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Modelling accessibility to urban green areas using Open Earth Observations Data and the GEOSS platform

UNGGIM-Europe Webinar – June 4, 2025

Gregory Giuliani (UNIGE) in collaboration with ESA, CNR, EVERSIS, JRC & GEO

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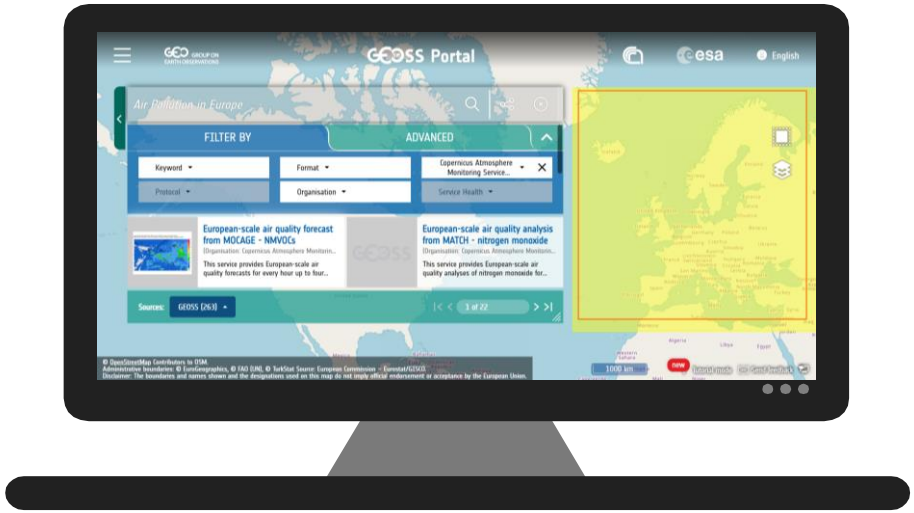
The GEOSS Platform concept



- A **data discovery and access system** bridging the gap between data providers and users.
- One main HCI, the **GEOSS Portal**
- Enabling the creation of **Community Portals** via customizable **GEOSS Mirrors**
- Enabling the configuration of the domain of interest via customizable **GEOSS Views**
- Accessible via open APIs, exposed by the **GEO Data and Access Broker** (middleware)
- Replicability, Reproducibility, Reusability, Robustness

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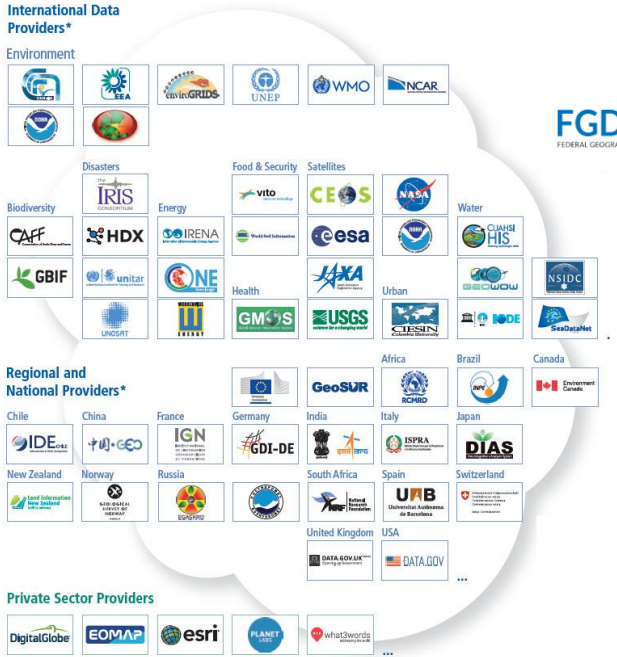
The GEOSS Platform: a bridge from data to Knowledge

Data, technologies,resources, Services providers



GEOSS
Global Earth Observation System of Systems

FGDC.GOV
FEDERAL GEOGRAPHIC DATA COMMITTEE

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Status Checker

GEOSS Platform

Yellow Pages

GEO DAB ⟷ GEOSS Portal ⟷

End-users (e.g. Decision Makers)

Intermediate users (e.g. Developers scientists)

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UPSTREAM

MIDSTREAM

DOWNSTREAM

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The envisaged evolution through The GEOSS Platform Plus (GPP) H2020 Project

Challenges

- Only data discovery and access, no other resources such as services, code, documents, tools, information, knowledge
- No relationships between resources that would enable to retrace the journey leading to results
- Set up of Community Portals and Views strongly depends on GEOSS Platform team support: this limits the engagement of new communities.
- Obsolete *discovery download process publish* paradigm (not suitable for big datasets)

Solutions

- **Discovery of services, information, knowledge, tools, models, algorithms, papers**
- **Semantic links** among resources that would enable *reproducibility, replicability, reusability and robustness analysis*
- Developing tools that enable **self-creation of community portals and views** to foster a broader engagement of new communities
- Leveraging Cloud technologies supporting **multi-Cloud approach** for knowledge generation

