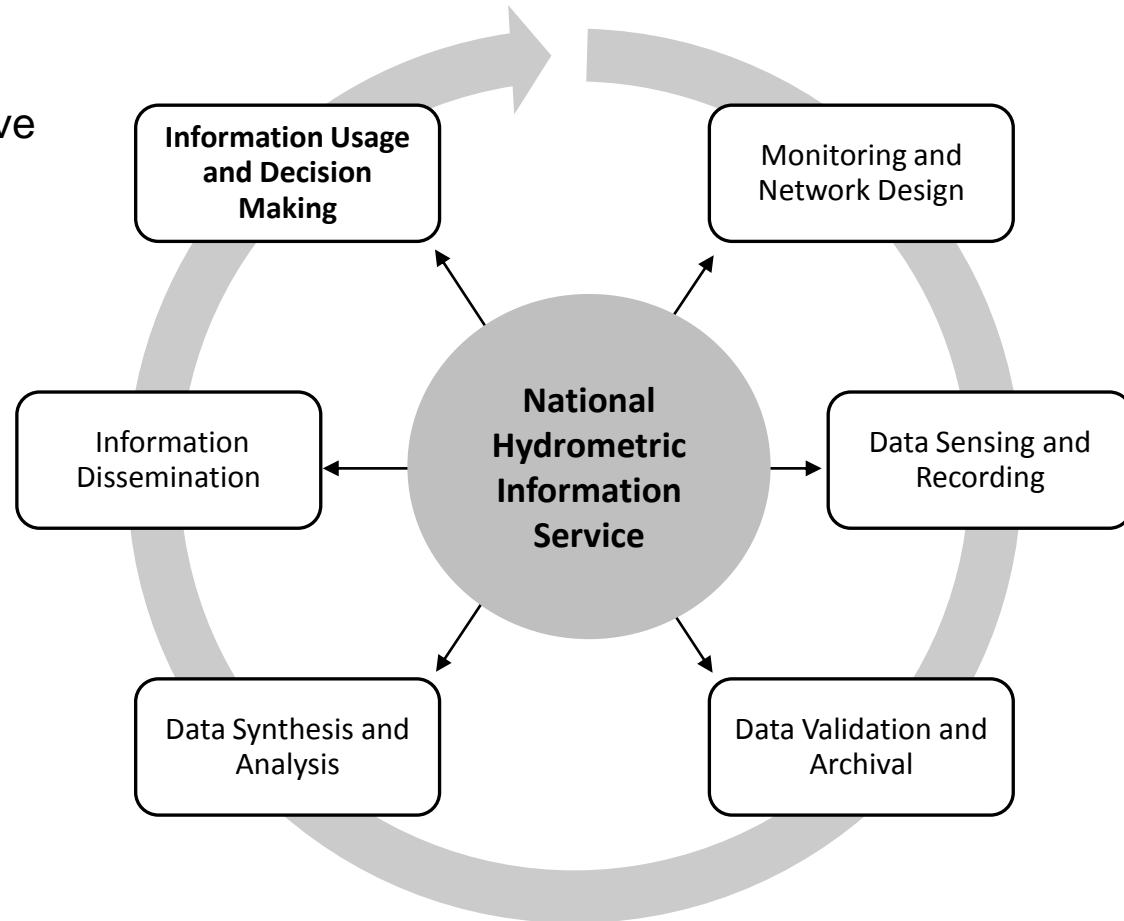
We don't know who tomorrow's users will be!



Conclusions

Improving national hydrometric data for the user:

