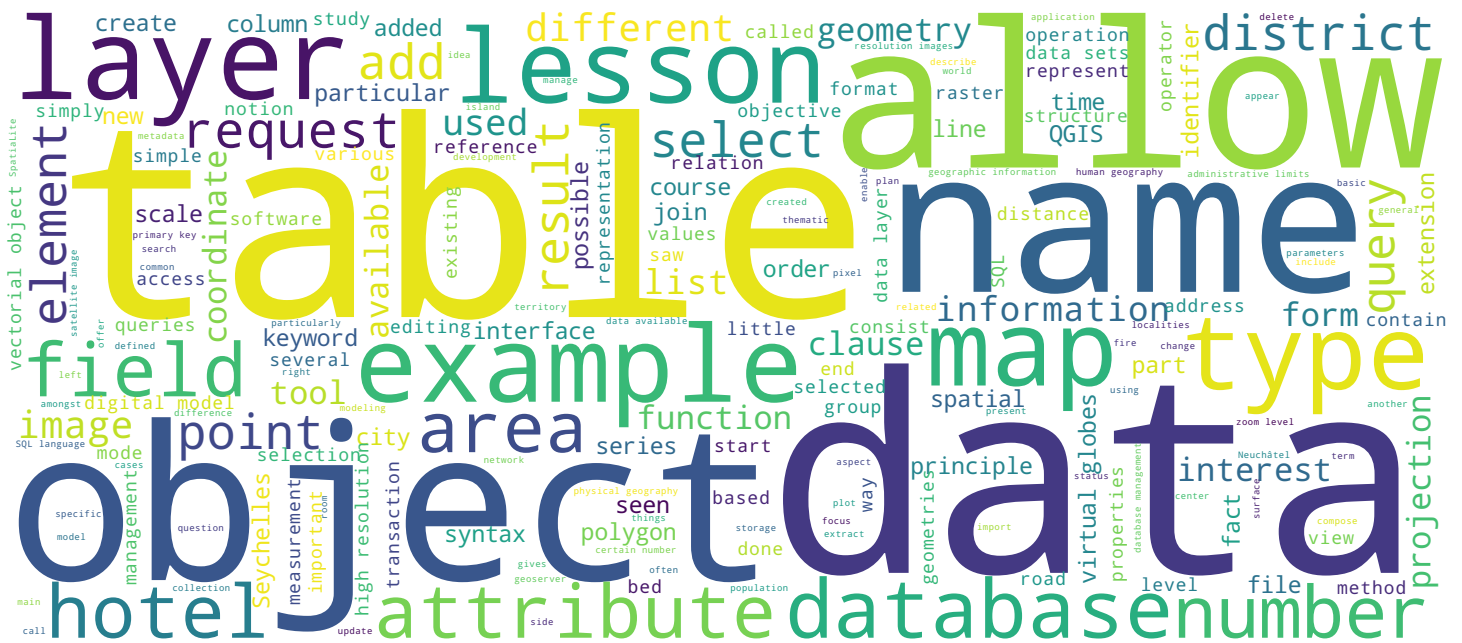


An Introduction to Geographic Information Systems

Sources of geodata

Stéphane Joost, Marc Soutter, Fernand Kouamé, Amadou Sall



Search MOOC



Video



EPFL

Sources of geodata



Objectives of the lecture

- To propose a guided tour of some sources of geodata available on the internet

After this lecture you should be able

- To integrate geodata provided by servers into GIS projects
- To search for and/or retrieve geodata sets on the internet

An Introduction to Geographic Information Systems

We saw in the 2 last lessons that the vectorization of data represents a considerable, tedious work, and that the automation of this process allows only partially to save the effort that must be made. It is therefore quite important when data have been digitalized and entered to make them available to as many users as possible. This is why most international organizations, most countries provide elaborated data sets more and more often particularly in the context of national geodata infrastructures. This lesson will therefore focus on these sources of geodata and their consultation and integration into GIS projects.

Notes

Summary

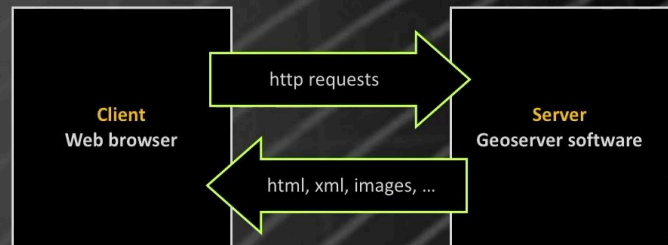


0m 21s

Geodata available on geoservers

Geodata available on the internet

- Client-server architecture
- ➔ server = machine / software able to listen and answer to requests
- ➔ http = hypertext transfer protocol
- ➔ geoserver = software able to return geodata (raster or vector) in response to requests



An Introduction to Geographic Information Systems

The objectives of this lesson are to offer you a guided tour of the main areas in which we find Internet data sets so that at the end of the lesson you are able on one hand to go to look for these data sets even if web addresses can be changed in the meantime so to go looking for these data sets but also to integrate them into a GIS project in the QGIS software. Data sources include 2 types of data which we will address successively. Firstly the data available on geoservers and then the data available for download amongst which we will distinguish digital model data of altitude, satellite imagery, physical geography data and human geography data. The data available on geoservers are therefore geodata accessible by Internet in a client-server architecture. The client is usually a web browser and the server a remote machine that houses a software that is able to listen to the traffic on the Internet network and respond to queries. The requests are sent by a browser as a HTTP chain and the geoserver is a software capable of sending back geodata either in a vectorial form or in an image form in response to such requests.

