

**WP4000**

## **European GEOSS Workshop on Water**

### **Workshop Report**

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### Change log

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## Acronyms

AIP	GEOSS Architecture Implementation Pilot
AWCCI	African Water Cycle Coordination Initiative
BfG	German Federal Institute of Hydrology
CCI	ESA Climate Change Initiative
CEOS	Committee on Earth Observation Satellites
CHy	WMO Commission for Hydrology
CoP	Community of Practice
DLR-DFD	German Aerospace Centre - Remote Sensing Data Centre
DSP	GEOSS Data Sharing Principles
DWD	Deutscher Wetterdienst
DWG	OGC Domain Working Group
EC	European Commission
ECMWF	European Centre for Medium Range Weather Forecasts
EDO	European Drought Observatory
EEA	European Environment Agency
EFAS	European Flood Alert System
EO	Earth Observation
ETC/W	European Topic Centre on Water
ETN-R	European Terrestrial Network for River Discharge
EUMETCast	EUMETSAT's Broadcast System for Environmental Data
EUMETNET	Network of European Meteorological Services
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
EURO-FRIEND	Flow Regimes from International Experimental and Network Data (Europe)
EUWI	European Water Initiative
ESA	European Space Agency
EWA	European Water Archive
G8	Group of Eight
GCI	GEOSS Common Infrastructure
GCOS	Global Climate Observing System
GEMS Water	Global Environment Monitoring System Water
GEO	Group on Earth Observation
GEOLAND	GMES integrated project on land cover and vegetation
GEOLAND-2	GMES preoperational Land Monitoring Service
GEOSEC	GEO Secretariat
GEOSS	Global Earth Observation System of Systems
GEWEX	Global Energy and Water Cycle Experiment
GISC	GMES In-Situ Coordination
GKSS	GKSS Research Centre
GlobCorine	Corine-compatible land cover/use service

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GMES	Global Monitoring for Environment and Security
GNU	GMES Network of Users
GPCC	WMO Global Precipitation Climatology Centre
GRACE	Gravity Recovery and Climate Experiment
GRDC	Global Runoff Data Centre
GTN-R	Global Terrestrial Network for River Discharge
GTOS	Global Terrestrial Observing System
HELP	Hydrology for Environment, Life and Policy
HEPEX	Hydrologic Ensemble Prediction Experiment
HLWG	European GEOSS High Level Working Group
H-SAF	EUMETSAT Theme on support to Hydrology and Water Management
HWRP	Hydrology and Water Resources Programme
HYDROWEB	HYDROWEB hydrological database
IAH	International Association of Hydrogeologists
ICSU	International Council for Science
IE	OGC Interoperability Experiment
IGOS	Integrated Global Observing Strategy
IGRAC	International Groundwater Resources Assessment Centre
IGWCO	Integrated Global Water Cycle Observations
IHME	International Hydrogeological Map of Europe
IHP	UNESCO International Hydrological Programme
INSPIRE	Infrastructure for Spatial Information in the European Community
JRC	European Commission, DG Joint Research Centre
MetOp	Meteorological Operational Satellite
NHS	National Hydrological Service
OWS	OGC Web Services
PUMA	Preparation for Use of MSG in Africa
RA VI	WMO Regional Association 6 (Europe)
SBA	Societal Benefit Area
SDIs	Spatial data infrastructures
SIF	Standards and Interoperability Forum
SMOS	ESA Soil Moisture and Ocean Salinity Mission
TYIP	GEOSS 10-Year Implementation Plan
VC	CEOS Virtual constellation
WACMOS	ESA initiative to produce global products for the whole water cycle
WCCoP	GEO Water Cycle Community of Practice
WFD	Water Framework Directive
WHYCOS	World Hydrological Cycle Observing System
WHYMAP	The World-wide Hydrogeological Mapping and Assessment Programme
WISE	Water Information System for Europe
WISER	Water bodies in Europe: integrative systems to assess ecological status and recovery
WMO	World Meteorological Organization

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## 1 Introduction

### 1.1 Background

The inter-governmental Group on Earth Observation (GEO) initiated the establishment of a coordinated Global Earth Observation System of Systems (GEOSS).

GEO was launched in response to calls for action by the 2002 World Summit on Sustainable Development and by the G8 (Group of Eight) leading industrialised countries. These high-level meetings recognised that international collaboration is essential for exploiting the growing potential of earth observations to support decision making in an increasingly complex and environmentally stressed world. GEO is a voluntary partnership of governments and international organisations. As of November 2009, GEO's members include 80 governments and the European Commission. In addition, 58 intergovernmental, international, and regional organisations with a mandate in earth observation or related issues have been recognised as participating organisations.


The development of GEOSS is supposed to qualitatively improve our understanding of the Earth system, enhancing global policy- and decision-making abilities to promote the environment, human health, safety, and welfare. GEOSS is expected to generate societal benefits in the following nine areas, the so-called Societal Benefit Areas (SBA):

- **Disasters:** reducing loss of life and property from natural disasters
- **Human health:** increasing the understanding of environmental factors affecting human health and well-being
- **Energy:** improving the sustainable management of energy resources
- **Climate:** improving the understanding and the prediction of climate variability and change as well as the adaptation to altered environmental conditions
- **Water:** improving sustainable water resource management through better understanding of the water cycle
- **Weather:** improving the information base with respect to meteorological parameters, weather forecasting and warning
- **Ecosystems:** improving the management and protection of terrestrial, coastal and marine ecosystems
- **Agriculture:** supporting sustainable agriculture and combating desertification
- **Biodiversity:** improving the understanding, monitoring and conserving of biodiversity

A GEOSS 10-Year Implementation Plan (TYIP, 2005-2015) was adopted during the Third Earth Observation Summit 2005 in Brussels to develop GEOSS. The Plan defines a vision statement for GEOSS, its purpose and scope, expected benefits, and the nine SBAs. The implementation of GEOSS is realised through a number of dedicated tasks that are defined in the GEO Work Plan. This document (the current version being the 2009-2011 Work Plan) is updated annually.

GEO is governed by a plenary consisting of all member states and participating organisations. It meets at least once a year at the level of senior officials and periodically at the ministerial level. An Executive Committee oversees GEO activities when the plenary is not in session. Additionally, GEO established four permanent bodies to guide the implementation of the TYIP. These committees are organised around four transverse areas which cut across, and are relevant to each of the nine SBAs:

- Architecture & Data Committee

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- Science & Technology Committee
- User Interface Committee
- Capacity Building Committee

## 1.2 Scope and objectives of the EUGENE project

The EUGENE project is an FP-7 funded support action to foster collaboration between pan-European organisations in the field of earth observation and to strengthen the coordination of national and regional programmes and organisations in their work towards GEO by establishing an appropriate coordination process. The goal of EUGENE is to contribute to the establishment of a coordinated and sustained European earth observing system component as part of GEOSS.