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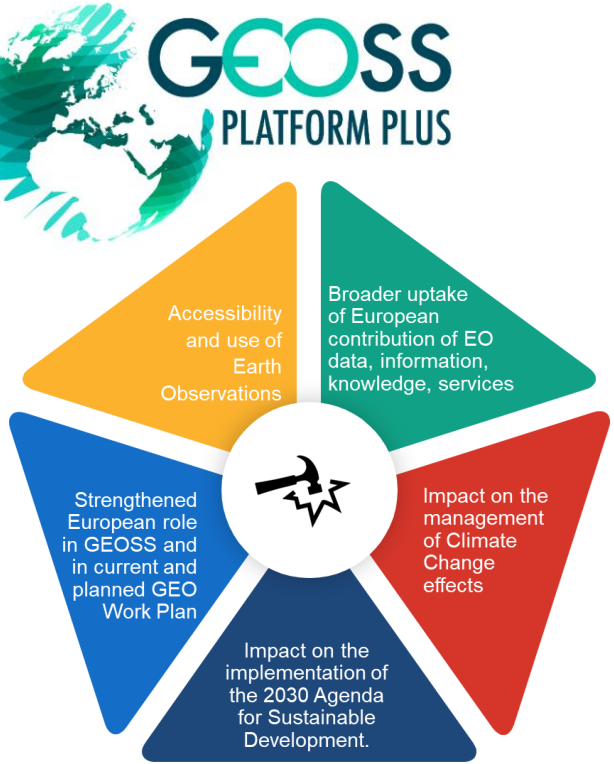
GEOSS Platform Plus



GPP will further evolve the GEOSS infrastructure with users' required functionalities to ***access and generate tailor-made information*** & ***actionable knowledge***.

GPP will enable *services to non-specialists* in the domain of *adaptation to extreme climatic events* and to *changes in climatic conditions*.

It will implement different scenarios benefiting from GEOSS Platform developments. It will as well consider *linking with the GKH to set up the foundations of more interoperability among knowledge platforms*.

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Urban expansion: a contribution to land degradation…

- Over the last three decades, cities worldwide have altogether increased in size by an area equivalent to Ireland
- Urbanization has a significant **impact on the use of open and green spaces** such as threat of their privatization or loss of their original functions
- **Public space has an essential role to play in making cities livable** and is interlinked with various other development issues such as environment and climate change, economic development, urban poverty, security, community cohesion, social interaction, civic identity, entertainment, gender and social equality and quality of life
- There is a **strong need to optimize the use of available space** requiring efficient and effective land use management strategies to enhance inclusive and sustainable urbanization

SDG 11.7

Objectives of the UC:

Use case on green spaces accessibility based on the work UNIGE have done for the SDG 11.7.

- This closely relates to climate change, urban sustainability, and health.
- The methodology uses a mix of NDVI data together with OpenStreetMap data and an accessibility model.
- It is envisaged to deploy this at different scales: a single city; a country, a region, or even potentially a global analysis.

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SDG 11.7: Objectives

- Re-use the same conceptual approach as the SDG15.3.1 use case: Data-Information-Knowledge
  - Data: OSM, DEM, Population, rivers, roads, …
  - Information: AccessMod model
  - Knowledge: Dashboard
- Re-use the new component(s) (e.g., Vlab, dashboard)
- Replicate the approach proposed by Giuliani et al. (2021)
  - Combination of satellite & crowdsourced EO Data
  - Compute the “Share of urban population without green urban areas in their neighbourhood”

11 SUSTAINABLE CITIES AND COMMUNITIES

Modelling Accessibility to Urban Green Areas Using Open Earth Observations Data: A Novel Approach to Support the Urban SDG in Four European Cities

by Gregory Giuliani [1,2,*], Ekkehard Petri [3], Eduard Interwies [4], Veronika Vysna [3], Yaniss Guigoz [1,2,5], Nicolas Ray [1,5] and Ian Dickie [6]

[1] Institute for Environmental Sciences, University of Geneva, Bd Carl-Vogt 66, CH-1205 Geneva, Switzerland

[2] United Nations Environment Programme, GRID-Geneva, 11 chemin des Anémones, CH-1211 Châtelaine, Switzerland

[3] European Commission—Eurostat, 5 Rue Alphonse Weicker, L-2721 Luxembourg, Luxembourg

[4] Intersus—Sustainability Services, Chodowieckistr. 2, 10405 Berlin, Germany

[5] GeoHealth Group, Institute of Global Health, University of Geneva, 9 chemin des Mines, CH-1202 Geneva, Switzerland

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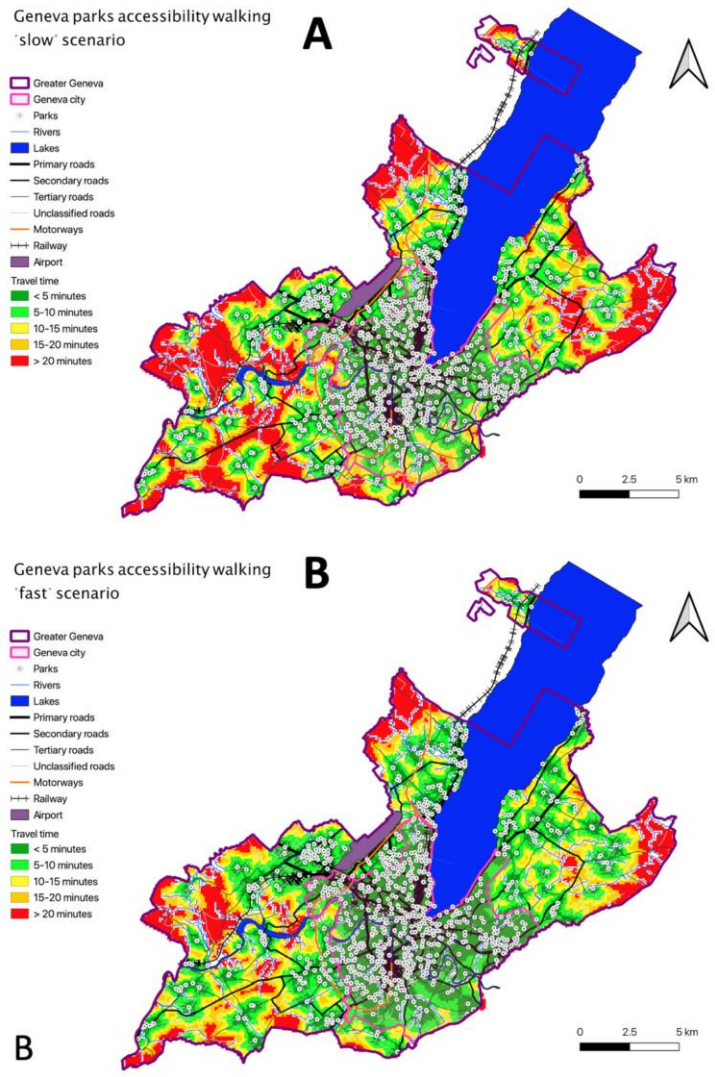
[*] Author to whom correspondence should be addressed.

