DigLogs

WP5 Pilot implementation

Test Cases
User documentation

5.3.3. Spatial Data Management System

Responsible partner: CFLI (PP1) Involved partners: All			
Version	**Status**	**Date**	**Author**
1.0	Final	30.09.2021	CFLI
Notes:			

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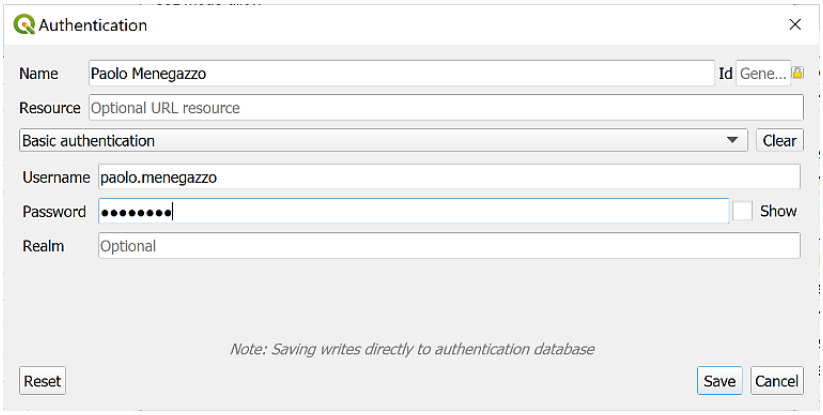
1 Test cases

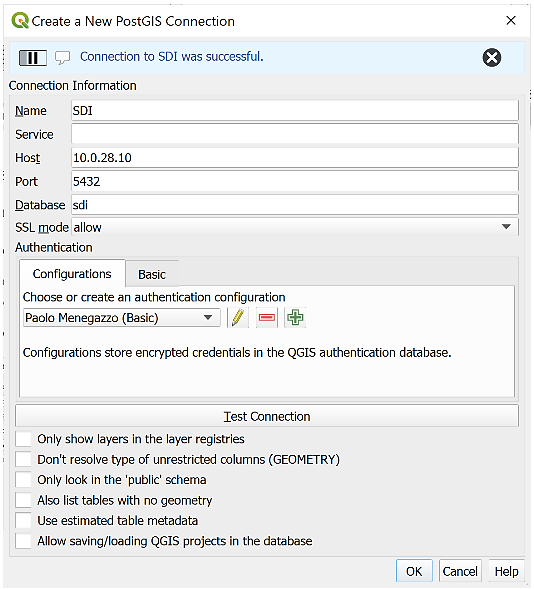
1.1 Environment configuration

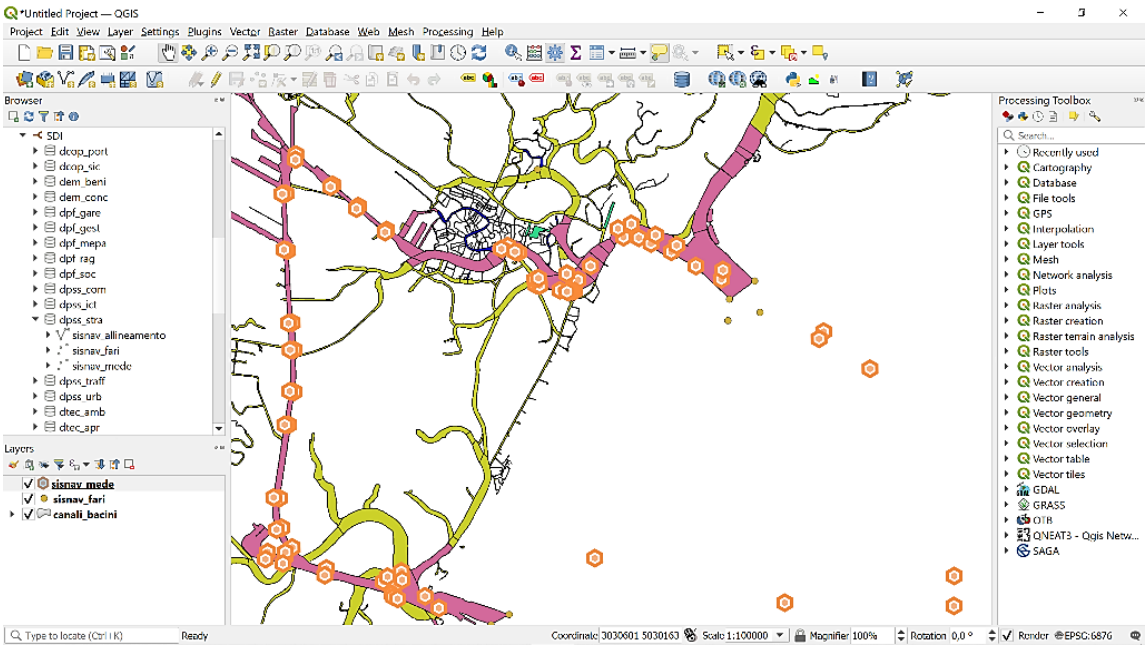
1.1.1 PostGIS connection setup

Function: *establish a connection to PostGIS database from QGIS Desktop using given credentials. Check read/write permissions.*

Result: *passed*



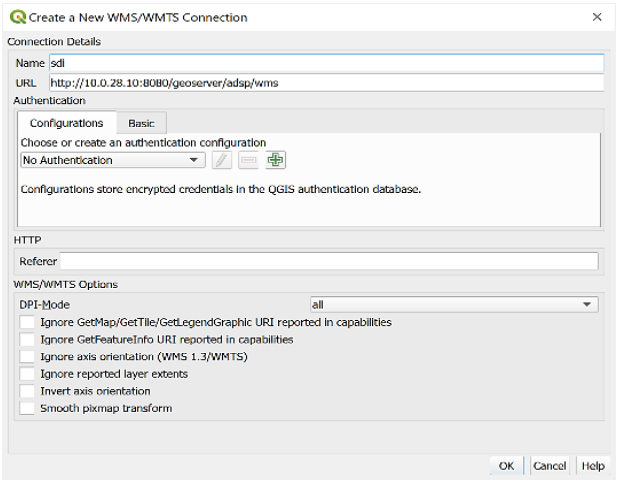


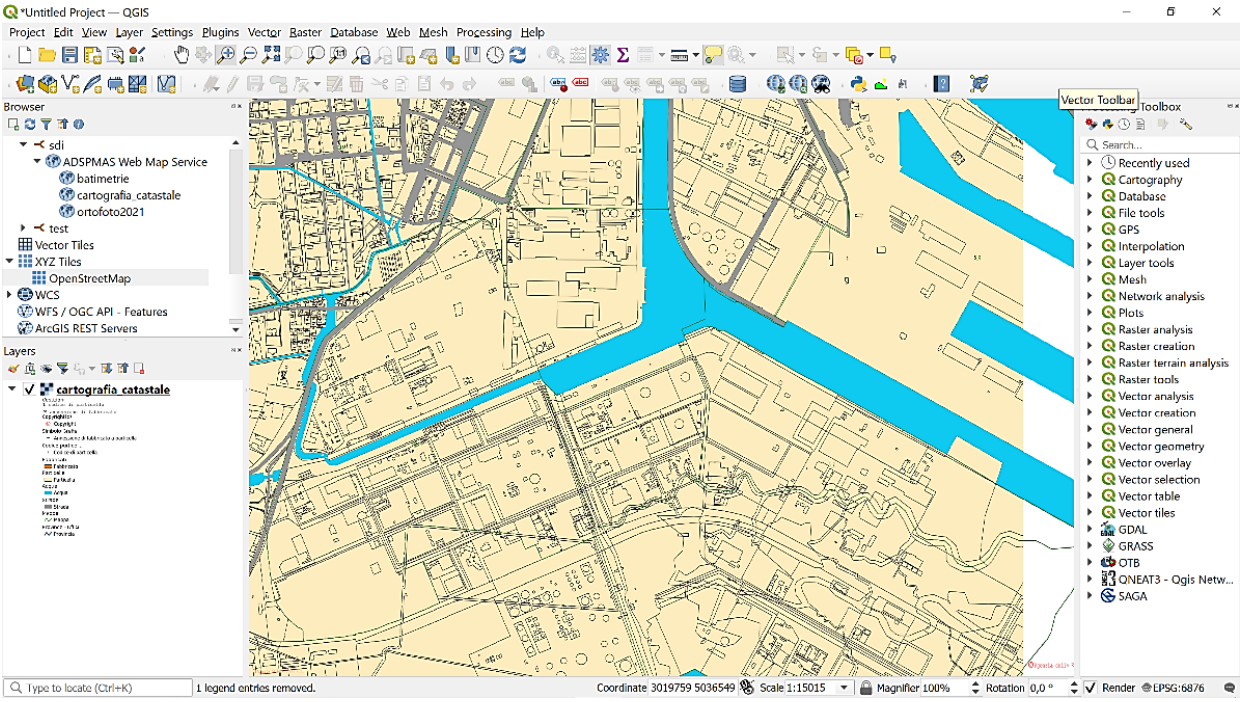


1.1.2 Geoserver WMS connection setup

Function: *establish a connection to Geoserver WMS service from QGIS Desktop.*

Result: *passed*




*Untitled Project — QGIS
Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help
Browser
sdi
ADSPMAS Web Map Service
batimetrie
cartografia_catastale
ortofoto2021
test
Vector Tiles
XYZ Tiles
OpenStreetMap
WCS
WFS / OGC API - Features
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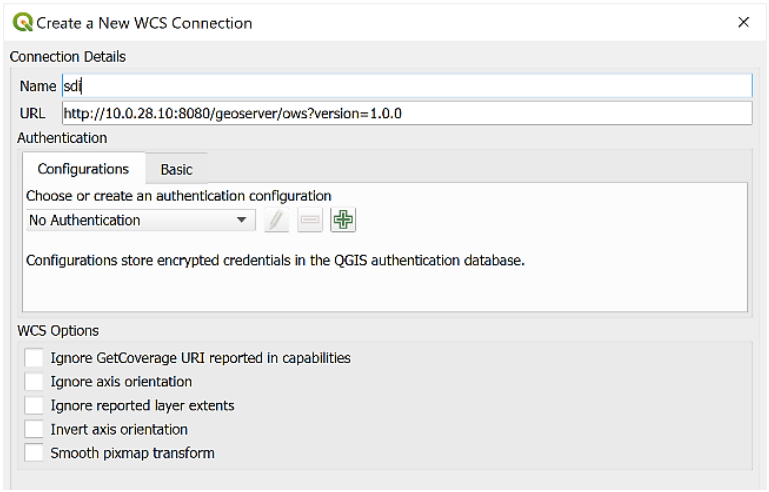
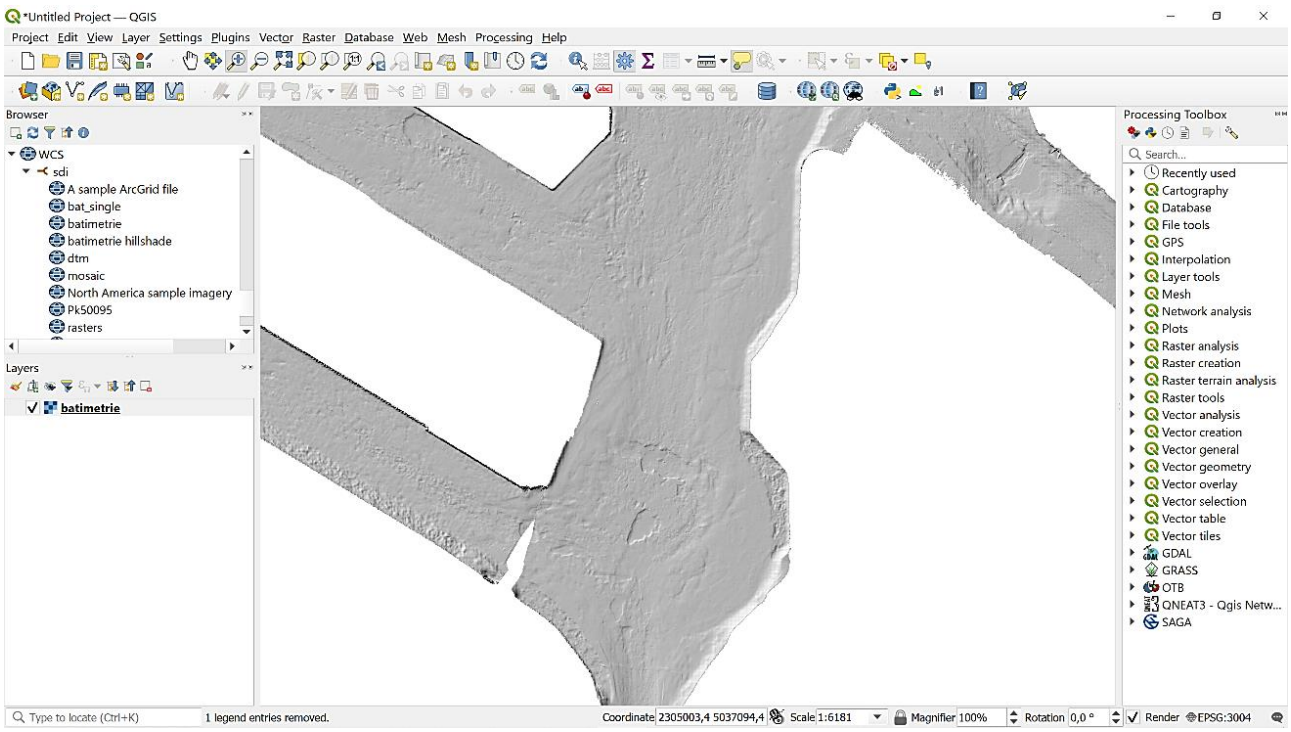
Layers
cartografia_catastale
Vector Toolbar
Toolbox
Search...
Recently used
Cartography
Database
File tools
GPS
Interpolation
Layer tools
Mesh
Network analysis
Plots
Raster analysis
Raster creation
Raster terrain analysis
Raster tools
Vector analysis
Vector creation
Vector general
Vector geometry
Vector overlay
Vector selection
Vector table
Vector tiles
GDAL
GRASS
OTB
QNEAT3 - Qgis Netw...
SAGA
Type to locate (Ctrl+K)
1 legend entries removed.
Coordinate 3019759 5036549
Scale 1:15015
Magnifier 100%
Rotation 0,0 °
Render
EPSG:6876

