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Geodata and Tools for Education and Research

AGILE Pre-Conference Workshop

June 14th 2022 - Vilnius, Lithuania (hybrid)

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Official Workshop Report

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“Geodata and Tools for Education and Research”

AGILE Pre-Conference Workshop organized by EuroSDR,

June 14th 2022 -Vilnius, Lithuania (hybrid)

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GEODATA AND TOOLS FOR EDUCATION AND RESEARCH

AGILE Pre-Conference Workshop organized by EuroSDR
June 14th 2022 -Vilnius, Lithuania (hybrid)

Official Workshop Report

With 8 figures

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1 INTRODUCTION

Geographical data and analyses are a useful asset in several domains of education and research including geography, history, urbanism or environmental science, amongst others, from primary school to higher education and life-long learning. In the specific context of Europe, as more and more data (including geographic data) becomes open for all, it is crucial to ensure these users have the capacity to make the most of the wealth of this data.

Reciprocally, from the perspective of data providers, education and research are particularly important application domains. They have the ability to link knowledge (production or dissemination) with data and adopt critical perspectives on this data.

In this context, a half-day workshop was organised by EuroSDR during the 2022 conference of the Association of Geographical Information Laboratories in Europe (AGILE). It focussed on current experiences developed by EuroSDR members, mainly at national mapping agencies, as well as proposals stemming from AGILE research communities, to share experiences and visions on this topic. It also targeted possible synergies to interconnect existing approaches, usually national, and achieve cross-national solutions, in Europe and beyond.

2 A panorama of approaches developed by EuroSDR members

In 2019 and 2020, the EuroSDR organization launched a survey to study existing EuroSDR members' initiatives to provide data and tools to second level pupils and their teachers, third level students and their lecturers and scientists. One motivation was to obtain feedback on geodata value and reusability from communities heavily involved in knowledge production and transfer, as well as on methods to improve spatial data literacy. Another motivation was to investigate emerging needs with these communities that may lead to the design of new products.

The panorama presented here is not exhaustive but provides a good representation of what can be found in this area in Europe. Thirty-two initiatives were examined, 10 by mapping agencies and 4 from other organizations. Target groups for these initiatives cover a wide range of participants, from pupils from the age of 5-years to university students and professionals as well as the general public.

Teachers and scientists use open data geoportals, which are developed by all mapping agencies. Some, but not all, of these portals have an English interface which facilitates their adoption by scientists from abroad. Dedicated sections within existing geoportals or agencies' websites can be added aimed specifically at schools and education. These specialised sections can include relevant manuals, data and services aimed at the specific target group, for example in Switzerland, see figure 1. Access can also be integrated within a teachers' digital working environment such as the case in Ireland where Ordnance Survey Ireland (OSi) have designed a specific section available from within the general purpose education platform Scoilnet (<https://maps.scoilnet.ie/>) or in France where the Edugeo solution is integrated within the general purpose Edutheque (<https://www.edugeo.fr/>).

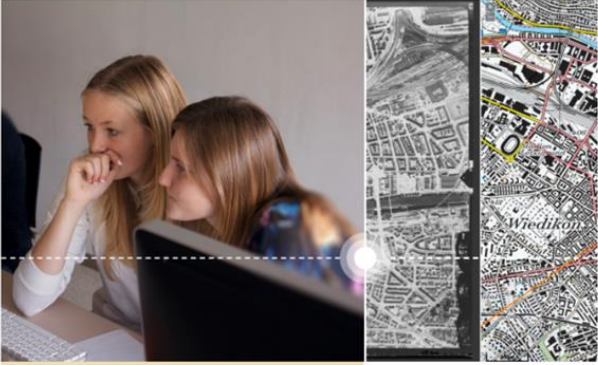
< Services

Services for schools

- Level 1 (primary level) >
- Level 2 (primary level) >
- Level 3 (secondary stage I) >
- Secondary stage II >
- Tertiary education (university) >

swisstopo teaching materials and services for schools

Free teaching materials and worksheets on map reading, treasure hunts, time travelling, geology and more for all educational levels.