Notes

Summary



Geodata available on geoservers

Geodata available on the internet

- Client-server architecture
- Decomposition into tiles



An Introduction to Geographic Information Systems

The transfer of images or rasters that represent large Internet data volumes represents an obstacle hence the use of tile decomposition of these images. The principle of this decomposition relies on the definition of a certain number of set zoom levels and at each new zoom level the previous image which is a small image of 256 pixels on the side is divided in 4 and again in 4 at the next zoom levels.

Notes

Summary

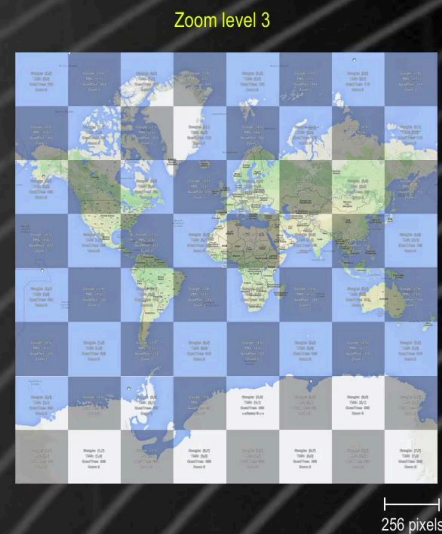


2m 52s

Geodata available on geoservers

Geodata available on the internet

- Client-server architecture
- Decomposition into tiles



An Introduction to Geographic Information Systems

The different tiles are numbered but unfortunately with slightly different systems for Google, TMS and Quadtree. We see that in the case of Google the numbering starts at the top on the left with a decreasing Y axis whilst in the TMS case, we start at the bottom on the left with an increasing Y axis.

Notes

Summary



Geodata available on geoservers

Geodata available on the internet

- Client-server architecture
- Decomposition into tiles
- WMS and WFS services
- ➔ Parametrized http requests

REQUEST: type of the request

LAYERS: layers to select

BBOX: coordinates of the area of interest

FORMAT: format of the objects to return

Etc.

An Introduction to Geographic Information Systems

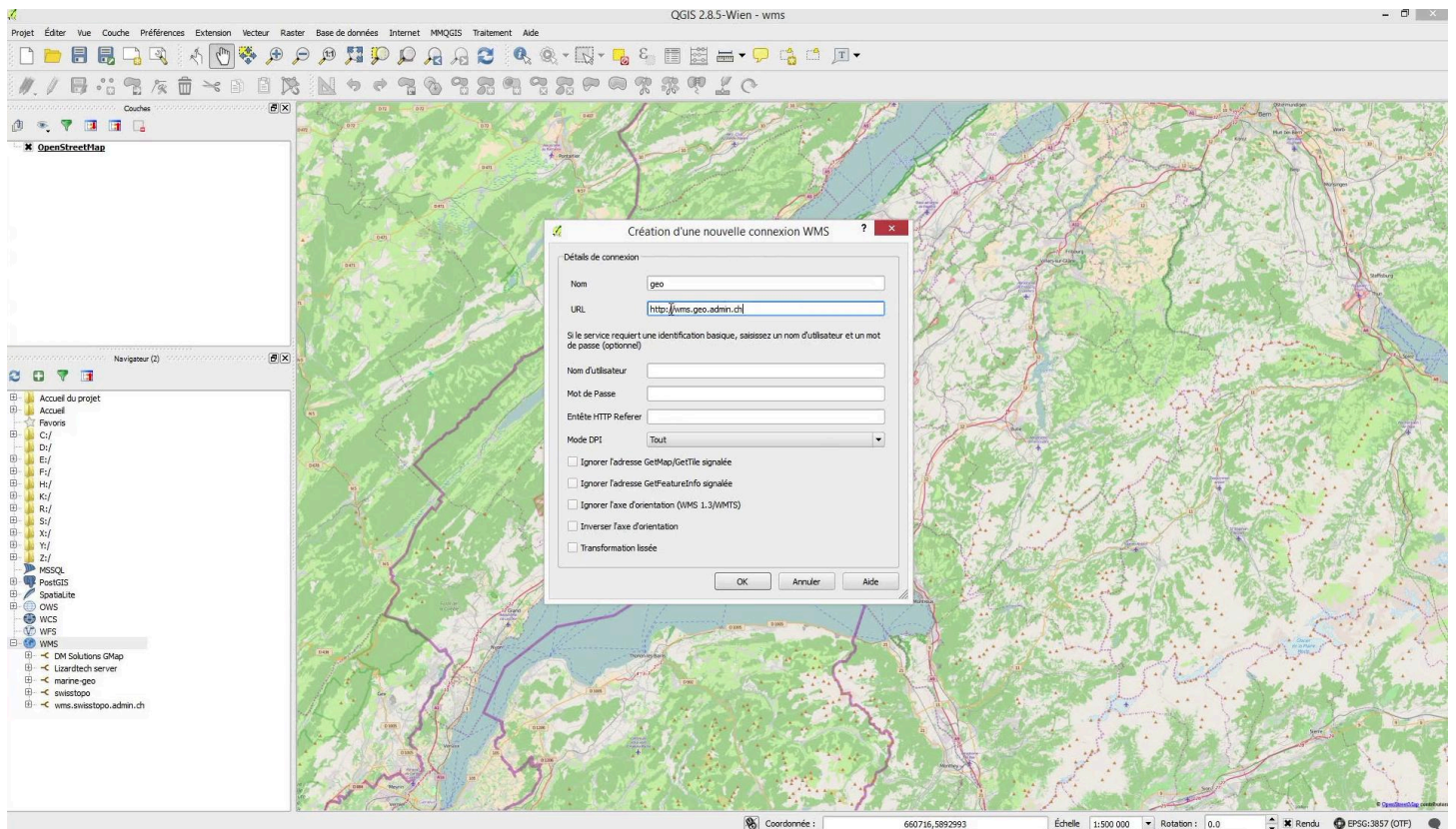
The tiling can be performed automatically by the geoservers softwares and the user simply drops the complete image on the server or this tiling can be done manually using a Gdal2tile tool which is part of the Gdal toolbox accessible on this Internet address. The geoservers softwares provide their tiles series in the form of WMS and WFS services. WMS for Web Map Service and WFS for Web Feature Service, in the first case we transfer images and in the second case vectorial objects.