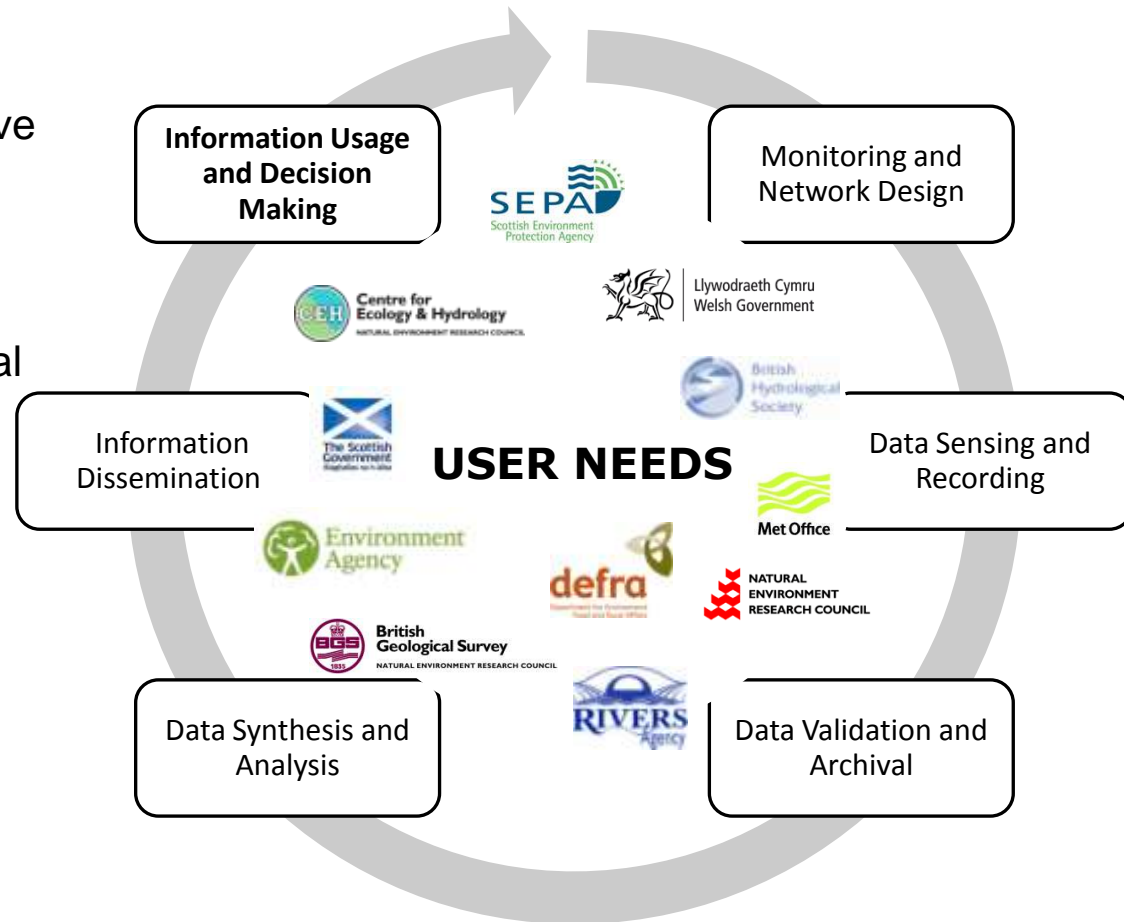
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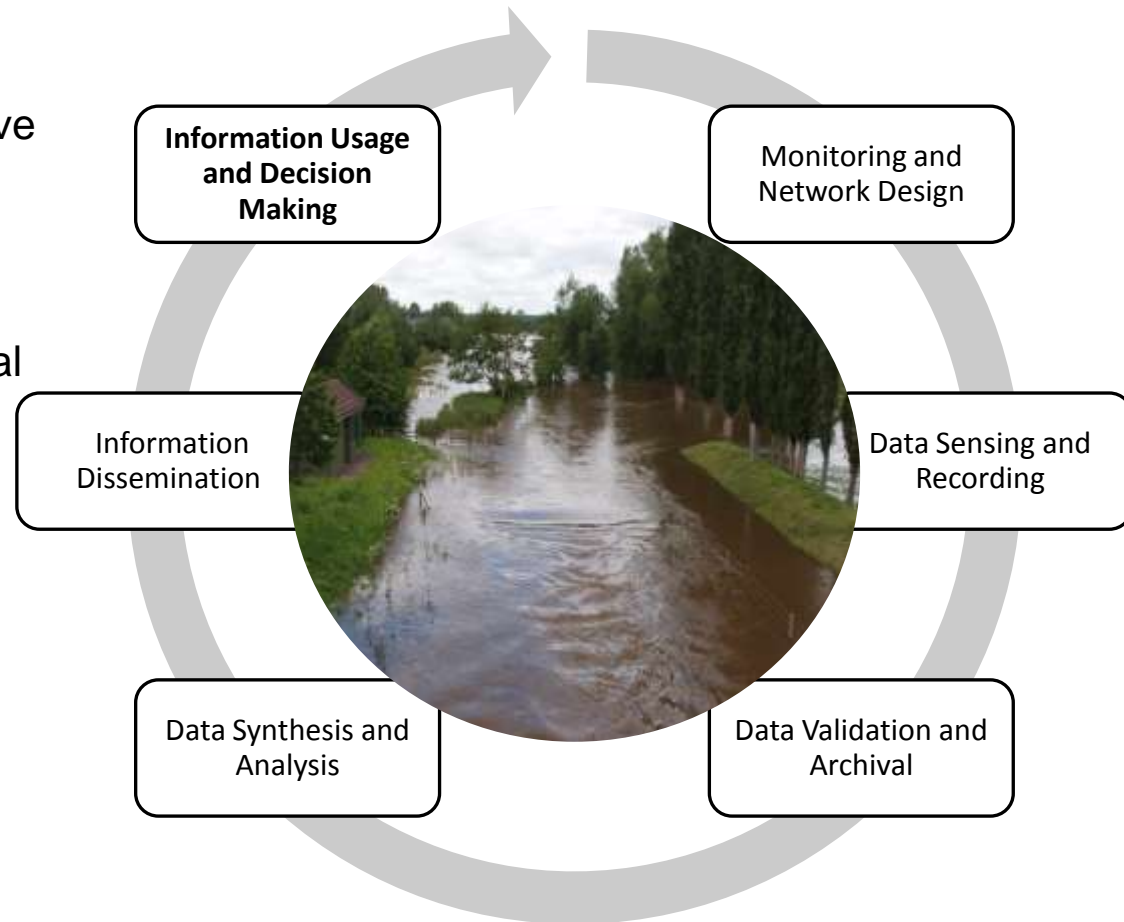
