

UNIVERSITY OF
BIRMINGHAM



Organización de las Naciones Unidas
para la Educación, la Ciencia y la Cultura

Workshop Drought Vulnerability

Anne Van Loon, David M. Hannah, Julian Clark, Sally Rangelcroft



Introduction workshop leaders

<i>Prof. David Hannah</i>	Professor of Hydrology (Water Science), research on hydroclimatology, hydrological extremes, snow & ice, river temperature, sensing and data analysis methods
<i>Dr Julian Clark</i>	Senior lecturer Human Geography, research on water governance
<i>Dr Anne Van Loon</i>	Lecturer Physical Geography (Water Science), research on hydrological drought processes
<i>Dr Sally Rangecroft</i>	Postdoc, research project “Adding the human dimension to drought”



Snow & glaciers

Climate-hydrology

River temperature

Hydroclimatology



hydroclimatology

alpine, Arctic, mountain and glacierized basins

- heat fluxes-melt
- hydrograph analysis
- runoff modelling
- stream temperature
- water sources
- physico-chemical habitat
- benthic communities

*Regions: Pyrénées; Nepal;
New Zealand; Sweden;
Svalbard; Greenland; Peru*

climate and river flow regimes

- regime classification
- climatic sensitivity
- teleconnections
- regionalisation
- seasonal forecasting
- global to UK drought
- eco. response
- data issues

*Regions: W. Europe; UK;
N. Atlantic; Nepal; Turkey;
Med.; Thailand; USA; global*

river energy budget and thermal dynamics

- heat fluxes
- temp. dynamics
- riverbed/ hyporheic
- riparian land-use
- climate change
- GW-SW interact.
- salmonid habitat
- ERS beetle habitat

*Regions: UK – Scottish
Highlands; River Severn;
Argentina; France*

hydroecology



United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological Programme

FRIEND -Water

FLOW REGIMES FROM INTERNATIONAL EXPERIMENTAL
AND NETWORK DATA



Workshop programme

<i>Monday 29 Feb</i>	Follow-up of workshop on “Groundwater Drought” in Chile in November 2015 (Anne Van Loon & Sally Rangelcroft)
<i>Tuesday 1 Mar</i>	Drivers of Drought, Drought Data (David Hannah & Sally Rangelcroft) THIS MORNING Drought Vulnerability (David Hannah, Julian Clark & Anne Van Loon) THIS AFTERNOON
<i>Wednesday 2 Mar</i>	Drought risk assessment (Julian Clark, David Hannah & Anne Van Loon)

Reflections on workshop day 1



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Workshop programme

Tuesday 1 March

Session 1 09.00 – 10.30	Introduction from David Reflection on workshop day 1 Mini presentation from David: <i>Data availability and management</i>	Group work: Discuss the current barriers to good data availability and solutions to these barriers	DMH, SR
Tea/coffee break: 10.30 – 11.00			
Session 2 11.00 – 12.15	Mini presentation from David: <i>European scale drought? Detecting climate drivers of drought?</i>	Group discussion: Discussing climate drivers of drought in Chile. What data is needed? How can these be analysed? How can they be used for early warning systems?	DMH, SR
Lunch: 12.15 – 13.45			
Session 3 13.45 – 15.00	Independent group work: Blue print Chilean Drought Vulnerability Map		
Session 4 15.00 – 17.00	Group presentations: Blue print Chilean Drought Vulnerability Map	Group discussion: Feedback from staff on these ideas	DMH, SR, AVL, JC
<i>Evening suggestion: Fill in 'Thinking books' – to be discussed Wednesday afternoon</i>			

Large-scale river flow archives: importance, status and future



**David M. Hannah¹, Siegfried Demuth², Henny van Lanen³,
Ulrich Looser⁴, Christel Prudhomme⁵, Gwyn Rees⁵,
Kerstin Stahl^{6,7}, Lena Tallaksen⁶**

¹University of Birmingham, UK. ²UNESCO. ³Wageningen University, the Netherlands.

⁴Global Runoff Data Centre. ⁵Centre for Ecology & Hydrology, UK.

⁶University of Oslo, Norway. ⁷University of Freiburg, Germany.

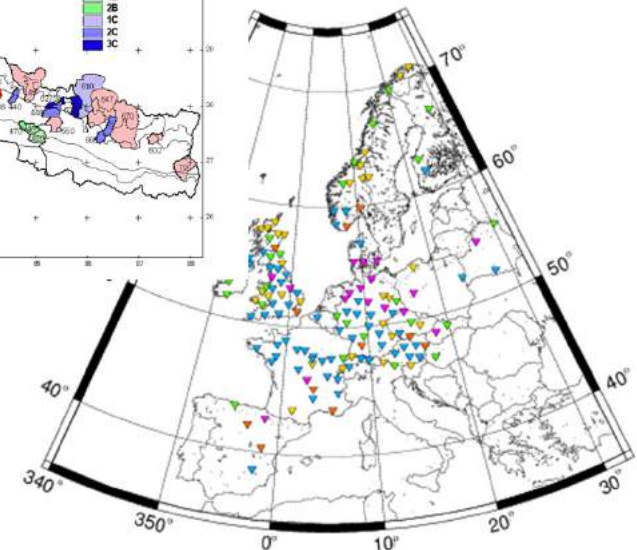
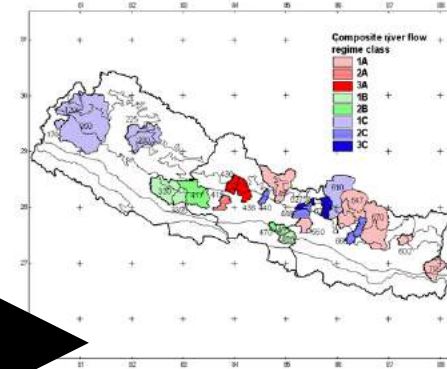
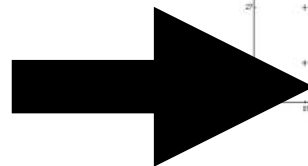
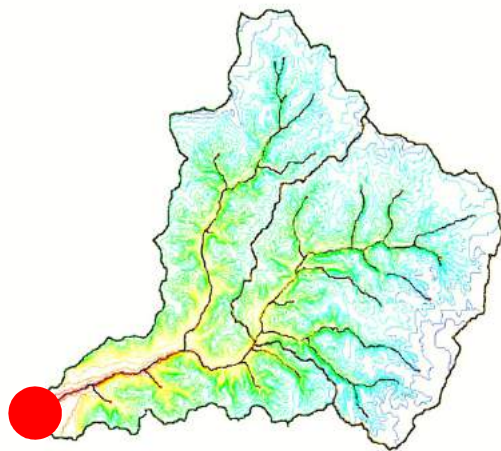


