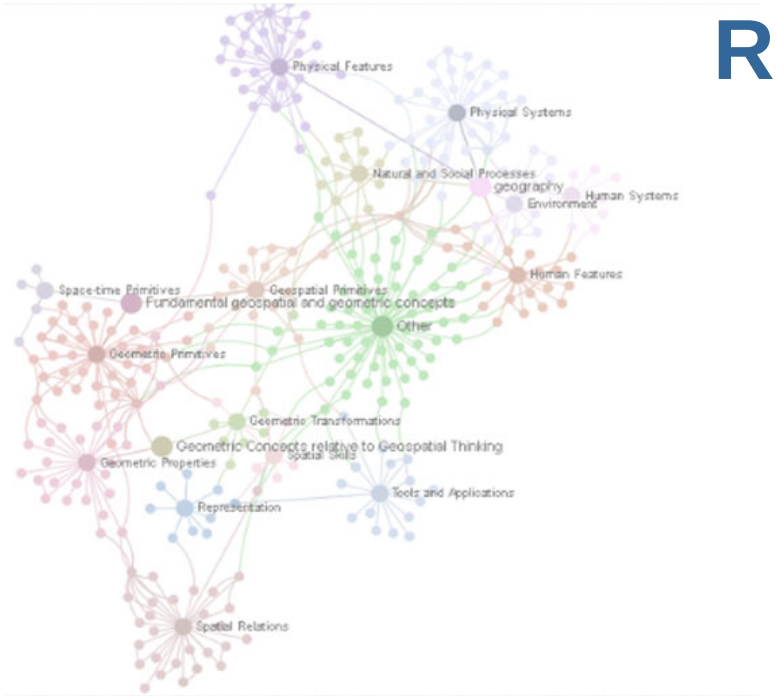
GEOTHNK Summer School
July 5th – July 10th, 2015
Attica Greece



Resources and Tools for Enhancing Spatial Thinking

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Lifelong Learning Programme

European Commission
Education, Audiovisual and Culture Executive Agency (EACEA)
Managing programmes and activities on behalf of the European Commission
Unit P1 - Lifelong Learning: Comenius, ICT, Languages and Programme Coordination

Outline

- Spatial thinking and its importance
- Motivation behind the GEOTHNK approach
- Resources for spatial teaching and learning
- Examples of teaching scenarios for enhancing spatial thinking

What is spatial thinking?

*(*Spatial Literacy Program, University of Redlands*)*

"*the confident and competent use of maps, mapping and spatial perspectives to address ideas, situations and challenges. The ability to visualize and interpret location, distance, direction, relationships, movement and change through space is fundamental to content understanding and problem solving".*

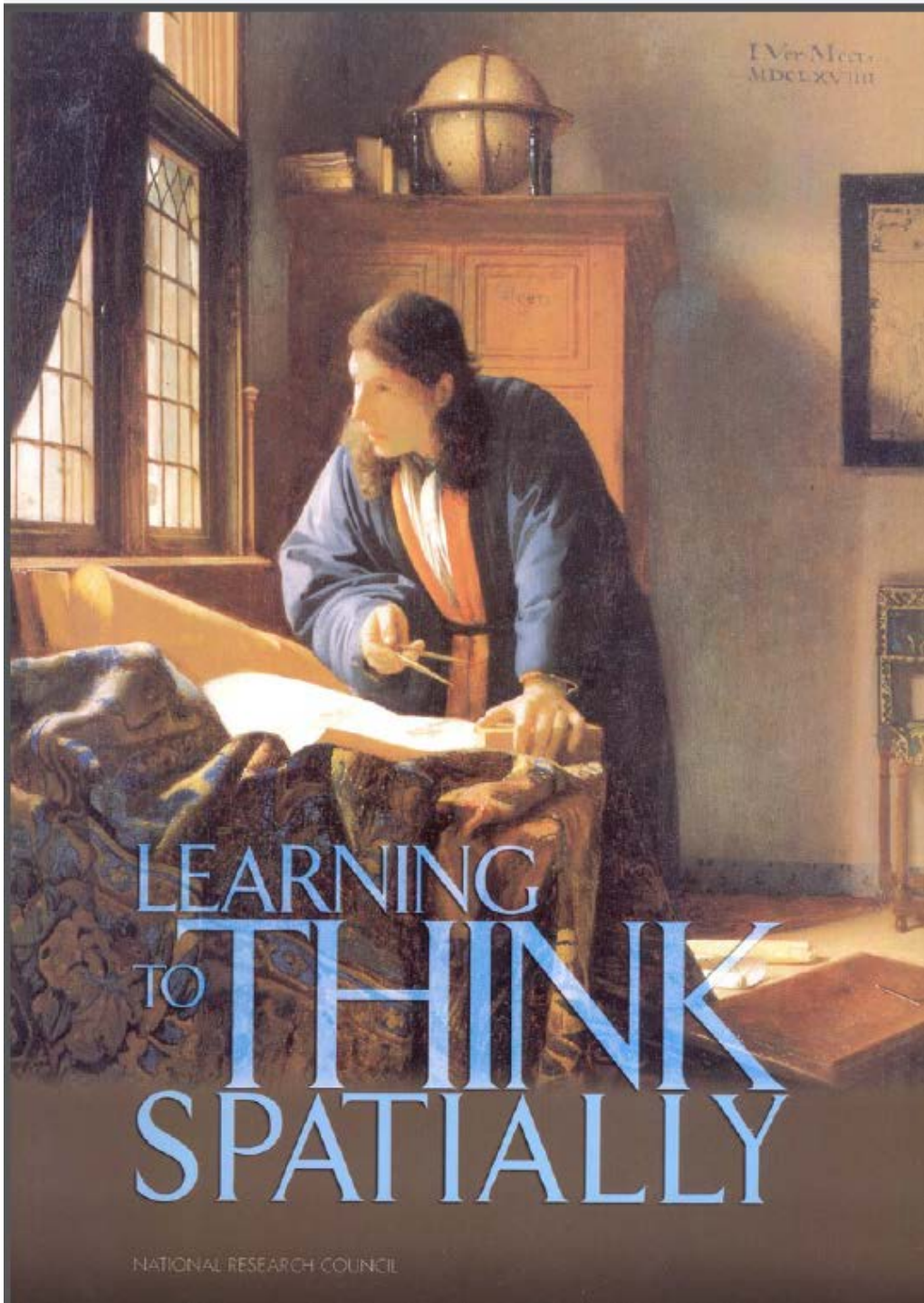
"*Learning to think spatially is a form of learning how to learn*"

Spatial thinking

- key ability for the *STEM disciplines*:
  - **increasing the participation in STEM disciplines**
  - vital talent for achieving STEM innovation: 90% of STEM doctorate holders scored in the top quartile of spatial ability during adolescence.
- highly relevant to *social sciences and humanities*
- critical for several tasks required in *daily life*, such as giving and following directions, navigating in known and unknown spaces, and interpreting images, graphs, and diagrams.

"*without explicit attention to [spatial literacy], we cannot meet our responsibility for equipping the next generation of students for life and work in the 21st century*".

National Research Council, 2006. "Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum", http://www.nap.edu/catalog/11019.html



Components of spatial thinking

(US National Research Council, 2006)

1. Spatial concepts (e.g., location, distance / proximity, elevation, etc.)

2. Representation tools (e.g., maps and terrain models)

3. Reasoning processes (e.g., combining maps and evaluating multiple criteria)

Geospatial thinking in education in Europe

- "At present there is no systematic, European, national or regional, educational agenda to promote GI*. It is rare to find any integration of GI in education or consideration of issues concerned and identified needs*"...
- "… *most of the activity remains centred largely outside Europe, developments are very dispersed across different sectors and in different locations*" (Donert, 2010).

GEOTHNK: why and how

- enhance and integrate the three components of spatial thinking: concepts, representation tools, and reasoning tools
- collect the wealth of resources available on the web
- provide for their meaningful, and interdisciplinary association

GEOTHNK: the result

- over 250 concepts and 770 resources for their explication (provided by GEOTHNK)
- 56 representation tools (provided by GEOTHNK)
- an open set of reasoning tools (provided by users as well)

Concepts

Three types of concepts:

- general concepts
- specific concepts relevant to particular disciplines
- interdisciplinary concepts

Concepts

- general concepts not particularly focused on any specific discipline, such as class, accuracy analysis, and analogy.
- specific concepts relevant to particular disciplines such as Geography, Earth Sciences, Environment, and Mathematics. For example, the concept ‘continent’ (Fig. 2) is mainly relevant to Geography, the concept ‘deforestation’ (Fig. 3) to Environment and the concept ‘interpolation’ to Mathematics (Fig. 4).

General concepts

Concept term

accuracy

Concept definition

the quality of being near to the true value

Resources

Wikipedia: Accuracy and precision
MathIsFun: Accuracy and precision
MathWorld: Accuracy
NOAA 200th – Surveying: Accuracy vs. Precision

Specific concepts relevant to particular disciplines

Concept term

continent

Concept definition

one of the large landmasses of the earth

Resources

Encyclopedia Britannica Kids: continent
Encyclopedia Britannica: continent (geography)
Nations Online Project: Continents of the World
Wikipedia: continent

Specific concepts relevant to particular disciplines

Concept term

deforestation

Concept definition

the state of being clear of trees

Resources

eSchoolToday: What is deforestation?
Kids.mongabay.com: What is deforestation?
National Geographic: deforestation
Wikipedia: deforestation
LiveScience: Deforestation: Facts, Causes & Effects
University of Michigan - Global Change: Deforestation

Specific concepts relevant to particular disciplines

Concept term

interpolation

Concept definition

(mathematics) calculation of the value of a function between the values already known

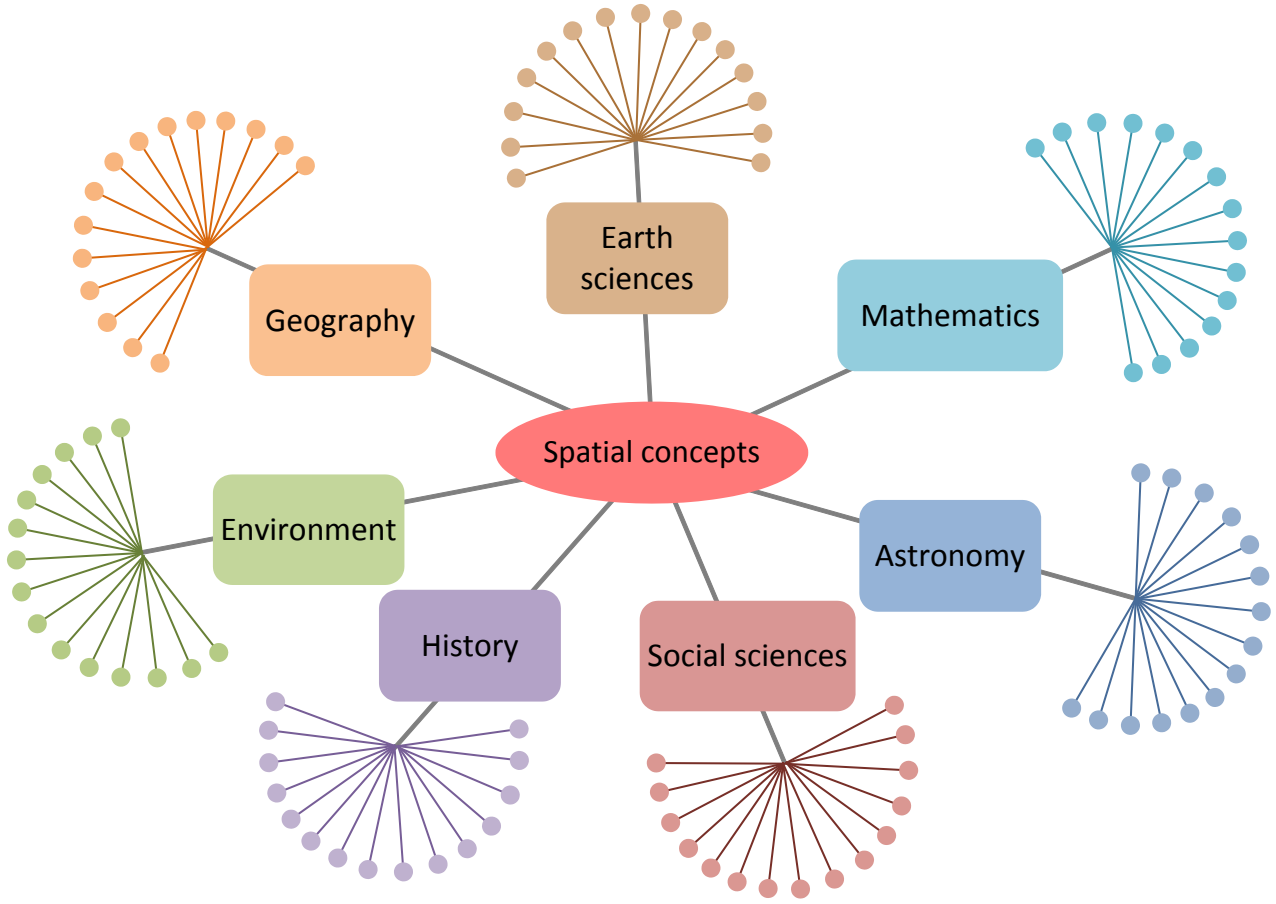
Resources

Encyclopedia Britannica: interpolation
Encyclopedia of Mathematics: interpolation
Wolfram MathWorld: interpolation

interdisciplinary concepts

- relevant to several scientific fields that function as a bridge for linking these fields and for developing multifarious scenarios.
- e.g., the concept ‘city’ may be used for several scenarios dealing with a variety of subjects, such as
  - develop a new city plan,
  - identify major cities and population distribution from satellite images showing night-time lights,
  - study cities in world history and analyze the phenomenon of urban sprawl.

Spatial concepts function as the bridge for linking different disciplines



Resources for Concepts

Concept term

natural resources

Concept definition

resources (actual and potential) supplied by nature

Resources

Encyclopedia Britannica Kids: Natural Resources
National Geographic: Natural Resources
BrainPop: Natural Resources