The EUGENE project aims at further developing a comprehensive European GEO strategy by proposing a structured European approach for selected GEO Societal Benefit Areas (SBAs). This will also encompass intrinsic cross-cutting issues, such as data sharing, with special attention to the relationship between relevant European frameworks and GEOSS.

EUGENE addresses European activities and actors in three SBAs, which correspond to European political priorities:

- Climate
- Disasters
- Water


The project work plan is intentionally limited to these three areas as a subset to start with and to allow working at a sufficient level of detail. For each of the three SBAs, a consolidated status-quo report has been documented. These reports provide information on relevant European activities and contributions to GEO. They form the basis for further considerations on a European GEO approach with the ultimate goal to establish a coordinated and sustained European earth observing system component as part of the GEOSS, maximizing both the GEO added value and the European benefit from GEOSS.

## 1.3 Purpose of this document

The purpose of this document is to report on the proceedings and major strategic outcomes of the European GEOSS Workshop on Water, which was held at the German Federal Institute of Hydrology (BfG) in Koblenz on the 11<sup>th</sup> and 12<sup>th</sup> May 2010.

This document includes

- An overview of the workshop objectives, agenda and the targeted audience (Chapter 2; Appendix-A; Appendix-B);
- A summary of workshop presentations and discussions (Chapter 3);
- A summary of the breakout group and final discussions (Chapters 4 and 5; Appendix-C);
- A synthesis of main strategic outcomes (Chapter 6).


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#### 1.4 Applicable documents

- [AD.1]: EUGENE Description of Work, 8<sup>th</sup> September 2009.  
[AD.2]: EUGENE Project Implementation Plan, 20<sup>th</sup> October 2009.

#### 1.5 Reference documents

- [RD.1]: Status-quo Report Water, version 0.3 (Draft); Doc. No.: EUGENE-WP4000-1.

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## 2 Workshop objectives, agenda and targeted audience

### 2.1 Objectives

The purpose of this workshop was to gather relevant European actors related to the GEO Societal Benefit Area Water and to assess the prospects of the European water community in the light of GEO. Additionally, the workshop aimed at elaborating possibilities to facilitate coordination of European Earth observation contributions to the Societal Benefit Area Water.

The Status-quo Report on Water [RD.1], which has been drafted beforehand, has been put up for discussion at the workshop. The workshop provided an important opportunity for a review of the report [RD.1] from an expert perspective, to take stock of Earth observation strategies and future plans of European organisations and to discuss these issues to update and supplement the report [RD.1] accordingly. Since the report [RD.1] forms the basis for strategic considerations on how to achieve a well-coordinated and sustained European GEO component as a contribution to the Societal Benefit Area Water, the workshop is considered to be an important mechanism for the strategy development within EUGENE.

The major outcomes of the workshop were expected to be

- An updated report on the European status quo relevant to the Water SBA;
- Inputs for a strategic document, referring to a coordinated European contribution to GEO for the Water SBA;
- Potential inputs to a coherent European position and visibility at the GEO Ministerial Summit taking place in Beijing in November 2010.

### 2.2 Agenda


The workshop agenda is provided in Appendix-A.

### 2.3 Participation

Pan-European organisations and programmes, major actors at European Member States level as well as global level organisations were encouraged to take part in the workshop.

An invitation has been sent to 35 selected organizations. In addition, the European GEO High Level Working Group (HLWG) was requested to forward the invitation at the national level of European Member States.

The participation list is provided in Appendix-B.

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### 3 Summary of workshop presentations and discussions

This chapter summarizes main presentation contents and discussion outcomes, if applicable. Each presentation is available online at [http://www.eugene-fp7.eu/water\\_ws.htm](http://www.eugene-fp7.eu/water_ws.htm).

#### 3.1 Welcome

The workshop was opened by **Hans Moser**, Head of the Division Quantitative Hydrology of the Federal Institute of Hydrology (BfG). He welcomed all participants and stressed

- The important role of Earth observations for the tasks of BfG;
- Germany's commitment to support the GEOSS initiative; and
- The importance of the efforts, EUGENE is undertaking to help European organisations strengthen their contributions to GEOSS.

#### 3.2 Introduction and objectives

**Ralf Busskamp** (BfG) presented the motivation for this workshop, objectives and an agenda. In accordance with Chapter 2.1, the objectives were to:

- Gather relevant European actors related to the GEO Societal Benefit Area Water;
- Assess the prospects of the European water community in the light of GEO;
- Elaborate possibilities to facilitate coordination of European Earth observation contributions to the Societal Benefit Area Water.


**Michael Nyenhuis** (University of Bonn) outlined the expected outcome of the workshop:

- An updated report on the European status quo relevant to the Water SBA;
- Inputs for a strategic document, referring to a coordinated European contribution to GEO for the Water SBA;
- Potential inputs to a coherent European position and visibility at the GEO Ministerial Summit taking place in Beijing in November 2010.

#### 3.3 Background to GEO and the EUGENE project

**Jens Danzeglocke** (DLR), manager of the EUGENE project, presented the project idea and current status of EUGENE. He also gave an overview of the GEO initiative. He addressed the following issues:

- Background: GEO initiative;
- EUGENE motivation;
- Objectives and expected outcome;
- Scope and methodology
- Partnership and main tasks

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- Current project status;
- Situation in Europe in the 3 SBAs considered;
- Feedback from the EU High Level Working Group (HLWG) on EUGENE;
- Link between GMES and GEOSS & report from a meeting of EUGENE and the GMES Bureau;
- Strategic issues and further issues to be discussed.

Most relevant discussion points:

- A question was raised, whether GEO is moving too slowly since even after years (half-way) very basic questions are still asked:
  - GEO is a complex process and mode of operation needed to be understood first; now there is time to structure the process; it is anticipated that the GEO process will accelerate after the GEO VII Ministerial Summit (Beijing 2010);
  - The voluntary nature of GEO is both a major strength and part of the problem; however, those (organisations/countries) that are well structured and coordinated will be able to steer the process;
  - Another problem is fragmentation of the water sector (both within and outside Europe – it applies to all international frameworks in the water sector).


