Centre National de l'énergie des sciences et techniques nucléaires (CNESTEN-Morocco)

Implementation of information system to respond to a nuclear emergency affecting agriculture and food products - Case of Morocco

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Context

- In nuclear disaster affecting agriculture, there is a need for rapid, reliable and practical tools and techniques to assess any release of radioactivity

- The research of hazards illustrates how geographic information is being integrated into solutions and the important role the Web now plays in communication and disseminating information to the public for mitigation, management, and recovery from a disaster.

Context

- Basically GIS is used to provide user with spatial information. In the case of the traditional GIS, these types of information are within the system or group of systems.

- Hence, this disadvantage of traditional GIS led to develop a solution of integrating GIS and Internet, which is called **Web-GIS**.

Project Goal

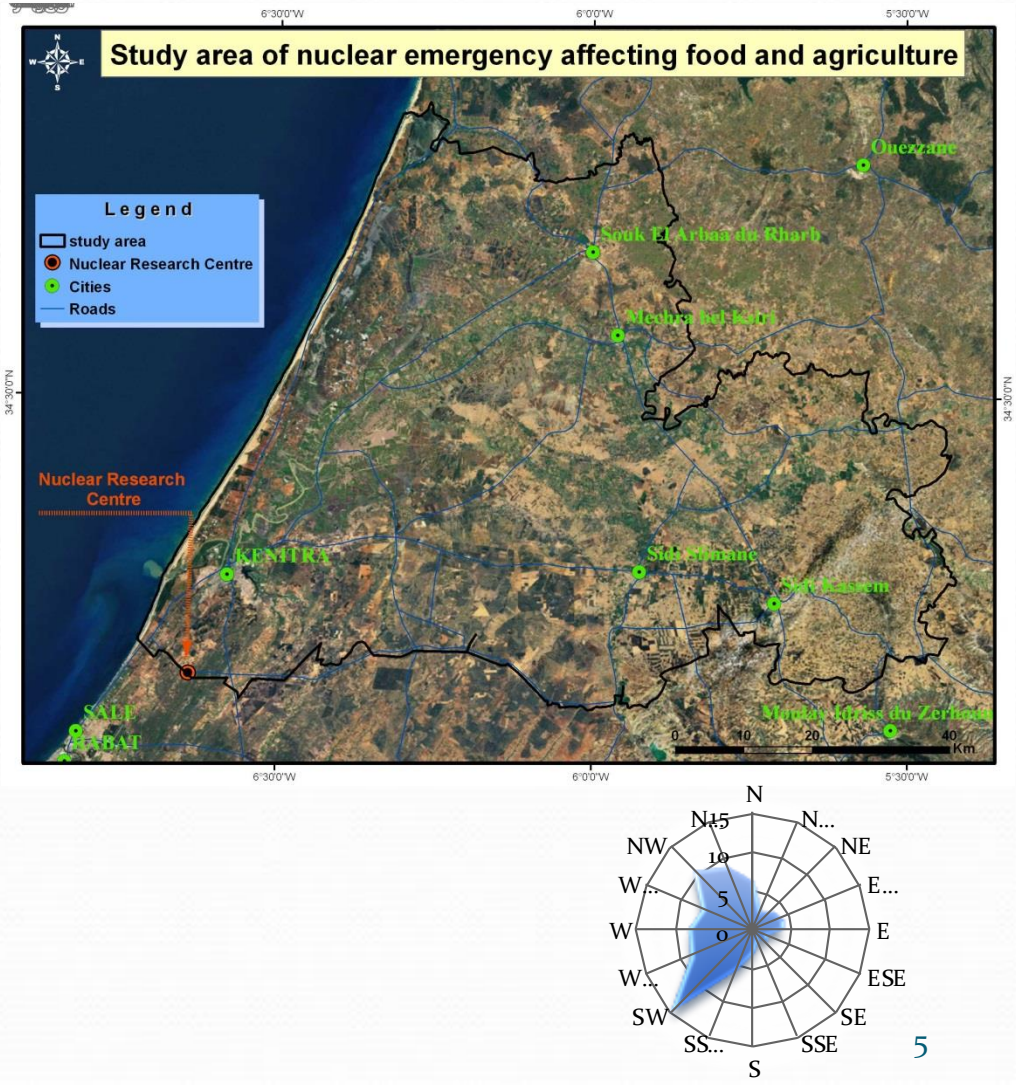
CRP1.50.15: " Response to Nuclear Emergency affecting Food and Agriculture"

The specific objective of our contribution is to design a prototype of web based mapping application that should be able to:

- 1. Supply maps to the restricted users (e.g.: other research groups, different organizations) through the Web, such as Web Map Services (WMS) and Web Feature Services (WFS),
- 2. Data on the map should be selectable, editable, zoomable, pannable etc. on Google Maps, and
- 3. Animate the map layers of an application.