Resources for Concepts

Concept term

scale

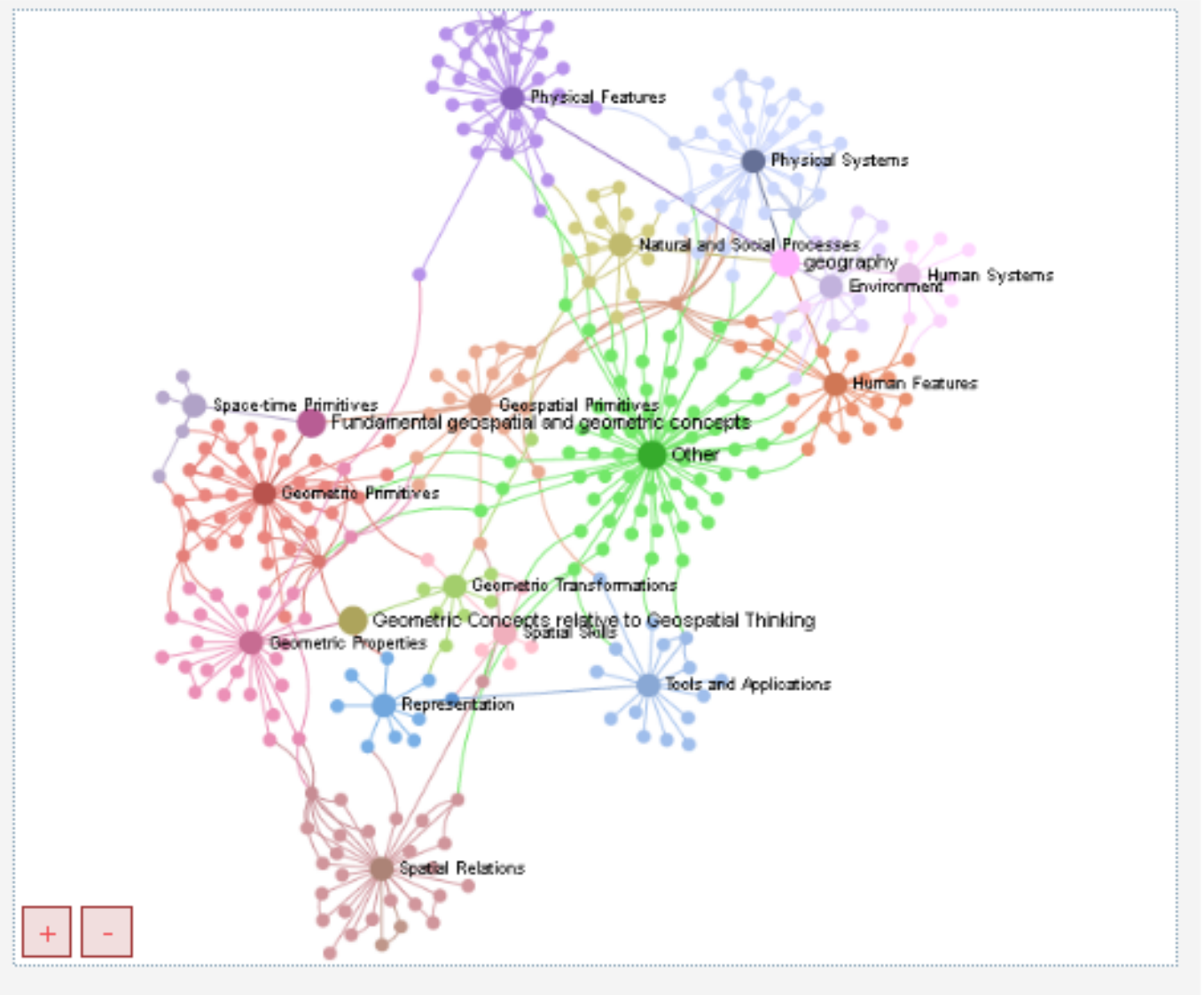
Concept definition

the ratio between the size of something and a representation of it

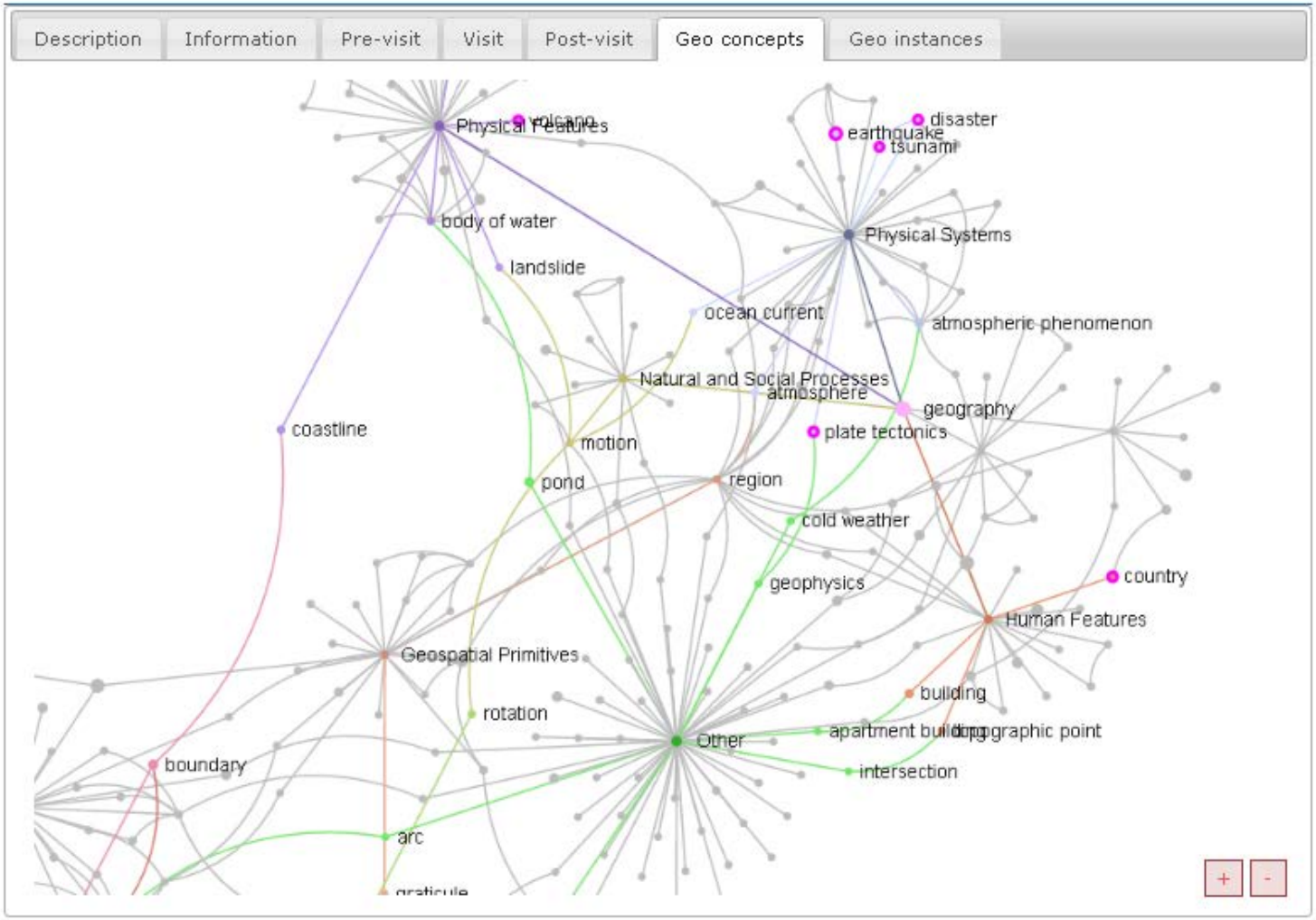
Resources

KidsGeo – Geography for Kids – Map Scale Types
Ordnance Survey – MapZone – Understanding Scale
Encyclopedia Britannica: Map scales and classifications

Semantic association of concepts

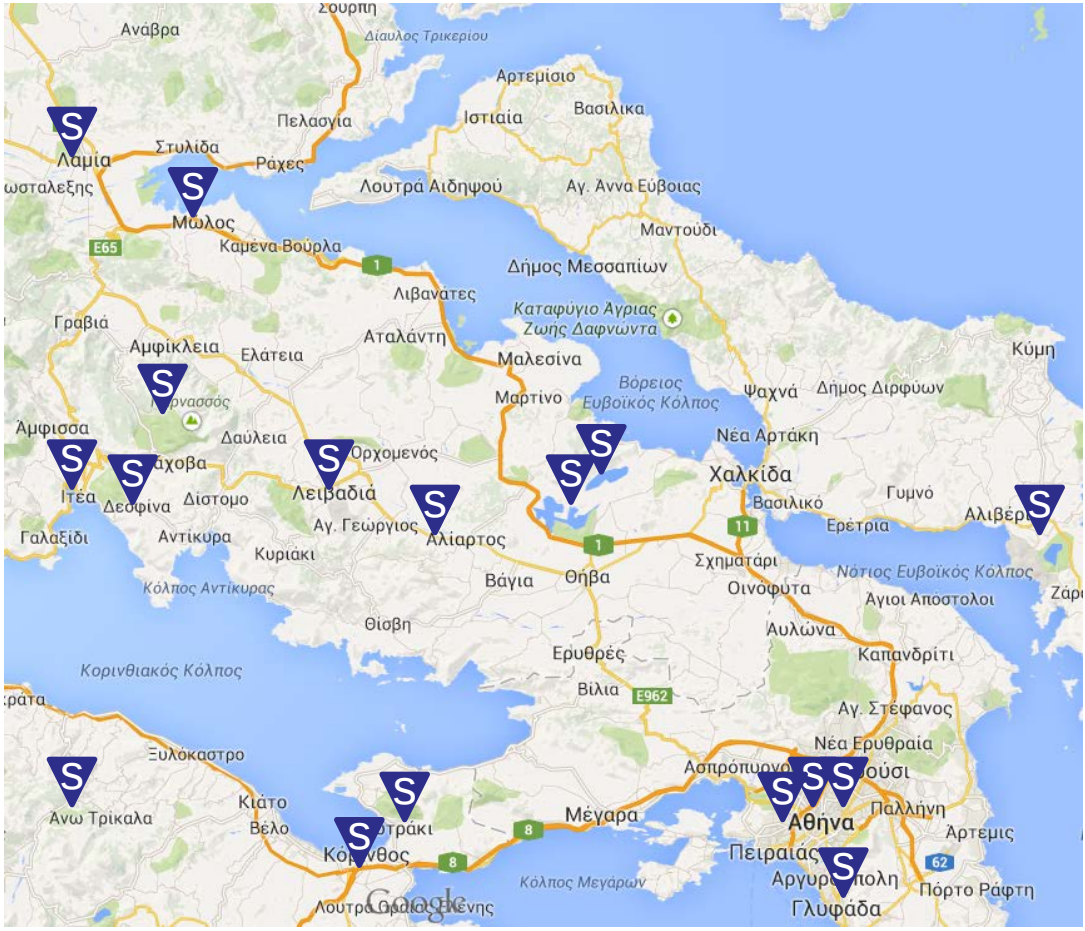


Semantic association of concepts

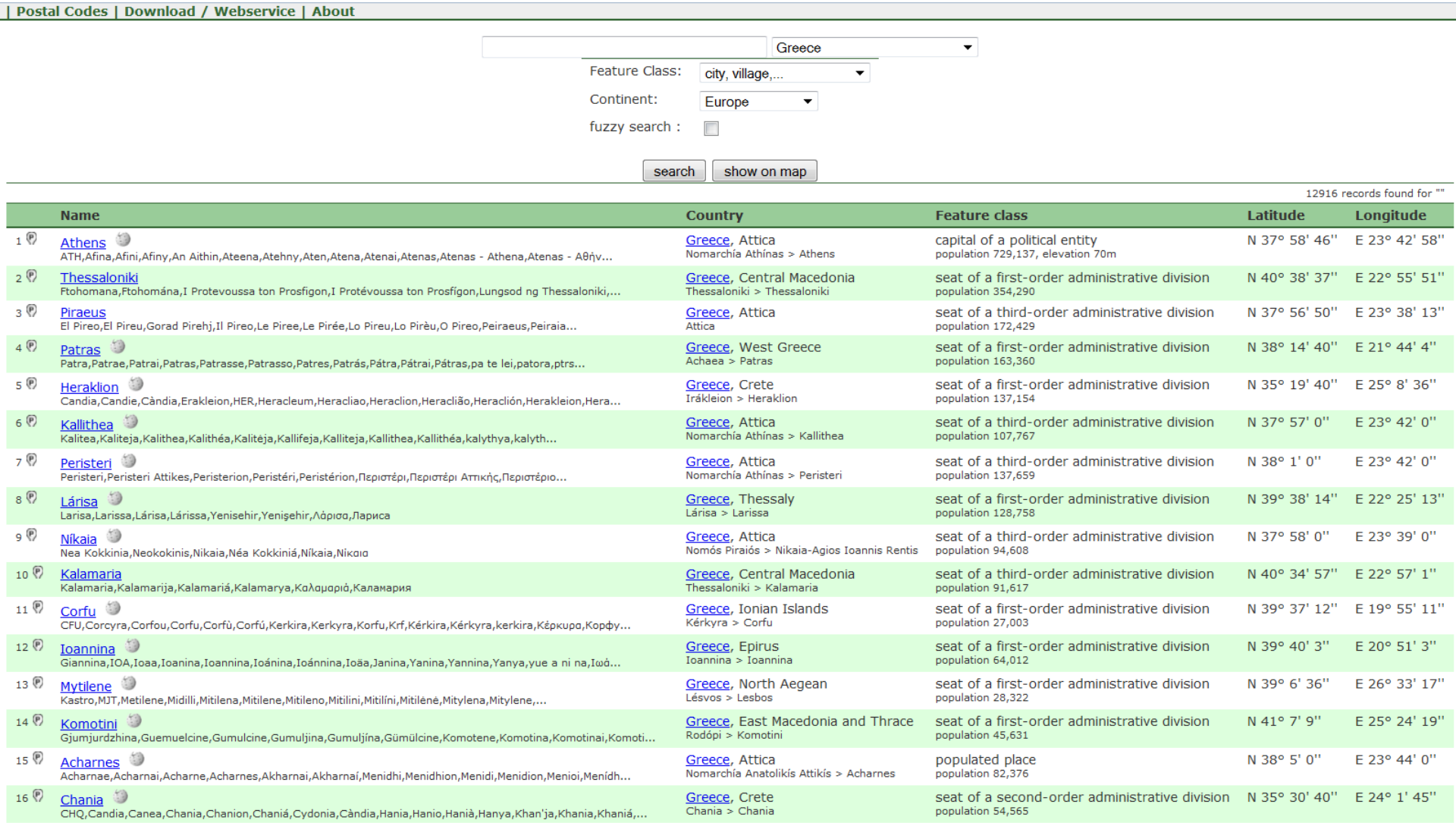


Instances

- Certain concepts are populated with instances (e.g., cities, rivers, mountains, etc.)
- Gazetteers provide the locations of these instances so as to support the map-based search of the learning pathways: “what scenarios have been created for a specific place or area on a map”?



Example of a gazetteer: geonames



| Postal Codes | Download / Webservice | About

Greece

Feature Class: city, village,...

Continent: Europe

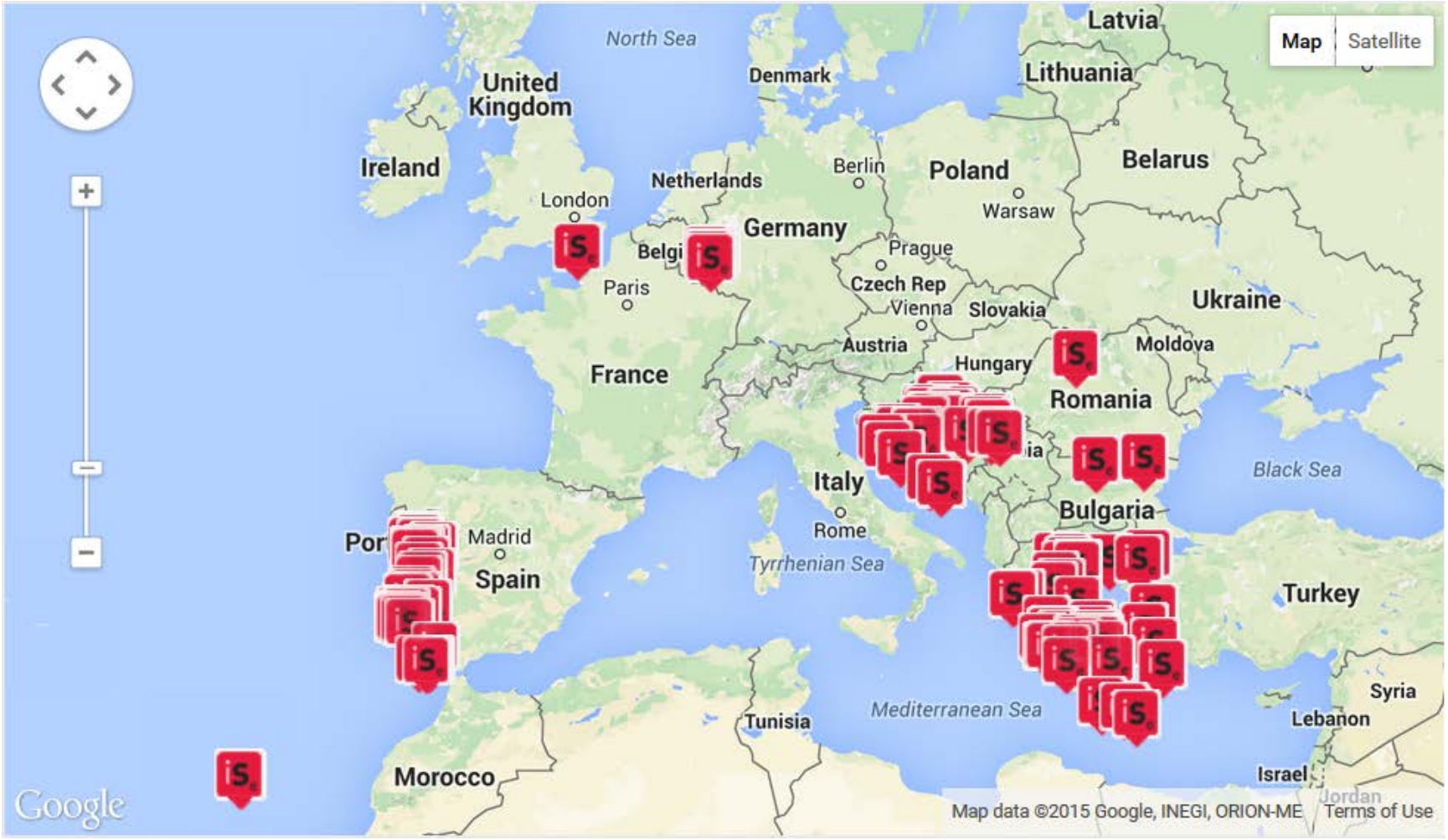
fuzzy search :

search | show on map

12916 records found for ""