1.1.3 Geoserver WCS connection setup

Function: *establish a connection to Geoserver WCS service from QGIS Desktop.*

Result: *passed*



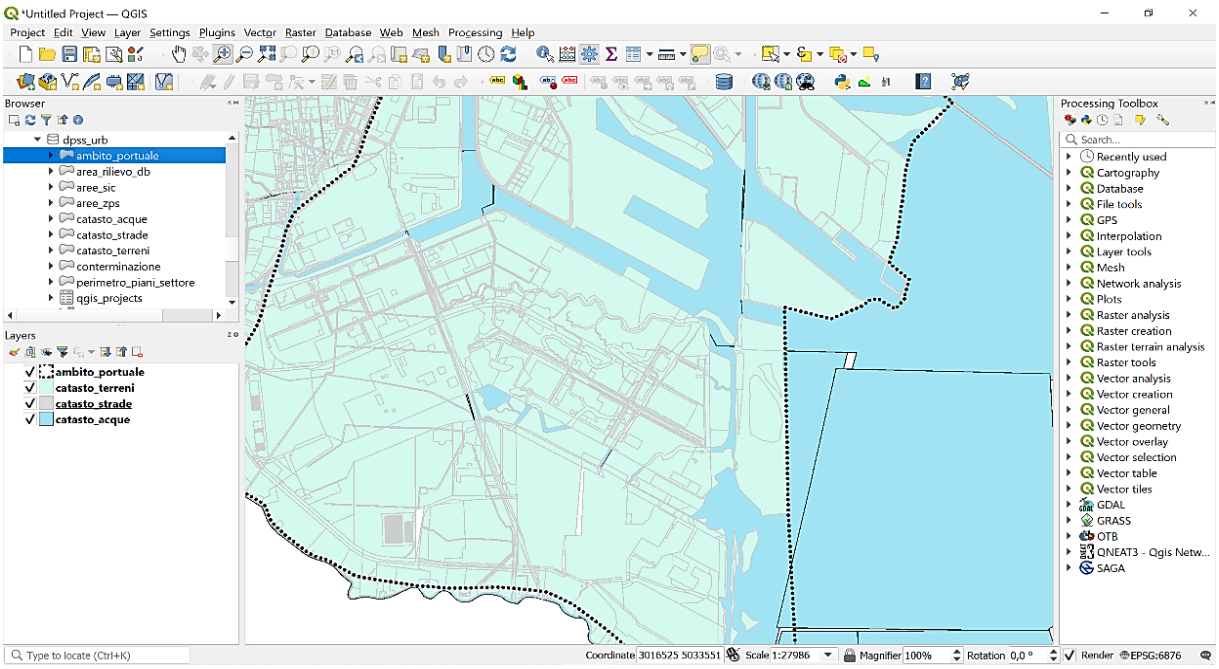


1.2 Vector data access

1.2.1 Layer visualization

Function: *load and visualize vector layer in QGIS Desktop from PostGIS. Check default symbology.*