Aims

1. To highlight the value of large-scale river flow archives for study of important blue-skies and applied issues
2. To present a state-of-the-art review of large-scale river flow datasets (threats, fit for purpose and case studies)
3. To propose ways to consolidate historical, and secure future, data
4. To stimulate debate on this topic, and action to move forward and overcome barriers to research and practice

Valuable archives

- UN views improved understanding of large-scale water cycle change process as essential for:
 - socio-economic development
 - global water-food-energy security
 - sustainable water management
- Vital point (basin) data set in regional to global, and long-term contexts



Valuable archives

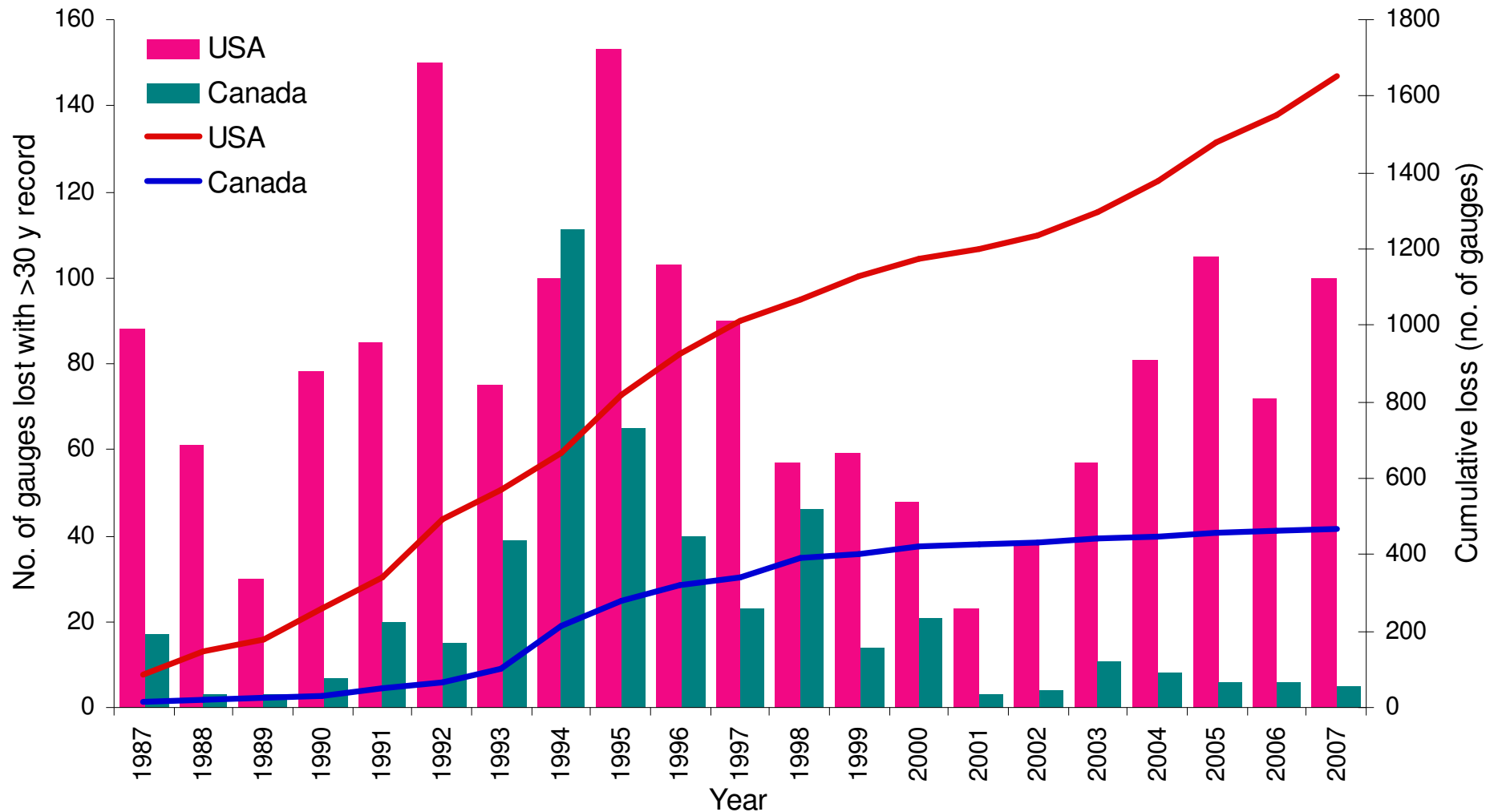
- To understand nested scales of variability
- To pinpoint locations and time periods most sensitive to climate and human impacts
- To force, parameterize, calibrate and validate Land Surface Hydrological Models and Global Hydrological Models
- To make predictions for ungauged basins
- To inform water resource assessment
- To advise decision makers on measures to mitigate water hazards and stress, including floods and droughts
- Hence, unequivocal logic for supporting large-scale (i.e. regional to continental to global) river flow archives

Status: hydrometric networks

- Cost and time intensive to maintain gauges and networks
- Storage and quality assurance at further expense
- Pressures on funding
- Threat to long-term datasets over large geographical domains