### 3.4 Status-quo Analysis Water

**Michael Nyenhuis** presented the Status-quo Analysis for the Water SBA, which has been conducted by the University of Bonn. A Status-quo Report on Water [RD.1] had been drafted beforehand and was distributed to all workshop participants for preparation of this workshop and with the request to review the document. M. Nyenhuis addressed the following points:

- Methodology & content of report
- User requirements (international/Europe)
- Existing Earth observation systems in Europe
- Major Earth observation gaps (international/Europe)
- Preliminary findings
- Next steps

Most relevant **discussion points** and feedback on the Status-quo Report:

- The **GEOSEC** recommended to analyse registry of European systems in the GEOSS Common Infrastructure (GCI) Registry System [accomplished in updated report]; it was also recommended to include the Global Precipitation Climatology Centre (GPCC) as a national European contribution to GEOSS [GPCC, GRDC and IGRAC are included in updated report];
- **BGR/EuroGeoSurveys** noted that the groundwater component has not been adequately addressed, which might be due to the fact that it is not yet operationally developed; however, a list of major groundwater parameters (e.g. groundwater quality) that are covered by operational programmes are captured;

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- **GNU** highlighted that no consolidated list of user requirements of European users exists and recommended to request appropriate documents from project coordinators of various GMES and FP7-projects; it was also mentioned by different participants that the GMES Bureau has drafted a report (GLOBLAND) covering user requirements [this report is not available yet].


### 3.5 The GEO Societal Benefit Area Water

On behalf of the GEO Secretariat (GEOSEC), **Douglas Cripe** gave an overview of the GEO Societal Benefit Area (SBA) Water. Main contents of his presentation:

- Background to GEO; difference between GEO and GEOSS;
- Main objectives of GEO;
- Concept of the Societal Benefit Areas;
- Scope of Water SBA and its strategic target;
- Overview and status of GEO Water Tasks;
- The GEO Portal;
- Communities of Practice: Water Cycle; the IGWCO (Integrated Global Water Cycle Observations; former IGOS Theme team).

Summary of major **discussion points**:

- The question was raised how GEO ensures that components of the GCI are up-to-date:
  - D. Cripe mentioned the efforts of different GEO committees (ADC, STC) and the GCI Task Force to assure this; he mentioned that data quality is a difficult issue and that an appropriate way may be an assessment of data quality by the users;
  - Jörn Hoffmann (DLR/STC Co-chair) highlighted that many of the GCI components already undergo extensive quality controls by the organisations, which provide the data; appropriate documentation of metadata is one way of documenting these control mechanisms;
- Regarding data sharing it was discussed,
  - Whether there should be components in the GCI, which need to be purchased – the GEOSEC sees no reasons why this should not be the case unless an organisation registers such a component;
  - That even though data exchange technology develops fast, registration of components is still an obstacle;
  - That something like the concept of Creative Commons may be a possibility for the GCI; and
  - That organisations need an early sign that GEOSS will be continued after 2015 in order to justify any investments;
- It was stressed that GEO needs to ensure that its messages reach the actors at national level.

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### 3.6 Presentations on special topics

A number of presentations have been given by major European players to introduce the following relevant topics:

- Surface water / water quantity
- Groundwater / in-situ observations
- Satellite observations / GMES Land Monitoring
- In-situ observations / reporting obligations
- Data sharing / data architecture and infrastructure

These topics were further discussed in the breakout group discussions (see Chapter 4).

#### 3.6.1 Surface water / water quantity

**Jutta Thielen** (JRC) gave a presentation about “Continental Flood Monitoring and Alert Systems”. Main content of the talk, which focused on the European Flood Alert System (EFAS):


- Background and purpose of EFAS;
- System design and examples for flood alerts;
- (Real-time) data collection on EU scale;
- Weather forecasts, hydrological modelling and forecast skills;
- Assimilation of satellite data;
- Knowledge transfer to other applications (in other regions such as Africa).

In the conclusion of the talk, J. Thielen stressed that

- Good quality and reliable input data are needed for modelling, calibration and validation of the models;
- Multiple information is needed (e.g. meteorological variables, soil data, land use data, soil moisture snow cover, DEM);
- Knowhow of data assimilation techniques for combining in-situ, remote sensing and modelling data is needed for obtaining the best data sets; and that
- GEO and GMES services contribute in many ways to improve the systems.

Summary of major **discussion points**:

- J. Thielen mentioned that EFAS is a testbed of HEPEX (Hydrologic Ensemble Prediction Experiment).
- EFAS has been developed in compliance with INSPIRE; the dynamic character of the INSPIRE initiative, however, imposed some problems since standards have been changed several times.

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- A question was raised, if EFAS intends to utilise groundwater data; J. Thielen replied that there have been discussions to do that but no concrete plans have been developed yet.
- GNU asked the question why data access is restricted; J. Thielen explained that the principle of the “single-voice” exists at WMO in case of early warning and emergency response and that EFAS is following this principle.

### 3.6.2 Groundwater / in-situ observations

**Wilhelm Struckmeier** (IAH/BGR/EuroGeoSurveys) gave a presentation on groundwater in-situ observations and hydrogeological mapping. In his talk, the following aspects were covered:

- High importance of groundwater as a freshwater resource;
- Requirements for groundwater in-situ observation and monitoring;
- Hydrogeological maps: function, importance, dissemination, examples (WHYMAP, IHME)

W. Struckmeier concluded with raising the questions of the relevance of groundwater and hydrogeological maps within GEOSS and how to proceed. He welcomed any suggestions from the workshop participants to further the issue of groundwater.


Summary of major **discussion points**:

- Both the WHYMAP and the IHME are not yet registered in the GCI. It was then stressed that hydrogeological maps have a long-term validity and are of great interest for GEOSS. [the IHME is included in the Status-quo Report on Water as a major European Earth observation activity];
- The GEOSEC and EUGENE offered assistance in registering groundwater maps in the GCI;
- It was suggested to define appropriate links to relevant communities within GEO to further promote the topic of groundwater.

### 3.6.3 Satellite observations / GMES Land Monitoring

**Jean-Christophe Calvet** (Météo-France) and **Thomas Schrage** (Infoterra) presented the FP7 project geoland-2, which has been established to implement the GMES Fast Track Service “Land”. Main contents of their presentation:

- Project overview (funding, partners, objectives)
- Functional organisation: 3 core mapping services, 7 core information services;
- Collaborations and project status;
- Global components of geoland-2: biophysical products, soil moisture, water bodies, land carbon, water/carbon fluxes, LAI;
- Core Information Service Water: background, product examples (nutrient balance, water balance, nutrient emissions and loads);

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Summary of major **discussion points**:

- It was stressed again, that geoland-2 mainly provides information on water quality [which is a topic that needs to be strengthened in GEOSS];
- While geoland-2 mainly delivers satellite-based information, in-situ data is obtained through ETC/Water and used for validation purposes;
- It was mentioned that a report (GLOBLAND) has been drafted by the GMES Bureau, which includes consolidated European user requirements related to GMES topics [report is not available yet].