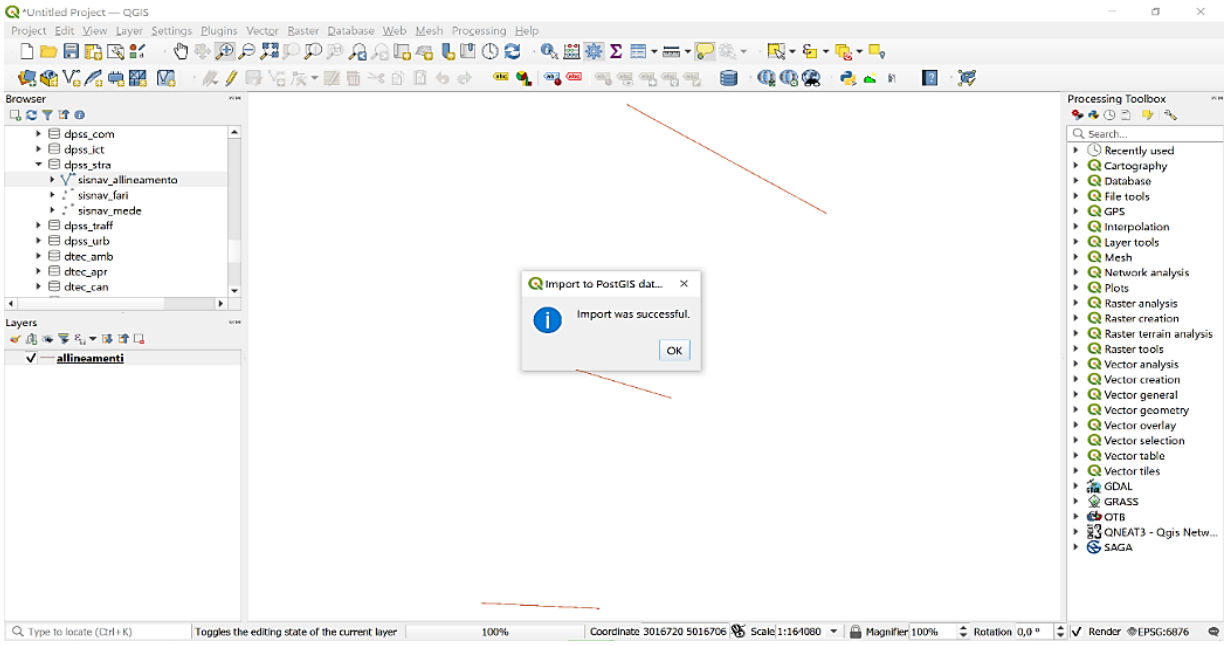
Result: *passed*



1.2.2 Layer import

Function: *load vector layer from QGIS Desktop to PostGIS.*

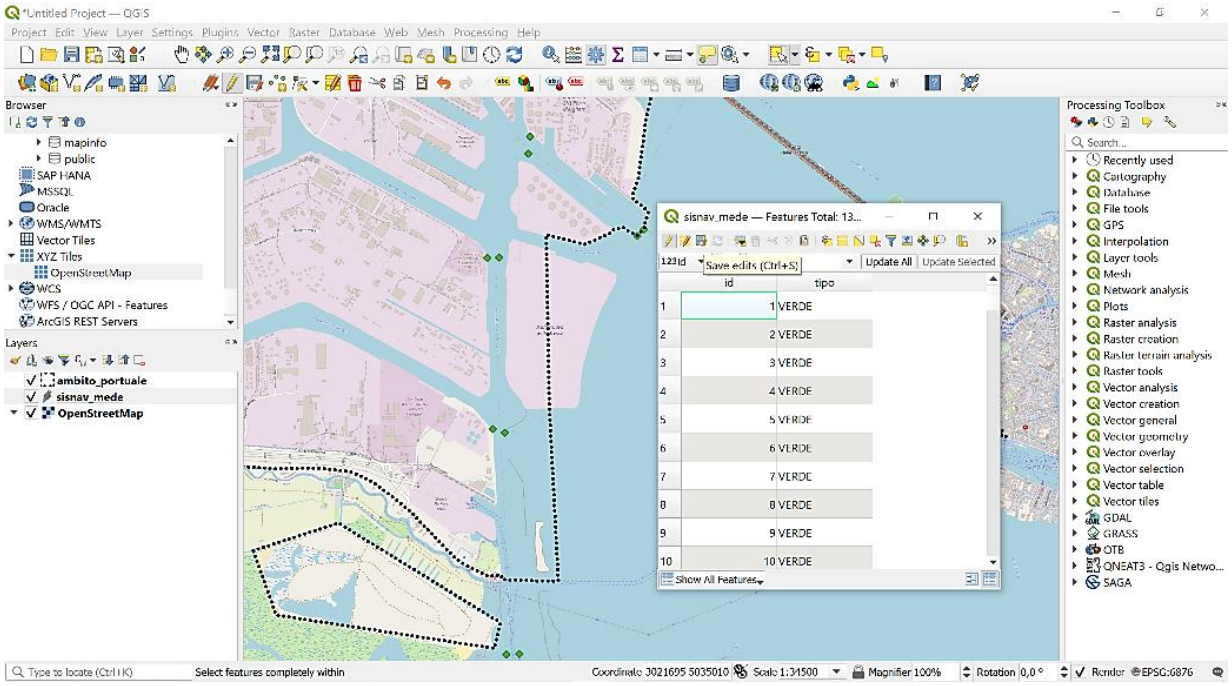
Result: *passed*



1.2.3 Layer editing

Function: *load vector layer from QGIS Desktop to PostGIS.*

Result: *passed*

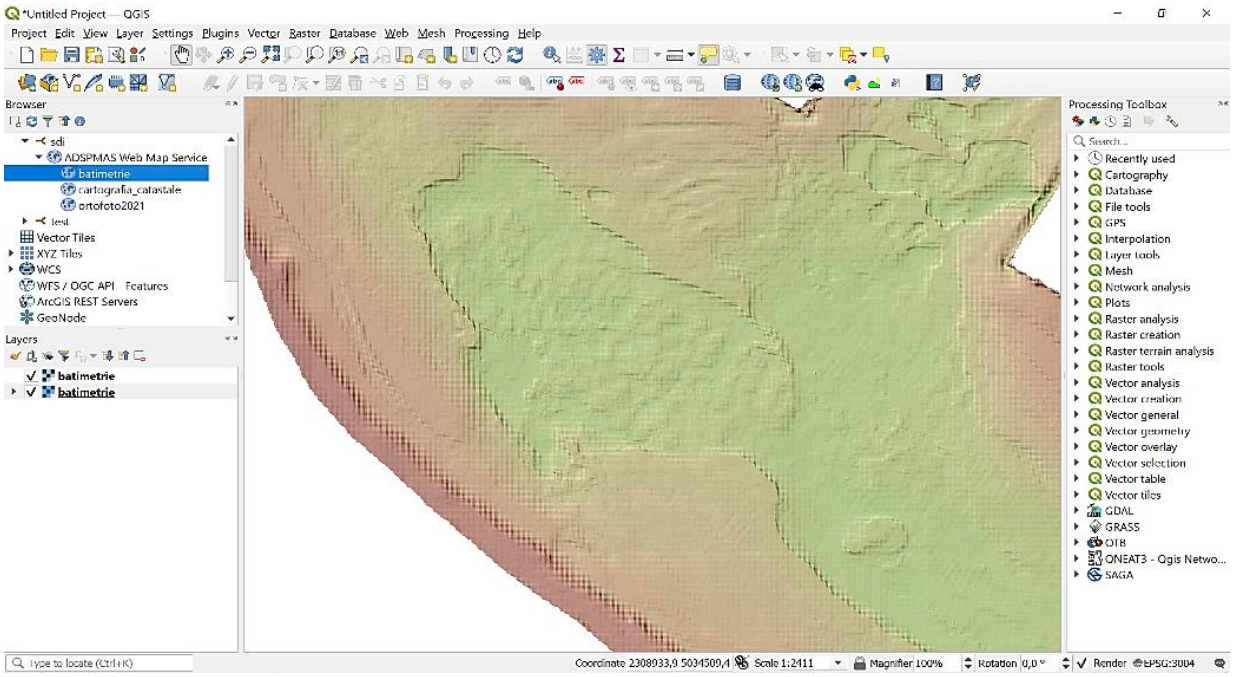


1.3 Web interoperability

1.3.1 WMS layer visualization

Function: *load and visualize WMS layer in QGIS Desktop from Geoserver.*

Result: *passed*

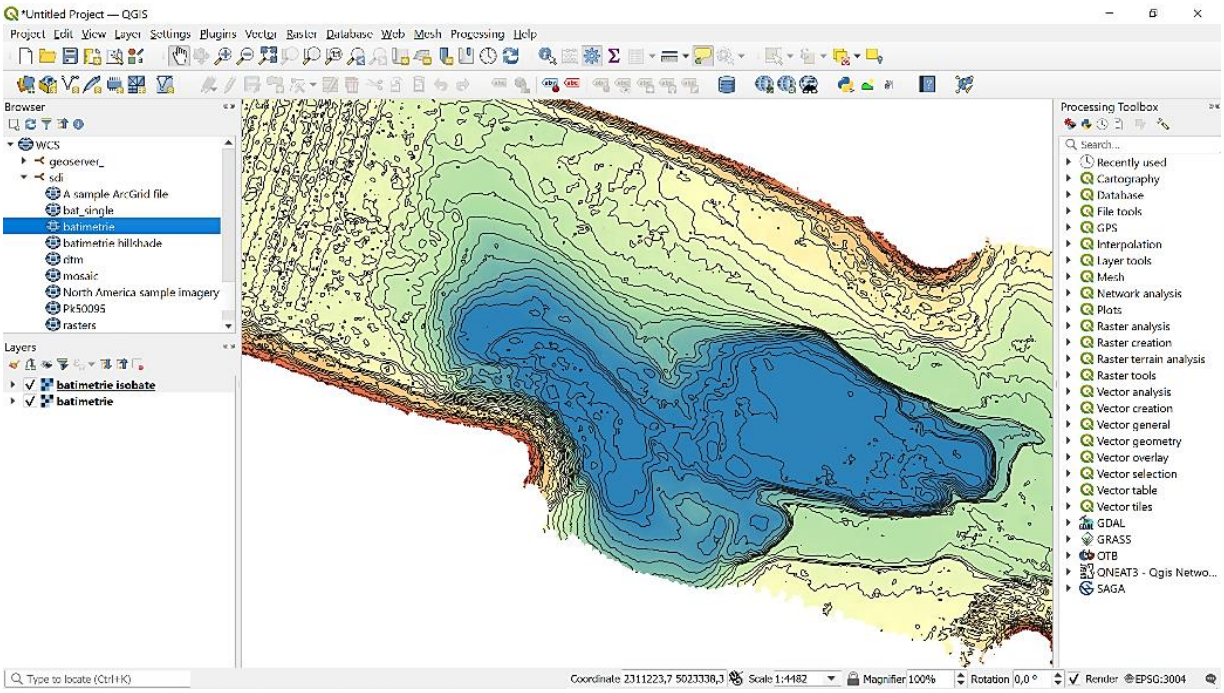


1.4 Raster data access

1.4.1 WCS layer visualization

Function: *load and visualize WCS layer in QGIS Desktop from Geoserver.*

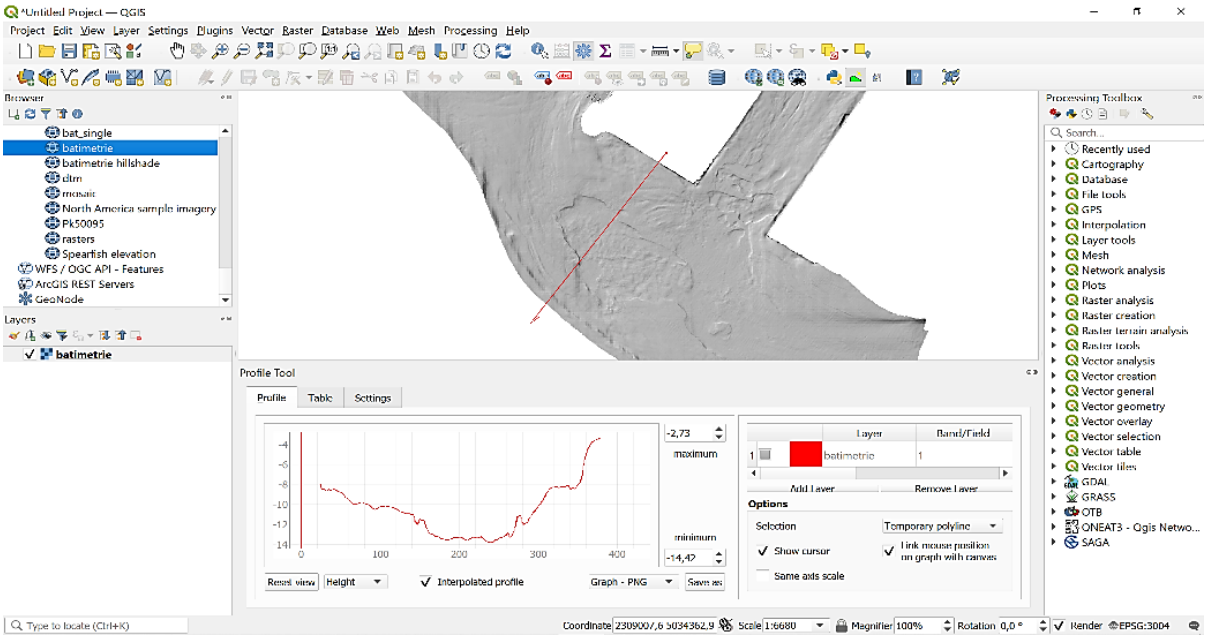
Result: *passed*



1.4.2 WCS layer processing

Function: *load and process WCS data in QGIS Desktop from Geoserver.*

Result: *passed*



1.5 Training program

Function: *training activities scheduling.*

Result: *passed*

DATE	HOURS		DEPARTMENT
15/03/2021	09:00	10:00	DTEC
	10:00	11:00	DTEC
	11:00	12:00	
	12:00	13:00	
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
17/03/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	ICT
	12:00	13:00	ICT
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
26/03/2021	09:00	10:00	DTEC
	10:00	11:00	DTEC
	11:00	12:00	
	12:00	13:00	
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
31/05/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
01/06/2021	09:00	10:00	DTEC
	10:00	11:00	DTEC
	11:00	12:00	DTEC
	12:00	13:00	DTEC
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
20/07/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
27/07/2021	09:00	10:00	ICT
	10:00	11:00	ICT
	11:00	12:00	ICT
	12:00	13:00	
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
28/07/2021	09:00	10:00	DTEC
	10:00	11:00	DTEC
	11:00	12:00	DTEC
	12:00	13:00	DTEC
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
31/08/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	DPSS
	15:00	16:00	DPSS
	16:00	17:00	DPSS
	17:00	18:00	DPSS
16/11/2021	09:00	10:00	DEM
	10:00	11:00	DEM
	11:00	12:00	DEM
	12:00	13:00	DEM
	14:00	15:00	DTEC
	15:00	16:00	DTEC
	16:00	17:00	DPSS
	17:00	18:00	DPSS
18/11/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	DTEC
	12:00	13:00	DTEC
	14:00	15:00	DCOP
	15:00	16:00	DCOP
	16:00	17:00	DPSS
	17:00	18:00	DPSS
22/11/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	DEM
	15:00	16:00	DPSS
	16:00	17:00	DEM
	17:00	18:00	DEM

24/11/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	DEM
	15:00	16:00	DEM
	16:00	17:00	DEM
	17:00	18:00	DCOP
29/11/2021	09:00	10:00	DEM
	10:00	11:00	DEM
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	DEM
	15:00	16:00	DEM
	16:00	17:00	DPSS
	17:00	18:00	DCOP
01/12/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	DTEC
	12:00	13:00	DTEC
	14:00	15:00	DCOP
	15:00	16:00	DCOP
	16:00	17:00	DCOP
	17:00	18:00	
06/12/2021	09:00	10:00	
	10:00	11:00	DEM
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	
10/12/2021	09:00	10:00	DTEC
	10:00	11:00	DTEC
	11:00	12:00	DPSS
	12:00	13:00	DCOP
	14:00	15:00	DCOP
	15:00	16:00	
	16:00	17:00	
	17:00	18:00	

13/12/2021	09:00	10:00	
	10:00	11:00	DCOP
	11:00	12:00	DPSS
	12:00	13:00	DCOP
	14:00	15:00	DTEC
	15:00	16:00	DTEC
	16:00	17:00	DEM
	17:00	18:00	
15/12/2021	09:00	10:00	DTEC
	10:00	11:00	DTEC
	11:00	12:00	DCOP
	12:00	13:00	DCOP
	14:00	15:00	DEM
	15:00	16:00	DEM
	16:00	17:00	DCOP
	17:00	18:00	DCOP
20/12/2021	09:00	10:00	DEM
	10:00	11:00	DEM
	11:00	12:00	DPSS
	12:00	13:00	DEM
	14:00	15:00	DTEC
	15:00	16:00	DTEC
	16:00	17:00	DCOP
	17:00	18:00	DCOP
22/12/2021	09:00	10:00	DEM
	10:00	11:00	DEM
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	DCOP
	15:00	16:00	DCOP
	16:00	17:00	DTEC
	17:00	18:00	
27/12/2021	09:00	10:00	
	10:00	11:00	DEM
	11:00	12:00	DEM
	12:00	13:00	
	14:00	15:00	DEM
	15:00	16:00	DEM
	16:00	17:00	
	17:00	18:00	
28/12/2021	09:00	10:00	DPSS
	10:00	11:00	DPSS
	11:00	12:00	DPSS
	12:00	13:00	DPSS
	14:00	15:00	DTEC
	15:00	16:00	DPSS
	16:00	17:00	DPSS
	17:00	18:00	DPSS

2 User documentation

2.1 Administrators user guide

2.1.1 Geodatabase configuration

2.1.1.1 Grants policy definition and management

The grants policy definition is based on the department organization in Venice Port Authority and includes 5 steps:

- Group roles definition
- Login roles definition
- Read-only privileges setup for “public” schema
- Read-only privileges setup for department schemas
- Full privileges setup for department schemas

Group roles definition

Needed group roles are 18: one with read-only grants and 17 with relative full access to specific department schema.

Actions:

1. **Create a group role for standard users for read-only access.**
    - adsp_users
2. **Create a group role for each department for full access to each schema.**

    NB: group roles names for the pilot have been assigned equal to schema name as following:
    - dcop_port
    - dcop_sic
    - dem_beni
    - dem_conc
    - dpf_gare
    - dpf_gest

- dpf_mepa
- dpf_rag
- dpf_soc
- dpss_com
- dpss_ict
- dpss_stra
- dpss_urb
- dtec_amb
- dtec_apr
- dtec_can

Login roles definition

Login roles are going to be one for each single operator. Each login role will have 2 membership roles: generic role (with read-only grants) and specific department role (with full access grants).

Actions:

1. **Create a login role for each user.**
   Login names can be assigned equal to ones assigned in existing account system or synchronized by a SSO system if available.
   - Standard login user role *[user_name]*
2. **Assign membership roles**
   (can also be done within step 1)
   - Standard group role *[common_role_name]*
   - Department full access group role *[dept_area_role_name]*

Read-only privileges setup for “public” schema

The “public” schema is the default schema, and it will provide read-only access. QGIS projects and layers styles are stored in this schema.

Actions and scripts:

- **Apply grants to existing tables and modify schema default privileges.**
  - ```
    GRANT SELECT ON ALL TABLES IN SCHEMA public TO adsp_users;
    ALTER DEFAULT PRIVILEGES IN SCHEMA public GRANT SELECT ON TABLES TO adsp_users;
    ```

- **Remove write privileges for "PUBLIC" role from schema "public".**

  ```
  REVOKE ALL ON SCHEMA public FROM PUBLIC;
  GRANT USAGE ON SCHEMA public TO PUBLIC;
  ```

- **Set privileges for system PostGIS table "layer_styles".**

  ```
  REVOKE ALL ON TABLE public.layer_styles FROM adsp_users;
  GRANT DELETE, INSERT, SELECT, UPDATE ON TABLE public.layer_styles TO adsp_users;
  REVOKE ALL ON TABLE public.layer_styles FROM PUBLIC;
  GRANT SELECT ON TABLE public.layer_styles TO PUBLIC;
  ```

Read-only privileges setup for department schemas

Each department schema will provide read-only access to users belonging to other departments.

Action and script:

1. **Apply grants to existing tables and modify schema default privileges.**

   Example for dpss_urb schema / group

   - ```
     GRANT SELECT ON ALL TABLES IN SCHEMA dpss_urb TO adsp_users;
     ALTER DEFAULT PRIVILEGES IN SCHEMA dpss_urb GRANT SELECT ON TABLES TO dpss_urb;
     ```

Full privileges setup for department schemas

Each department schema will provide full access to the users they belong to. It is needed to explicitly assign grants to tables, sequences, functions and types.

