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Executive Summary

This document is the deliverable to the corresponding next future OGC interoperability public engineering report. This document explains the WaterInnEU approach to standardization and interoperability issues in the water domain and it exposes the proposal solution for integrating data from different heterogeneous sources into a centralized hydrological model execution. This proposed solution has been implemented into the context of an OGC Pilot, called RiBaSE.

The presented solution is a Web Processing Service (WPS) that launches and controls all involved process (from the access to data to publish the results and to send alerts) in a flooding scenario. This scenario has been deployed for three case studies, three river basins with different hydrological and technological characteristics: Maritsa, Scheldt and Severn.

Different Interoperable services and client interfaces have been developed or reused for this Pilot, and present deliverable explains the key details on the implementation. Additionally to this deliverable, the D5.4 Interoperability recommendations report completes the RiBaSE approach.

The presented interoperability analysis, the corresponding efforts in the implementations and the related tests aim to achieve a more efficient emergency management in a flooding scenario and to contribute for improving the current ICT solutions into the river basin management context and in relation to the European Directives (WFD and INSPIRE).

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1. Introduction

European directives such as the Infrastructure for Spatial Information in the European Community (INSPIRE), the Water Framework Directive (WFD), or the EU Floods Directive (Directive 2007/60/EC), as well as agendas and roadmaps include many recommendations in terms of harmonization, standardization and interoperability goals. They indeed raise very important challenges for progressing in these issues.

WaterInnEU (WorkPackage5) designs a strategy to promote the interoperability as the core of the proposal solution for promoting the outcomes of these previous projects, following one of the primary WaterInnEU's goals:

> *b) Assess the level of standardization and interoperability of these outcomes as a mechanism to integrate ICT-based tools, and incorporate open data platforms and generate a palette of interchangeable components that are able to use the water data emerging from the data sharing processes and data models stimulated by initiatives such as the INSPIRE directive.*

There are several standardization committees and international organizations relevant for water domain Information Technology applications: International Organization for Standardization (ISO), World Wide Web Consortium (W3C), Institute of Electrical and Electronics Engineers (IEEE), etc. Related to the Infrastructure for Spatial Information in Europe (INSPIRE), the Open Geospatial Consortium (OGC) is one of the main players (with the ISO TC211) providing standardized specifications of spatial information and interoperability of the corresponding spatial data services. Most of these standards are using in different current applications at Water domain; however, a big effort for integrating data and models and the corresponding implementations as a services, is needed. This Pilot aims to analyze these integration issues.

The scenario for this analysis and for testing the proposed solution is a flooding event. Flood modeling is a paradigmatic example in the water domain that needs to integrate meteorological data, hydrological models and alerting tools for a potential emergency event. This present document aims to describe a global interoperable workflow for supporting decision makers in an inland flood risk situation. This integration must be automatic in a useful real time application, and the proposed solution must concatenate all different processes from a unique starting point.

For a more complete context, the previous documents into the development of WorkPackage 5 needs to be considered. The previous deliverables had prepared the developed tasks in the current deliverable. In particular *D5.1 Compendium of available standards* collects the review of the current standards that can be useful in the water sector, also it describes the design for the better strategy to promote the interoperability. The *D5.2 European water interoperability experiment request for participation* explains the initial concept of the WaterInnEU Interoperability Pilot, called ***RiBaSE,*** the candidate participants and organizations, the preliminary architecture's design and its components, the scenarios, etc and it disseminated a public request for participation. The response of this call and the consequently very fruitful external participation is described in the next RiBaSE: dissemination activities section.

2. OGC Interoperability Pilots

2.1. The OGC Interoperability Program

The OGC Interoperability Program (OGC-IP) is a global, innovative, collaborative, hands-on engineering and rapid prototyping program for validating and testing geospatial technology based on OGC standards. OGC-IP activities include specification of requirements, implementation of prototypes, and demonstrations for broad awareness. The OGC IP provides evidence of technology maturity to support the consensus adoption of standards in OGC Standards Program.

The primary purpose of OGC's Interoperability Program is to bring organizations together in rapid, hands-on, collaborative engineering efforts to achieve one or more of the following objectives:

- Produce and test Candidate Implementation Standards for geoprocessing interoperability;
- Perform research on the use of information technology (IT) regarding relevance and ability of standards to help solve geospatial interoperability problems;
- Develop and test prototype interoperable infrastructures based on OGC and related standards;
- Advance and demonstrate the maturity of interoperable implementations sufficient for organizations to base procurement decisions

2.2. Technology Maturation Strategy

Through fast paced testbeds, experiments, pilot initiatives and related feasibility studies, OGC's Interoperability Program promotes rapid prototyping, testing and validation of standards. The OGC approach recognizes that development and management of prototypes provides for communications and progress in the development and evolution of OGC standards. Prototypes engage an organization's thinking in explicit solutions. The OGC process combines the emphasis on agile prototypes with architecture activities for consistent design patterns and communications.

In tandem with the OGC IP, the OGC Compliance Testing Program contributes to the development of the maturity of interoperable technology. By providing a process whereby compliance can be tested Compliance testing program permits developers and users to increase the value and benefit of the standards that OGC has created. OGC IP Initiatives regularly contribute technology to the Compliance Test Program, e.g., reference implementations.

2.3. Interoperability Initiatives

Governed by a set of proven policies, processes and procedures, the OGC IP initiatives fall under one of the following categories:

- **Test beds** are fast-paced, multi-vendor collaborative efforts to define, design, develop, and test candidate interface and encoding specifications. These draft specifications then move into the OGC Standards Program where they are reviewed and potentially approved as new international standards.
- **Pilot projects** apply and test OGC standards in real world applications using Standards Based Commercial Off-The-Shelf (SCOTS) products that implement OGC standards. Pilot projects are an opportunity for users to understand how to best address their requirements using standards-based architectures.
- **OGC Engineering Services** are designed to help organizations with open, standards-based architectures.

- **Interoperability Experiments** are brief, low-overhead, formally structured and approved initiatives led and executed by OGC members to achieve specific technical objectives that further the OGC Technical Baseline.
- **Concept Development** studies assess emerging technologies and architectures capable of supporting eventual Interoperability Initiatives and Standards activities. They may examine alternative mechanisms that enable commercial technology to interoperate to meet sponsor requirements.
- **OGC Network**™ is a window onto the dynamic, constantly changing geospatial web as described by the OGC Reference Model (ORM). Multiple communities of interest for research in geospatial interoperability are supported, and persistent demonstration capability is provided.

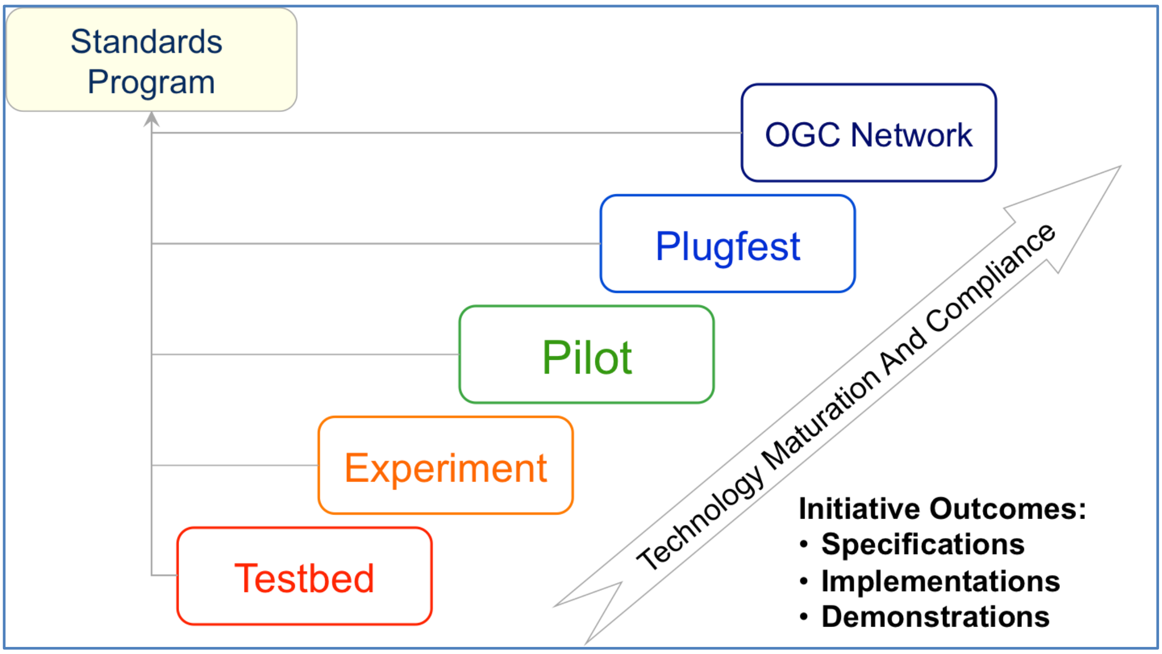


Figure 1: Interoperability Initiatives

2.4. The RiBaSE Interoperability Pilots

An OGC Pilot is a collaborative effort that applies the OGC Technical Baseline and other (non-OGC) technologies to the given scenarios. In practice, a Pilot is where an OGC specification – or set of OGC specifications – can be “stress tested” and perfected based on real-world application and experience. While some research may be done during a pilot in terms of refining, documenting, and distributing specifications and in terms of developing prototypical software that exercises the refined specification, this research is directed at improving existing specifications rather than in creating new specifications.

The general approach to performing pilots is to go through a four step process:

1) Concept development
2) RFQ/CFP Development
3) Team Formation and Kick-off
4) Pilot Execution

OGC Pilots are normally funded by Sponsors and executed by Participants. The RiBase ‘*sponsor*’ is the WaterInnEU project and the participants the project partners (albeit the pilot is open for other to contribute in-kind).

The primary goal of a pilot from the perspective of the RiBase project is to implement a prototypical set of software and reuse an existing software components that exercise a set of OGC specifications and draft specifications for which the project have requirements in terms of enabling and promoting interoperable geospatial technologies within its (water) environment. This prototypical capability will be instantiated in an environment determined by the project. Therefore, participants will provide their prototypical software components and will conduct TIEs to determine if these components can function in an interoperable environment.

In each initiative type, one or more of the following deliverables are produced:

1) Engineering Report (this document), which maybe draft standards intended to become standards or reports of testing results and conclusions. Change Requests to existing standards are also created and entered the OGC Change Request database.
2) Software implementations of OGC standards and draft standards as debates are settled using the approach of "interoperable running code wins."
3) Demonstrations of the software and standards in real world examples to show why the technology matters to end-users.