### 3.6.4 In-situ observations / reporting obligations

**Anita Künitzer** (European Topic Centre on Water, ETC/W) presented in-situ observation activities of the European Environment Agency (EEA) in the field of water and related reporting mechanisms in Europe. Main contents of the presentation:

- Overview of European Environment Agency (EEA) and European Environment Information and Observation Network (Eionet);
- Reportnet, Water Information System for Europe (WISE), Waterbase;
- In-situ data issues in the GMES Marine Services;
- FP7-project GMES In-Situ Coordination (GISC): overview, status and activities.


Summary of major **discussion points**:

- The structure of EIONET was detailed again:
  - Reportnet is a reporting obligation database, dictionary and central data repository – the input side of EIONET;
  - WISE is an information system (with Waterbase feeding the interactive map viewer of WISE), which provides water related information for the public – the output side of EIONET in the water sector.

### 3.6.5 Data sharing / data architecture and infrastructure

**Athina Trakas** (OGC Europe) presented the OGC organisation and their activities related to GEOSS. Main contents of the presentation:


- OGC: overview, mission, status and networks;
- OGC open standards;
- OGC Web Services (OWS);
- OGC Interoperability Program;
- Interoperability Experiments (IE): examples from water sector;
- GEOSS support activities

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- Architecture Implementation Pilot (AIP): AIP-3 with scenario on water (drought and water quality);
- Standards and Interoperability Forum (SIF).

Summary of major **discussion points**:

- The role of the Hydrology Domain Working Group (DWG), a joint working group of WMO and OGC was discussed; the Hydrology DWG aims at developing candidate standards for adoption by the WMO Commission of Hydrology (CHy) as appropriate;

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## 4 Breakout group discussions

### 4.1 Topics and seed questions

In order to gather additional information for the Status-quo Report Water [RD.1] and to review its content, six breakout groups met during the workshop.

On the first day, Groups 1-3 focused on Earth observation needs, capabilities and gaps of existing and planned systems and European Earth observation activities:

- Group 1: Earth observation user requirements and needs in Europe;
- Group 2: Capabilities and gaps of Earth observation systems in Europe (satellite observations);
- Group 3: Capabilities and gaps of Earth observation systems in Europe (in-situ observations).

On day two, Groups 4-6 addressed coordination and governance of pan-European Earth observation initiatives, international/global cooperation, spatial data infrastructures and data sharing:

- Group 4: Pan-European Earth observation initiatives – coordination, governance and cooperation in the light of GEO;
- Group 5: International / global cooperation opportunities;
- Group 6: Spatial data infrastructures (SDIs), data sharing and reporting obligations.

For each breakout group, a number of seed questions were provided to stimulate and focus the discussions. The seed questions and a list of organizations, which were represented in the breakout groups, are documented in the following sections. Main discussion points are documented in Appendix-C and represent a basis for the strategic workshop outcomes (Chapter 6).

#### 4.1.1 Group 1: Earth observation user requirements and needs in Europe


**Moderator:** Herbert Haubold (GMES Network of Users, GNU)

**Facilitator:** Thomas Lüllwitz (BfG, EUGENE project)

**Organisations represented:** BfG, CHMI, DLR, EC DG-RTD, GNU and WMO (RA VI WG Climate and Hydrology)

#### **Seed questions:**

- User requirements for Earth observation data have been analysed in the framework of different European initiatives and by various European organisations. Are you aware of any consolidated European user requirement documents related to the topics under the GEO Water SBA? How could a European user position be elaborated and brought forward to GEO?
- How can users of Earth observation data in the Water SBA be categorised? What are the major differences between users in Europe and users on global level?
- Are there noticeable overlaps of user groups of different European Earth observation activities? Are abundant overlaps being addressed by appropriate coordination mechanisms? If not, how could GEO help?

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- What are the major challenges in terms of data sharing, which hamper user-oriented development/delivery of Earth observation data and products?
- Do you feel the need to establish coordinated quality assessment mechanisms for individual European Earth observation initiatives?
- Which major Earth observation user requirements emerge from the European policy framework in the water area?

#### 4.1.2 Group 2: Capabilities and gaps of Earth observation systems in Europe (satellite observations)


**Moderator:** Jörn Hoffmann (DLR, GEO STC)

**Facilitator:** Michael Nyenhuis (University of Bonn, EUGENE project)

**Organisations represented:** BMVBS, DLR, ETC-Water, EUMETNET, GEOLAND-2, GEOSEC, GEO STC, University of Bonn and Waterwatch

**Seed questions:**

- What are the major strengths / gaps of European satellite systems for hydrologic applications compared to non-European systems?
- Which major gaps in remote sensing for hydrology (in Europe and globally) can be especially addressed by European satellite systems? Which gaps can only be addressed by global cooperation (under GEO)?
- Which relevant Earth observation data (in-situ and satellite) held by organisations outside Europe could/should be made accessible through GEOSS? What are the anticipated benefits for Europe (and the GEO Water SBA as such)?
- In-situ data is important for validation of remote sensing data whereas satellite data is needed to supplement in-situ networks to close spatial/temporal observation gaps – which application areas in hydrology could benefit from integrated products utilising various data sources?
- Please discuss the need for automated data exchange with data systems vis-à-vis direct (interactive) data retrieval/delivery. Which functionality is anticipated from the GEOSS Common Infrastructure (GCI)?
- Do you think that calibration/validation (cal/val) activities in European Earth observation initiatives (esp. GMES) are sufficient? What are the major unmet in-situ requirements for cal/val activities?

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#### 4.1.3 Group 3: Capabilities and gaps of Earth observation systems in Europe (*in-situ* observations)

**Moderator:** Sophie Vermooten (IGRAC)

**Facilitator:** Ralf Busskamp (BfG, EUGENE project)

**Organisations represented:** BfG, BGR, CHMI, DLR, EFAS, ETN-R, EUMETNET, EuroGeoSurveys, GRDC, IGRAC, and IRSA-CNR

**Seed questions:**

- What are the major strengths / gaps of European hydrologic networks compared to non-European networks?
- Which solutions have been developed under European leadership that have closed major gaps/shortcomings in hydrologic in-situ observations? Are these solutions transferable to other regions? Which major gaps can only be addressed by global cooperation (under GEO)?
- Which relevant Earth observation data (in-situ and satellite) held by organisations outside Europe could/should be made accessible through GEOSS? What are the anticipated benefits for Europe (and the GEO Water SBA as such)?
- In-situ data is important for validation of remote sensing data whereas satellite data is needed to supplement in-situ networks to close spatial/temporal observation gaps – which application areas in hydrology could benefit from integrated products utilising various data sources?
- Please discuss the need for automated data exchange with data systems vis-à-vis direct (interactive) data retrieval/delivery. Which functionality is anticipated from the GEOSS Common Infrastructure (GCI)?
- Many in-situ networks are operated by NHS to meet national demands of hydrologic observations. What justifies European and global level coordination of in-situ networks and how could GEO facilitate coordination processes in the light of other European and global initiatives (e.g. GMES, GCOS/GTOS)?