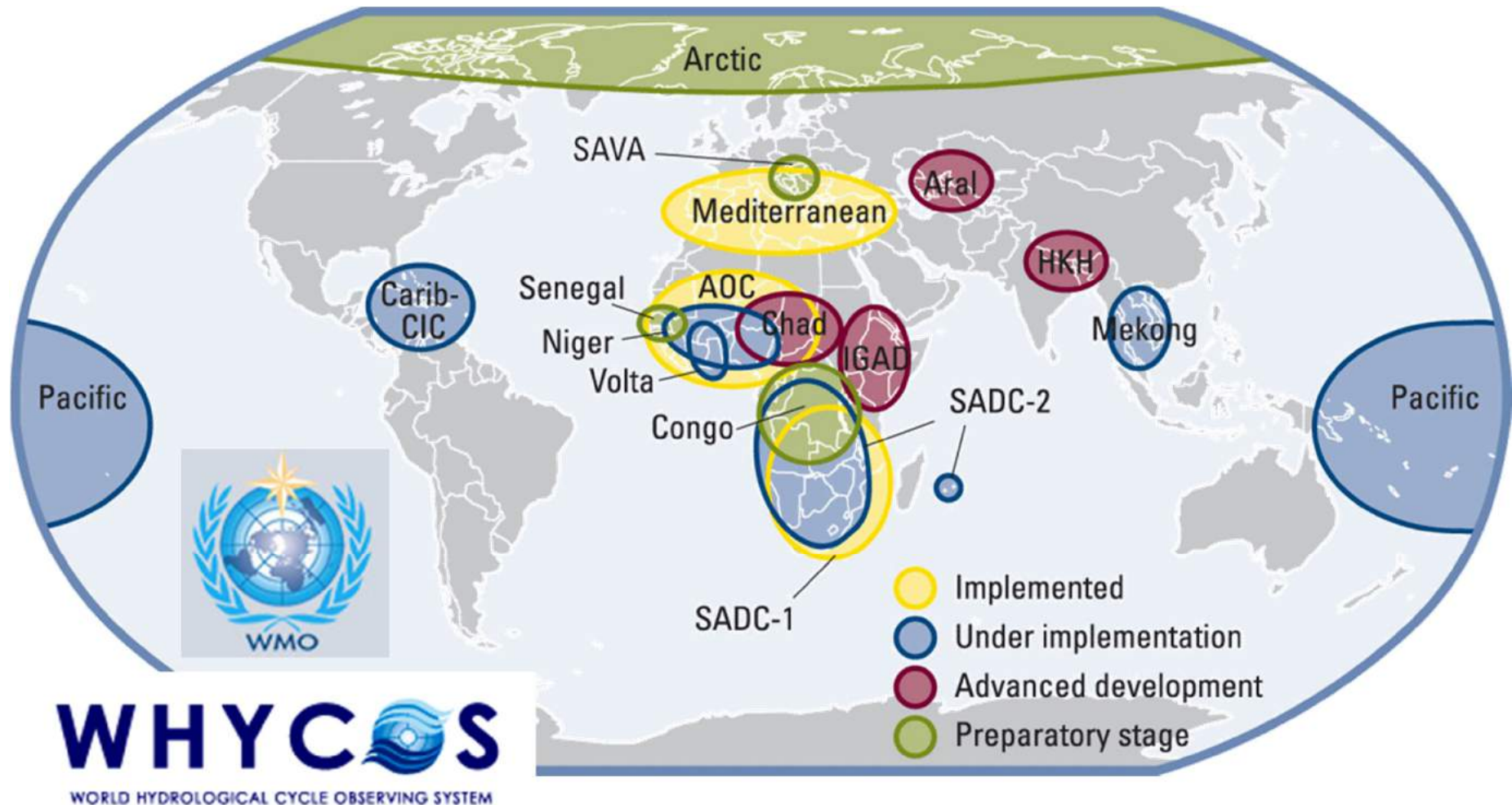


- *“The reliability and availability of data have declined sharply since mid-1980s, particularly in Africa, in Eastern Europe and in the Arctic” WWAP (2003, p. 67)*



- Reduction in station numbers not equate necessarily to degradation of network information value
- Problem: if closure not based on hydrometric quality or representativeness → previously valuable stations lost

Status: hydrometric networks



- New gauging networks in several regions

Status: data access and sharing

- Scientific ideal of data sharing vs. reality of restrictions
- Identification of data providers and protocol for requests
- Anecdotally, some hydrometric authorities submit fraction of stations to archives or do not provide recent data:
 - data policy
 - administrative
 - political
 - technical
 - human and financial resources



Status: data access and sharing

- Nations/ provinces dependent on trans-boundary inflows → state's geopolitical power and economical independence overshadow benefits of data sharing

Map source: WWF's "10 Rivers Most at Risk"



- Legal constraints (e.g. copyright rules) → licensing
- More data out there: but not shared



Nelson (2009), *Nature*

Status: commoditisation

- Some national and regional hydrometric authorities data policies of charging
- Central and Eastern Europe: several national hydrometric agencies work on commercial basis
- Commercialisation of water supply → expansion of river gauging networks by private companies, but overall decrease in data availability
- European Union supports principle of free data sharing →
 - relaxed data restrictions (e.g. France and Spain)
 - more data through Water Framework Directive obligatory monitoring?

Status: data issues

- Archived data must be fit for purpose
- Need: good spatial coverage, long-term and up-to-date
- Do not meet criteria and lack metadata
- Trans-boundary river archives: different standards and procedures for collection and quality assurance
- Incompatible data resolutions and formats

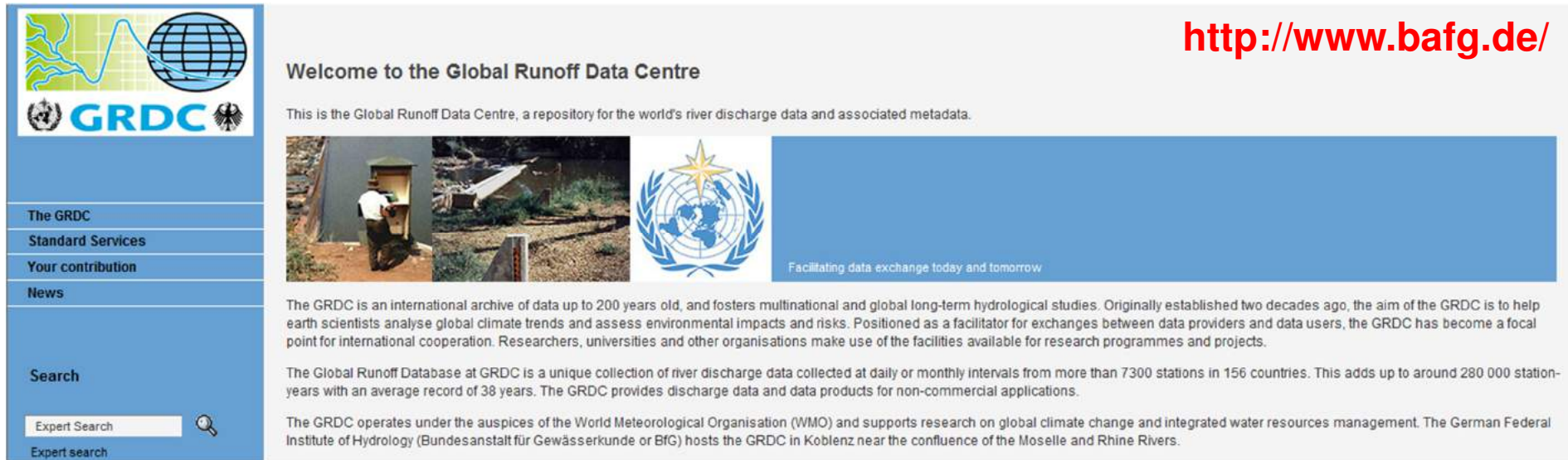
"We don't just have to analyse the data, we need to make sure the data are right."

