

EuroGEOSS and GENESIS FP7 projects

Comprehensive Drought Index Use Scenario in the GEOSS Architecture Implementation Pilot – Phase 3 (AIP-3)

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EuroGEOSS and GENESIS FP7 projects response to the GEOSS AIP-3 CFP

1 Overview

The European Drought Observatory (EDO -JRC) provides a series of drought products from various sources (e.g. model simulations, meteorological data post-processing, remote-sensing products) to detect and monitor drought events at the European scale. A novel first-guess ‘comprehensive’ drought index will be calculated within EDO to provide a NRT drought hazard raster dataset. An alert mechanism can be set up on top of this monitoring data to provide decision makers with alerts on the zones that are currently under drought hazard.

We propose to provide decision makers with a web viewer where they can visually analyse risks related to drought by overlaying such “drought hazard zones” with various type of data (e.g. population, infrastructures, natural resources), but also with drought information from national and regional sources he can find through a multi-lingual catalogue broker

This proposal is based on the previous interoperability experiences of GEOSS IP3 (Nativi et al., 2007; Khalsa et al., 2009) and AIP-2 (GEOSS AIP-2, 2009a, 2009b) for climate change and biodiversity. It aims to develop a use scenario for the Drought SBA and to further enhance the IT framework developed in those contexts.

Part of this use scenario is taken from the FP7 EuroGEOSS (<http://www.eurogeoss.eu>) project and from the FP7 GENESIS (<http://genesis-fp7.eu/>) project.

2 Proposed Contributions

2.1 Societal Benefit Area Alignment and Support

Drought is one of the major weather related disasters. Persisting over months or years, it can affect large areas and may have serious environmental, social and economic impacts. These impacts depend on the duration, severity and spatial extent of the precipitation deficit, but also and to a large extent on the environmental and socio-economic vulnerability of affected regions. Recent European droughts have emphasized that the impact on European economies can be significant. While Europe as a whole has abundant freshwater resources, there exists a strong regional imbalance across the continent. Water shortage, therefore, is an important problem in many European regions, specifically in the semi-arid and continental climatic zones (Vogt and Somma, 2000).

Thus, predicting (and possibly preventing) the impact of drought events involves a number of cross-domain information in addition to strictly drought data. The contribution we propose is the development, complying with the GEOSS architecture principles, of a use scenario for assessing a novel ‘comprehensive’ drought index.

This is achieved by developing interoperability solutions among: an existing framework for drought index calculation, a drought hazard alert system, a discovery and access brokering framework, and a visualization tool for the cross-domain analysis of the risk.

The starting point for this scenario will be represented by European Drought Observatory (EDO) System (<http://edo.jrc.ec.europa.eu>) of the Joint Research Centre (JRC) (Vogt et al., 2000).

The purpose of EDO is to provide a series of drought products from various sources (e.g. model simulations, meteorological data post-processing, remote-sensing products) to detect and monitor drought events at the European scale. A novel first-guess ‘comprehensive’ drought index will be calculated within EDO to provide a NRT (Near Real Time) drought hazard raster dataset.

By setting up a mechanism for monitoring the generated indexes, it will be possible to raise up an alert when a zone is detected to be under a drought hazard. In order to analyze the risks connected to the hazard, decision makers need to take into account several other information concerning both drought data from other national/regional sources and data from other domains –such as agriculture, biodiversity, etc. This challenging task is achieved by developing interoperability with the brokering framework successfully experimented in the context of GEOSS IP3 (Nativi et al., 2007; Khalsa et al., 2009) and AIP-2 (GEOSS AIP-2, 2009a, 2009b) for climate change and biodiversity.

The brokering framework will be enhanced to interoperate with a tool to visually analyse risks related to drought by overlaying the calculated “drought hazard zones” with various data types (e.g. population, infrastructures, natural resources), as well as drought information from national and regional sources.

Figure 1 depicts the future possible Internet portal developed for EDO (Niemeyer, 2008).

