User Oriented Operational Services, based on Joint Data & Services Quality, Preliminary Situation Modeling and Reference database

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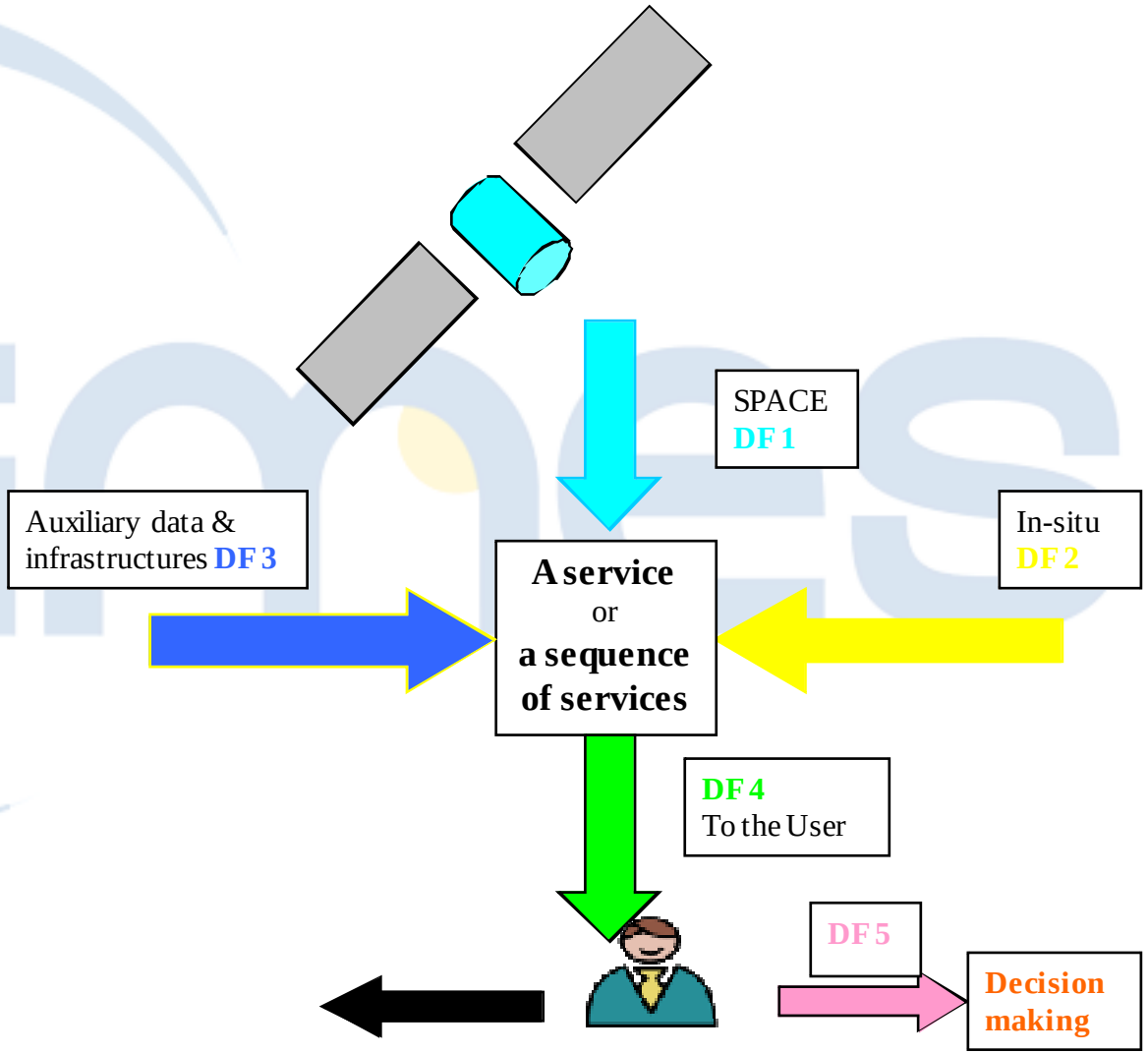
I. GMES Operational Services

In general, GMES consists in a complex set of systems which collects data from multiple sources – Data Flows (DF) - earth observation satellites and in situ sensors, other sources), processes these data and provides users with reliable and up-to-date information through services. Some of these systems and data sources already exist today, as well as prototype services but many developments are still required in all domains. The so called GMES Service Component consists of core and downstream services making a special portfolio of **operational services** based on Earth observation systems.
GMES provides decision-makers with precise data they need to coordinate policies and formulate strategies relating to the environment and security.