— Szabocs Márka

Cited by: Nelson (2009), *Nature*



Case study: WMO's GRDC dataset



The screenshot shows the GRDC website interface. On the left is a blue sidebar with navigation links: 'The GRDC', 'Standard Services', 'Your contribution', 'News', and a 'Search' section containing an 'Expert Search' input field and a magnifying glass icon. The main content area has a white header with the GRDC logo (a globe with a river and the text 'GRDC') and the text 'Welcome to the Global Runoff Data Centre'. Below this is a blue banner with a photograph of a person at a river station, the WMO logo, and the text 'Facilitating data exchange today and tomorrow'. The main body contains two paragraphs of text describing the GRDC's mission and data collection.

<http://www.bafg.de/>

Welcome to the Global Runoff Data Centre

This is the Global Runoff Data Centre, a repository for the world's river discharge data and associated metadata.

The GRDC is an international archive of data up to 200 years old, and fosters multinational and global long-term hydrological studies. Originally established two decades ago, the aim of the GRDC is to help earth scientists analyse global climate trends and assess environmental impacts and risks. Positioned as a facilitator for exchanges between data providers and data users, the GRDC has become a focal point for international cooperation. Researchers, universities and other organisations make use of the facilities available for research programmes and projects.

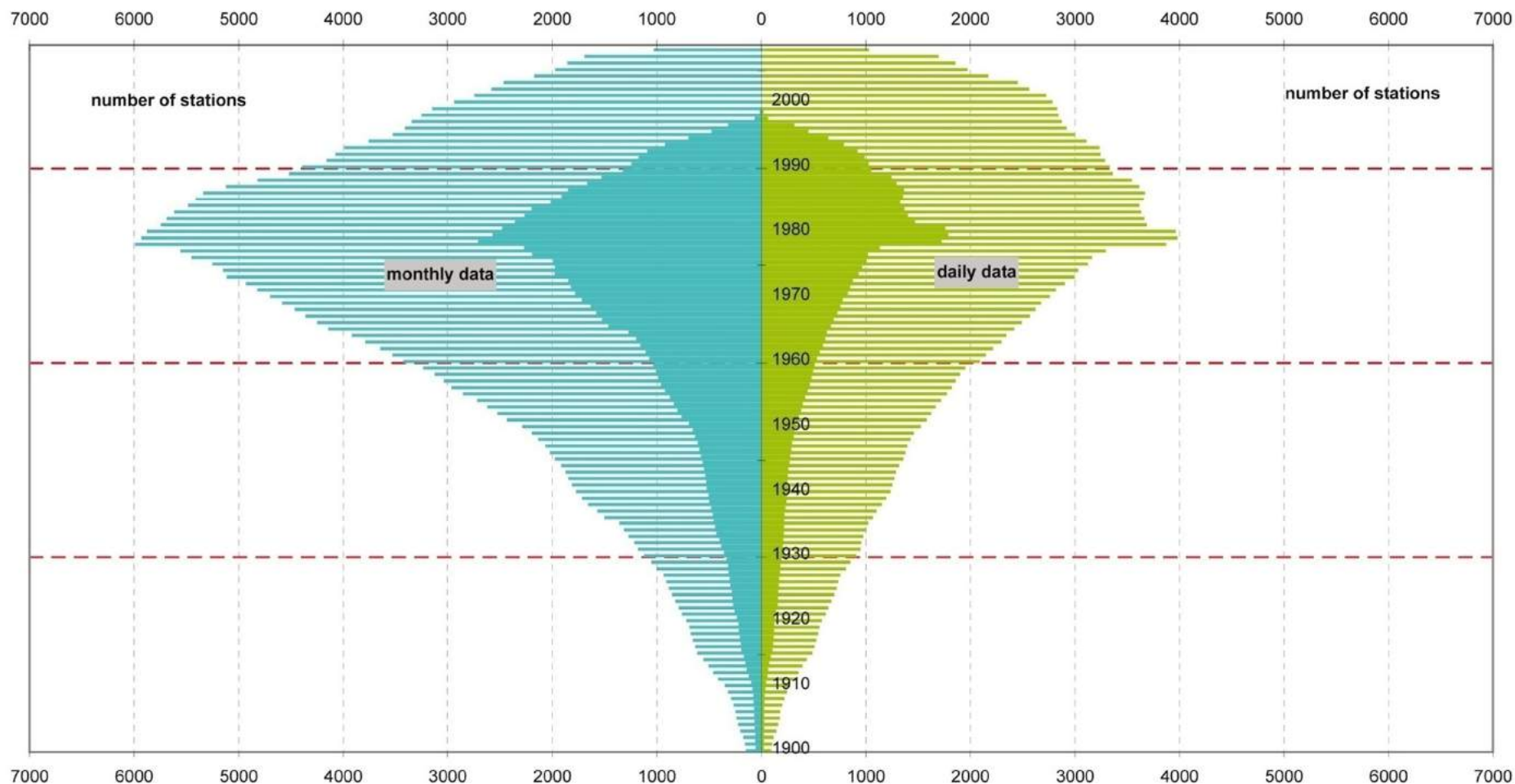
The Global Runoff Database at GRDC is a unique collection of river discharge data collected at daily or monthly intervals from more than 7300 stations in 156 countries. This adds up to around 280 000 station-years with an average record of 38 years. The GRDC provides discharge data and data products for non-commercial applications.

