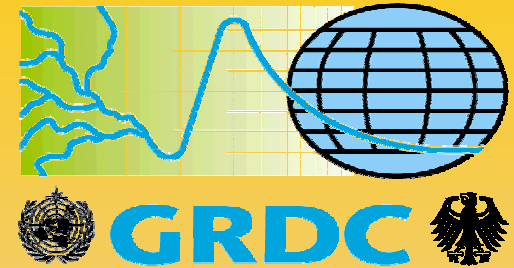


Global Runoff Data Centre



## The Global Terrestrial Network for River Discharge (GTN-R)

Near real time data acquisition and dissemination tool for online river discharge and water level information

1st International Symposium on Geoinformation for Disaster Management, Delft, The Netherlands, 21 March 2005

[thomas.maurer@bafg.de](mailto:thomas.maurer@bafg.de)

Bundesanstalt für Gewässerkunde  
Koblenz



# Overview

- Why River Discharge data globally?
- GRDC and problems with data **accessibility** (less, but also, **availability**)
- Global Terrestrial Network for Hydrology (GTN-H) and for River Discharge (GTN-R)
- Need for an improved global data infrastructure, including standardised metadata management (=library catalogue)

# (not only) Hydrologists have questions...

...among other related to the following aspects of  
**Disaster mitigation / risk management:**

- Intensity or frequency of floods and droughts
- Impact of global change / climate change and variability
- Water resources availability and use

# (not only) Hydrologists have questions...

...but these cannot always satisfactorily be answered on a local or regional scales

=> In order to arrive at improved predictions the phenomena have to be examined in their global context!



# Is the global hydrological cycle accelerating ?

There is yet no evidence for a significant global trend over the last 20 years, but regional anomalies occur.

- How are regional trends distributed ?
- What is the human influence ?
- Will intensity or frequency of extremes increase ?

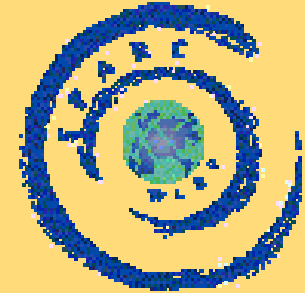
# Understanding the Complex System Earth

- highly **interacting** processes of various domains
- **feedback** cycles at various scales
- **complex** geometry
- **past**: separately studied by individual disciplines, concentrating on their “**sphere**” and viewpoint/scale, e.g.
  - » atmosphere
  - » oceanosphere
  - » biosphere
  - » pedosphere
  - » hydrosphere
- **today**: ever increasing efforts for further integrated view
  - » increasing computer & network power
  - » new types of observations (satellites, in situ)

# WCRP current major projects



SPARC 1992 →



CLIVAR 1995 →



CliC 2000 →



GEWEX 1988 →



International Satellite Land Surface Climatology Project



ACSYS 1994–2003



ARDB

A service provided by GRDC

# The Global Runoff Data Centre...

operates under the auspices of the  
**World Meteorological Organization**  
on the advice of an  
**International Steering Committee**



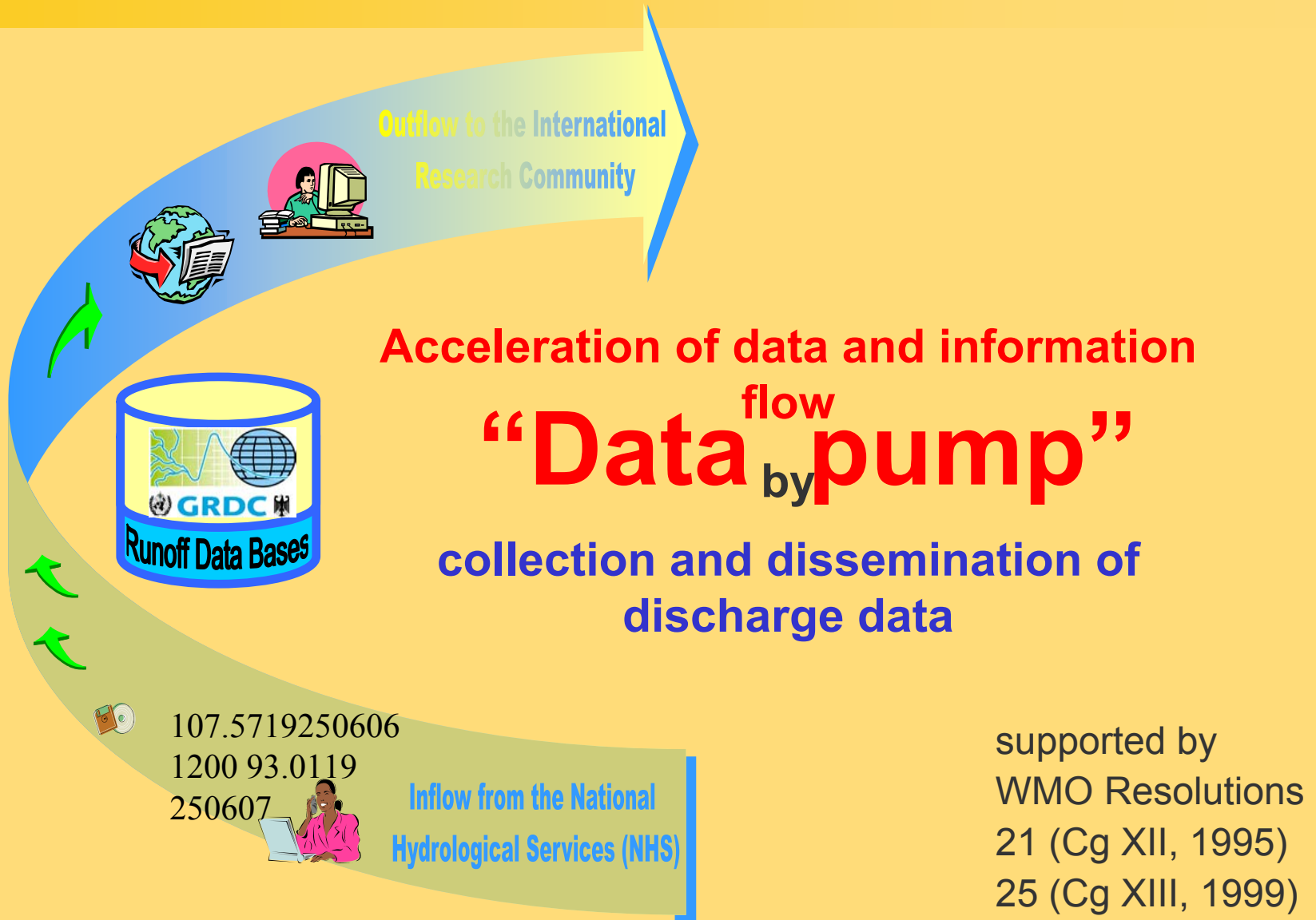
with the financial support of the  
**Federal Republic of Germany**