#### 4.1.4 Group 4: Pan-European Earth observation initiatives – coordination, governance and cooperation in the light of GEO


**Moderator:** Jean-Christophe Calvet (GMES Land Monitoring Service/geoland-2)

**Facilitator:** Björn Baschek (BfG)

**Organisations represented:** BfG, BGR, DLR, EFAS, EuroGeoSurveys, GEO STC, GMES Land Monitoring Service/geoland-2, and WMO (RA VI WG Climate and Hydrology)

**Seed questions:**

- Which major Earth observation activities for hydrologic applications can be identified in Europe? Which major European online Earth observation data portals and databases that address hydrologic applications are you aware of?

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- Which major Earth observation requirements emerging from the European policy framework in the water area are addressed by the individual European Earth observation activities? Which global level requirements are known – and addressed?
- What are the current challenges related to the coordination of major European Earth observation activities such as GMES, INSPIRE and WISE? Which are major challenges related to coordination/exchange with GEO? Which role does GEOSS play for European implementation processes?
- Please list major global scale Earth observation components, which are provided by Europe. How can GEO / GEOSS be used to facilitate expansion of GMES services to the global scale?
- Do you feel sufficiently informed about the ‘Earth observation landscape in Europe’? What could be improved in terms of labelling of initiatives?
- What are the major challenges/opportunities in terms of coordination of in-situ observations and networks in the framework of European Earth observation initiatives (esp. GMES)? Please consider both pan-European and national/sub-national implications.

#### 4.1.5 Group 5: International / global cooperation opportunities


**Moderator:** Douglas Cripe (GEOSEC)

**Facilitator:** Michael Nyenhuis (University of Bonn, EUGENE project)

**Organisations represented:** BMVBS, CHMI, DLR, EUMETNET, GEOSEC, GNU, and IGRAC

**Seed questions:**

- Which global level Earth observation initiatives are you directly involved in and in which role?
- How can/does GEO support coordination processes in the application field you are involved in? Which are the strengths and challenges of GEO in terms of coordination?
- Which major Earth observation gaps (in the water area) can only be addressed by GEO / GEOSS, involving global, regional and national level organisations and governments?
- Which overlaps exist between European and global level Earth observation initiatives? Which European and global level activities need to be better coordinated, e.g. to avoid double work and to close Earth observation gaps?
- Which global level organisations exhibit European (and other regional) branches/associations? Could the GEO Water Cycle Community of Practice (WCCoP) be an appropriate forum for European Earth observation initiatives to maximise benefit from the GEO Water SBA?
- The GEO WCCoP is an important operative nucleus of the GEO Water SBA. Which (direct / indirect) links do already exist between Europe and the WCCoP and how could effective cooperation / exchange be realised?

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#### 4.1.6 Group 6: Spatial data infrastructures (SDIs), data sharing and reporting obligations


**Moderator:** Ralf Busskamp (BfG, EUGENE project)

**Facilitator:** Thomas Lüllwitz (BfG, EUGENE project)

**Organisations represented:** BfG, DLR, EC DG-RTD, ETC-Water, ETN-R, EUMETNET, GRDC, IRSA-CNR, OGC, and Waterwatch

**Seed questions:**

- Which are the major challenges to coordinate data flows from Europe to global level organisations (and vice versa) and how could GEO help?
- Which voluntary and obligatory reporting data flows to the global level are currently maintained by European organisations?
- Which voluntary and obligatory reporting data flows could benefit from increased use of the GEOSS Common Infrastructure (GCI)?
- Which requirements need to be met, if the GCI is operationally used alongside existing/planned European spatial data infrastructures?
- Which major challenges in terms of coordination, governance and data architecture need to be overcome to realise interoperability between European SDIs and the GCI?
- Data sharing in hydrology is hampered by various reasons such as security concerns, national data policies or poor data quality. What are the major challenges for sharing hydrological data from a technological, SDI related point of view and how are these addressed?

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## 5 Final discussion: strategic considerations

The EUGENE project aims at elaborating a strategy for Europe to establish a coordinated and sustained contribution to the GEOSS. The EUGENE strategy will propose a structured European approach in selected GEO Societal Benefit Areas (SBA) to reach this objective.


The final workshop discussion aimed at elaborating ways to establish and contribute to such a strategy with special attention to the GEO Ministerial Summit 2010 (Beijing). As a starting point for the discussion, a paper was distributed beforehand, which included numerous generic questions to be discussed:

### 1) Major strengths, gaps, challenges and opportunities of European earth observation

- Effective promotion of European strengths
- Where could Europe claim a global leading position?
- International collaboration to close observational gaps?
- Limits of GMES services to be expanded to the global scale
- How to achieve a sustained operation of earth observation systems in Europe?

#### Main discussion points:

- The following areas have been identified, where Europe could claim a **leading position**:
  - **Groundwater maps** are a clear European highlight (due to the historical background and because Europe has set standards);
  - Knowledge gained in the **INSPIRE process** should be brought to GEOSS; European involvement is visible under the GEOSS Architecture Implementation Pilots (AIP); compatibility problems of INSPIRE and GEOSS Data Sharing Principles (DSP) exist but can be overcome;
  - The **Water Framework Directive (WFD)** is a unique legal framework; the basic concepts/ideas of the WFD may be transferable to other regions of the world and should be brought to GEO;
  - The **continuity/sustainability of European space activities** in Earth observation, e.g. through meteorological satellites and recently through the Sentinel programme, is a clear European strength and should be promoted as an example how to reach sustainability of GEOSS components;
  - The **Water Information System for Europe (WISE)** should be promoted as a repository for water related data [WISE is a component in the GCI Registry];
  - The **data assimilation experience of ECMWF** was highlighted; ECMWF already has a world leading position in this field [ECMWF is actively contributing to different GEO Tasks];
  - The **European Flood Alert System (EFAS)** could be promoted as a good example how to use different data sources and to follow a pan-European approach; transfer of EFAS principles to other regions may be facilitated under the GEO umbrella [GMES provides an additional platform for EFAS (e.g. related to GMES Africa)].

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## 2) Benefits from a strong European involvement in GEO?

- Incorporation of international data into European systems and programmes
- Better coordination of international activities: Closing gaps instead of double work?
- Influencing GEO to maximise Europe's benefits from GEO/GEOSS
- Could developments in Europe (GMES, data sharing) be facilitated by a strategic involvement?
- Could international visibility of European and national achievements increase political support within Europe?