I. GMES Operational Services

Practically, GMES information will be provided to users through a set of services in six thematic areas: land, marine, atmosphere, emergency, security and climate change. A land monitoring service, a marine monitoring service and an atmosphere monitoring service contribute directly to the monitoring of climate change and to the assessment of mitigation and adaptation policies. Two additional GMES services address respectively emergency response (e.g. floods, fires, technological accidents, humanitarian aid) and security-related aspects (e.g. maritime surveillance, border control).

1) The GMES land monitoring service provides accurate and cross-border harmonized geo-information at global to local scales.

It covers a wide range of thematic areas, like land use / land cover change, soil sealing, water quality and availability, spatial planning, forest monitoring and global food security. They are divided in mapping services and Information services.

The initial operations (2011-2013) should focus on the priorities defined from the consultation of land user communities (land cover at various scales, dynamic land monitoring including provision of sets of Essential climate Variables, improved access to reference data). The scope might be enlarged later to thematic components (e.g. water management, biodiversity, agriculture, forestry etc.), depending on the user demand.

GEOLAND2 FP7 project is developing the Land Core Service.

2) The GMES marine environment monitoring service provides regular and systematic reference information on the state of the oceans and regional seas. It addresses four main domains:

- Marine safety (e.g. marine operations, oil spills, ship routing, defense, search & rescue, etc);
- Marine resources (e.g. fish stock management, etc);
- Marine and coastal environment (e.g. water quality, pollution, coastal activities, etc);
- Climate and seasonal forecasting.

MyOcean FP7 project is developing the Marine Core Service.

I. GMES Operational Services

3) The GMES atmosphere monitoring service provides data records on atmospheric composition for recent years, current data for monitoring present conditions and forecasting the distribution of key constituents for a few days ahead. The service addresses the following:

- Greenhouse gases;
- Reactive gases, which influence the air we breathe;
- Ozone layer and solar UV radiation;
- Aerosols, which affect temperature, air quality and the transmission of solar radiation.

MACC FP7 project is developing the Atmosphere Core Service.

4) The GMES emergency management service addresses, with a worldwide coverage, a wide range of emergency situations resulting from natural or man-made disasters. It covers in particular:

- Floods;
- Forest fires;
- Landslides;
- Earthquakes and volcanic eruptions;
- Humanitarian crises.

SAFER FP7 project is developing the Marine Core Service.

5) The GMES services for Security applications aim at supporting the related European Union policies in the following priority areas:

- Border surveillance
- Maritime surveillance
- Support to EU External Action.

II. Data & Services Quality

Some remarks and definitions

For the needs of the present presentation we will not differ between data and information – will use only term **data**!

We are going to use the following abbreviations

- QoD = **DQ** (Data quality) guarantee a certain level of accuracy in a data flow (**DF**), despite DQ depends of many attributes (or dimensions) of data: accuracy, precision, correctness, currency, consistency, integrity, completeness and relevance; DQ is recognized as an important property of all types of data.
- **DQA** (Data quality assurance) is the process of verifying the reliability and effectiveness of data.
- **QA** – quality assurance – a framework of rules for assessment of necessary compliance for each quality requirement.
- QoS = **SQ** (Service quality) guarantee a certain level of performance to a data flow; it is very important when the flows are in/between networks (which is the usual case). SQ importance is the key attribute for all systems.
- **DM** – Data mining – authomatacally selected data and information from different electronic *media* sources, which is used for assessment of quantity and quality of natural and anthropogenic catastrophes and for preliminary risk&security planning;

In the life cycle of data, data may be at various times collected, transferred to intermediate cache, quality controlled, verified, backed-up, stored for use and re-use, then perhaps replaced with new data, retired, overwritten or transferred to archive.