Our range of educational material includes:

- Fun materials such as treasure hunts.
- Map reading manuals.
- "A journey through time": Switzerland in its entirety since 1864, so you can show the development of a city or a landscape, for example.
- LUBIS: swisstopo aerial photos and image strips from 1920 to the present.

Figure 1: section of the Swiss open data portal dedicated to Schools.

Organisations may also produce dedicated resources such as Data portfolios, StoryMaps or fun materials. This is the case for example in Switzerland where Swisstopo have developed resources for schools: <https://www.swisstopo.admin.ch/en/services/offer-for-schools.html> and also in France where the teaching-book of Edugéo can be accessed: <https://www.edugeo.fr/support/teaching-book>. Resources can include hardware including the Geocube kit designed at IGN-France to set up technical classrooms where pupils can acquire data and publish online. A recurring resource is the production of data for gaming and more particularly for the Minecraft game or its free version, Minetest, as shown on figure 2. There is a high level of adoption of these initiatives as evidenced in Great Britain in 2019, where 2710 Schools, 190 Colleges and 120 Universities adopted Ordnance Survey (OSGB) products for education.

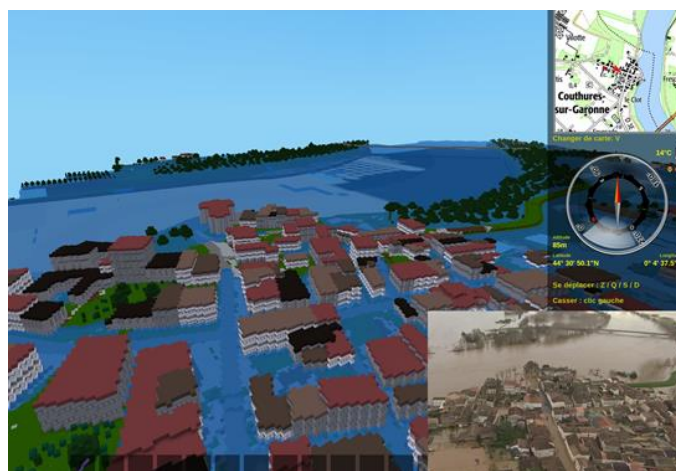


Figure 2: rendering reference data for the Minecraft platform, and include a flood simulation.

Data dedicated to a specific theme can also be produced, very often during collaborative research projects, such as the Shellfish Safety Data or Seabed Viewer designed with the Irish Marine Institute, see figure 3.

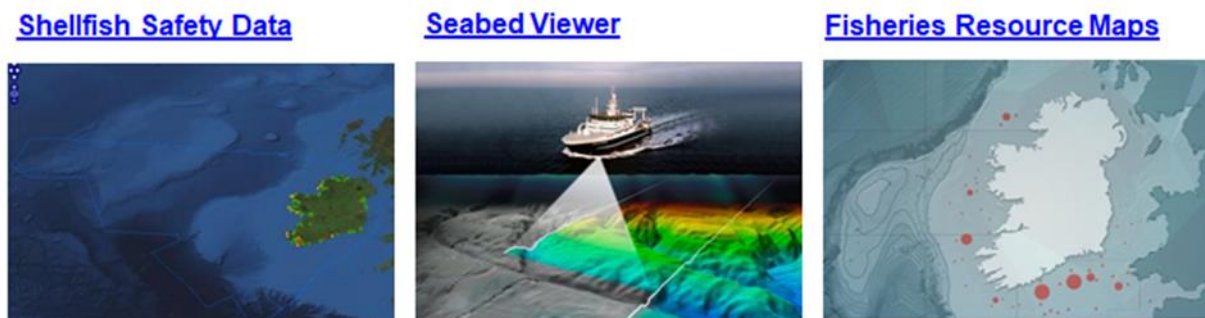


Figure 3: different thematic data products dedicated to specific communities in Ireland.

Specific events such as treasure hunts or escape games can also be organised. In addition, many organisations provide manuals, online training material, online courses, and professional training support, for example in Spain, <https://cursos.ign.es>, or France, <http://cours-fad-public.ensg.eu/>, such courses are normally in the local language. These above mentioned initiatives were found to have a high level of adoption and are well maintained.

