E-LEARNING COURSE FOR TEACHERS: *Innovative Educational Tools for Assessment of the Hydraulic Heritage with by ICT Tools.*

MODULE IV (Part 3) : INNOVATIVE EDUCATIONAL TOOLS IN SCHOOL

Part 3: Hydraulic heritage and Geotech for learning and knowledge

Module IV: Innovative educational tools in school

1. Geotechnologies for learning and knowledge
2. GPS and geolocation
3. Remote sensing and geo-data capture
4. Geographic Information Systems and data processing
5. Web Mapping: Interoperability and Spatial Data Infrastructures (SDI)
6. The future: GIS and cloud computing in education

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1. Geotech for learning and knowledge

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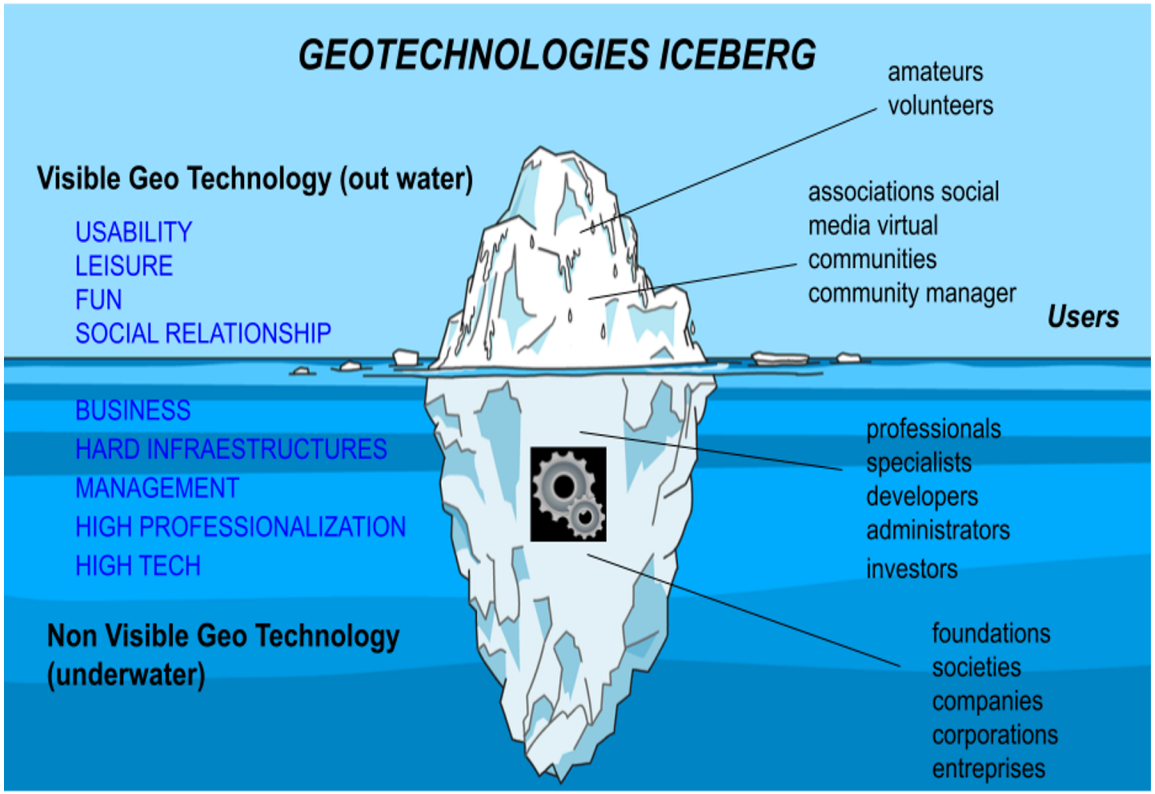

Hydrological heritage with:

G.P.S.

Remote Sensing

G.I.S.