II. Data & Services Quality

DQ is a very complicated matter – just an example: quality measures could be related to the geometric, temporal and semantic accuracy, the completeness (presence and absence of features, their attributes and relationships) or the logical consistency of the data; also thematic accuracy (accuracy of quantitative attributes and the correctness of non-quantitative attributes and of the classifications of features and their relationships) or temporal accuracy (in particular temporal validity or validity of data with respect to time)

There are many indicators for DQ. An example is the spatial resolution - it is an indicator of the level of detail of the data related to a spatial resource. It can be expressed as an equivalent scale (typically, for maps or map-derived products), or a resolution distance for gridded data and imagery-derived products. Spatial resolution provides a rough indication of the accuracy and potential quality of a spatial resource.

When we say DQ&SQ, the key words are: assessment/validation using certain methods/procedures, standards, protocols, metadata, where to validate, testing area, etc.

And the last but not the least is the question of **Cost effectiveness (CE)** - analysis of the added value of products derived from core services, in light of preliminary user requirements elaborated closely with the user, including specification of quality requirements and tolerance levels (reasonable, explicit and well-defined precision, reliability, availability and integrity requirements for the products/service). The quality (DQ&SQ) and the cost are inversely proportional. But well-done analysis could significantly reduce the cost, and vice versa. One approach to increase CE is to divide the quality criteria in groups of importance/compulsory.

II. Data & Services Quality

DQ is a component that defines the quality level of each spatial dataset using the criteria defined in the ISO 19100 series of standards, including completeness, consistency, currency and accuracy.

DQ is often defined as "validity for purpose" in an environmental context. That includes a broader view than the definition of data quality for spatial data as currently defined in the ISO 19100 series. The validity for a specific purpose is depending on the specific use case/application.

Some Normative references

- **ISO 19113***:2002, Geographic information – Quality principles* The quality principles documented in ISO 19113 have driven the establishment of ISO 19115 conceptual schema, particularly but not only its quality section. These quality principles have to be followed when quality information is included in the metadata.
- **ISO 19114***:2003, Geographic information – Quality evaluation procedures* ISO 19114 standard specifies a methodology for evaluating the quality of geographic information and expresses requirements in term of reporting of the evaluation results. It is acknowledged for the goodness of geographic information users that the quality evaluation proceeded by the managers of the spatial information is generally not provided in details within the metadata. As a result, several quality measures can be aggregated into a single quality measure which is reported in the metadata while the other quality measures have to be expressed in a quality report.
- **Conceptual metadata standards for spatial resources**
- **ISO 19115** specifies a conceptual schema for geospatial information metadata
- **ISO 19119** defines a full conceptual schema for spatial service metadata.
- ISO 8000 (under development?) is the international standard for data quality.

II. Data & Services Quality

From technological point of view on first place is to avoid data quality problems and/or to fix the existing problems and/or to improve data. On second place is to decide where, respectively whose is the responsibility, to do these, – just next to the source of data, in the frame of the service, or some mix approach. The decision should be taken before or during a service development!

To find place of a problem sometimes is a complicated challenge – e.g. gaps and overlaps between parcels (quality problem in the database, not in reality)

Data validation is the process of ensuring that a service operates on clean, correct and useful data. There are tools for validation that check for correctness, meaningfulness, and security of data that are input to the service. Data validation checks that data are valid, sensible, reasonable, and secure before they are processed.

Another very important issue is **data harmonisation** - in order to ensure harmonization of spatial data among the states from the region and for constant monitoring of sustainable development, risk and security at national, regional and EU level, a reference information system (using **reference databases**) from Earth and in-situ observations should be developed.

There is another aspect of harmonization - during the development of the OS many parallel Initiatives, Directives, Programs and Policies were enforced, some very important (INSPIRE, Flood, etc). Last years many efforts were done to synchronise/harmonize them. It is time to put them together, at least virtually.

