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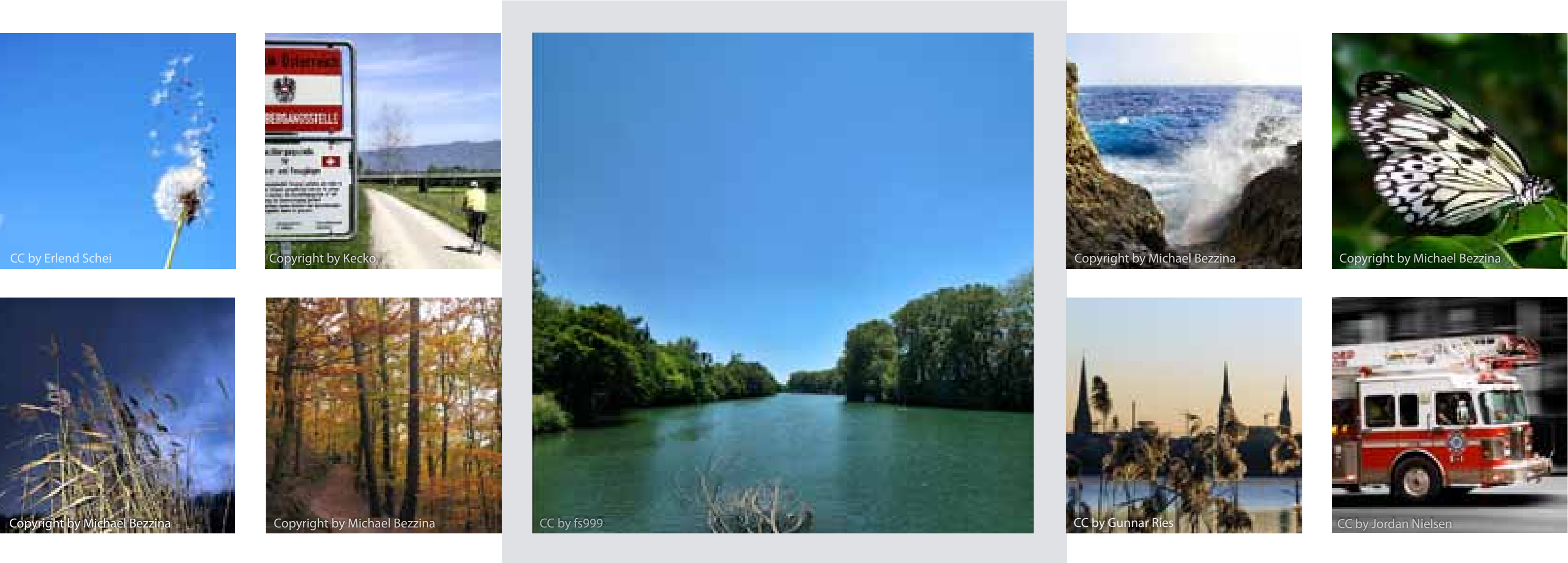

HUMBOLDT Application Scenario: Transboundary Catchment

USER REPORT

SUPPORTING THE HARMONISATION OF SPATIAL INFORMATION IN EUROPE

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Introduction

The preparation to ensure a long-term sustainability of the results of the HUMBOLDT project, such as the developed approaches, the software framework and the community website have already begun during the main project's runtime. These efforts are to be substantially complemented during the extension, by increasing the community, by creating lasting documentation of methodological aspects in the form of edited books and by implementing aspects of the project's exploitation plan.

User Reports are part of the community outreach strategy. They describe the impact that the usage of harmonised data and the application of HUMBOLDT methodology and tools have through the experiences of current HUMBOLDT users in an easy-to-understand way, and can be directly used for dissemination and training.

Application context

The Transboundary Catchments Scenario is focused on specific data harmonisation needs in the creation of a hydrological model for transboundary catchments areas. Water management in transboundary catchments strongly relies on collaboration of stakeholders from both sides of the border. Any integrated water management requires a joint effort and data interchange to reach adequate decision support.

Both sides of the border collect a large number of very detailed and actual data sets. A list of data, required for hydrological modelling, includes hydrometeorological data (mainly time series of rainfall data, records of river discharge) and geographical data necessary for setting the conditions influencing hydrological processes (i.e. transformation rainfall into a water flow). For the use cases, the theme river network was chosen, which is one of the mandatory datasets for hydrological modelling.