Study area

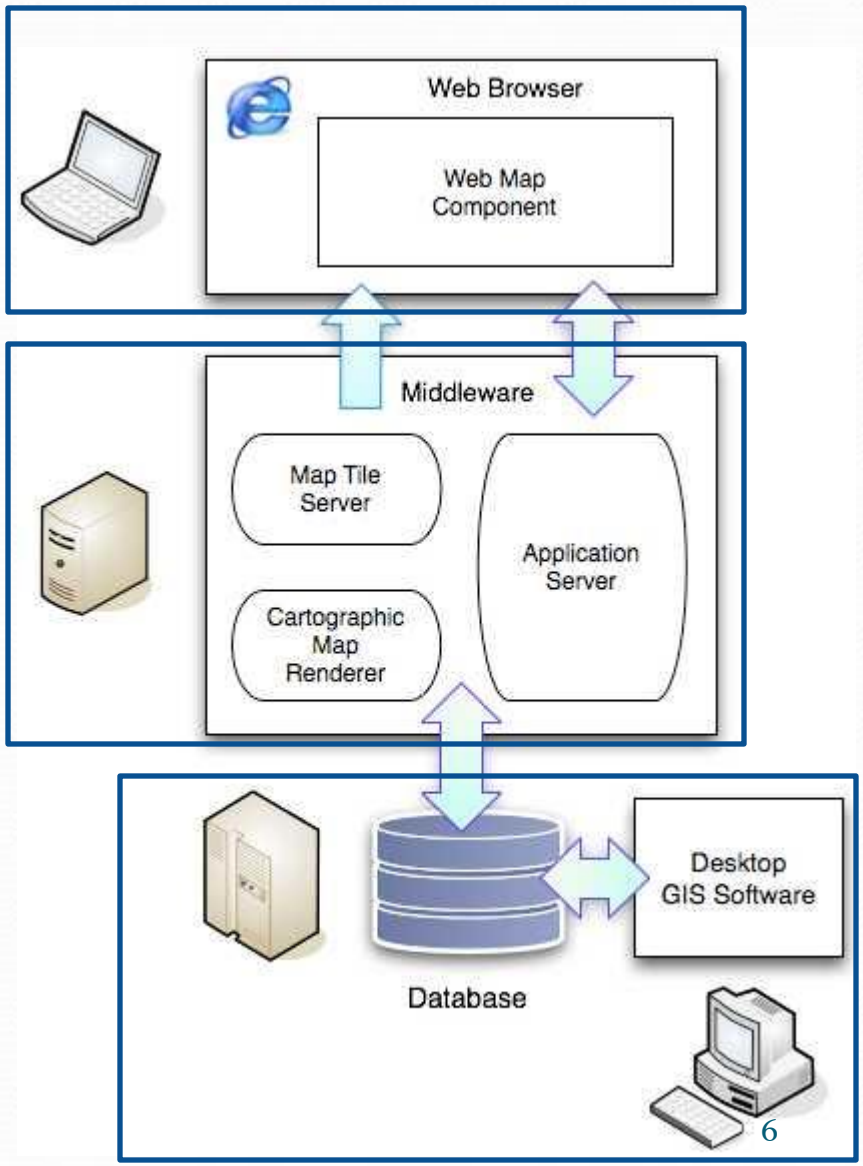
- The study area belongs to Gharb region, located in north-western Morocco, selected on the basis of:
  - Availability of geographical and agro-ecological data,
  - Most highly developed areas in terms of agriculture and farming due to the important availability of water and favorable soil and climatic conditions,
  - Besides, it includes the nuclear installation (CEN: Centre d'Etudes Nucléaires) in the south.



Methodology

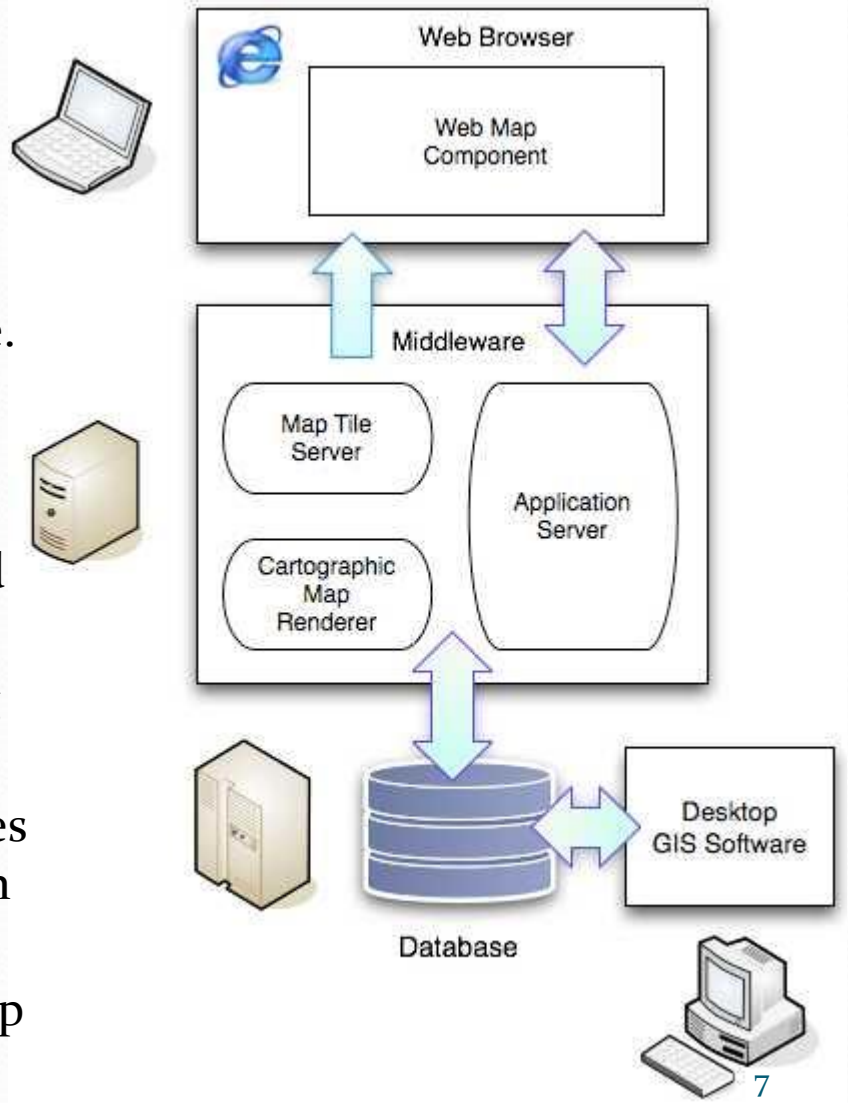
- The overall methodology adopted for creating the system architecture for the WEB-GIS is shown in this Figure,

- The concept comprise three tiers:
  - a base tier that is devoted to data storage and integrity,
  - a middle tier for data processing,
  - a top tier for data presentation.



Methodology

- A typical solution consists of the following functional part:
- **1. Spatial database** that can provide random access to large data sets, query processing that understands spatial relationships
- **2. Desktop software** that can provide direct editing and visualization of data in the database. For data management, quality control, and ad hoc reporting.
- **3. Cartographic map renderer** reads spatial data from the database, applies styling rules and outputs map images
- **4. Application server** provides a programming framework for custom applications.
- **5. Map tile server** store pre-rendered image tiles and serve them up quickly to make maps refresh faster.
- **6. Web map component** that can provide a map component inside a web browser.