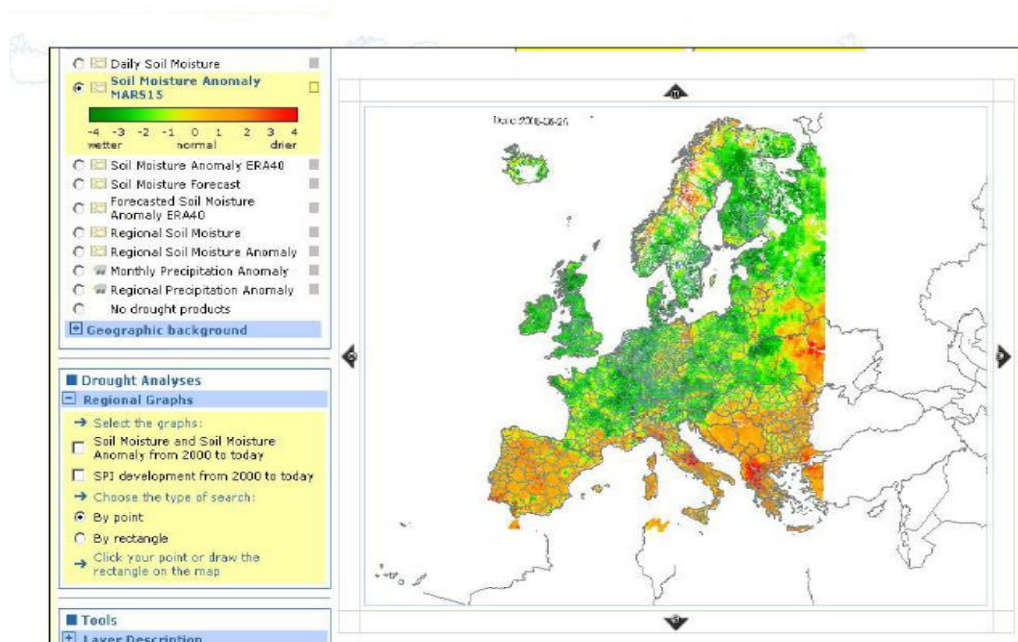


Figure 1 - The future EDO Internet portal (Niemeyer, 2008).

2.1.1 Use Scenario

The main steps composing the scenario are the following:

1. The EDO system provides drought indexes through standard services.
2. An alert mechanism, based on standard interfaces (e.g. SWE), recognizes the geographic zone under potential drought hazard.
3. When a potential hazard is detected, an alert is sent to the decision support tool;
4. The decision support tool starts the potential hazard assessment phase:
 1. expert is required to discover drought hazard related information –through the advanced broker component.
 2. The broker provides the selected information access.
5. The decision support tool combine the selected information with the potential hazard layer.
6. The expert assesses the hazard impact.

Figure 2 depicts the scenario steps through a business process sequence diagram.