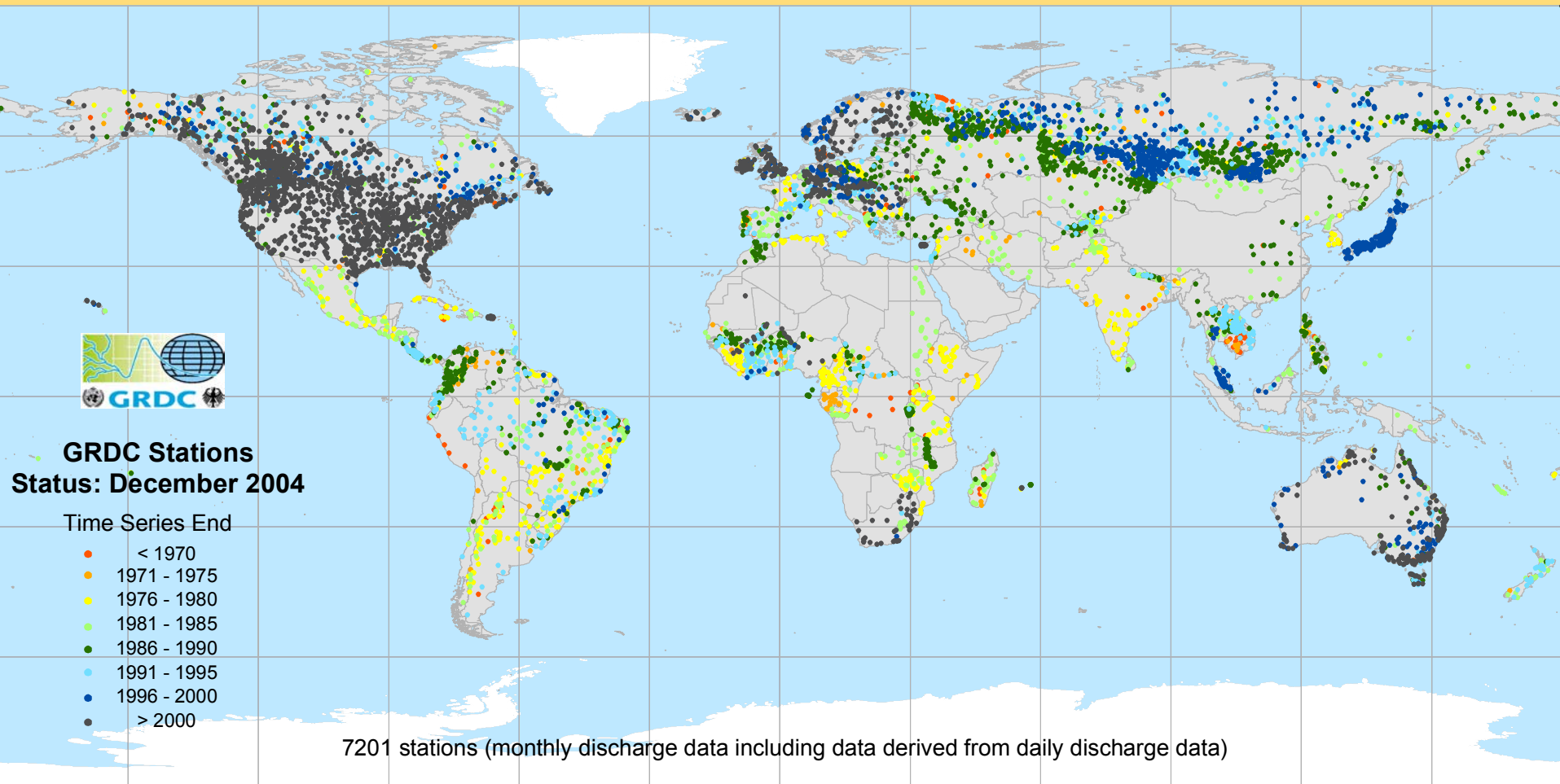
within the premises of the  
**Federal Institute of Hydrology**



# The main objective of the GRDC...

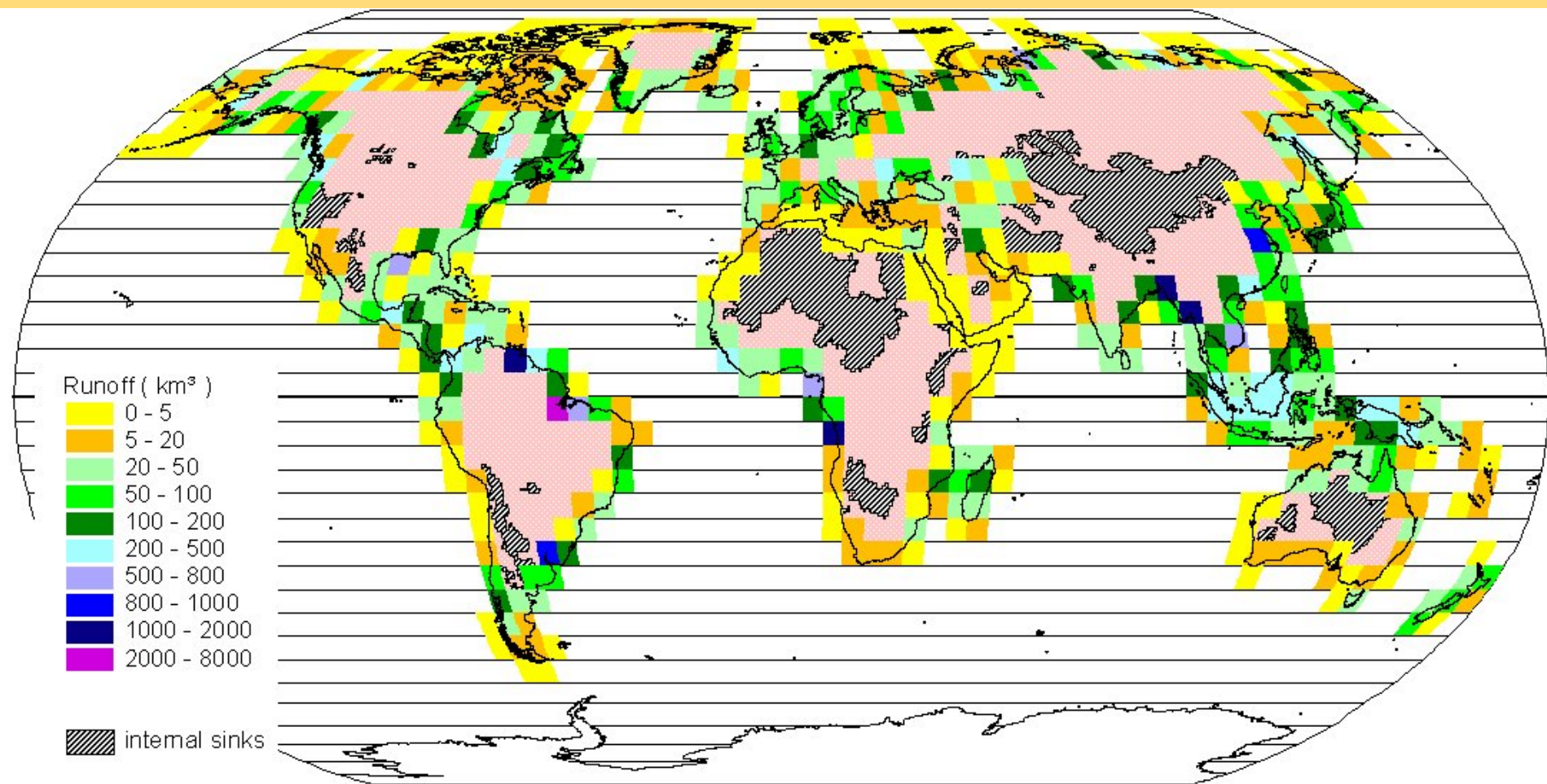


# 7201 GRDC Discharge Data Stations





# GRDC Data Product: Estimate of Long Term Mean Annual Freshwater Surface Water Fluxes into the World Oceans



# GRDC Data Product: Estimate of Long Term Mean Annual Freshwater Surface Water Fluxes into the World Oceans

**Desired by research community: higher temporal resolution:**

- Long term monthly mean
- Time series of annual means
- Time series of monthly means
- Near real time estimates