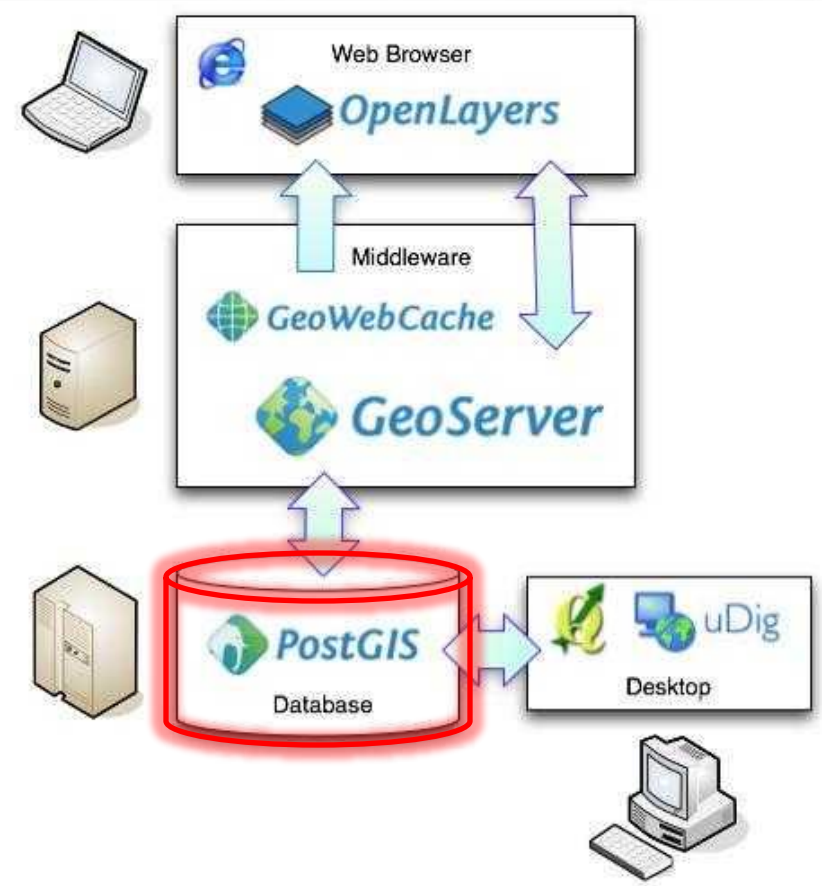


Results

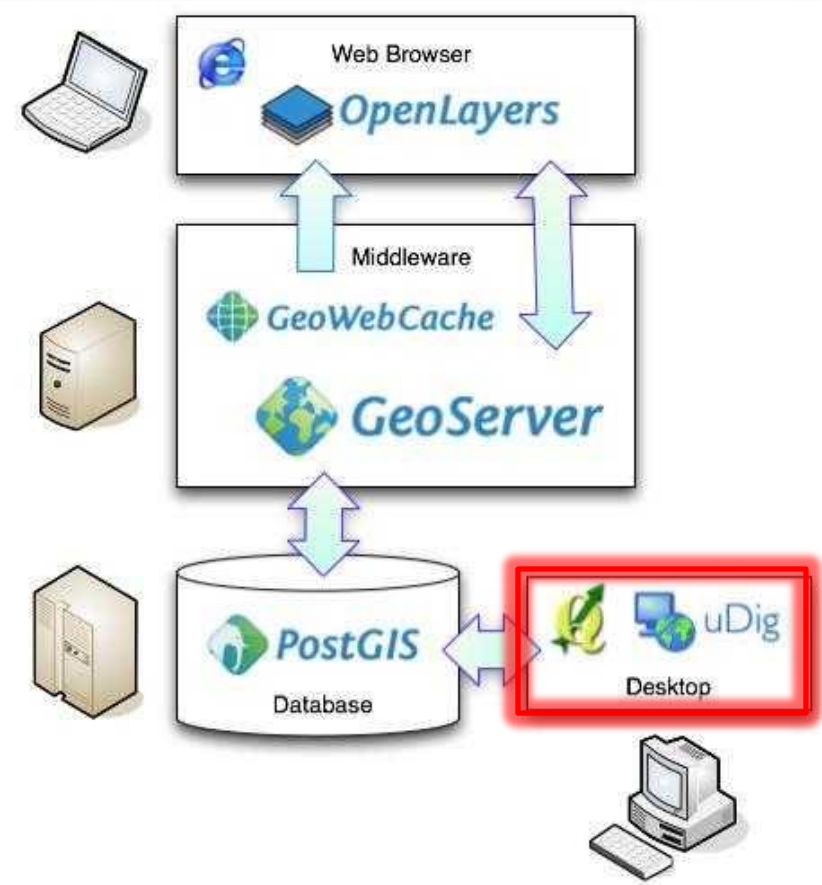
- 1st step: Among the different Free Open Source server software we have decided to focus on **OpenGeo Suite**, since it has a robust and flexible architecture that enables to reliably manage and publish geospatial data.
- This suite includes PostgreSQL/PostGis, Qgis, Geoserver, Openlayers,
- Apache tomcat have been used as web server.

Results

- **PostgreSQL and PostGis** control the creation, maintenance, and use of a database which contains spatial and attribute data.