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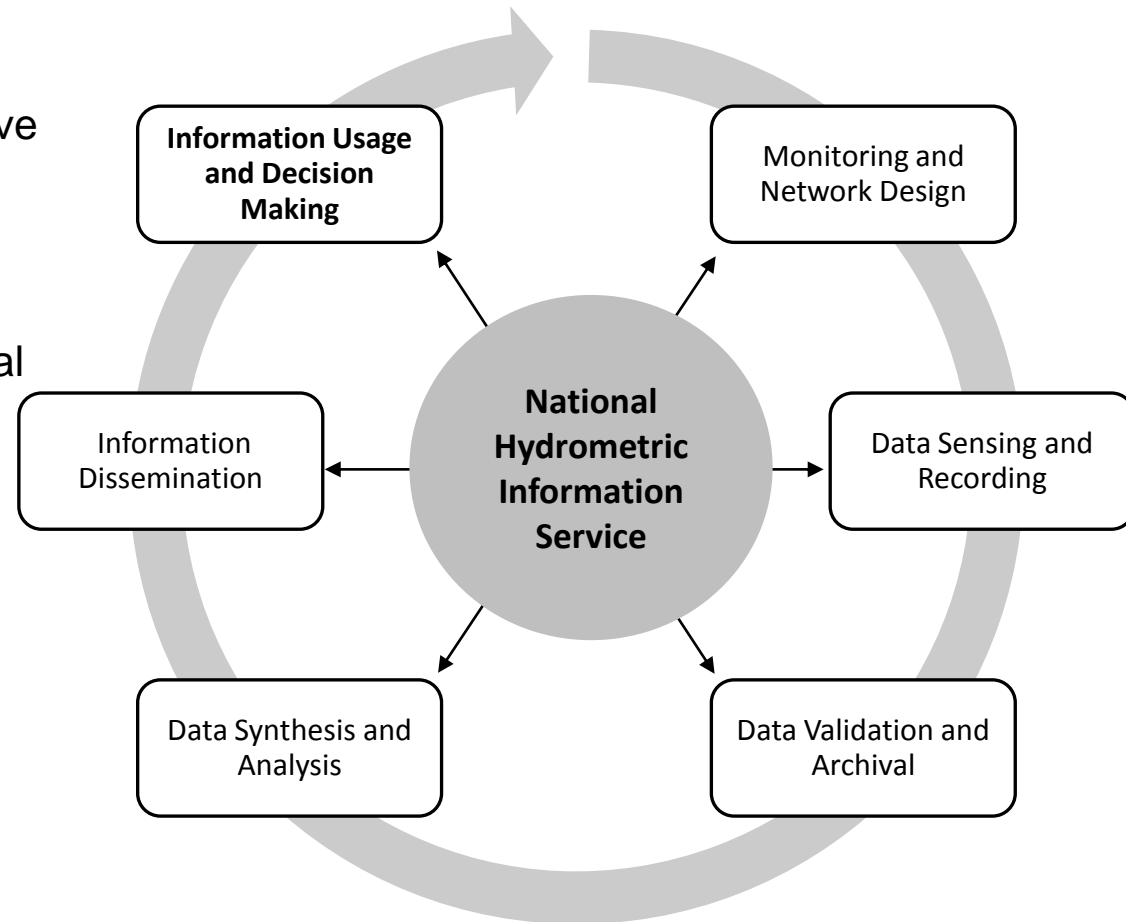