Notes

Summary



3m 47s



Access to these web services involves the use of configured HTTP requests with a number of keywords in particular the type of request which in the case of the WMS, can be a capacity request, what is the server able to send as data layer in particular, of research for a specific card, of information research on the objects that compose this map. In the case of WFS servers, we find the same principle but with slightly different functionalities including queries that search this time, and in certain cases when editing is possible, some requests which allow to block the editing of an object and to record a transaction so a modification of this object. Amongst the other settings, the layers to be selected, the area of interest, the format of the objects that we want to have in return either jpeg, png image format for maps or GML, GeoJSON format for vectorial objects. We have here a QGIS project that represents the Lausanne region. We add the browser that allows to access the file tree and there we find a heading that inventories the WMS services. A new WMS connection is created which is documented with a name and with an address which is the HTTP address of the Swiss Federal Administration servers.

Notes

Summary



4m 26s

Geodata available on geoservers

Geodata available on the internet

- Client-server architecture
- Decomposition into tiles
- WMS and WFS services
- Integration in QGIS



An Introduction to Geographic Information Systems

This connection is added to the list of connections and, when we selected... when we select it we send a query of GET Capacity type to retrieve the list of available layers on this service and we see that amongst these layers, here we have a layer... Mosaic Landsat that gives a satellite picture ... at a low resolution. Amongst these different layers, we also see here the canton borders layer, of different Swiss cantons. We see in this list of available services a heading that inventories the Web Feature Services and we will also add here a new WFS connection type which is about the canton of Neuchâtel so we will call it "Neuchâtel" and then we paste the address at which this service is available. Similarly a first click will... lead to load the available data layers and we see that the data layer available, the only available it is the layer of municipalities of the canton of Neuchâtel. Here, it appears. We then see that by right clicking on this municipality layer we access its attributes, its attribute table and we see that it is indeed a vectorial layer with objects whose only available attribute is the identifier. These objects can be selected or consulted with the information access tool and we see that in the information available, we find the properties of a vectorial object namely the perimeter and the area since it is a polygon.

Notes

Summary

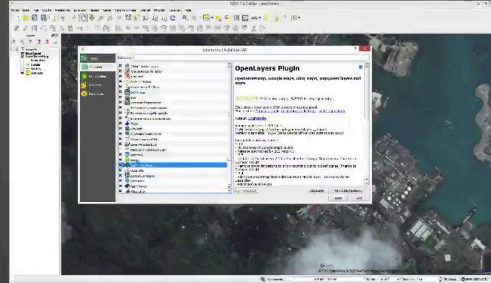


6m 02s

Geodata available on geoservers

Virtual globes

- Main sources
- Integration in QGIS



An Introduction to Geographic Information Systems

The virtual globes are a special category of data accessible by geoserver with as main sources OpenStreetMap here for the city of Dakar, Google maps in map and satellite image version, Bing maps, so the Google equivalent product of Microsoft, MapQuest which is another cartography source of map type, Yahoo maps also in satellite image, Yandex maps of russian servers and finally the maps provided by ArcGIS online. The integration of these different virtual globes data sources in QGIS goes through the OpenLayer plugin which is usually installed automatically. we see that we have here the list of the different... the list is not necessarily complete but a list of a certain number of virtual globes that can be added to the map, here first the OpenStreetMap map for the island of Mahe in the Seychelles and satellite image of Bing. So if we zoom in a little in the area of the capital, Victoria, we see the details of these images and map. This OpenStreetMap plugin is an extension that is automatically installed as I said but which must sometimes be installed on foot, it is, like all extensions, in this "extensions" menu.