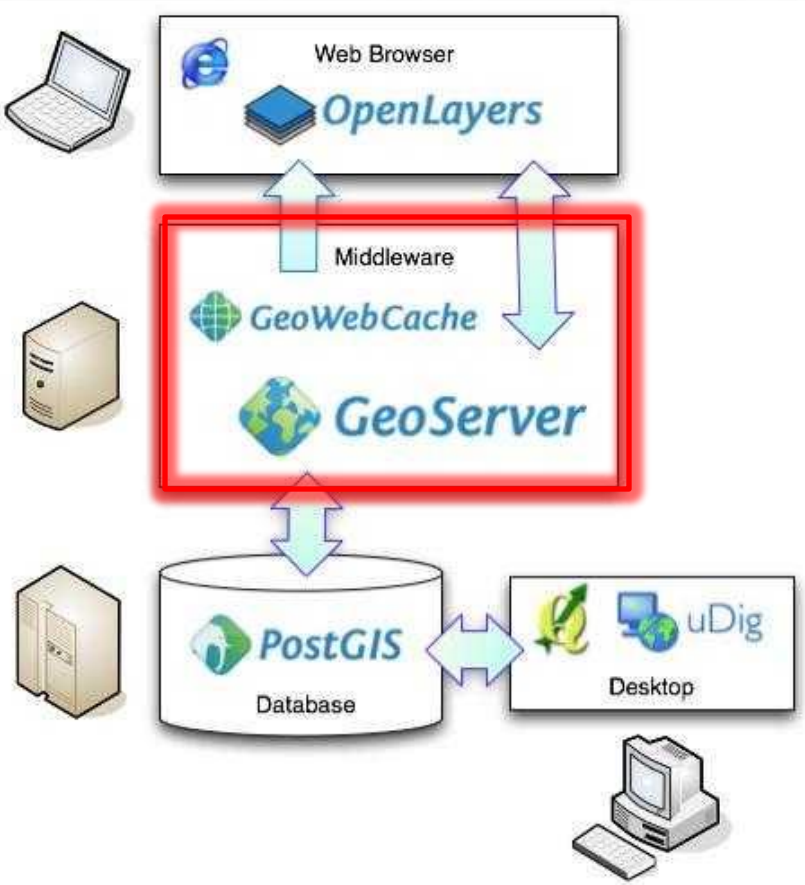


- **Qgis** is Desktop Gis application, which allows creation, edition and visualization of geospatial data.

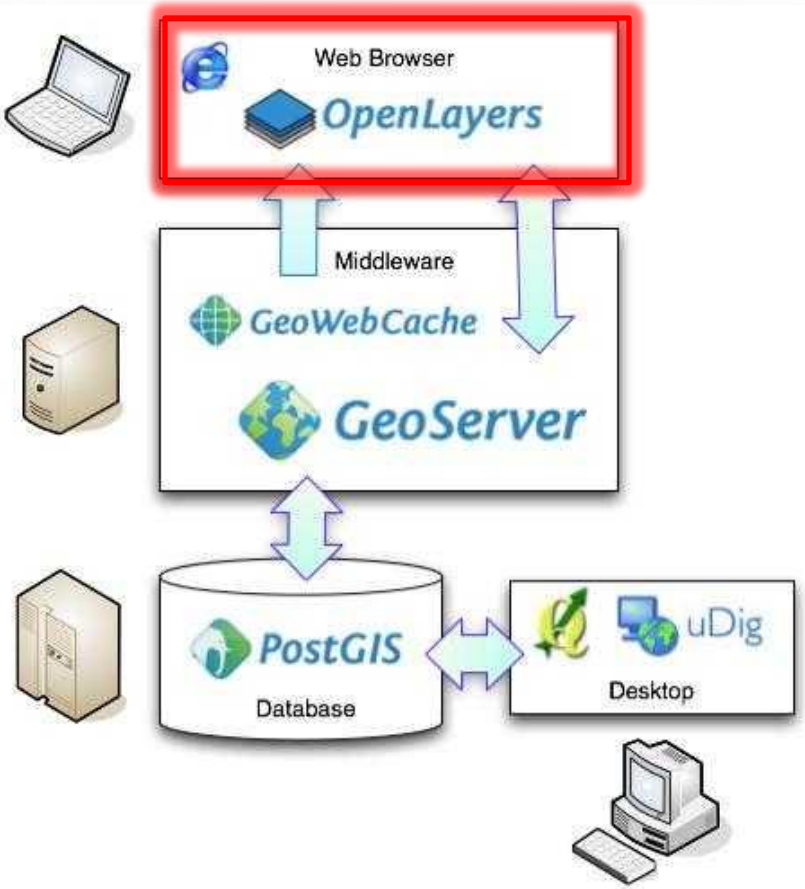


- **GeoServer** is server side software which reacts to requests from a web browser through **OpenLayers** and generates geographical web objects dynamically. The software is written in Java and is the reference implementation of the OGC: Web Feature Service (WFS) and Web Coverage Service (WCS) standards.

- **GeoWebCache** is a simple caching engine that is used to speed up repetitive requests in a multiuser environment where server time can become imperative. GeoWebCache also conforms to the Web Map Server (WMS) standard.

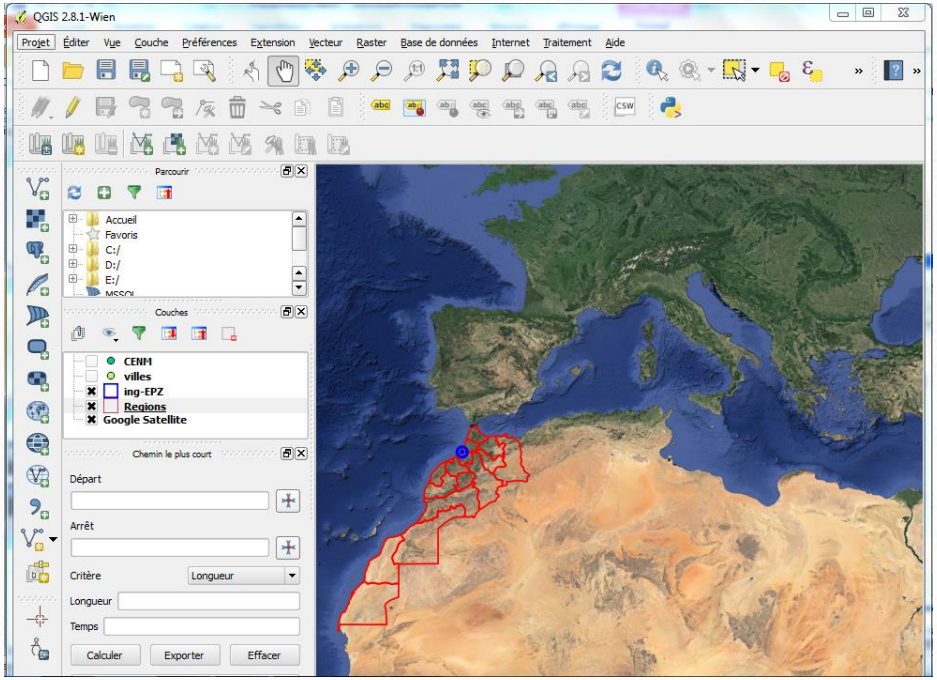


- **OpenLayers** is an open source toolkit that is loaded into the web browser for creating queries to the Geoserver through GeoWebCache. If the required tile does not exist in the cache GeoServer will create it.