**This inevitably requires:**

- better global coverage with discharge stations
- more up-to-date data

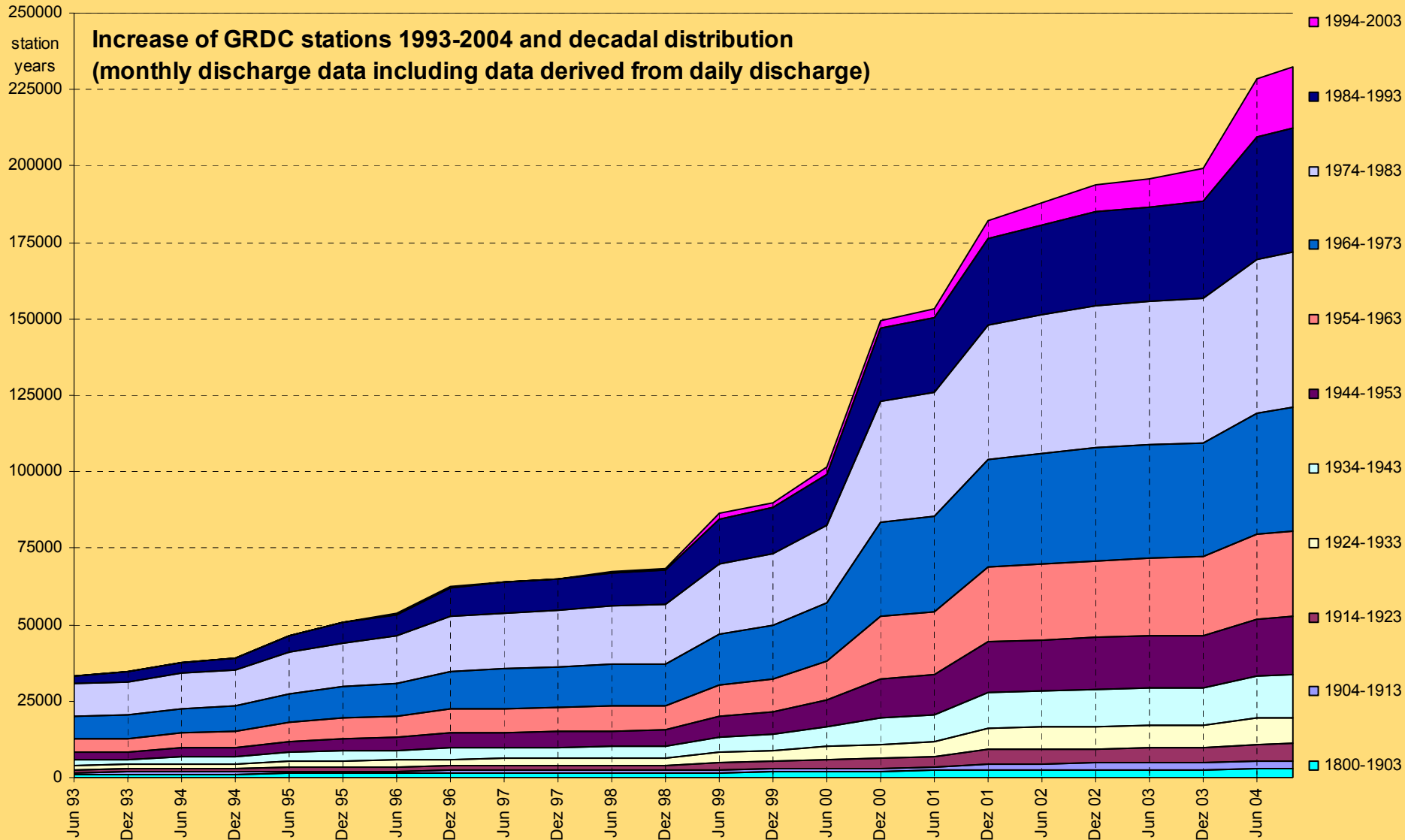
**Need urgently  
to be tackled by  
the international  
community**

**But multifold problems on availability and access to hydrological data remain:**

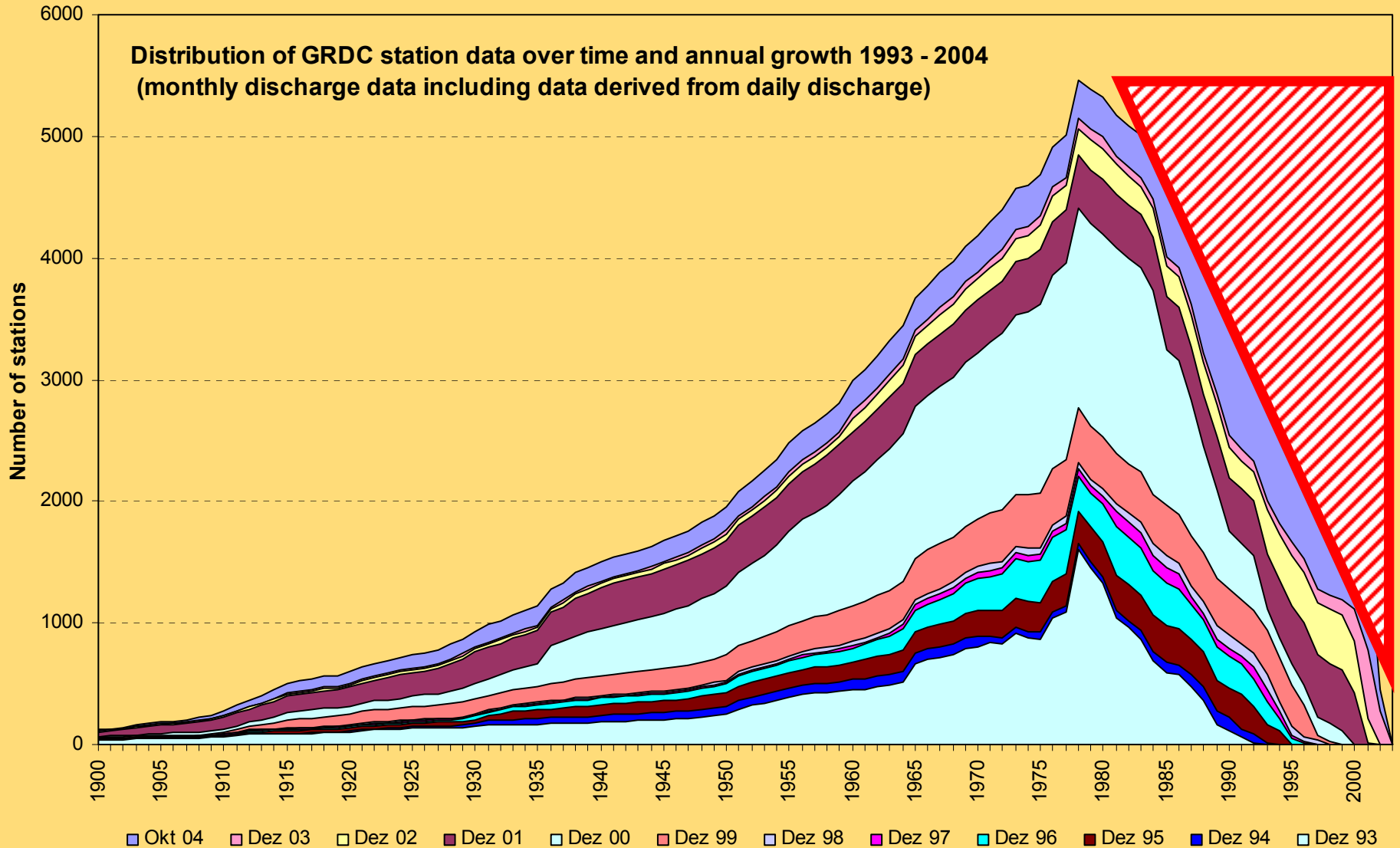
- Inadequate exchange of available data
  - Fragmented, not standardised data holdings
  - Lag time in data processing and provision
  - Declining networks
  - Quality of data
- political problems  
technological problems  
organisational problems  
financial problems  
scientific problems



# Increase of GRDC Data (Station-Years)



# Distribution of GRDC stations data over time





GCOS

GTOS

HWRP

What is GTN-H?

GTN-H Partners

## GTN-H

## Global Terrestrial Network - Hydrology

### Welcome to the GTN-H

What's New?

Sources of  
Hydrological Data

Hydrological Data  
Products

Data Sharing  
Strategies

Expert Meetings

Coordination

Links

Contact Us

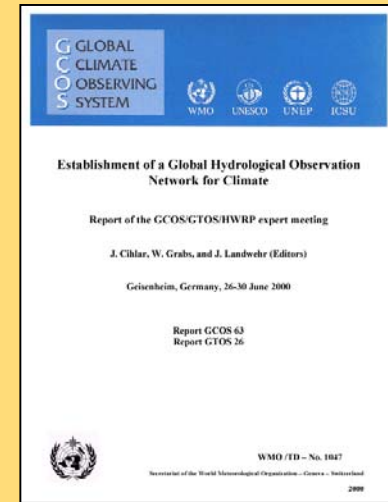
This site is a gateway to an evolving global observing system for hydrological data, known as the Global Terrestrial Network for Hydrology, or GTN-H. The GTN-H is intended to support a range of climate and water resource objectives, building on existing networks and data centres, and producing value-added products through enhanced communications and shared development.