### Main discussion points:


- The identification of benefits proved to be difficult, since generic formulations are not helpful and benefits should rather be shown with concrete examples;
- One participant noted that benefits for the European economy can be anticipated as long as the industry is visible within GEOSS; further, the open source business is already benefitting from the GEOSS process;
- Regarding potential benefits for GMES from GEOSS, it was mentioned that GMES already includes global scale services; since GMES and GEOSS are partly following the same goals on comparable spatial scales, coordination efforts should be further increased.

## 3) Effective involvement in GEO and GEOSS


- Which issues should be addressed by a European GEO strategy?
- Organisational or structural deficiencies within Europe?
- Definition of relationship between GMES and GEOSS
- Is there sufficient political/scientific support? How could it be improved?
- Utilisation of GEO to facilitate coordination processes within Europe: Are GEO communities (Task Teams, Communities of Practice) suitable vehicles?
- How could a European GEO strategy be brought into effect?

### Main discussion points:

- The question was raised whether there is an **overarching European framework** in the water sector
  - The **WMO Working Group on Climate and Hydrology** within the Regional Association VI (Europe) was identified as such a framework; the fragmentation in the water sector also seems to be reflected in the different Hydrology activities at WMO;
  - It was mentioned that many pan-European structures already exist in Europe and that there is no need to create new initiatives; there is, however, the need to increase exchange and improve coordination on national level;

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- National Hydrological Services (NHS) contribute both to operational observations (which are very cost intensive) and to research in Earth observations on international level; there is a need for a better organization of this national involvement;
- It was stressed that national involvement in international initiatives requires **communication** of international developments **on ministerial level**, which is often not happening;
- Effective coordination processes in such a diverse region like Europe can be seen as a strength as such;
- Dedicated initiatives could be undertaken to **increase visibility of existing organisations in Europe.**

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## 6 Synthesis of main strategic outcomes

The Status-quo report on Water [RD.1] was well received by the workshop participants, especially with regard to the overview it provides over EO activities in the water sector in Europe. Useful feedback on the report has been gathered, e.g. improvements of methodology, more details on European initiatives and further documents to be analysed.

Based on the workshop presentations and discussions, the following conclusions are drawn:

### Identified European capabilities:

- **Earth observation capabilities and expertise**
  - Operational **hydrological networks**, established and maintained by European National Hydrological Services (NHS);
  - European and international **satellite missions** such as SMOS, ASCAT (on MetOp), GOCE, GRACE, ENVISAT, future Sentinel missions and meteorological satellites as such;
  - **Data archives, monitoring and early warning systems and maps** that contain information on different hydrological parameters, e.g. Water Information System for Europe (WISE), European Water Archive (EWA), Global Soil Moisture Network, International Hydrogeological Map of Europe (IHME), European Flood Alert System (EFAS), European Drought Observatory (EDO);
  - The **data assimilation experience** of ECMWF as a world class European capability;
  - The **European Water Framework Directive (WFD)** as a legal basis for Integrated Water Resources Management (IWRM), international cooperation and data exchange, especially for transboundary river basins;
  - The **continuity/sustainability of European space activities in Earth observation**, e.g. through meteorological satellites and recently through the Sentinel programme, is a clear European strength and should be promoted as an example how to reach sustainability of GEOSS components.
- **Programmatic frameworks:**
  - The **GMES (Global Monitoring for Environment and Security) programme**, which encompasses water resource and food security services and products in Europe, but also at global level, and with a special focus on Africa. The transfer of GMES into the initial operations phase (2011-13) is an important milestone to establish a sustainable and long-term Earth observation programme in Europe; full and open access to the data produced under GMES is a key element of the GMES programme;
  - Through the **INSPIRE process**, Europe has acquired considerable experience in the field of spatial data standards and infrastructure development, which should be brought into the GEO process;
  - **Engagement in capacity building** for Earth observations through dedicated programmes such as PUMA, EUMETCast, TIGER and AMESD and various national European projects;
- **International cooperation:** Europe has developed extensive capabilities in Earth observation that are contributing to the implementation of key international frameworks such as GCOS/GTOS, IHP and HWRP. European countries support these international cooperation ef-

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forts, e.g. by hosting international data centres such as the Global Runoff Data Centre (GRDC), the Global Precipitation Climatology Centre (GPCC) and the International Groundwater Resources Assessment Centre (IGRAC) and by providing scientific expertise.

#### Specific areas where European contributions to GEOSS could be strengthened:


- Groundwater maps are a clear European highlight (due to the historical background and because Europe has set standards); European organisations could therefore contribute (even further) to **foster groundwater issues and related activities within GEO**; these activities should also include efforts to rescue (historical) hydrological data;
- Observations and activities related to **water quality** are not very well established within GEO; Europe has abundant capabilities and activities related to water quality and could promote this topic within GEO; the GMES Land Service (geoland-2) could be a potential starting point;
- The importance of in-situ observations of hydrological and hydrogeological parameters has been stressed many times during the workshop; Europe's current efforts to coordinate the **GMES in-situ component** (via an FP7 funded project) also open possibilities to develop relevant contributions to the GEOSS Water SBA;
- Important **developments in the framework of GMES** are currently ongoing (e.g. "GMES and Africa" process; coordination of GMES in-situ component; transition from R&D to operations). Thus, the opportunity arises to even **further dovetail GMES developments with GEO** in order to assure that Europe effectively contributes to GEOSS and benefits as much as possible from GEOSS;
- Promote **full and open access to hydrological data** within GEOSS, since restrictive and complex data policies pose a major obstacle in hydrology so far;
- Many of the GEOSS components already undergo extensive **quality controls** by the organisations/countries, which provide the data; appropriate documentation of metadata is one way of documenting these control mechanisms; Europe should assure **proper documentation of quality assurance procedures** when registering components in GEOSS, e.g. by appropriate metadata descriptions;
- The issue of **fragmentation of the water sector** was repeatedly mentioned during the workshop. Therefore, an **improved coordination of existing initiatives and actors at national level** seems to be appropriate; experience has shown that well organised and structured organisations/countries are best able to take a steering role within GEO.
- European and national involvement in an international initiative like GEOSS requires **communication** of international developments **on ministerial level**, which needs to be improved in Europe.

#### Opportunities for targeted actions by Europe:

- To **promote groundwater issues in GEOSS** and associated European activities, the registration of groundwater maps (WHYMAP, IHME) in the GEOSS Common Infrastructure (GCI) should be aspired; links from the groundwater community to other groups of interest within GEO should be established (e.g. via EUGENE or the GEO Water Cycle Community of Practice);
- **GEO activities in Africa** (African Water Cycle Coordination Initiative, AWCCI) should be followed, especially in relation to current GMES developments (GMES Africa Action Plan).