Notes

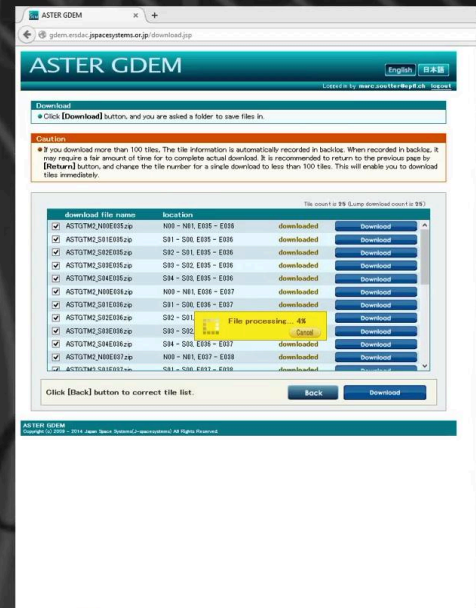
Summary



7m 52s

Digital elevation models

- ASTER-DEM – 30m
- ➔ <http://asterweb.jpl.nasa.gov/gdem.asp>
- ➔ <http://reverb.echo.nasa.gov>



Finally we find various tools on Internet which allow to download the tiles of these virtual globes maps and to amalgamate them into a mosaic to achieve a complete picture. we see here an example of a commercial software which enables to recover almost all the tiles of all the types of virtual globes that I evoked earlier with different levels of zoom and then we define an area of interest by these coordinates in latitude and longitude. Besides the virtual globes, downloading data are about digital models of altitude. First, data from the Aster satellite from 30 m of resolution which are accessible on the two sites mentioned here. These sites offer an interface in which we can choose the area of interest, here the Kilimanjaro area and then later retrieve different... the different images which compose this digital model of altitude.

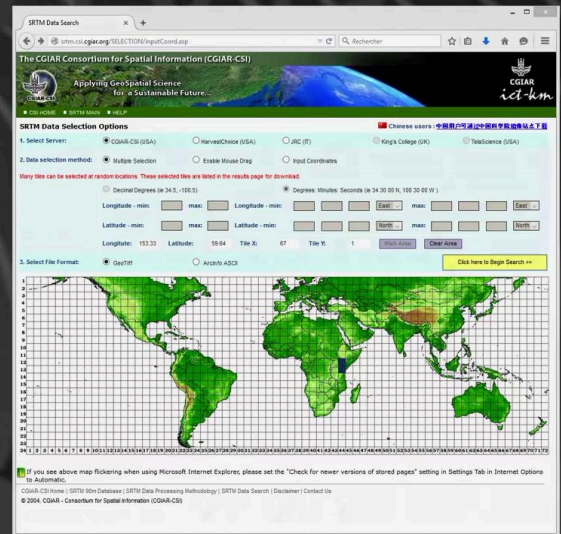
Notes

Summary



Digital elevation models

- ASTER-DEM – 30m
 - ➔ <http://asterweb.jpl.nasa.gov/gdem.asp>
 - ➔ <http://reverb.echo.nasa.gov>
- SRTM – 30m
 - ➔ <http://earthexplorer.usgs.gov/>
- SRTM – 90m
 - ➔ <http://srtm.csi.cgiar.org>



An Introduction to Geographic Information Systems

Another possibility, the SRTM data at 30 or 90 m resolution that come from the US space shuttle here also with an interface that allows to select an area of interest and then to recover the corresponding digital model of altitude.