2004/09/22 13:24

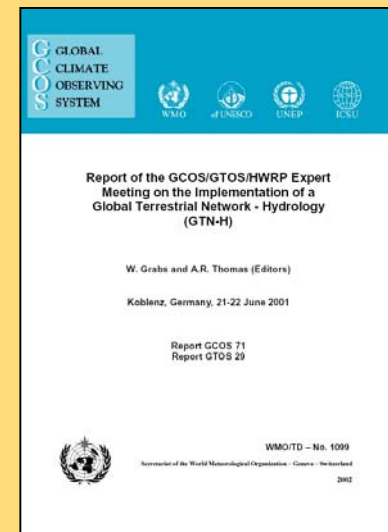
GTN-H Home

# Global Terrestrial Network for Hydrology (GTN-H)

Workshop in Geisenheim,  
26-30 June 2000:  
**Global Hydrological Observation  
Network for Climate**  
(hosted by DWD/GPCC)



Expert Meeting in Koblenz,  
21-22 June 2001  
**Implementation of a Global  
Terrestrial Network for Hydrology  
(GTN-H)** (hosted by BfG/GRDC)



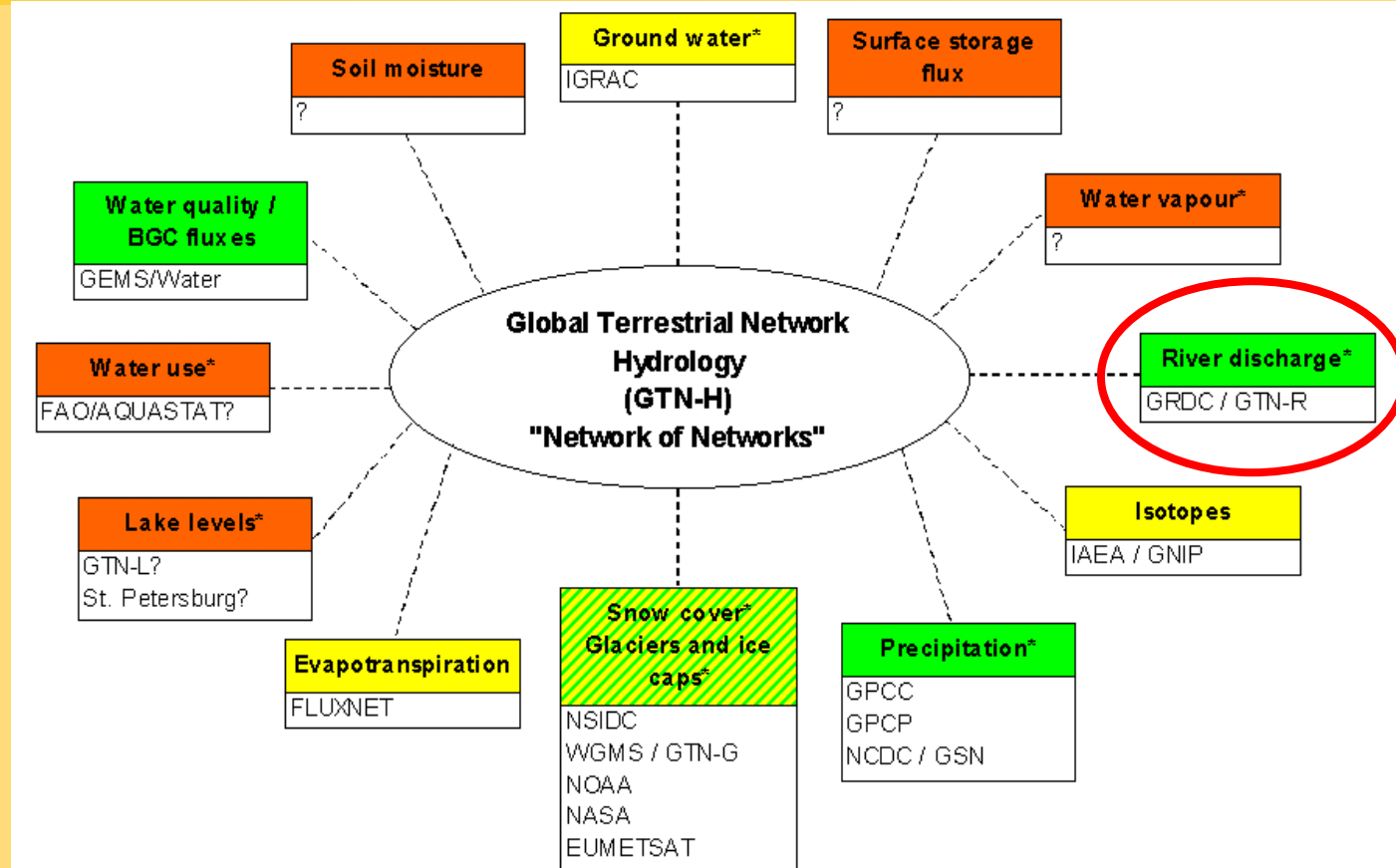
Expert + Coordination Meeting in Toronto,  
18-22 November 2002  
**Hydrological Data for Global  
Studies**

# Global Terrestrial Network for Hydrology (GTN-H)

“Network of networks”

12 variables

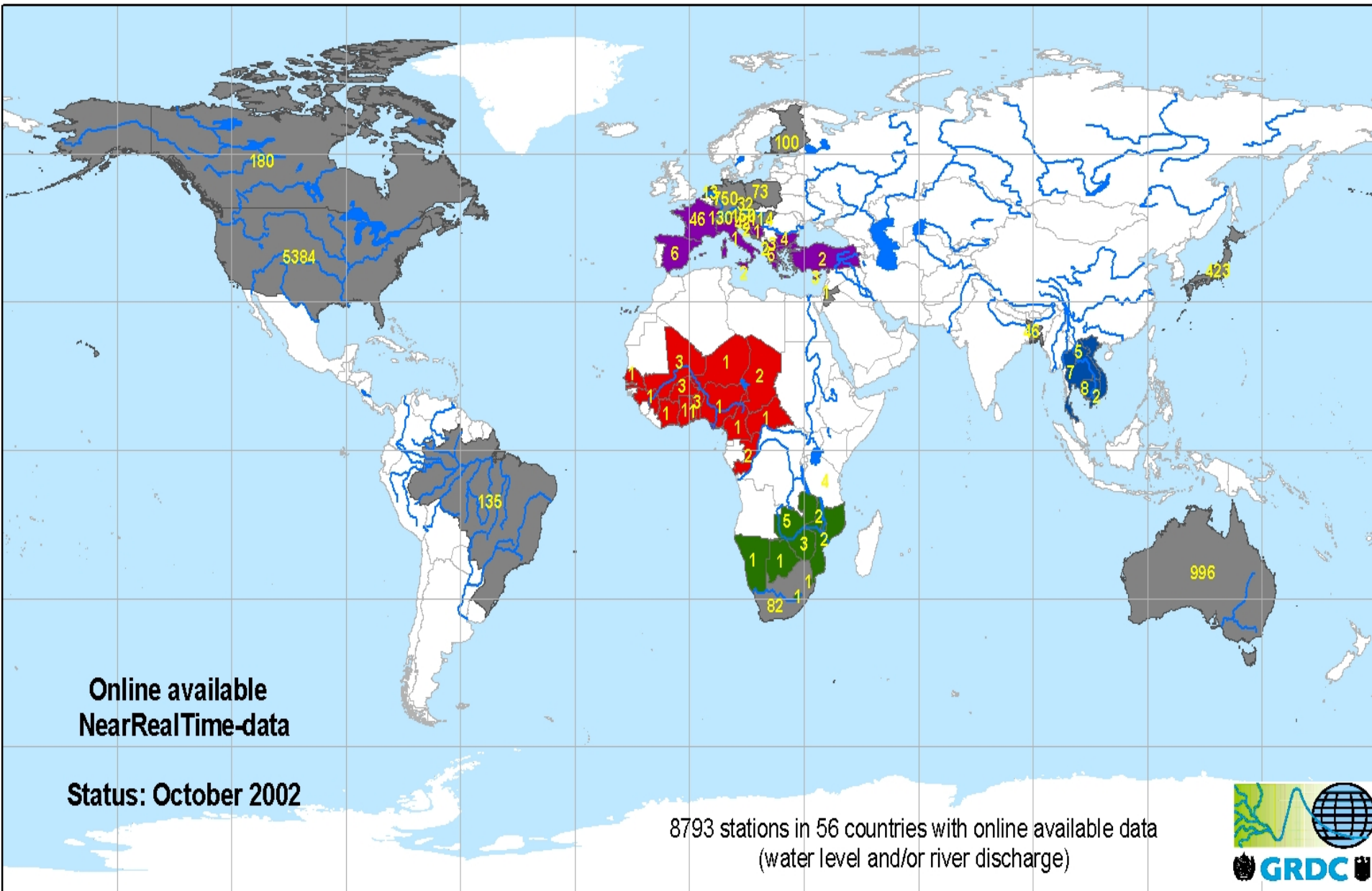
Near Real Time (NRT)