28052: River Sow at Great Bridgeford – June 2007
Photo: Richard Severn (EA Midlands)

Conclusions

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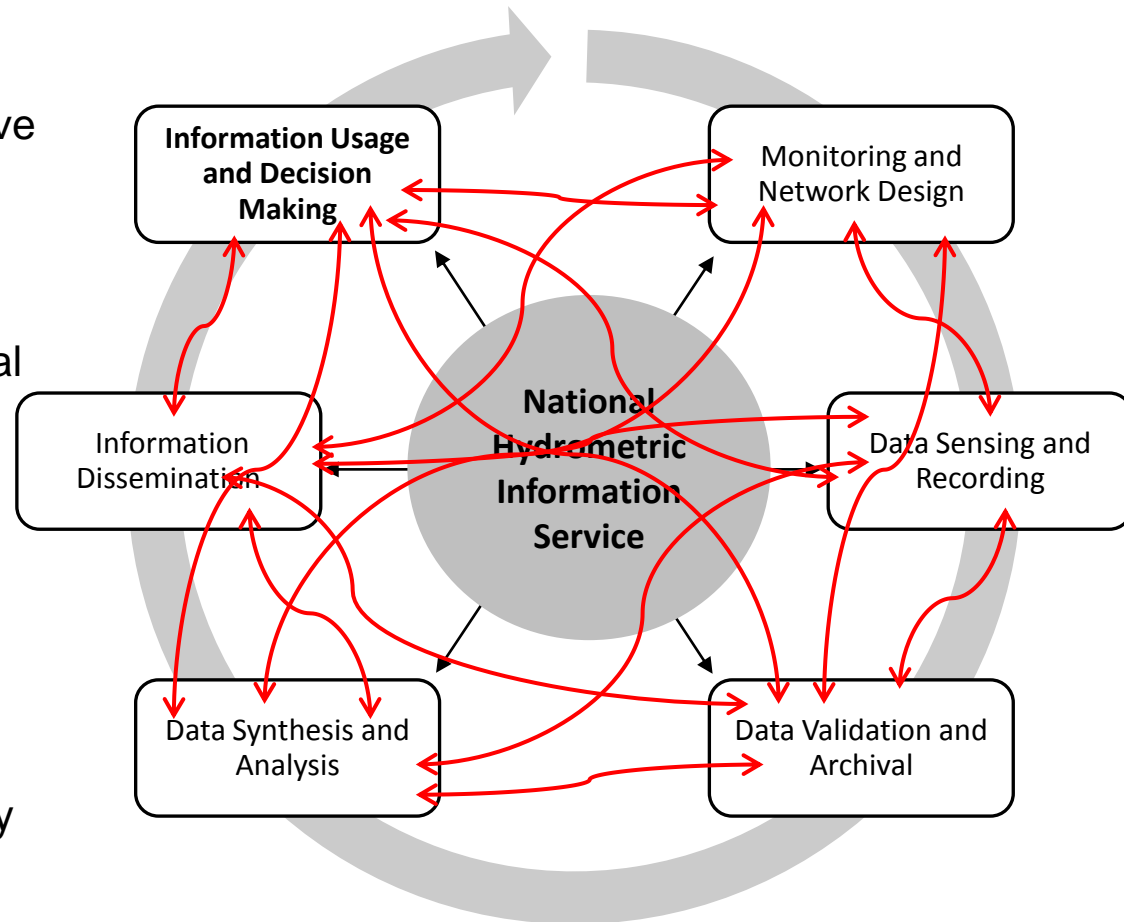
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Conclusions

Improving national hydrometric data for the user:

1. Delivering an efficient and effective hydrometry service should be seen as a cycle of connected stages
2. Collaboration between operational hydrology, research community and policy makers is key
3. Communicating caveats in data should be improved at all stages
4. Need to keep up with changes in technology
5. Feedback is vital - It's not actually a neat cycle!



WHY: DOES THE UK STILL NEED A NATIONAL RIVER FLOW ARCHIVE?



Centre for
Ecology & Hydrology

NATURAL ENVIRONMENT RESEARCH COUNCIL



WHY: DOES THE UK STILL NEED A NATIONAL RIVER FLOW ARCHIVE?

BECAUSE: ACCESS TO COHERENT NATIONAL HYDROMETRIC DATA IS VITAL FOR EFFECTIVE WATER RESEARCH AND MANAGEMENT



Thank you

NRFA:

CEH Wallingford

<http://www.ceh.ac.uk/data/nrfa>

nrfa@ceh.ac.uk

01491 692599

Details of references can be found at:

<http://www.ceh.ac.uk/data/nrfa/publications>