	Name	Country	Feature class	Latitude	Longitude
1	Athens ATH,Afina,Afini,Afiny,An Aithin,Ateena,Atehny,Aten,Atena,Atenai,Atenas,Atenas - Athena,Atenas - Αθήν...	Greece, Attica Nomarchía Athínas > Athens	capital of a political entity population 729,137, elevation 70m	N 37° 58' 46''	E 23° 42' 58''
2	Thessaloniki Ftohomana,Ftohomána,I Protevoussa ton Prosfigon,I Protévoussa ton Prosfígon,Lungsod ng Thessaloniki,...	Greece, Central Macedonia Thessaloniki > Thessaloniki	seat of a first-order administrative division population 354,290	N 40° 38' 37''	E 22° 55' 51''
3	Piraeus El Pireo,El Pireu,Gorad Pirehj,Il Pireo,Le Piree,Le Pirée,Lo Pireu,Lo Pirèu,O Pireo,Peiraeus,Peiraia...	Greece, Attica Attica	seat of a third-order administrative division population 172,429	N 37° 56' 50''	E 23° 38' 13''
4	Patras Patra,Patrae,Patrai,Patras,Patrasse,Patrasso,Patres,Patrás,Pátra,Pátrai,Pátras,pa te lei,patora,ptrs...	Greece, West Greece Achaea > Patras	seat of a first-order administrative division population 163,360	N 38° 14' 40''	E 21° 44' 4''
5	Heraklion Candia,Candie,Càndia,Erakleion,HER,Heracleum,Heracliao,Heraclion,Heraclião,Heraclión,Herakleion,Hera...	Greece, Crete Irákleion > Heraklion	seat of a first-order administrative division population 137,154	N 35° 19' 40''	E 25° 8' 36''
6	Kallithea Kalitea,Kaliteja,Kalithea,Kalithéa,Kalitèja,Kallifeja,Kalliteja,Kallithea,Kallithéa,kalythya,kalyth...	Greece, Attica Nomarchía Athínas > Kallithea	seat of a third-order administrative division population 107,767	N 37° 57' 0''	E 23° 42' 0''
7	Peristeri Peristeri,Peristeri Attikes,Peristerion,Peristéri,Peristérion,Περιστέρι,Περιστέρι Αττικής,Περιστέριο...	Greece, Attica Nomarchía Athínas > Peristeri	seat of a third-order administrative division population 137,659	N 38° 1' 0''	E 23° 42' 0''
8	Lárisa Larisa,Larissa,Lárisa,Lárissa,Yenisehir,Yenişehir,Λάρισα,Ларисса	Greece, Thessaly Lárisa > Larissa	seat of a first-order administrative division population 128,758	N 39° 38' 14''	E 22° 25' 13''
9	Níkaia Nea Kokkinia,Neokokinis,Nikaia,Néa Kokkiniá,Níkaia,Νίκαια	Greece, Attica Nomós Piraiós > Nikaia-Agios Ioannis Rentis	seat of a third-order administrative division population 94,608	N 37° 58' 0''	E 23° 39' 0''
10	Kalamaria Kalamaria,Kalamarija,Kalamariá,Kalamarya,Καλαμαριά,Каламария	Greece, Central Macedonia Thessaloniki > Kalamaria	seat of a third-order administrative division population 91,617	N 40° 34' 57''	E 22° 57' 1''
11	Corfu CFU,Corcyra,Corfou,Corfu,Corfù,Corfú,Kerkira,Kerkyra,Korfu,Krf,Kérkira,Kérkyra,kerkira,Κέρκυρα,Корфу...	Greece, Ionian Islands Kérkyra > Corfu	seat of a first-order administrative division population 27,003	N 39° 37' 12''	E 19° 55' 11''
12	Ioannina Giannina,IOA,Ioaa,Ioanina,Ioannina,Ioánina,Ioánnina,Ioăa,Janina,Yanina,Yannina,Yanya,yue a ni na,Ιωά...	Greece, Epirus Ioannina > Ioannina	seat of a first-order administrative division population 64,012	N 39° 40' 3''	E 20° 51' 3''
13	Mytilene Kastro,MJT,Metilene,Midilli,Mitilena,Mitilene,Mitileno,Mitilini,Mitilíni,Mitilénē,Mitylena,Mitylene,...	Greece, North Aegean Lésvos > Lesbos	seat of a first-order administrative division population 28,322	N 39° 6' 36''	E 26° 33' 17''
14	Komotini Gjumjurdzhina,Guemuelcine,Gumulcine,Gumuljina,Gumuljína,Gümülcine,Komotene,Komotina,Komotinai,Komoti...	Greece, East Macedonia and Thrace Rodópi > Komotini	seat of a first-order administrative division population 45,631	N 41° 7' 9''	E 25° 24' 19''
15	Acharnes Acharnae,Acharnai,Acharne,Acharnes,Akharnai,Akharnaí,Menidhi,Menidhion,Menidi,Menidion,Menioi,Menídh...	Greece, Attica Nomarchía Anatolikís Attikís > Acharnes	populated place population 82,376	N 38° 5' 0''	E 23° 44' 0''
16	Chania CHQ,Candia,Canea,Chania,Chanion,Chaniá,Cydonia,Càndia,Hania,Hanio,Hanià,Hanya,Khan'ja,Khania,Khaniá,...	Greece, Crete Chania > Chania	seat of a second-order administrative division population 54,565	N 35° 30' 40''	E 24° 1' 45''

Map-based search



Representation tools

Categories:

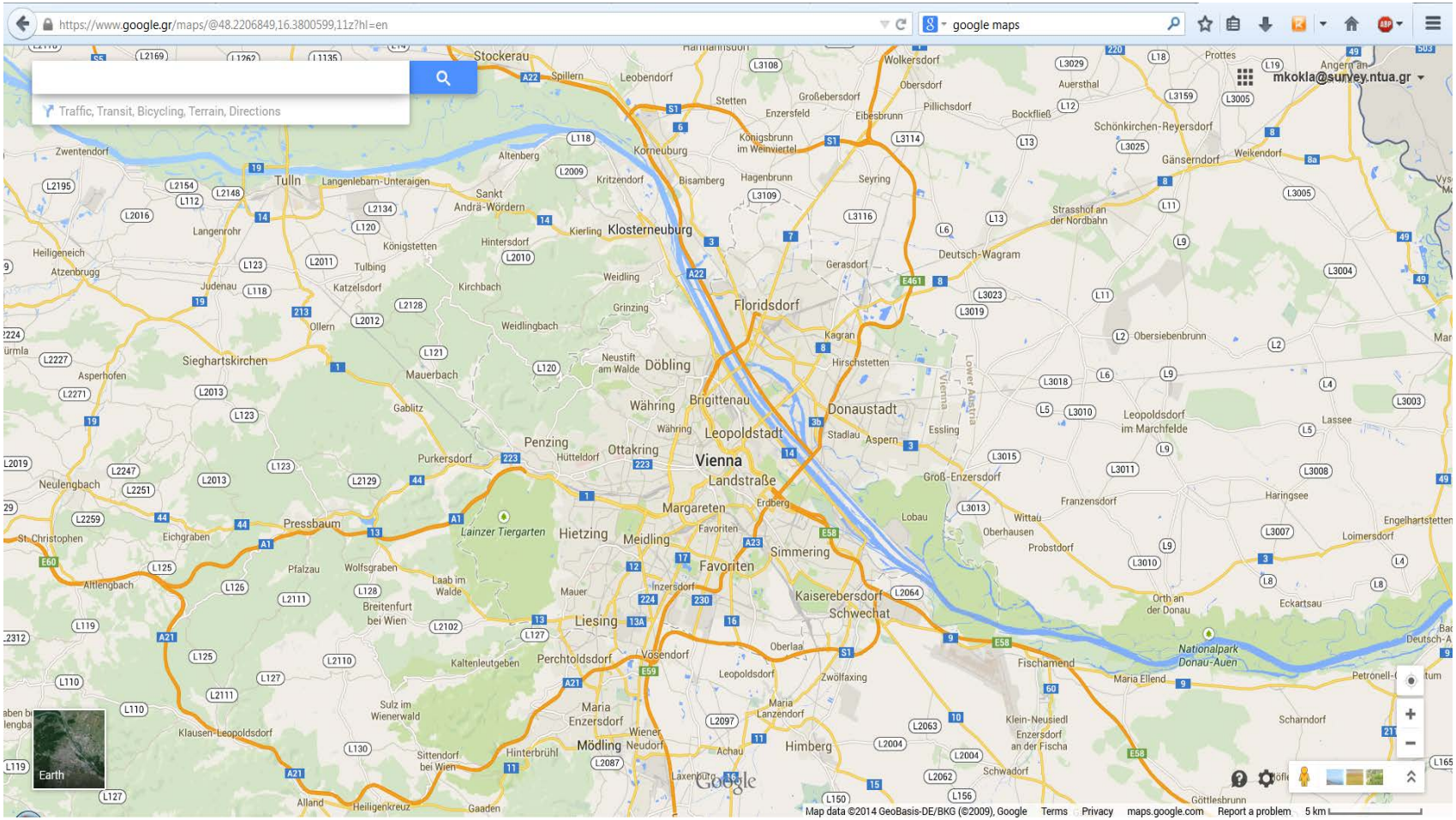
- Maps, Map Viewers, and Map Making
- Country Maps
- Atlases
- Historical maps
- Virtual globes
- Satellite and Areal Imagery
- Data Visualizations
- Models

Maps, Map Viewers, and Map Making

- online maps and web mapping applications for:
  - viewing maps (e.g., Google Maps, Bing maps, Yahoo! maps, OpenStreetMap, GeoCommons, National Geographic Maps and others) and
  - making maps (e.g., MapMaker Interactive)
- usually offer:
  - street maps
  - satellite imagery
  - 3D maps
  - street View perspectives
  - functions such as a route planning

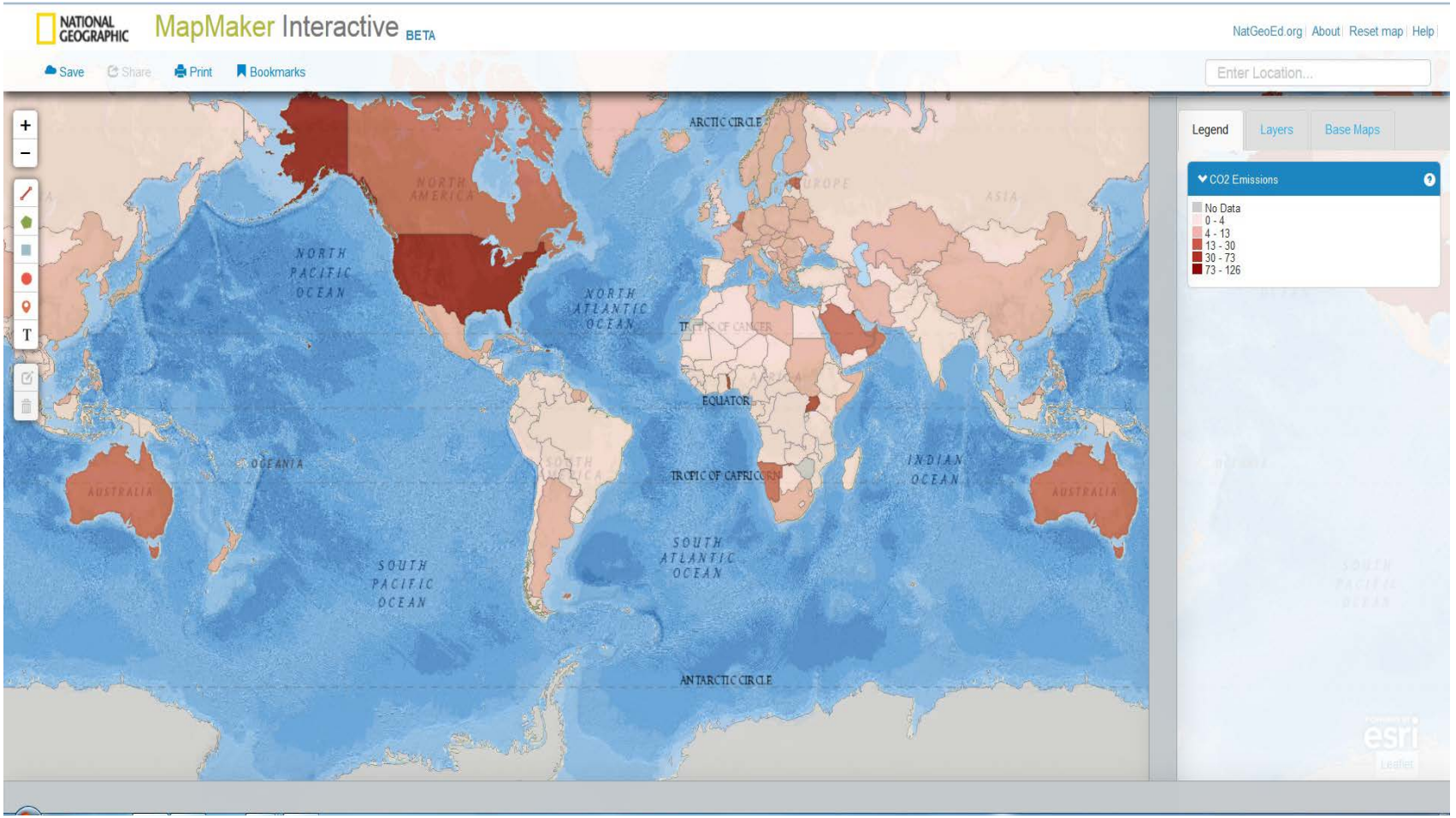
Google maps

https://maps.google.com/



MapMaker Interactive showing CO2 Emissions

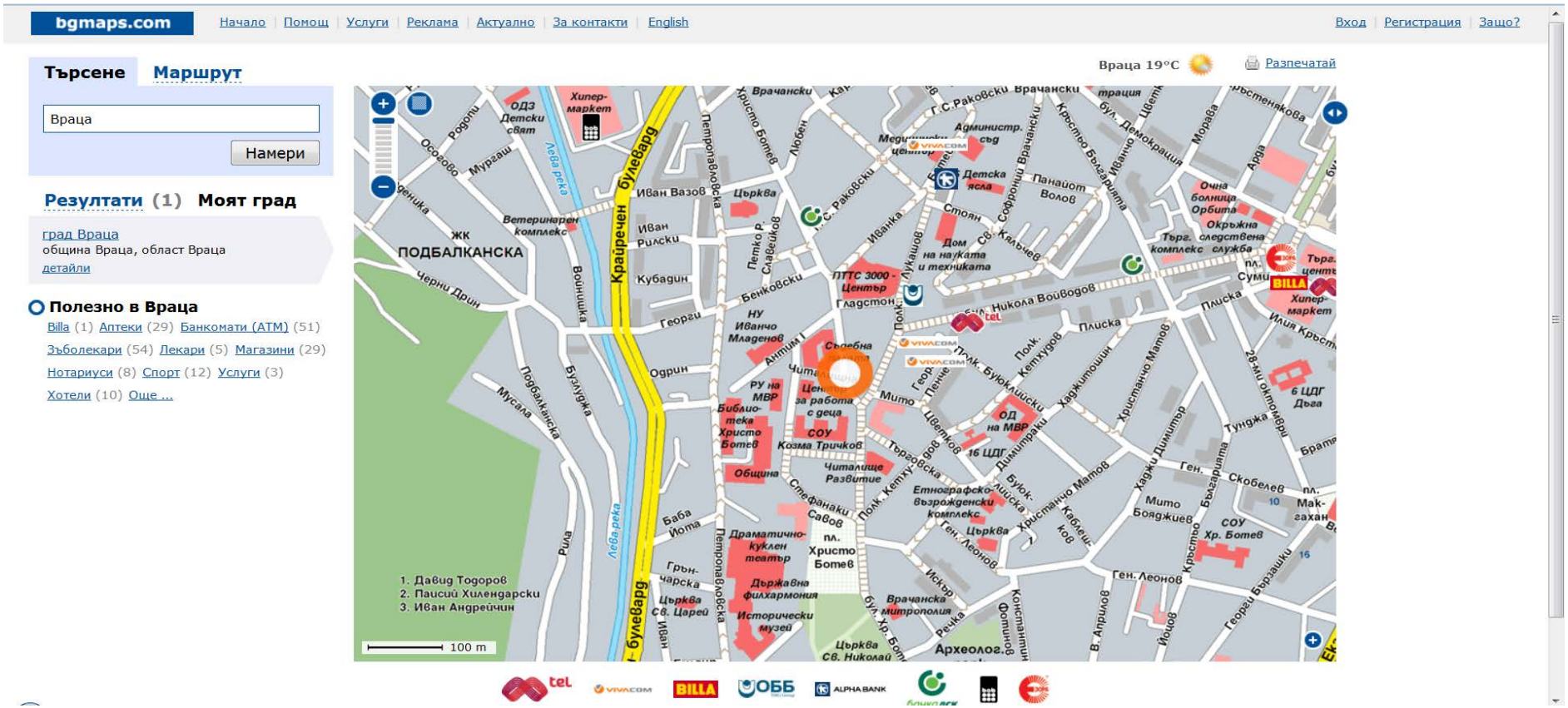
http://mapmaker.education.nationalgeographic.com/



Country Maps

- Includes maps for GEOTHNK partner countries:
  - Austria
  - Bulgaria
  - Greece
  - Romania
  - The Netherlands

Maps of Bulgaria from BGMaps

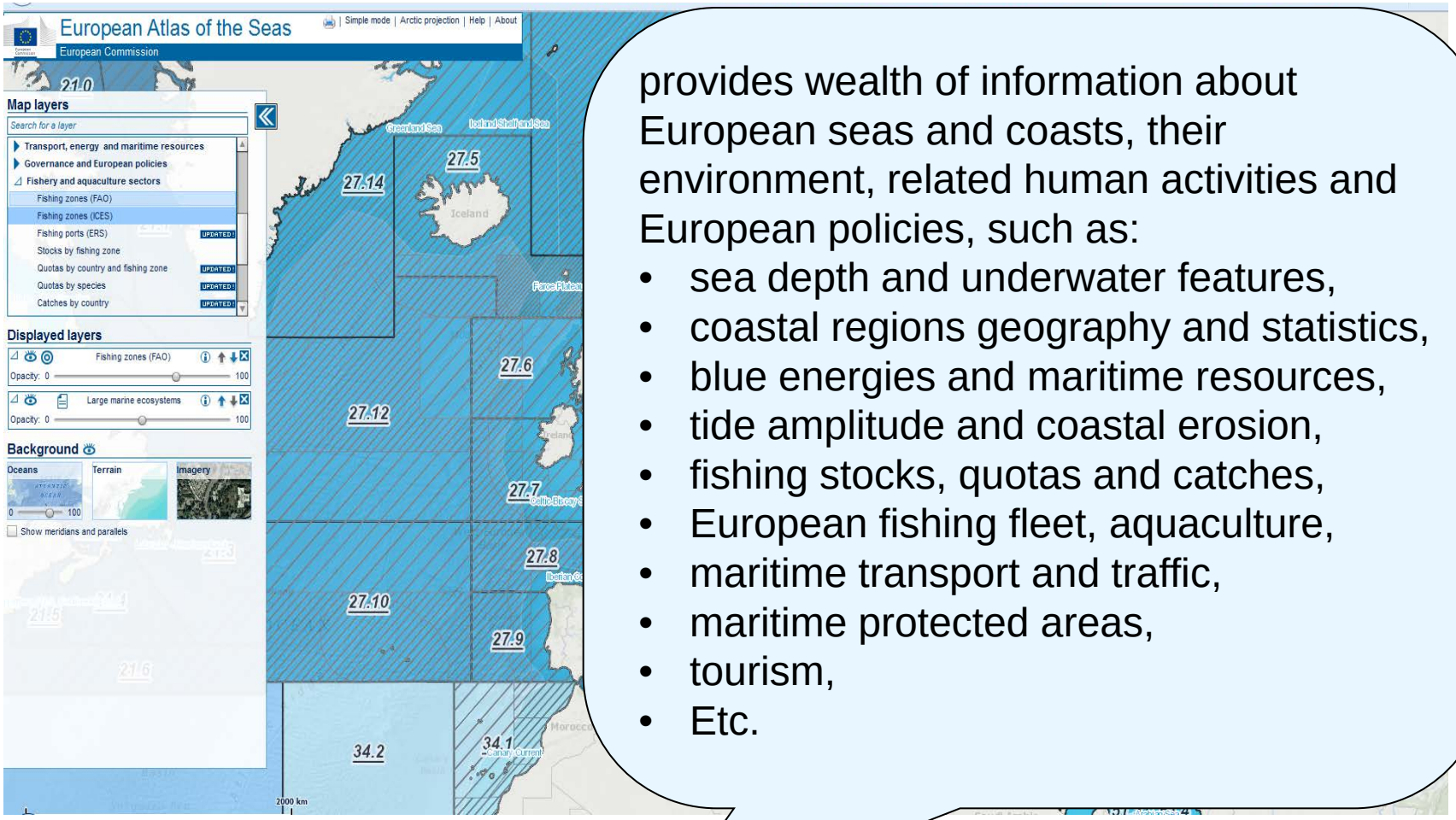


Atlases

- educational resources for world maps which are accompanied with other useful information about countries and places on Earth, such as geopolitical, social, religious and economic statistics.