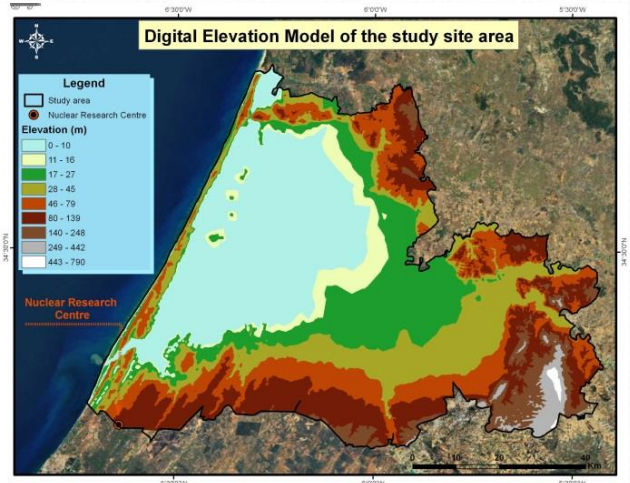


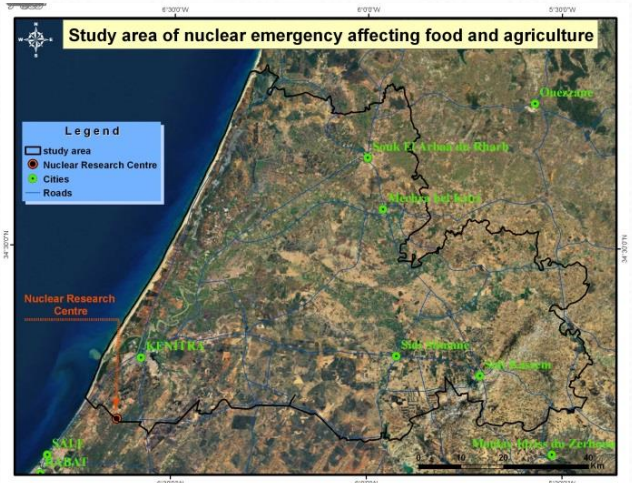
Data acquisition (Qgis)

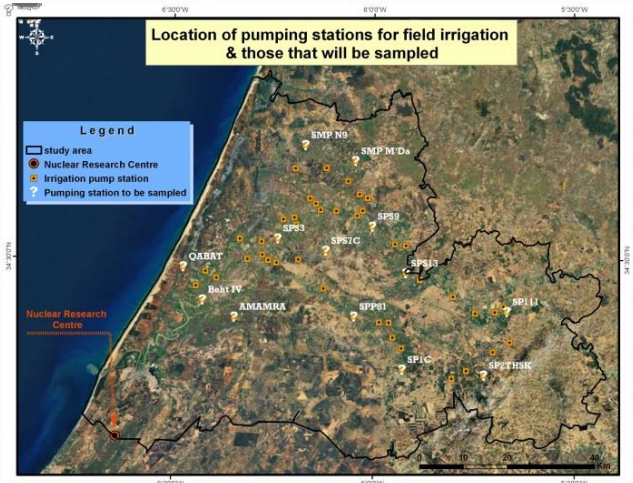
- The 2nd step: we generate vector and raster data with the help of QGIS and collect some other from national partners or from the web, such as:
- - Satellite imagery: LANDSAT 7 ETM+ (*Tiff)
- - Location of food markets (*shp)
- - Spatial distribution of the food industry (*shp)
- - Spatial distribution of the population (*shp)
- - The National land transport network (*shp)
- - The administrative divisions map (*shp)
- - Agricultural development centers (*shp)
- - Watersheds and water system (*shp)
- - Pumping stations for field irrigation (*shp)
- - Irrigated and rainfed agriculture (*shp)
- - Digital elevation model (DEM) (*TIN)
- - Geological map, Soil types map, Land cover map (*shp)

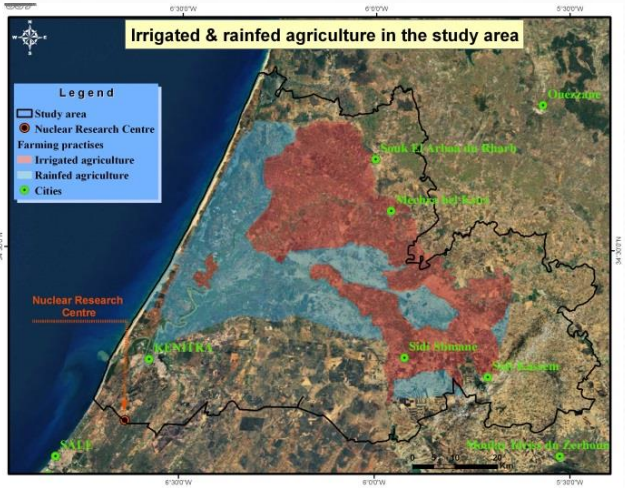


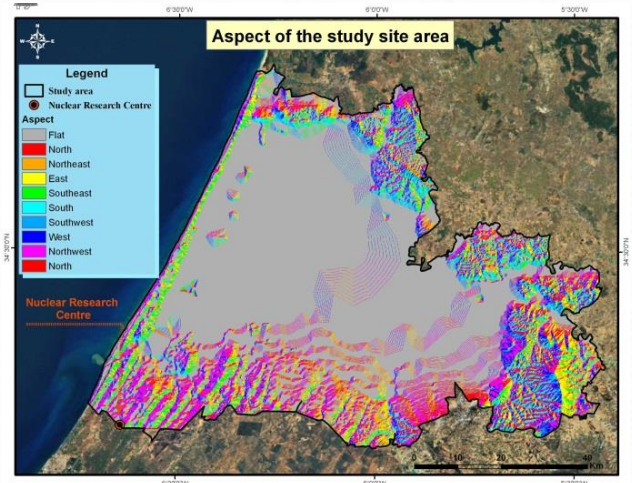
Data acquisition (Qgis)