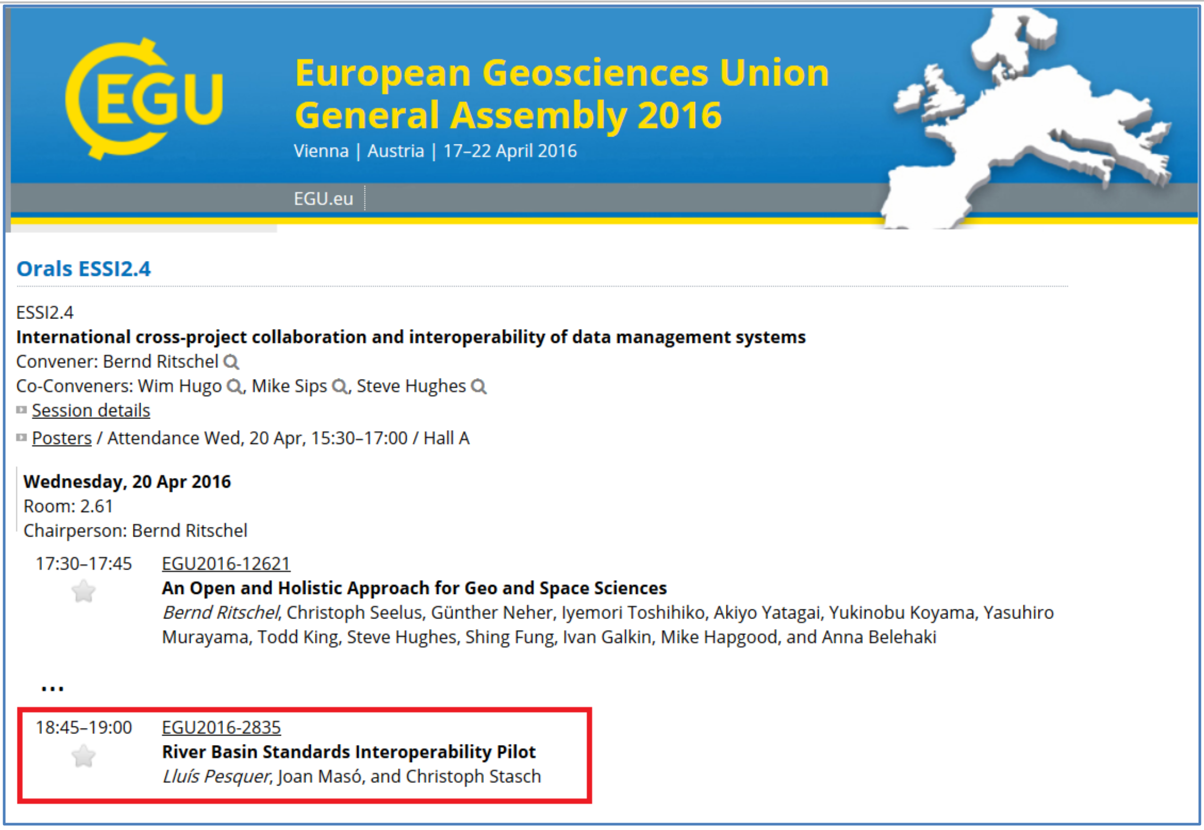
3. RiBaSE: dissemination activities

RiBaSE: RIver BAsin Standards interoperability Experiment is the developed OGC Pilot in the WaterInnEU project. The main activities for the RiBaSE are collected in its corresponding web site: http://www.ogcnetwork.net/node/1976 . This is also the second channel communication (the first one is e-mail) and the main repository of related information. Additionally all activities are published in WaterInnEU dissemination channels: public project web-site, Twitter, Linked-in, etc.
These activities started with the kick-off meeting that took place during the EIP Water Conference 2016 in Leeuwarden (February 9th -10th). The participant institutions on this kick-off meeting are collected in Annex A (plus some additional participant in next meetings). The WaterInnEU consortium really appreciates their participation and contributions to the Pilot.

Following the agreed actions on the kick of meeting, in the starting stage, frequent teleconferences allowed to improve the first design and to solve implementing details. In the core development stage and in the final of the pilot, the plenary RiBaSE on-line meetings were less frequently, but particular peer-to-peer specific discussions were very useful for solving different issues in the integration of the involved architecture's components.

During the development of this Pilot some dissemination activities were conducted:

In April 20th **EGU General Assembly** 2016 (Pesquer *et al*. 2016a) Vienna at ESSI2.4 *International cross-project collaboration and interoperability of data management systems* session http://meetingorganizer.copernicus.org/EGU2016/EGU2016-2835.pdf. This session was targeted to all geoscientists, computer and information scientists who want to present their expertise and experiences in cross-project collaboration activities especially related to the design of technical solutions for the achievement of interoperability between different data management systems.



European Geosciences Union General Assembly 2016
Vienna | Austria | 17–22 April 2016
EGU.eu

Orals ESSI2.4

ESSI2.4
International cross-project collaboration and interoperability of data management systems
Convener: Bernd Ritschel
Co-Conveners: Wim Hugo, Mike Sips, Steve Hughes
Session details
Posters / Attendance Wed, 20 Apr, 15:30–17:00 / Hall A

Wednesday, 20 Apr 2016
Room: 2.61
Chairperson: Bernd Ritschel

17:30–17:45 EGU2016-12621
An Open and Holistic Approach for Geo and Space Sciences
Bernd Ritschel, Christoph Seelus, Günther Neher, Iyemori Toshihiko, Akiyo Yatagai, Yukinobu Koyama, Yasuhiro Murayama, Todd King, Steve Hughes, Shing Fung, Ivan Galkin, Mike Hapgood, and Anna Belehaki

...

18:45–19:00 EGU2016-2835
River Basin Standards Interoperability Pilot
Lluís Pesquer, Joan Masó, and Christoph Stasch

Figure 2: RiBaSE presentation in an ESSI session for the EGU General Assembly

In August 31[st], WaterInnEU presented the progress in this Pilot in the **Geospatial Sensor Webs Conference** 2016, Muenster (Germany) (Pesquer et al 2016b). This conference aimed to discuss the status and future directions of Sensor Web standards and technologies based on experiences in a variety of application domains, one of them, the water sector.

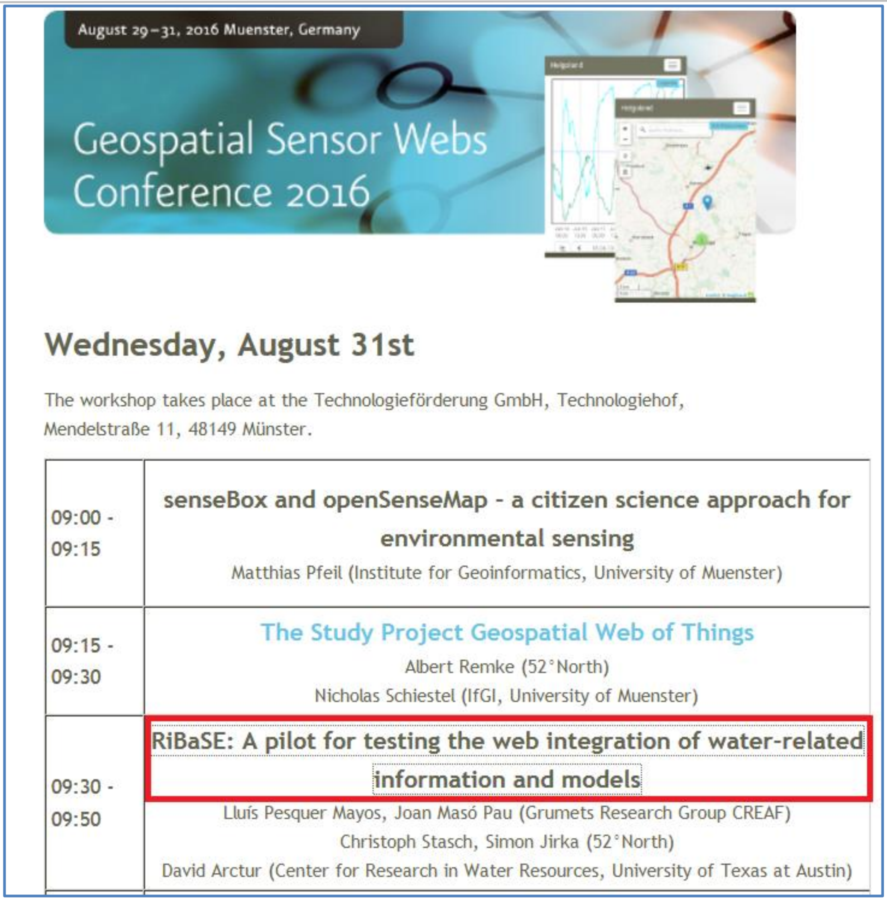


Figure 3: RiBaSE presentation in the Geospatial Sensor Webs Conference

In September 30th, WaterInnEU made the titled presentation: *Towards an integration of interoperable tools and open data in water management* into the UNESCO audience (Paris) **Open Workshop Fostering inclusive and sustainable economic growth, employment and decent work (SDG#8) through ICT job creation tools for ensuring water security (SDG#6)**.

Figure 4: Interoperability vision for water management in UNESCO workshop

In all these presentations, WaterInnEU met to experts, stakeholders, researches, end-users, etc. in the interoperability issues on the geospatial and water domain. The corresponding open discussions and the feedback has been very useful for a better-built design and implementation.

4. Architecture

The RiBaSE concept focus on the integration of different OGC services and promoting their corresponding standard OGC encodings. The initial proposal of the architecture is explained in *D5.2 European water interoperability experiment request for participation*, and the current section of present report explains the architecture that was finally implemented (Figure 5).