Action and scripts:

1. **Apply grants to existing tables and modify schema default privileges.**

   Example for dpss_urb schema / group

   - ```
     GRANT ALL ON SCHEMA dpss_urb TO dpss_urb;
     GRANT ALL ON ALL TABLES IN SCHEMA dpss_urb TO dpss_urb;
     ```
     ```

```
GRANT ALL ON ALL SEQUENCES IN SCHEMA dpss_urb TO dpss_urb;
GRANT EXECUTE ON ALL FUNCTIONS IN SCHEMA dpss_urb TO dpss_urb;
ALTER DEFAULT PRIVILEGES IN SCHEMA dpss_urb GRANT ALL ON TABLES TO dpss_urb;
ALTER DEFAULT PRIVILEGES IN SCHEMA dpss_urb GRANT ALL ON SEQUENCES TO dpss_urb;
ALTER DEFAULT PRIVILEGES IN SCHEMA dpss_urb GRANT EXECUTE ON FUNCTIONS TO
dpss_urb;
ALTER DEFAULT PRIVILEGES IN SCHEMA dpss_urb GRANT USAGE ON TYPES TO dpss_urb;
```

Grants automatic assignments Event Trigger

To automatically assign grants to each new table to all group roles members a special event trigger function is needed:

1. **Trigger function.**

- ```
  CREATE FUNCTION public.on_create_table_funct()
      RETURNS event_trigger
      LANGUAGE 'plpgsql'
      COST 100
    VOLATILE NOT LEAKPROOF SECURITY DEFINER
  AS $BODY$

  DECLARE
      sch text;
  BEGIN
  FOR sch IN SELECT nspname FROM pg_namespace WHERE nspname NOT LIKE 'pg%' AND nspname NOT
  LIKE 'information%'
      LOOP
          EXECUTE format($$ GRANT SELECT ON ALL TABLES IN SCHEMA %I TO adsp_users $$, sch);
          EXECUTE format($$ GRANT ALL ON ALL TABLES IN SCHEMA %I TO %I $$, sch, sch);
          EXECUTE format($$ GRANT ALL ON ALL SEQUENCES IN SCHEMA %I TO %I $$, sch, sch);
          EXECUTE format($$ GRANT EXECUTE ON ALL FUNCTIONS IN SCHEMA %I TO %I $$, sch, sch);
      END LOOP;

  END;
  $BODY$;

  ALTER FUNCTION public.on_create_table_funct()
      OWNER TO postgres;

  GRANT EXECUTE ON FUNCTION public.on_create_table_funct() TO postgres;
  GRANT EXECUTE ON FUNCTION public.on_create_table_funct() TO PUBLIC;
  ```

  NB: it is very important to use a SUPERUSER account to create the function and to activate the "SECURITY DEFINER" option in order to allow the function to set permissions over all schemas.
  ```

2. Event Trigger.

- ```
  CREATE EVENT TRIGGER set_grants_on_table_creation ON DDL_COMMAND_END
      WHEN TAG IN ('CREATE TABLE')
      EXECUTE PROCEDURE public.on_create_table_funct();

  ALTER EVENT TRIGGER set_grants_on_table_creation
      OWNER TO postgres;
  ```

2.1.2 Dataset management procedures

2.1.2.1 Bathymetry datasets management

The procedure allows to integrate a new scan file (in TXT or XYZ text format) within the existing bathymetry general DEM WCS web service so that possible parts overlapping already surveyed areas overcome old data values. WCS service in Geoserver is managed by the ImageMosaic plugin that allows to visualize and process sets of raster files as if they were a single layer without physically merge them into a single huge raster file.

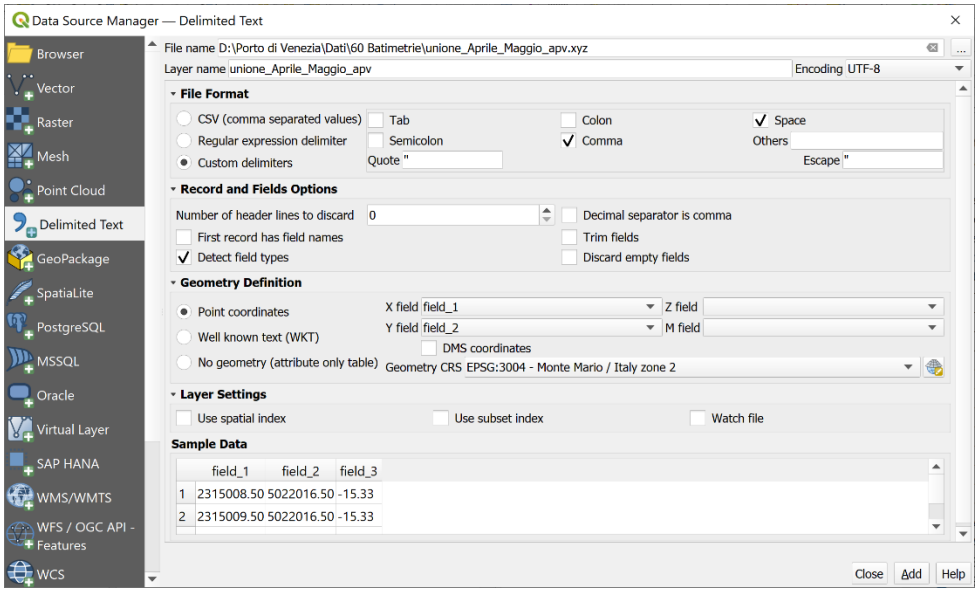
The processing stages are actually 3:

a. **Rasterization** of the new vector scan file
b. Assigning the **file name** according to a “date-based” protocol and place it into the data folder
c. **Update the Geoserver** ImageMosaic data store configuration