Remote Sens. **2021**, *13*(3), 422; https://doi.org/10.3390/rs13030422



11 SUSTAINABLE CITIES AND COMMUNITIES

Open Access | Article

Modelling Physical Accessibility to Public Green Spaces in Switzerland to Support the SDG11

by Camille Chênes [1], Gregory Giuliani [1,2] and Nicolas Ray [1,3,*]

[1] Institute for Environmental Sciences, University of Geneva, Bd Carl-Vogt 66, CH-1205 Geneva, Switzerland

[2] United Nations Environment Programme, GRID-Geneva, 11 chemin des Anémones, CH-1211 Châtelaine, Switzerland

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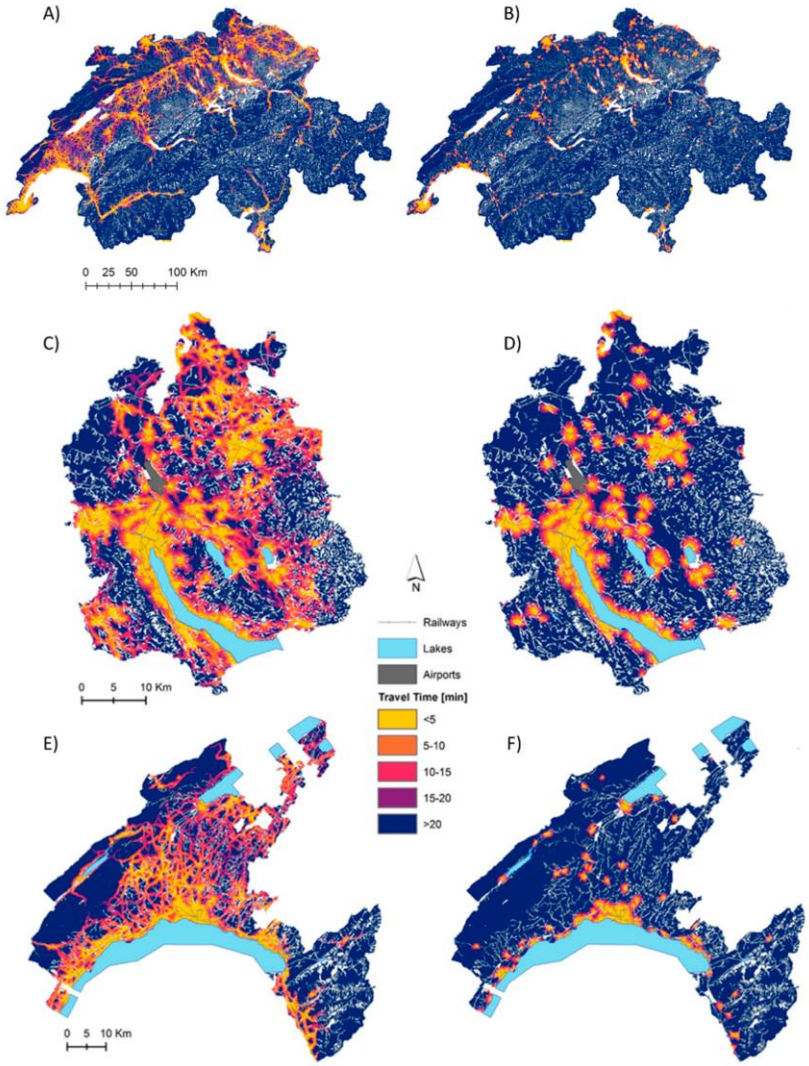
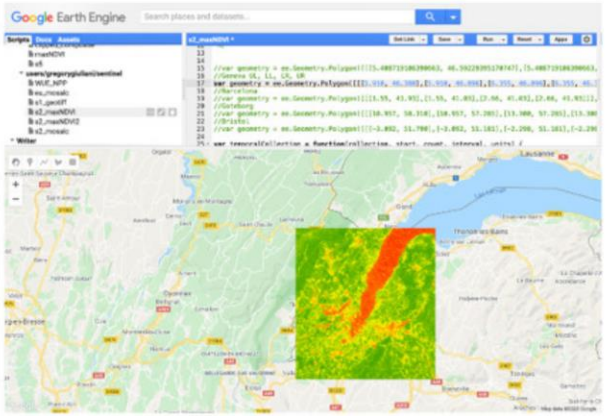
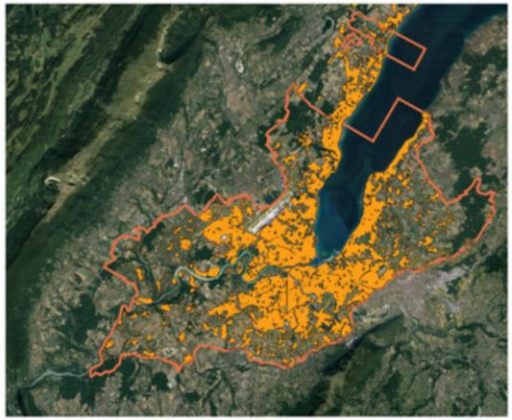
Academic Editor: Naser El-Sheimy