Following this 2019 and 2020 survey, EuroSDR wished to identify possible new resources that could be achieved through a collaboration between European National Mapping and Cadaster Agencies (NMACs), with specific objectives including:

- to provide an Eduserv course on all educational resources, on how gain access and apply them, to understand data characteristics and to know where to obtain information about the data characteristics (metadata),
- to promote and accompany the usage of 3D or historical data,
- to establish links between national dataset portals, to support data discovery and reuse,
- to support pupils editing data or contributing to scientific data Europe-wide via Volunteered Geographic Information (VGI).

The following section outlines three new resources that fit the criteria outlined above.

3 Global, regional and national level spatial data for teaching and research in GIS in Estonia

The Department of geography of the University of Tartu (Estonia) uses global, regional, and national level data in teaching and in research. It benefits from one of the most advanced geoportals in Europe: The Estonian Land Board Geoportal, see figure 4.

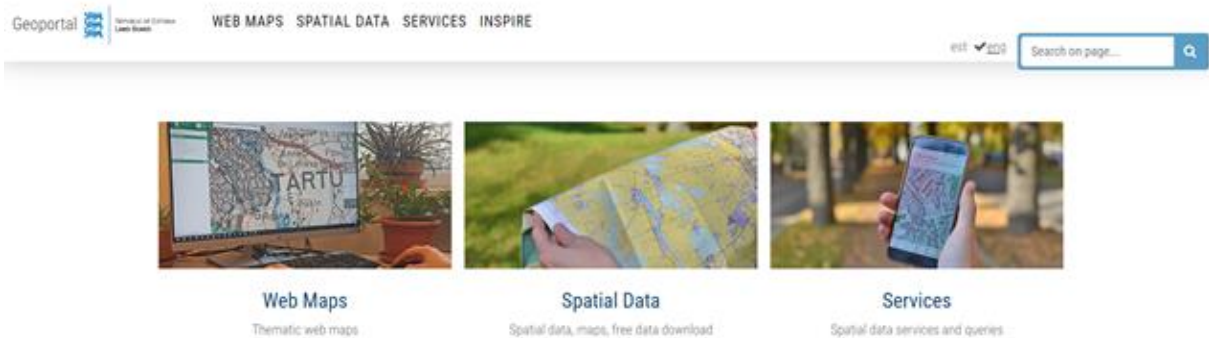


Figure 4: Geoportal of the Estonian Land Board, <https://geoportaal.maaamet.ee/eng/>.

The main requirements and limitations for teaching of the datasets in this portal are:

- good metadata that describes data lineage, Coordinate Reference System (CRS), attribute values etc. To enable international uptake, the metadata should be in English
- open formats - ideally the data is in open format or provided in several data formats, so the uptake would not be limited to proprietary software;
- different resolution/scale: national level data is often very high resolution which in teaching might be too “heavy” to process and therefore more generalised data is very useful e.g. Digital Elevation Model (DEM) models with 100m resolution
- should be easy download or Web Feature Service (WFS), however, with large datasets (more than 1GB) WFS can get slow
- WMS as a basemap could have the possibility to render layers separately which enables to use it more efficiently as a basemap in map design

Important aspects include: proper metadata, Findability Accessibility Interoperability Reusability (FAIR) principles [Wilkinson et al. 2016], and open access to the data with open standards.

4 5*S: Space, Surveyors and Students - STEM Outreach

The Departments of Geography/Education in Maynooth University, Ireland are leading a collaboration with Ordnance Survey Ireland (OSi - Irish National Mapping Agency), the Society of Chartered Surveyors Ireland (SCSI), Esri Ireland and Technological University Dublin to showcase satellites and survey data to students.

5*S: Space, Surveyors and Students – STEM and the Sustainable Development Goals is a Science, Technology, Engineering and Mathematics (STEM) outreach project that builds on two existing national school-based programmes to target a national audience. A collaboration between Esri Ireland’s award winning, *ArcGIS for Schools* programme and the *SCSI Day in the Life* recruitment programme offers the opportunity to combine a national network of volunteers with an existing data/training infrastructure. 5*S is funded by Science Foundation Ireland and is now entering its fourth year with demonstrations carried out to over 15,000 students, 250 teachers and over 2000 App downloads. 5*S has two main work packages (WP), see figure 5:

WP 1 - Top Down: The top down approach develops and delivers satellite focussed content to students, with content tailored for students aged 13 – 16yrs. Satellite themed content has been developed and delivered for Science, Geography and History. All content is made available to students through ArcGIS StoryMaps (Figure 5a) with interactive components throughout to interest the students and keep them engaged. The 5*S partnership with the Department of Education in Maynooth University also opens the initiative to teachers and student teachers on both under/postgraduate teaching degrees there and enables co-creation of lesson plans tailored for different age-groups.