The European Atlas of the Seas

http://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/#lang=EN;p=w;



provides wealth of information about European seas and coasts, their environment, related human activities and European policies, such as:

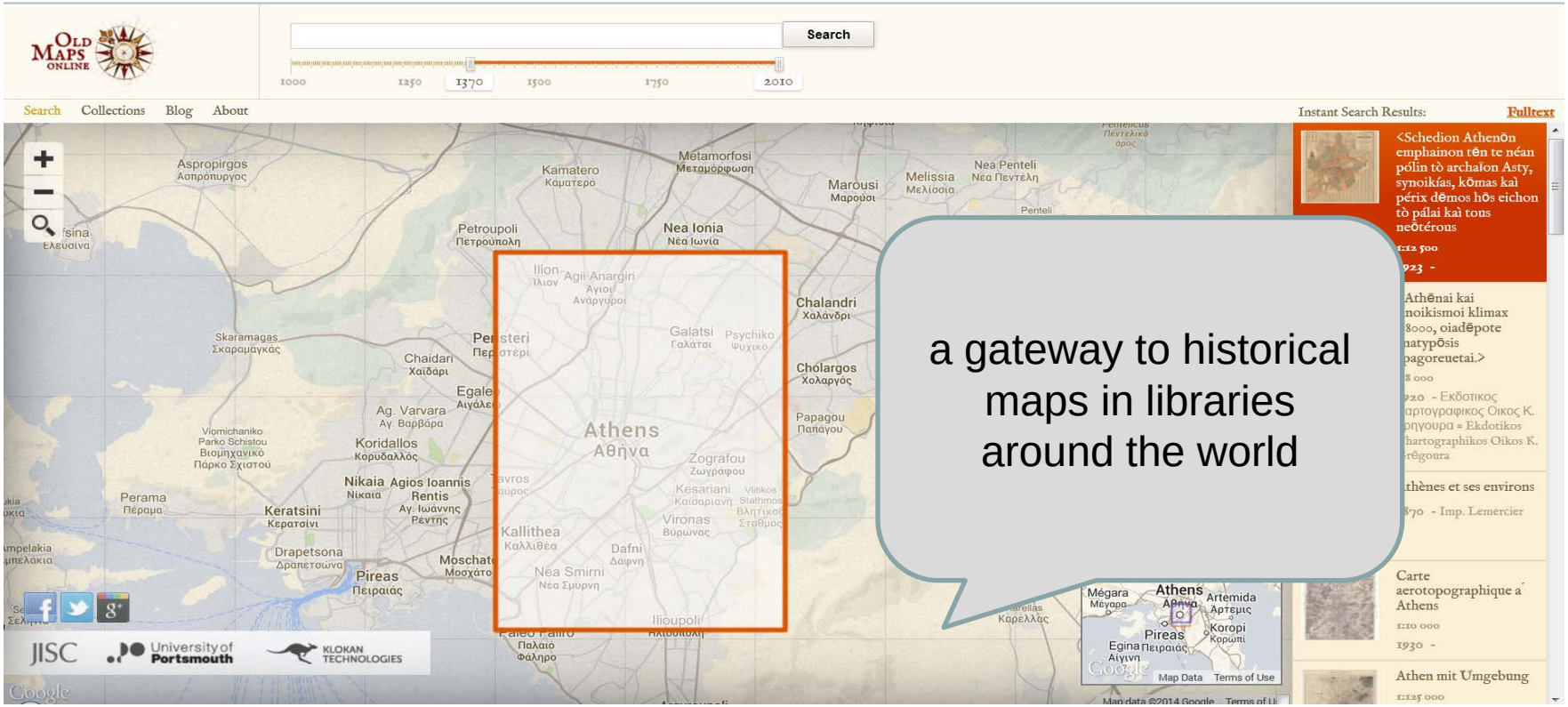
- sea depth and underwater features,
- coastal regions geography and statistics,
- blue energies and maritime resources,
- tide amplitude and coastal erosion,
- fishing stocks, quotas and catches,
- European fishing fleet, aquaculture,
- maritime transport and traffic,
- maritime protected areas,
- tourism,
- Etc.

Historical maps

- historical maps provided from Libraries, some of which are georeferenced and may be used for the development of educational scenarios that study the evolution of geospatial entities through time, e.g., the spatiotemporal change of countries and their boundaries due to historical events or the reform of cities due to economic events such as the Industrial Revolution.

OldMapsOnline portal for searching for historical maps

http://www.oldmapsonline.org/

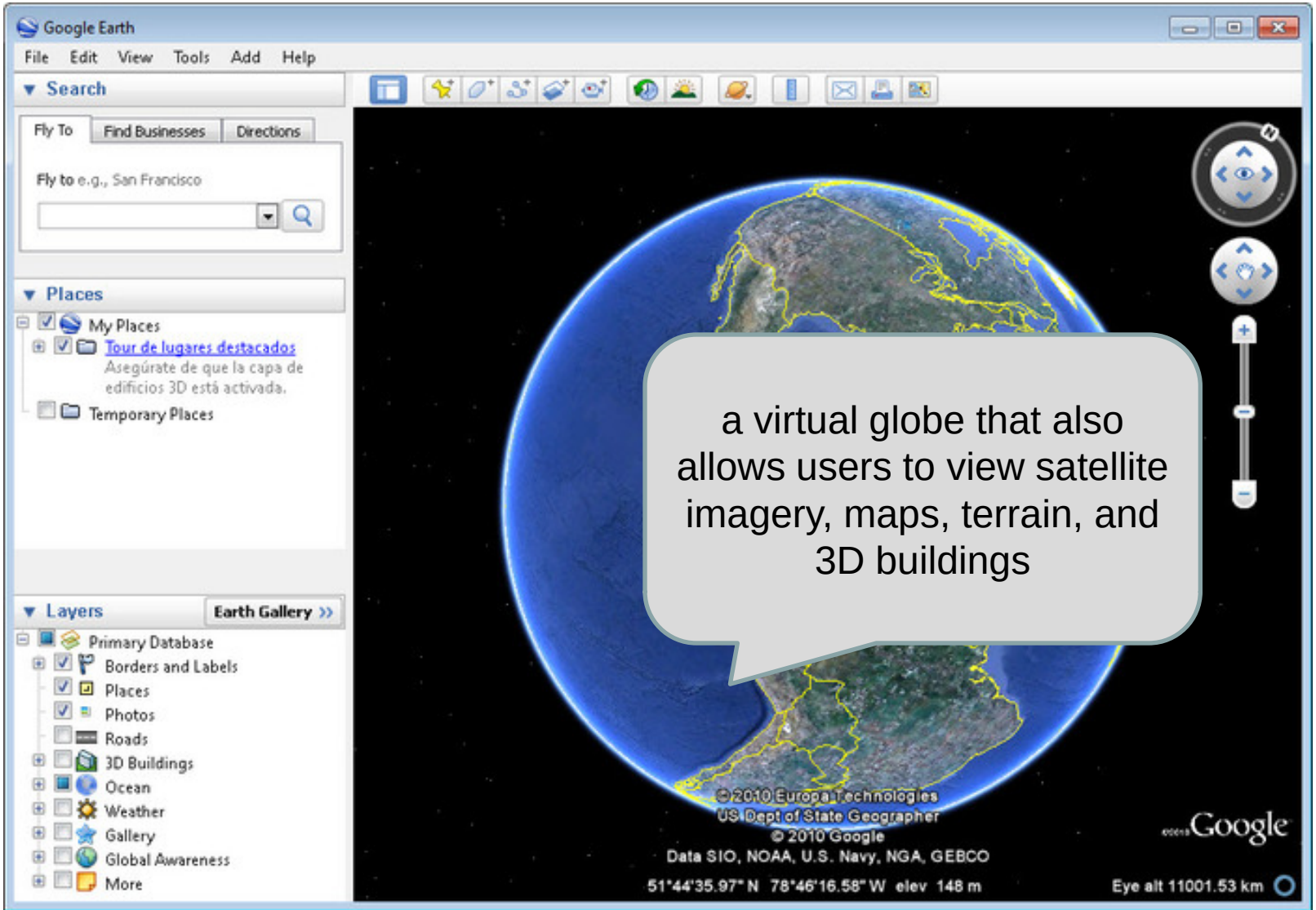


Virtual globes

- 3D applications that display geographic data on a spherical representation of the Earth

Google Earth

https://www.google.com/earth/

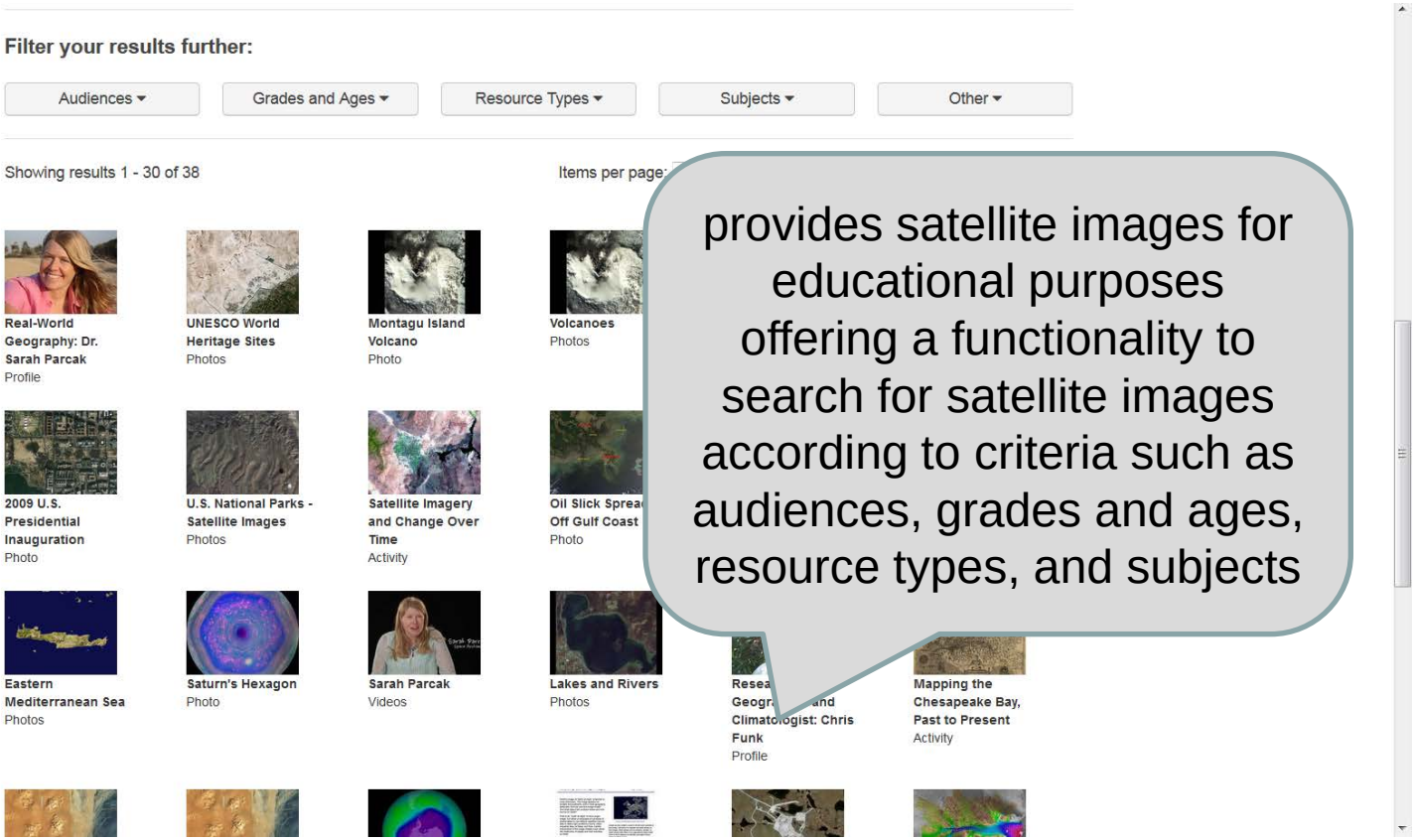


Satellite and Areal Imagery

- aerial photographs and satellite images provided mainly for educational purposes. Most of them are categorized according to educational criteria, such as the age, level, resource types, etc

National Geographic Education search for satellite imagery

http://education.nationalgeographic.com/education/topics/satellite-imagery/?ar_a=1



NASA Wavelength Digital Library

http://nasawavelength.org/data-and-images

Following are sources for NASA Earth and space science data & imagery, which are presented in

Introductory: These NASA science images, animations, and visualizations don't need special sof
illustrate a concept, to engage students, to develop an educational exhibit, program or product, lea

Intermediate: Access science data and tools designed for use in the classroom, informal educati

Advanced: Access full scientific datasets and/or analysis tools for conducting research and analy

provides NASA Earth and space science data and imagery, which are classified in three categories: introductory, intermediate, and advanced

Introductory

NASA science images, animations, and visualizations that don't need special software or tools to
to engage students, to develop an educational exhibit, program or product, learn about the latest s

Legend: Earth Moon Sun Planets Universe

Astronaut Views of the Home Planet http://earth.jsc.nasa.gov/sseop/efs/	This online da and is searchable by clic hurricanes and weather, g features and more.
AstroPix http://astropix.ipac.caltech.edu/	AstroPix offers access to the collected image libraries of a variety of the leading astronomical observatories, including a range of astronomical observations, illustrations, charts, and photographs spanning the field of Astronomy. The site automatically pulls in the latest imagery as soon as it becomes available. Initial partners include Spitzer, Chandra, Hubble, Galex, WISE, and ESO, with more coming soon.
Earth Observatory http://earthobservatory.nasa.gov	Shares the images, stories and discoveries that emerge from NASA Earth science research, including its satellite missions, in-the-field research and climate models. View global maps of NASA data, check out the Image of the

USGS Earth Explorer

http://earthexplorer.usgs.gov/

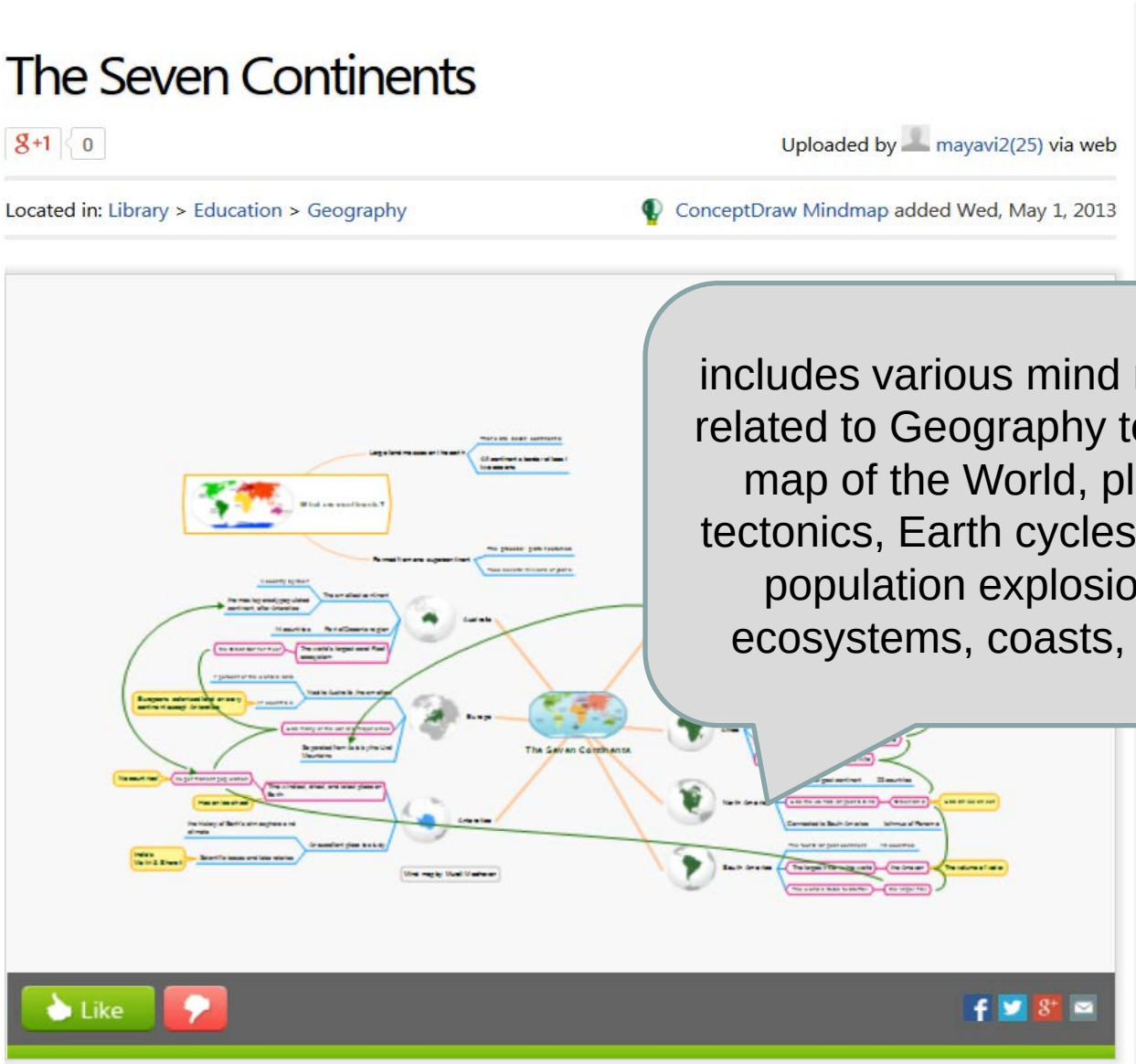
web application that provides users the ability to search and view satellite images, aerial photographs, and cartographic products from several sources.