- Global network/coverage defined and contact established
- Global network/coverage partly existing/identified and/or contact to be improved
- No global network/coverage identified

\* GCOS Essential Climate Variable

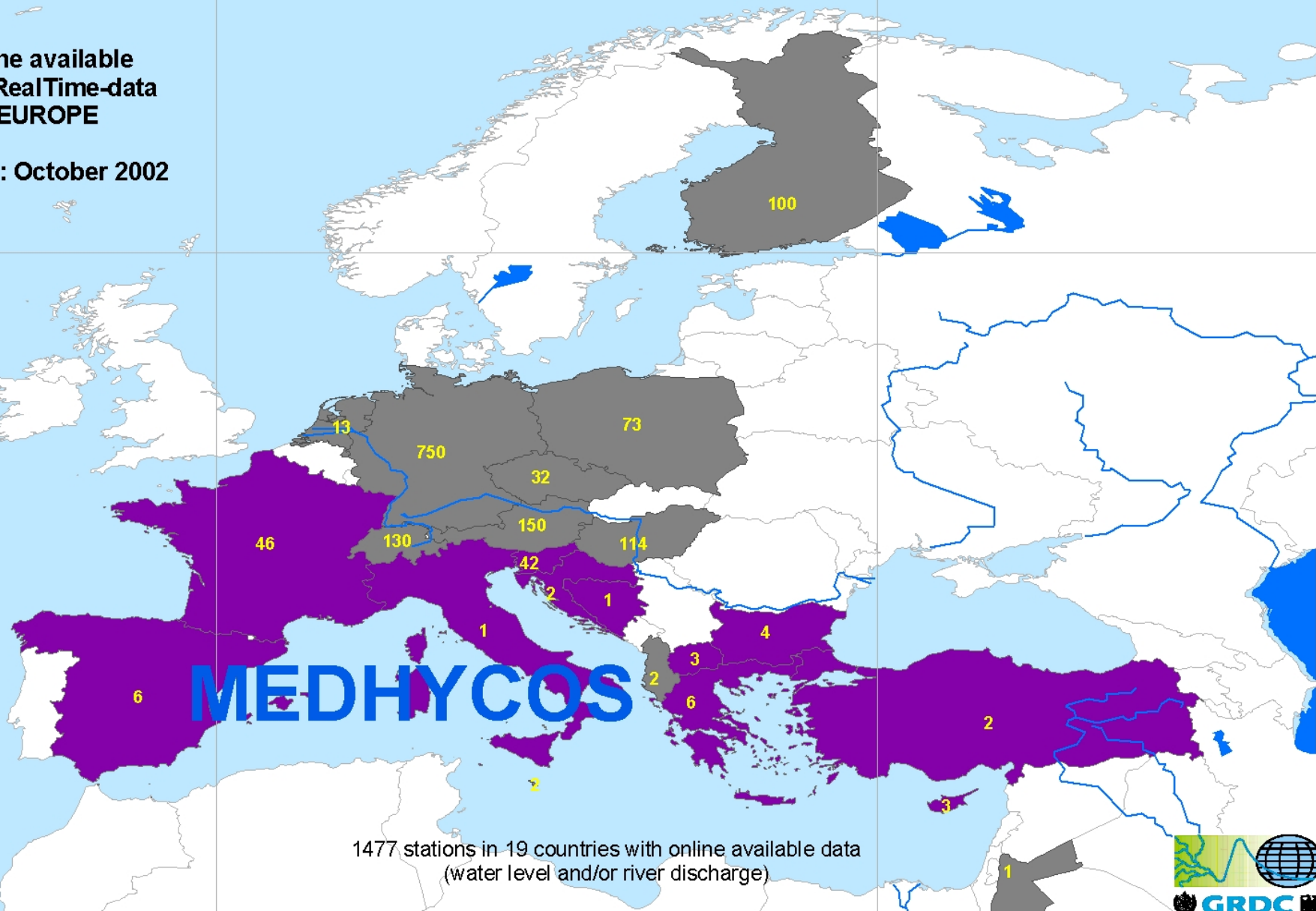
# Overview of available online stations



# Overview of available online stations

Online available  
NearRealTime-data  
EUROPE

Status: October 2002



1477 stations in 19 countries with online available data  
(water level and/or river discharge)





# Near-Real-Time (NRT) discharge data availability

Heterogeneous in many respects!

## Heterogeneous in many respects!

Data type	Time structure	Access structure	Access style
* discharge	* Many values per day <i>(e.g. hourly)</i>	ZIP-archives	ASCII - Tables
* water stage	* One value per day <i>(at fixed time)</i>	Grouped by: <i>country</i> <i>river-basin</i> <i>region</i> <i>year</i>	HTML - Tables
	* Daily statistic <i>(min., max., mean)</i>	search features	HTML - Pages
		Metadata available	Tables as bitmap
			Values in bitmap
			Hydrograph as bitmap



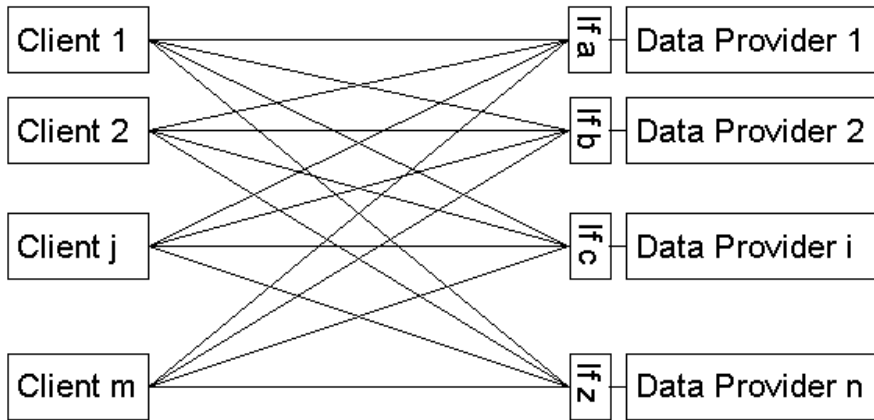
countless combinations possible and available!!!



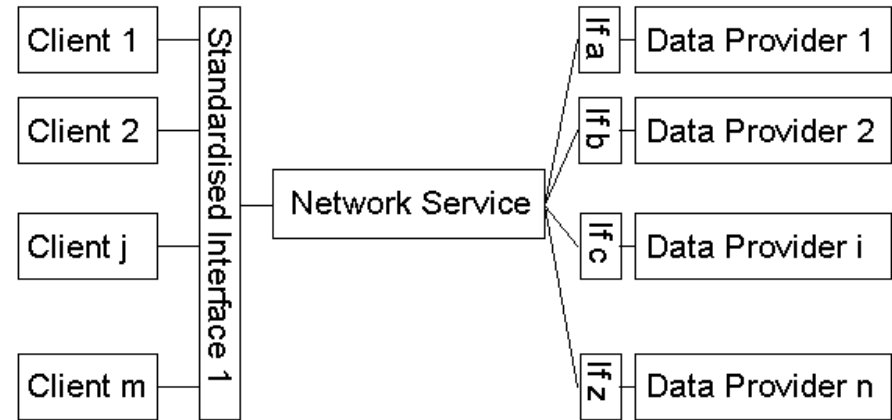
permanent changes, highly instationary



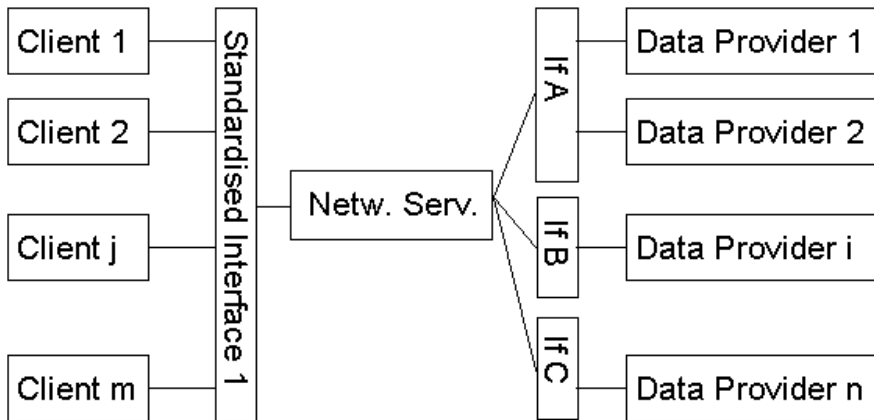
# Different types of communication network structures