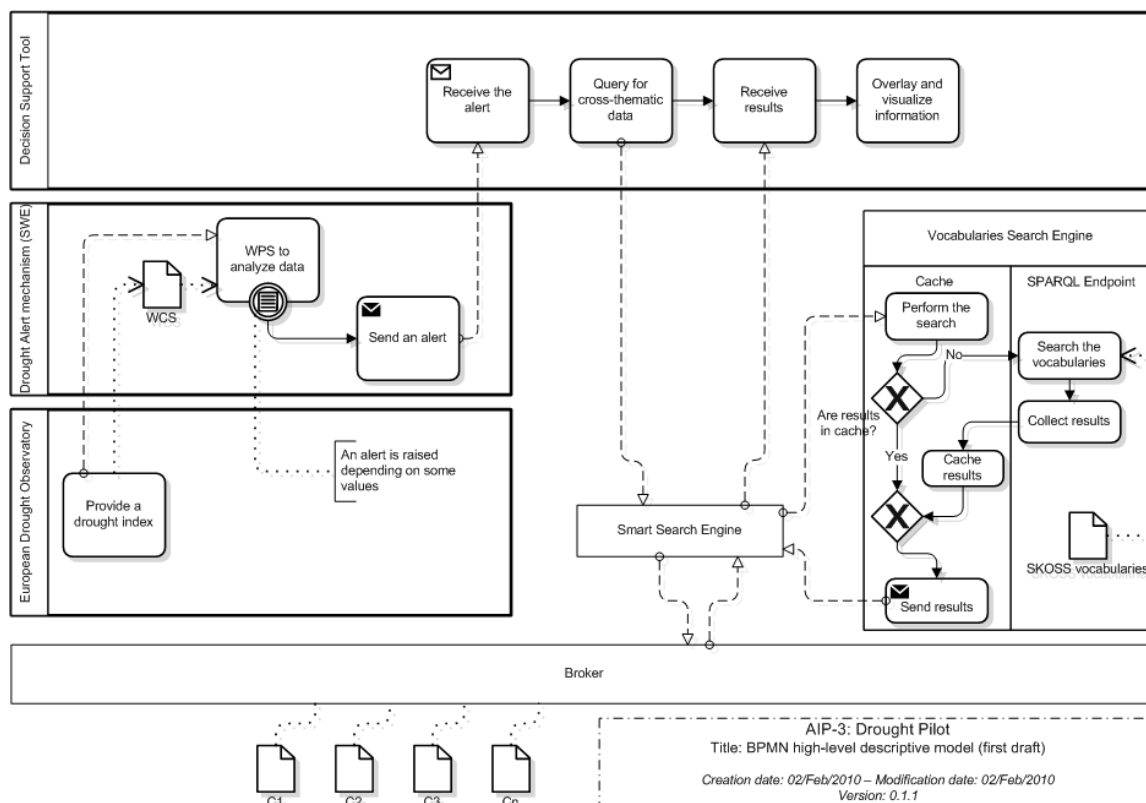


Figure 1 – Simplified Business Process of Use Scenario Steps

2.1.2 Users

Users for this scenario are:

Governmental Organizations

A recent study performed commonly by the European Commission and Member States estimates the costs of droughts in Europe over the last thirty years to at least 100 billion Euro (EC, 2007). The work described in this proposal aims to provide decision-makers with a valuable and flexible tool for predicting the impact of drought events and thus their cost for society.

Countries

National and regional drought information systems are currently being developed or already in use (e.g. Sistema Integrado de Información del Agua: SIA, SAIH Ebro, etc.).

Civil Society

There is an increasing request of scientific information on drought by the wider public. Giving access to robust and consistent information on the drought value of and the potential risk areas can augment the interest of the civil society to the drought issues.

2.2 Component and Service Contributions

The EuroGEOSS/GENESIS FP7 projects will host, register and operate a broker component –developed by EuroGEOSS and based on the IP3/AIP-2 Brokering&Mediation component (GEOSS AIP-2, 2009a, 2009b); this framework will be advanced with the semantics and workflow services implemented by the GENESIS project. This component enables the federation of resources (datasets, services, etc.) from several domains, exposing them through common and standard interfaces, such as:

- OGC CSW Core;
- OGC CSW ISO Application Profile;
- OGC CSW ebRIM/EO Extension Package;
- OGC CSW ebRIM/CIM;
- OGC CSW OpenSearch Extension.

Moreover, the broker framework implements mediation services (i.e. implements specific interoperability arrangements) important for multi-disciplinary interoperability allowing the implementation and deployment of community standards (i.e. interoperability arrangements), e.g. for Biodiversity, Climate Change and Forestry Communities. They

include protocols and data models like: GBIF RESTful interoperability services, THREDDS/OPeNDAP/netCDF interoperability services, OpenSearch/Web 2.0 services.

The broker will implement the access to “drought-related” catalogues, at national and regional level, based on the current EuroGEOSS FP7 project initial operating capacity (IOC).

The EuroGEOSS broker may interoperate with other registered components and services to assist in the realization of the CFP SBA scenarios.

It may contribute to the implementation and testing of GEOSS functionalities, such as:

- 1) Access functionalities: once a resource is discovered it must be accessed;
 - a. Broker solutions to manage heterogeneity.
 - b. Mediation and adaptation solutions.
- 2) Workflow functionalities: resource chaining.
 - a. Light and flexible environments.
 - b. Mediation and adaptation solutions.
- 3) Models composability.
- 4) Semantics based services (e.g. advanced discovery and queries).

The EDO system will be integrated with standard services (e.g. WCS and/or SOS) in order to achieve interoperability with the other components described in the scenario. These services will be registered in the GEOSS CSR. A WPS for calculating drought hazard using EDO indexes might be registered as well.

The EuroGEOSS/GENESIS FP7 projects will develop and register a decision support tool interfacing with EDO system and with the brokering framework in order to perform the impact assessment of recognized potential drought hazards.

A smart search engine component will be developed to support the discovery of cross-domain resources related to the drought hazards assessment. This component will interoperate with the broker, making use of a SKOS repository.

2.3 Architecture and Interoperability Arrangement Development

The main objective of this scenario is to illustrate the interoperability benefit of coupling the EDO (i.e. a drought specific system) with a discovery and access brokering framework advanced with ontology capabilities for selecting useful resources to assess potential drought hazards. In fact the heterogeneity of involved resources, requires the use of a brokering and mediation framework to harmonize the discovery and access functionalities.