The core of this architecture is the OGC Web Processing Service (WPS), a successful standard in hydrological modelling (Castronova *et al.* 2013). The WPS is the responsible of:

- Execute the invoked flooding model
    - Access to the data inputs (SOS)
    - Run the flooding model
    - Generate the polygon layer of the affected areas
- Launch the WFS in order to publish the results
- Launch the Pub/Sub service in order to alert potential affected areas

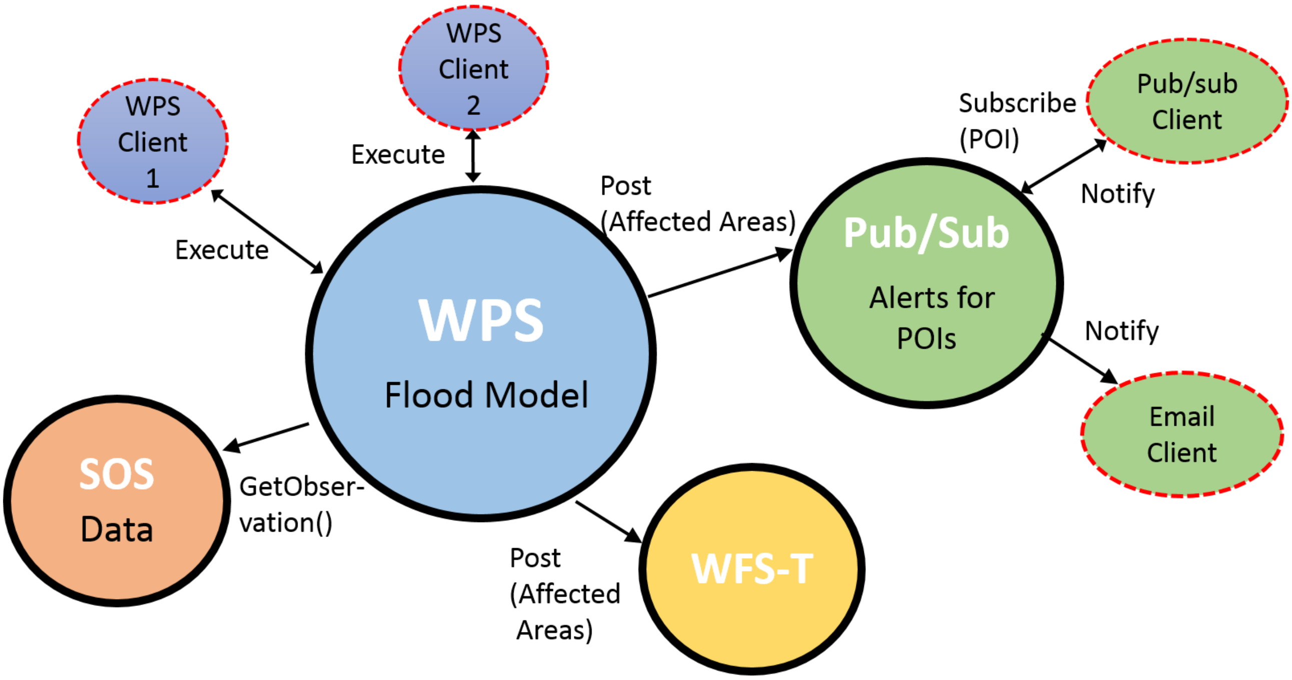


Figure 5: Architecture and relations between the different involved components and the corresponding clients and servers.

4.1. WPS component

The WPS service is hosted in http://www.ogc.uab.cat/cgi-bin/WaterInnEU/MiraMon.cgi. This a Common Gateway Interface (CGI) application based on MiraMon (Pons 2000) tools. Some examples for invoking these WPS functionalities are showed in Table 1 and Figure 6 is an example of XML file with a concrete set of parameters of one execution.

HTTP GET	GetCapabilities	http://www.ogc.uab.cat/cgi-bin/WaterInnEU/MiraMon.cgi?VERSION=1.0.0&REQUEST=GetCapabilities&SERVICE=WPS&LANGUAGE=en-US
HTTP GET	DescribeProcess	http://www.ogc.uab.cat/cgi-bin/WaterInnEU/MiraMon.cgi?SERVICE=WPS&VERSION=1.0.0&REQUEST=DescribeProcess&IDENTIFIER=MiraMon:Inundac:Param01:2&LANGUAGE=en-US

HTTP POST	Execute	http://www.ogc.uab.cat/cgi-bin/WaterInnEU/MiraMon.cgi

Table 1: Syntax for the WPS functionalities


```xml
<?xml version="1.0" encoding="iso-8859-1"?>
<Execute service="WPS" version="1.0.0" xmlns="http://www.opengis.net/wps/1.0.0" xmlns:ows="http://www.opengis.net/ows/1.1" xmlns:xlink="
http://www.w3.org/1999/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.opengis.net/wps/1.0.0
http://schemas.opengis.net/wps/1.0.0/wpsExecute_request.xsd">
  <ows:Identifier>MiraMon:Inundac:Param01:2</ows:Identifier>
  <DataInputs>
    <Input>
      <ows:Identifier>Option</ows:Identifier>
      <Data>
        <LiteralData>2</LiteralData>
      </Data>
    </Input>
    <Input>
      <ows:Identifier>Basin</ows:Identifier>
      <Data>
        <LiteralData>Severn</LiteralData>
      </Data>
    </Input>
    <Input>
      <ows:Identifier>ISODateTime</ows:Identifier>
      <Data>
        <LiteralData>2006-05-05T00:00:00.000</LiteralData>
      </Data>
    </Input>
    <Input>
      <ows:Identifier>SampleData</ows:Identifier>
      <Reference xlink:href="file:///F:/SIWeb/WaterInnEU/Dades/Severn/DadesOrigen/SampledDataList.lst" mimeType="application/x-lst"/>
    </Input>
  </DataInputs>
  <ResponseForm>
    <ResponseDocument storeExecuteResponse="true" status="true">
      <Output asReference="true" mimeType="application/gml+xml" encoding="ISO-8859-1" schema="
http://schemas.opengis.net/schemas/gml/3.1.1/base/gml.xsd">
        <ows:Identifier>OutputFile</ows:Identifier>
      </Output>
    </ResponseDocument>
  </ResponseForm>
</Execute>
```


Figure 6: Example of *Execute* request file to be sent by POST to server

This WPS flood model has two types of data input:

- Time dependent: Ideally, these datasets are provided by SOS services in WaterML format. If SOS does not exist, the WPS accesses a prepared WaterML dataset.
- Non-time dependent: The Digital Elevation Model (DEM) and the river layer define a derived model that it is called Height Above the Nearest Drainage (HAND). For efficiency, this is pre-prepared for three case studies using HAND (Nobre *et al.* 2011) and TauDEM [1] tools.

These affected areas are calculated through generating areal influence polygons (based on Thiessen method) over the pre-calculated Height Above the Nearest Drainage digital model following the methodology by Ferrando *et al.* 2015. This prepared HAND digital model allows avoiding calculations. These calculations are not time dependent; they only depend on topography: terrain and the riverbed location. In this model, the time dependent observations at gauge locations, river level, are extended to the influence polygons for generating the potential flooded areas.

[1] http://hydrology.usu.edu/taudem/taudem5/index.html

The WPS execution generates a GML file with the polygons of the affected areas (also an optional SHP file could be generated, when it is required). Immediately a POST message is sent to the Pub/Sub endpoint for launching the alerting services (see Figure 7) and another POST message is sent to the WFS Transactional (explained in 4.4 section) in order to update the database and the layer of the affected areas. The WFS allows a standard way to server the result polygon affected area layer, this is not an either a map or a picture, this is the complete collection of features and attributes.

http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/publications/pip-pub


```
<?xml version="1.0" encoding="UTF-8"?>
<wfs:FeatureCollection xmlns:wfs="http://www.opengis.net/wfs" xmlns:gml="http://www.opengis.net/gml"
    xmlns:xlink="http://www.w3.org/1999/xlink"  xmlns="http://miramon.uab.cat/wps/appl_schema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.opengis.net/wfs
http://schemas.opengis.net/wfs/1.1.0/wfs.xsd http://miramon.uab.cat/wps/appl_schema
http://www.ogc.uab.cat/cgi-temp/Scheldt2016_06_15.xsd" timeStamp="2016-11-30T11:11:29.794Z" numberOfFeatures="44">
 <gml:boundedBy>
 <gml:featureMember>
  <Scheldt gml:id="pol_1">
   <gml:boundedBy>
   <n_vertexs>598895</n_verte
   <perimetre>324.598888889</perimetre>
   <perimetree>20329373.731</perimetree>
   <area>0.865379274</area>
   <areae>6752177615.333</areae>
   <n_arcs>88163</n_arcs>
   <n_polig>53174</n_polig>
   <flooded>1</flooded>
   <basin>Scheldt</basin>
   <sam_date>2016-06-15T00:00:00.000</sam_date>
   <geometry>
    <gml:MultiPolygon srsName="EPSG:4326">
      <gml:polygonMember>
      <gml:polygonMember>
        <gml:Polygon srsName="EPSG:4326">
          <gml:exterior>
            <gml:LinearRing srsName="EPSG:4326">
              <gml:posList srsDimension="2">3.9927777778 51.1622222267 3.9941666667 51.1622222267 3.9941388889
51.1619833378 3.9943055556 51.1619055600 3.9941500000 51.1617388933 3.9933166667 51.1617388933 3.9928368794
51.1619680896 3.9927777778 51.1622222267</gml:posList>
            </gml:LinearRing>
          </gml:exterior>
        </gml:Polygon>
      </gml:polygonMember>
      <gml:polygonMember>
        <gml:Polygon srsName="EPSG:4326">
          <gml:exterior>
            <gml:LinearRing srsName="EPSG:4326">
              <gml:posList srsDimension="2">4.0713888889 51.1597222267 4.0711702128 51.1597813283 4.0711833333
51.1599277822 4.0713297872 51.1599409028 4.0713888889 51.1597222267</gml:posList>
            </gml:LinearRing>
          </gml:exterior>
        </gml:Polygon>
      </gml:polygonMember>
```


Figure 7: Example of POST message for sending the GML affected area to Pub/Sub server

4.2. SOS component

The explained architecture is prepared for accessing time series datasets of hydrological measurements by a SOS service. The SOS server must be hosted on the web domain of the data provider because it does not make sense to develop own RiBaSE SOS service with a partial and local copy of these real datasets, or otherwise, or to generate hydrological simulated measurements. In present experiment, the SOS by the NRHA CEH[2] is a very relevant component for testing our proposal. This service is working for river basin (Severn) (see more details in the Case studies section). Otherwise, when SOS service does not exist, this Pilot propose two different alternative solutions for accessing to real hydrological measurements.

A first example for accessing to the information of one gauge station (feature of interest) is:

```
http://nrfa-ceh.cloudapp.net:8080/52n-sos-dev/service?service=SOS&version=2.0.0&request=GetFeatureOfInterest&procedure=http://nrfa-ceh.cloudapp.net:8080/52n-sos-dev/procedure/nrfa/21003
```


```xml
<?xml version="1.0" encoding="UTF-8"?>
<sos:GetFeatureOfInterestResponse xmlns:sos="http://www.opengis.net/sos/2.0" xmlns:xsi="
http://www.w3.org/2001/XMLSchema-instance" xmlns:wml2="http://www.opengis.net/waterml/2.0" xmlns:gml="
http://www.opengis.net/gml/3.2" xmlns:sf="http://www.opengis.net/sampling/2.0" xmlns:xlink="
http://www.w3.org/1999/xlink" xmlns:sams="http://www.opengis.net/samplingSpatial/2.0" xsi:schemaLocation="
http://www.opengis.net/waterml/2.0 http://schemas.opengis.net/waterml/2.0/timeseries.xsd
http://www.opengis.net/sos/2.0 http://schemas.opengis.net/sos/2.0/sosGetFeatureOfInterest.xsd
http://www.opengis.net/gml/3.2 http://schemas.opengis.net/gml/3.2.1/gml.xsd
http://www.opengis.net/samplingSpatial/2.0
http://schemas.opengis.net/samplingSpatial/2.0/spatialSamplingFeature.xsd http://www.opengis.net/sampling/2.0
http://schemas.opengis.net/sampling/2.0/samplingFeature.xsd">
  <sos:featureMember>
    <wml2:MonitoringPoint gml:id="mp_9D10AC8AA1BC0FEC1FBDF17A121EA0CDF35D79E3">
      <gml:identifier codeSpace="http://www.opengis.net/def/nil/OGC/0/unknown">
http://nrfa-ceh2.cloudapp.net:8080/52n-sos-dev/featureOfInterest/21003</gml:identifier>
      <gml:name codeSpace="http://www.opengis.net/def/nil/OGC/0/unknown">21003</gml:name>
      <sf:sampledFeature xlink:href="http://nrfa-ceh2.cloudapp.net:8080/52n-sos-dev/nrfa/sites"/>
      <sams:shape>
        <ns:Point xmlns:ns="http://www.opengis.net/gml/3.2" ns:id="
point_mp_9D10AC8AA1BC0FEC1FBDF17A121EA0CDF35D79E3">
          <ns:pos srsName="http://www.opengis.net/def/crs/EPSG/0/4326">55.6480068839 -3.18024680097</ns:pos>
        </ns:Point>
      </sams:shape>
    </wml2:MonitoringPoint>
  </sos:featureMember>
</sos:GetFeatureOfInterestResponse>
```