II. Data & Services Quality

When we are talking about spatial data we should have in mind **INSPIRE! Why?**:

In short terms – INSPIRE directive defines the standards for future European SDI.

- SDI is a base collection of technologies, data, human resources, policies, institutional arrangements, and partnerships that enable the availability, exchange of and access to geo-related information using common practices, protocols, and specifications.

In longer terms – it is Infrastructure for integrated spatial information services that should allow the users to identify and access spatial or geographical information, visualize information layers;

In long terms - SDI consists of a framework that enables users with different mandates and disciplines to operate in a cooperative and cohesive manner to acquire access, retrieve, analyze and disseminate geospatial data and information in an easy and secure way – it is a distributed infrastructure.

The INSPIRE Directive gives a base for:

- - quality and validity of spatial data sets
- - easy creation of the SDI; it provides a package of methodologies, incl. such for quality and validity
- - use of standards - ISO191xx and other standards,
- - provides an interoperability framework for other initiatives,
- - provides a set of standard services,
- - avoids duplication,
  - - plays a key role in data harmonisation.

First of all, **DQ** means standards.

For spatial data, the **standards** are under the scope of **INSPIRE**.

II. Data & Services Quality

All the operational GMES services have some link to **SPATIAL DATA THEMES** in Annexes I, II and III of the Directive INSPIRE.

Quality and validity of spatial resources are also matter of INSPIRE:

- Art. 5 is dedicated to Metadata and requires the following:
- *2. Metadata shall include information on the following:*
- *(c) the quality and validity of spatial data sets;*
- *3. Member States shall take the necessary measures to ensure that metadata are complete and of a quality sufficient to fulfill the purpose set out in point (6) of Article 3.*

Additional requirements for Metadata come in Art. 11-1 (a) and 11-2 in which Member States are required to establish and operate discovery services making it possible to search for spatial data sets and services on the basis of the corresponding metadata, and to display the content of such metadata, based at a minimum on the following criteria:

- *(c) the quality and validity of spatial data sets;*

The term quality is used from a user perspective and is described as a first estimate of whether or not a resource is relevant or usable for a specific problem.

Who are We?

Bulgarian Information Office for EO-GMES (BIOG)

BIOG-GMES-Bulgaria project aims to support the participation of Bulgaria, other member-states and candidate countries in the European EO Program - Global Monitoring for Environment and Security.

The establishment of **a single national point** called Bulgarian Information Office for GMES (BIOG) aims to concentrate information, advisory and support activities related to GMES in one institution, what should result in an increased efficiency and synergy.

BIOG focuses on the following priorities:

- Support for participation of Bulgarian institutions, organizations in GMES thematic projects and introduction of institutions from other candidate countries into these projects
- Support in developing national and regional operational capacity in GMES services
- Enhancing the active participation of the Community's small and medium enterprises
- Support to the realization of a special capacity building unit as part of the GMES program (including the space segment) in the (new) member states
- Clear distinction and different approach between environmental monitoring, and risk and security management
- Support Regional unit for integrated risk and security management for South East Europe

Specific attention will be given to:

- Reference models and reference datasets; ISO-based Quality assurance of Geodata management and GIS implementations; Data mining (news watch, information extraction from Web through data mining and ontology)

BIOG members :

Alliance for Environment; Remote Sensing Application Centre; Union of Surveyors and Land Managers in Bulgaria, United experts association, "Bulgarian Land" Association; Experts Pool Association ; Agency for Sustainable development and Eurointegration-Ecoregions, Agricultural Academy.

Who are We?

Some info on main partners in scope of the workshop:

The **Agency for Sustainable Development and Eurointegration** (**ASDE**) is a non-profit organization for public benefit. In 2004, ASDE was the initiator of a proposal for National Unified Databases, approved by Resolution of the Council of Ministers N 761 in 2004. ASDE supported the integrated cadastre and property register, established in 2007, as well as assisted the transposition of the Directive 02/07/EU-INSPIRE and the preparation of a National Act on spatial data access in 2008-2009. ASDE also was among the initiators of the GMES operational capacity workshops and the concept for decentralisation and user-oriented management in EO-GMES through a regional network for integrated risk and security management in 2009-2010.