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- **Participation of European organisations in the GEO Water Cycle Community of Practice as a forum for the European water community** should be considered;
- European organisations, which are already **involved in various water related GEO Tasks** should further focus their work towards these issues and assure proper visibility of their contribution to GEOSS;

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## Appendix-A Workshop agenda

### Tuesday, 11<sup>th</sup> May 2010

Moderator: R. Busskamp

- 12:00 – 13:00 Registration
- 13:00 – 13:15 Welcome address (*H. Moser, BfG*)
- 13:15 – 13:30 Workshop introduction and objectives (*R. Busskamp; M. Nyenhuis*)
- 13:30 – 14:00 GEO background and the EUGENE project (*DLR*)
- 14:00 – 14:30 Status-quo Analysis Water (*M. Nyenhuis, University of Bonn*)
- 14:30 – 15:00 Discussion and update of draft Status-Quo Report Water
- 15:00 – 15:25 Coffee & Tea break
- 15:25 – 15:30 Charge to breakout groups
- 15:30 – 17:00 Breakout groups 1 - 3
- These discussions will focus on EO needs, capabilities and gaps of existing and planned systems and European EO activities.*
- 17:00 – 17:15 Summary of breakout group discussions by Moderators
- 17:15 Adjourn


### Wednesday, 12<sup>th</sup> May 2010

Moderator: R. Busskamp

- 09:00 – 09:05 Introduction

#### Key note speeches

- 09:05 – 09:30 **GEO Societal Benefit Area Water**  
*Douglas Cripe, Seconded National Expert Water, GEO Secretariat*
- 09:30 – 09:55 **GEO Water Cycle Community of Practice** (to be confirmed)
- 09:55 – 10:15 Discussion
- 10:15 – 10:35 **Surface water / water quantity**  
*Jutta Thielen, JRC, Coordinator European Flood Alert System (EFAS)*
- 10:35 – 10:55 **Groundwater / in-situ observations**  
*Wilhelm Struckmeier, President of IAH; EuroGeoSurveys representative*
- 10:55 – 11:20 Coffee & Tea break
- 11:20 – 11:50 **Satellite observations / GMES Land Monitoring, Soil Moisture, Water Bodies, Water Quality**  
*Jean-Christophe Calvet (Meteo France) & Thomas Schrage (Infoterra GmbH), EC FP7 geoland2 project*

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**11:50 – 12:10 In-situ observations / reporting obligations**

*Anita Künitzer, Head of European Topic Centre on Water (ETC/W)*

**12:10 – 12:30 Data sharing / data architecture and infrastructure**

*Athina Trakas, OGC, Director of European Services*

12:30 – 13:30 Lunch (BfG canteen)

13:30 – 13:35 Charge to breakout groups

13:35 – 15:00 Breakout groups 4 - 6

*These discussions will focus on coordination and governance of pan-European Earth observation initiatives, international/global cooperation, spatial data infrastructures and data sharing. If necessary, discussions from day 1 will be resumed.*

15:00 – 15:15 Summary of breakout group discussions by Moderators


15:15 – 15:30 Coffee & Tea break

15:30 – 16:15 Strategic considerations (*Moderator: U. Gärtner, DLR*):

- European visibility at the GEO Ministerial Summit 2010


- Towards coordinated European contributions to the Water SBA

16:15 Adjourn

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## Appendix-B Workshop participants

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## Appendix-C Main points of breakout group discussions

Seed questions and participation for each breakout group are documented in Chapter 4.1.


Subsequent comments and interpretations by the author of the Workshop report are given in squared brackets, where applicable.

### **Group 1: Earth observation user requirements and needs in Europe**


- The terms “needs” and “requirements” were defined/discussed:
  - User needs refer to the demand side and to which information is needed for a specific application by a certain user group;
  - Requirements are generally system/mission specific and imply technical, engineering specifications.
- It was highlighted that **requirements for in-situ** and **satellite-based observations** should be treated separately.
- A **European user position** regarding GEOSS could be elaborated by taking stock of existing user requirement studies; it should address both user needs and requirements.
- Related to the **fragmentation of the European water sector**, it was noted that the meteorological community is gathered completely under WMO and that this is not the case for the hydrological community. There are, however, clear links of the hydrological community to WMO, [e.g. through the Working Group on Climate and Hydrology of the Regional Association VI (Europe) of WMO].
- It was also voiced that European policies such as the Water Framework Directive foster fragmentation of the European water sector.
- Different ways to categorize users were discussed (political level; industry/research/public; value adding chain).
- European activities related to GEO should primarily be based on identified user requirements and should not be constrained by developments of GEO (shaping of GEO process through European user requirements).
- Regarding **data sharing** it was conceived that data sharing and publication of [hydrological] data is sometimes restricted, which leads to a discrepancy between the needs of data and the availability of data. Also, resources are needed to transfer/share data; a set of data policies as a basis for data sharing.
- **Reporting formats** for water quality data have been established, e.g. by EUROSTAT

### **Group 2: Capabilities and gaps of Earth observation systems in Europe (satellite observations)**

- In comparing **access possibilities** to European and non-European satellite data it was voiced that technical access to non-European products is often much easier (e.g. Landsat, MODIS) than to comparable European products.
- Different Earth observation activities were mentioned as good examples for **European capabilities**:

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- The SMOS (Soil Moisture and Ocean Salinity) mission (ESA), since it has taken the lead in L-Band;
  - The ASCAT (advanced scatterometer on METOP) surface soil moisture product is issued in near real time by EUMETSAT; meteorological centres are about to assimilate this quantity in numerical weather prediction models;
  - Data from ESA's GOCE (Gravity Field and Steady-State Ocean Circulation Explorer) mission has been used [in combination with hydrological models] to derive information on continental hydrology, but is limited since it only measures the static component of the gravity field;
  - An example for international collaboration with European participation (NASA, DLR, CNES) is the GRACE (Gravity Recovery and Climate Experiment) mission; however, since GRACE is a research mission, its continuity and potential follow-up missions seem not to be guaranteed;
  - Data about water quality in coastal areas has been successfully delivered by ENVISAT (MERIS), e.g. in the framework of different GMES and FP7 projects;
  - A database of river and lake levels based on altimetry data (from Jason mission) has been developed (Hydroweb) in France; a planned mission of NASA and CNES (SWOT - Surface Water Ocean Topography) is supposed to deliver high resolution altimetry.
- The group agreed that **meteorological satellites represent a major European strength** in terms of quality and coverage (both spatial and temporal).
  - The group discussed **capabilities and challenges of different remote sensing technologies** to deliver hydrological earth observation parameters, e.g.: river/lake stages, flood extent, land cover, soil moisture, precipitation, transmissivity of atmosphere:
    - A global precipitation mission is planned by US; a European element has been planned but has not been implemented yet.
  - It was mentioned that EUMETSAT develops different **hydrological products based on Meteosat** and that these may be developed for the **global scale** to benefit GEOSS; the question was raised, whether geoland-2 is trying to use these potential services; GEO was identified as a potential entity to coordinate this.
  - It was highlighted that CEOS has not yet developed a **virtual constellation (VC)** explicitly for hydrological applications; however, at the last planning meeting of the IGWCO, there were discussions about setting up a VC for the water cycle, including further components of the water cycle such as precipitation measurement.
  - Regarding potential contributions to GEOSS and the GEO VII Ministerial Summit (Beijing 2010), the global soil moisture network (coordinated by Vienna University of Technology) was mentioned.
  - It was noted that data on fluxes is very important and that GEO might help to make data from FLUXNET better accessible.