Figure 8: Example of the respond of the *GetFeatureOfInterest* request

A second example of request, for accessing in a particular time period data (2006 complete year) for one gauge station (54001) and the corresponding response is showed in Figure 9, as an example with the headers and one measurement (81.49 m^3/s) at January 1st 2016

```
http://nrfa-ceh.cloudapp.net:8080/52n-sos-dev/service?service=SOS&version=2.0.0&request=GetObservation&featureofinterest=http://nrfa-ceh.cloudapp.net:8080/52n-sos-dev/featureOfInterest/54001&temporalFilter=om%3AphenomenonTime%2C2005-12-31/2006-12-31
```

[2] http://www.ceh.ac.uk

```xml
<sos:GetObservationResponse xmlns:sos="http://www.opengis.net/sos/2.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:om="http://www.opengis.net/om/2.0" xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:wml2="
http://www.opengis.net/waterml/2.0" xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.opengis.net/sos/2.0
http://schemas.opengis.net/sos/2.0/sosGetObservation.xsd http://www.opengis.net/om/2.0
http://schemas.opengis.net/om/2.0/observation.xsd http://www.opengis.net/gml/3.2 http://schemas.opengis.net/gml/3.2.1/gml.xsd
http://www.opengis.net/waterml/2.0 http://schemas.opengis.net/waterml/2.0/waterml2.xsd">
<sos:observationData>
<om:OM_Observation gml:id="o_99925">
<om:phenomenonTime>
<gml:TimePeriod gml:id="phenomenonTime_99925">
</om:phenomenonTime>
<om:resultTime>
<om:procedure>
<om:observedProperty xlink:href="http://nrfa-ceh.cloudapp.net:8080/52n-sos-dev/observableProperty/gaugedDailyFlow"/>
<om:featureOfInterest xlink:href="http://nrfa-ceh.cloudapp.net:8080/52n-sos-dev/featureOfInterest/54001" xlink:title="54001"/>
<om:result>
<wml2:MeasurementTimeseries gml:id="timeseries.99925">
<wml2:metadata>
<wml2:TimeseriesMetadata>
</wml2:metadata>
<wml2:defaultPointMetadata>
<wml2:DefaultTVPMeasurementMetadata>
<wml2:uom code="m3/s"/>
<wml2:interpolationType xlink:href="http://www.opengis.net/def/timeseriesType/WaterML/2.0/continuous" xlink:title="Instantaneous"/>
</wml2:DefaultTVPMeasurementMetadata>
</wml2:defaultPointMetadata>
<wml2:point>
<wml2:MeasurementTVP>
<wml2:time>2006-01-01T00:00:00.000Z</wml2:time>
<wml2:value>81.49</wml2:value>
</wml2:MeasurementTVP>
</wml2:point>
</wml2:MeasurementTimeseries>
</om:result>
</om:OM_Observation>
</sos:observationData>
</sos:GetObservationResponse>
```


Figure 9: Example of request and respond of one of the test SOS services from the NRFA-CEH

4.3. Pub/Sub component

The Publish/Subscribe (1.0) Pub/Sub is an interface specification that aims to bring a mechanism to support publish/subscribe requirements across OGC services, interfaces and data types. This standard defines a common Publish/Subscribe conceptual framework and functionality, independently of specific binding technologies (e.g., KVP, SOAP, REST).
The Pub/Sub RiBaSE component is implemented by 52°North as a REST API based on the recently published core standard. The current development version of the Pub/Sub component is hosted at http://pilot.52north.org/wieu-eventing-rest-api/dev/v1. Some examples for invoking functionalities are shown in Table 2 (all functionalities are detailed in Annex B).

HTTP GET	GetSupscriptions	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/subscriptions
HTTP GET	GetPublications	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/publications
HTTP GET	GetTemplate	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/templates/<templateId>
HTTP PUT	UpdateSubscription	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/subscriptions/<subscriptionId>

Table 2: Selection of the Pub/Sub implemented functionalities

The responses of these requests are mainly JSON or XML files.
The interested user on receiving notifications needs to create a subscription in a specific point of interest (Figure 10) and the selected delivery method is the email:


```
{
   "label":"Test",
   "publicationId":"pip-pub",
   "template":{
      "id":"pointInPolygon",
      "parameters":{
         "coordinates":{
            "value":"60.0 60.0"
         }
      }
   },
   "deliveryMethods":[{
      "id":"email",
      "parameters":{
         "to":{
            "value":"test@test.de"
         }
      }
   }],
   "enabled":true,
   "endOfLife":"2030-06-19T13:22:08.248+02:00"
}
```


Figure 10: JSON file response in the Create Subscription

After the flooding model execution, a subscribed Point of Interested will be notified when it is inside the affected area; for this purpose, a Point in Polygon Pattern Template is created. In next example, the definition attribute of the pattern function is a FES-based filter description that performs a geometric intersect for all subscribed locations on incoming polygons. This FES description contains placeholders for subscribed locations, which get listed in the parameters attribute.

In the developed eventing REST API, there has been implemented an additional endpoint to allow publishing GML polygons in order to perform the point in polygon tests. Once a GML polygon has been pushed to that endpoint (Figure 11), the service automatically checks all subscriptions to that specific publication and triggers the assigned delivery methods for each subscription for which the point in polygon test becomes true.


```
<?xml version="1.0" encoding="UTF-8"?>
<wfs:FeatureCollection                xmlns:wfs="http://www.opengis.net/wfs"
xmlns:gml="http://www.opengis.net/gml"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns="http://miramon.uab.cat/wps/appl_schema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/wfs
http://schemas.opengis.net/wfs/1.1.0/wfs.xsd
http://miramon.uab.cat/wps/appl_schemaSevern2006_03_15.xsd" timeStamp="2016-
08-26T10:42:50.381Z" numberOfFeatures="17">
      <gml:boundedBy>
            <gml:Envelope srsName="EPSG:4326">
                  <gml:lowerCorner>-3.701700 51.547156</gml:lowerCorner>
                  <gml:upperCorner>-0.981528 52.965972</gml:upperCorner>
```

```
            </gml:Envelope>
      </gml:boundedBy>
      <gml:featureMember>
            <Inun_rastop23ci66yo8256wn073ku9 gml:id="pol_1">
                  <gml:boundedBy>
                        <gml:Envelope srsName="EPSG:4326">
                              <gml:lowerCorner>-3.701700
51.547156</gml:lowerCorner>
                              <gml:upperCorner>-0.981528
52.965972</gml:upperCorner>
                        </gml:Envelope>
                  </gml:boundedBy>
                  <n_vertexs>179673</n_vertexs>
                  <perimetre>121.950556531</perimetre>
                  <perimetree>7874614.072</perimetree>
                  <area>1.115067661</area>
                  <areae>8460758515.558</areae>
                  <n_arcs>16679</n_arcs>
                  <n_polig>8888</n_polig>
                  <_1>1</_1>
                  <geometry>
…
```


Figure 11: XML Request Body for the POST message that WPS pushes to the end point

4.4. WFS component

The WFS server is hosted in http://62.82.217.38:8080/geoserver/web/. This is a GeoServer 2.9.1 WFS-Transactional service. The aim of this service is offering the output of the WPS in an interoperable way. It means to provide the polygons of the affected areas for the flooding model as features themselves, for more complex analytics purposes than just giving a picture, a map by a WMS service.
The supported operations are showed in Table 3 and Figure 12.

HTTP GET	GetCapabilities	http://62.82.217.38:8080/geoserver/wfs?service=wfs&version=1.1.0&request=GetCapabilities
HTTP GET	DescribeFeatureType	http://62.82.217.38:8080/geoserver/wfs?service=wfs&version=1.1.0&request=DescribeFeatureType
HTTP GET	GetFeature	http://62.82.217.38:8080/geoserver/wfs?service=wfs&version=1.1.0&request=GetFeature&typeName=RiBASE:Scheldt&featureID=Scheldt.18
		http://62.82.217.38:8080/geoserver/wfs?service=wfs&version=1.1.0&request=GetFeature&typeName=Scheldt&propertyName=FLOODED,SAM_DATE
HTTP POST	Insert	http://62.82.217.38:8080/geoserver/wfs

Table 3: Examples of WFS-T implemented functionalities

```xml
<?xml version="1.0" encoding="iso-8859-1" standalone="no"?>
<wfs:Transaction version="1.1.0" service="WFS" xmlns="http://miramon.uab.cat/wps/appl_schema" xmlns:gml="
http://www.opengis.net/gml" xmlns:wfs="http://www.opengis.net/wfs" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/wfs http://schemas.opengis.net/wfs/1.1.0/wfs.xsd">
  <wfs:Insert idgen="UseExisting">
    <wfs:FeatureCollection xsi:schemaLocation="http://miramon.uab.cat/wps/appl_schema
http://www.ogc.uab.cat/cgi-temp/Scheldt2016_06_15.xsd" numberOfFeatures="43">
      <gml:featureMember>
        <Scheldt xmlns="http://miramon.uab.cat/wps/appl_schema" gml:id="pol_1">
          ...
          <flooded>1</flooded>
          <basin>Scheldt</basin>
          <sam_date>2016-06-15T00:00:00.000</sam_date>
          <geometry>
            <gml:MultiPolygon srsName="EPSG:4326">
              <gml:polygonMember>
                <gml:Polygon srsName="EPSG:4326">
                  <gml:exterior>
                    <gml:LinearRing srsName="EPSG:4326">
                      <gml:posList srsDimension="2">3.9919444444 51.1616666711 3.9920035461 51.1618853472
3.9921500000 51.1618722267 3.9921631206 51.1617257728 3.9919444444 51.1616666711</gml:posList>
                    </gml:LinearRing>
                  </gml:exterior>
                </gml:Polygon>
              </gml:polygonMember>
              <gml:polygonMember>
                <gml:Polygon srsName="EPSG:4326">
                  <gml:exterior>
                    <gml:LinearRing srsName="EPSG:4326">
                      <gml:posList srsDimension="2">3.9927777778 51.1622222267 3.9941666667 51.1622222267
3.9941388889 51.1619833378 3.9943055556 51.1619055600 3.9941500000 51.1617388933 3.9933166667 51.1617388933
3.9928368794 51.1619680896 3.9927777778 51.1622222267</gml:posList>
                    </gml:LinearRing>
                  </gml:exterior>
                </gml:Polygon>
              </gml:polygonMember>
              <gml:polygonMember>
                <gml:Polygon srsName="EPSG:4326">
                  <gml:exterior>
                    <gml:LinearRing srsName="EPSG:4326">
                      <gml:posList srsDimension="2">4.0713888889 51.1597222267 4.0711702128 51.1597813283
4.0711833333 51.1599277822 4.0713297872 51.1599409028 4.0713888889 51.1597222267</gml:posList>
                    </gml:LinearRing>
```


Figure 12: Example of the XML file with the INSERT transaction of some polygons to Scheldt affected area

5. Front-end interfaces

5.1. WPS client

As shown in Figure 5, different clients had been developed or reused for this Pilot. Between them, the main one is the WPS client: http://www.ogc.uab.cat/WPS/WaterInneu/client/. The client consists of a map with that includes the three pilot regions with a Digital Elevation Model visualization of each region. Through this client interface and selecting in the legend the region to model, the user builds the right syntax for launching the WPS flood model execution and control the chain of different involved processes. This main client is developed using MiraMon JavaScript libraries, following the previous OGC Web Services implementations (Masó et al 2011) and continuing previous WPS developments (Pesquer et al. 2012).