The **Remote Sensing Application Centre** (**ReSAC**) is acting as the best positioned Bulgarian research organization in the 7th Framework program GMES targeted projects. Jointly with other research organisations and institutes (mainly the National Institute for Hydrology and Meteorology – BAS) it becomes a focal point for providing core and downstream service capabilities.

The **Cluster on Aerospace research and technologies** (**CASTRA**) was created, uniting the potential of different research institutes from the Bulgarian Academy of Sciences, ASDE, ReSAC, Sofia University, SMEs developing high technologies in the field of space and in-situ infrastructures.

The **Institute for Informatics and Mathematics** (**IMI-BAS)** – BAS includes satellite-derived and ground-based information and decision support tools to operational and development users - government, local administration, public sector and business, in a wide variety of programme areas such as e-government services and spatial database, security early warning, risk assessment,

The **Agricultural Academy** - research/development in support to the implementation of the EU Common Agriculture Policy, crop forecasting, natural resources management and disaster preparedness, impact assessment and response, including the international environmental conventions and especially the EU directives, programmes and initiatives.

And many other partners: SME's, Economics Strategies Centre, Agencies, Bulgarian Institute for Standardization, etc.

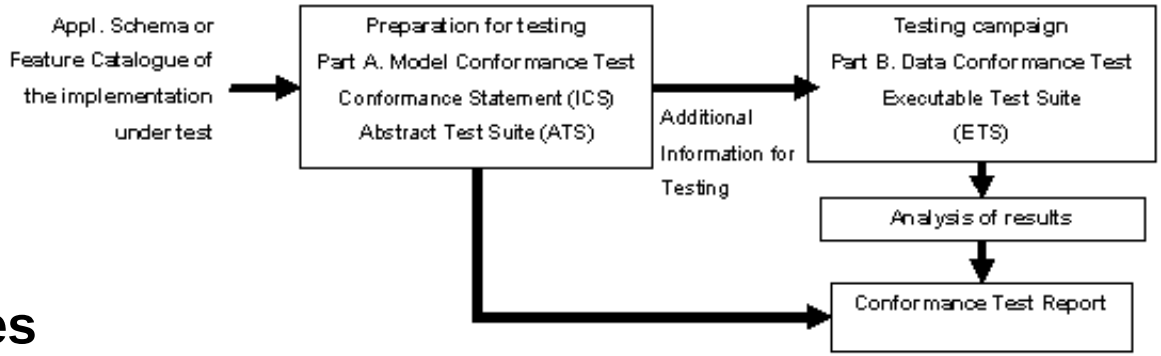
Some example of activities:
Capacity Building in Quality Assurance of Geodata Management and GIS implementations

Model conformity

- logical consistency
- completeness

Correctness of data values

- thematic accuracy
- temporal accuracy and temporal validity
- completeness



Source: http://marswiki.jrc.ec.europa.eu/wikicap/index.php/GAMMA_2.a

Based on the principles laid down in ISO 19114, 19113 and ISO/TS 19138 (as well as the draft ISO 19144-2)

Inspired by the innovative approach developed by the MARS Unit of the IES, EC-JRC for the quality assessment of the Land Parcels Identification Systems in the EU Member States (as required by Art. 6.2 of CommReg 1122/2009).