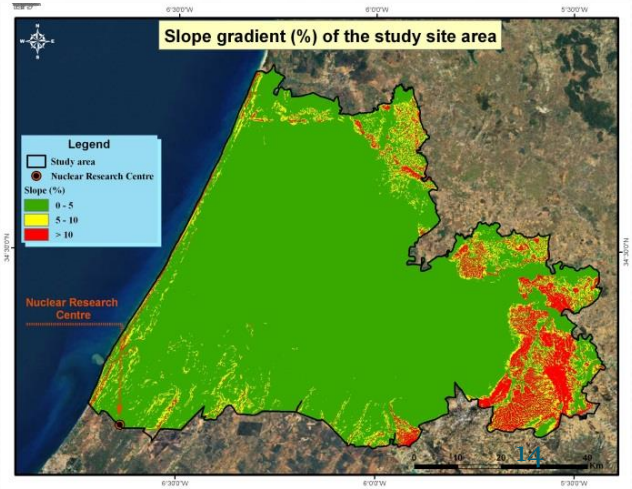






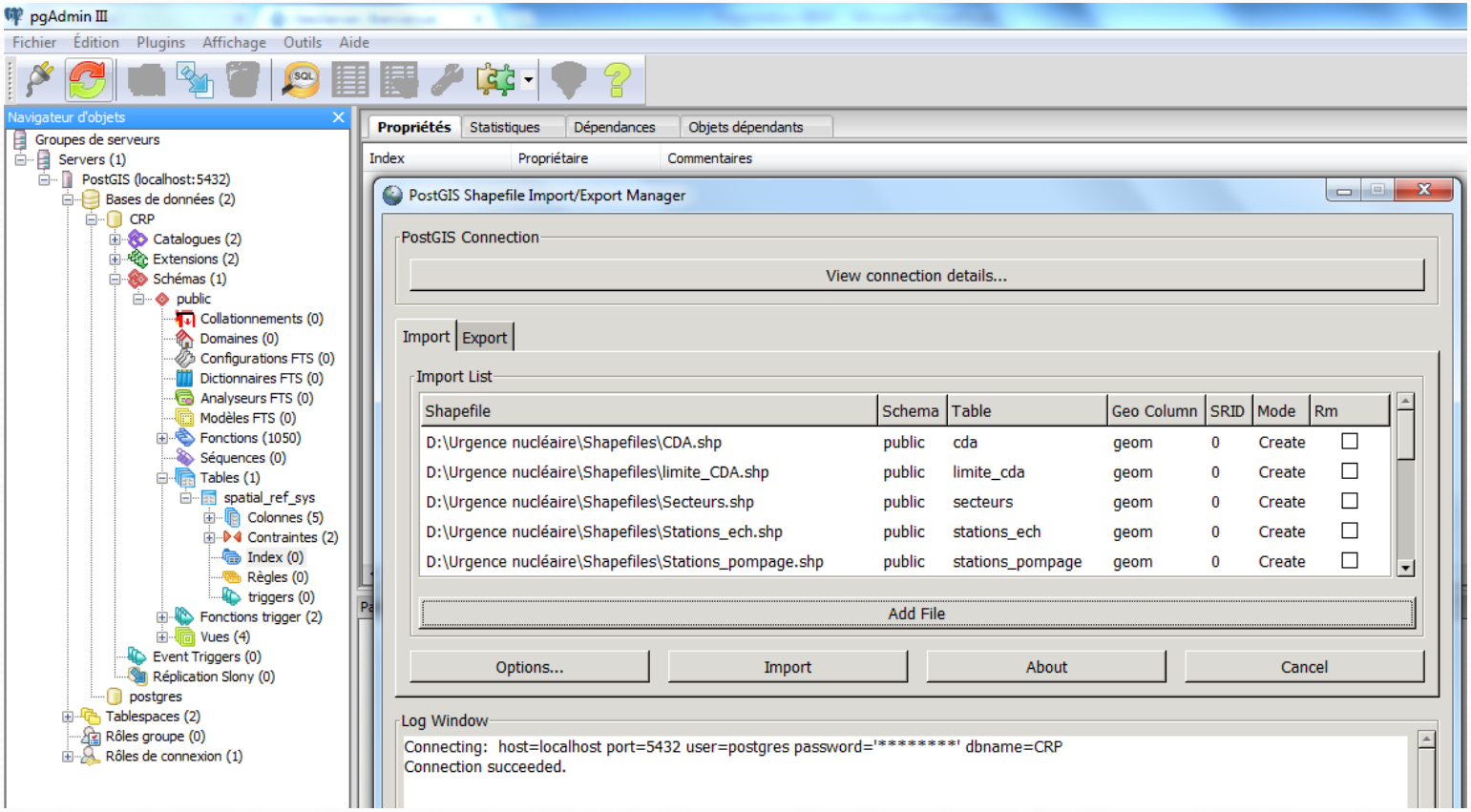




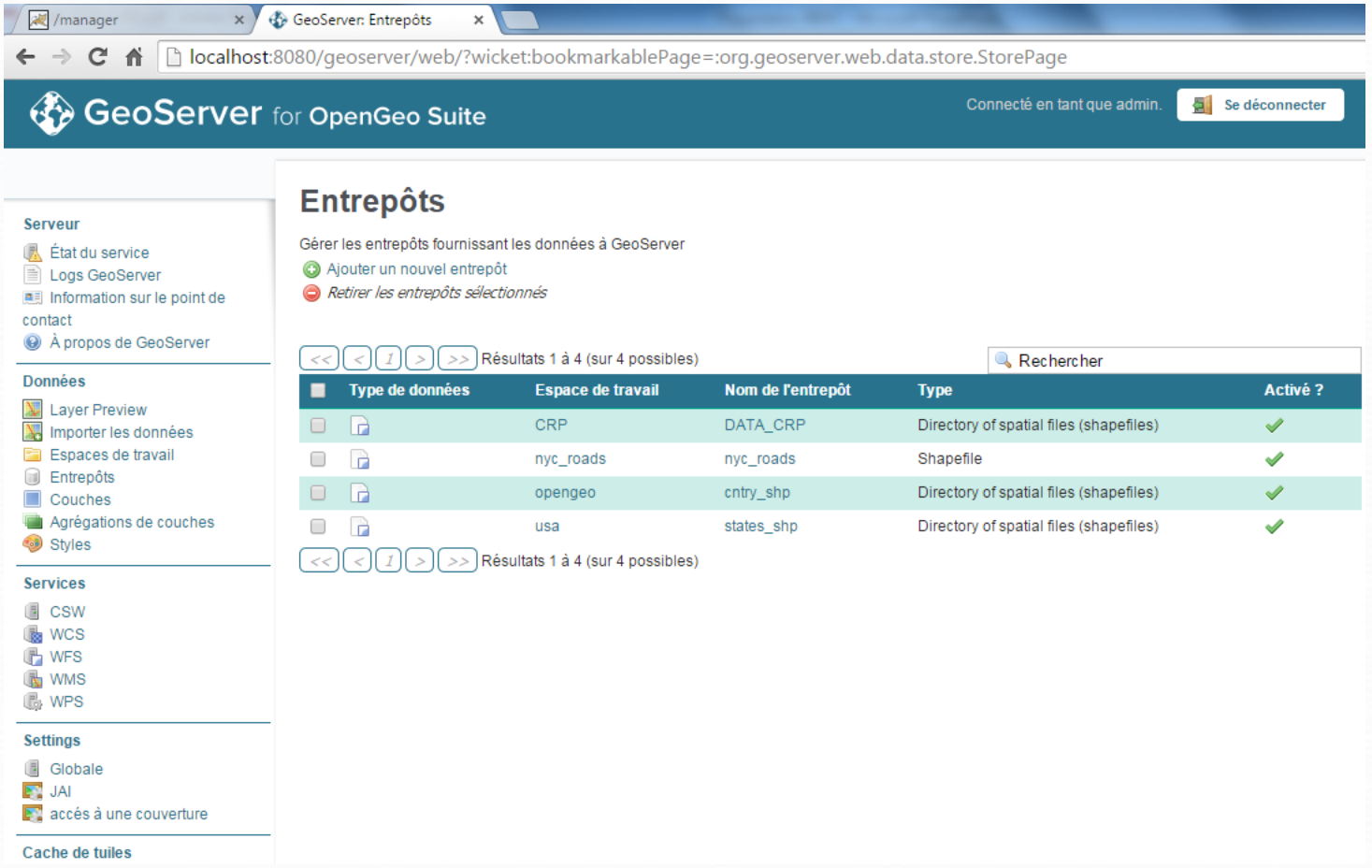


Data Storage & Management (PostgreSQL/PostGis)

- The 3rd step: To prepare all the layers with the non-spatial attribute and to create spatial data base, the PostgreSQL/PostGIS data base has been used.