WP 2 - Bottom up: This WP has been designed to promote active, student-lead learning. Encouraged by the success of augmented reality (AR) in apps such as Pokemon Go, the 5*S team have developed a free AR app entitled *SatelliteSkill5* (Figure 5b). *SatelliteSkill5* leads the students through a series of interactive challenges using a phone or tablet, introduces them to satellite data and demonstrates the importance of this data and other survey related datasets in tackling the United Nations Sustainable Development Goals (UN SDGs). The 5*S partner - OSi has played an active role on the United Nations Global Geospatial Information Management (UN-GGIM) Committee of Experts since 2012 and the UN GGIM fundamental geospatial data themes are also introduced in this app.



Figure 5: Structure of the 5*S project: (a) WP1 entails school visits and ‘Train the Trainer’ events, while WP2 (b) encourages self-directed learning through AR in the *SatelliteSkill5* app - Available for free on PlayStore and AppStore <https://5sdiscover.maynoothuniversity.ie/downloads/>

5 Use of Edugéo for teaching Geography and History

Geographical Information Systems (GIS) have revolutionized the traditional geography classroom which was previously based on memorizing the world as a huge puzzle from large paper maps. This basic approach to learning can be boring for pupils and students, however maps have become better playgrounds thanks to GIS. It is now easier to create outdoor pedagogic activities involving the pupils, for example designing maps of a place that they will later visit and compare, or geocaching. To ease the usage of the French Geoportal data and services for classrooms, in 2010, the Édugéo platform was established by IGN-France in partnership with the Ministry of National Education, Higher Education and Research. For more than 10 years, expert teachers have succeeded in developing educational proposals adapted to classes from primary level to high school, and now higher education.

Students can display an urban map from 1960, circle the building, then superimpose the same map on it today and visualize at a glance what “suburbanization” means. Similar comparisons can be made with “coastal retreat” and “low density spaces”, and they can prepare a report through the narrative maps module. Students can access statistics from the French National Statistics Institute and draw thematic maps, as shown in figure 6. In addition, students can visualise topographical data in a virtual and fun environment (Minetest) and experiment with 2D and 3D simulations of natural risks (floods, avalanches, volcanic eruptions).