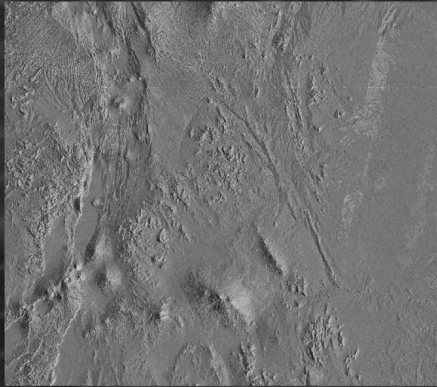
Notes

Summary

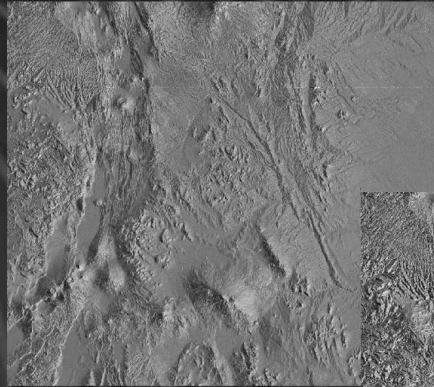
10m 46s



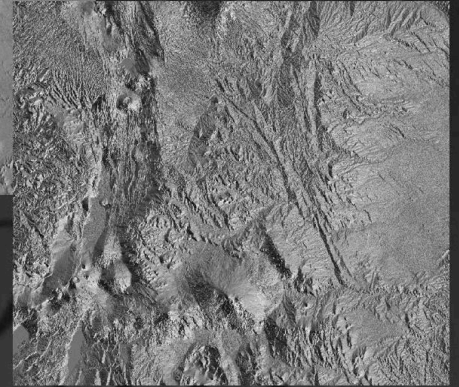
Digital elevation models



ASTER-DEM 30m



SRTM 30m



SRTM 90m

An Introduction to Geographic Information Systems

We see that the differences in resolution translate into differences in granularity of the obtained model.

Notes

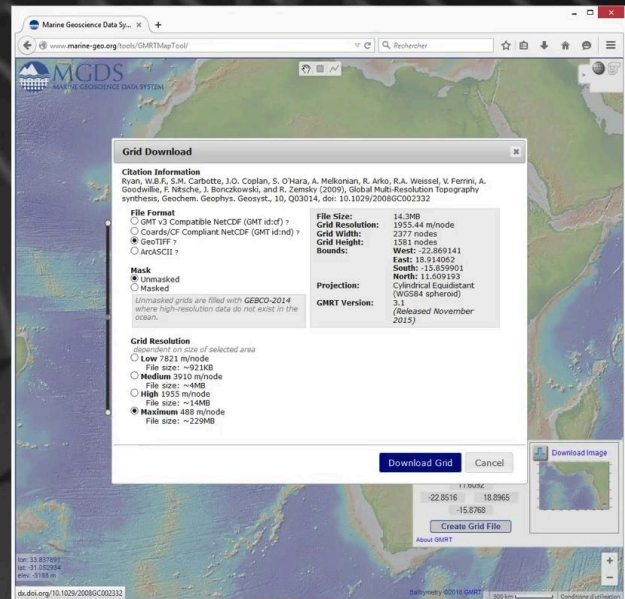
Summary



11m 04s

Digital elevation models

- ASTER-DEM – 30m
 - ➔ <http://asterweb.jpl.nasa.gov/gdem.asp>
 - ➔ <http://reverb.echo.nasa.gov>
- SRTM – 30m
 - ➔ <http://earthexplorer.usgs.gov/>
- SRTM – 90m
 - ➔ <http://srtm.csi.cgiar.org>
- Marine Geoscience Data System
 - ➔ <http://www.marine-geo.org>



An Introduction to Geographic Information Systems

Finally, altimetric data which are more about bathymetry with the Marine Geoscience Data System which also offers an interface allowing to select an area of interest and retrieve the data in different formats regarding the digital model of altitude including the submarine model.

Notes

Summary

11m 10s

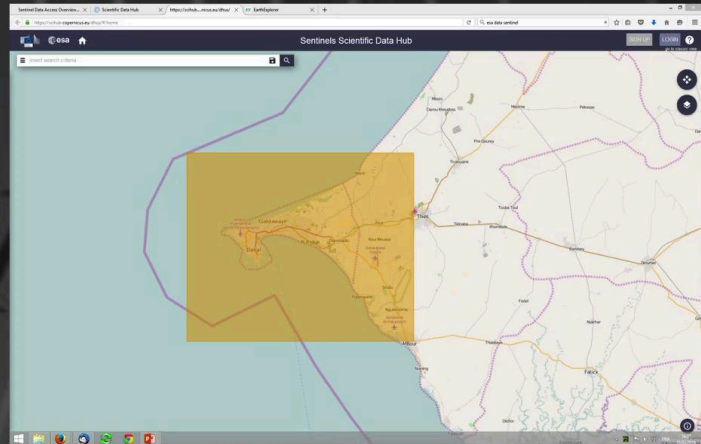


Satellite imagery

«Open» sources

• ESA – Sentinel

➔ <https://scihub.copernicus.eu/>



An Introduction to Geographic Information Systems

The satellite imagery field is a bit special in the sense that the high-resolution images are generally provided by commercial companies.