There were two basic possibilities of data transformation – a one side transformation from French data model into Italian data model or more universal transformation into INSPIRE based schema which means data sets from both countries are transformed into the INSPIRE compliant schema to make their integration more applicable in transboundary domain related tasks (e.g. hydrological modelling).

Summary of pre-HUMBOLDT state

The use case targeted different data harmonisation problems, mechanisms and techniques applied to solve these issues while developing a transboundary rainfall-runoff model. The Roia/Roya River Basin is used as an example for the purpose of runoff prediction (estimation of peak discharge etc.) and can subsequently serve as input to the other modelling as well as management purposes. The aims were to demonstrate that harmonised data sets help in developing integrated hydrological models, which represent a tool necessary for joint, collaborative and integrated management improving the decision-making in transboundary catchment areas (e.g.erosion modelling, ecological modelling, flood protection, shared and coordinated usage of water sources, coordinated water source protection).

The harmonised data model (for two side transformation) was based on specification of INSPIRE as a key component of current SDI. Following specifications were mainly utilised:

- Hydrography data theme (INSPIRE Annex I) to exchange hydrological information (applied for dataset related to water network, e.g. watercourse, water bodies, etc.),
- Elevation data theme (INSPIRE Annex II) and Geographical Grid Systems (INSPIRE Annex I, II) for Digital Terrain Model (altitude information necessary for watershed schematisation),
- Land cover data theme (INSPIRE Annex II) for land cover information influencing runoff,
- Environmental Monitoring Facilities data theme (INSPIRE Annex III) and Meteorological Geographical Features data theme (INSPIRE Annex III) for measurements (time series of water discharge, precipitation etc.).

It is important to highlight that the data model was INSPIRE based but not fully INSPIRE adopted.

Integration of HUMBOLDT solutions

The schema (below) shows a simplified harmonisation process. Data profiles from both sides of the border, together with common data profiles (INSPIRE inspired), are instrumental for the target schema creation. Using the HUMBOLDT Framework, data are harmonised, merged and prepared to be used for rainfall-runoff modelling.

The top priorities of the harmonisation steps for Transboundary catchment are:

- Schema transformation
- Classification Mapping
- Layers alignment
- Coordinate reference systems transformation

The following HUMBOLDT Framework Tools were used to demonstrate the required harmonisation:

- HUMBOLDT Alignment Editor: to define mapping between source and target schemas
- Conceptual Schema Transformer (CST): to perform the schema transformation
- Mediator Service: for interaction of the Scenario client and the Framework services
- Workflow Design and Construction Service (WDCS): for workshop training materials

Expert defines the mapping rules between source and target data sets using HALE software. These mapping rules saved as OML files could be implemented to CST tools or another GIT tools. These software component was used by user to harmonize (transform) concrete data sets.