Data Visualizations

- includes tools and resources for viewing, exploring, and creating data visualizations, i.e. presentations of data in a graphical format

Biggerplate

http://www.biggerplate.com/education-mindmaps/33/geography



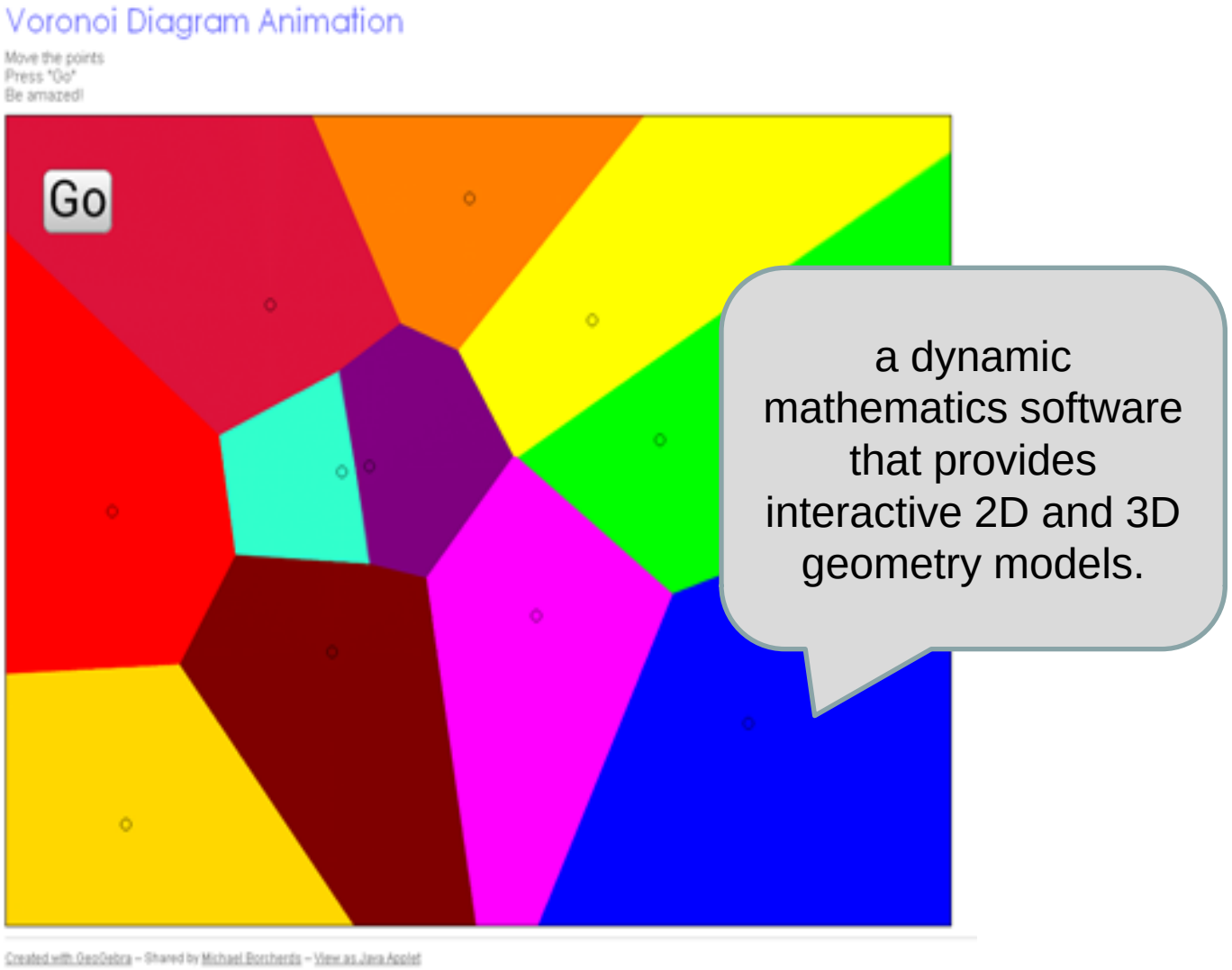
includes various mind maps related to Geography topics: map of the World, plate tectonics, Earth cycles, soil, population explosion, ecosystems, coasts, etc.

Models

- includes 2D and 3D geometrical models which are commonly used for supporting STEM (Science, Technology, Engineering and Mathematics) education

GeoGebra

http://www.geogebra.org/



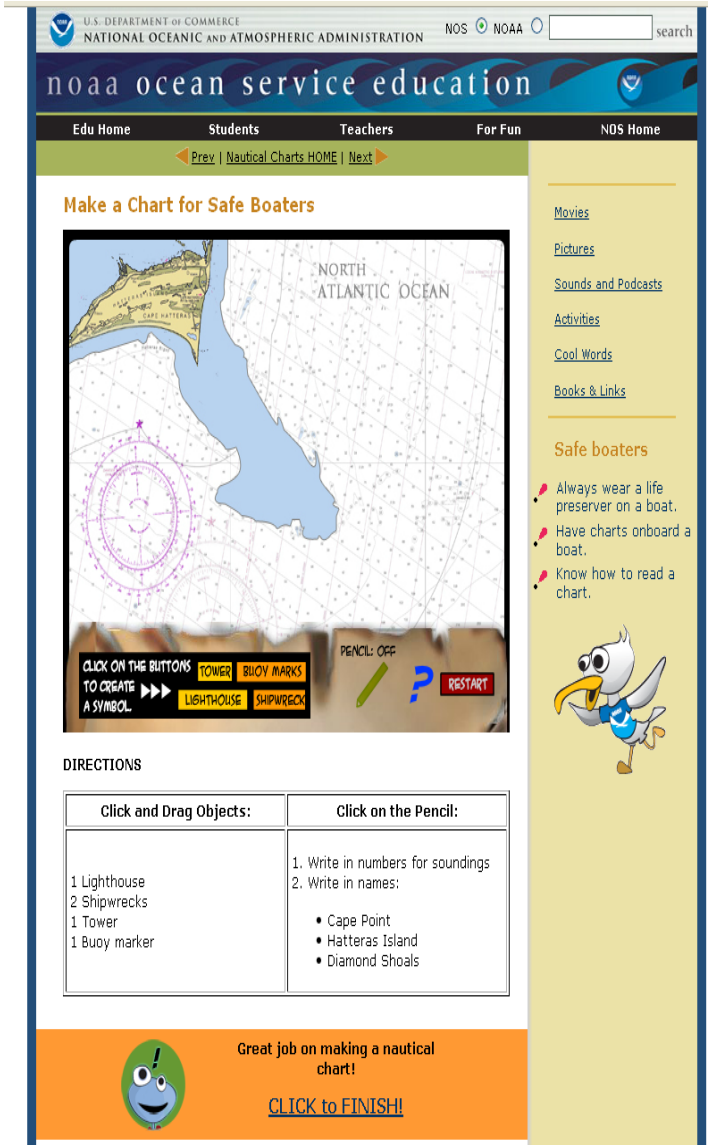
a dynamic mathematics software that provides interactive 2D and 3D geometry models.

Reasoning tools

- Any kind of tool (educational game, learning activity, interactive application, etc.) that may facilitate the understanding of a concept or scenario and prompt reasoning processes.
- All partners (and end-users) will be able to add reasoning tools relative to their scenarios to the GEOTHNK platform.

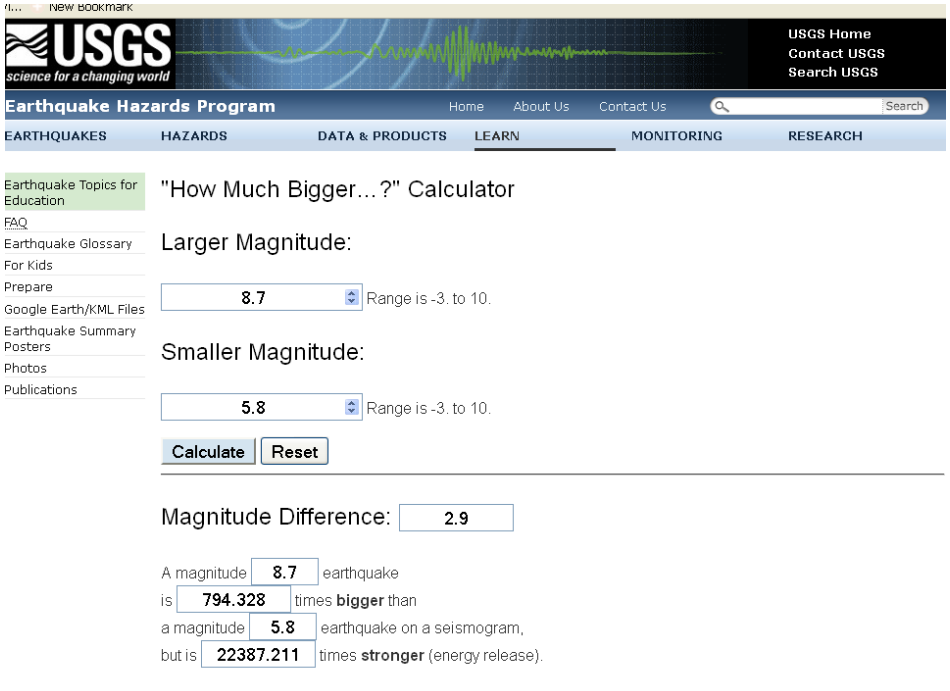
Make a Chart for Safe Boaters

- Tool that allows young learners to create their own nautical charts for safer navigation!
- Owner: National Ocean Service, National Oceanic and Atmospheric Administration, Department of Commerce, USA.gov
- **Links:** NOAA's National Ocean Service Education: Nautical Charts



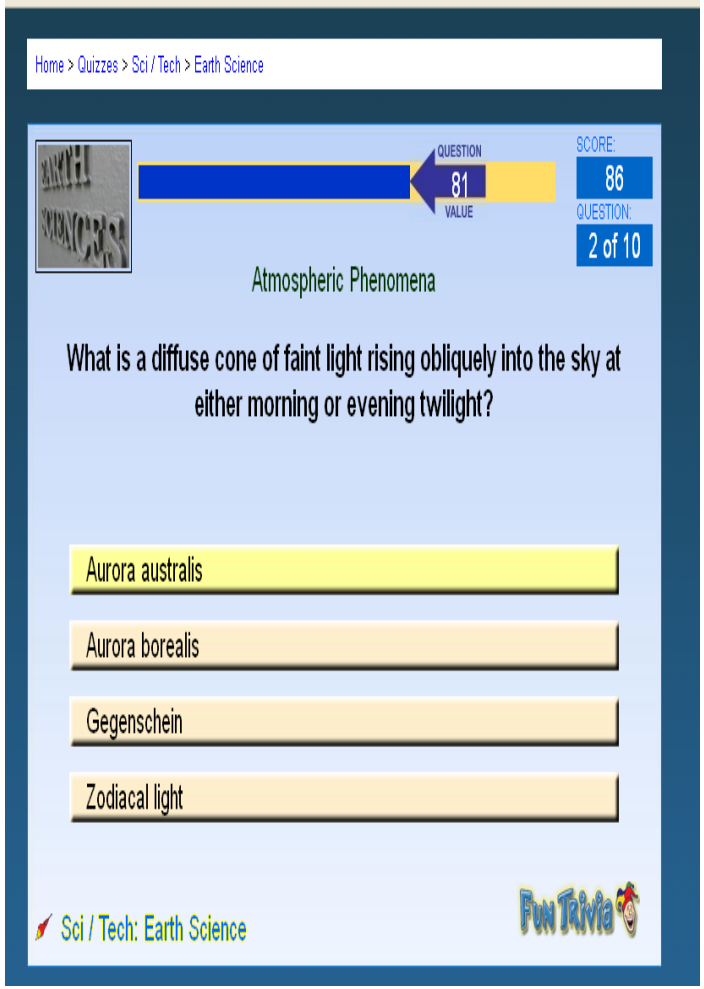
Comparison of earthquakes' magnitude

- The tool allows learners to compare between two earthquakes of different magnitudes so that they realise how bigger an earthquake really is compared to another of lower magnitude.
- Owner: U.S. Geological Survey
- **Links:** "How Much Bigger…?" Calculator



Atmospheric Phenomena Quiz

- Atmospheric Phenomena quiz gives a description of some type of atmospheric phenomenon and the learner determines the answer (author: almach)
- Owner:
- FunTrivia.com, the World's Largest Trivia Website (http://www.funtrivia.com)
- **Links:** Atmospheric Phenomena - A time quiz game

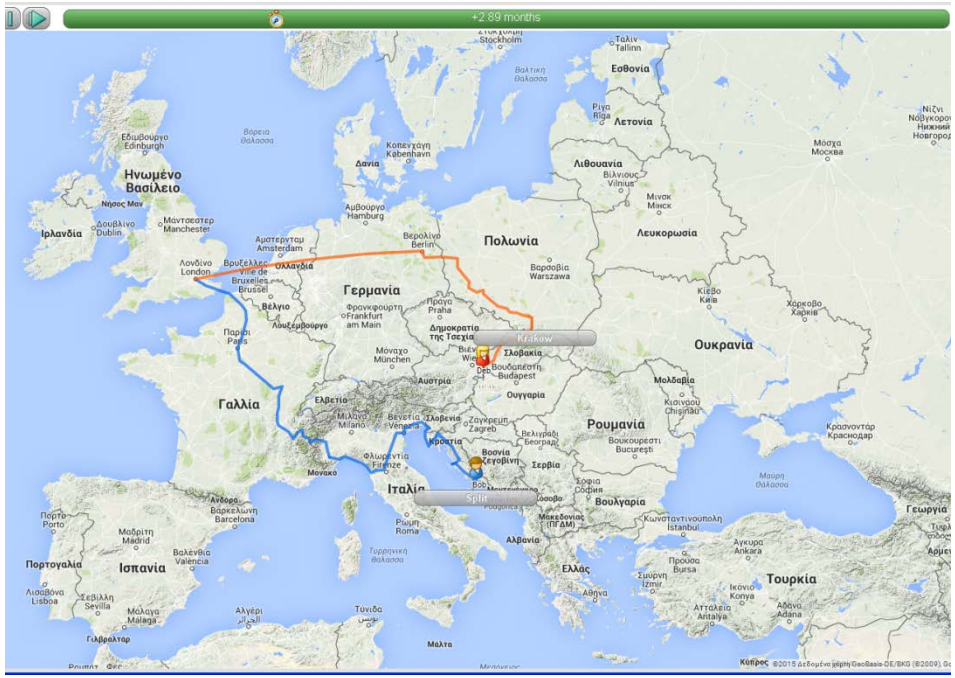


Layers of the Atmosphere virtual lab

- Interactive virtual lab tool that shows the structure (different layers) of the Earth's atmosphere, provides information on atmospheric data (e.g. pressure, temperature, density) at different altitudes, and shows meteorological and astronomical phenomena of the different layers.
- Owner: McGraw-Hill Education
- **Links:** Earth's Atmosphere Structure

Animaps

- "Animaps extends the My Maps feature of Google Maps by letting you create maps with markers that move, images and text that pop up on cue, and lines and shapes that change over time."
- Owner: Animaps
- Links: http://www.animaps.com/



Example Scenario 1:

BUILD YOUR OWN CITY PLAN

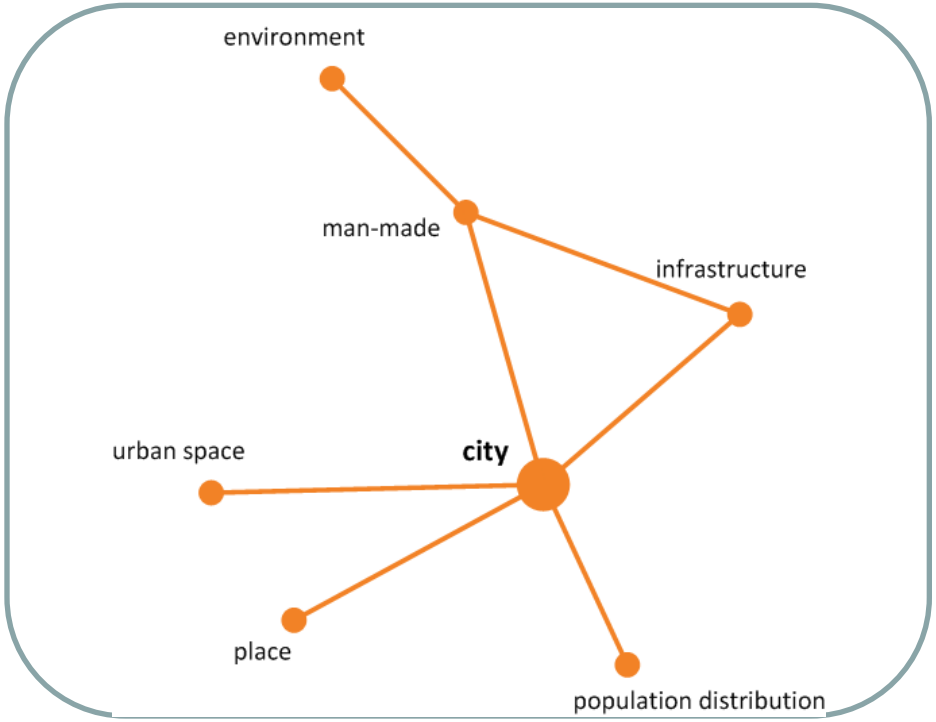
Build your own city plan

- Description: build the plan of an ideal city
- Objectives:
    - The world in spatial terms
    - Human systems
    - Uses of geography
    - Understanding space and environment
    - Understanding urban space and interactions
- Target group: primary and secondary school teachers

Concepts | Instances | Representation tools | Reasoning tools

city

City
Urban space
Place
Infrastructure
Population distribution
Environment
Man-made
…..