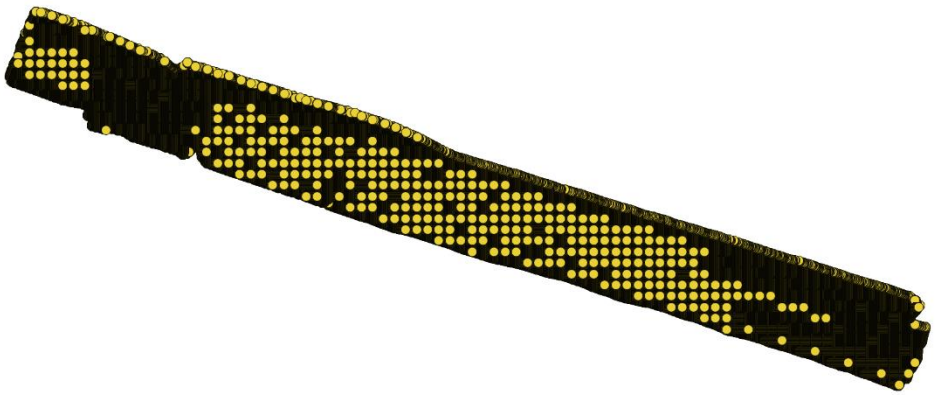
Data conversion procedure

1) open the XYZ point cloud file using the Data Source Manager - Delimited text dialogue box
    - check column delimiter character (usually it is the comma)
    - ensure the point is the decimal separator (deselect decimal separator is comma)
  ```

- set first column as X field and second column as Y field (do not set Z and M fields)

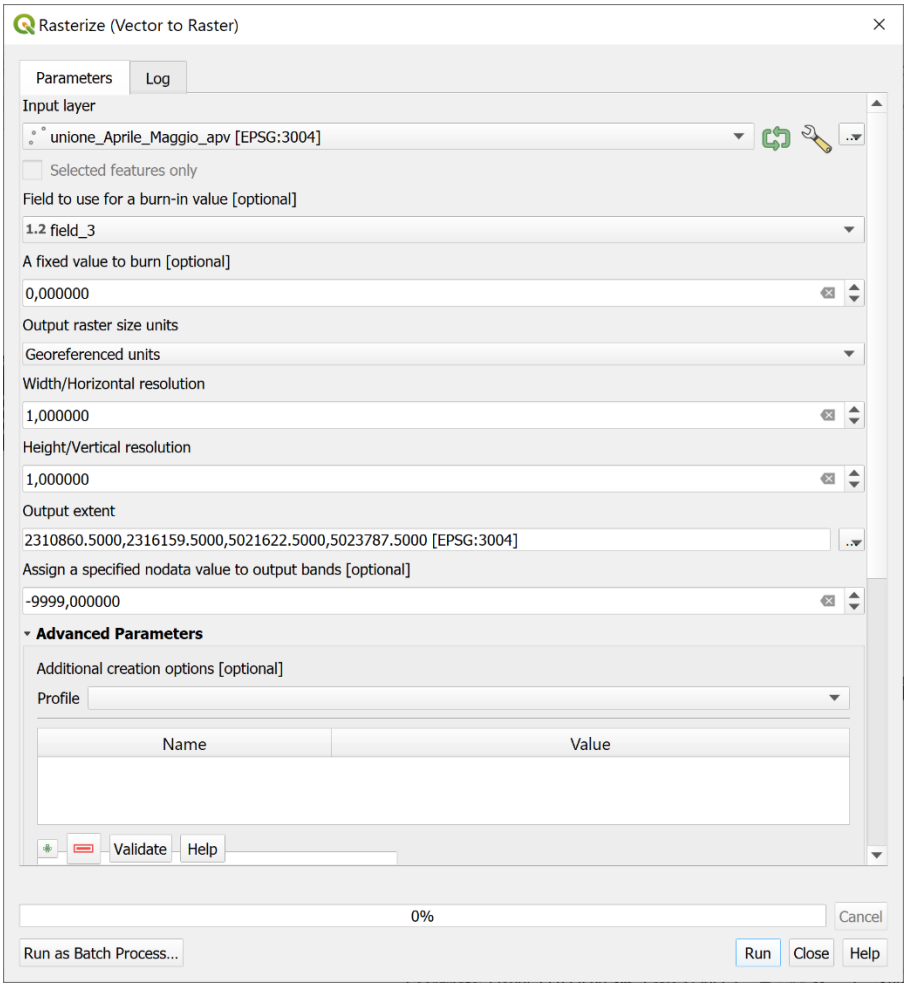


2) save the file in the SHP format
   - deselect the first two output fields as they aren't needed but keep the third one that contains the elevation value (usually QGIS gives it the name "field_3")

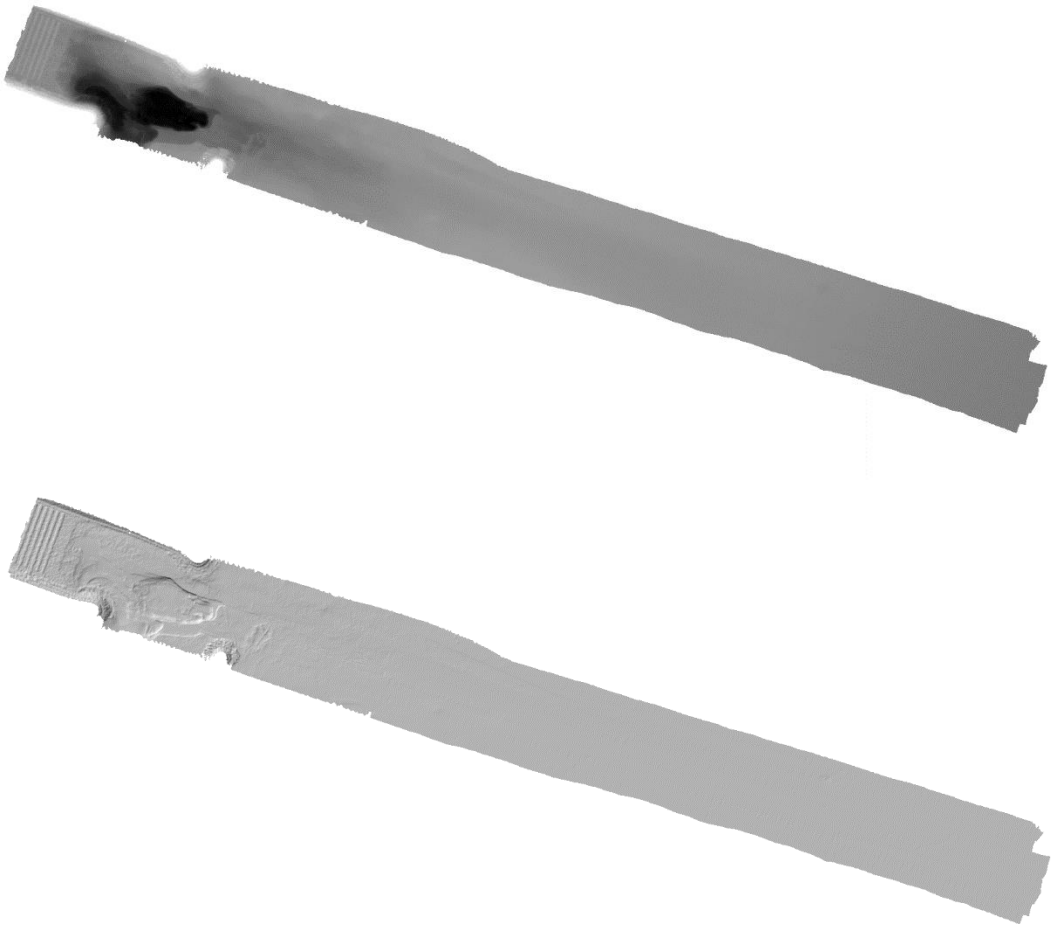


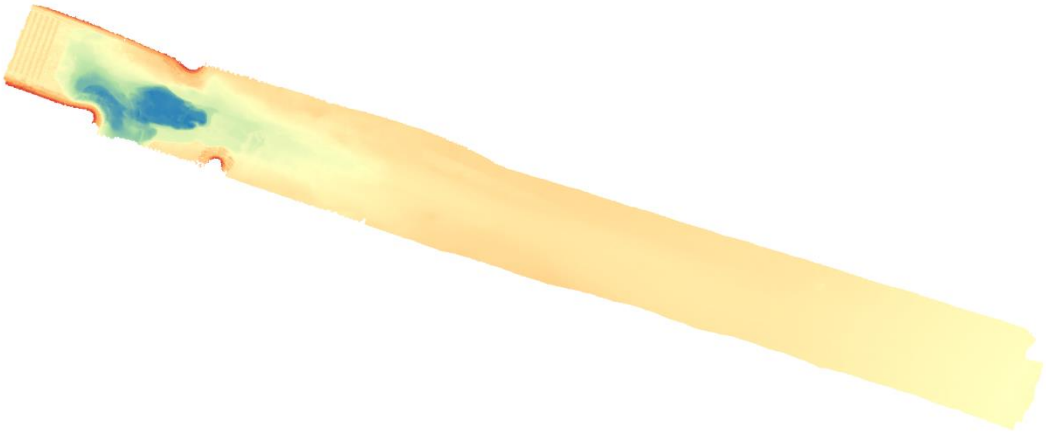
3) execute the "rasterize (vector to raster)" tool (Raster->Conversion) using the following settings:
   - input layer: the point cloud SHP file previously created (be sure not to choose the TXT / XYZ file)

- field to use for a burn-in value: select the only SHP file field (field_3)
- output raster size units: georeferenced units
- widht and height: use the point cloud scan interval (e.g.: 1 o 0.5)
- output extent: select “Calculate from layer” and the SHP file layer
- assign a specified nodata value to output bands: -9999
- execute ... (execution time: about 1 minute)
- a temporary DEM file will be created and named "Rasterized" (it is possible to rename it if desired)



4) save the file using “Export->Save As” command choosing geotiff output format





5) Use a “yyyymmdd” protocol to define the new geotiff file name (e.g., 20210426_Malamocco.tif) in order to enable Geoserver to merge the files starting from the oldest
6) Copy/Move the TIF file to the Geoserver data folder
7) Delete from the Geoserver data store the previous defined index shapefile (basically, all files except TIF files)
8) Enter Geoserver admin console, go to “stores” section, click the ImageMosaic bathymetry store name and press “Save” button. The index shapefile will be updated and rebuilt.

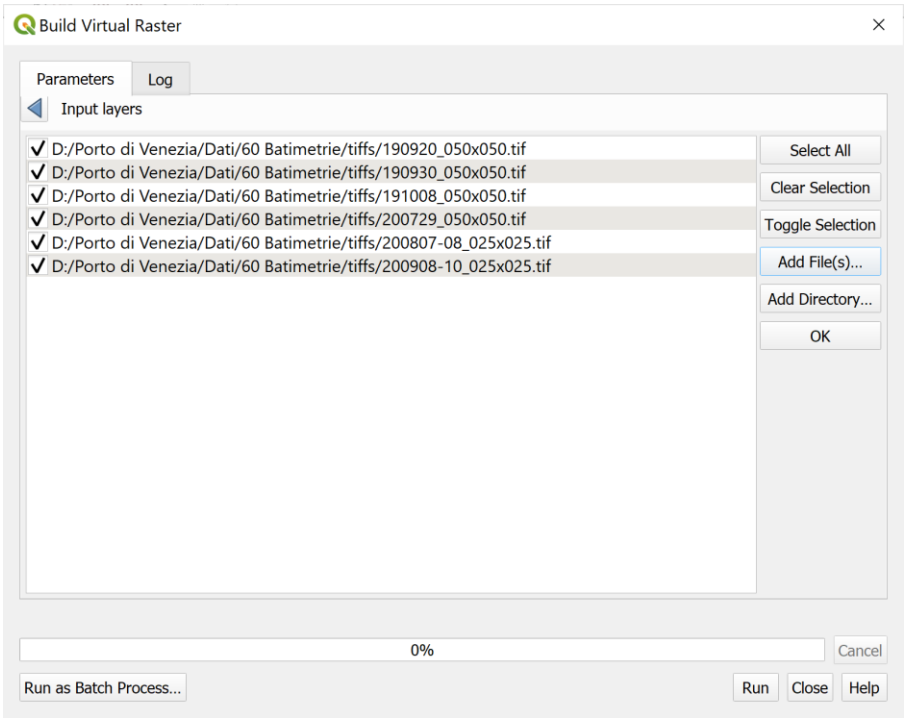
QGIS virtual layer creation procedure

In order to make custom visualization or temporary processing operation, in QGIS, it is possible to build a “Virtual Raster” that performs an “on-the-fly” virtual merge of different geotiffs, and enable to manage them as a single layer without physically merge them into a new big file.

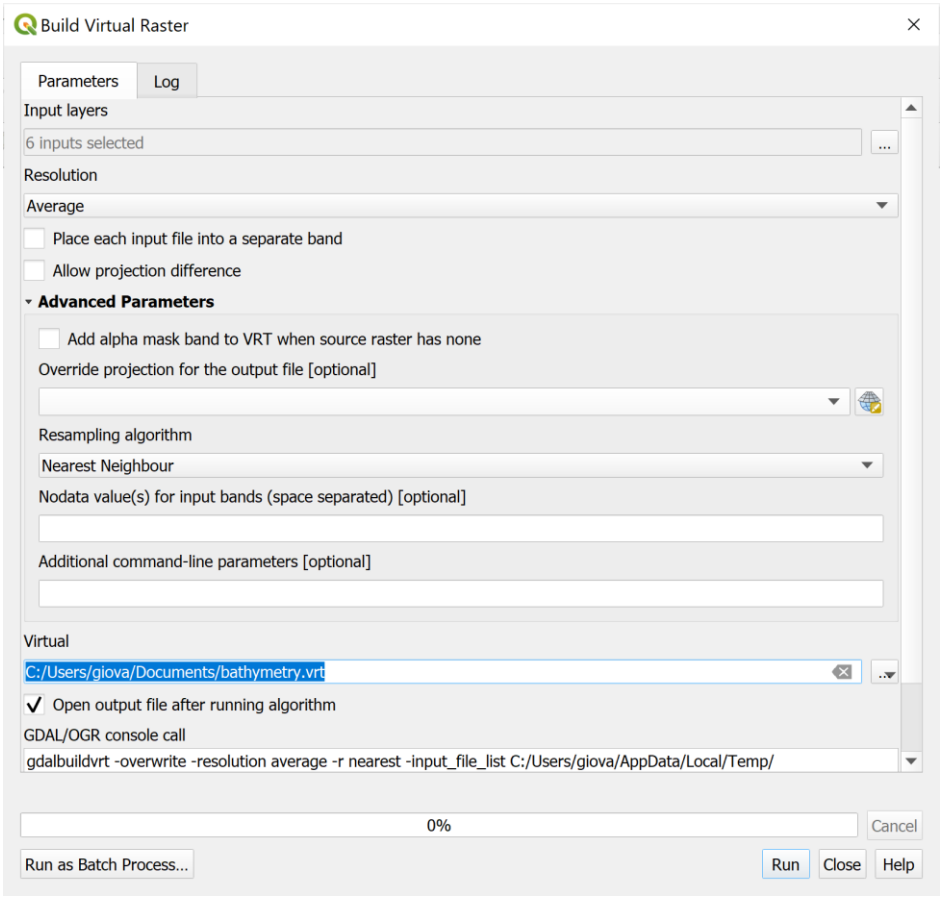
Select “Raster->Miscellaneous->Build Virtual Raster” from the QGIS main menu.

1. Click the button on the right of “Input layers” to select/add the tiff files to process

2. Choose from the list of existing layers or add files using the computer file browser



3. Choose path and filename in order to save the virtual raster as a file



NOTE: do not leave blank the “Virtual” textbox as it will not be possible to save the VRT file later.

The VRT file is a XML based file that contains references of the TIFs. So it is recommended to save it into the same folder of TIFs in order to create a VRT with relative paths and open it from any folder or drive.

2.1.3 Geoserver configuration

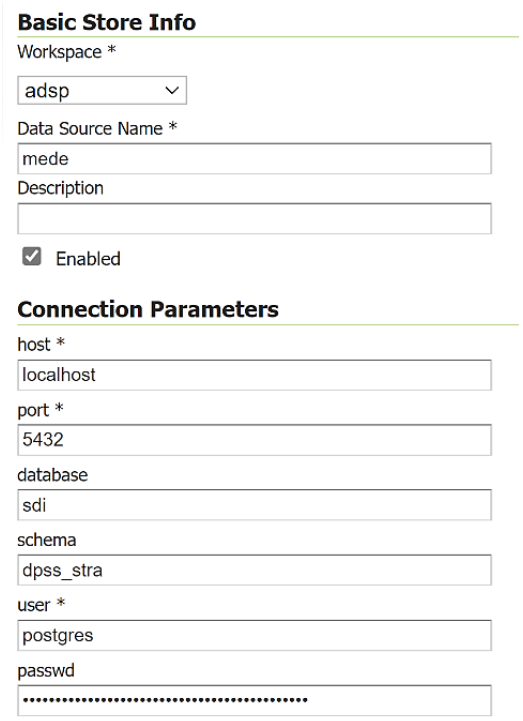
All Geoserver configuration can be done through the web-based admin interface.

2.1.3.1 Basic layer setup for WMS service

The WMS is the web service provided by OGC compliant mapping servers, such as Geoserver, in order to interactively visualize any raster/vector spatial data through the HTTP interoperability. Note that, despite the type of data (e.g. raster or vector), the WMS provides data, already styled, as a set of image tiles in the typical web formats (JPEG, PNG).

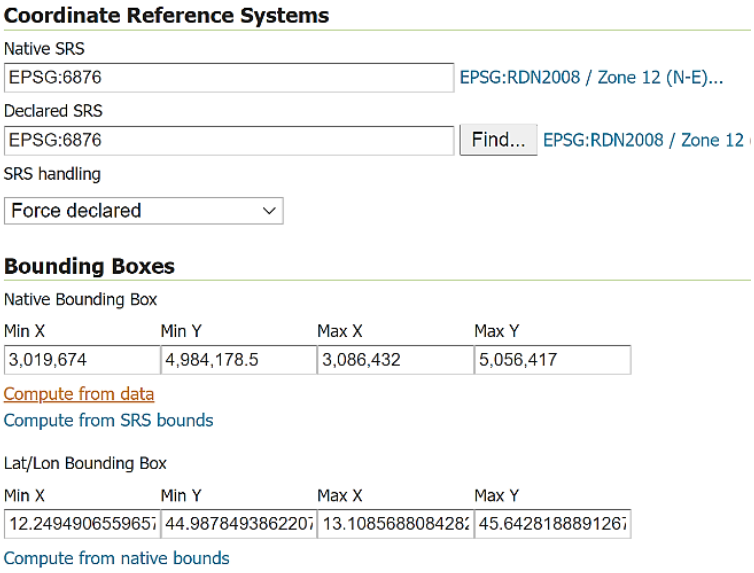
To expose a new layer as WMS service follow these steps:

1. Setup the data store
    a. From the main Geoserver menu choose “Stores” under “Data” section
    b. Click on “Add a new Store” (the green + icon on top)
    c. Click on “PostGIS database”
    d. Select the default workspace (“adsp” for this case)
    e. Choose a name for the data source and, optionally a description
    f. Type “localhost” as host; 5432 as port, “sdi” as database, and a schema to get the table from
    g. Type credentials



h. Click “save” to save the Store

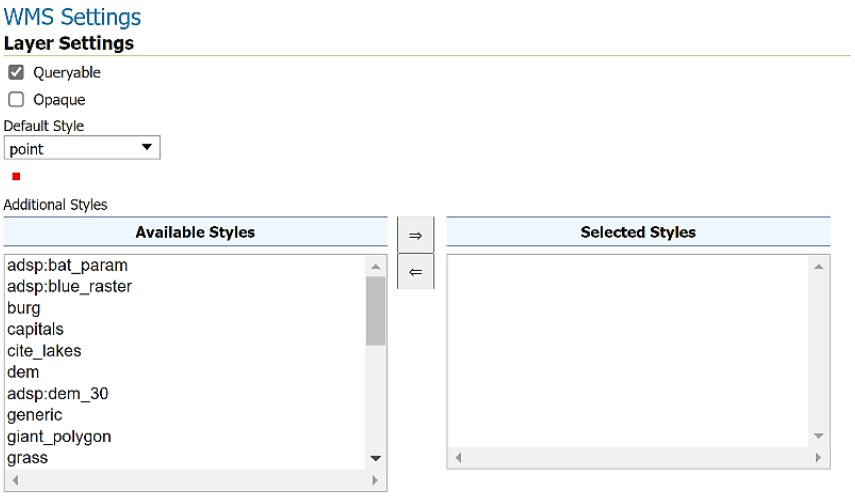
2. Publish a Layer
   a. From the main Geoserver menu choose “Layers” under “Data” section
   b. Click on “Add a new layer” (the green + icon on top)
   c. Choose the Store to get the data from
   d. Click “Publish” on the PostGIS geospatial table to create the layer from
   e. Optionally, modify the Name and the Title (note that the Title is shown as the layer label when browsing server content)
   f. Under “Coordinate Reference Systems” section check the right EPSG detection
   g. Under the “Bounding Boxes” section click on “Compute from data” and on “Compute from native bounds” to populate bounding box coordinates



h. Switch to the “Publishing” tab

i. Optionally, select “Selectively enable services for layer” if it is needed to enable only WMS or WCS service.

j. Under “WMS Settings” -> “Layer Settings” select the proper style (if needed create a new style before publishing the layer)



k. Click “Save”

3. Check the WMS service

a. From the main Geoserver menu choose “Layer preview” under “Data” section

b. Locate the last created layer and click on “Openlayers” to open the web viewer and check the correct visualization.

2.1.3.2 WCS data source setup

The WCS is the web service provided by OGC compliant mapping servers, such as Geoserver, in order to access to raster raw data through the HTTP interoperability.

Unlike WMS, WCS provide raw, lossless raster data that can be styled and processed as if it were a local dataset.

To expose a new layer as WCS service follow these steps:

1. Setup the data store
    a. From the main Geoserver menu choose “Stores” under “Data” section
    b. Click on “Add a new Store” (the green + icon on top)
    c. Click on “GeoTIFF”
    d. Select the default workspace (“adsp” for this case)
    e. Choose the data file by clicking “browse” on the bottom left

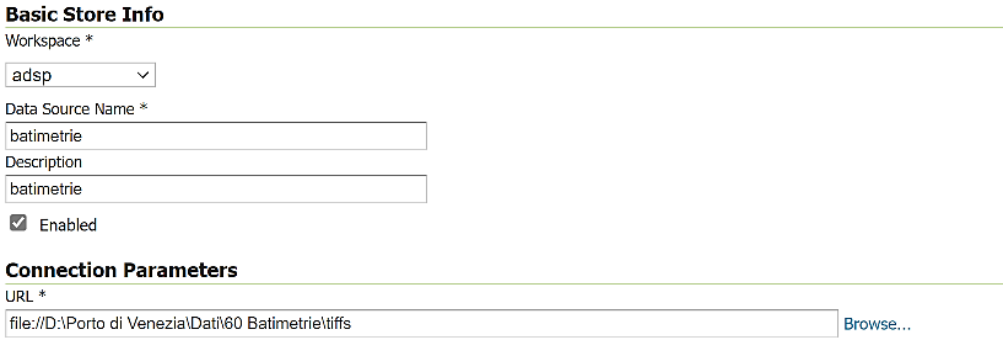
    f. Click “save” to save the Store
2. Publish a Layer
    a. Follow the same steps as point 2 of the previous paragraph
3. Check the WCS service
    a. Open a GIS client such as QGIS Desktop, configure and access the WCS service and include the layer into the project. Check standard raster operational functions.

2.1.3.3 ImageMosaic store setup procedure for WCS

The WCS store can be based on different data types. In case of a geotiff imagery (e.g. set of contiguous or overlapping tiff images) it is possible to create an ImageMosaic data Store in order to publish the entire folder contents as a single layer.

To create an ImageMosaic Store follow these steps:

1. From the main Geoserver menu choose “Stores” under “Data” section
2. Click on “Add a new Store” (the green + icon on top)
3. Click on “ImageMosaic”
4. Select the default workspace (“adsp” for this case)
5. Choose the folder containing the data files by clicking “browse” on the bottom left



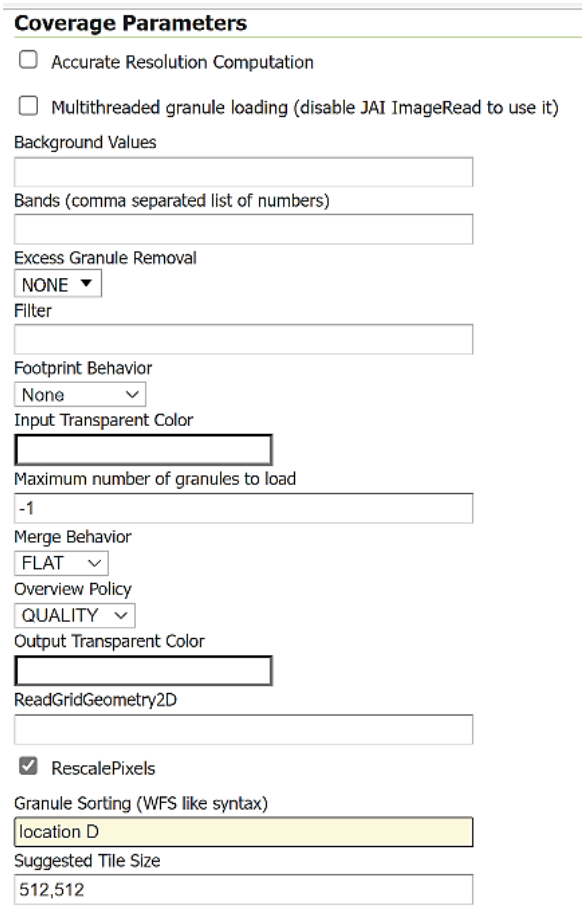
6. Click “save” to save the Store

When creating the ImageMosaic data store, Geoserver will create a special SHP index file with the same name of the store and places it within the same folder. The basic data model of the SHP file includes only the geometry of the bounding box of each geotiff with a text field that stores its name. It is possible to add additional fields to manage file sorting.

To manage overlapping it is possible to setup the sorting criteria in order to define from which data file get the pixel data when more than one overlap. You can use special additional fields inside the index file or even choose the filename to get a standard alphabetical order sorting. The syntax admits the parameter “D” to set descending order.

Some SDI imagery uses descending alphabetical sorting; to set up this follow these steps:

1. Open the layer setup from the “Data” section on the main Geoserver menu
2. Go to “Coverage parameters” and insert “Location D” into the “Granule Sorting (WFS like syntax)” text box



3. Click “Save” to apply changes.

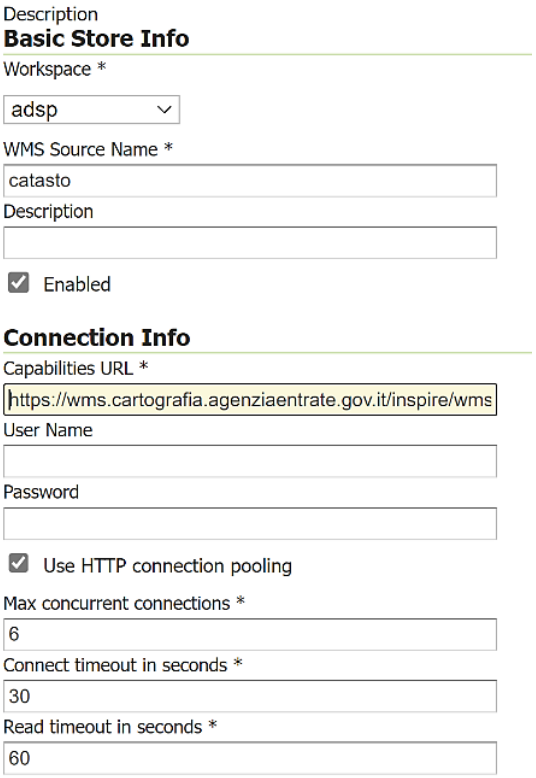
IMPORTANT NOTE: to get the correct indexing after any modification to the imagery dataset it is recommended to delete the index shapefile and regenerate it by clicking “Save” on the store setup.

2.1.3.4 WMS data stores for external services mirroring

WMS Service can be used to mirror public web services on the Internet in order to quickly access them from a single point.