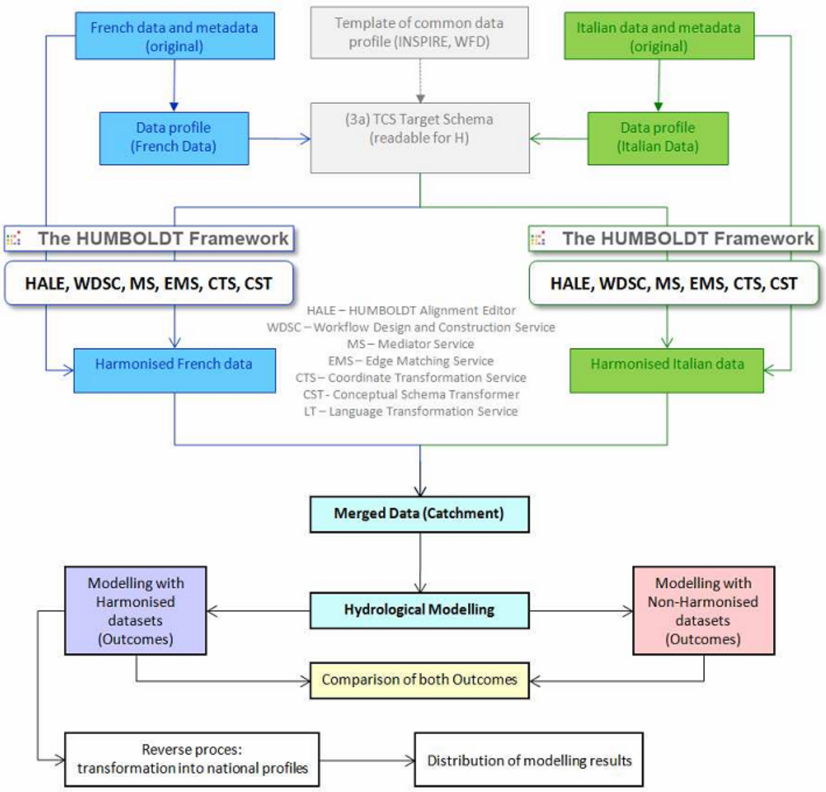


Figure 1. Transboundary Catchment Scenario Harmonisation Concept

Summary of HUMBOLDT-enabled state

There are four main goals of the project. The spatial data harmonization experts developed the methods and procedures of spatial data harmonization in conjunction with INSPIRE directive. These methods and procedures were implemented to Humboldt software and services. Methods and software tools were used and evaluate by Humboldt scenarios. Finally there were created the training and dissemination materials based on all results of the Humboldt project (methods, tools, scenarios). All output are non-commercial and accessible to public (see the web page of the Humboldt project and its training platform).

HUMBOLDT tools in action: Application examples

In the perspective of the implementation example, the practical demonstration is based on HTML capability. There are presented two examples:

- **Example 1 - USING THE HUMBOLDT ALIGNMENT EDITOR (HALE)**
- **Example 2 - USING THE HUMBOLDT WORKFLOW DESIGN AND CONSTRUCTION SERVICE (WDCS)**

First example describes the creation of the mapping file important for conceptual schema transformation (data structure/profile) from original profile into the target data model. To show the automation of the harmonisation constituted from several transformation tasks, the second example describes the usage of the HUMBOLDT Workflow Design and Construction Service (WDCS) usage.

Excerpt from the Example 1

First, we transform data from the French watercourse dataset called **HYLCOV00_rivers** to INSPIRE compliant schema (developed within the scenario). After loading our source schema (HYLCOV00_rivers) from Web Feature Service´s GetCapabilities (http://www.gisig.it:8081/geoserver/ows?service=WFS&request=GetCapabilities), we have to load target schema for transboundary catchment scenario in *.xsd format.

The exploration of matching possibilities between the given dataset and INSPIRE based schema revealed that four attributes have to be transformed. The remaining attributes of the source dataset are not needed and can be excluded from the transformation process using INSPIRE Nil reason function.