Web Mapping

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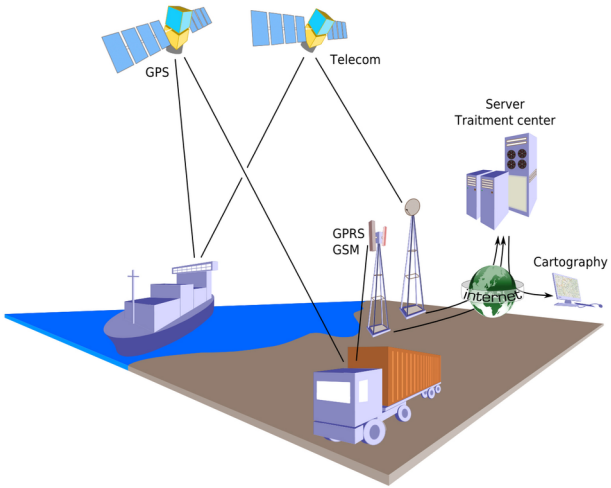
2. GPS & Geolocation

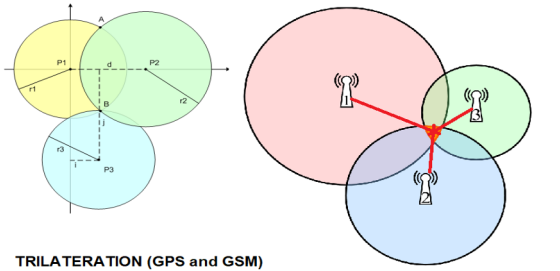
The **Global Positioning System** (GPS) is a **global navigation satellite system (GNSS)** that provides geolocation and timing information to a GPS receiver.

It's a **complex global system based** on constellations of satellites, atomic clocks and ground radio communication stations, most of them military (Navstar-USA, Glonass-Russia, Beidou-China, Galileo-EU, Navic-India, QZSS-Japan...).

The main advantage of this technology is its **the usability**. It is easy play GPS from any mobile device for **facilitates didactic applications** like geotagging, geocoding, geocaching, etc.

In teaching experience on the valuation of hydraulic heritage offers: **usability**, **make the mapping attractive and simple, facilitates collaborative work, field work and active learning.**





TRILATERATION (GPS and GSM)

Scheme of calculating the positioning of an element from trilateration with three distances from known points

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3. Remote Sensing & Geo-data capture

3

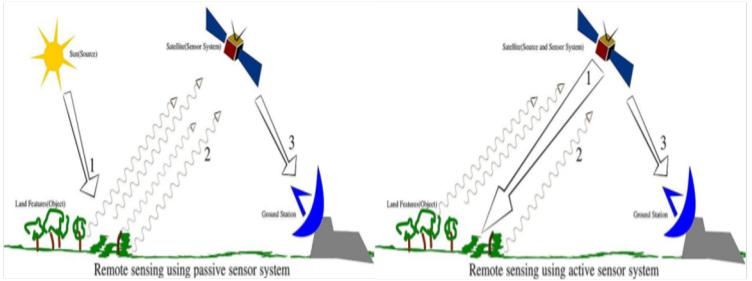
Remote sensing provides large **volumes of digital geographic information** of the earth's surface.

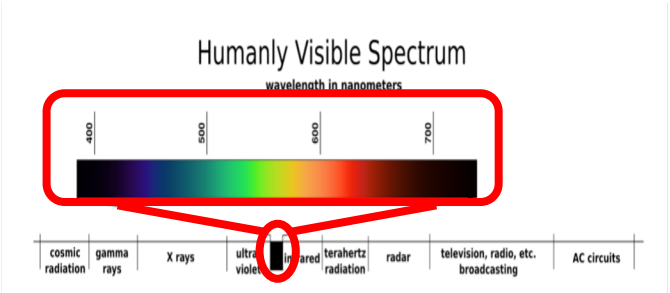
The variety of remote sensors provides us with geographic data **beyond what the human eye sees**.

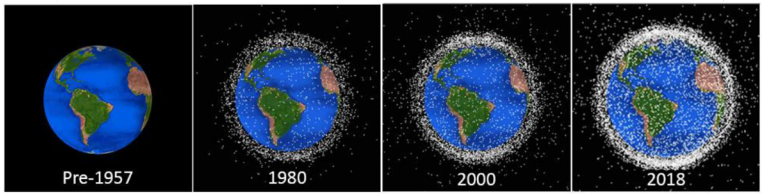
This huge collection of geo-data, we have become aware of the fragility of our planet and now **we can see how human activities affect it globally**.