Geomatics **2021**, *1*(4), 383-398; https://doi.org/10.3390/geomatics1040022

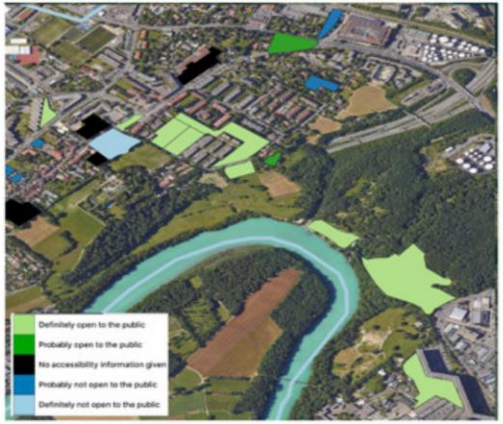




(1) Compute maxNDVI

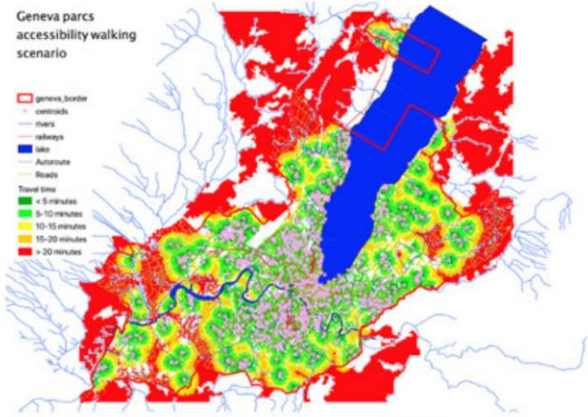


(2) Delimit Built-up area



(3) Mask public/private

(4) Overlay



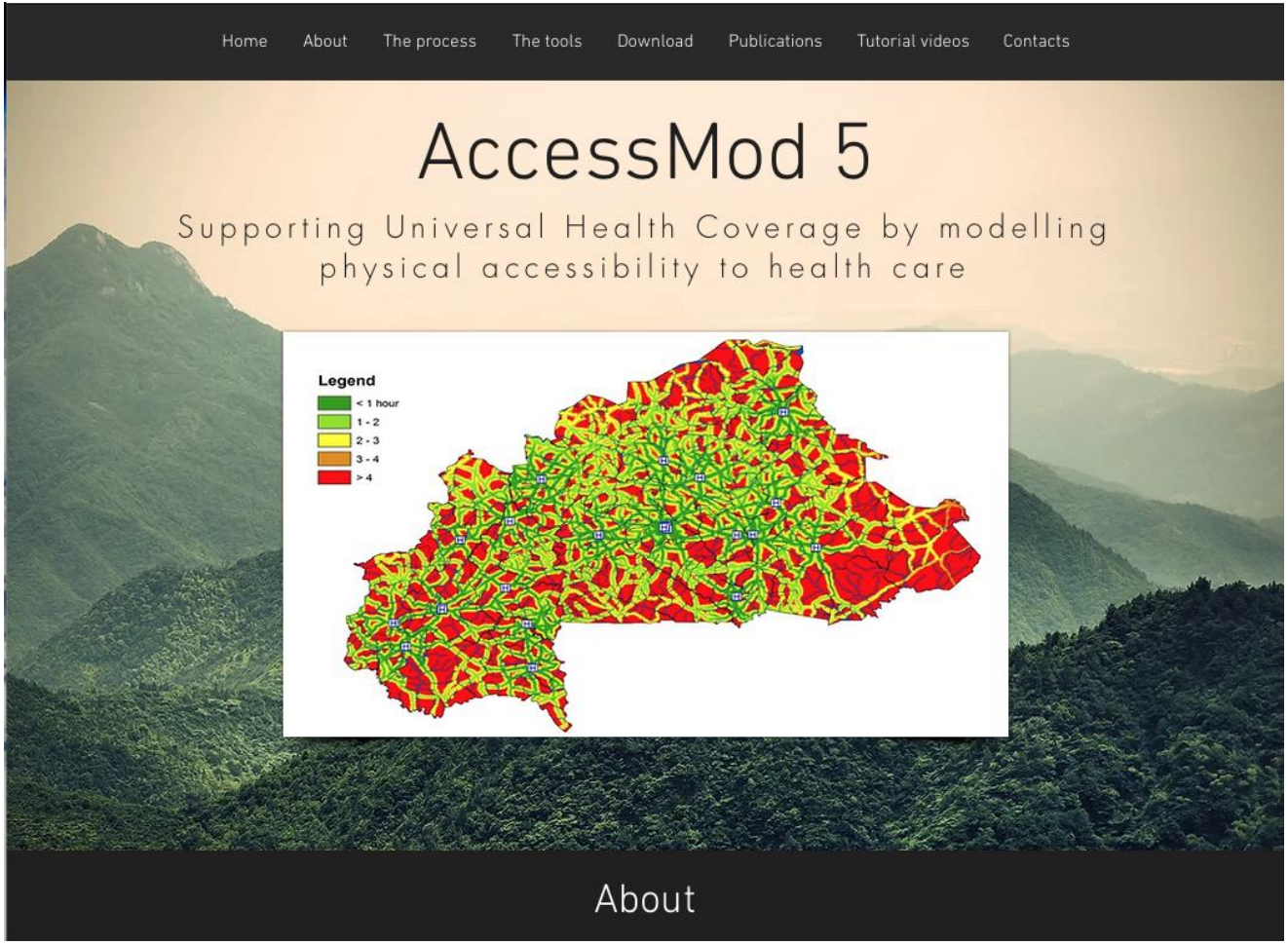
(5) Model accessibility

Data inputs

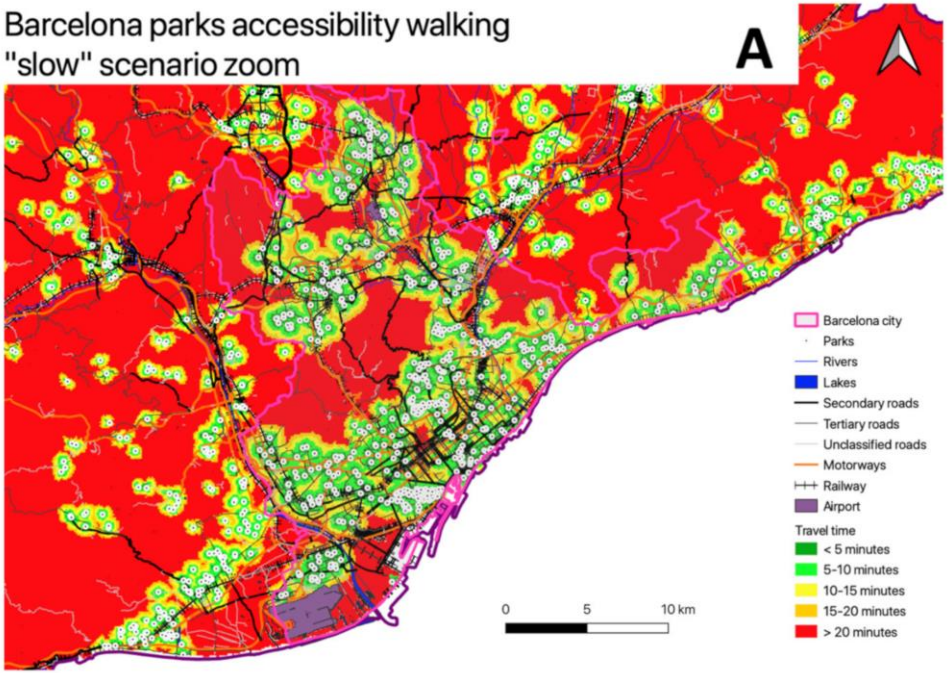
Table 2. Input data required for modelling physical accessibility and computing statistics.

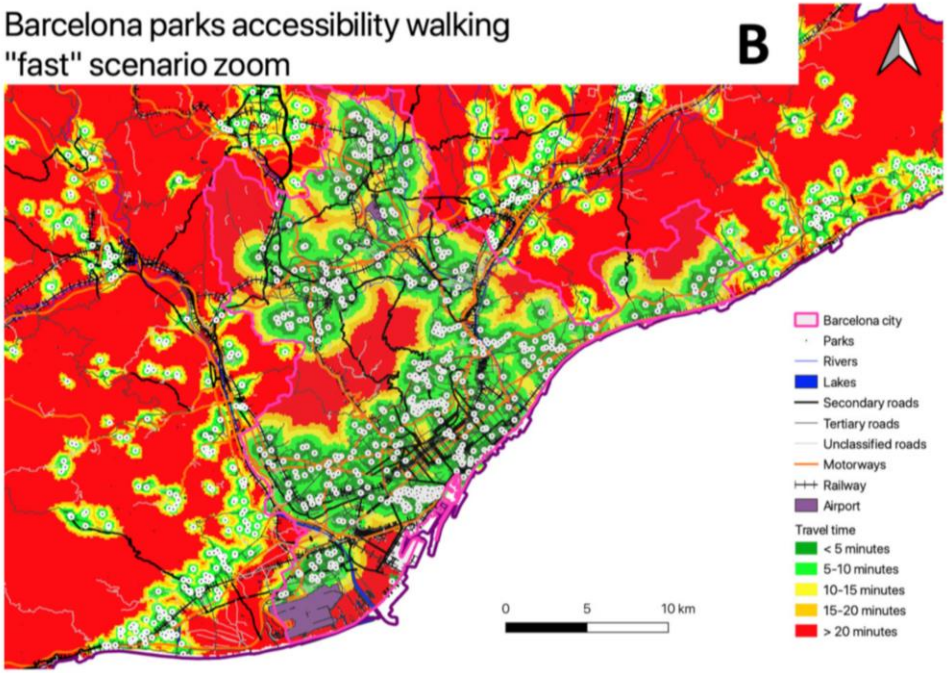
Raster Data	**URL**
Digital Elevation Model (Shuttle Radar Topography Mission (SRTM))	https://srtm.csi.cgiar.org/srtmdata/
Population grid (WorldPop or Center for International Earth Science Information Network (CIESIN)/Facebook)	https://data.humdata.org/organization/facebook?groups=che&q=&ext_page_size=25 https://www.worldpop.org/project/categories?id=3
Land cover (CORINE)	https://land.copernicus.eu
Vector Data	**URL or OSM tag(s)**
Roads (OpenStreetMap)	Highway = motorway, trunk, primary, secondary, tertiary, residential, unclassified
Rivers (OpenStreetMap)	Waterway = river
Lakes (OpenStreetMap)	Natural = water
Other barriers (airport, railways) (OpenStreetMap)	Railway = rail; aeroway = aerodrome
Centroids (urban green areas)	Provided by Section 2.2.4
Administrative boundaries (Urban Atlas)	https://land.copernicus.eu/local/urban-atlas
Additional Data	**Description**
Travel scenario file	Used to inform the model on the modes and speeds of travel for the population willing to reach the nearest green public space. In this study, we only consider walking as the means of transport, and therefore do not consider other means such as car, bike, or public transportation.