- To load shape files in database, the Loader utility PgAdmin III has been used.



Data processing (Geoserver)

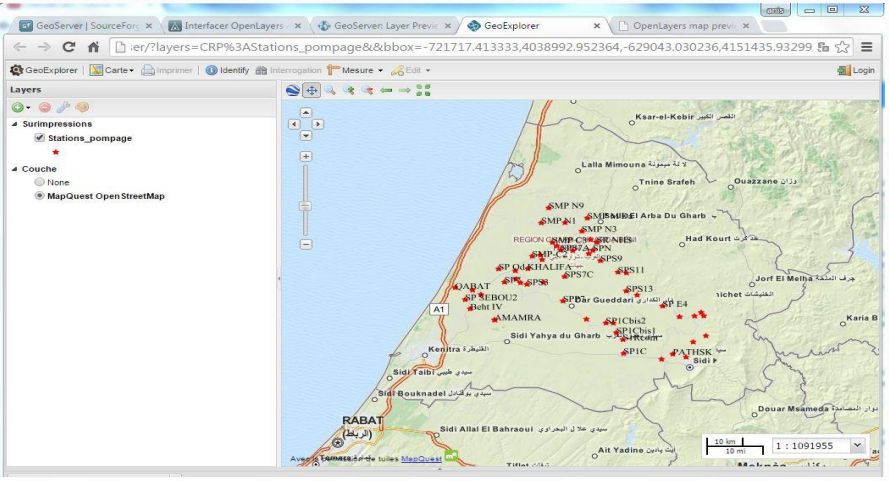


4th Step: Workspace > Data store > Add layers > Styles > Publish

Data Visualization (WMS)

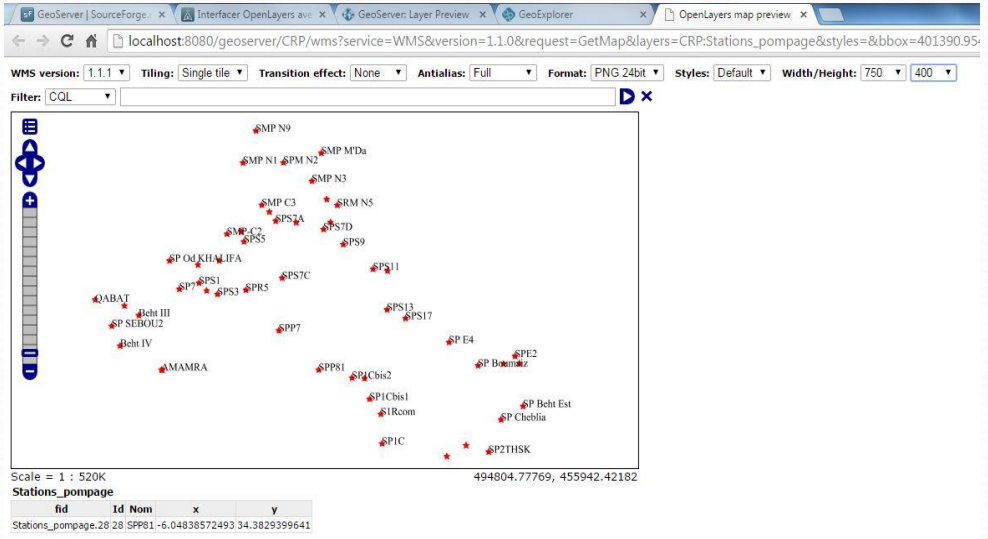
5th step: Client request spatial data from server WMS via Browser web