Concepts | Instances | Representation tools | Reasoning tools

Concept term

city

Concept definition:

a large and densely populated urban area; may include several independent administrative districts

Links

United Nations Cyberschoolbus: What is a city?
UK Cities: What is a city?
Cities In Europe: The New OECD-EC Definition

Concept term

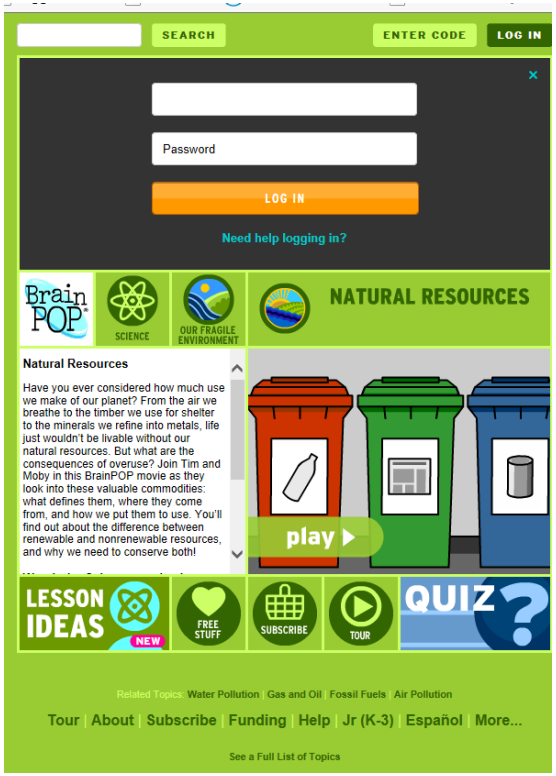
natural resources

Concept definition:

resources (actual and potential) supplied by nature

Links

National Geographic: Natural Resources
BrainPop: Natural Resources



Concepts | Instances | Representation tools | Reasoning tools

Concept:

City

Instance:

Athens

Instance:

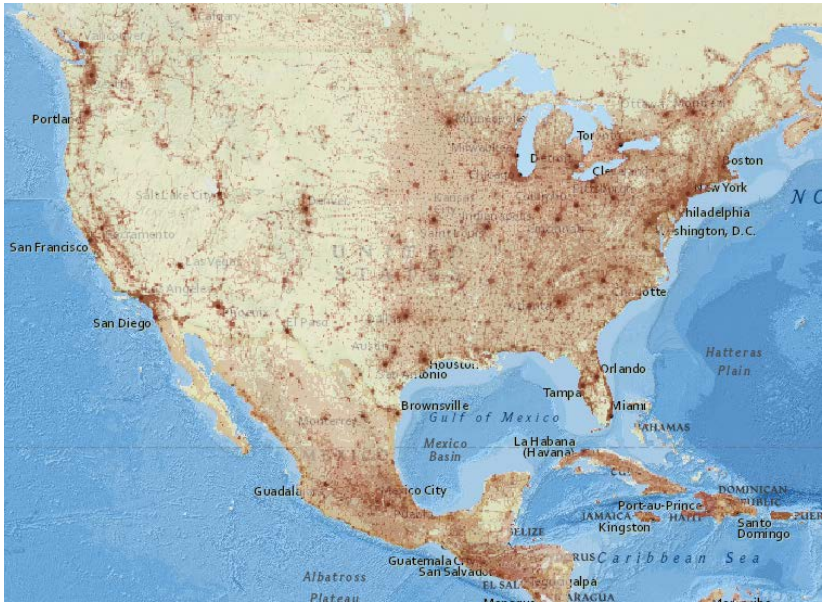
Amsterdam

Category:

Map

Tool:

MapMaker Interactive



Category:

Satellite image

Tool:

NASA Earth Observatory/NOAA NGDC

Title:

Plan It Green

Short Description:

Educational game for building a sustainable city

Age range:

14+

Time:

1 hour

Link:

http://www.planitgreenlive.com/en/build-your-own-city

Example Scenario 2:

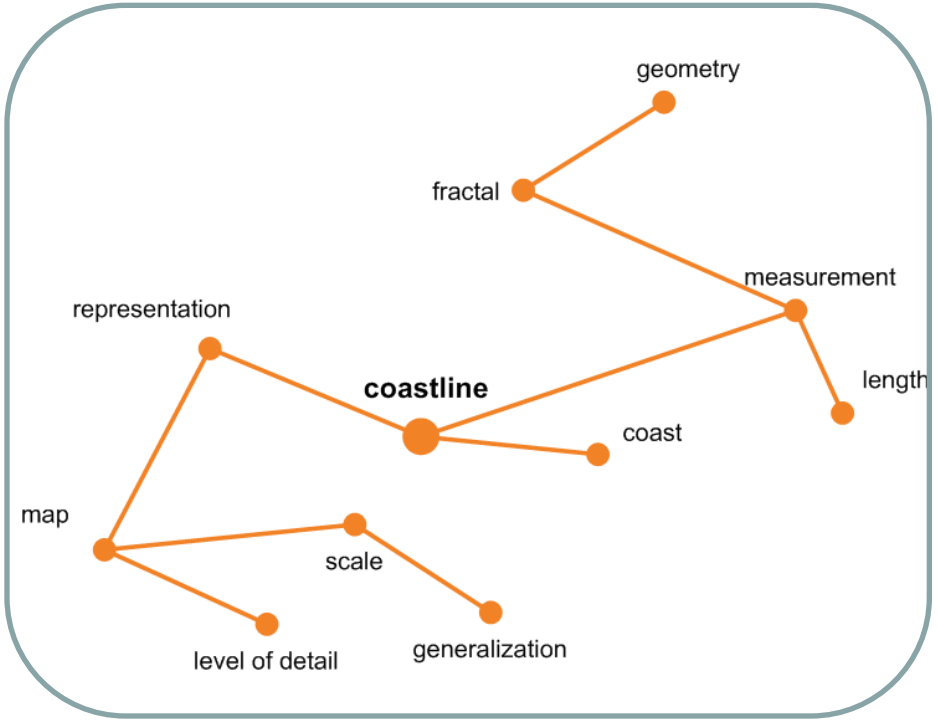
COASTLINE PARADOX

Coastline Paradox

- Description: measure the length of a coastline at different scales
- Objectives:
  - understand spatial concepts such as measurement, scale and length as well as mathematical concepts such as fractals
  - link knowledge components from different disciplines.
- Target group: university students

Concepts | Instances | Representation tools | Reasoning tools

Coastline
Coast
Length
Measurement
Scale
Generalization
Fractal



Concepts | Instances | Representation tools | Reasoning tools

Concept term

coastline

Concept definition:

the outline of a coast

Links

http://www.bbc.co.uk/learningzone/clips/an-introduction-to-the-coastline/8429.html
http://science.nationalgeographic.com/science/earth/surface-of-the-earth/coastlines-article/

Concepts | Instances | Representation tools | Reasoning tools

Concept term

scale

Concept definition:

the ratio between the size of something and a representation of it: *"the scale of the map"; "the scale of the model"*

Links

http://www.kidsgeo.com/geography-for-kids/0028-map-scale-types.php
http://www.slideshare.net/tbonnar/social-studies-geography-skills-scale
http://mapzone.ordnancesurvey.co.uk/mapzone/PagesHomeworkHelp/mapability/understandingscale/

Concept term

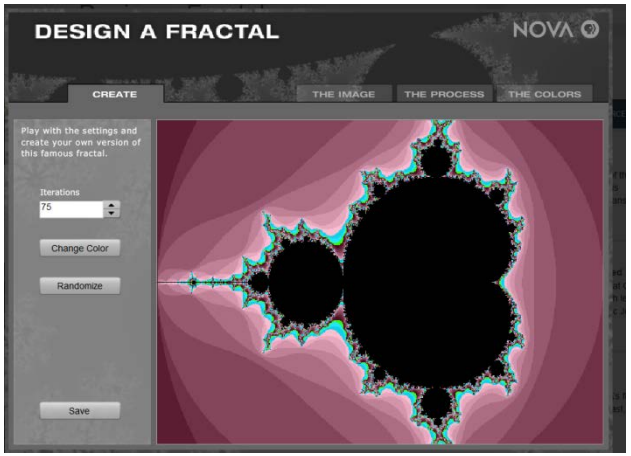
fractal

Concept definition:

(mathematics) a geometric pattern that is repeated at every scale and so cannot be represented by classical geometry

Links

http://www.pbs.org/wgbh/nova/education/activities/3514_fractals.html
http://www.pbs.org/wgbh/nova/physics/fractal-generator.html



Concept:

Coast

Instance:

Côte d'Azur

Instance:

Costa Smeralda

Category:

Satellite image

Tool:

Google maps

Title:

Fractal Dimension of a Coastline

Short Description:

Students learn that measuring the length of a natural shape such as a coastline depends on the scale of the ruler with which they measure it.

Age range:

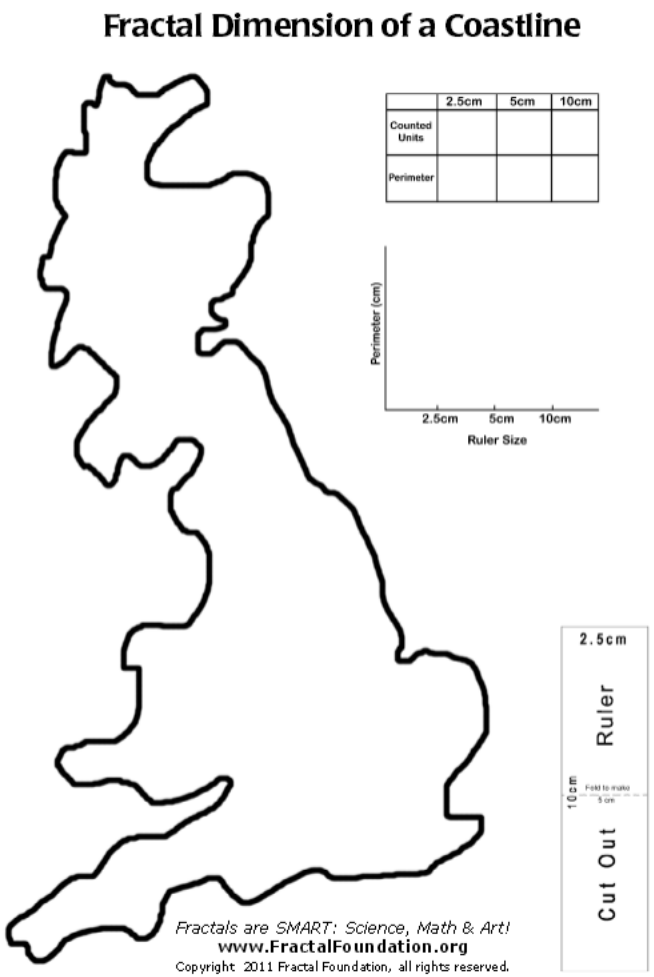
18+

Time:

1 hour

Link:

http://www.sfafs.org/pdfs/coastlinedimension.pdf



Title:

Measure the length of a coastline using Google Earth

Short Description:

Use Google Earth to measure the length of a coastline at 3 different levels of detail (scale)

Age range:

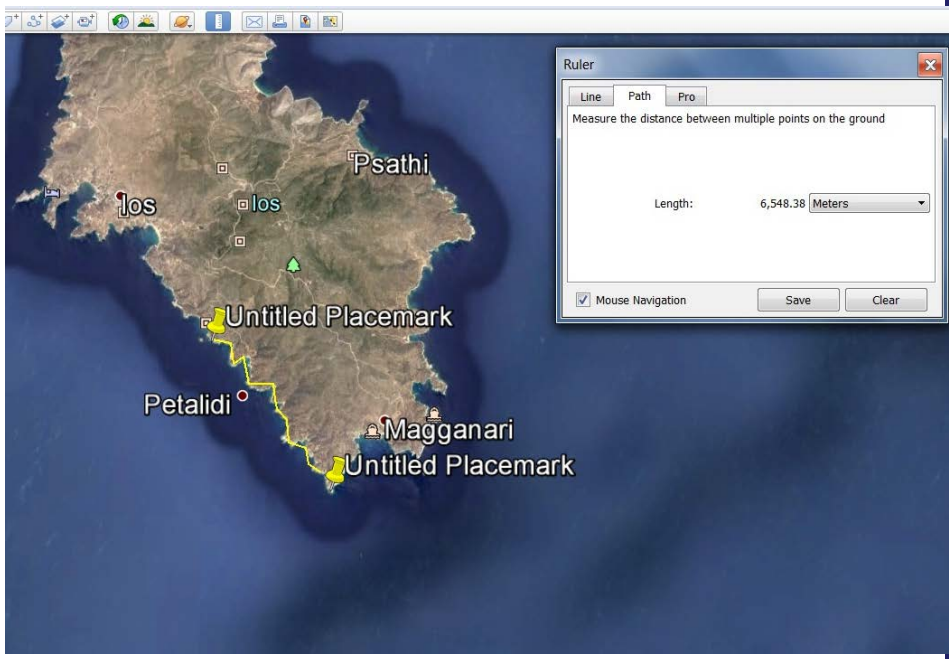
18+

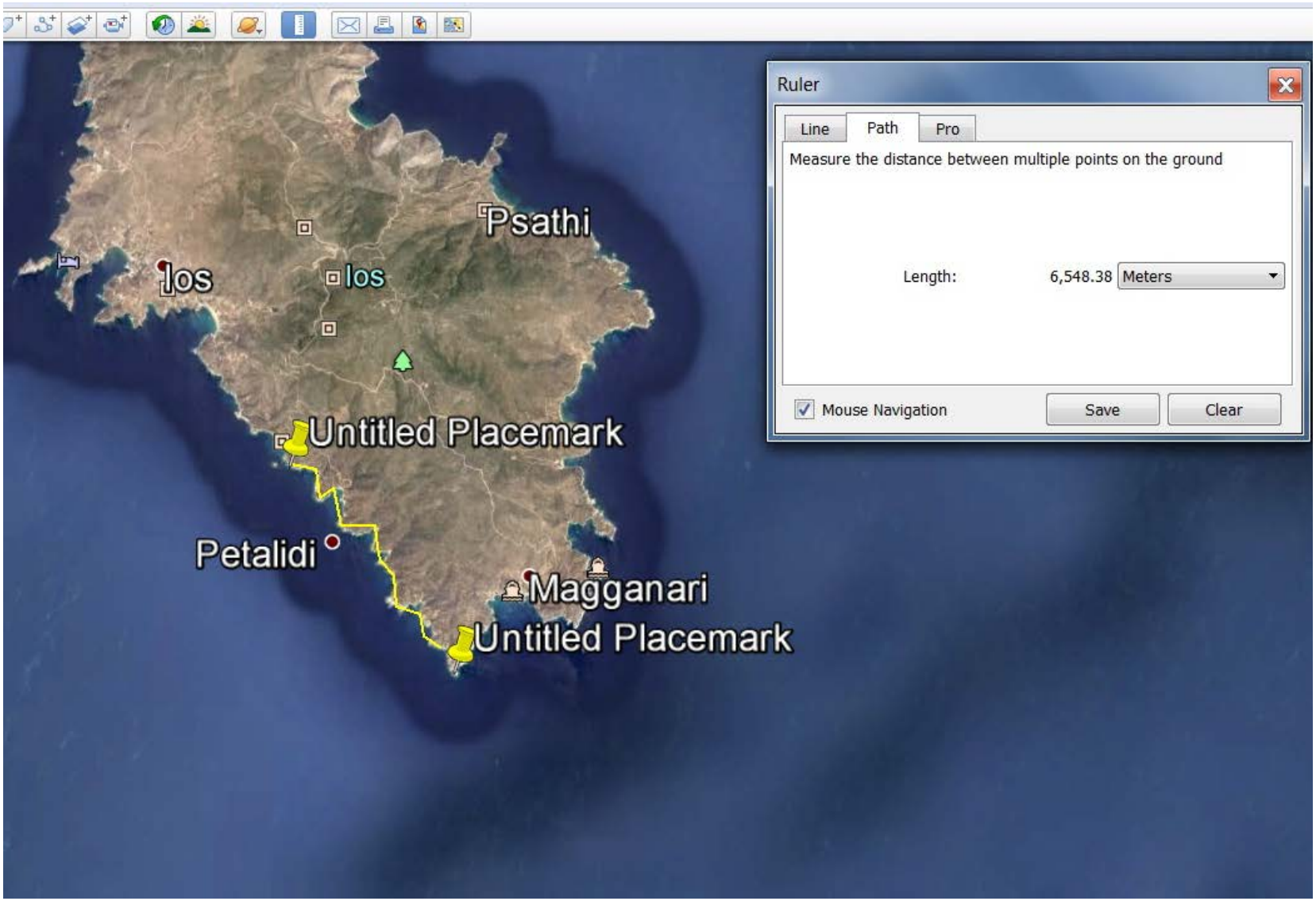
Time:

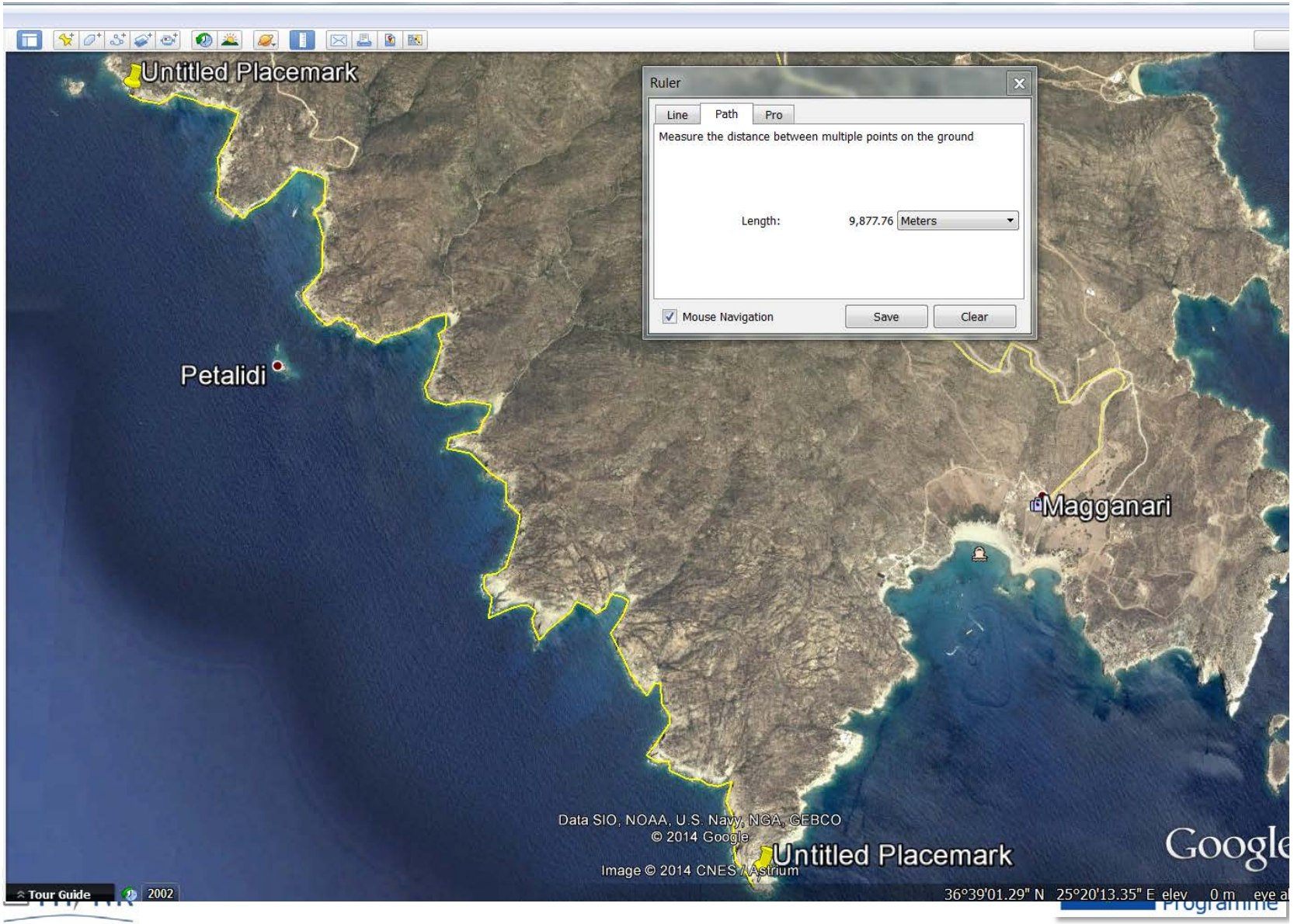
1 hour

Link:

earth.google.com/




Ruler
Line
Path
Pro
Measure the distance between multiple points on the ground
Length:
6,548.38
Meters
Mouse Navigation
Save
Clear
Psathi
Ios
Ios
Untitled Placemark
Petalidi
Magganari
Untitled Placemark


Untitled Placemark
Ruler
Line
Path
Pro
Measure the distance between multiple points on the ground
Length:
9,877.76
Meters
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Save
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Petalidi
Magganari
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2014 Google
Image © 2014 CNES / Astrium
Untitled Placemark
Google
Tour Guide
2002
36°39'01.29" N 25°20'13.35" E elev 0 m



San Francisco sea level rise at 1.5 m. and 4 m.
http://www.storagefront.com/therentersbent/what-will-sea-level-rise-look-like-west-coast-edition

Example Scenario 3:

WHICH CITIES WILL BE COMPLETELY UNDERWATER IN LESS THAN 100 YEARS?

Which Cities Will Be Completely Underwater In Less Than 100 Years?

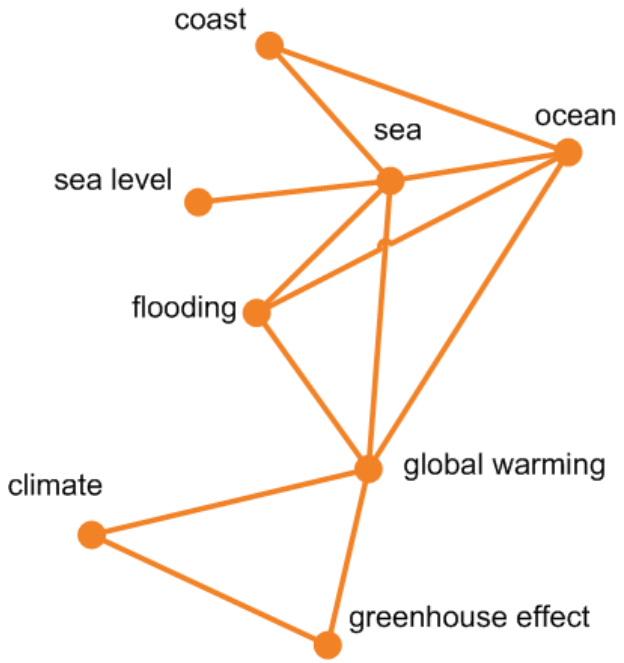
- Description: identify areas vulnerable to flooding due to a sea level rise
- Objectives:
  - understand spatial concepts such as location, elevation, proximity as well as environmental concepts such as global warming, greenhouse effect, etc.
  - semantically link knowledge components from different disciplines.
  - raise awareness on the environmental consequences of human activities
- Target group: teachers, university students, adults

Concepts

- Spatial: location, distance, proximity, elevation, city, sea, ocean, sea level, etc.
- Non-spatial: flooding, global warming, climate change, greenhouse effect, etc.

Concepts | Instances | Representation tools | Reasoning tools

Location
Distance
Proximity
Elevation
Sea
Ocean
Sea level
Flooding
Global warming
Climate change
Greenhouse effect



Concept term

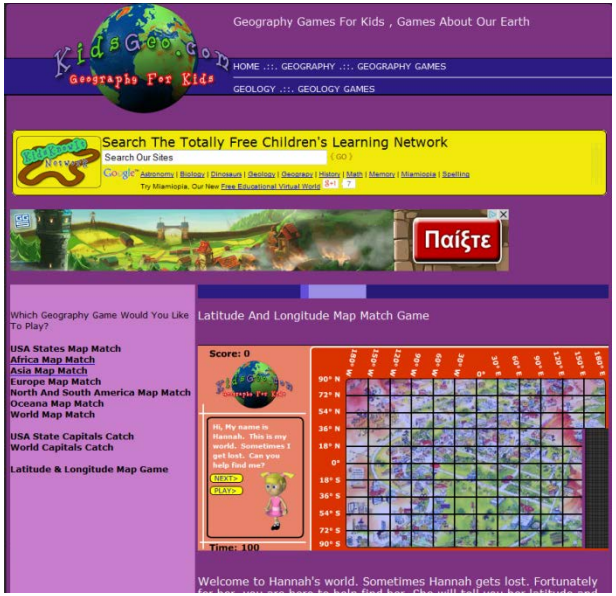
location

Concept definition:

a point or extent in space

Links

http://www.teachspatial.org/concept-browser/location
http://vocabulary.curriculum.edu.au/scot/2315.html
http://dbpedia.org/resource/Location_(geography)



Concept term

Global warming

Concept definition:

an increase in the average temperature of the earth's atmosphere (especially a sustained increase that causes climatic changes)

Links

http://www.c2es.org/science-impacts/basics/faqs/climate-science
http://en.wikipedia.org/wiki/Global_warming
http://earthobservatory.nasa.gov/Features/GlobalWarming/

Concepts | Instances | Representation tools | Reasoning tools

Concept:

City

Instance:

Venice

Instance:

San Francisco

Representation tools

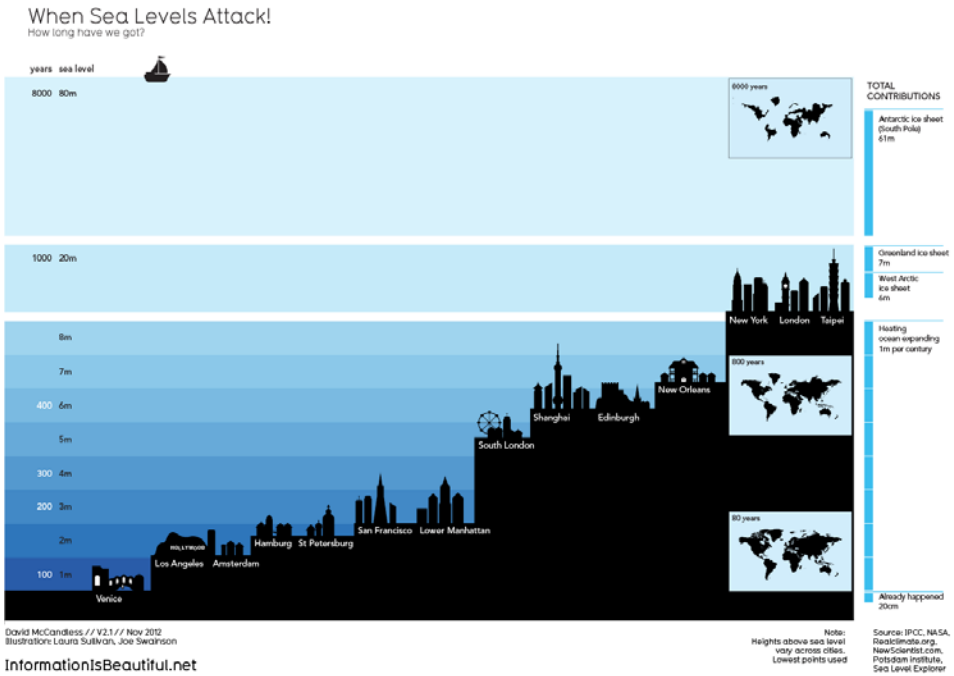
- Maps
- Digital elevation models
- Interactive applications
- Diagrams
- Images

Category:

Diagram

Tool:

When sea levels attack!



Concepts	Instances	Representation tools	Reasoning tools

Title:

The New York Times: What Could Disappear

Short Description:

Maps show coastal and low-lying areas that would be permanently flooded, without engineered protection, in three levels of higher seas.

Age range:

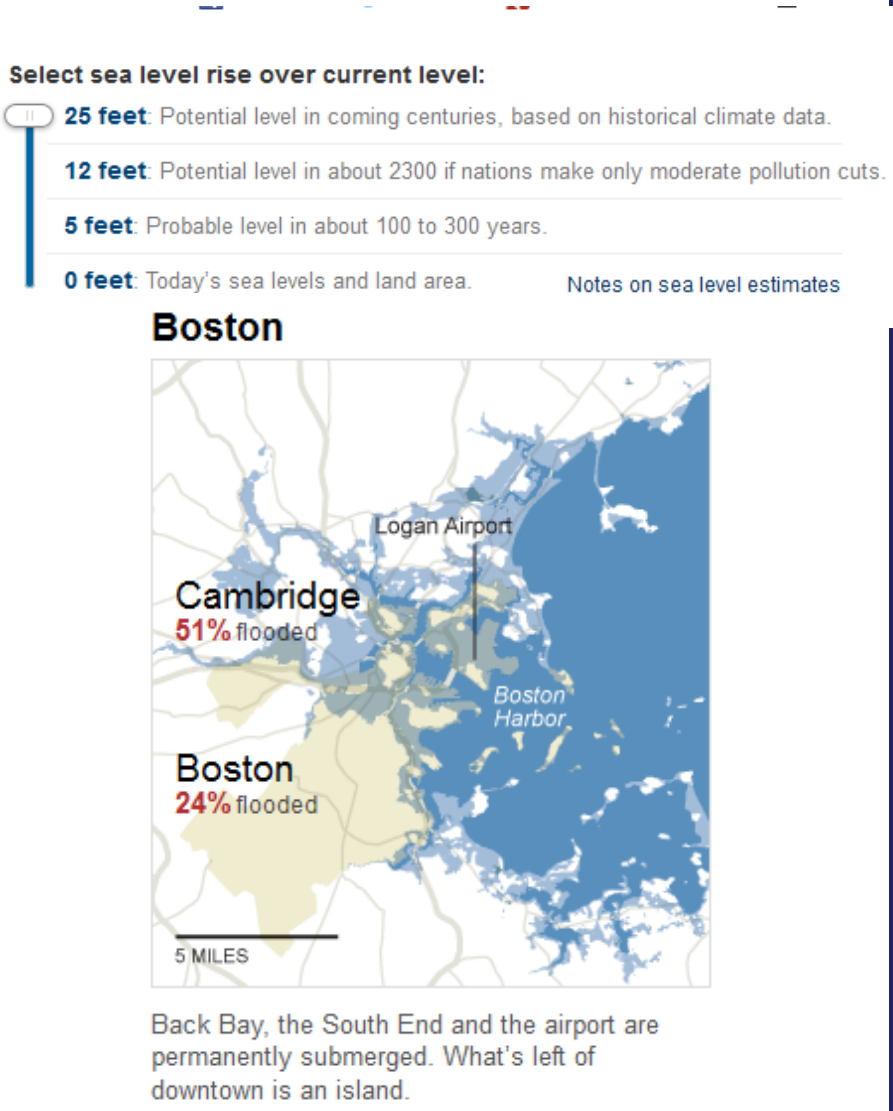
14+

Time:

30 minutes

Link:

http://www.nytimes.com/interactive/2012/11/24/opinion/sunday/what-could-disappear.html?_r=0



Title:

Geology.com: Global Sea Level Rise Map

Short Description:

The map shows areas that would be flooded at various stages of sea level rise. You can select a value of sea level rise using the dropdown box in the upper left corner of the map.

Age range:

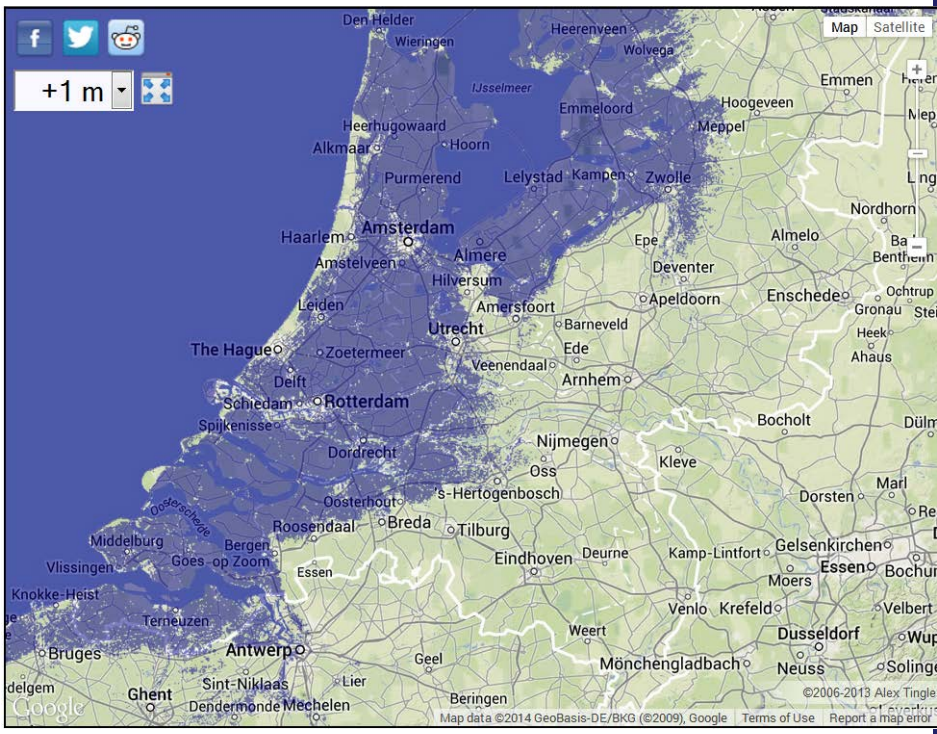
14+

Time:

