

GEO - Human Planet Initiative;

Application for GEO Work Programme 2020-2022

Revised version 30/04/2019

1. Executive Summary

Title

Group on Earth Observation - Human Planet Initiative

Sub-title

GEO-HPI

GEO Classification

Initiative

Overview

The Human Planet Initiative (HPI) is committed to develop a new generation of measurements and information products that provide new scientific evidence and more integrated understanding of the human presence on planet Earth in support of global policy processes with agreed, actionable and goal-driven metrics. The goal is to generate the global-scale data and knowledge needed to advance our understanding of societal processes and their impact on Earth systems, and to generate useful indicators to inform policy.

An immediate objective of the Human Planet initiative is to support the post-2015 international frameworks: the UN Third Conference on Housing and Sustainable Urban Development (Habitat III, 2016), the 2030 Agenda for Sustainable Development (SDGs), the UN Framework Convention on Climate Change (UNFCCC), and the Sendai Framework for Disaster Risk Reduction 2015-2030. The international frameworks are accompanied by targets that are further elaborated by indicators focused on measurable outcomes. These indicators are action oriented, global in nature, and universally applicable.

The initiative relies on a core set of partners committed to producing global spatial baseline data for human settlements and population, and an enlarged community of supporting partners. The core partners include the European Commission, Directorate General Joint Research Center (DG JRC) and the Center for International Earth Science Information Network (CIESIN)¹ at Columbia University, which co-lead HPI. The extended partnership involves more than 200 individual scientists and policy makers from 120 different organizations including academic organizations, national governmental and international institutions, and the private sector.

Planned activities

The implementation plan will follow the schedule of the tasks as described in chapter 4. Description

¹ CIESIN operates the NASA Socioeconomic Data and Applications Center (SEDAC), a data center in NASA's Earth Observing System Data and Information System (EOSDIS)

of activities, Tasks definition, overall logic and phasing. The milestones are phased with the annual releases of the Human Planet Atlas. The tasks include:

1. Global historical spatial grids on built-up and population
2. Global spatial baseline data on built-up based on Sentinel sensor (10m)
3. Global spatial baseline on built-up by integrating data from different sensors
4. Global human settlement classification schema and indicators
5. Global high resolution age-structured population maps
6. Global settlements, infrastructure and population data inter-comparison
7. Regional and national show cases
8. Human Planet web platform
9. Human Planet Atlas annual releases

Point of contact

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2. Purpose

Rationale

The Human Planet Initiative (HPI) is committed to develop a new generation of measurements and information products that provide new scientific evidence and more integrated understanding of the human presence on planet Earth in support of global policy processes with agreed, actionable and goal-driven metrics. The goal is to generate the global-scale data and knowledge needed to advance our understanding of societal processes and their impact on Earth systems, and to generate useful indicators to inform policy.

Mandate

The HPI provides services to international institutions and other stakeholders. For example, the HPI provides data, and knowledge to generate the **New Degree of Urbanization**, a partitioning of all human settlements of the world in classes of settlement size. That classification is then used to further characterize them in urban and rural settlements. The work is in support of the European Commission policy services, Organization for Economic Cooperation and Development (OECD), Food and Agricultural Organization (FAO), United Nations Habitat (UN Habitat) and World Bank and the outcome will be considered for adoption at the UN Statistical Division, in February 2020.

Actual Deliverables

In the 2017-2019 time frame the Global Human Settlement WG has produced the following global baseline data.

- A. GHS_BUILT – global map of built-up areas using remotely sensed data input collected by the Landsat platform in the epochs 1975, 1990, 2000, and 2014. Various sensors involved MSS, TM, ETM.
- B. GHS_POP global resident population grids in the epochs 1975, 1990, 2000, and 2015 estimated by merging GHS_BUILT with population census data harmonized by the CIESIN.
- C. GHS_SMOD – global multi-temporal settlement model and urban-rural spatial classification schema based on the GHS_BUILT and GHS_POP baseline data.
- D. Human Planet Atlas for 2016, 2017, 2018.

The data are shared as pre-release for early testing purposes inside the GEO international partnership.

Planned outputs of the initiative

The 2020-2022 HPI plan foresee the following tasks.

1 Global historical baseline data on population and built-up areas 1975-1990-2000-2015

Description: Built-up areas from global historical records of Landsat platform in the epochs 1975, 1990, 2000, and 2014 **will be continued in the 2020-2022 time frame to assure continuity and updates.** Various sensors (MSS, TM, ETM), input spatial resolution 60, 30, 15 meters, integration with global EO-derived land cover and voluntary geographic information (OpenStreetMap) for driving the automatic machine learning process. Global population grids at 250m of spatial resolution by integrating EO-derived built-up areas with global census sources from CIESIN.

Planning: Yearly updates with improvements

Partners' responsibilities: Leader JRC GHSL; **supporting** CIESIN, WorldPop

Resources: in-kind support

Geographical scope: Global

2 Global spatial baseline data on built-up areas from Sentinel sensors (10m)

Description: Global built-up areas detection and characterization using Sentinel 2 data of the EU Copernicus program. 10-m of spatial resolution, yearly updates starting from 2019+.

