
WP23_25: Global Urban Observation and Information

1258,177

Basic Information

Full title of the Initiative

Global Urban Observation and Information

Short Title or Acronym

GUOI

Current category in the 2020-2022 GWP

GEO Initiative

Proposed category in the 2023-2025 GWP

GEO Initiative

Points of Contact

First Name	Last/Family Name	Email
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Purpose

Objective

GUOI will generate various data products of global urban areas using Earth Observation (EO) data, provide EO-based urban data services through various systems and tools, develop new models and algorithms to assess and monitor urban environments, create a better knowledge of cities and to develop essential urban variables and indicators for sustainable cities for SDG Goal 11.

Please provide a short description of the Initiative

GUOI intends to improve urban monitoring and assessment by developing a series of satellite based essential urban variables and indicators of sustainable cities through international cooperation and collaboration; to provide datasets, information, technologies to pertinent urban users in World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries; and to support UN SDG Goal 11: Make cities inclusive, safe, resilient and sustainable.

Why is this Initiative needed?

GEO advocates the value of Earth observations, engage communities and deliver data and information in support of Sustainable Urban Development by assisting in the development of resilient cities and assessment of urban footprints; in order to make cities and human settlements inclusive, safe, resilient and sustainable through identifying economic externalities, managing environmental, climate and disaster risks, and building capacity to participate, plan and manage based on objective information regarding urban development. The objectives and

activities of GUOI are to support GEO's objective on Sustainable Urban Development. In particular, GUOI supports the development of urban resilience (including coastal resilience) by supplying objective data and information on the footprints of global urbanization and cities, developing essential urban variables and indicators for sustainable cities in support of UN's SDG Goal 11, and developing innovative methods and techniques in support of effective management of urban environment, ecosystems, natural resources and other assets, and the adaptation and mitigation of urbanization adverse impacts as well as climate change.

What evidence is there to support this need?

The UN has developed a specific Sustainable Development Goal 11, which is divided into 10 targets and 14 indicators at the global level. GUOI is to support SDG 11.

Is this Initiative open to participation by representatives of any GEO Member, Participating Organization, and GEO Associate?

Yes

Are you aware of other projects or initiatives at a global or regional scale (both in GEO and externally) that provide similar products or services?

No

Please identify the most important actual and/or intended outputs (products, services, etc.) produced by the Initiative, along with their intended and/or actual users. This list does not need to be comprehensive but should identify the outputs which are most used and are expected to have the greatest potential impact.

Output	Status	Users	Additional info
Urban data sets	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries	Urban footprint/urban extent, urban land cover change, human settlement datasets, urban environment variables (land surface temperature, impervious surface, green space, nighttime light, and so on) at global, regional, and national scales generated by several groups.
Models and algorithms	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries	(1) Spatio-temporal Adaptive Data Fusion Algorithm for Temperature mapping (SADFAT) – Merge coarse resolution and medium resolution satellite image data to generate daily medium resulting data; (2) DELTA algorithm to reconstruct consistent, daily land surface temperature data at Landsat resolution based solely on Landsat imagery; (3) Object-based Urban Thresholding method for NTL image data (NTL-OUT) – Calibrate inconsistent time-series DMSP/OLS NTL image data to map and update large-scale urban areas; and (4) The NOA System of real-time, operational, 5 minute monitoring of land and air surface temperature and humidity for cities and the offered service called EXTREMA (Emergency notification system for extreme temperatures, www.extrema.space)
Systems and tools	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries	(1) Thematic Urban Observation Hub (TUrbO-Hub) - Platform for the Mapping, Analysis, Monitoring and Assessment of Urban Development; (2) SAR4Urban: Provide

			data sets of selected cities from ESA radar imagery to the users of the cities
Services	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries	A set of indicators for SDG 11
Knowledge base	Occasionally updated	World Bank, UN, Asia, Africa, South America, and planning and environmental management agencies in other developing countries	gaps in integration of global urban observations with (i) data characterizing urban ecosystems, thermal environment, geohazards, air quality, and carbon emission; (ii) indicators of population density, environmental quality, and quality of life; (iii) social and economic data; and (iv) patterns of human, environmental and infectious diseases.
Book	In development	Academia, researchers, and practitioners on urban observation and informatics	"Geospatial Big Data for Sustainable Cities".
Engagement workshops	Planned	Urban data and technologies users in Asia, especially in land use, planning and environmental management agencies	Assessment of the developed tools, systems, and models by decision makers and user partners.
Annual Symposium	Planned	All GEO and non-GEO researchers and students	Annual International Summer School; Joint filed works in selected cities or regions; and annual GEO Global Urban Observation symposium.