Notes

Summary



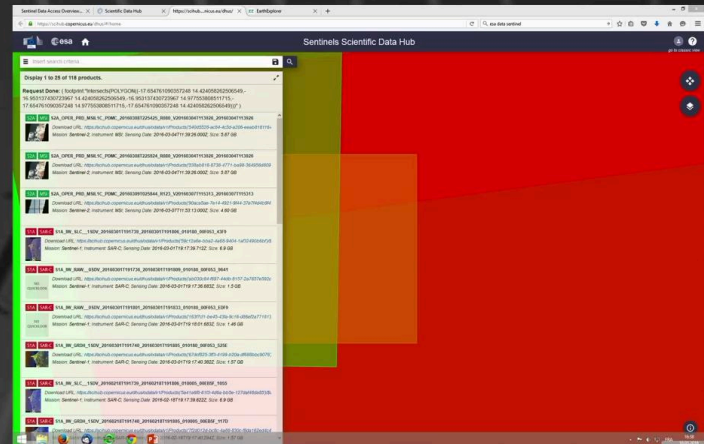
11m 44s

Satellite imagery

«Open» sources

• ESA – Sentinel

➔ <https://scihub.copernicus.eu/>



An Introduction to Geographic Information Systems

The images available and freely accessible are generally of a lower resolution in the order of 10 m for Sentinel images and 30 m for Landsat images, up to 15 m for the panchromatic band in the latter case.

Notes

Summary

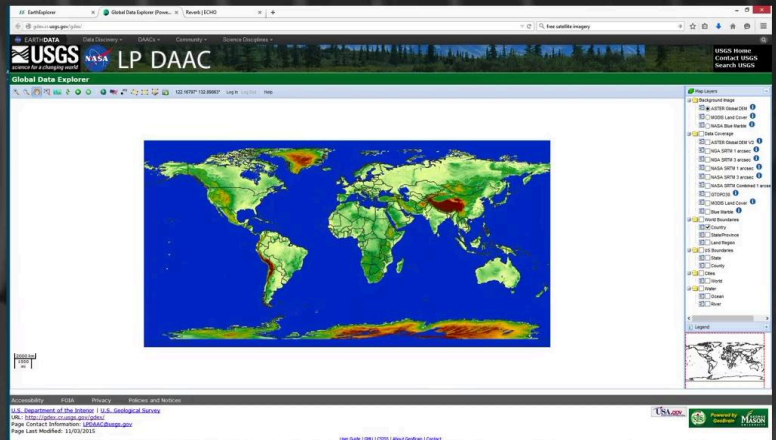
12m 00s



Satellite imagery

«Open» sources

- ESA – Sentinel
 - ➔ <https://scihub.copernicus.eu/>
- USGS – earth explorer
 - ➔ <http://earthexplorer.usgs.gov/>
- USGS – global data explorer
 - ➔ <http://gdex.cr.usgs.gov/gdex/>



An Introduction to Geographic Information Systems

In the easily accessible images amongst the best sites the Copernicus website of the European Space Agency, Earth Explorer of the US Geological Service, or the Global Data Explorer of the same service, or the NASA Reverb site.

Notes

Summary

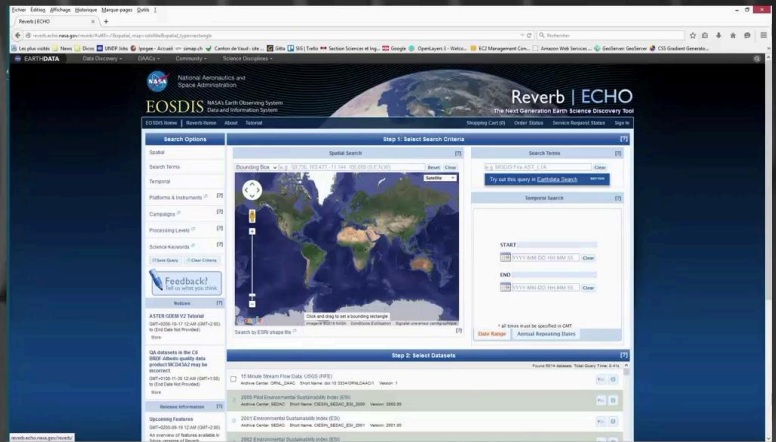


12m 09s

Imagerie satellitaire

Sources «open»

- ESA – Sentinel
➔ <https://scihub.copernicus.eu/>
- USGS – earth explorer
➔ <http://earthexplorer.usgs.gov/>
- USGS – global data explorer
➔ <http://gdex.cr.usgs.gov/gdex/>
- NASA - Reverb
➔ <http://reverb.echo.nasa.gov>



Introduction aux systèmes d'information géographique

In the 4 cases we have an interface which allows to select an area of interest on a map and then to explore the different product types provided by different satellites and various measuring instruments for different years and in different periods of the year.