Planning: Integrated Sentinel prototype, technical specs for operational service in 2019+

Partners responsibilities: Leader JRC GHSL ; **supporting** CIESIN, Worldpop, extended partnership

Resources: in-kind support

Geographical scope: Global

3 Global spatial baseline data on built-up based on integrating different sensors

Description: Global built-up areas detection and characterization using **Sentinel 1 and 2 data** of the EU Copernicus program, with 10-m of spatial resolution, yearly updates starting from 2019+. The work-package may include the processing of other high resolution imagery.

Planning: Integrated Sentinel prototype, technical specs for operational service in 2019+. The work may become part of the EU Copernicus services

Partners responsibilities: **Leader** JRC GHSL ; **supporting** CIESIN, Worldpop, extended partnership and private partnership
Resources: If part of the EU Copernicus services, it will be part of the EU contributions to GEO.
Geographical scope: Global

4 Global settlement classification schema and indicators

Description: harmonized definition of the spatial extension the global human settlements based on density of population and built-up infrastructures. Rural-urban continuous. City-level aggregation of exposure, impact, and accessibility indicators.

Planning: Release, 1km resolution model; second release 250m-resolution model

Partners responsibilities: **Leader** JRC GHSL ; **supporting** DG REGIO, WB, UN Habitat, Extended partnership

Resources: in-kind support

Geographical scope: Global, individual city level, regional/national show cases

5 Global high-resolution age-structured population maps 2000-2022

Description: Through funding from the Bill and Melinda Gates Foundation, the WorldPop project (www.worldpop.org) will lead construction of global population distribution maps for the 2000-2020 period. This represents a multi-organization international collaboration, principally between WorldPop at the University of Southampton, the University of Louisville, CIESIN at Columbia University, the JRC, the Flowminder Foundation (www.flowminder.org), the German Space Agency (DLR) and the World Bank, with computing support from Microsoft and Google. Modelling methods for multi-temporal census count disaggregation from administrative units to 100x100m grid squares have previously been developed (e.g.

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0107042>,

<http://www.nature.com/articles/sdata20165>), and these will be scaled up to construct global, age-structured population distribution datasets for the 2000-2020 period.

Planning: The first global layers are anticipated to be completed in early 2019, with ongoing updates released at regular intervals of time.

Partners responsibilities: **Leader** WorldPop; **supporting** CIESIN, JRC GHSL, extended partnership

Resources: in-kind support

Geographical scope: Global

6 Global settlement classification schema and indicators

Description: harmonized definition of the spatial extension the global human settlements based on density of population and built-up infrastructures. Rural-urban continuous. City-level aggregation of exposure, impact, and accessibility indicators.

Planning: Release, 1km resolution model; second release 250m-resolution model

Partners responsibilities: **Leader** JRC GHSL ; **supporting** DG REGIO, WB, UN Habitat, Extended partnership

Resources: in-kind support

Geographical scope: Global, individual city level, regional/national show cases

7 Regional and National show cases

Description: Processing of national image archive for national based built-up.

Planning: Based on national requests

Partners responsibilities: **Leader** JRC GHSL ; **supporting** DG REGIO, WB, UN Habitat, Extended partnership

Resources: in-kind support

Geographical scope: Global, individual city level, regional/national show cases

8 Human Planet Web Platform

Description: HPI communication web platform hosted possibly through the GEO secretariat. The HPI will promote the exchange of data and the access of HPI product to partners, scientist, expert groups of, and decision makers. **HPI fast data web visualization interface (HPI-WVI)**, based on JEODPP technology hosted at JRC IT facilities. The HPI-WVI will be available to HPI partners with restricted access.

Planning: **HPI communication** Web platform may be available end of 2019 while the Web based data exploration too.

Partners responsibilities: **Leader** JRC GHSL ; **supporting** all partners

9 Human Planet Atlas releases

Description: Periodic publication of the Human Planet Atlas (HPA) where the core evidences and derived indicators produced by the initiative are presented. The Atlas includes a facts-and-figures section, a cross-cutting thematic section, and an executive summary delivering periodic key messages and narratives based on the core evidences and derived indicators.

Planning: Every year the Atlas will address a specific thematic area following the example of the past three releases of 2016, 2017, and 2018.

Partners responsible: **Leader** JRC GHSL ; **supporting:** all partners

Actual and Intended uses of the Outputs

An immediate objective of the Human Planet initiative is also to support the post-2015 international frameworks: the UN Third Conference on Housing and Sustainable Urban Development (Habitat III, 2016), the 2030 Agenda for Sustainable Development (SDGs), the UN Framework Convention on Climate Change (UNFCCC), and the Sendai Framework for Disaster Risk Reduction 2015-2030. The international frameworks are accompanied by targets that are further elaborated by indicators focused on measurable outcomes. These indicators are action oriented, global in nature, and universally applicable. In particular, both the built-up and population grids are to be used as exposure in disaster impact assessment and disaster risk assessment that generate the knowledge as advocated by the Sendai Framework for Disaster Risk Reduction 2015-2030. The two variables referred also as **Essential Societal Variables** are used in global climate impact assessment in global urbanization analysis.