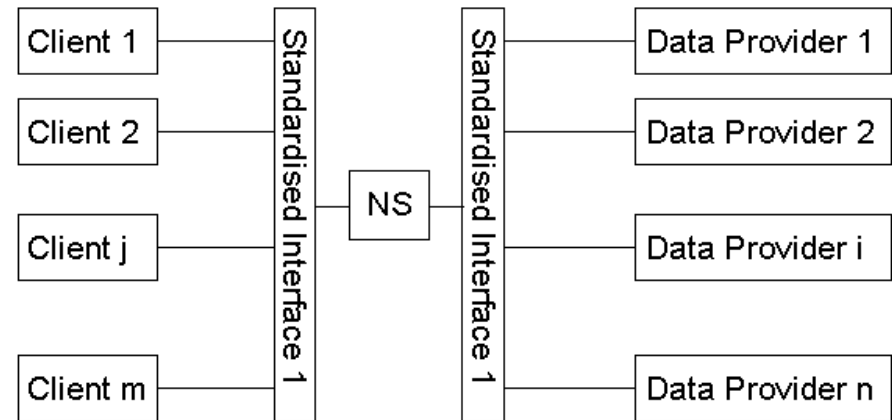
(a) **ad hoc** communication (e.g. for projects j)



(b) **client-side standardized** intensive, network-service-supported communication



(c) **hybrid** of (b) and (d)



(d) **fully standardized** network service communication

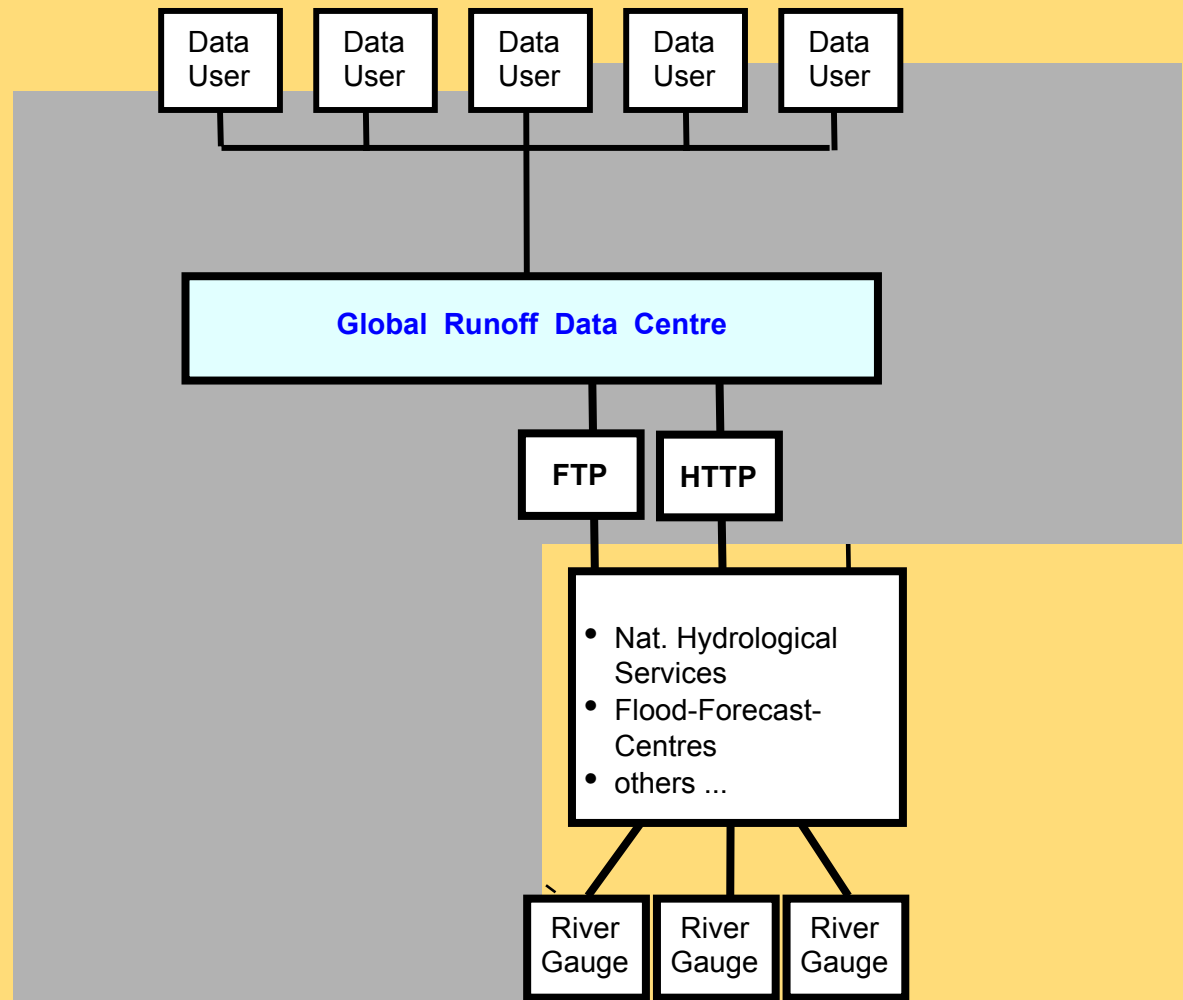
# GRDC NRT River Discharge Data Collector

Principle:

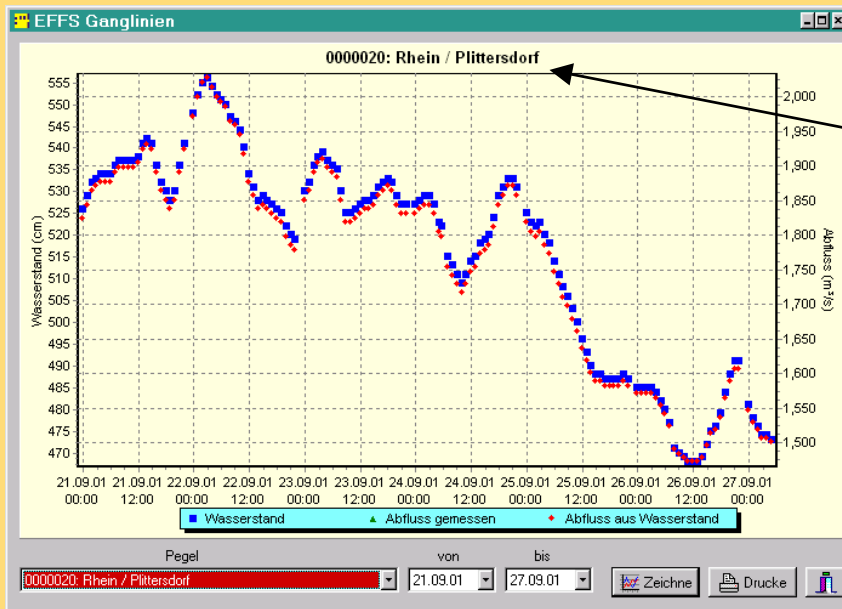
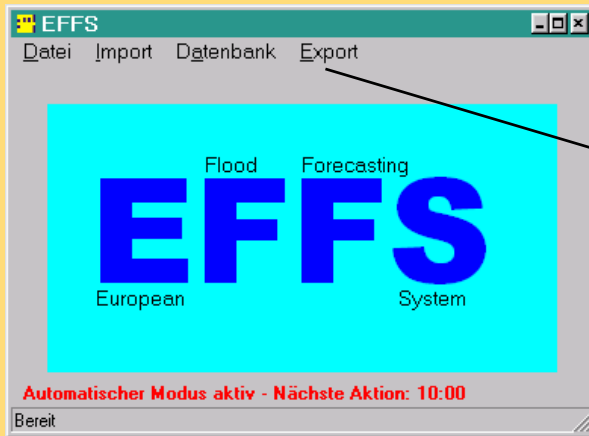
Collection of near-real-time (NRT)-discharge data from distributed servers in the internet (GRDC NRT-Monitor)

Harmonising of data

Providing data again in one standard format via a FTP-server.