Server Side: Pre-visualization GeoExplorer



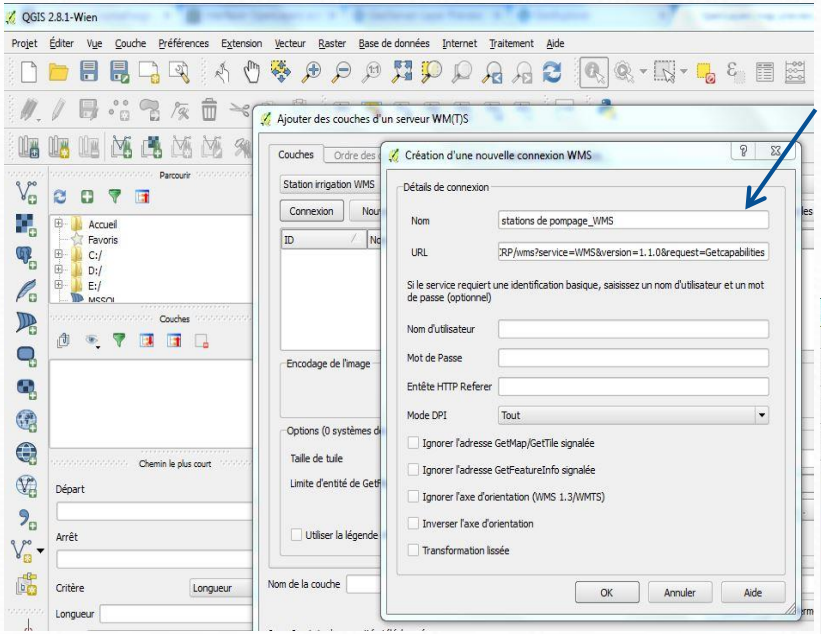
Server Side: Designing HTML Page

Client Side: Visualization via Web Browser

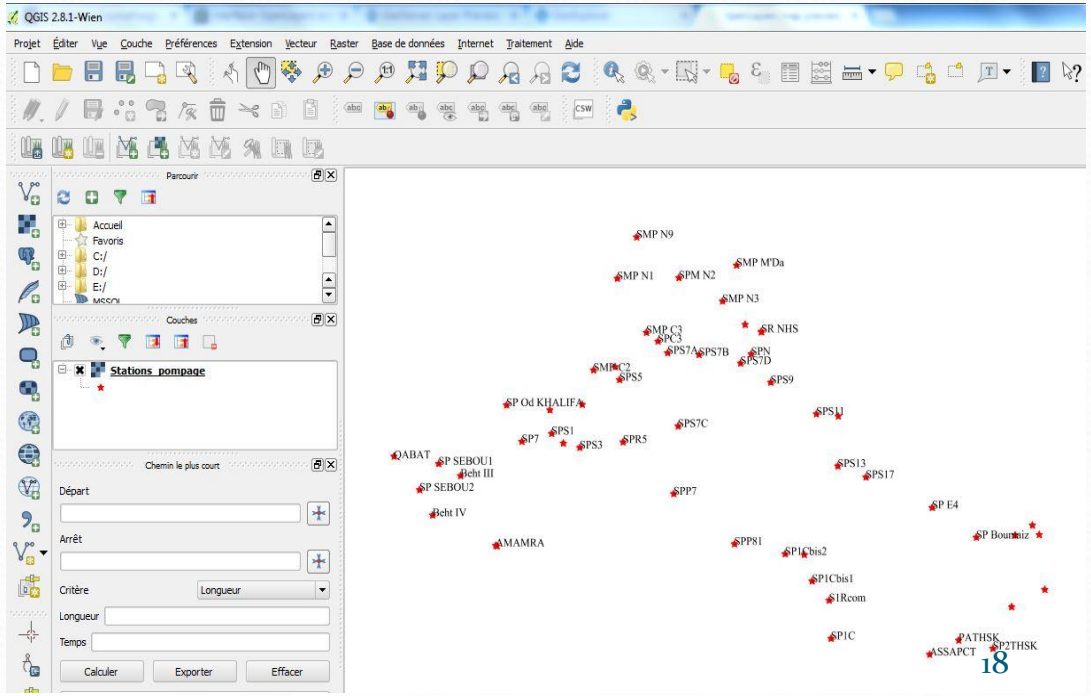


Data Visualization (WMS)

5th Step: Client request spatial data from server WMS via standalone GIS application



URL:
http://localhost:8080/geoserver/CRP/wms?service=WMS&version=1.1.0&request=Getcapabilities



The developed web application was able to achieve the objectives desired. It visualizes geospatial data in Web Browser/GIS application and provides attribute data on each layer in a pop up dialog box.

Conclusion

- This work presents the first steps of building the necessary infrastructure for the growing needs of collaboration efforts in the context of nuclear emergency affecting agriculture and food products.
- We use service-based GIS technology to build the platform for researchers to efficiently explore large amount of data. It also gives researchers the tools to deliver their knowledge in a timely manner to emergency planners and responders. However, many gaps still need to be addressed with future research and development.

Perspectives

- Our future work includes developing additional cloud-specific features on the service-based GIS framework, and migrating from local platform to the cloud infrastructure.

- Participation on national and international exercises to exchange geospatial data with national partners and other member states through this client-server application

obrigado
Dank U
Merci
mahalo
Köszi
спасибо
Grazie
Thank you
mauruuru
Takk
شكرا
Gracias
Dziękuję
Děkuju
danke
Kiitos