Remote sensing is a **great pedagogical tool**, because:

- It's image and image is a powerful ally in the learning process.
- It allows us to see phenomena better than on a map.
- There are historical series, that allow learning about the evolution of human or natural landscapes.
- Facilitates the geolocation of hydraulic heritage targets and are of great help in field work with students.







A NASA rendering of orbital debris growth.
Source: NASA, Orbital Debris Program Office 2018

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4. GIS and data process

Geographic information System (GIS) are database applications with geographical operational capabilities.

GIS digitizes geographic information with 2 topological systems: **raster** and **vector**.

When spatial data have been digitized, GIS allows the addition of other non-spatial thematic attributes.

GIS is hard core of Geotechnologies.

GIS in classroom has the same disadvantages as other sophisticated technological tools: need hardware, teachers training also is needed, availability of geo data and user-friendly programs

For voluntary cartographic information about Hydrological Heritage, GIS software have a **desktop** version for PC, an **online** version for WEB and a version mobile for field work from smart cells

In High School, the leadership in most of the teaching experiences is the GIS software online

Cloud computing is a solution to equipment and learning needs.

Availability of interoperable and standardized data from geo WEB portals and Spatial Data Infrastructures (SDI) is an incentive for the use of GIS in classroom.

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5. Interoperability and SDI

1 2 3 4 **5** 6 7 8 9 10

We need to speak the same geographic language for sharing data, this process is defined as: **geographic data interoperability.**
Institutions such as the **Open Geospatial Consortium** (OGC Foundation), specify the **standardization of formats and services** that guarantee the easy use of geographic data.

In Europe, the **INSPIRE Directive** legally regulates and harmonizes the entire geographic information dissemination policy for all member states.

Countries and institutions develop **Spatial Data Infrastructures (SDI)**. Web tools that integrate a set of resources of Geographic Information, complying with international interoperability standards and allowing to make use of cartography and combine geographic data in a simple way.

The pedagogical practices in High School make indirect use of **SDI data in Web Mapping**. This is important, as they are the operational basis on which to share, create or disseminate our own content.

GEOSPATIAL WORLD CC 2.0 Flickr

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6. Future: GIS & cloud computing

GIS can be used in a Cloud Computing environment. The **GIS Cloud** will be the successful modality for teaching in the near future.

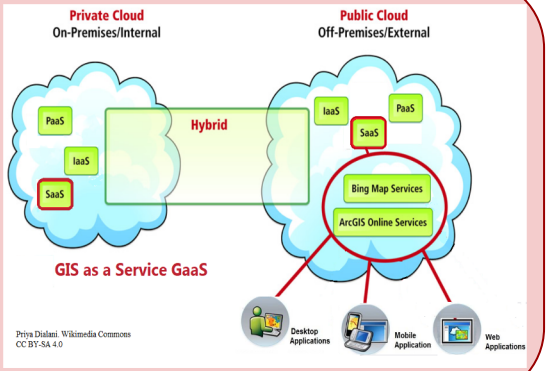
There are **3 modalities of GIS Cloud**:

Undoubtedly, **the most used is Software as a Service (SaaS)** that offers the user of a web browser access to web services and data (GIS as a Service, like ArcGis Online).

Other modalities are **Infrastructure as a Service (IsaS)** or Virtualized hardware in the cloud, and **Platform as a Service (PaaS)** so that users can use a software platform and do geoprocessing over the Internet (such as ArcGis Server or EOS Landviewer for Remote Sensing, for example)

GIS Cloud is present in many Geo Educational initiatives, because:

- **Eliminates** hardware and software **problems** in classroom.
- Is very **profitable in learning curve**.
- Is **free of charge** for schools and students
- **Ability to incorporate data** from different origins and formats.
- Possibility of **sharing** these didactic units in the cloud. (can be reused by other educational centers)



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