

Making authoritative and non-authoritative data interoperable in near-real time through data policy and technology.

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Spatial data infrastructures, Earth observations, and citizen sensing

GEOSS or the Global Earth Observation System of System is the implementation of a global interoperable Spatial Data Infrastructure (SDI) that meets a multitude of societal needs. Data on a wide range of temporal and spatial resolutions are made available through a data portal. These SDI's and/or Earth observation systems, provide mostly authoritative data originating from governmental bodies such as NASA, the European Space Agency (ESA), the National Oceanic and Atmospheric Administration (NOAA) etc.. Social computing provides non-authoritative information and thus represents a challenge both with respect to technical interoperability as well as institutional and legal aspects.

GEOSS can be set up to take up new kind of Earth observations and expand its utility. Social media can both function as new kind of sensors (human) as well as validate, calibrate other Earth observations (upper/lower limits, provide constraints on models etc). See fig. 1.

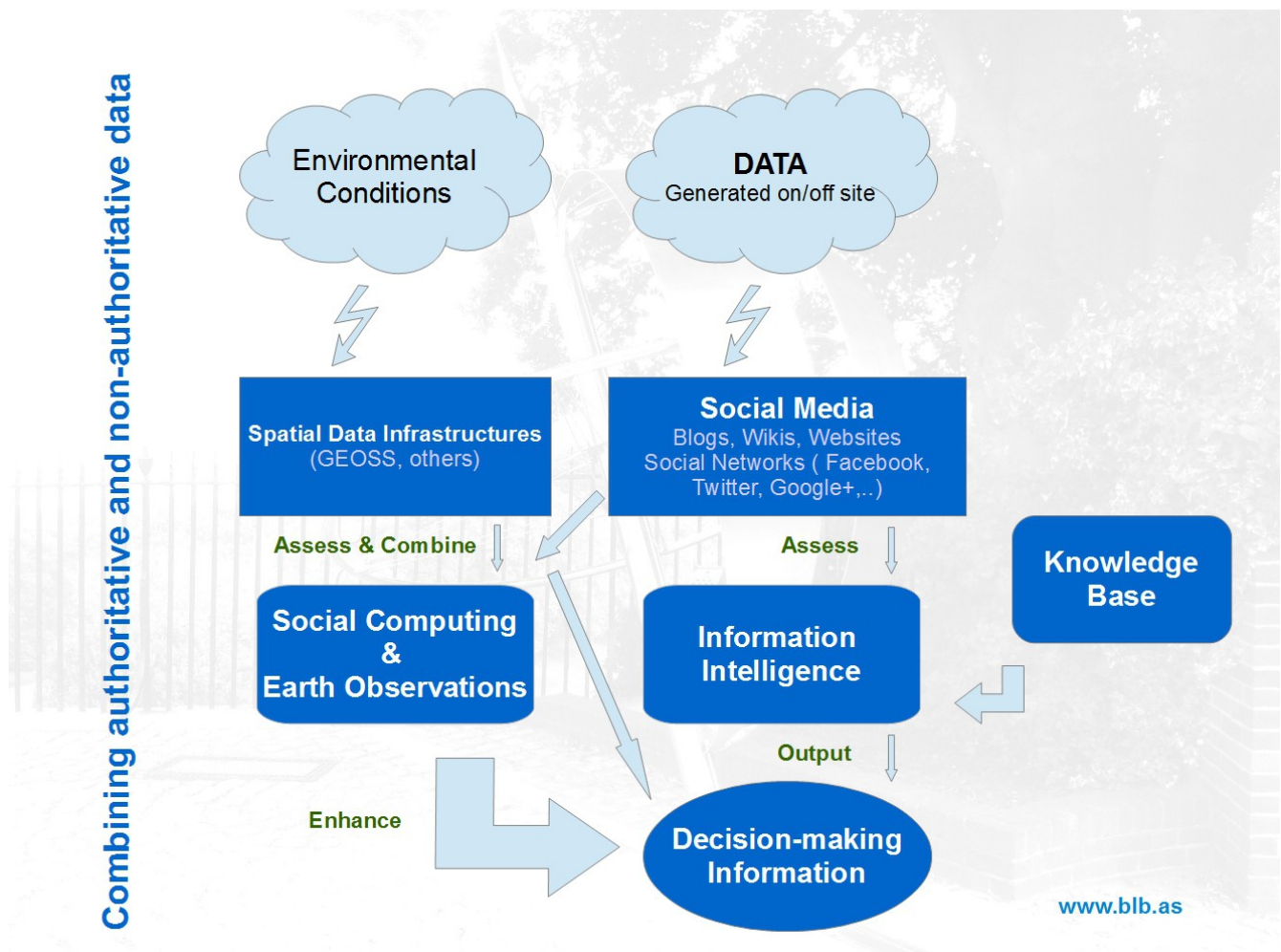


Fig 1. Combination of authoritative and non-authoritative data requires a set of technical procedures in order to both validate and enhance information for decision-makers. Graphics by Bente Lilja Bye/ BLB