If needed, please provide additional comments or explanation to accompany the outputs table

- no answer given -

What kinds of decisions are the outputs of this Initiative primarily intended to support?

Urban monitoring and assessment, land use planning, urban planning, environmental management, and sustainable urban development.

How will these decisions benefit from the outputs of this Initiative?

These decisions cannot be practically made without the global urban observation datasets and technologies.

What kinds of impacts (for example, reduced loss of life, monetary savings, conservation of biodiversity, etc.) are anticipated as a result of the use of the outputs of this Initiative?

Reduced adverse impacts of urbanization; better quality of life of urban citizens; reduced impacts of climate change; conservation of biodiversity.

Has this Initiative been asked to provide specific information (for example, reports, data, services) on an ongoing basis to an international convention, organization, or other multilateral body?

No

Technical Synopsis

Please provide a brief description of the methods used by the Initiative to produce its (actual or planned) outputs.

While some activities are extensions of the GEO 2020-2022 GUOI, others are proposed anew. These activities of different organizations and countries are coalesced as one single GEO initiative through collaborative and affiliated projects, annual symposia, international summer school, joint field works, publications, and coordinated user engagement efforts. GUOI will generate various data products of global urban areas using Earth Observation (EO) data, provide EO-based urban data services through various systems and tools, develop new models and algorithms to assess and monitor urban environments, create a better knowledge of cities and to develop essential urban variables and indicators for sustainable cities for SDG Goal 11.

Below are the main outputs we intend to produce and their methods:

- (1) Develop a series of satellite based essential urban variables and indicators of sustainable cities to support UN SDG Goal 11 through international cooperation and collaboration.
- (2) Establish a Global Institute of Sustainable Cities (GISC) - Explore EO as an enable technology for development of sustainable cities and for supporting GEO's objective on urban resilience and coastal resilience by providing EO methods and technologies, supplying objective information on the footprint of global urbanization and assisting in the development of indicators for sustainable cities to support the UN's sustainable development goals.
- (3) Megacities Observation and Monitoring (MOM) program: Expanded from the Global Urban Supersites Initiative under GEO SB-04 and GI-17. These projects focus on global urbanization of megacities and providing data sets for municipalities for megacities worldwide.
- (4) Continued generation of Global Urban Footprints Layers at various international and national levels and seek synergies among them. The main partners of this program include NOAA, USGS, DLR, University of Pavia, University of Tokyo, and Hong Kong Polytechnic University.
- (5) Implementing a Virtual Global Urban Remote Sensing Laboratory through joint projects: The main objective is to develop an online tool for acquiring, processing, visualizing, and sharing of urban data sets.
- (6) Continuing joint projects on Impervious Surface Mapping in Tropical and Subtropical Cities - ISMITSC (Asia, Africa, and South America): This initiative focuses on urban mapping and providing datasets and EO technology services to developing countries.
- (7) Organize Annual GEO Global Urban Observation Symposium.
- (8) Create an annual International Summer School to train and educate students and young researchers worldwide, which may be held in conjunction with Joint Field Work in Selected Cities/Regions, during a GEO event.
- (9) Collaboration with IEEE GRSS Hong Kong Chapter for capacity building and to showcase and disseminate research results.
- (10) Seek synergies with other GEO flagships/initiatives.
- (11) The activities, and thus the outputs, will be mainly coordinated by the PolyU JC STEM Center for Earth Observations (POLEIS), hosted by the Hong Kong Polytechnic University.

If you would like to provide further details on the technical methods, you may upload one or more documents here.

- no supporting documents provided -

Are there any significant scientific or technical challenges that need to be resolved by the Initiative during the 2023-2025 period?

No

Does the Initiative expect to complete any key new outputs, improvements to existing outputs, or improvements to the methods of producing outputs, in the 2023-2025 period?

Yes

Please describe these new outputs or improvements.

(12) Initiate Impervious Surface Mapping for Southeast Asian Cities - IMapSEANcities: This initiative focuses on urban mapping and providing datasets and EO technology services to the Southeast Asian countries.

Please identify the key tasks that must be implemented to ensure delivery of these changes, with target dates for completion.

Task	Task description	Expected completion (month/year)
Urban LULC mapping	Urban land use/cover dataset	12/2023
Impervious surfaces mapping	Impervious surfaces dataset	12/2024
EO services	EO data and technology services	12/2024

Resources

Have all resources required to implement the Initiative's planned work in the 2023-2025 period been secured?

- Gap in financial resources

What is the estimated funding gap for the 2023-2025 period?

The estimated cost of 150,000 USD for a supporting staff at the headquarter of the GUOS would be greatly beneficial for program development and activities coordination.