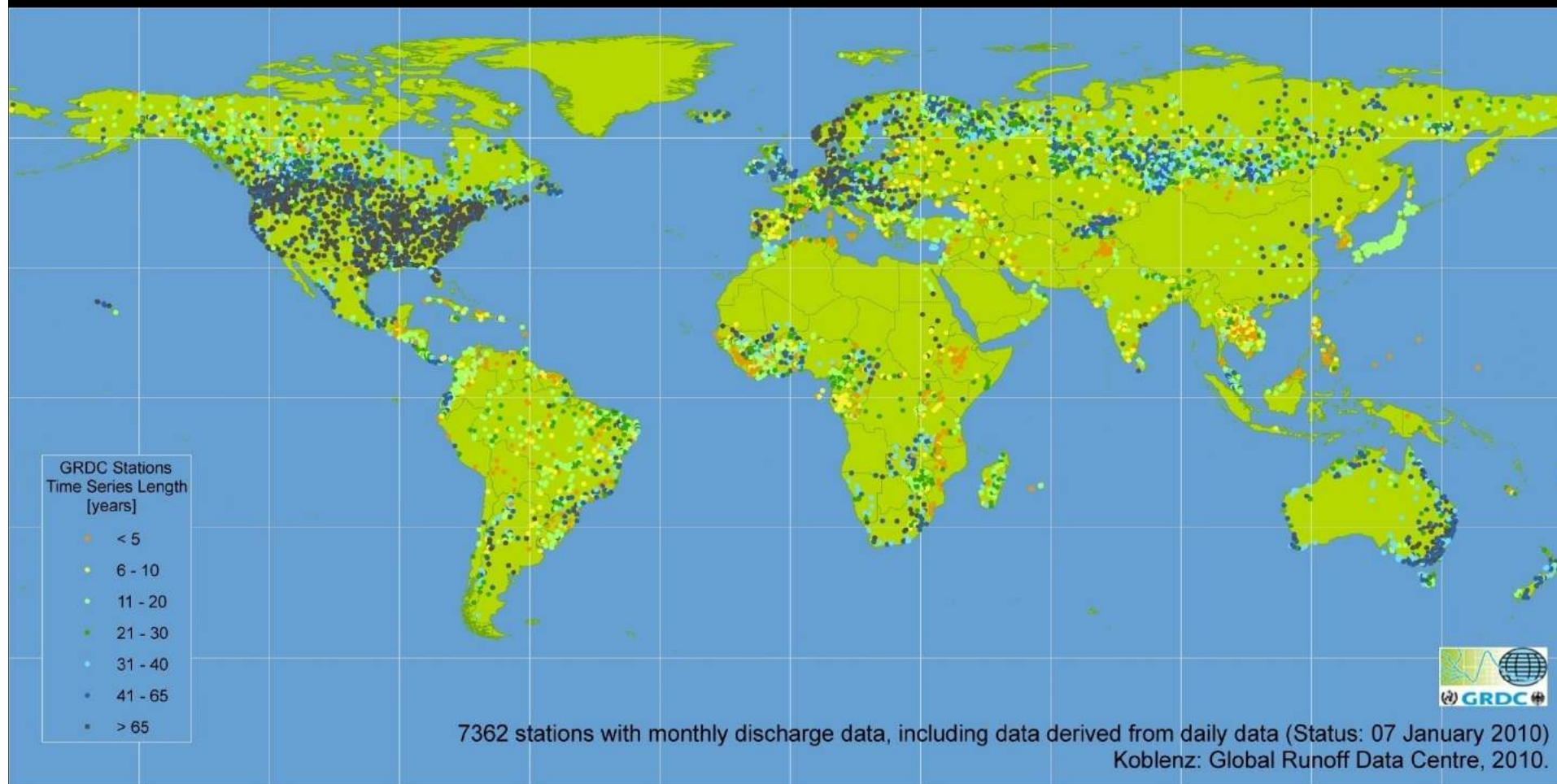
The GRDC operates under the auspices of the World Meteorological Organisation (WMO) and supports research on global climate change and integrated water resources management. The German Federal Institute of Hydrology (Bundesanstalt für Gewässerkunde or BfG) hosts the GRDC in Koblenz near the confluence of the Moselle and Rhine Rivers.

- Established under auspices of WMO in 1988
- To support climate change and trans-boundary water resources research
- Data and metadata provision supported by various WMO resolutions, but not legally-binding
- Thus, data supply is voluntary


Availability of historical discharge data in the GRDC database by year

Number of stations per year represented in the GRDC database: status 2009 vs. status 1999






Case study: FRIEND-EWA



NE-FRIEND | Projects | European Water Archive

Project 1

European Water Archive (EWA)



A central feature of Northern European FRIEND, since its inception in 1985, has been the development of a hydrological database, the European Water Archive (EWA) archive is now one of the most comprehensive hydrological archives in Europe, containing long-term daily flow data and catchment information for about 4000 river gauging stations in 29 countries.

The continued development and maintenance of the archive is the responsibility of the Database Group (Project Group 1). This group has formal responsibilities for coordinating data acquisition, applying quality control procedures and disseminating data to FRIEND researchers. Data is supplied to the archive on a voluntary basis, free of charge, and made freely available to FRIEND researchers on condition that these data are used exclusively for FRIEND research.

The Global Runoff Data Centre (GRDC), Federal Institute of Hydrology, Koblenz, Germany, hosts the European Water Archive.

The EWA website provides information on:

- Geographical overview of stations
- EWA station catalogue
- [Ordering](#) data from EWA
- Providing data to EWA

<http://ne-friend.bafg.de/>

Contact | Imprint | Sitemap | Print | Send

Northern European FRIEND

Projects

- > European Water Archive
 - >> Ordering
- > Low Flow and Drought
- > Large Scale Variations
- > Extreme Rainfall and Floods
- > Catchment Processes