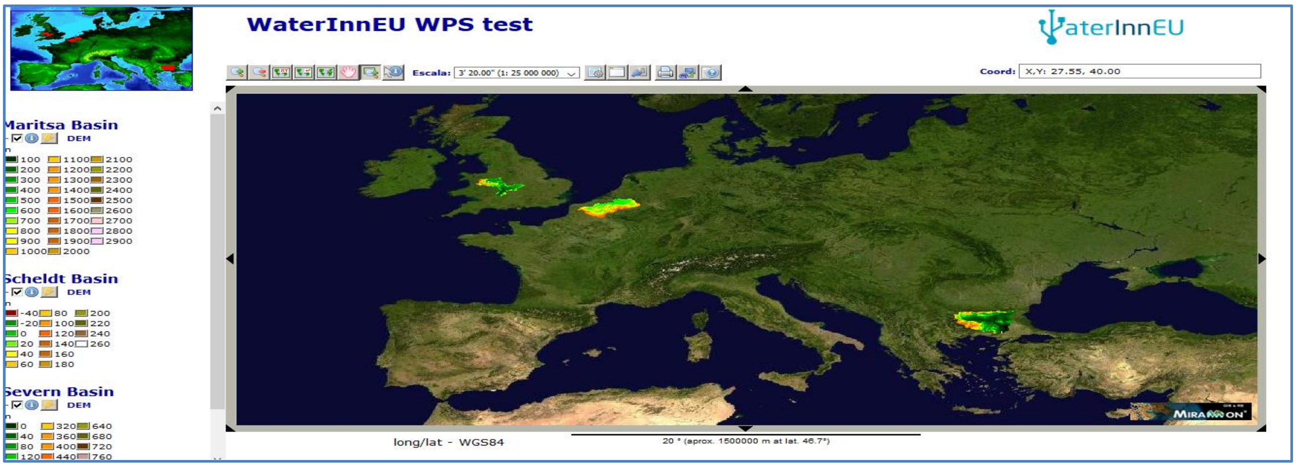


Figure 13: The WPS portal (MiraMon client)

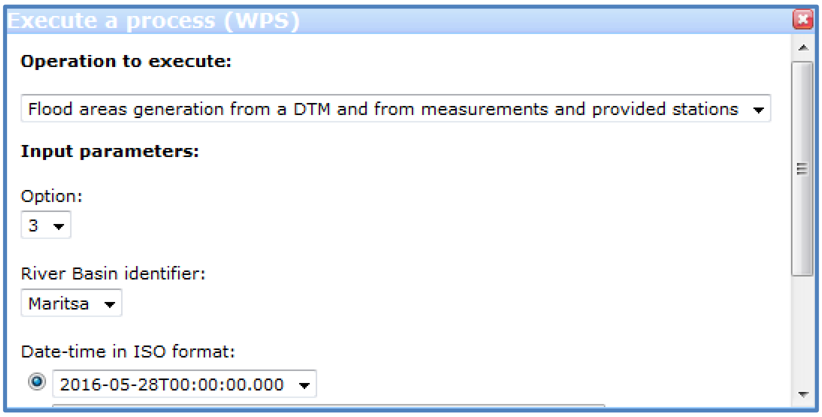


Figure 14: Interface for defining the parameters' execution

A second client (http://geoprocessing.demo.52north.org:8080/wps-js-client/), with different owner (52North) and different programming libraries, has been used in order to test the interoperability of the implemented WPS server. This validation is described in next Interoperability Test section.

5.2. Pub/Sub client

As described in section 4.3, the developed Pub/Sub component performs point in polygon tests for subscribed Point of Interests on affected areas generated by the flooding model. In order to manage subscriptions to this Pub/Sub service, an additional AngularJS-based Web client (https://wieu-eventing.herokuapp.com/) has been developed that allows users to create, delete, and modify subscriptions.

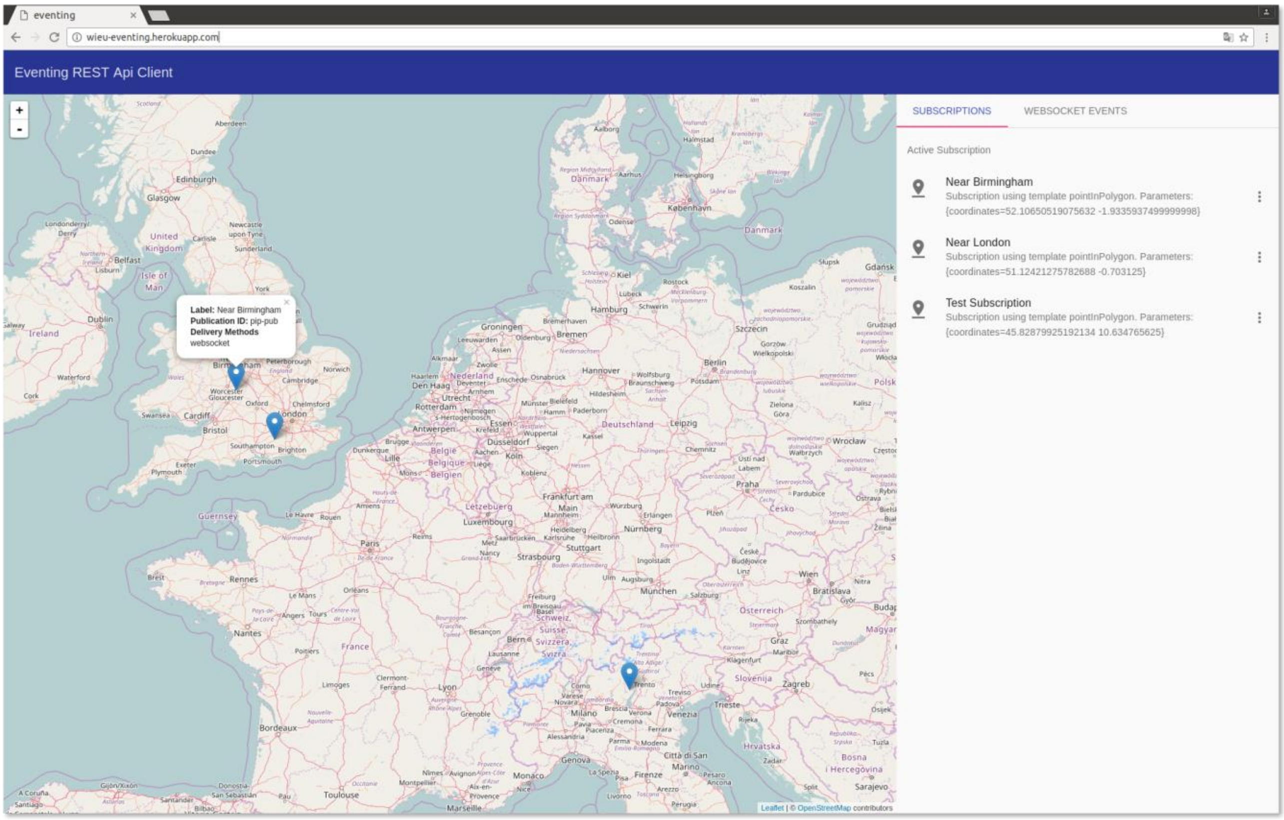


Figure 15: Screenshot of the RiBaSE Subscription Client

The client consists of a map and list representation showing all active subscriptions on the specific publication. A user can add further subscriptions by clicking on the intended location within the map. A dialog opens, as shown in Figure 15, in which the user can set several attributes related to that subscription such as the delivery method and time of expiration. So far, the developed Pub/Sub component described in Section 4.3 provides email and websocket as ready-to-use delivery methods. Each user has to select at least one of this delivery method in the client in order to get notified when a specific subscription gets matched to an incoming flooding surface. Beside of the ordinary management capabilities, the client is also able to receive notifications of triggered events over websockets.