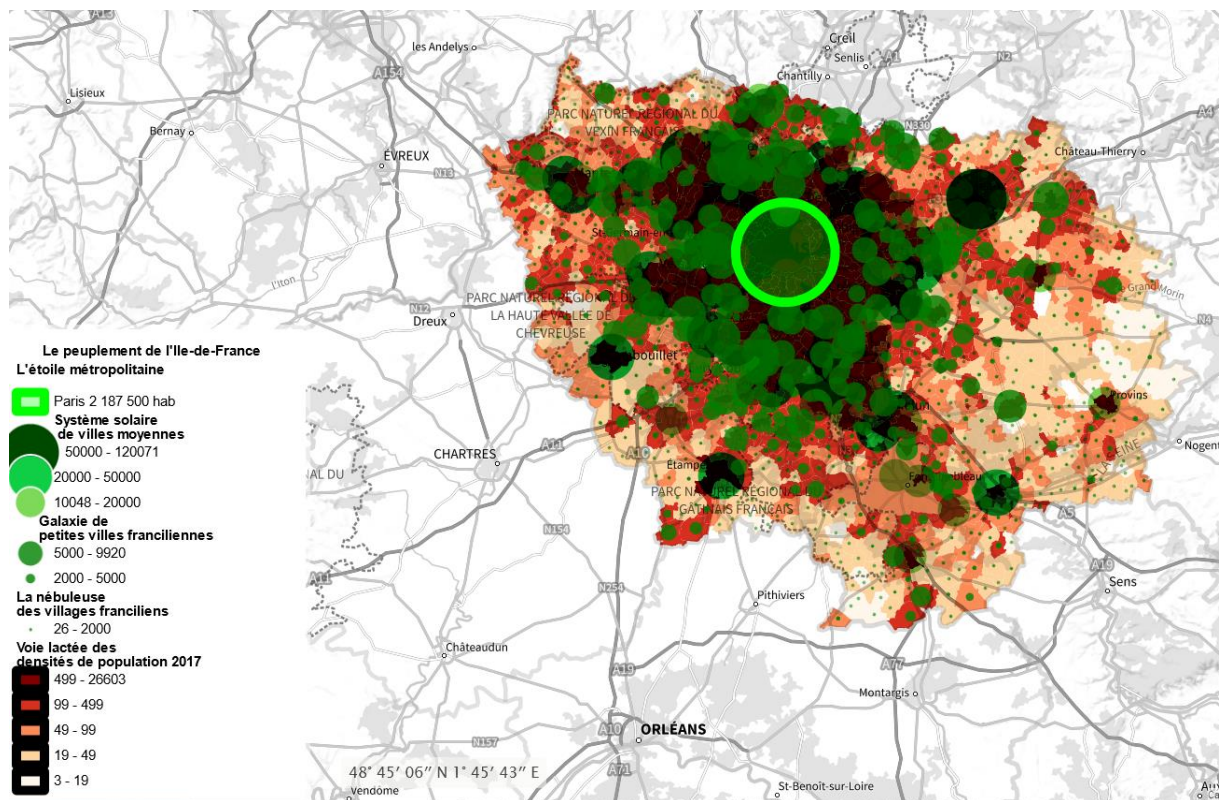


Figure 6: Thematic map drawn by students to display and analyze population densities in greater Paris.

World data can be integrated in the Edugéo platform for the study of land change across the globe. For example southeast of Shanghai is an area of major land change with the Nanhui New City that covers about 74 square kilometers. The main feature of the new city is a circular artificial lake, visible from satellite imageries series starting in 2004. Its concentric structure can also be clearly seen. The building of the Donghai Bridge that connects the city to one of the largest shipping ports is also visible with its 32.5km long and six lanes of traffic.

Narrative threads can also be used to study through debating, for example the Beyrouth blast disaster, Brexit consequences on borders between UK and France or the Lubrizol factory disaster in Rouen. In the latter, encouraging students to get involved in a citizen debate nurtures their culture of risk.

Finally, IGN-France offers a library where each professor, student or anyone can use the weblink of a story map or another map product and insert in the support of their choice. In this library, resources are referenced using items from the official program of the ministry of education as shown on figure 7.

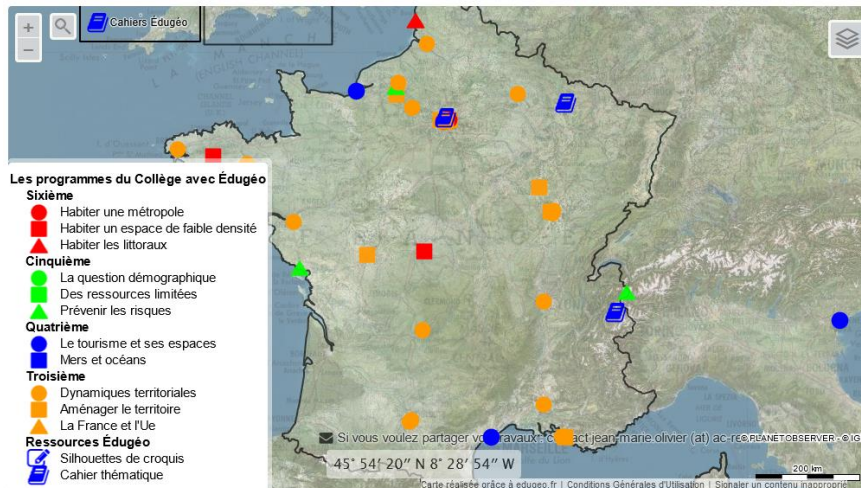


Figure 7: Registration of story maps on Edugeo through official education programs: to live in a big city, to live in a low density area, to live on the seashore, demography, limited resources, etc.