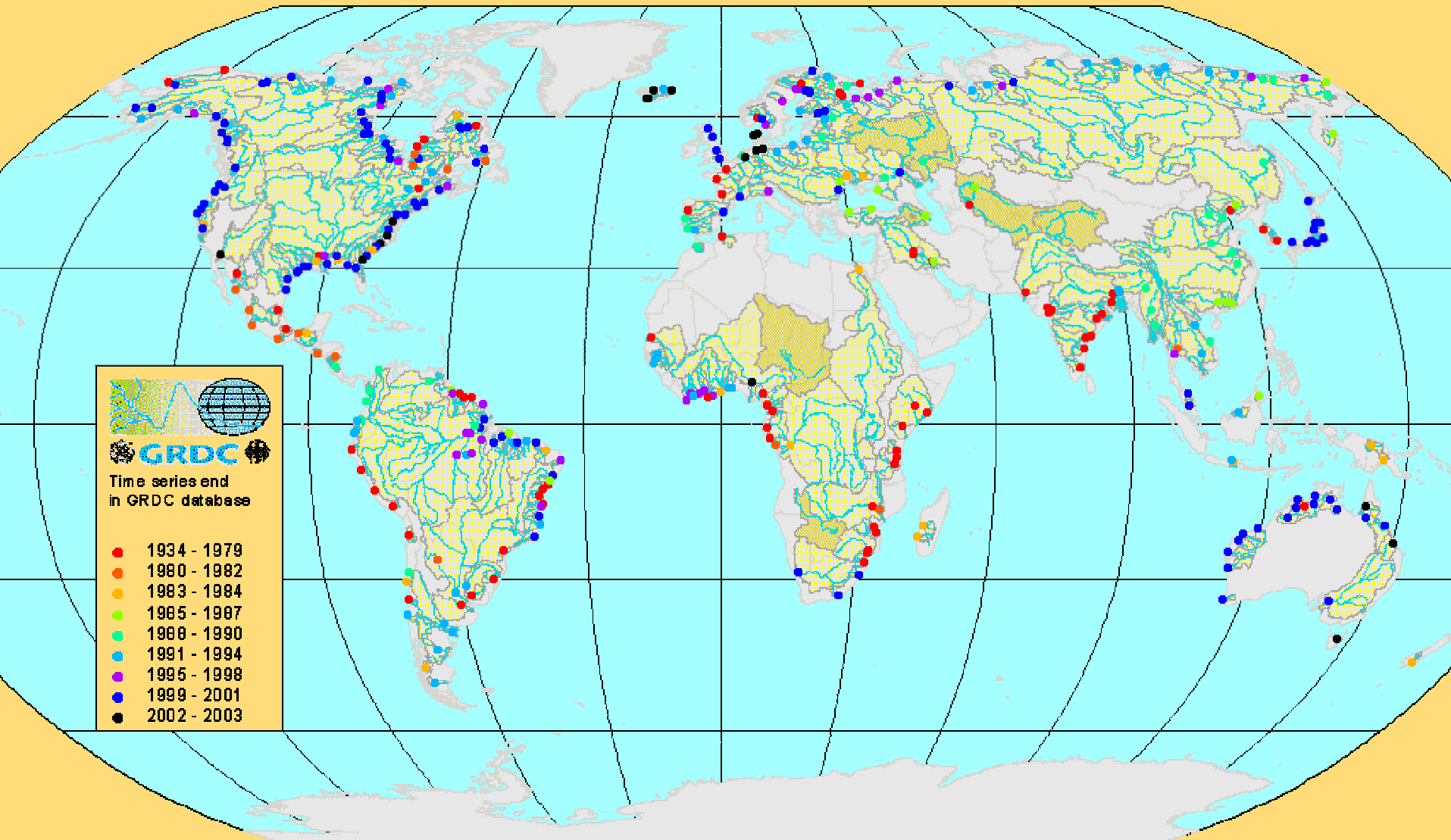


# EFFS-NRT-Database - Screenshots



# Global Terrestrial Network for River Discharge (GTN-R)

<http://gtn-r.bafg.de>



**G** GLOBAL  
**C** CLIMATE  
**O** OBSERVING  
**S** SYSTEM



WMO



of UNESCO



UNEP



ICSU

WORLD METEOROLOGICAL  
ORGANIZATION

INTERGOVERNMENTAL  
OCEANOGRAPHIC COMMISSION

**IMPLEMENTATION PLAN FOR THE  
GLOBAL OBSERVING SYSTEM FOR CLIMATE  
IN SUPPORT OF THE UNFCCC**

October 2004

GCOS - 92

(WMO/TD No. 1219)



# GLOBAL CLIMATE OBSERVING SYSTEM



WMO



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ORGANIZATION

INTERGOVERNMENTAL  
OCEANOGRAPHIC COMMISSION

## Action T4 (TF2)

**Action:** Confirm locations of GTN-R sites, determine operational status of gauges at all GTN-R sites, ensure that the GRDC receive daily river discharge data from all 380 sites within one year of their observation (including measurement and data transmission technology used).

**Who:** National Hydrological Services, through WMO CHy in cooperation with TOPC, GTOS and the GRDC.

**Time-Frame:** 2006 for finalization of network and reporting of any historical records, complete compliance, i.e., one-year time lag by 2009.

**Performance Indicator:** Reports to WMO CHy on the completeness of the GTN-R record held in the GRDC including the number of stations and nations submitting data to the GRDC, National Communication to UNFCCC.

**Cost Implications:** Category II increasing to III.

# User Interface

The screenshot displays the GRDC's Data Retrieval Program interface. The main window contains a table of data sources and a tree view of stations. An 'Add a Datasource' dialog box is open in the foreground, showing fields for Datasource ID, Partner ID, File Type, Filename, Server Type, Server Location, Server Username, Server Password, and Download Frequency.

Datasource ID	Partner ID	Filetype	Path and	Server Type	Server Location	Server I	Server	Download Frequen	Download Time	Active	Last Download
us07337000	USGS-RT	USGS		HTTP	http://waterdata.usgs.gov/nwis/dv?dd_cd=0;			Daily	Daily.10.00	Yes	12/10/2004 12:02:37
us09521100	USGS-RT	USGS		HTTP	http://waterdata.usgs.gov/nwis/dv?dd_cd=0;			Daily	Daily.10.00	Yes	12/10/2004 12:02:24
us14105700	USGS-RT	USGS		HTTP	http://waterdata.usgs.gov/nwis/dv?dd_cd=0;			Daily	Daily.10.00	Yes	12/10/2004 12:02:46

The 'Add a Datasource' dialog box contains the following fields:

- Datasource Information:
  - Datasource ID: BfG\_Koblenz
  - Partner ID: BfG
  - File Type: GRDC Standard
  - Filename: EFERATE/GRDC/koblenz.bfg
  - Active: Yes
- Download Information:
  - Server Type: FTP
  - Server Location: www.bafg.de
  - Server Username: (empty)
  - Server Password: (empty)
- Download Frequency:
  - Frequency Setting: Daily
  - Day: Daily
  - Hour: 11
  - Minute: 05

Buttons at the bottom of the dialog include 'Clear Values', 'Add', and 'Cancel'. The main window has buttons for 'Show All', 'View Selected', 'Remove Selected', 'Undo', 'Add', 'Edit Selected', 'Delete Selected', and 'Create FTP File'.

Data objects: **Partners**, which provide  $n$  **DataSources**, which have  $m_n$  **GaugingStations**

# Information “Infarct” - Information “Tsunami”

- Level of **model complexity** is continuously growing
  - domain extension covered
  - variety of processes modelled and coupled / sectors covered
  - scales resolved / subgrid variability explicitly modelled
  - IT infrastructure required
- **Data requirements** are also permanently growing
- Our **ability to appropriately organise this data has not grown in the same pace**, especially in the terrestrial domain
  - data is collected sectorally and regionally
  - difficulties to identify and consider all relevant scattered/ fragmented data sources
    - in limited (project) time
    - with limited capacity (manpower, funds)