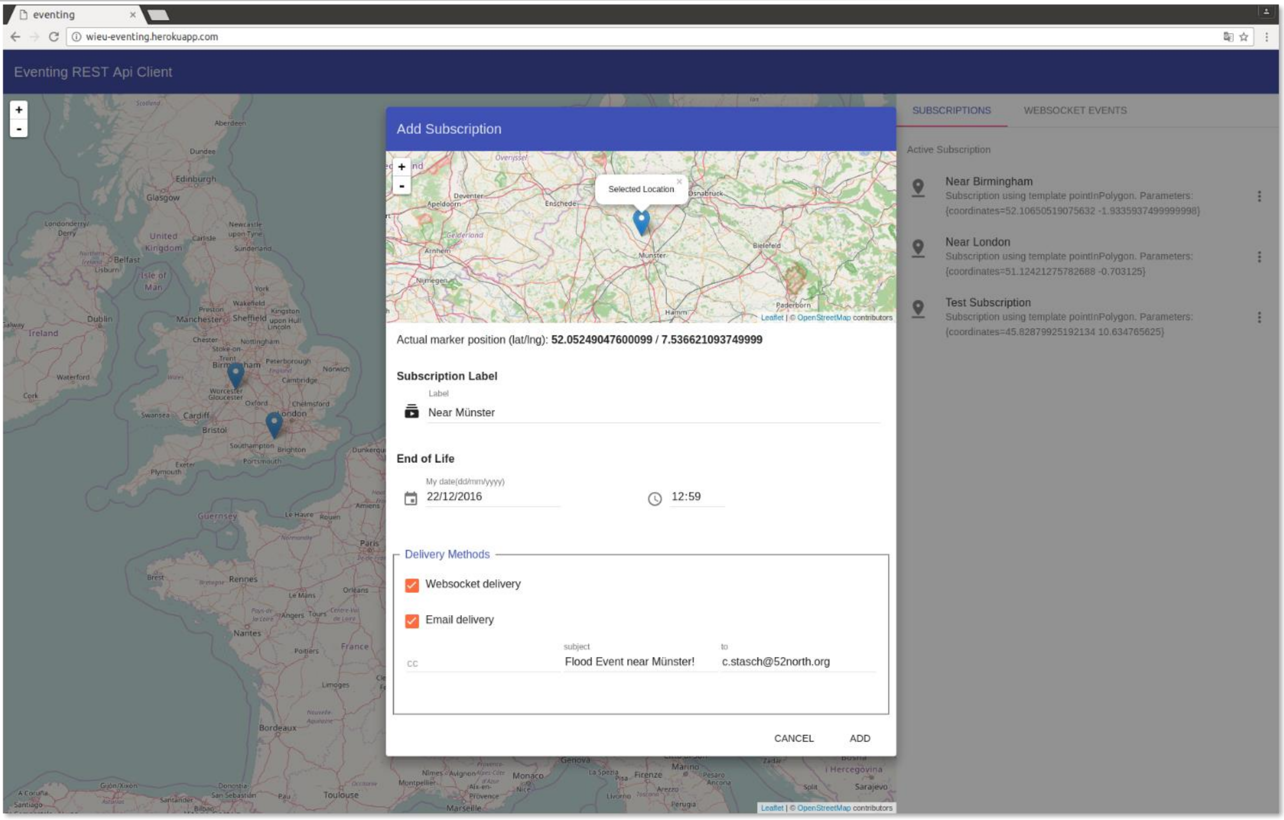


Figure 16: Screenshot of the Add Subscription Form in the Subscription Client

6. Interoperability Test

Since the main client implemented uses the same technology as the WPS Server, we need to add some independent validations.
The second tested client is the 52°North client (http://geoprocessing.demo.52north.org:8080/wps-js-client/). It shows a generic interface, non-adapted to any particular WPS, but has all functionalities for invoking other WPS services that follow the standard specifications (Schut 2007) so this absolutely useful for these interoperability purposes.

This generic client needs a previous configuration (see Figure 17) and these tests include all WPS requests of the Table 1 (two examples in Figure 18).

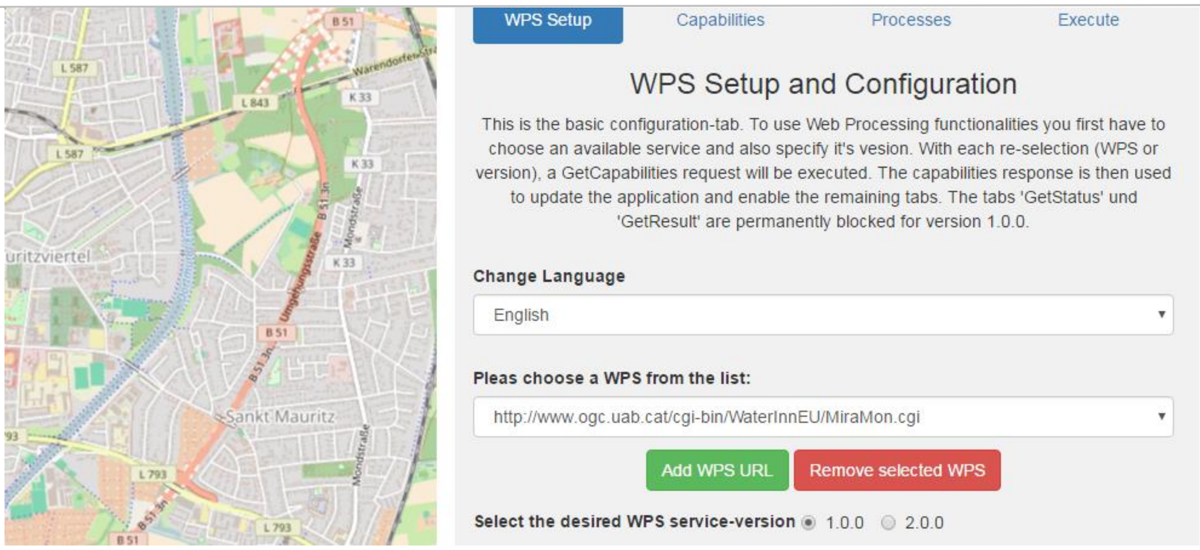


Figure 17: 52North generic WPS client configuration

All functionalities of Table 1 has been successful tested, in particular for the *Execute* a set of different executions with different parameters as river basin, data, additional SHP output, has been tested and verified. Figure 18 shows some examples of the interface for the corresponding requests.

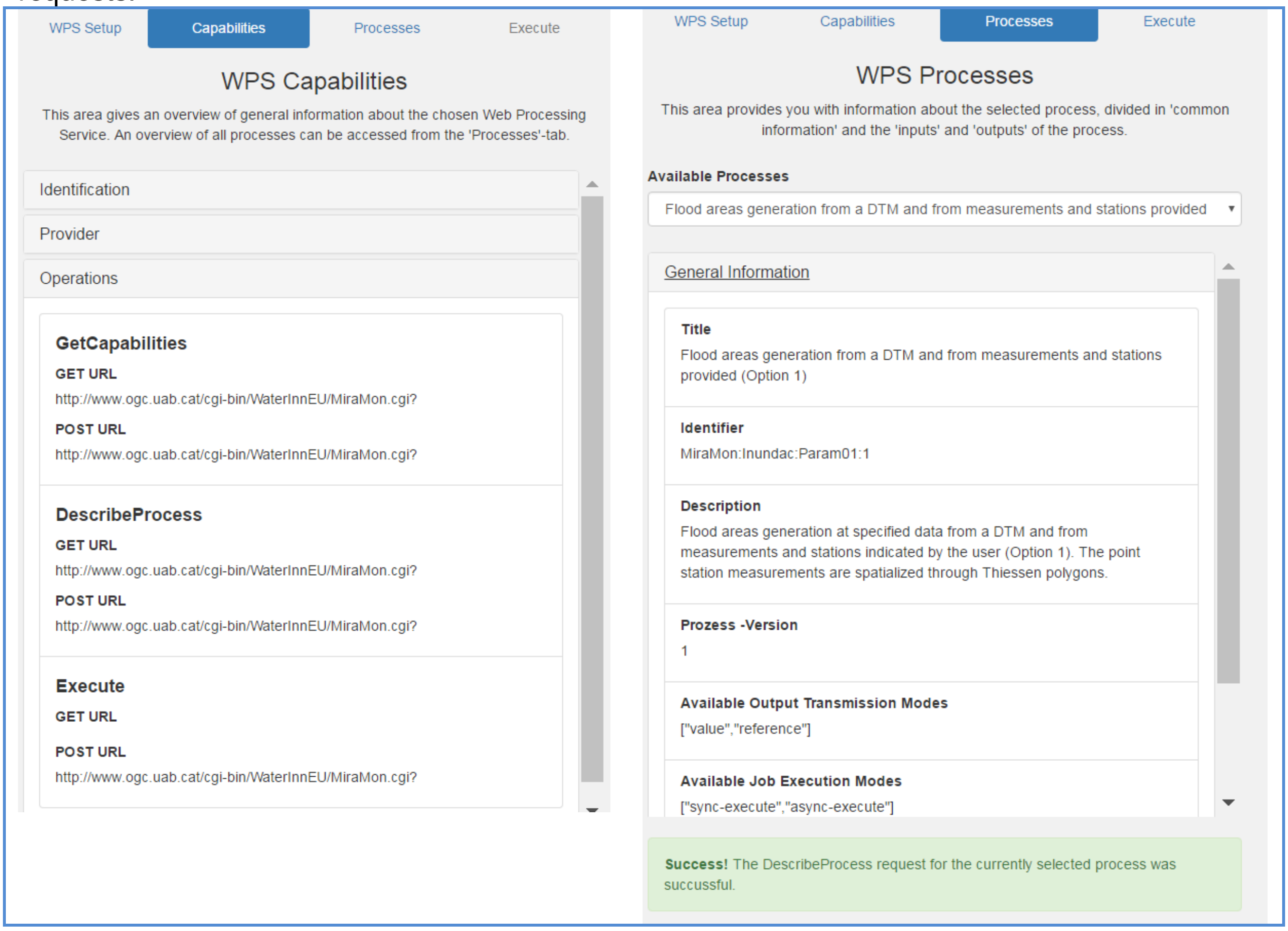


Figure 18: Standard requests in the 52North WPS client: *GetCapabilities* and *DescribeProcess*

7. Case studies

The model has been deployed in three different case studies: Scheldt, Maritsa and Severn. Scheldt and Maritsa are also case studies of the whole WaterInnEU project and Severn is and additional and very interesting case study for testing the SOS integration. In terms of hydrological characteristics, the three cases studies have relevant differences, nevertheless, this pilot is not focused on flooding modelling; as explained in next subsections, the three cases studies are three different ways to integrate in-situ data measurements in WaterML format.