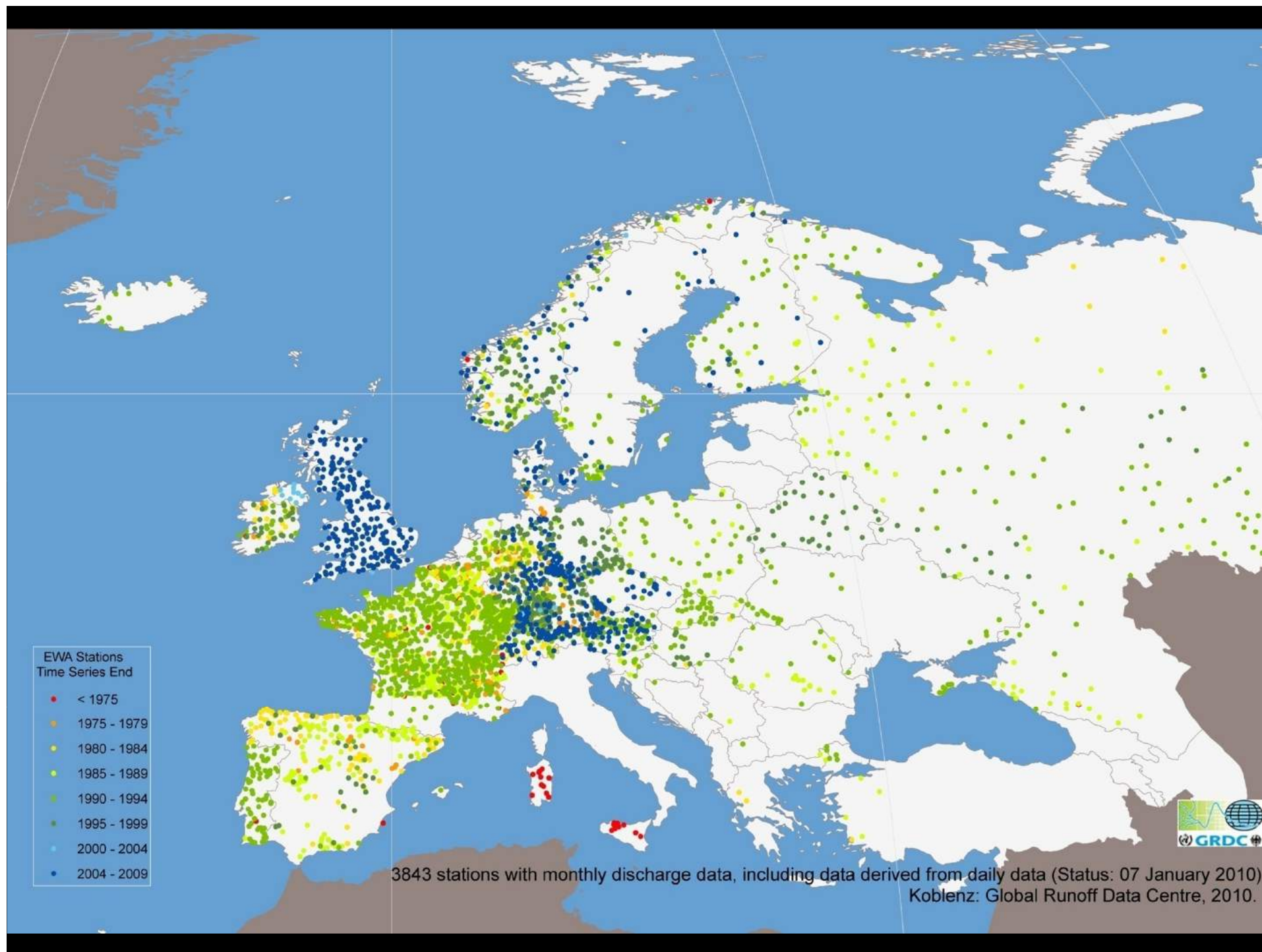
Meetings

Publications

Contact

External links

- UNESCO-IHP identified need 1985 and helped to establish
- >3800 stations across >29 European countries
- Set of criteria for archive inclusion
- Data and metadata provision is voluntary by project participants or hydrometric authorities
- Efforts to update from individuals and FRIEND community



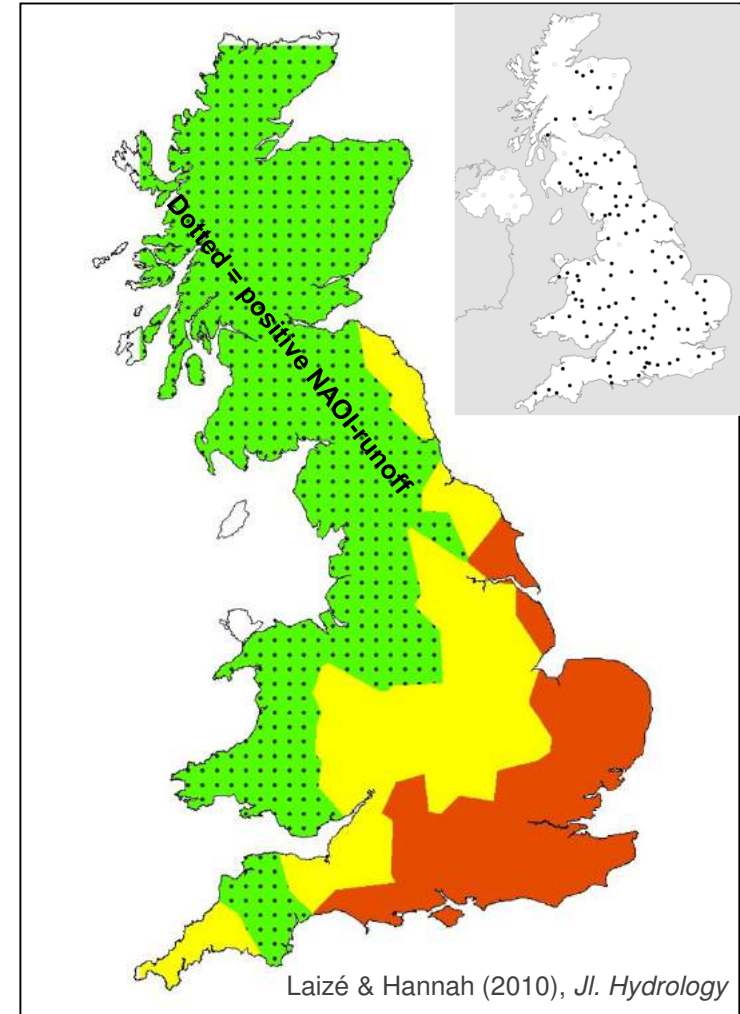
3843 stations with monthly discharge data, including data derived from daily data (Status: 07 January 2010)
Koblenz: Global Runoff Data Centre, 2010.

Outlook: future and ways forward

- Data users need to work more closely with data producers
- Together set priorities for data collection, discuss data requirements and formats, and find funds
- Data producers must be credited by users for contribution
- Models rely on for reliable observations, not substitute
- World Water Assessment Programme (2009) suggests major reason for decline in networks is insufficient awareness of value of data → hydrologists must be active in publicising societal and environmental relevance of research

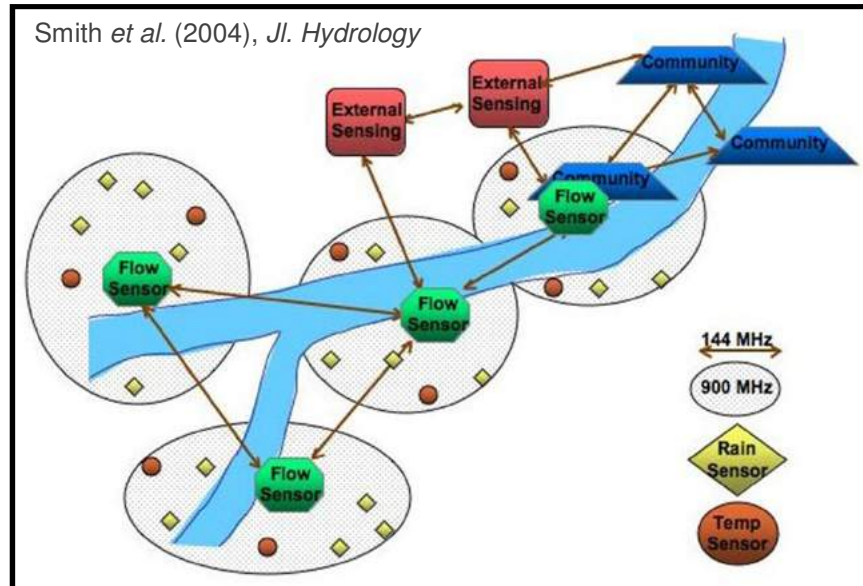
Outlook: measurement and technology

- Expert knowledge and tools → optimise hydrometric sampling design
- Benchmark sites for detecting trends and other changes (e.g. UK National River Flow)
- Need for capacity building in less developed world to improve:
 - data collection
 - archiving protocol
 - institutional capacity