What actions is the Initiative taking to obtain the required resources?

Prof. Qihao Weng, the GUOS Lead, has applied to the Jockey Club

Please list all financial and non-financial contributions to the Initiative (other than in-kind, voluntary participation by individual contributors) having a value of more than USD 50,000.

- no answer given -

Lessons from the 2020-2022 Period

Were all planned activities for the 2020-2022 period implemented as expected?

Yes

Were there any key challenges faced by the Initiative in the 2020-2022 period?

Yes

Please describe.

International cooperation and collaboration have been hindered and interrupted due to the Covid-19. Annual GEO Global Urban Observation Symposium, International Summer School, and Joint Field Work were not possible since 2020. Other activities were also adversely impacted.

Were there any impacts or changes to operations due to COVID-19?

Yes

Please describe.

International cooperation and collaboration have been hindered and interrupted due to the Covid-19. Annual GEO Global Urban Observation Symposium, International Summer School, and Joint Field Work were not possible since 2020. Other activities were also adversely impacted.

Please describe the key changes proposed for the 2023-2025 period, for example, new projects, new areas of focus, or adjustments to the activity governance.

1. New project: Initiating Impervious Surface Mapping for Southeast Asian Cities - IMapSEANcities: This initiative focuses on urban mapping and providing datasets and EO technology services to the Southeast Asian countries. There are a few research personnel have been recruited from the ASEAN to work at the Hong Kong Polytechnic University commencing September 2022 under the supervision of Prof. Qihao Weng.

2. The Hong Kong Polytechnic University has determined to set up a lab for Prof. Qihao Weng, with financial support of 12 million Hong Kong Dollar. The lab is tentatively named "PolyU JC STEM Center for Earth Observations (POLEIS)". The Jockey Club Charities Trust has intended financial support of additional, up to 10 million to this lab. This lab will help the coordination of activities of GUOI 2023-2025.

Does the Initiative have outputs (products, services, etc.) available to users now, even if only on a pilot or testing basis?

No

Do you have evidence of any impacts that have occurred in part as a result of using the outputs of the Initiative (for example, policy decisions taken, behaviour changes by users, risks mitigated)?

No

Have there been any internal or external reviews or evaluations of the Initiative since 2019?

No

Please indicate any GEO Work Programme activities with which you have ongoing collaboration.

- EO4SDG - Earth Observations for the Sustainable Development Goals
- HUMAN-PLANET - GEO Human Planet
- LAND-COVER - Global Land Cover

- GUOI - Global Urban Observation and Information

Please indicate any additional GEO Work Programme activities with which you would like to establish new collaborations.

- AOGEO - Asia-Oceania Group on Earth Observations
- DE-PACIFIC - Digital Earth Pacific
- EO4DRM - Earth Observations for Disaster Risk Management
- EO4EA - Earth Observations for Ecosystem Accounting
- EO4HEALTH - Earth Observations for Health
- GEO-EV - GEO Essential Variables
- GEO-ECO - GEO Global Ecosystems
- GEO-WETLANDS - GEO Wetlands
- GSNL - Geohazard Supersites and Natural Laboratories
- GEOSS Infrastructure Development - GEOSS Infrastructure Development
- LAND-COVER - Global Land Cover
- DELTA-ESTUARY - Global Observation of Deltas and Estuaries
- IN-SITU-ESC - In-Situ Observations and Applications for Ecosystem Status of China and Central Asia
- NIGHT-LIGHT - Night-Time Light Remote Sensing for Sustainable Development Goals

Stakeholder Engagement and Capacity Building

Are there specific countries or organizations that your Initiative would like to engage?

Yes

Please list these countries, regions or organizations.

ASEAN

What are your plans to engage them?

Through international cooperation and collaboration, GUOI intends to develop and to provide urban related datasets, information, technologies to pertinent users in ASEAN. First, we aim to share research findings to help tackle urban and environmental challenges via the GEO Global Urban Observation and Information Initiative network, which includes many global partners. Secondly, we plan to develop a Virtual Global Urban Remote Sensing Laboratory through international joint projects. Thirdly, we plan to transfer models, algorithms, systems, and tools to our local and global users and partners for potential commercialization. Fourthly, we will identify and invite potential users to assess the tools, models, and datasets through a series of engagement workshops. Fifthly, we will invite potential users to assess the tools, models, and datasets through a series of Engagement Workshops. Finally, we plan to establish a Global Institute of Sustainable Cities by collaborating with all global and local partners.

Does your Initiative engage users in the work of the Initiative (for example, consultation, testing, co-design)?

No

Does the Initiative have a user engagement strategy or similar kind of document?