The scenario will be implemented leveraging and enhancing the IT interoperability framework developed in the context of GEOSS IP3 (Nativi et al., 2007; Khalsa et al., 2009) and AIP-2 (GEOSS AIP-2, 2009a, 2009b) for multi-disciplinary resources management.

The brokering framework will be enhanced to interoperate with a SKOSS repository and support multilingual and ontology-enabled discovery functionalities.

The EuroGEOSS/GENESIS FP7 projects aim to contribute to the definition/refinement of existing standards. Interoperability solutions for providing comprehensive drought index through standard services will be investigated, as well as their integration with a WPS for potential drought hazards recognition. This will be achieved according to the model web paradigm (Geller & Turner, 2007). In fact, The EuroGEOSS/GENESIS FP7 projects aim to provide a demonstration framework for the GEOSS Model Web Development (GEO, 2009) in order to experiment with model components interoperability.

EuroGEOSS/GENESIS FP7 projects will contribute to the refinement of the GEOSS AIP architecture including how the broker and Model Web components fit into the GEOSS Architecture Engineering Viewpoint.

EuroGEOSS/GENESIS FP7 projects will recommend where open standards are not currently meeting the needs of the disciplines including draft recommendations to the standards developing organizations based upon the GEOSS "Special Arrangements."

EuroGEOSS/GENESIS FP7 projects will compare the proposed Special Arrangements of the discipline systems with the Interoperability Arrangements based on open standards. Where the open standards are unable to fulfill the functionality achieved with the Special Arrangements, the EuroGEOSS/GENESIS FP7 projects will convey these gaps to the SIF and to the relevant standards developing organizations, including recommendations on further development of open standards based upon the Special Arrangements.

EuroGEOSS/GENESIS FP7 projects will help to test and experiment with the Special Arrangements recognized by the SIF. EuroGEOSS/GENESIS FP7 projects will help investigating the full integration of components which implement "interoperability arrangements" services. EuroGEOSS/GENESIS FP7 projects will contribute and refine the overall architecture of GEO Task AR-09-01b.

3 Description of Responding Organization

The proposers of this response are the European FP7 Projects:

1. EuroGEOSS
2. GENESIS

In particular, contributing organizations (i.e. members of the FP7 projects) are:

- Join Research Centre of European Commission (JRC).
- Italian National Research Council (CNR).
- BRGM - Centre scientifique et technique (BRGM).
- University of Munster (UOM).

In addition, the 52 North company will provide a contribution on the SWE services interoperability development.

3.1 FP7 EuroGEOSS Project

The EuroGEOSS project will contribute to an increased capacity for scientists from different disciplines to work together, share data and models with less effort. This collaboration will develop better understanding and better predictions of environmental phenomena and their social impacts. While the program is focused initially on the European information infrastructure, the developments have global implications for advanced monitoring of the health of our planet. Improved knowledge is crucial to underpin action by government, and industry, but also by individuals, who can make a real difference through changes in their daily activities. For this reason, EuroGEOSS will exploit the latest development of the Web that allow for social networks and communities to contribute information, and share their knowledge on their local environment.

More information is available at: <http://www.eurogeoss.eu>

3.2 FP7 GENESIS project

The Genesis project has the objective of providing those involved in environment management and health services in Europe with an efficient, web-based solution for monitoring air quality, fresh and coastal water quality and their impacts on health. The advanced, ICT-based solution that will result from this research and development will combine open, collaborative information networks while integrating systems that already exist in Europe.

This simple yet innovative objective perfectly aligns with the goals set out in the European union's i2010 Lisbon Agenda to drive Europe to become the most dynamic economy in the world. The initiative not only promotes an open and competitive digital economy, but also sets out to improve the quality of life in Europe. Genesis will provide the tools to help achieve this aim.

More information is available at: <http://genesis-fp7.eu/>

3.3 52 North

52°North Initiative for Geospatial Open Source Software GmbH is an international research and development company whose mission is to promote the conception, development and application of free open source geo-software for research, education, training and practical use. 52°North backs an open initiative, which is driven by leading research organizations and individuals in the international GIS field. Cooperation partners participate in research and development with foci on Sensor Web Enablement (SWE), Web Security and Geo-Rights Management, as well as Geo-Processing .

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