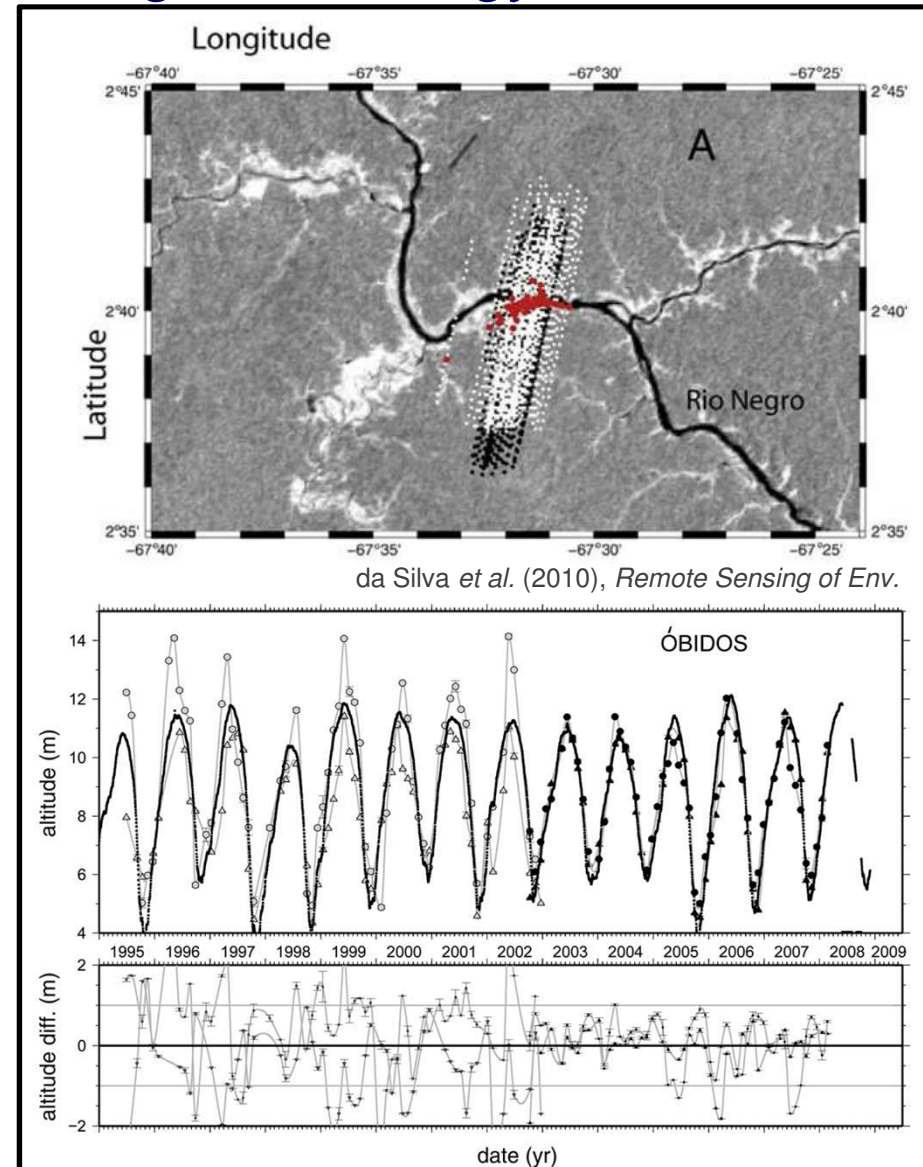


Outlook: measurement and technology

- Wireless sensor networks, although technology issues

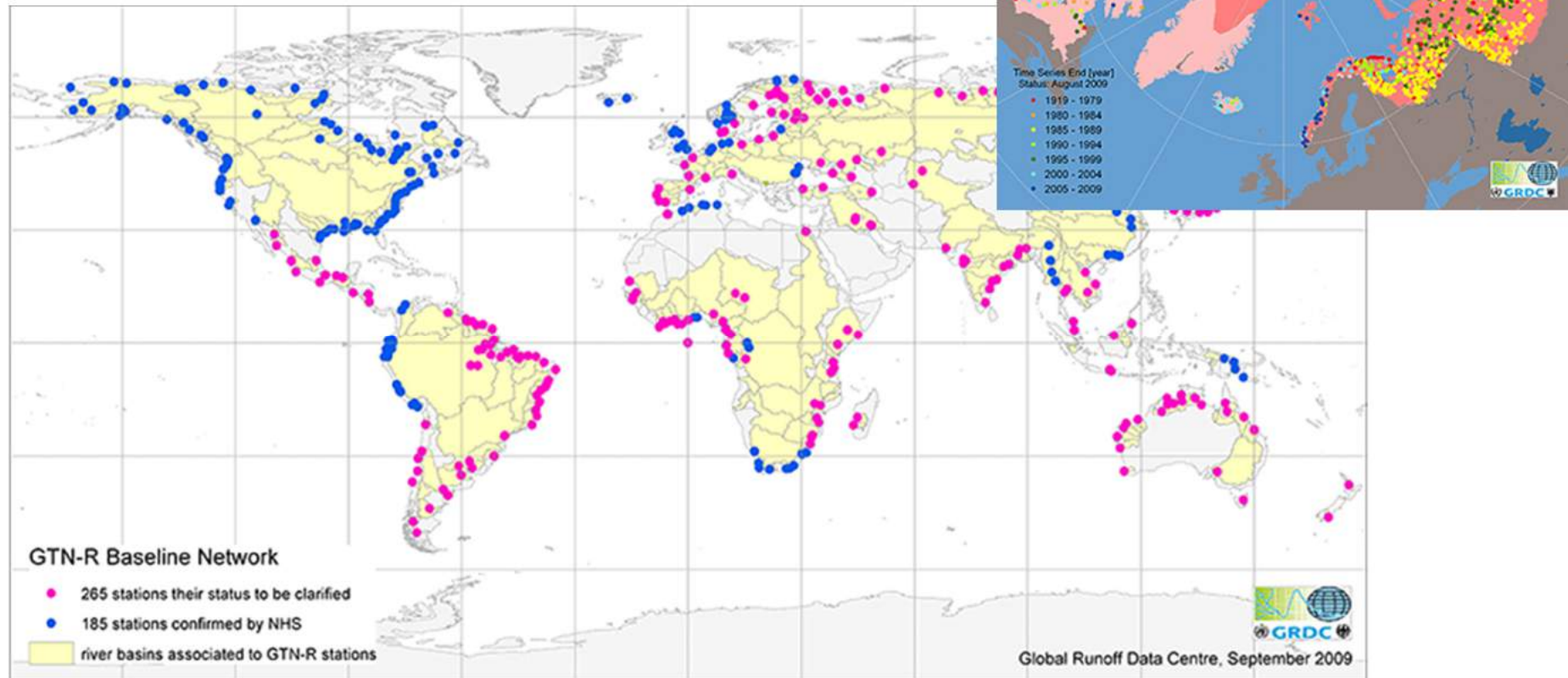


- Satellite altimetry...
- But observation uncertainty, low temporal resolution and need ground-truthing by gauging station data



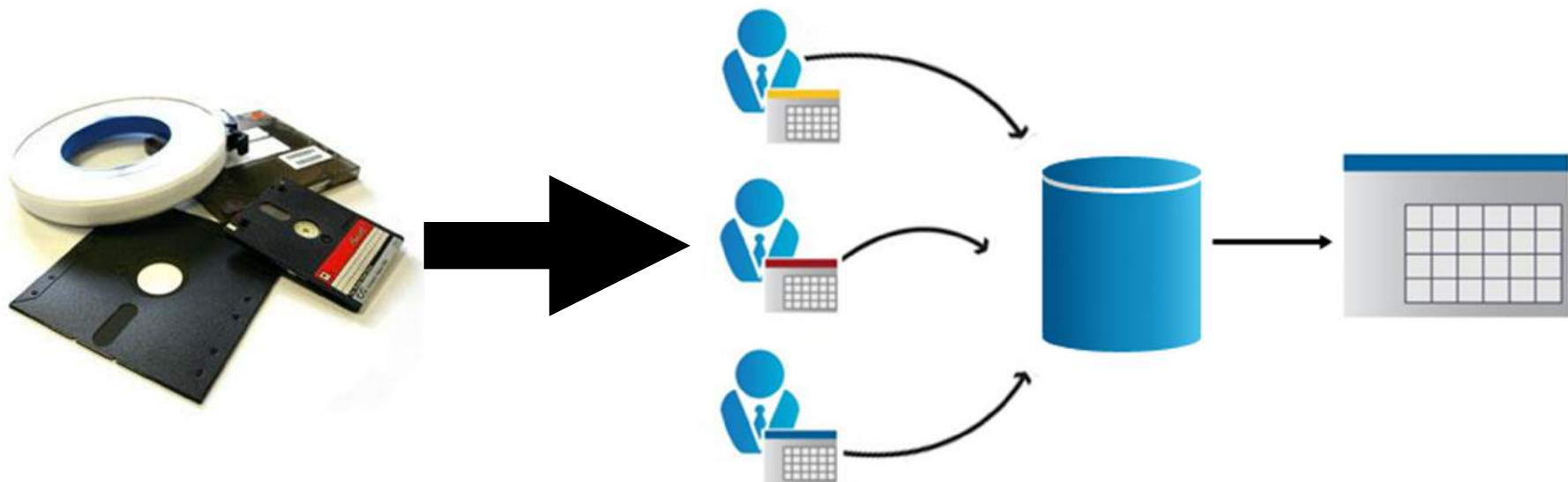
Outlook: purpose orientated datasets

- Science and management question driven → ensure fit for needs → 'purpose orientated datasets'



Outlook: data standards

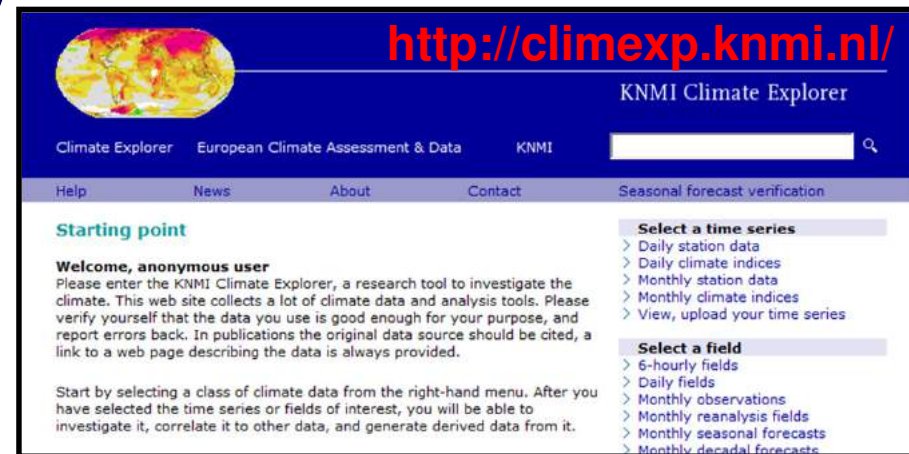
- International standards on how digital information formatted and metadata listed
- Needs agreement between ISO, WMO and hydrometric agencies
- Integrated metadata catalogues, including hierarchical river gauge numbering system
- Continuous updating



Outlook: data access and sharing

- Harmonisation of legal framework
- WMO Res. 25, Cg-XIII 1999 → adopted → choose to ignore due to commercial benefits of selling data
- Thus, need alternative incentives:
 - formal data accreditation in journals for suppliers
 - cultural change (cf. climate science)
 - research benefits → hydrometric authorities

**"We need to change
the culture of science to
one that equally values
publications and data."
—William Michener
Cited by: Nelson (2009), *Nature***



- Trust and better communication between data providers and scientific community

Outlook: data access and sharing

- Actual and virtual hydrological data centres
- Internet searching and web portals (restricted access and out-of-date)
- Increasing use of internet tools and services (e.g. social networking)
→ increased data interoperability
- Distributed computing (e.g. clouds)
→ transform data management
- Large-scale archives must evolve and adapt to embrace new technology → survive and retain utility/ relevance



Discussion starter points

In Chile...

- What is the status of hydrometric networks?
- What is the capacity for data archiving?
- How easy is data access and sharing?
- What are the ways forward to protect, develop and invest in these valuable hydrological resources?

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