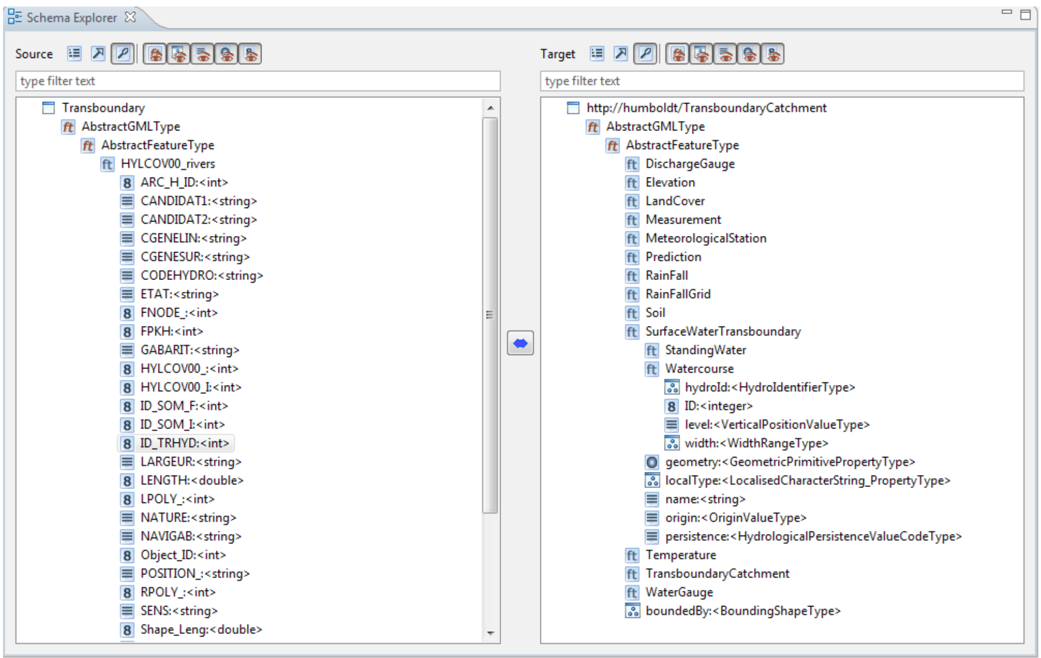
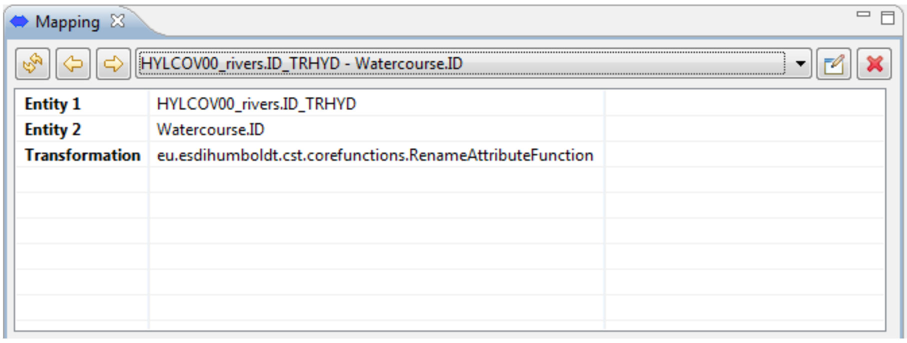
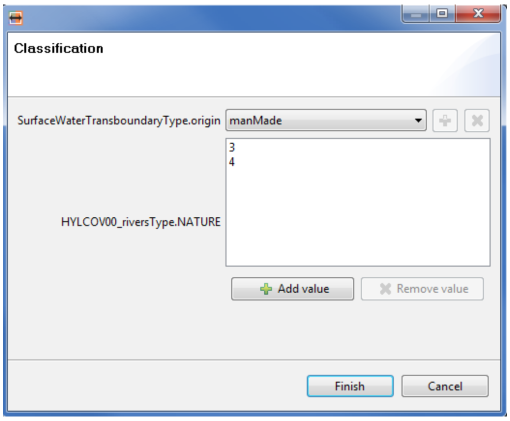


Figure 2. Source and Target Schemas in HALE schema explorer

The attribute **ID_TRHYD** is equivalent to **ID** in INSPIRE schema (the target schema). We use rename function" for this transformation. The transformation is repeated for attributes **LARGEUR** (rename to **WIDTH**), **NATURE** (rename to **ORIGIN**) and **POSITION** (rename to **LEVEL**):



Next step is to classify some values inside attributes that are mandatory in the **watercource** attribute subset of the target INSPIRE schema. Classification mapping function allows to map values of a source attribute to fixed values of a target attribute (to reclassify values of a source attribute to the required values of the target). The relation is always a many to one relation, and each code from the source schema can only be mapped once. The function **"Classification mapping"** is applied to replace values in the attributes **LARGEUR**, **NATURE** and **POSITION**:



Conclusions

Our experiments have shown that HALE and CST are very promising developments, which close a large gap in the market, i.e. conceptual schema mapping and automatic data transformation. As shows in our paper it is possible to design either one-side transformation (datasets from foreign country to match local datasets) or two-side transformation (where data from both countries are transformed into a common target schema) using HALE. The transboundary scenario is a good demonstration since many of the mentioned data sets are relevant for other cases and scenarios.

Nevertheless, some issues still obstruct full implementation of all proposed tools. One of these drawbacks in the INSPIRE implementation process is the requirement of GML 3.2.1 which is not widely adapted in current applications. Even more existing implementations of GML are not consistent. It may be a critical issue for the wide utilisation of the Humboldt framework.

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http://www.esdi-humboldt.eu/scenarios/transboundary_catchment.html

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