With mobile technology one can also collect information from various apps. No matter what kind of social media information, weather random or dedicated to specific purposes, social computing (a set of technical procedures such as filtering and analysis of that data for validation, quality assessment, reliability check, etc.) is necessary. In cases of crisis, these procedures need to take place in near-real time.

Interoperability

There are several approaches to creating interoperable systems, including: standards, a reference frame, and system brokering. It is necessary to be able to share these data seamlessly and therefore open data policies must also be considered an important element in interoperability. Open data policies are particularly challenging when it comes to sharing real-time and near-real time data and information.

Standards

Developing international standards requires long processes. Characteristics of data and systems that are suitable for standardization include that they belong to mature and controlled environments.

The EU's INSPIRE Directive provides a framework for developing and managing governmental standards. To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas (Metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting). EU INSPIRE through its Coordination Team has contributed to the development and integration of standards in GEO through participation in its various fora, from GEO Plenary to working groups. The EC FP7 program has funded several projects contributing to the GEO work plan. Through this contribution Europe has aligned these regional standards with global standards enabling seamless exploitation of global Earth observations.

A global reference frame

There is a need for a stable geodetic reference frame for ground-truth observations at reference sites and/or observatories or calibration and verification of satellite products. In addition, a reference frame forms the bases for a high resolution common spatial system for all Earth observations. This is required for re-use of Earth observations as well as for the combination of multi-disciplinary data sets. A geodetic reference frame is pivotal for The European Plate Observing System (EPOS), a Research Infrastructure and E-science for Data and Observatories on Earthquakes, Volcanoes, Surface Dynamics and Tectonics, just to mention a few examples.

System brokering

GEOSS combines several types of data sets and information provided by many nations around the world. The systems are both in-situ and space-based and cover a plethora of disciplines. A number of these systems are fast evolving and as they are heterogeneous, they are not always suitable for international standardization. The brokering system developed mainly by European researchers with funding from EC FP7 (in projects such as EuroGEOSS, GEOWOW, GEOViQua) makes this challenge manageable. With the implementation of GEOSS Common Infrastructure, GEO sees a boom in accessibility to datasets from around the world.

Data policy

One of the first accomplishments of the Group on Earth Observations was the acceptance of a set of high level Data Sharing Principles as a foundation for GEOSS. Ensuring that these principles are implemented in an effective yet flexible manner remains a major challenge. The 10-Year Implementation Plan says "The societal benefits of Earth observations cannot be achieved without data sharing" and sets out the GEOSS Data Sharing Principles:

- There will be full and open exchange of data, metadata and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation;
- All shared data, metadata and products will be made available with minimum time delay and at minimum cost;
- All shared data, metadata and products being free of charge or no more than cost of reproduction will be encouraged for research and education.

Another relevant and illustrating data sharing policy is found in the INSPIRE directive.

The INSPIRE directive came into force on 15 May 2007 and will be implemented in various stages, with full implementation required by 2019. The INSPIRE directive aims to create a European Union (EU) spatial data infrastructure. This will enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe. A European Spatial Data Infrastructure will assist in policy-making across boundaries. Therefore the spatial information considered under the directive is extensive and includes a great variety of topical and technical themes.

INSPIRE is based on a number of common principles:

- Data should be collected only once and kept where it can be maintained most effectively.
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications.
- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes.
- Geographic information needed for good governance at all levels should be readily and transparently available.
- Easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

Data policy (access, permits)

Standards (metadata, catalogues, semantics)

Reference frame (GI, positioning)

Brokering (access, search, other)

Fig 2. Elements required for interoperable data and information systems.

Discussion

Can GI and new technological standards facilitate faster interoperability allowing also non-authoritative data and information being used in near-real time with known quality and thus provide decision-makers with more powerful information tools?

What kind of implications will this represent for data policy documents?