To do this, a WMS type data store is needed. To setup a WMS Store follow these steps:

1. From the main Geoserver menu choose “Stores” under “Data” section
2. Click on “Add a new Store” (the green + icon on top)
3. Click on “WMS” on the bottom “Other data sources” section
4. Setup workspace, name and description as seen before
5. Insert the public WMS URL into the “Capabilities URL *” textbox and leave all remaining parameters as default



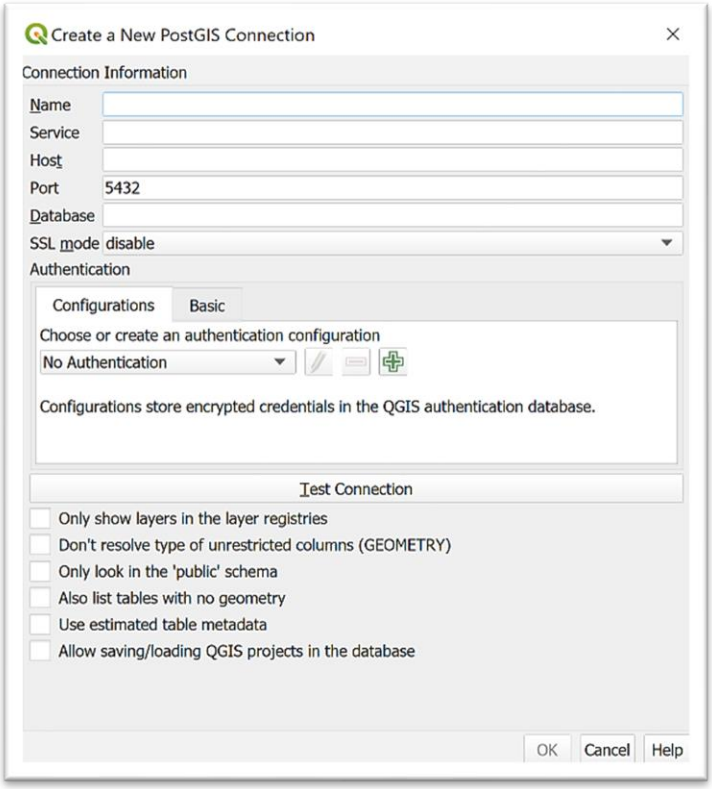
6. Click “save”
7. Publish the layers with the procedures described before.

2.2 Operators user guide

The Venice Port Authority SDI user manual is based on QGIS ver.3 as Geographic Information System (GIS) client software.

2.2.1 GIS environment setup

The GIS connection to PostGIS (SDI database) has to be setup just once for each workstation. To set it up, the “new connection” option must be chosen inside the “PostGIS” node in the QGIS browser panel; the following form will be shown:



The values to be inserted are the following:

- Name: **SDI** (or any other of choice)

- Service: (optional: leave blank)
- Host: **10.0.28.10**
- Port: **5432** (default)
- Database: **sdi** (lowercase)
- SSL mode: **allow**
- Authentication:
    - "Configurations" tab -> [press the **+** green button]
        - Name: any of choice
        - Resource: (optional: leave blank)
        - [Basic authentication]
        - Username: the one provided by SDI administrator
        - Password: the one provided by SDI administrator
        - Realm: (optional: leave blank)

Press the "test connection" button to ensure the connection works.

It is recommended to select the following checkbox at the bottom of the form:

a) Also list tables with no geometry
b) Allow saving/loading QGIS projects in the database

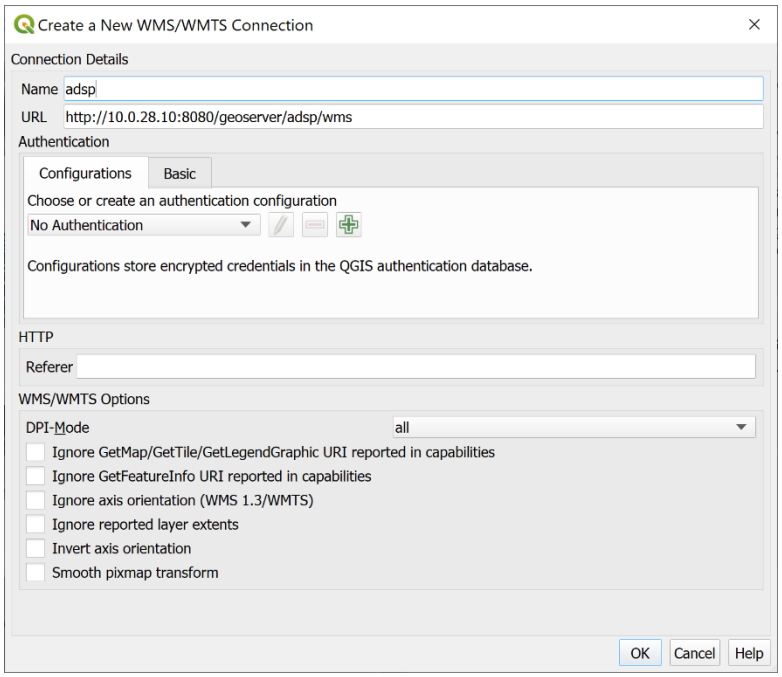
Press the "OK" button to complete connection setup. A new node named "SDI" will appear under the "PostGIS" node in the QGIS browser panel.

NB: it is strongly recommended NOT to use the "Base authentication" method to configure the connection to PostGIS inside QGIS; this may cause the theft of credentials by malicious people who can read them in any QGIS project files (.QGZ / .QGS) sent by email or in other ways.

Raster datasets and layers are available through WMS/WCS interoperable web services.

WMS is the Web Map Service, to be used only for visualization purposes, while WCS is the Web Coverage Service, to be used for accessing raster raw data and processing purposes.

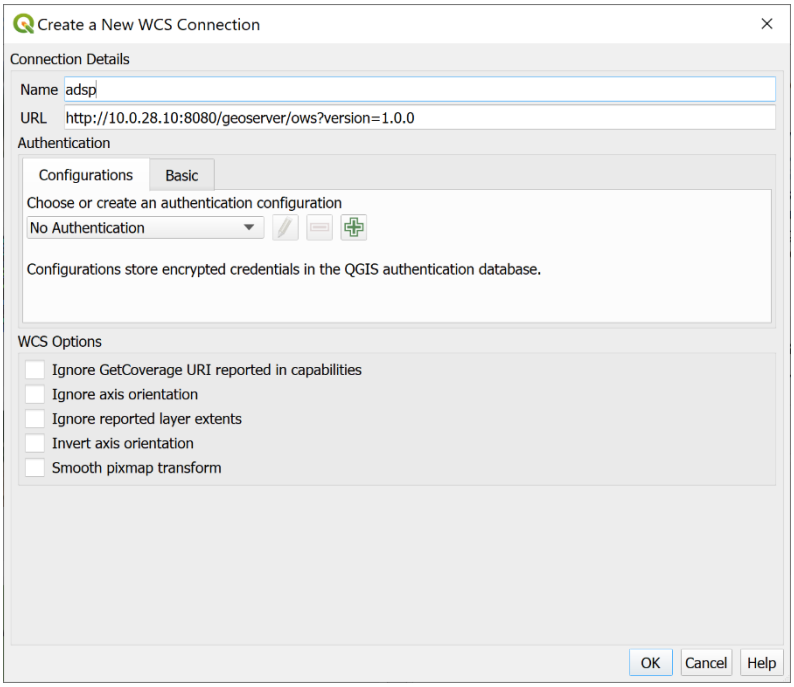
To setup WMS, right-click on WMS/WMTS option within the browser panel and choose “New connection”; the following form will be shown:



The values to be inserted are the following (leave others as default):

- Name: **ADSP** (or any other of choice)
- URL: **http://10.0.28.10:8080/geoserver/adsp/wms**

To setup WCS, right-click on WMS/WMTS option within the browser panel and choose “New connection”; the following form will be shown:



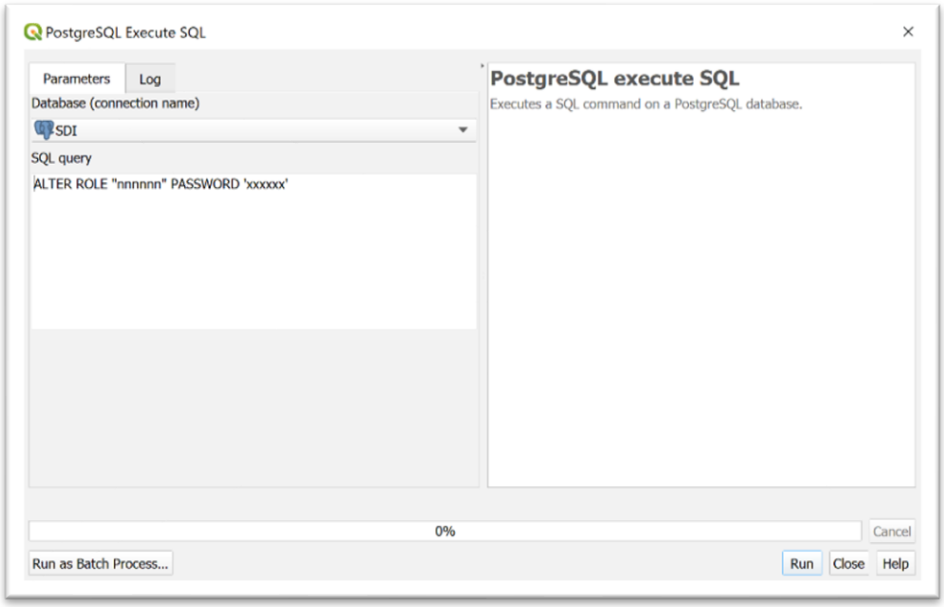
The values to be inserted are the following (leave others as default):

- Name: **ADSP** (or any other of choice)
- URL: **http://10.0.28.10:8080/geoserver/ows?version=1.0.0**

2.2.2 User password management

Users can change their account password by using the following procedure in QGIS:

- Ensure QGIS has a working connection to SDI
- From processing toolbox choose: Database -> PostgreSQL execute SQL



- Choose the connection to SDI from the combo box
- Type the following SQL query (replace nnnnnn with the owned username and xxxxxx with the desired password; be sure to strictly keep single and double quotes)
    - **`ALTER ROLE "nnnnnn" PASSWORD 'xxxxxx'`**
- Press the “run” button
- Edit the SDI configuration to update the stored password or delete it and set it up from scratch following the previous paragraph procedure.

In case of password loss, contact the SDI administrator.

2.2.3 Accessing spatial data

The datasets stored inside the SDI database are organized into several sections: each section is named as a particular ADSPMAS department area using the acronyms already in use within the organization.

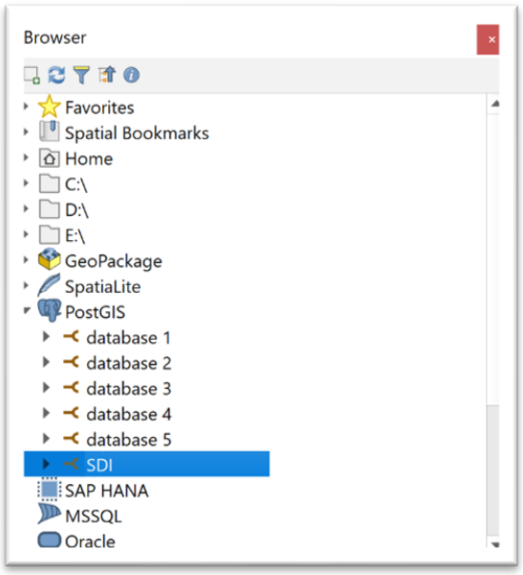
Each user account has been created with the right membership setup according to the ADSPMAS organization.

The membership policy for the SDI database is the following:

- **Users can access in read-only mode to all areas**
- **Users can access in write mode only to layers, tables, and projects inside the area they belong to**
- **Users can access in write mode to all styles stored into the SDI styles library**

To access spatial and table data stored inside SDI browse the "SDI" node under "PostGIS" in the QGIS browser panel follow these steps:

1. Expand the "PostGIS" node into the QGIS browser panel



2. Expand the sub-node related to the organization area (ex. "dpss_stra")
3. Drag&Drop (double click or even right click + "add layer to project") the desired layers/tables into the GQIS Layers panel to add the data to the project
4. Confirm the possible SRS transformation choice
5. The editing functions will be enabled only for the datasets stored inside the area to which the logged-in user belongs.

BE CAREFUL that dragging layers and tables from the layers panel to the browser panel will attempt to import/copy the data into the SDI database as a new dataset.

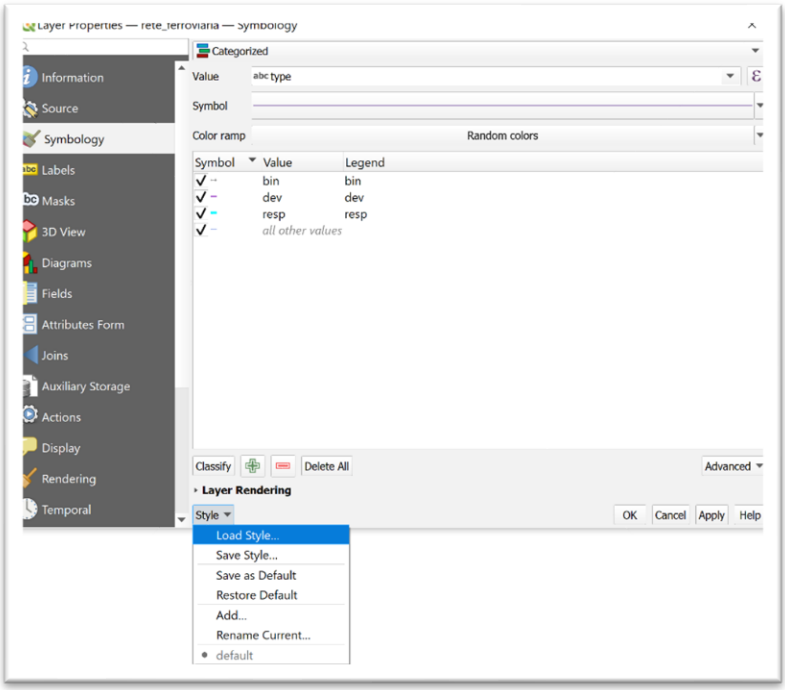
For the layers with a stored predefined display style, the stored style will be applied as default instead of the standard random style.

2.2.4 Spatial data styling and visualization

Each layer accessed from the SDI database can be displayed and processed in the same manner as any other file-based GIS dataset (e.g. SHP, GeoJSON etc.). In addition, the SDI database can store different display styles (symbologies) and set one of them as default style (the default style will be applied by default any time the user will add the layer to a project).

To manage the stored styles, use the “database styles manager” as following:

1. Under “symbology tab” of any vector layer, choose “load style” from the “Style” combo box at the bottom of the form:

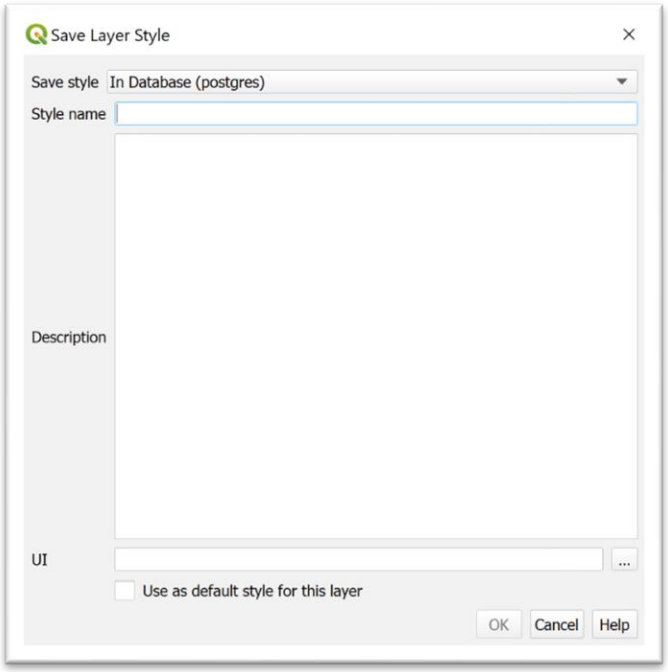


2. Select “load file from database (postgres)” from the first combo-box

3. Choose and select one of the available styles shown into the “Styles related to the layer” box
4. Press “Load style” button on the bottom of the form
5. Press “OK” or “Apply” to confirm the style application for the current project

To store new styles into the database follow these steps:

1. Under “symbology tab” of any vector layer, choose “save style” from the “Style” combo box at the bottom of the form



2. Insert a name for the style into the “Style name” text box
3. Insert a description of the style into the “Description” text area; it is recommended to write at least the type of style (e.g. “categorized”, “graduated”, etc.) and the field/expression used for the values.
4. Optionally, select the “Use as default for this layer” checkbox to set the new style as predefined for all users.

2.2.5 Layers and tables management

To store a new layer or table into the database it is recommended to operate within QGIS interface; advanced users can use other SQL-based client interfaces.

The simpler way to sore data into the SDI is to create an export/copy of data from other formats (e.g. SHP, TAB, KML, XLS and others).

To migrate data from local files into the SDI database follow these steps:

1. Create a new blank project in QGIS
2. Expand the node related to the area that the user belongs to (otherwise the writing operation will be denied) from the "SDI" node into "PostGIS" of the browser panel
3. Add one (or more) layers/tables in any local files format
4. For each layer to migrate, if possible, do the following:
    - Rename layer in the layer panel using only lowercase letters; avoid special characters and spaces; avoid beginning with a number
    - Rename field names using only lowercase letters; avoid special characters and spaces; avoid beginning with a number
    - Delete unwanted/unused fields
5. Ensure the assigned CRS is a known one (see the "source" tab of layer properties if the selected CRS is one with a proper EPSG:nnnn code). If not, process the layer with the "reproject layer" algorithm.
6. Drag the layer from the layer panel to the browser panel, paying attention to drop the item exactly over the right area name, and wait the operation to be completed (several minutes may be necessary depending on the size of the dataset and connection speed).