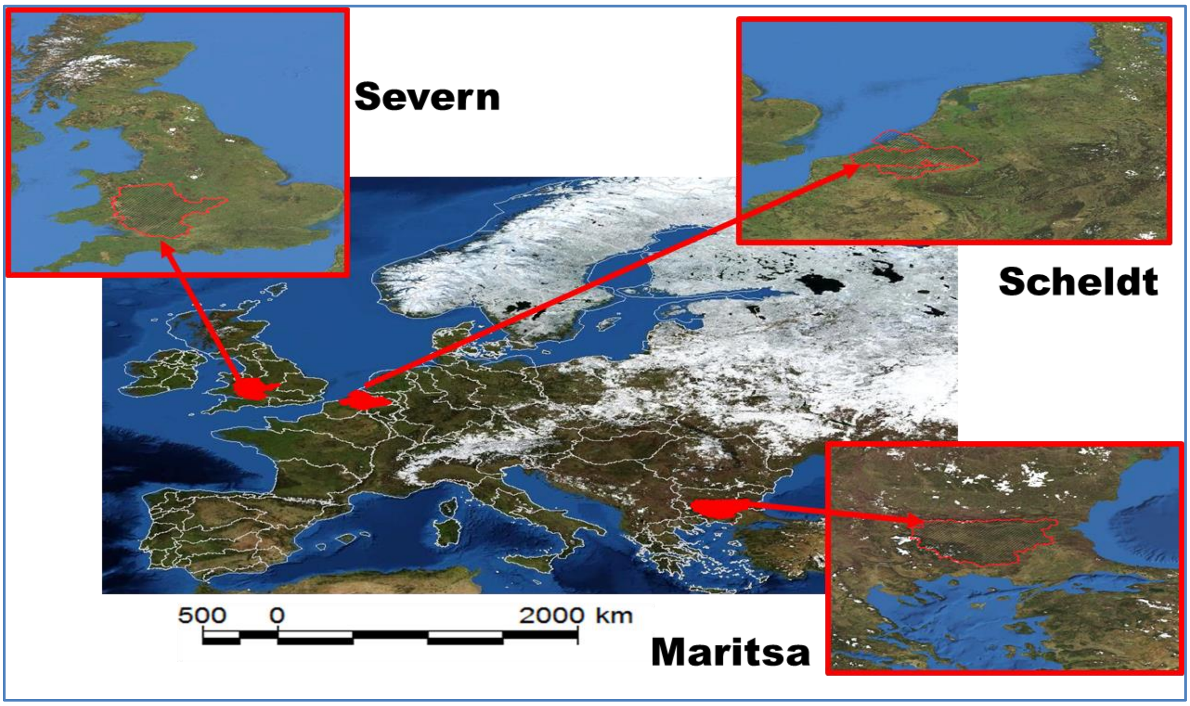


Figure 19: Map location of the pilot river basins

7.1. Maritsa

Maritsa is the largest river in Balkan Peninsula. The total watershed is 53,000 km2 shared by Bulgaria, Greece and Turkey. It has its origin in two Maritsa Lakes in Rila Mountain at 2,378 m above sea level in Bulgaria. Water scarcity in all region and flood risk in lower parts of the basin is high, these flooding event cause important economic damages.
The hydrological dataset has been provided by the Global Water Partnership Central and Eastern Europe, thanks to an agreement with the National Institute of Meteorology and Hydrology (Bulgaria)[3] and East Aegean River Basin Directorate. This database is not a standard format, it is an ESRI Geodatabase and there is not any existing service, in consequence, it will not be allowed to automatically update it with future data. Nevertheless, this hydrological geodatabase is useful for this Pilot and it allows executing the WPS model, replacing the SOS component by a reading process of the corresponding SHP + WaterML files with the time series of hydrological content in the Geodatabase.

[3] http://www.meteo.bg/en

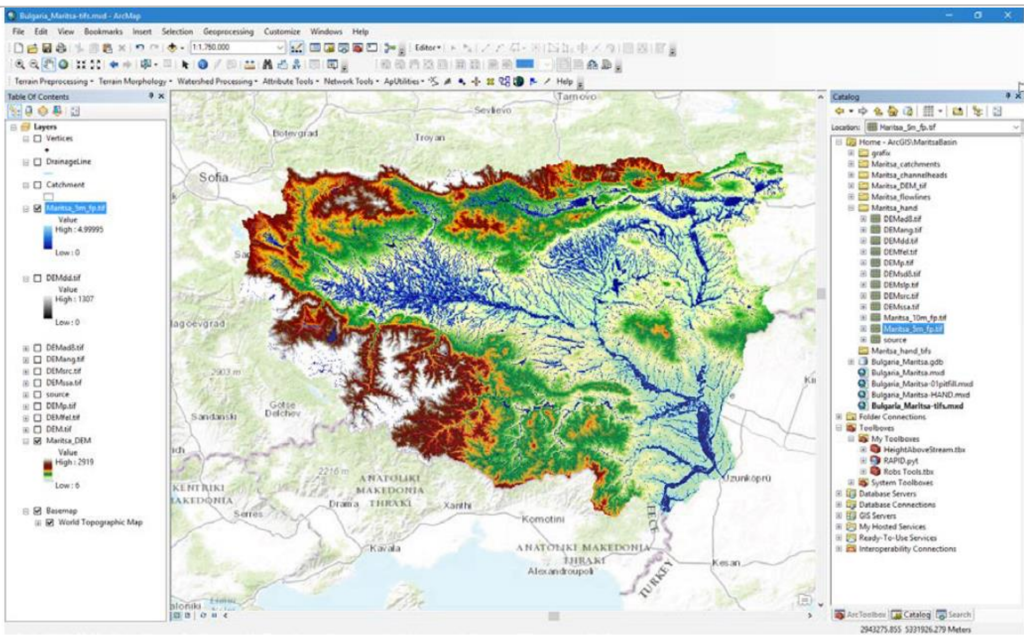


Figure 20: Maritsa Digital Elevation Model and example of affected area (blue region) in ArcMap visualization.

7.2. Scheldt

The Scheldt is the main river in the international Scheldt River basin district (ISRBD). The Scheldt District covers a surface of 36,416 km², which makes it one of the smaller European river basin districts but also one of Europe's most densely populated and most industrialised river basin districts. The well is located on the Saint-Quentin plateau, at 95 m above sea level. The Scheldt then flows through Wallonia, Flanders and the Netherlands, and discharges in the North Sea at Flushing. The river is 350 km long and large sections have been canalized.

The hydrological dataset has been provided by the Flemish Water Management in WaterML 2.0 format. The way for accessing this data as an automatic process is not based on an OGC interoperable service. It means that a manually downloading process from the WaterInfo portal[4] (see Figure 21) is needed in order to integrate this database to the present interoperable architecture. In this case, the WPS execution must to get to access to an internal repository, where a collection of WaterML files, one for each measurement station, contains all time period of existing data.

[4] http://www.waterinfo.be/

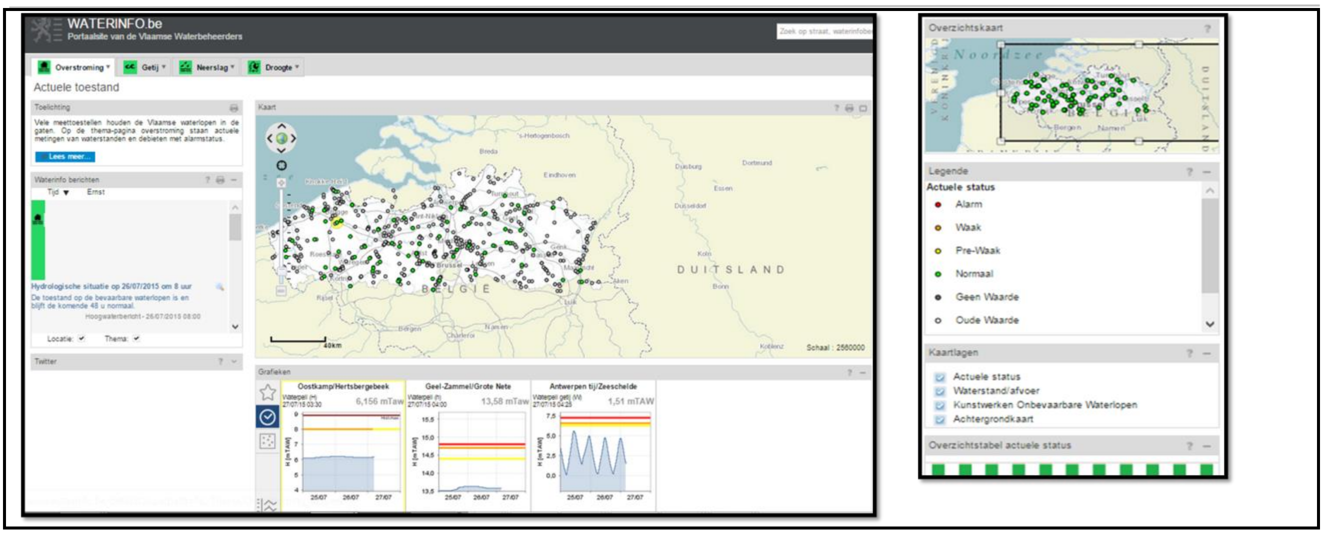


Figure 21: Interface of the WaterInfo Portal

As explained in the section 4, the hydrological model generates a polygon layer of the affected area; Figure 22 shows the polygons over the Digital Elevation Model in a sub region of Scheldt.

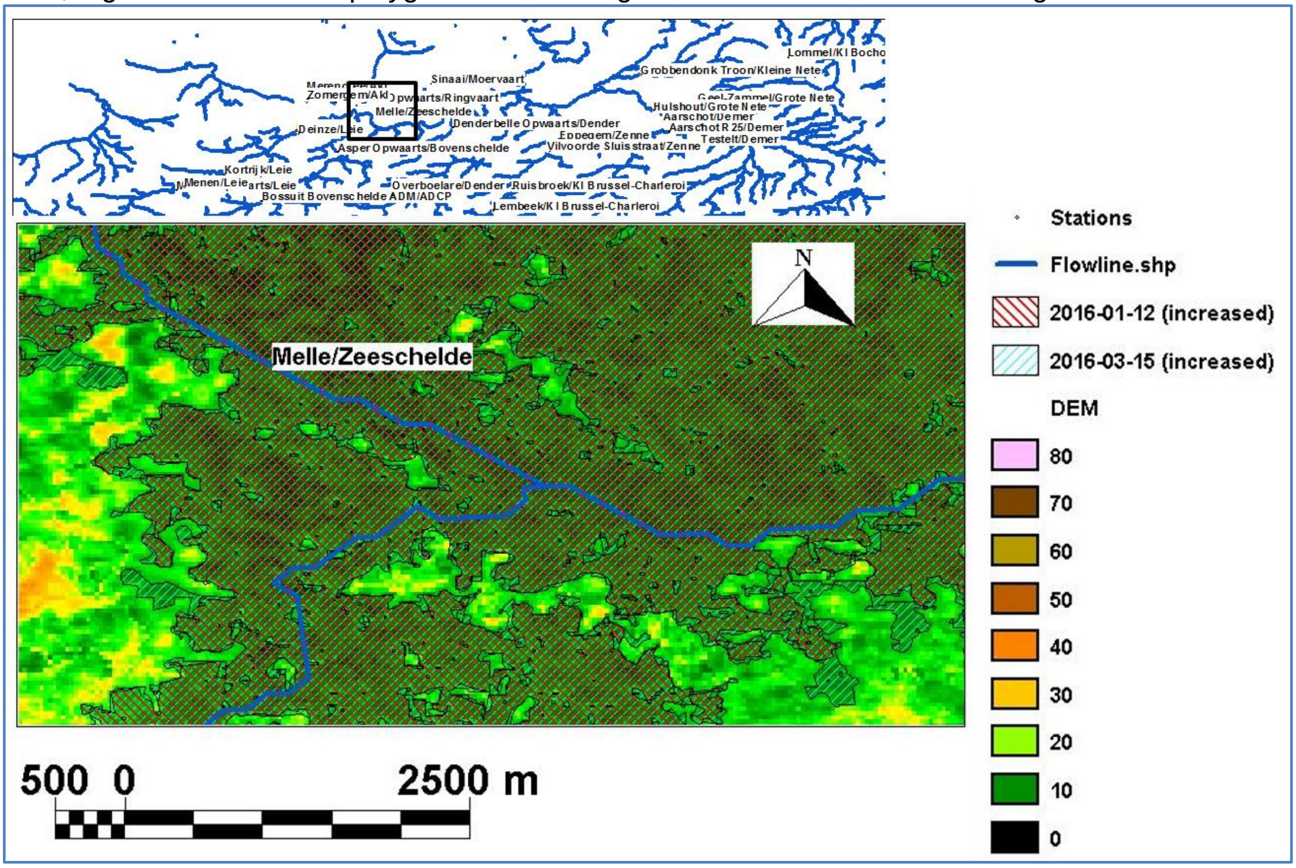


Figure 22: Affected area in two different dates for simulated (increased) measurements.