Notes

Summary



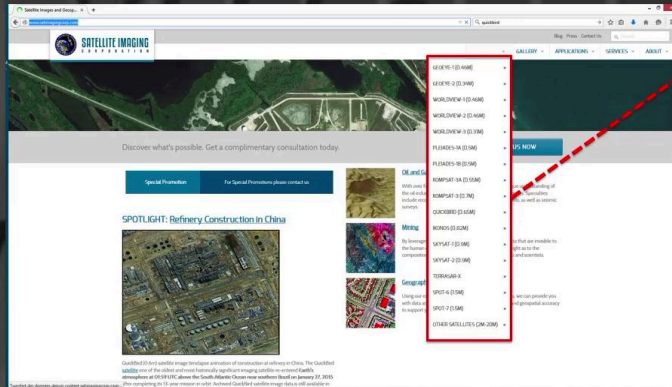
12m 24s

Satellite imagery

Commercial sources – Very High Resolution (VHR)

- Satellite Imaging Corporation

➔ <http://www.satimagingcorp.com/>



GEOEYE-1 (0.46M)
GEOEYE-2 (0.34M)
WORLDVIEW-1 (0.46M)
WORLDVIEW-2 (0.46M)
WORLDVIEW-3 (0.31M)
PLEIADES-1A (0.5M)
PLEIADES-1B (0.5M)
KOMPSAT-3A (0.55M)
KOMPSAT-3 (0.7M)
QUICKBIRD (0.65M)
IKONOS (0.82M)
SKYSAT-1 (0.9M)
SKYSAT-2 (0.9M)
TERRASAR-X
SPOT-6 (1.5M)
SPOT-7 (1.5M)
OTHER SATELLITES (2M-20M)

An Introduction to Geographic Information Systems

Commercially, many very high resolution images that are sold and often very expensive with GeoEye satellites which have very very low resolutions 34 cm for the best, Worldview, the Pleiades satellites of the European Space Agency QuickBird, Ikonos, etc. etc. Many companies provide or sell these images, the one mentioned here is only one amongst all these companies.

Notes

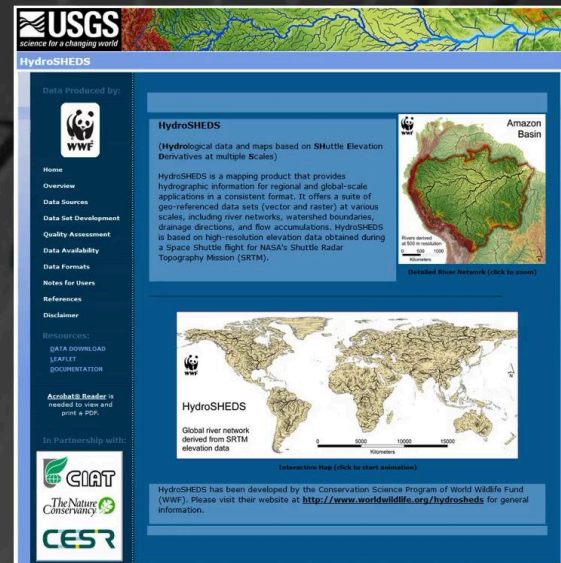
Summary



12m 39s

Physical geography

- General data
- ➡ Group on Earth Observations
- ➡ Natural earth
- Climate, hydrology, snow and ice
- ➡ Worldclim
- ➡ Hydrosheds



<http://hydrosheds.cr.usgs.gov>

An Introduction to Geographic Information Systems

It has the advantage of providing almost all the range of existing high resolution images. In the physical geography field, first for general data, the GEOSS site, which is an access portal to a large number of information sources then the Natural Earth site. This website offers both raster and vector data for different topics which are related to physical geography. In the climatic weather field, we have Worldclim which provides globally fairly high resolution maps of climatic parameters, the average rainfall for the year, for different months of the year, temperatures, etc.

Notes

Summary

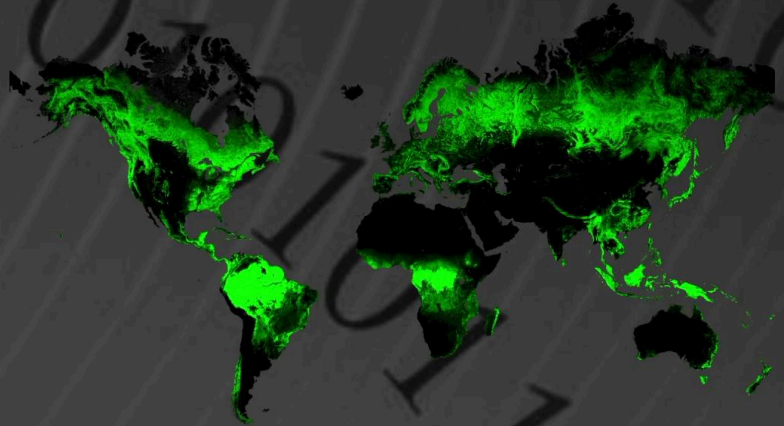
13m 15s



Physical geography

- Environment
- ➡ Forests

% of forest cover in 2000



<http://data.globalforestwatch.org/>

An Introduction to Geographic Information Systems

Hydrosheds, which provides catchment basins and hydrographic networks of the waterways for all the catchment basins of the planet and the Global Land Ice Measurements, which provides information on all the glaciers, as we can see here the different glaciers of the western Switzerland alps. For the ground we have Soilgrids and Globcover for the ground cover and the Landcover layer of Climate Change Initiative which actually took over from Globcover.