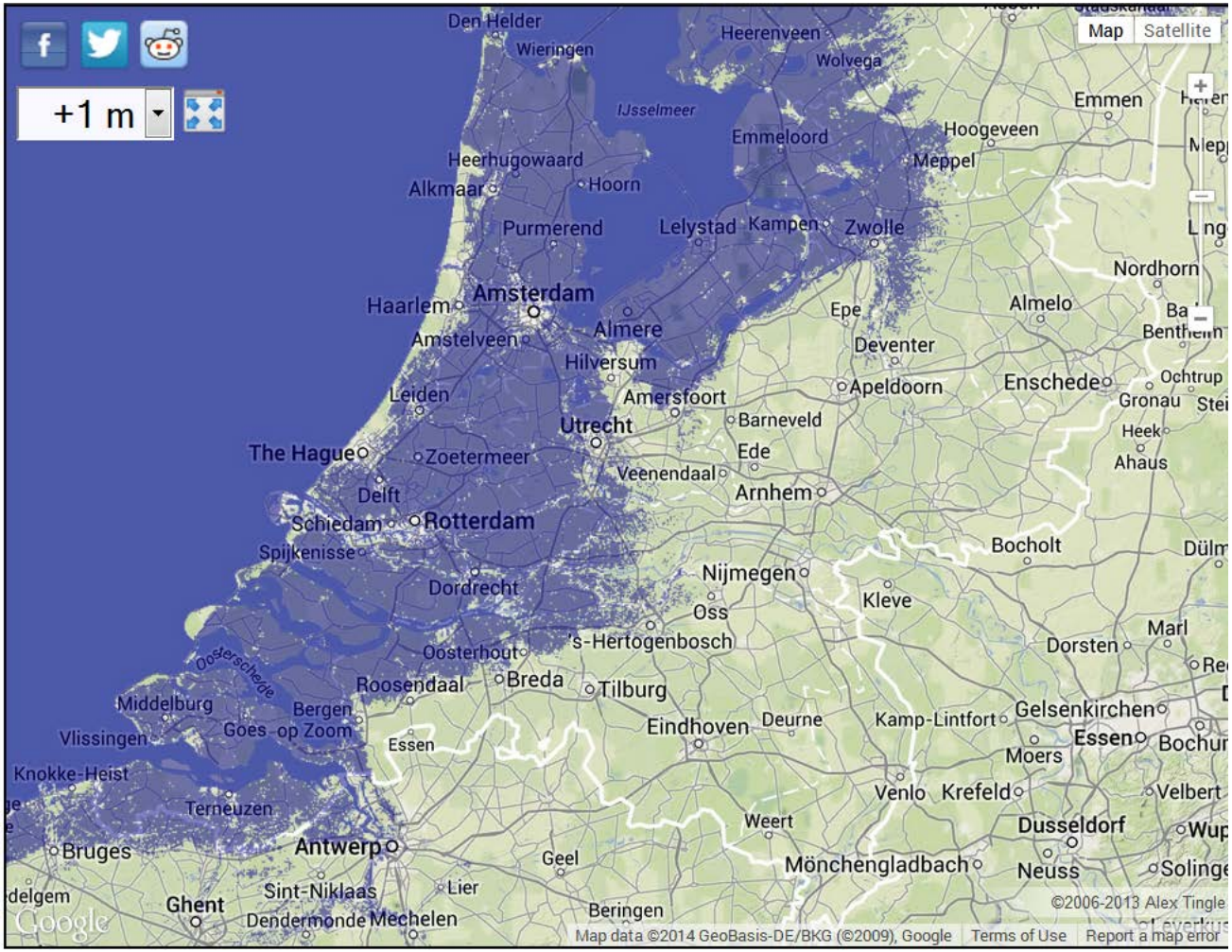
30 minutes

Link:

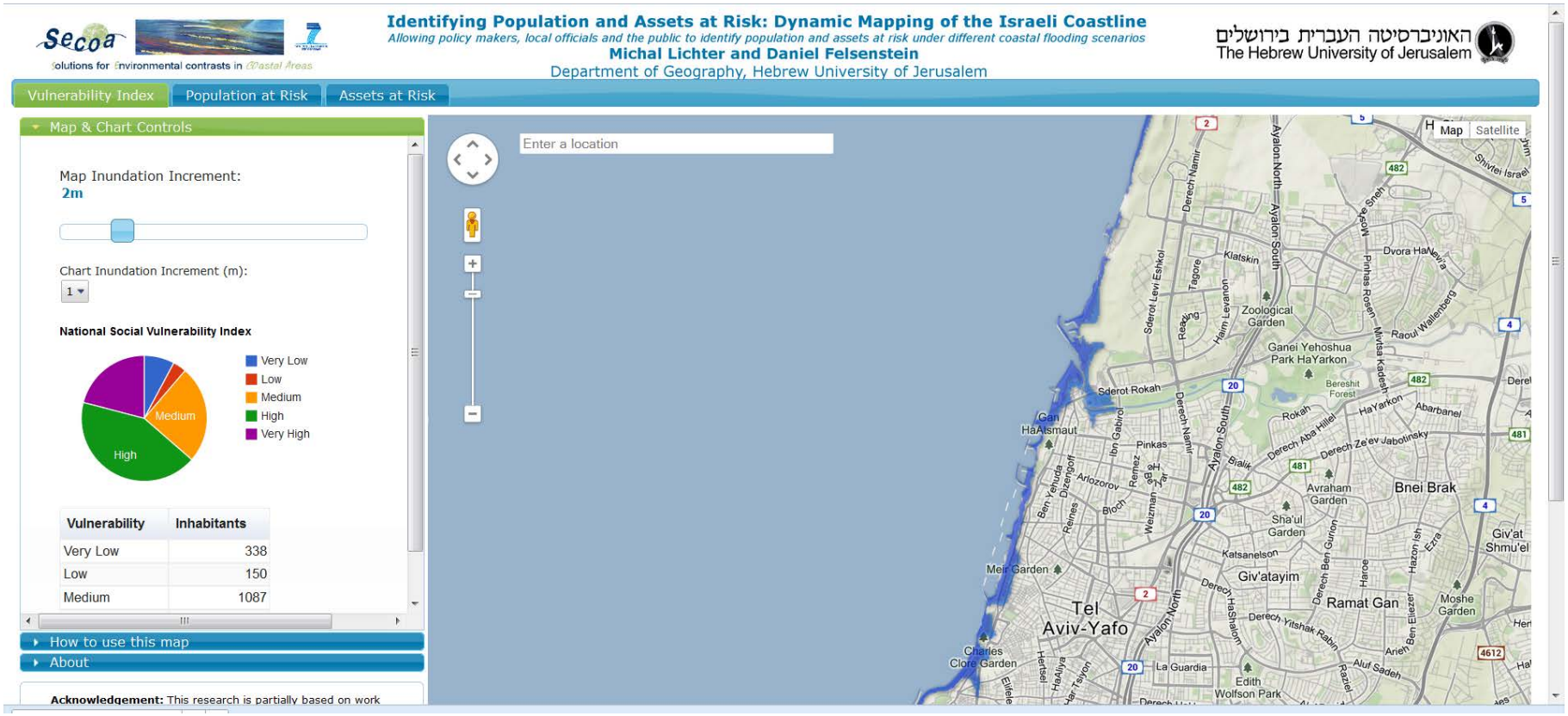
http://geology.com/sea-level-rise/



Geology.com: Global Sea Level Rise Map



http://geology.com/sea-level-rise/



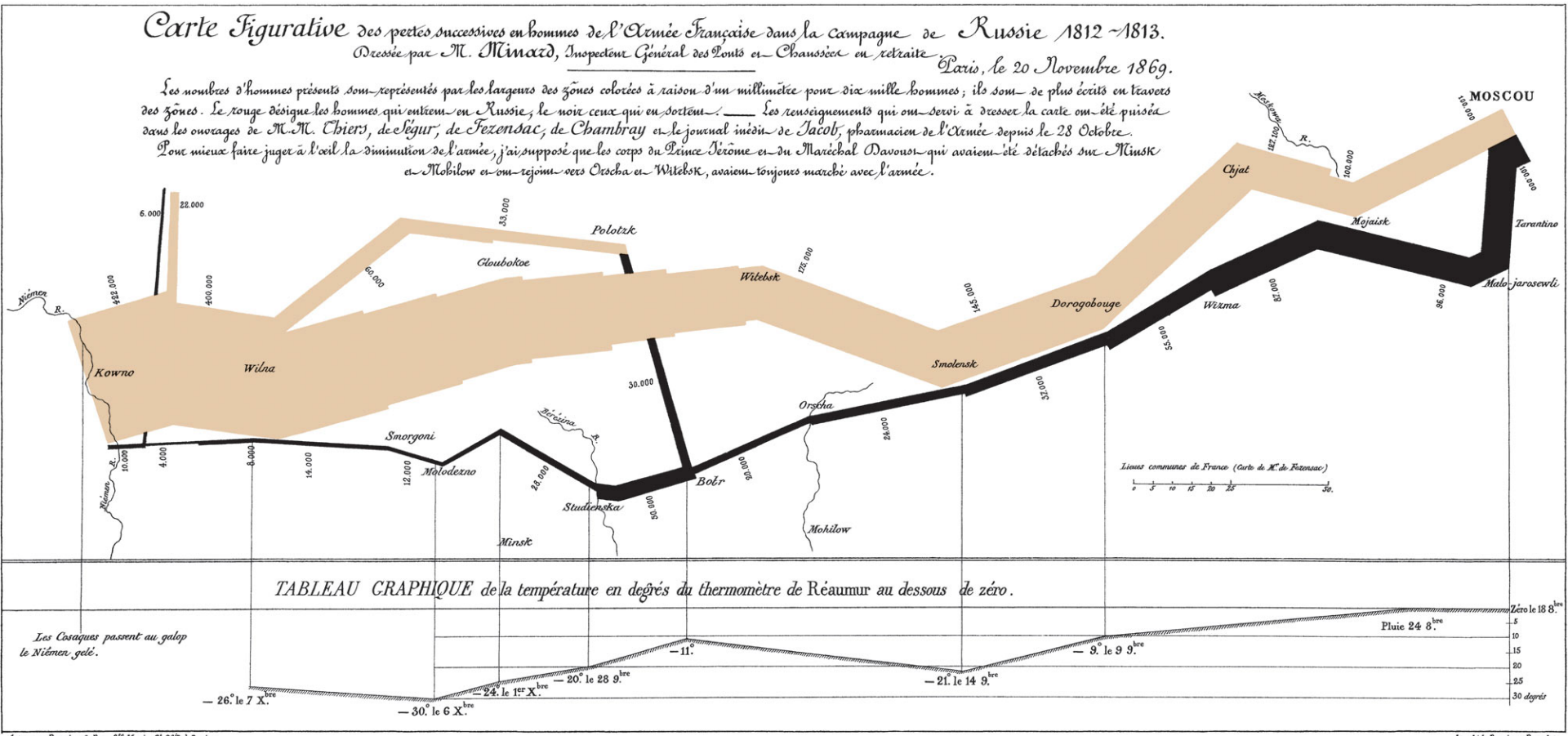
http://ccg.huji.ac.il/dynamicmap/index.html

Learning activity

- Combine a map and a digital elevation model using a free GIS software, evaluating multiple criteria (e.g., the location of settlements and other socioeconomic activities) and making inferences about environmental consequences

What about social sciences and humanities?

Minard's Map of Napoleon's March on Moscow

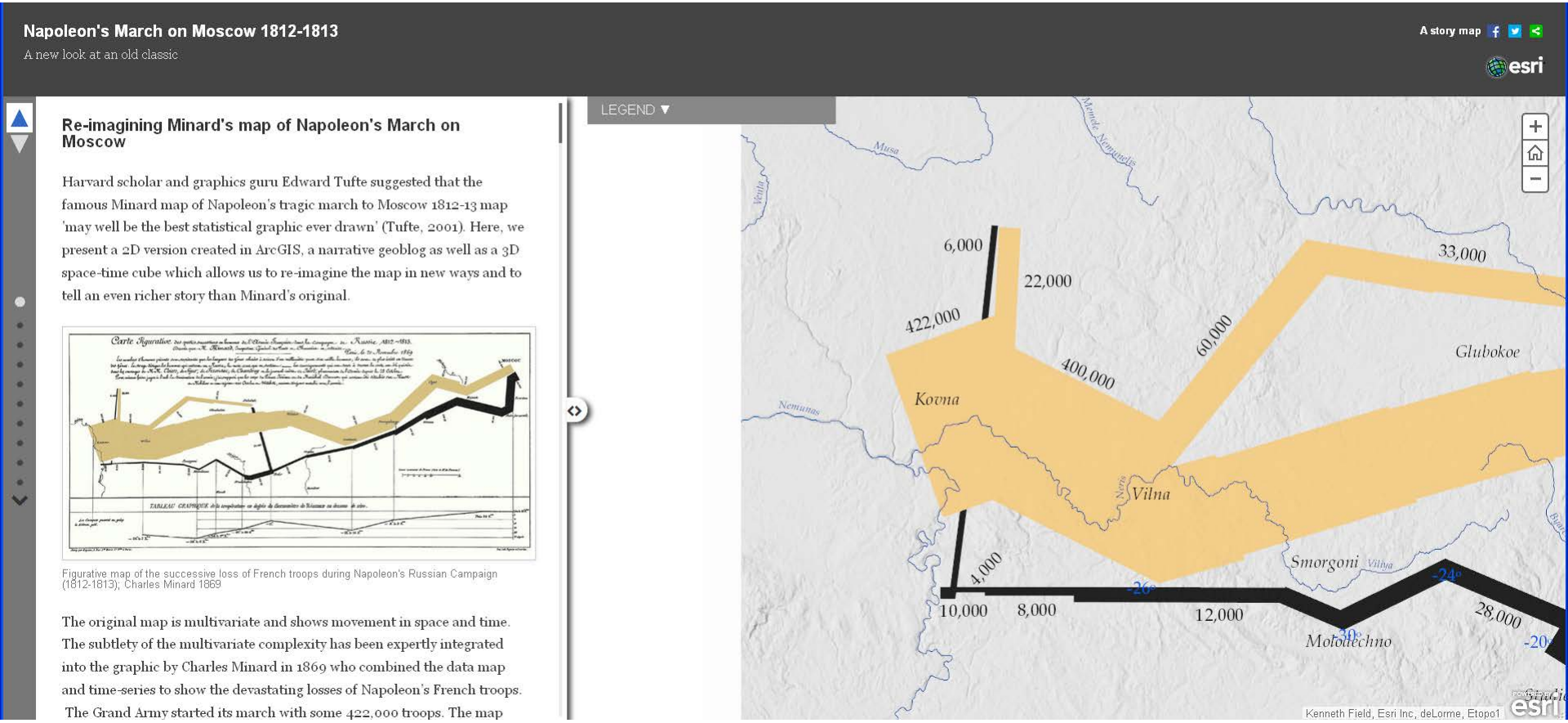


Autog. par Regnier, 8. Par. Ste Marie St Gain à Paris.

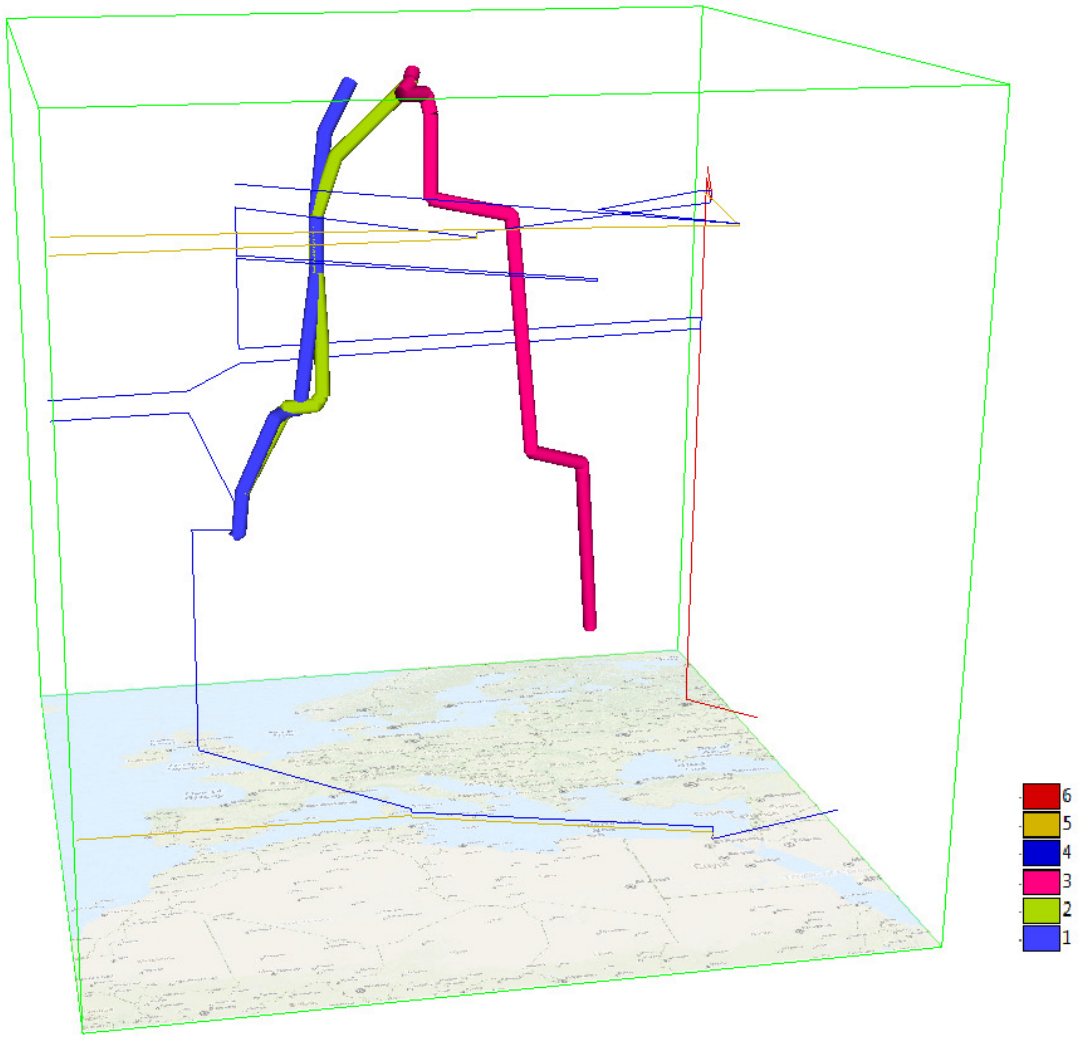
Imp. Lith. Regnier et Dourdet.

Storymaps

http://storymaps.esri.com/templates/development/stable/geoblog/?appid=42459c24c8a44f328e55c9043bf26208



Space time cube depicting the movement of leaders and troops during the Second World War



http://show.mappingworlds.com/world/