AccessMod - https://www.accessmod.org



Accessibility





- Scenario “slow”:
  - 3 km/h walking in town and on roads/footpaths.
  - 2 km/h walking in rural areas off-road.

- Scenario “Fast”:
  - 5 km/h walking in town and on roads/footpaths.
  - 2 km/h walking in rural areas off-road.

Statistics

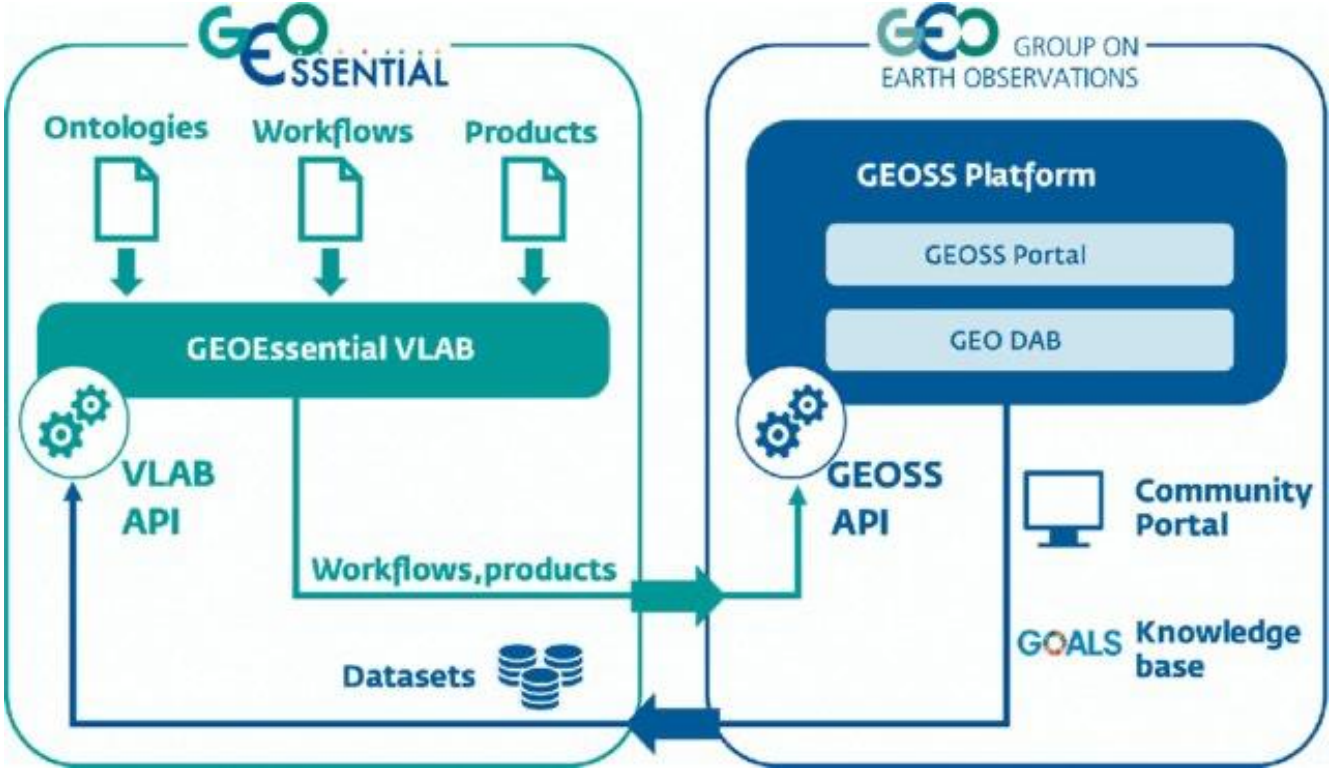
Table 3. Share of urban population without green urban areas in their neighbourhood, with two walking scenarios (slow and fast), and computed with 2018 population density estimates.

	Geneva		Barcelona		Goteborg		Bristol	
Walking Time	**Slow**	**Fast**	**Slow**	**Fast**	**Slow**	**Fast**	**Slow**	**Fast**
5 min	29.39	16.54	78.72	58.74	52.91	33.86	73.66	47.53
10 min	14.35	11.43	50.29	26.61	29.09	19.32	36.94	14.62
15 min	11.79	10.74	31.21	15.05	20.94	14.08	17.32	11.3

Table 4. Share of urban population without green urban areas in their neighbourhood, with two walking scenarios (slow and fast), and computed with 2012 population density estimates.