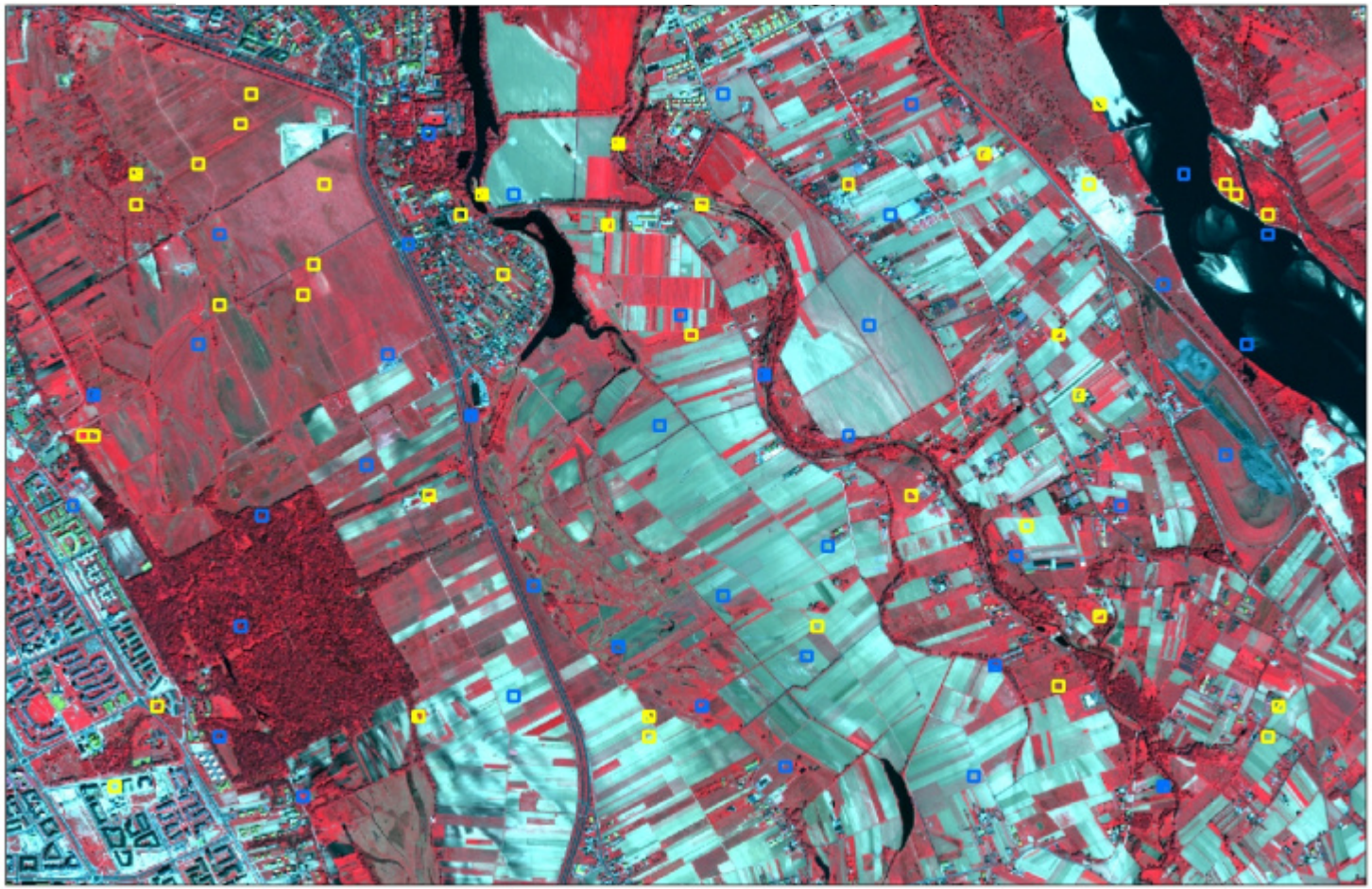
New task – DQA under URBAN-NEXUS FP7 networking project

Capacity Building in Quality Assurance – Validation of Change Detection under CMS SATChMo

GIS methodology for description of data, validation, inspection procedures and reporting,