NOTE that this operations are a "SAVE-AS" kind of commands, namely they create A COPY of the layer/table; Once migrated the data, in order to use it as current shared dataset, it is recommend to delete the old dataset and reconfigure the projects to read it from the SDI instead of the local files.

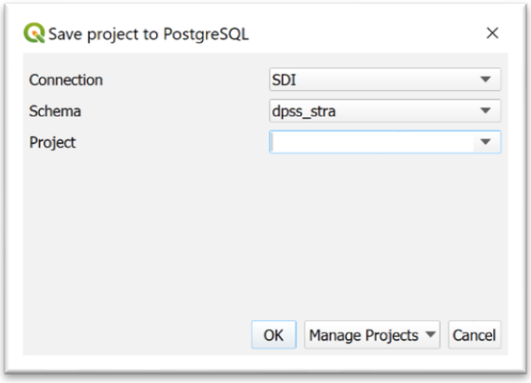
According to the same access policy, layers can be deleted directly from the QGIS browser panel right-clicking upon the layer to drop and choosing "Delete layer". BE EXTREMELY CAREFUL since the deletion cannot be undone.

2.2.6 GIS Workspace management

In addition of single layers and tables, the SDI PostgreSQL/PostGIS engine is able to store QGIS projects as an alternative of saving them as QGS/QGZ local files (see also point b of previous "GIS environment setup").

To save projects into the SDI database follow these steps:

1. Choose "Save to" from the main QGIS "Project" menu



2. Select "SDI" from the "connection" combo-box
3. Choose the proper area from the "Schema" combo-box (the one the user belong to)
4. Write the name of the project into the "Project" combo-box
5. Press OK to save

To delete an existing project from the database follow the previous 3 steps an then:

4. Choose the project to delete from the "Project" combo-box
5. Press "Manage projects" and choose "Remove project". BE CAREFUL because the operation cannot be undone.

2.3 Training administrators framework guide

2.3.1 Content structure reference

This content reference framework is the first guideline defined to help in the definition of the detailed training and educational program.

2.3.1.1 Training module types

- ❑ Seminars

  Mainly theoretical contribution aimed at deepening political-cultural, informative, awareness-raising aspects or, in more specific cases, understanding of the potential and limits of some technological or methodological approaches. Contents are divided in three main categories: ICT reference scenario, territorial issues, technological in-depth.
  Optimal duration; 1 hour

- ❑ Workshop/training-on-the-job

  Training modules carried out with the use of computers and software aimed at providing specific skills in the use of data processing tools and methods. The aim is not to train a specialist but to make aware of advantages / disadvantages / criticalities of the use of certain tools and methods, as well as introducing the participants to the use of new tools and allow them to self-train according to the future needs.
  Contents are divided in six topics: Spatial data management, Data Base, GIS data processing, Remote Sensing, Web / geospatial-Web, Info design and spatial data visualization.
  Optimal duration: variable 8-20 hours for 1 to 5 days, depending on the needs and content.

- ❑ Project work

  Mainly a strategic design type educational activity, with possible small technical insights. In the most effective formulation, it provides joint and synergistic activity between decision-makers and executives by simulating the work of a multidisciplinary team.
  Optimal duration: variable from 4 to 8 hours within one day.

The following reference lists are intended as basic ranges of topics useful for the definition of a custom educational path based on the specific needs of the participants.

2.3.1.2 Seminars content reference list

ICT scenario:

- *Smart Cities & Communities / Sustainable Cities*
- *Geography and knowledge about territory: ICT based approaches*
- *Data interoperability, Open Source and Open Data approaches*
- *Big Data and Data Analytics*
- *Mobile APPs and Mobile Web*
- *IOT – Internet of Things*
- *Internet, knowledge sharing and participatory processes*
- *Institutional data sources and spatial data: the regulatory scenario*

City, environmental and territorial issues

- *Hydraulic and Hydrogeological risk management*
- *Biodiversity protection*
- *Energy and sustainability*
- *Logistics and transportation*
- *Tourism, landscape, and cultural heritage*
- *Sustainable land use*
- *Territorial planning and regulations*
- *Technological network and infrastructures maintenance*
- *Urban life quality, comfort and health*

ICT technologies

- *Geographic Information System and Spatial Data Infrastructures*
- *Geodatabase Management System*
- *Geo-Web solutions*
- *Big Data and Data visualization*

- *Geostatistics*
- *Terrestrial and marine sensing*
- *Satellite and airborne remote sensing*
- *Satellite active sensors monitoring*
- *Thermographic monitoring*
- *Mobile APP and Web application for geospatial data*
- *Wireless Sensor Networks and IOT*
- *Mobile Mapping Systems for road networks maintenance*
- *GPS, Laser scanning and UAV survey and monitoring*
- *Information Design and Data Visualization with geospatial data*

2.3.1.3 Workshop/training-on-the-job content reference list

- Cartography and spatial data management:
  Introduction to Geographical Information Systems, digital cartography, institutional data sources, geocoding techniques.
- Database
  Database design basis, SQL, DBMS applications, geospatial extensions.
- GIS. Geographic Information System:
  Basics of geospatial data modelling, visualization and thematic mapping techniques, data integration techniques and geoprocessing.
- Remote Sensing:
  EOS - Earth Observation Systems introduction, remote sensing data types and formats, raster data processing techniques, raster data classification.
- Web / Geospatial-Web:
  Web browsers, web services, basics of HTML, CSS, Javascript, mapping servers, geographic web services and interoperability protocols.
- Info Design and spatial data visualization:
  Information Design and User Centered Design, data visualization techniques and tools, mapping tools design, basics of Interaction Design.

2.3.1.4 Project work content reference list

- Air, water, and soil pollution risk
- Hydraulic and hydrogeological risk
- Mobility, Infomobility and logistics, road safety, intermodality and transportation
- Biodiversity protection
- Production and sustainable use of energy sources
- Protected areas management
- Cultural heritage enhancement and sustainable tourism
- Emergencies management
- Urban quality and services
- Waste management
- Infrastructures, green areas, and services maintenance

2.3.2 Training programme

2.3.2.1 Seminars

1. Geography and knowledge about territory: ICT based approaches	
Learning objectives	**Content**
Knowing new tools and methods to improve the knowledge of the territory and the decision-making effectiveness.	The transition from the traditional discipline of Geography to the new Information and Communication Technologies age. Overview of innovative tools and solutions to gain added value from the new data sources available in the age of connected sensors and the Internet.

2. Data interoperability, Open Source and Open Data approaches	
Learning objectives	**Content**
Understand the reasons for the need to share data and information between institutions	Why share data and between whom. The concept of interoperability.

and organizations and know the strategies to achieve the goal.	Standards and tools to ease data sharing between institutions, organizations, companies, local communities, and citizens. Application of the Open-Source approach to Information Technology and to the development of smart objects and systems. From Open Source to Open Data: the challenge of free access to the knowledge and information.

3. ICT and geospatial data for logistics and transportation	
Learning objectives	**Content**
Know the most innovative ICT solutions for logistics and transport, Infomobility, and transportation / infrastructure safety.	Issues and challenges about people and freight transportation: management, efficiency, building and maintenance of infrastructures, safety and services. Overview of applied ICT solutions, used technologies and strategies. Regulatory framework and related resources.

4. ICT and geospatial data for territorial planning and regulations	
Learning objectives	**Content**
Understanding the benefits in spatial data infrastructures implementation in the recent territorial planning regulation scenarios. Know techniques and tools available for both executives and decision-makers.	Geographic Information Systems and Spatial Data Infrastructures in the recent regional, national and community regulations about territorial planning. Application overview and case studies. Review of ICT tools and methodologies for the analysis and decision-making support in planning and evaluation activities.

5. ICT and geospatial data for technological network and infrastructure maintenance	
Learning objectives	**Content**