No

Are there categories of users that are not represented at this time, but you would like to engage?

No

Does the Initiative have a documented capacity development strategy?

No

Please describe the approach to capacity development that is being implemented by the Initiative?

Urban extent, urban land use/cover, urban climate and environment variable datasets will be developed and delivered to local stake holders in cities of ASEAN. The geospatial data and information will be used in conjunction with local environmental, social and economic data to support implementation of sustainable development goals in major cities of these nations through engagement workshops, training sessions, and summer schools.

Are there any commercial sector organizations participating in this Initiative?

Yes

Please list the commercial sector organizations.

Organization name	GEO Member/PO/...	Country in which the organization is based	City in which the organization is based
FUGRO		The Netherland	Hong Kong (Asia HQ)
SHIDA WEIZHI Ltd.		China	Guangzhou

Are there opportunities for commercial sector uptake of the outputs of the Initiative?

Yes

Please describe these opportunities.

GUOI provides urban datasets, information, technologies to pertinent urban users in World Bank, UN, pertinent city planning and environmental management agencies in other developing countries and supports UN SDG Goal 11. Commercial sector can benefit from GUOI by understanding the goals of SDG and thus re-define and identify new business opportunities. In addition, the commercial sector can work together with the GUOI team to produce and to deliver the urban datasets and technologies to pertinent users.

Is there already commercial uptake occurring?

No

Are there opportunities for further commercial sector participation in the Initiative?

Yes

Please describe these opportunities.

New cooperation mechanisms need to be established between the GUOI and the commercial sector benefit both sides and the users of urban datasets, technologies, and services. The GUOI is good at producing and providing urban datasets and technologies, while the commercial sector typically focuses on providing services of earth observations (EO) datasets and technologies. The GUOI team has academic strength, research expertise and global network, and the commercial sector can help to take urban datasets, knowledge and inventions to the hands of the pertinent users.

Does the Initiative have a plan for commercial sector engagement?

No

Governance

Please describe the roles of each of the key leadership positions, as well as any team structures involved in day-to-day management.

Role, Member or PO, Implementing Entity, Contact Name, Email Address

Lead (PoC), Hong Kong, Hong Kong Polytechnic University, Qihao Weng, qihao.weng@polyu.edu.hk

Co-Lead, Germany, German Aerospace Center (DLR), Thomas Esch, thomas.esch@dlr.de

Co-Lead, IEEE GRSS, Univ. of Pavia, Paolo Gamba, paolo.gamba@unipv.it

Co-Lead, Greece, National Observatory of Athens, Iphigenia Keramitsoglou, ik@noa.gr

Co-Lead, India, National Institute of Urban Affairs, Umamaheshwaran Rajasekar, urajasekar@niu.org

Co-Lead, United States, United States Geological Survey, George Xian, xian@usgs.gov

Is there a steering committee or other governance bodies that advise the Initiative but are not involved in day-to-day management?

Yes

Please describe the roles of each body. If there are multiple governance bodies, please describe the relationships among them (such as through a governance structure diagram).

Advisory Committee Members:

Brazil, INPE, Claudia Almeida, claudia.almeida@inpe.br

Austria, University of Salzburg, Thomas Blaschke, thomas.blaschke@sbg.ac.at

China, National Geomatics Center of China, Jun Chen,

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United States, Universities Space Research Association, Miguel O. Román, mroman@usra.edu

United States, Yale University, Karen Seto, karen.seto@yale.edu

- no supporting documents provided -

What methods does the Initiative use to communicate with its participants?

- Email / e-newsletters
- Regular conference calls
- Website
- Regular events

Please describe the key risks that could delay or obstruct the completion of the planned activities and outputs of the Initiative, along with any actions taken to mitigate these risks.

- no answer given -

What methods are used by the Initiative to monitor its effectiveness?

- Informal discussions with users / beneficiaries
- User or beneficiary surveys
- Website statistics
- Evaluations

Would the Initiative be interested in assistance from the GEO Secretariat for developing an impact plan?

Yes

How are the results of the monitoring and evaluation activities shared with participants and the wider GEO community?

Through reports to GEO Secretariat and dissemination by web and social media.

Are any monitoring or evaluation activities required by funders/contributors?

No

Participants

Please list the active individual participants in the Initiative

First name	Last name	Email address	Member	Org
Thomas	Blaschke	thomas.blaschke@sbg.ac.at	Austria	- University of Salzburg
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Other information

Please provide any other comments or information that was not included in the previous sections, but you would like to appear in the Implementation Plan.

- no answer given -

- no supporting documents provided -

Co-Editor Management

List of co-editors for this initiative

- no answer given -