	Geneva		Barcelona		Goteborg		Bristol	
Walking Time	**Slow**	**Fast**	**Slow**	**Fast**	**Slow**	**Fast**	**Slow**	**Fast**
5 min	29.24	16.28	78.59	58.55	52.66	33.48	73.76	47.54
10 min	14.12	11.3	50.12	26.45	28.73	19.09	36.94	14.64
15 min	11.66	10.67	31.06	14.92	20.67	13.92	17.3	11.31

The Virtual Laboratory (VLab)



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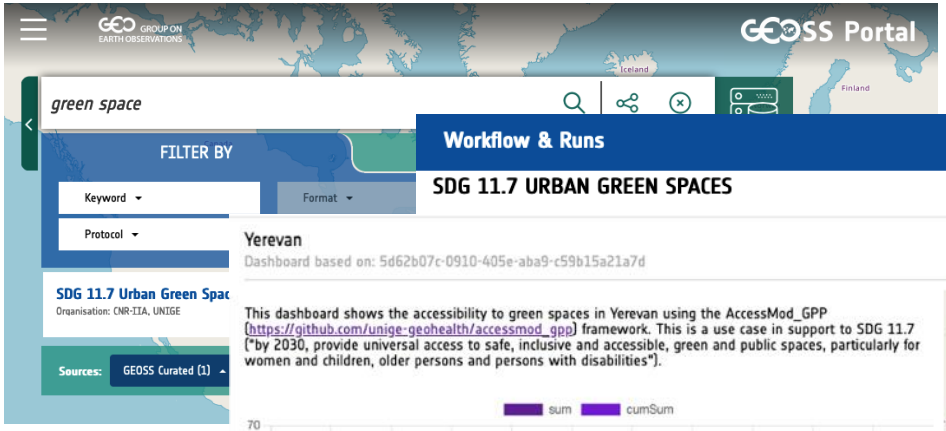
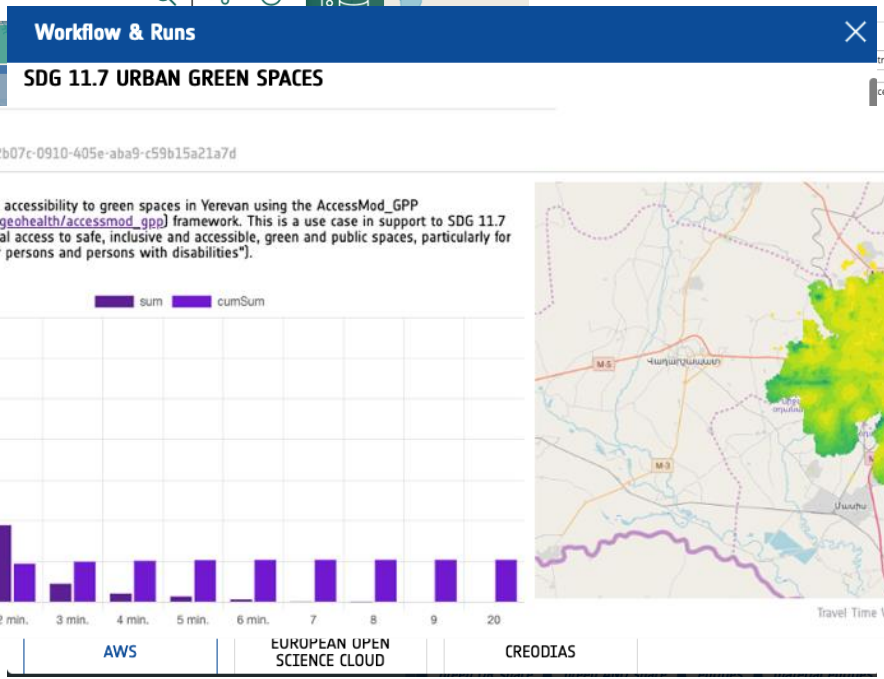
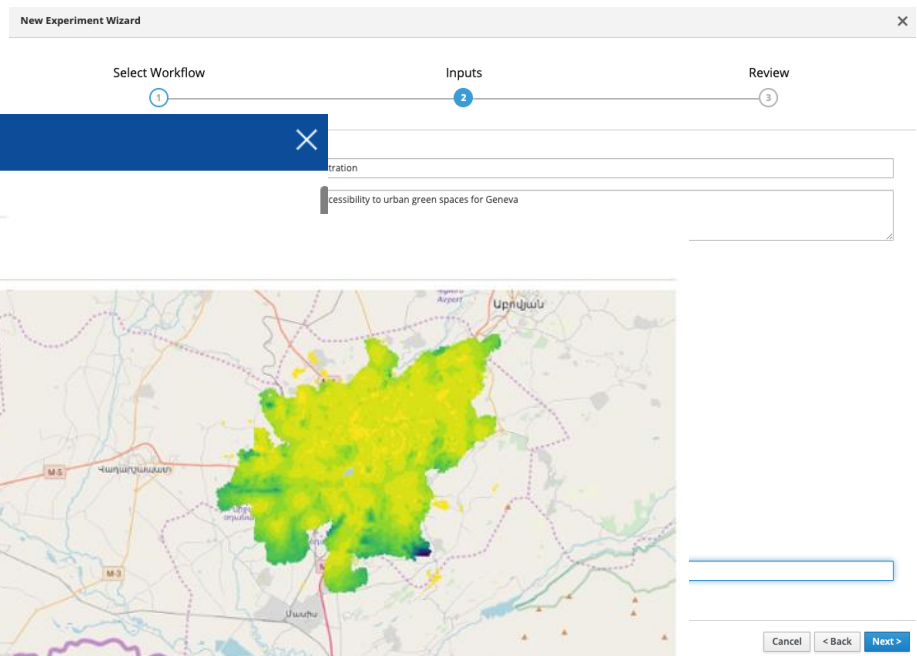
Results and outcomes







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Stakeholders and impact

- Geneva state > tested in the frame of GE-EN-VIE activities
- Yerevan > currently being tested by the CENS center
- Contact with GEO Global Heat Resilience Service > interest about this service