7.3. Severn

The Severn rises on the northeastern slopes of Plynlimon (Wales) and follows to the Bristol Channel and the Atlantic Ocean. It is the longest river in the United Kingdom, at about 354 km and its drainage basin area is 11266 km^2.

The hydrological dataset is provided by the National River Flow Archive (NRFA) through a SOS hosted in the Centre for Ecology & Hydrology (CEH). The CEH-NRFA allows to visualize and query these data by a portal (Figure 23: Portal of CEH-NRFA), but in this pilot the SOS component is used. The service detailed in section 4.2 SOS component allows to remotely access to this data in an interoperable way. The system access to the dataset through a loop of instructions showed in Figure 9 for all active gauge stations (features of interest). Considering that the Severn dataset and service are maintaining for the Centre provider and they are updating with current measurements, this case study is available for real-time scenarios.

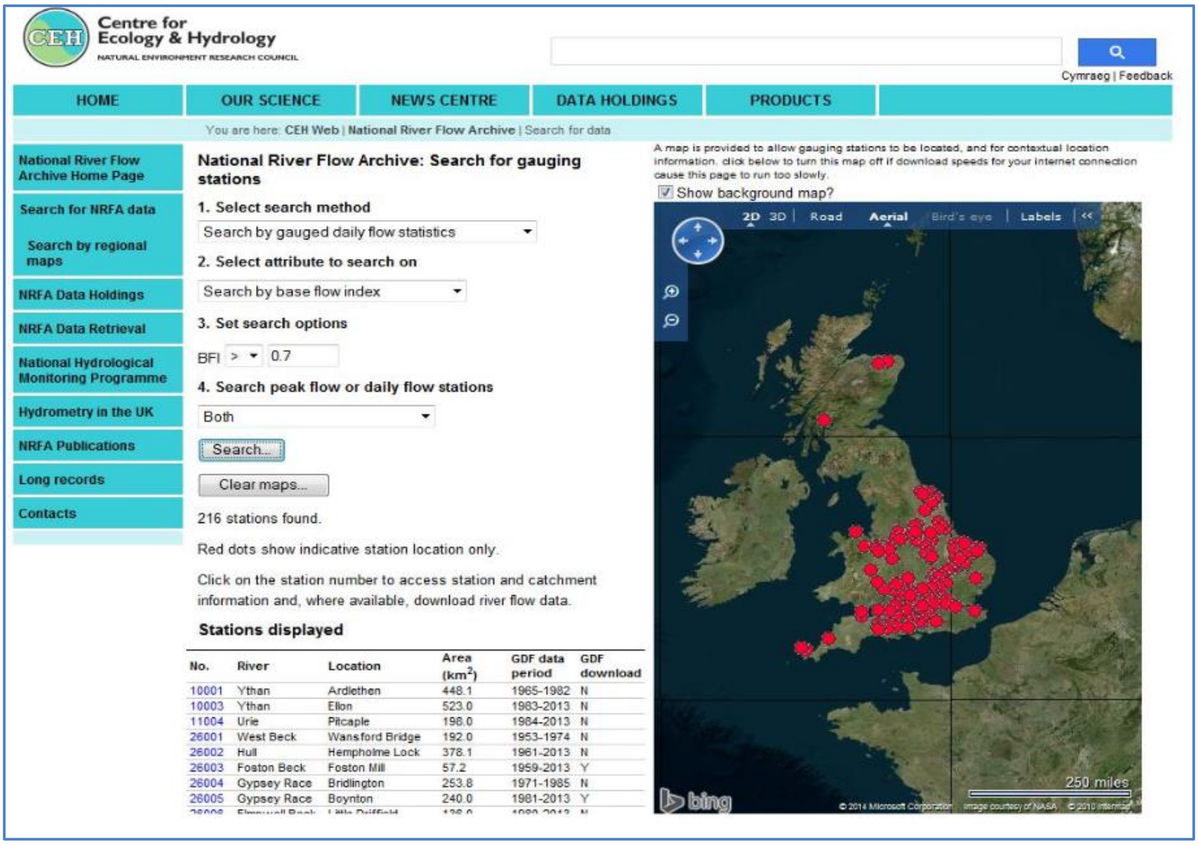


Figure 23: Portal of CEH-NRFA

8. Conclusions

A Pilot for integrating specific water domain standards (WaterML) and generic measurement services (SOS) into general geospatial standards (WPS, WFS) is designed, implemented and tested in three heterogeneous study regions: Maritza, Scheldt and Severn.

An additional alerting Pub/Sub service is integrated and it represents an interoperable solution for providing automated notifications for Points-of-interest in a flooding scenario.

The core of the present design is a WPS service that is the responsible for launching and chaining all involved processes. The corresponding WPS client is the front-end portal for a potential user in a decision-making framework.

The SOS service provided by the CEH for the Severn case is the best solution for an operational alert system in a real time scenario, any non-automatic accessing to data is useful more modelling purposes but without the option to automatically chaining to other services and processes.

Finally, this Pilot has generate interesting recommendations for future works in this standardization and interoperable goals; they are detailed in D5.4 Interoperability recommendations report.

9. Acknowledgment

To all contributors of RiBaSE detailed in Annex A, in different levels of contributions: developers, advisors, data providers, etc. should do a special mention to the Professor David Arctur (University of Texas at Austin).

10. Bibliography

Blower J.D., Masó J, Díaz D, Roberts C.J., Griffiths G.H., Lewis J.P., Yang X., Pons X. (2015) Communicating Thematic Data Quality with Web Map Services. *International Journal of Geo-Information* 4(4): 1965-1981. DOI: 10.3390/ijgi4041965.

Castronova, A.M. Goodall, J.L.., Elag, M.M. (2013) Models as web services using the Open Geospatial Consortium (OGC) Web Processing Service (WPS) standard. *Environmental Modelling and Software* Volume 41,, Pages 72-83

Ferrando I., Federici B., Sguerso D., Marzocch R. (2015) The r.inund.fluv tool for flood-prone areas evaluation in GRASS GIS: application to the terminal reach of Magra River, *Geomatics Workbooks* n° 12, FOSS4G Europe Como 2015.

Nobre A.D., Cuartas L. A., Hodnett M., Rennó C.D., Rodrigues G., Silveira A., Waterloo M. Saleska S. (2011), Height Above the Nearest Drainage – a hydrologically relevant new terrain model, *Journal of Hydrology*, 404(1–2): 13-29.

Masó J., Pomakis K., Julià N. (2011) Web Map Tile Service Standard (WMTS). *OGC 07-057r7*: http://www.opengeospatial.org/standards/wmts.

Pesquer L., Prat E., Díaz-Delgado R., Masó J., Bustamante J., Pons X. (2012) Automatic modelling and continuous map generation from georeferenced species census data in an interoperable GIS environment. *6th International Congress on Environmental Modelling and Software*, Leipzig (Germany).

Pesquer L., Masó J., Stasch C. (2016) River Basin Standards Interoperability Pilot. *Geophysical Research Abstracts* Vol. 18, EGU2016-2835

Pesquer L., Masó J., Stasch C., Jirka S., Arctur D. (2016) RiBaSE: A pilot for testing the web integration of water-related information and models

Pons X., 2000. MiraMon. Geographical Information System and Remote Sensing Software, CREAF. The Internet: http://www.miramon.cat

Reed C., Buehler K., McKee L. (2015) OGC consensus: How successful standards are made ISPRS International Journal of Geo-Information, 4 (3), pp. 1693-1706

Schut, P. (2007) OGC Implementation Specification: Web Processing Service (WPS) 1.0.0 (05-007r7) *Open Geospatial Consortium* Inc. Wayland, MA, USA.

WaterInnEU project deliverable (2016) D5.2 European water interoperability experiment request for participation. http://ddd.uab.cat/record/145183

WaterInnEU project deliverable (2016) D5.4 Interoperability recommendations report.

WaterInnEU project deliverable (2015) D5.1 Compendium of available standards. http://ddd.uab.cat/record/149981

11. Acronyms

API	Application Programming Interface
CGI	Common Gateway Interface
EGU	European Geosciences Union
EU	European Union
FES	Filter Encoding Standard
HTML	Hyper Text Markup Language
HTTP	Hypertext Transfer Protocol
ICT	Information and Communication Technology
ISO	International Organization for Standardization
INSPIRE	Infrastructure for Spatial Information in Europe
JSON	JavaScript Object Notation
OGC	Open Geospatial Consortium
SOS	Sensor Observation Service
WFD	Water Framework Directive
WFS	Web Feature Service
WMS	Web Map Service
WPS	Web Processing Service
XML	eXtensible Markup Language

Annex A

Attendee list of institutions to the kick-of meeting of the RiBaSE and corresponding role during the development of the pilot.

Institution participant	Reference	Role in RiBaSE
CREAF	http://www.creaf.cat/	Coordinator, analyst and developer in all components
52°North	http://52north.org/	SOS, Pub/Sub analyst and developer, WPS analyst and interoperability advisor
OGC Europe	http://www.opengeospatial.org/ogc/regions/europe	Organizer and interoperability advisor
University of Texas	https://www.jsg.utexas.edu/	Hydrological and interoperability advisor
Eurecat	http://eurecat.org/	Interoperability advisor and WFS developer
CEH	http://www.ceh.ac.uk/	SOS expert, data provider
SUPSI	http://www.supsi.ch/home_en.html	Advisor
Deltares	https://www.deltares.nl	Participant
EIP Water	http://www.eip-water.eu/	Participant
Info-logica	http://www.info-logica.com/index.php	Data provider
OIEau	http://www.oieau.fr/	Participant
TU Delft	http://www.tudelft.nl/en/	Participant
adelphi	https://www.adelphi.de	Participant

Annex B

Actions, functions and corresponding end-points of the standard implemented functionalities for the Pub/Sub component.

HTTP GET	Get DeliveryMethods	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/deliveryMethods
HTTP GET	Get DeliveryMethod	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/deliveryMethods/<methodId>
HTTP GET	GetSupscriptions	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/subscriptions
HTTP GET	Get Subscription	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/subscriptions/<subscriptionId>
HTTP POST	Create Subscription	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/subscriptions
HTTP DELETE	Delete Subscription	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/subscriptions/<subscriptionId>
HTTP PUT	UpdateSubscription	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/subscriptions/<subscriptionId>
HTTP GET	GetPublications	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/publications

HTTP GET	GetPublication	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/publications/<publicationId>
HTTP GET	GetTemplates	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/templates
HTTP GET	GetTemplate	http://pilot.52north.org/wieu-eventing-rest-api/dev/v1/templates/<templateId>