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### **Group 3: Capabilities and gaps of Earth observation systems in Europe (in-situ observations)**

- The following **water cycle variables** were in the focus of the participants of this breakout group: water quantity, quality, surface and groundwater; beyond variables, indicators of water management are of interest.
- The group identified as a **major strength** of European hydrological networks that monitoring is well established, even for long time series; a European groundwater monitoring network, however, is not yet in place.
- As **major weaknesses** of existing European networks, the group identified:
  - Access to data (not digitally available; hard to find, not accessible because of data policies).
  - Inhomogeneous data sets across borders.
- **Solutions**, which have been developed under **European leadership**:
  - Legislative frameworks (e.g. Int. Commissions, Water Framework Directive);
  - Scientific communities (e.g. UNESCO-EURO-FRIEND);
  - Technical methods (e.g. INSPIRE).
- **Major gaps**, which can only be **addressed by global cooperation**:
  - Applications on large scale issues (e.g. climate change);
  - Monitoring in extreme regions (e.g. in high altitudes);
  - Global methodological harmonisation (standardisation).
- Many observation networks are operated by NHS. What justifies global level coordination and how can GEOSS facilitate to solve the problems caused by different national approaches?
  - Data have to be comparable – this needs standardisation;
  - Agreed quality control (QC) protocols are necessary for quality assurance (QA);
  - In-situ data are necessary to complement [and validate] remote sensing data.

### **Group 4: Pan-European Earth observation initiatives – coordination, governance and cooperation in the light of GEO**


- The following **major Earth observation activities** for hydrologic applications have been identified by the group:
  - GMES Land Monitoring Service (geoland-2: soil moisture, water bodies, water quality);
  - H-SAF (EUMETSAT – soil moisture, precipitation, snow cover/status/water equivalent);
  - ESA projects: SMOS (ESA/CNES – soil moisture), ESA Climate Change Initiative (CCI), WACMOS (evapotranspiration, precipitation, soil moisture), TIGER-2 (water resource assessment in Africa);
  - GEWEX European hydrological experiments (e.g. Baltex)

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- Meteorological analyses: EURO4M (FP7 – pan-European atmospheric analyses, incl. precipitation), ERA-Interim (ECMWF – global atmospheric reanalysis, incl. precipitation);
- Data access: AMESD (EUMETSAT), DEVCOCAST (FP7 - dissemination to users in developing countries using EUMETSAT infrastructure), ADAGUC (KNMI « geoservices », AMSR-E soil moisture products), HYDROWEB (LEGOS, water level & gravimetry products);
- As a major challenge related to coordination of European Earth observation activities, the group identified lacking **coordination of GMES and GEO at European level** and recommended a simplification of governance of those two initiatives.
- The group identified the following potential **European global scale Earth observation components**:
  - **In-situ**: WHYMAP / IHME (World Hydrogeological Map / International European Hydrogeological Map);
  - **Space component**: SAR systems such as TerraSAR-X, Tandem-X, meteorological satellites, SMOS;
  - **Services**: GMES Land Monitoring Service (geoland-2), GMES Emergency Response Service (SAFER); EUMETSAT Satellite Application Facilities (H-SAF, L-SAF), ESA Climate Change Initiative;
  - The role of GEO could be to coordinate multi-mission data access, to make in-situ data from outside of Europe available and to establish transfer of expertise.
- **Main challenges in terms of coordination of in-situ observations and networks**:
  - An improved definition/coordination of the water quantity program (water balance) by EEA is needed;
  - Coordination is needed because of the fragmented landscape in hydrology; the same level of organisation as for meteorological parameters is desirable;
  - Very few pan-European programmes exist – new initiatives have to be encouraged (question of leadership and governance: National vs. EU responsibilities);
  - Data access/policy, data quality, harmonisation of practices/protocols.

#### **Group 5: International / global cooperation opportunities**

- It was voiced that GEO could support coordination processes by **transferring knowledge amongst different communities**; GEO's major strength being the networking component.
- One participant noted that **data flows to UN organisations** are voluntary and that regional (European) data centres could be endorsed by GEO to support their work and facilitate data exchange.
- The concern was raised by different participants that there is a **gap of in-situ groundwater observations** (data rescue from perishing media is a major issue); an infrastructure needs to be installed/maintained and existing data needs to be digitized; historic data is of special importance from groundwater since it has a "long-term-validity".
- More investments in groundwater monitoring are also needed.

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- It was further discussed, that there is a huge **lack in ocean in-situ observations** and that international efforts are needed to build up an in-situ network (reference to the ARGO network was made); one participant noted that there is a “run” on coastal zones and the exclusive economic zones but not on **open seas** and **Arctic/Antarctic zones**; however, these regions are likely to experience increased human activities in the future – thus, coverage of Earth observations needs to be improved in these regions.
- It was voiced that GEO might help to conduct user consultations in relation to the GLOB-CORINE initiative.
- Interest was expressed by different participants to cooperate with the GEO Water Cycle Community of Practice (WCCoP); it was also noted that WMO operates communities on specific topics (best-practices groups) [informal cooperation of EUGENE with WMO’s Working Group on Hydrology for RA VI (Europe) was established upon the workshop].

#### **Group 6: Spatial data infrastructures (SDIs), data sharing and reporting obligations**

- The group discussed several challenges to coordinate data flows from Europe to global level and vice versa.
- **INSPIRE** was seen as the common European perspective.
- Europe is not able to support many different technical standards.
- **INSPIRE standards** should be registered under GEOSS; it was noted that the INSPIRE standards are much more detailed [than current GEOSS standards] since they define domain data models.
- It was recommended that the GEOSS Common Infrastructure (GCI) should support web catalogue services and that GEOSS should consider domain related geoportals
- Regarding data access it was highlighted that the principle of GEOSS to provide data **free of charge** is not necessarily compatible to the INSPIRE principle, that EU Member States and organisations decide whether data are free of charge or not.