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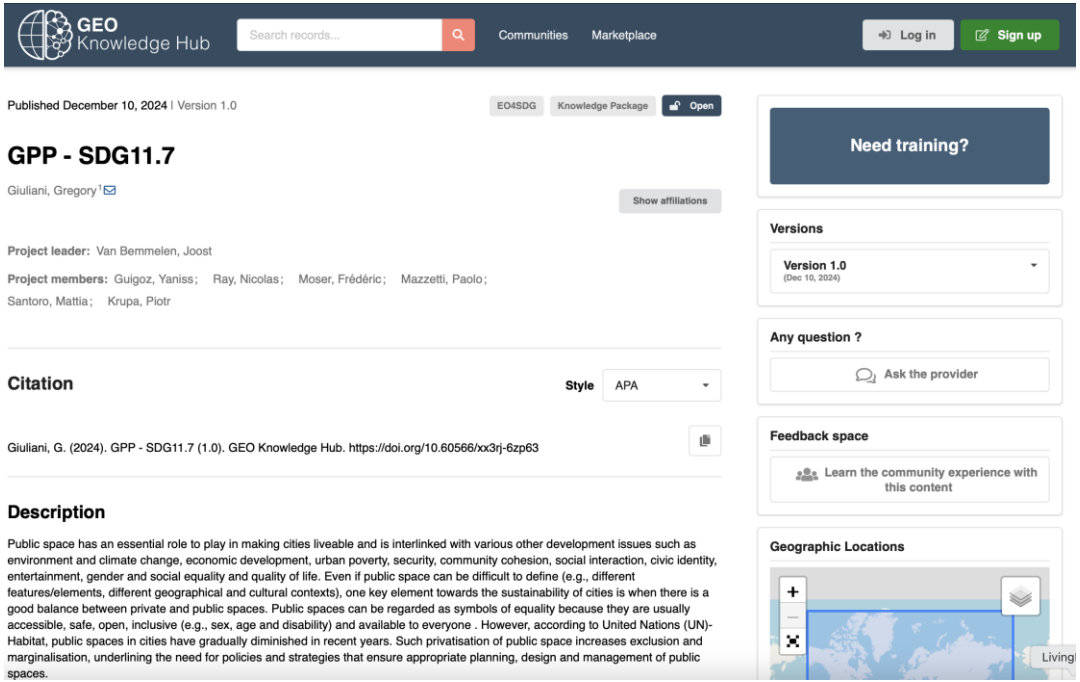
Stakeholders and impact

- Registered in the GEO Knowledge Hub: https://doi.org/10.60566/xx3rj-6zp63



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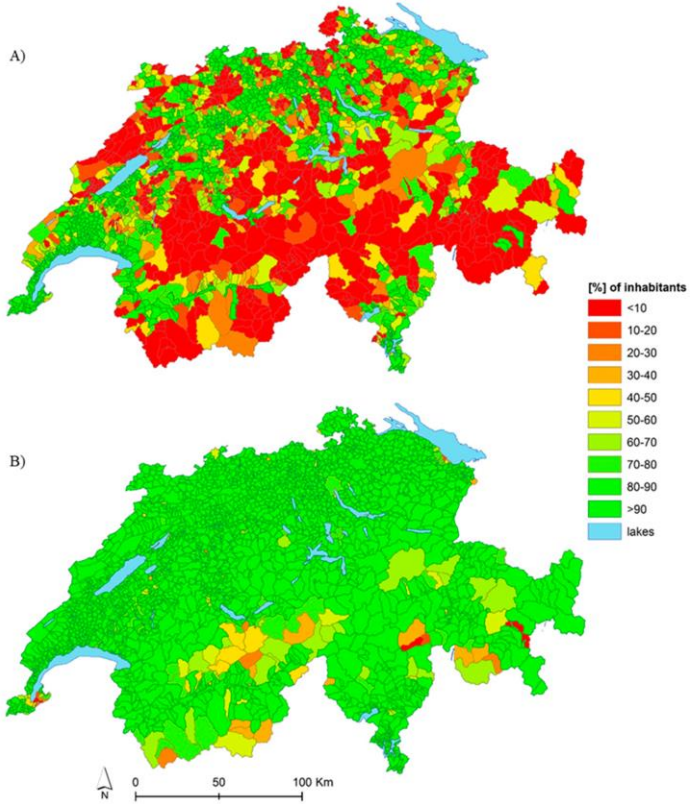
Exploitation

- We will continue the development with the Institute of Global Health (Geneva)
- Started a global analysis of more than 5000+ cities
- Two scientific papers in prep:

- *Automatized modeling of geographical accessibility using the AccessMod framework*
- *Open and reproducible knowledge on accessibility to urban green spaces – supporting cities to adapt to climate change in the frame of the SDGs*



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Conclusions

The proposed approach enhance:

1. *Reproducibility:* users can reproduce the experiment (same data/same analysis)
2. *Replicability:* users can replicate the experiment (different data /same analysis) >> use of national/local datasets instead of global ones.
3. *Reusability:* users can reuse/apply the approach in different contexts >> change the model and/or data sources.

GPP will further evolve the GEOSS infrastructure with users' required functionalities to ***access tailor-made information*** & ***actionable knowledge***.

GPP will enable *services to non-specialists* in the domain of *adaptation to extreme climatic events* and to *changes in climatic conditions*.

Open Data, Source, Algorithms, Standards/FAIR principles > **one step towards reproducible science**.

Facilitate connecting/utilizing existing (European) developments and knowledge, in a collaborative way.

Promoting collaborative approaches for Policy implementation

GEO role in connecting and facilitating some existing "dots", incubating possible "ecosystems".

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GEOSS PLATFORM PLUS

“In my lifetime, I’ve witnessed a terrible decline.
In yours, you could witness a wonderful recovery!”

Sir David Attenborough, COP26 Summit, November 1, 2021

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