Know the newest tools for acquiring underground ad network services data, processing topological networks and support	Strategies and methods to manage the complexity of network infrastructures in cities underground, design techniques, management and maintenance issues; standards and regulation requirements.

the construction, management and maintenance of underground infrastructures.	Design support tools, diagnostic tools, network data management methods and techniques. Review of case studies and resources for the topic deepening.

6. Geographic Information System and Spatial Data Infrastructures	
Learning objectives	**Content**
Know and understand the use and the advantages provided by spatial data processing software (GIS) and by systems for organizing territorial and environmental information.	Geographic Information System (GIS) software features, spatial data visualization and processing tools and techniques. Mapping techniques, visualization and interaction tools for decision-making support. Geoprocessing tools and multi-criteria approaches to analyse territorial phenomena. Applications and study cases; resources for in-depth and self-study.

7. Geodatabase Management Systems	
Learning objectives	**Content**
Understand the potential and application fields of managing spatial data with spatial-enabled DBMS software solutions.	SQL, databases and DBMS management systems fundamentals GeoDBMS technology: differences and affinities with traditional DBMS and GIS. Examples of use of storage functions and spatial data processing functions. Review of applications and resources for in-depth study and self-study.

8. Geo-Web solutions	
Learning objectives	**Content**
Understand uses and features of web oriented spatial applications.	Web-oriented technologies and GIS systems integration fundamentals. Web-GIS architectures and solutions.

	Choice criteria about desktop GIS, web GIS and mobile GIS applications. Technologies and tools for web-based GIS systems development and management; spatial data interoperability, Open Data philosophy, Metadata systems. Review of applications and resources for in-depth study and self-study.

9. Information Design and Data Visualization with geospatial data	
Learning objectives	**Content**
Know the most important techniques and tools for digital maps visualization and interactive interface development for spatial data browsing and processing.	Infodesign and Interaction Design fundamentals. Spatial data visualization tools and techniques. Design criteria for screen-based interactive tools to browse and query spatial databases and digital maps. Review of applications and resources for in-depth study and self-study.

2.3.2.2 Workshop/training-on-the-job

1. Cartography and spatial data management	
Introduction to Geographical Information Systems, digital cartography, institutional data sources, geocoding techniques.	
Learning objectives	**Content**
Know data formats and structures needed to make digital cartographies. Know how to search and retrieve public spatial datasets to create a GIS project. Understand the potential of data correlation, derivation and geocoding.	Geodesy and Spatial Reference Systems fundamentals. Database design methods. Raster and vector data models in GIS systems. Types and features of digital cartographies and maps. State and corporate cartographic production and overview of the main online spatial data repositories. Georeferencing conception; direct and indirect georeferencing, methods, techniques, and tools; issues.

2. Database	
Database design basis, SQL, DBMS applications, geospatial extensions.	
Learning objectives	**Content**
Know the basics of Database theory and data modelling techniques. Know how to design and implement a database using a DBMS, query the system and process the responses. Understand the potential of spatial extensions of DBMS.	Theory of Databases; fundamentals and terminology. Systems types and architectures. Logical and physical Databases design techniques. Fundamentals about entities, attributes, keys, relationships and cardinality. SQL syntax. Types of operations and queries. Simulation of creation and use of a database. Examples of building tables and views, setting integrity constraints in a database. Overview of the most popular DBMS spatial extensions; main functions and methods. Examples of querying data using spatial operators.

3. GIS. Geographic Information System	
Basics of geospatial data design, visualization and thematic mapping techniques, data integration techniques and geoprocessing.	
Learning objectives	**Content**
Know features and structure of the main data types and formats to be used with GIS software; understand the main strategies and techniques to manage spatial datasets and set up a GIS project. Know how to create and modify data in a GIS (editing) and to use information attributes to dynamically create thematic maps. Know how to process multiple layers to create new layers and maps.	Main GIS software architecture; features of the project file and relationship structure with dependant data files. Description of the main storage formats of GIS layers. Overview of the GIS interface and functions. Example of creating new projects using several data sources. Data conversion, export and derivation. Selection and visualization techniques with spatial criteria; print tools for digital maps. Examples of creation of new layers, feature editing and thematic maps creation. Overview of geo-processing functions; examples of popular operations like buffer, dissolve, and intersection.

4. Web / Geospatial-Web	
Web browsers, web services, basics of HTML, CSS, Javascript, mapping servers, geographic web services and interoperability protocols.	
Learning objectives	**Content**
Know the web browsers engine and the fundamentals about HTML/CSS and Javascript languages. Understand how a map server works and how to connect with spatial data sources. Know how to configure the output of a mapping server using the OGC compliant interoperable standards.	The architecture of web, clients, servers, and web browsers. Fundamentals of HTML, Cascading Style Sheets (CSS) and Javascript languages for web pages development. Fundamentals of client-server computer applications. Example of installation and configuration of a mapping server, data sources configuration and layers publication through web services. Examples of data management and visualization with WMS, WFS and WCS services. Basics of XML and Styled Layer Descriptor (SLD) map styles format. Example of creation of simple web pages for browser-based maps visualization and access WFS services from GIS software.

2.3.2.3 Project work

1. Mobility, Infomobility and logistics, road safety, intermodality and transportation
Objectives
This topic can include different management, programming or planning issues as well as some security and risk reduction aspects. The topic understanding key highly depends on the considered actors: stakeholders' needs can be taken into consideration for what concerns improving the efficiency of communication and intermodality systems. Institutions, instead, can be considered for what is related to control and reduction of accidents, resources allocation or infrastructure implementation, while common users of transportation systems or tourists can be interested in the developing of innovative "smart" services for mobility or sustainability.

2. Emergencies management
Learning objectives
The topic mainly concerns decision support systems design for emergency planning and Civil Protection procedures. This case study can include both aspects of real-time monitoring, which concerns for example the management of data flows and early warning systems, and historical data analysis aimed at carrying out procedures such as risk assessment. A further understanding key may concern the collection and management of detailed information on territorial vulnerabilities useful for estimating the level of danger during emergencies.

3. Infrastructures, green areas, and services maintenance
Learning objectives
The maintenance of infrastructures and service areas can be a key topic in the context of a port area, especially regarding the possible application of ICT tools and related methodologies. Indeed, these are mainly management aspects for which specific decision support systems and spatial information systems can be effectively applied. Frequent common issues are often related to difficulties of maintaining the data assets about infrastructures and services as well as the tuning of decision support systems for the planning of interventions.