6 Discussion and perspectives

Approaches and experiences presented during the workshop, mostly developed in national contexts, were found to be relevant for all countries and could be adapted. Yet these approaches are not very intervisible and during the workshop wrap-up, participants insisted on the necessity to pursue exchanges.

It was found that opening up data is not sufficient to engage teachers. Swisstopo dedicated a specific section of its portal, centralizing all information relevant to this community. In the 5*S project and Edugeo, for a teacher to adopt a resource or open his classroom to the team it was necessary to describe how the proposed resources fit in the official educational program.

Teachers and scientists often need data from many providers, to study world-wide and more local phenomena.

The fast evolution of the field of GI makes it relevant to design teaching modules for those who learned GIS decades ago and who are not familiar with the new technologies, as was undertaken in Tartu University.

More specific topics for follow up events were identified. The first topic is how to improve the visibility of all existing approaches, tools, good practices, reusable resources, for example to design and maintain a dynamic survey.

The second topic for further work is to analyse user scenarios which would benefit from a European approach and distinguish what already exists to support them and what is needed and could be achieved in a joint activity. Examples of solutions that already exist include global solutions such as Google Earth Engine, OpenStreetMap, ESRI Land Cover products. As illustrated in the figure 8, each product has its advantages and disadvantages and is valuable to these communities.

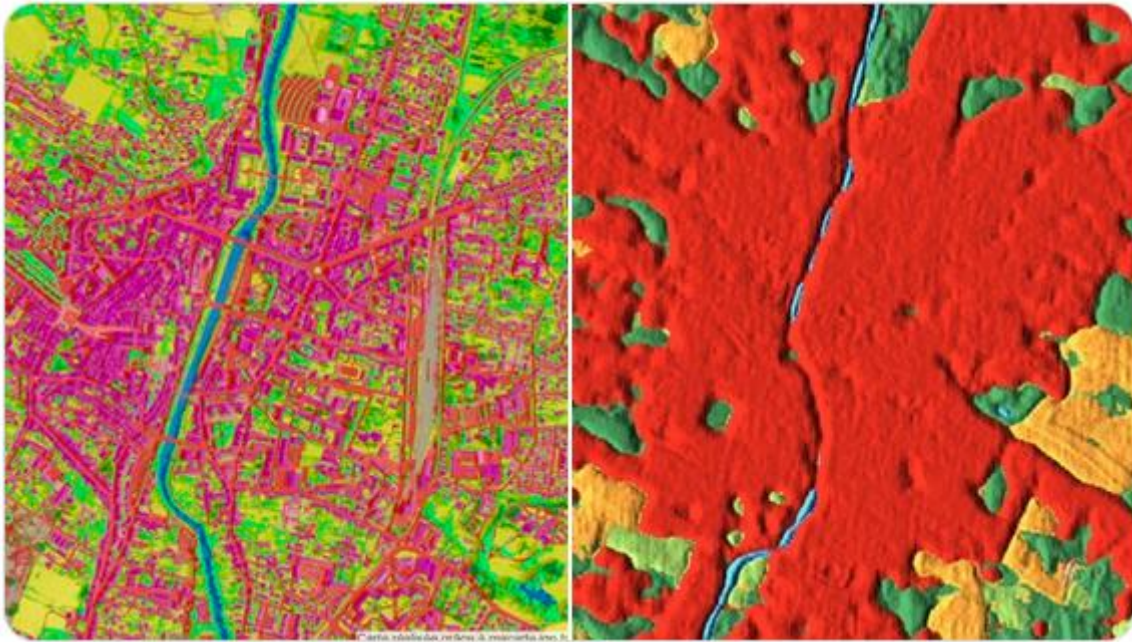


Figure 8: Comparison of Land cover products, produced through state of the art Artificial Intelligence and sensors, on a city in South of France, one from the national mapping agency and one from Google.

The third topic of importance is funding: what are opportunities. As reported by EuroSDR [Bucher et al. 2020], national initiatives to engage with education communities are funded and maintained by national funds. Identifying funding for European or international projects necessitates considering other categories of funding.

The participants of the workshop convened to draft and submit to EuroSDR and AGILE a joint activity on « Geodata and tools for education and research».

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