# Consequences - Countermeasures - Benefits

- increasing problem complexity
- increasing data requirements

**but:** constant capacity of individuals

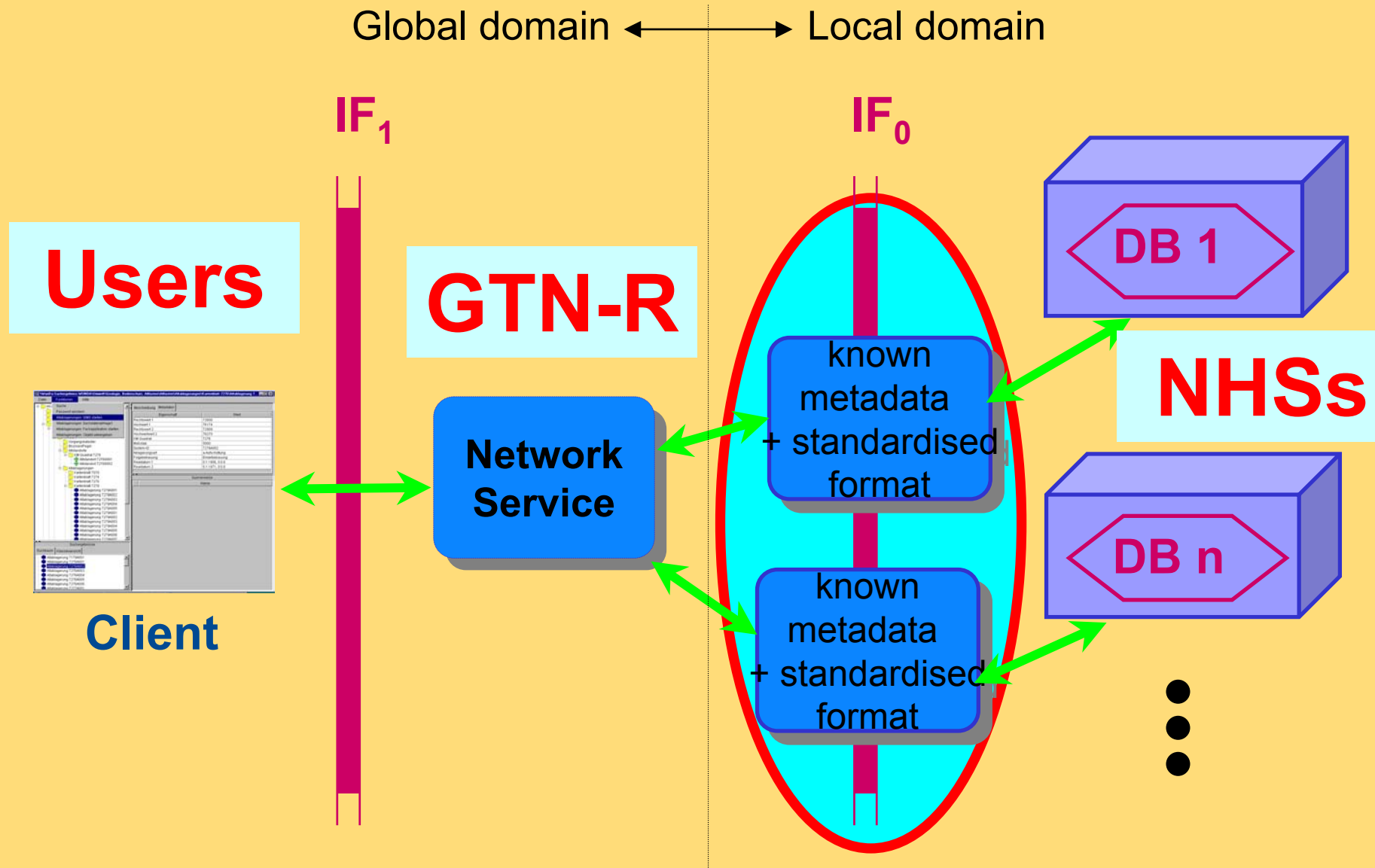
=> more individuals need to be involved **and coordinated**

- requires overall increasing **communication efforts**
- needs to be **automated / standardised** as much as possible

=> **freeing researchers to apply their expertise**

rather than: - getting stuck with data handling or  
- being forced to omit relevant information

# Architecture for data and information integrating systems



**G** GLOBAL  
**C** CLIMATE  
**O** OBSERVING  
**S** SYSTEM



WMO



of UNESCO



UNEP



ICSU

WORLD METEOROLOGICAL  
ORGANIZATION

INTERGOVERNMENTAL  
OCEANOGRAPHIC COMMISSION

UNITED NATIONS  
ENVIRONMENT PROGRAMME

INTERNATIONAL COUNCIL FOR  
SCIENCE

# THE SECOND REPORT ON THE ADEQUACY OF THE GLOBAL OBSERVING SYSTEMS FOR CLIMATE IN SUPPORT OF THE UNFCCC

April 2003

(WMO/TD No. 1143)

## Effective Data Exchange and Access

In Decision 14/CP.4, the COP *Urged* Parties to undertake free and unrestricted exchange of data to meet the needs of the Convention, recognizing the various policies on data exchange of relevant intergovernmental and international organizations. Yet, as this Report points out repeatedly with respect to almost all of the variables, the record of many Parties in providing full access to their data is poor. Indeed, most Parties appear to be unaware of their performance in this respect.

### Conclusion:

- 2) Adherence by nations to the agreed policy of **free and unrestricted exchange** is urgently required for **both *in situ* and satellite climate observations**, particularly in respect of observations of the Essential Climate Variables listed in Table 1, as well as their associated climate products; and
- 3) Nations need to ensure that their observations and associated metadata for the Essential Climate Variables, including historical observations, are available at international data centres<sup>6</sup> for application to climate analyses.

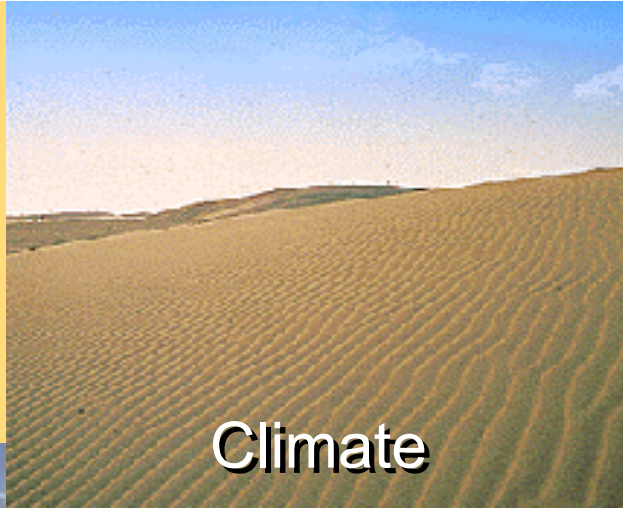
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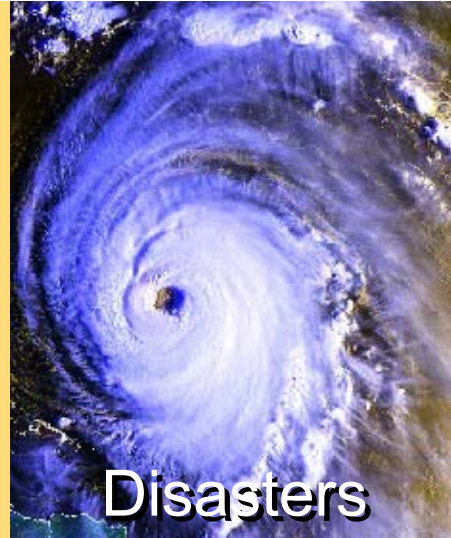
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**Climate**



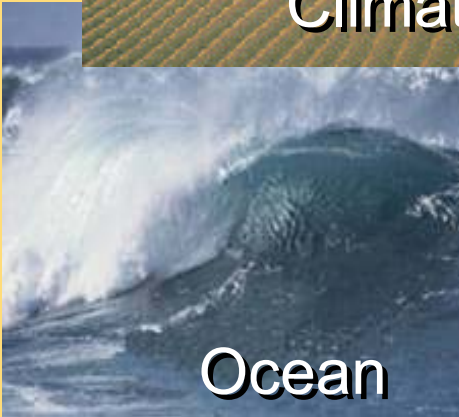
**Disasters**



**Ecosystems**



**Water Resources**



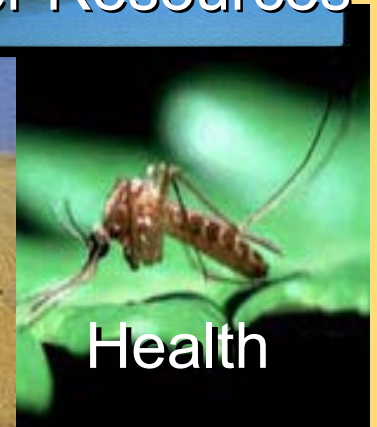
**Ocean**



**Atmosphere**



**Land**



**Health**

**Vision of a  
Global Earth Observation System of Systems (GEOSS)**

