Searching drought-related resources through a specialized vocabulary: Testing the interoperable infrastructure of the EuroGEOSS project

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Outline

1. Introduction to EuroGEOSS and drought IOC
2. Development of a specialized drought vocabulary
3. Integration of the drought vocabulary within the IOC
4. Conclusions
5. Outlook on future applications
1. Introduction to EuroGEOSS and drought IOC

General objectives of EuroGEOSS:

- Interlinkage of systems and applications in the strategic areas of drought, forestry and biodiversity
- **Discovery, access and analysis** of data from three and more disciplines
- Usage of GEOSS and INSPIRE frameworks for interoperable infrastructure
EuroGEOSS for Drought

Objectives:

• Explore and define interoperability arrangements for drought information systems in Europe
• Establish interoperability between European Drought Observatory and national and regional drought information
• Contribute to multi-discipline research with other thematic areas of EuroGEOSS
• Facilitate access to European drought information through GEOSS

→ Need of a common infrastructure or Initial Operating Capacity (IOC)
Components of the IOC

• Creation of drought-relevant data
  – ~210 datasets from regional (JRC EDO, DMCSEE), national (OSE), and local (CHE) observatories

• Deployment of services (~22)
  – Portrayal (WMS)
  – Access (WFS, WCS)

• A metadata catalogue for discovery
  – Metadata editor according to INSPIRE [CatMDEdit, EUOSME]
  – OGC CSW Metadata catalogue [CatalogCube]
  – Web application for searching and updating the drought catalogue

• A Web portal for an integrated access
  – EDO Map Server
IOC components

Identification Information

Citation

Title

Composite Drought Indicator

Abstract

The composite drought indicator combines four drought indices provided by EDO: SPI, fAPAR anomaly, NDWI and soil moisture anomaly. The values of the composite drought index vary between 0 and 4 depending on the number of indices reporting a drought in a specific point. The evaluation and improvement of this composite drought indicator is ongoing.

Point of contact

Organisation name

JRC-IES

Contact information

Address

Electronic mail address

stefan.niemeyer@jrc.ec.europa.eu

Role
IOC components
IOC components
IOC components
First experiences with the IOC

• The IOC provides the setting of a real scenario for testing the interoperability between drought observatories
  – Non-drought experts (administratives) can assess the drought situation in Europe
  – Drought experts can explore specific resources
• First results obtained based on this prototype
  – This infrastructure allows the technical interoperability
  – But some improvements are needed in terms of semantic interoperability

30 June 2011
Semantic interoperability difficulties

Improvements needed in semantic interoperability:

- Initial common vocabularies (GEMET, SBA) proposed in EuroGEOSS were not specific enough for the requirements of drought experts in real scenarios
- *Water, Drought Control, or Drought prediction* are too broad for a drought expert trying to find data on agricultural droughts, specific drought indexes, …

Our proposal:

- Speak a common language to facilitate the discovery and integration of knowledge from different sources
- Develop a specific drought vocabulary for annotation and discovery
2. Development of a specialized drought vocabulary

Methodology:

Iterative process including these steps

- Compilation of terms and creation of hierarchical draft taxonomy
- Refinement of the taxonomy (and other properties)
- Translation into different languages
- Formalization in SKOS format
Compilation of terms and draft taxonomy

- Use of a common language (English)
- Sources
  - Knowledge from partner experts
  - Related terms in well-known sources
    - GEMET
    - AGROVOC

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<td>discharge</td>
<td>I low flow</td>
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<td>drought hazard</td>
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</table>
Refinement of the taxonomy and other properties