Notes

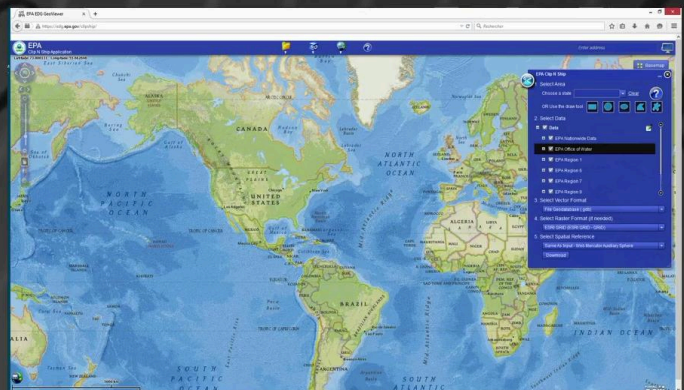
Summary



14m 12s

Physical geography

- Environment
- ➔ Forests
- ➔ UNEP-PNUE
- ➔ EPA



<https://edg.epa.gov/metadata/catalog/main/home.page>

An Introduction to Geographic Information Systems

In the field of environment, forests with the percentage of forest cover, the data provided by the United Nations Environment Program and data from the US Agency for Environmental Protection.

Notes

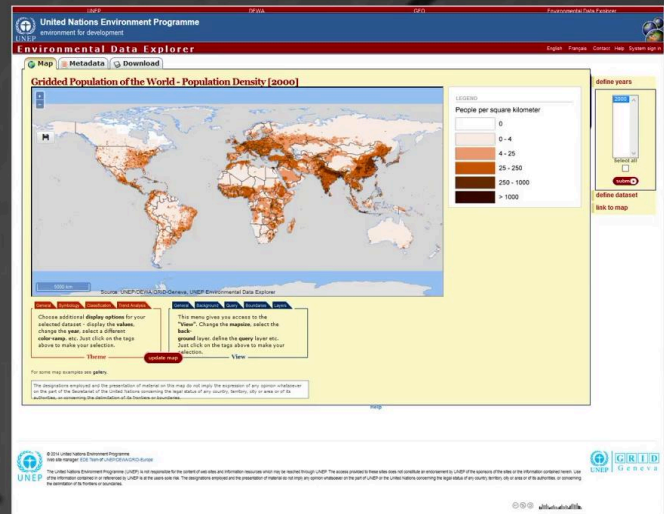
Summary



14m 48s

Human geography

- General data
- ➔ Natural Earth
- ➔ UNEP-PNUE



<http://geodata.grid.unep.ch/>

An Introduction to Geographic Information Systems

Finally in the field of resources, we have a portal for geology and here a site that constitutes a global observatory of energy. In the field of human geography, we find general data on the Natural Earth site including the administrative limits data: public places, urban areas, transport infrastructure, etc. Again, the United Nations Program on Environment site which contains many data particularly in relation with the population or with socio-economic themes.

Notes

Summary

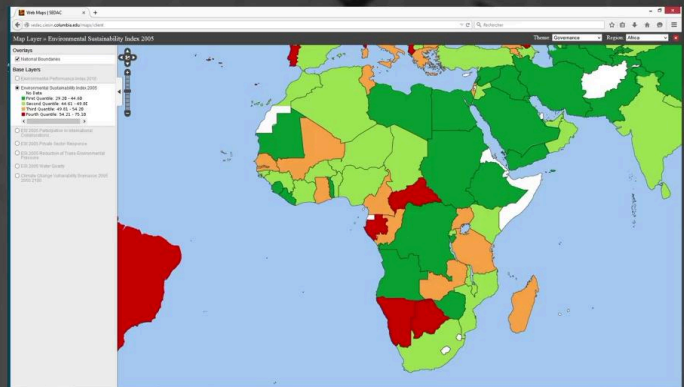
15m 02s



Human geography

- General data
- ➡ Natural Earth
- ➡ UNEP-PNUE
- ➡ World bank
- ➡ Socio-Economic Data and Application Center

Environmental sustainability index 2005



<http://sedac.ciesin.columbia.edu>

An Introduction to Geographic Information Systems

Other useful sources of information from the human geography perspective, it is all the maps provided by the World Bank and finally the center of application and socioeconomic data related I believe to NASA which is found here.

Notes

Summary



15m 55s

Human geography

- General data
 - ➡ Natural Earth
 - ➡ UNEP-PNUE
 - ➡ World bank
 - ➡ Socio-Economic Data and Application Center
- Population
 - ➡ Worldpop
- Toponymy and administrative limits
 - ➡ Geonames
 - ➡ Global Administrative Areas



<http://gadm.org/>

An Introduction to Geographic Information Systems

For more targeted thematic we find Worldpop for the population and for toponymy, the Geonames site with here a selection of toponyms from Ghana and for the administrative limits, Global Administrative Areas, a site that provides the administrative limits of level 0 so national and of level 1 - 2 - 3 for the subdivisions, by districts, by municipalities, etc. etc.

Notes

Summary



16m 13s