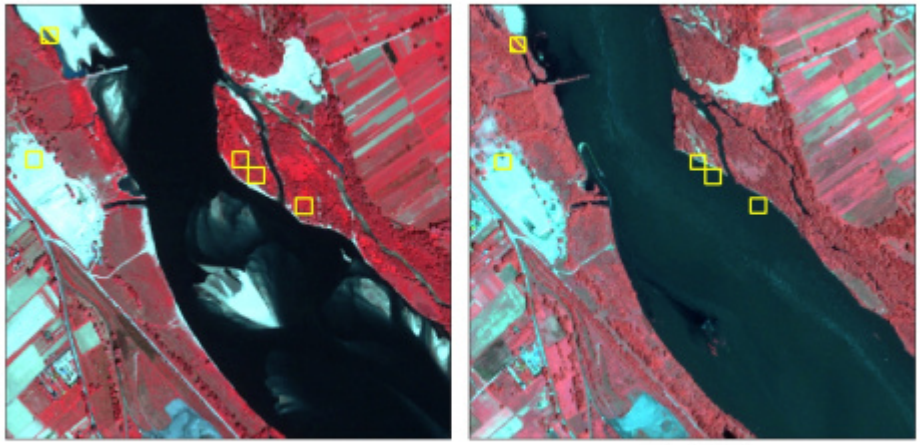
- **Industry practices and standards (ISO) for acceptance sampling and decisions**
- **EO and in-situ data, and know-how on photointerpretation as a source for the validation, based on external reference information.**

Validation Units



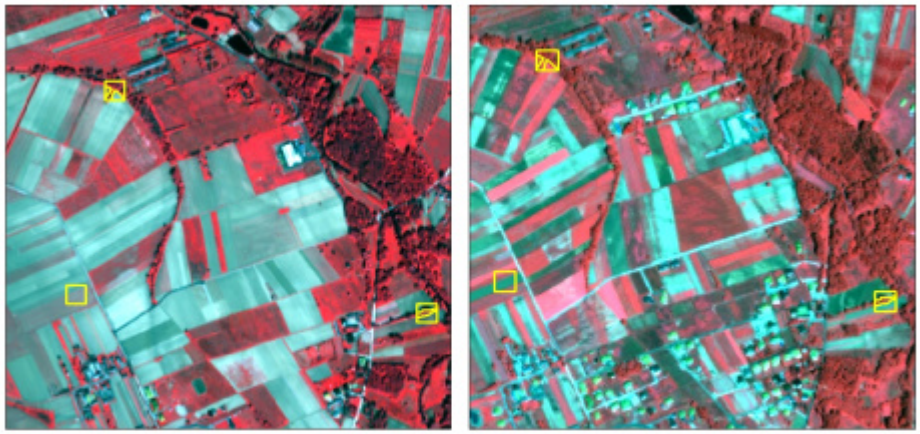
Validation of Change Detection Maps of the test areas in Europe Project Geoland-2 sub-project Seasonal & Annual Change Monitoring (SATChMo)

Changes



Year 2002 *Year 2008*

No Changes



Year 2002 *Year 2008*

Data Mining

The proposed **“Riskwatch"** version is a first level of a cheap system for collecting information about risks with relatively low accuracy of the obtained data, but with a broader range of action and almost negligible invested value for the datum.The system supports several modules:
(1) Identification of risks
(2) Web GIS access to the information – It is represented by the following two steps: first collection Rss data from various Rss-generators, then processed by Rss - disasters analyzer recording in a new table from the working database. Current records are submitted to a web-GIS environment, sorted by the following features:
• Priority of the event in order of importance;
• Priority of the event space position (location);
• Priority of the event date.
(3) Update the data in the system - The system updates data in about 15-30 minutes period, by reading RSS editions of the major Bulgarian news portals and sites. This systems is expected to be integrated with the thematic information systems of JRC – EFAS, EFFIS, EMM - Europe Media Monitor

Under discussion is a new possibility for efficient use of private and local communication systems (including GSM) in the field of Earth Observation, combined with geo-referred images and text/voice information for emergencies, rescue and monitoring/surveillance (**ICT Solutions for Governance and Policy Modelling)**

“Riskwatch” can be accessed on the web from :

smes.asde-bg.org

THANK YOU FOR YOUR ATTENTION!

www.gmes-bg.org

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