• Identification of categories (groups of concepts)
• Refinement of hierarchical relationships
  – is-a
    • a “rainfall anomaly” is a kind of “precipitation anomaly”
  – whole-part
    • “drought duration” has an “onset” and an “end”
  – instance-of
    • “EDO” is an instance/individual/particular case of a “drought monitoring system”
  – related
    • not hierarchical
    • “soil” is related to “soil moisture”
• Identification of synonyms
  – Preferred label vs. alternate labels
    • e.g., separate acronyms from their complete name
Soil, Hydrology

```
soil:soil -> soil:soil moisture -> soil:soil moisture deficit

hydrology:water run off
hydrology:water stress
hydrology:water scarcity
hydrology:reservoir
hydrology:water stored in reservoir
hydrology:reservoir volume
hydrology:piezometric level
hydrology:low flow
hydrology:discharge
hydrology:ground water
hydrology:water deficit
```

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## Translation of terms

- **15 languages**
  - English, Slovenian, Spanish, French, German, Bosnian, Turkish, Italian, Portuguese, Croatian, Serbian, Albanian, Macedonian, Greek, Montenegrin

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<td>Εμπόριο на леимарий</td>
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</table>
Formalization of the drought vocabulary (I)

- Creation of a SKOS representation of this vocabulary
- SKOS (Simple Knowledge Organization System)
  - family of formal languages designed for representation of thesauri, classification schemes, taxonomies, subject-heading systems, or any other type of structured controlled vocabulary
  - built upon RDF and RDFS, its main objective is to enable easy publication of controlled structured vocabularies for the Semantic Web
Formalization of the drought vocabulary (II)

• How has the vocabulary been transformed?
  – *is-a*, *whole-part* and *instance-of* relationships has been mapped to the *skos:broader* and *skos:narrower* relationships
  – the *related* relationship has been maintained
  – possibility of grouping concepts: *skos:collections*
    • Meteorology
    • Drought
    • Soil, hydrology, statistics...
4. Integration of the drought vocabulary within the IOC

• Annotation with the drought vocabulary
  – We need to update metadata to include explicit references to these new drought vocabulary
Searching with the drought vocabulary

- Selection of terms from the drought vocabulary
  - Uses displayed term and all its translations
  - Searches in the title, abstract and subject
- Optional selection of terms from other thesauri/vocabularies
Drought Vocabulary allows a restriction of search results
5. Conclusions (I)

- We have created the technical infrastructure that enables the integration of local and national systems within the prototype of a European Drought Observatory
- We have identified the need for a specialized vocabulary in order to facilitate discovery for experts
5. Conclusions (II)

- After an open and collaborative process, the EuroGEOSS Drought Vocabulary has been created and published in SKOS format.
  - 103 concepts, organized in groups, with preferred and alternate labels in 15 languages
  - Also related and hierarchical relations
- This vocabulary has been matched with more general vocabularies to facilitate multidisciplinary interoperability in EuroGEOSS
6. Outlook on future applications

• Current IOC allows the portrayal and the download of drought-relevant information for selected areas
• However, more advanced queries without the need of visual supervision would help the work of experts
  – e.g., identify areas on alert
  – e.g., compare the situation of an area according to different indexes
• The drought specialized vocabulary could be the basis for a heavyweight ontology (with axioms and constraints) allowing complex searches/analysis on data sources without manual supervision
An example to facilitate the exploration of drought indexes

- Each drought index requires a specific interpretation
  - Different range of values
  - Different qualitative values
  - Different representation
- An ontology could be used to specify this knowledge, and facilitate the work of experts

Find regions under ‘drought emergency’ in any drought index

JRC-SPI: Find regions in WCS whose numeric value is lower than -1.5 (severe dry, extremely dry)

CHE-Hydro: Find regions in WFS whose numeric value is lower than 0.15 (EMERGENCIA)

...
European Drought Observatory
http://edo.jrc.ec.europa.eu/

EuroGEOSS Drought Catalogue resources
http://eurogeoss.unizar.es/home/

Advanced Information Systems Group,
University of Zaragoza
http://iaaa.cps.unizar.es

DESERT Action,
Institute for Environment and Sustainability,
Joint Research Centre
http://desert.jrc.ec.europa.eu/