Expected outcomes

In the 2020 – 2022 time frame HPI will continue to improve the existing data layers, and to generate new information that gradually will improve our understanding of human impact.

Expected impacts

The New Degree of Urbanization analysis is providing a fresh outlook on urbanization considered. The concept is considered for adoption by the UN Statistical Division in February 2020. The data layers produced are used by scientist for modeling disaster impact and disaster risk, in system of indicators (i.e. INFORM) used by policy makers, and in the calculation of SDG indicators including SDG11.3.1 and SDG 15.3.1.

3. Background

The Human Planet Initiative contributes to all three Strategic Objectives that guides GEO activities through 2025: advocacy for the value of Earth observations as a fundamental component of timely information; engagement with stakeholder communities to address societal challenges; and delivery of critical data, information and knowledge to inform decision-making. A set of joint and coordinated activities targets each of the strategic objectives as follows.

Strategic Objective 1: To Advocate the importance of Earth observations as irreplaceable resources that must be protected, rendered fully and openly accessible (including through contribution to GEOSS), and integrated to provide maximum value in support of achieving national and international calls for resilient societies, sustainable economic growth, and a healthy environment worldwide. The HPI addresses this by **demonstrating the relevance of EO extracted information to the user community that includes** scientist, practitioners, and decision makers.

In fact, HPI aims to:

- a. Continue to improve information extraction from EO data archives and generate EO-derived global open data describing the spatial extent of the **physical infrastructures** of human settlements and its characteristics (coordinated by EC JRC GHSL, contributors CIESIN, WorldPop).
- b. Generate attributes for physical information products including **building height and/or building stock volume and use**.
- c. Test new EO-based measurement technologies for characterizing the built environment.
- d. Benchmark existing global information products on settlements.

Strategic Objective 3: **To Deliver data, information and knowledge enabling stakeholders to improve decision-making processes and inform policy requirements**, promote the exchange of best practices, enable the uptake of new technologies, and create new economic opportunities while leveraging public sector investment through standardization, collaboration and innovation.

The HPI aims to:

- e. Improve the available open global gridded population density datasets by combining settlement physical data with census data (coordinated by CIESIN, contributor WorldPop, GHSL).

- f. Generate continental and global gridded population attributes (coordinated by WorldPop, contributor CIESIN, GHSL).
- g. Integrate physical human settlement data and generate an harmonized definition of human settlements of all sizes (GHSL, OECD, DG Regio, FAO).
- h. Integrate geo-spatial settlement information with statistical data for use by national statistical offices.

Strategic Objective 2: To **Engage with stakeholder communities** and foster strategic partnerships to address global and regional challenges, by increasing the understanding and use of Earth observations available in support of science-based and data-driven decision and policy-making. The HPI aims to:

- i. Co-produce with decision makers the Settlement Model used in the New Degree of Urbanization
- j. Promote the uptake of the New Degree of Urbanization model. The model is used in international fora including the United Nations (European Commission/DG REGIO) to compare urbanization globally.
- k. Test and demonstrate the use of new integrated global spatial data in support of the monitoring of the implementation of post-2015 frameworks (coordination by GHSL, contributor extended partnership).
- l. Reach out to GEO Flagships, GEO initiatives, and international programs and identify areas of cooperation and data integration.

Intended Users of the Outputs

The current users of HPI products include Scientists, Practitioners, and Decision Makers mostly from the International Community. For example, planners and hazard analyst use gridded population and built-up produced to address urbanization and exposure in disaster risk assessment. Crisis management practitioners from the international community rely on the Global Disaster Risk and Coordination System (GDACS) to alert and monitor for hazard impact. GDACS² relies on HPI core datasets. Decision makers use INFORM a set of composite indicators that include HPI data layers, to guide allocation of humanitarian and development aid.

Expected outcomes, impacts and user/societal benefits

HPI geospatial information products are requested and used as evidence in: i) modelling *exposure and vulnerability* to natural hazards, violent conflict, environmental contamination, environmental degradation, climate change, and other issues of concern; ii) measuring the *impact* of human activities and their metabolic output on life supporting ecosystems and Earth's biogeochemical cycles; and iii) in estimating human/societal demand for and usage of natural and other resources.

The Human Planet initiative operates within the framework of GEO's open and free data access policy that includes the full data production and dissemination cycle (open input, open processing methods, open outputs, open sharing platforms). The HPI aims to enhance the scientific evidence used in monitoring the post-2015 international frameworks, including characterization of changes over time and of uncertainties in data and methods. HPI also aims to improve the integration and

² <http://www.gdacs.org/>

the quality of global open and public baseline data describing human settlements, to facilitate multi-lateral convergence on facts assessing the human presence in the planet over space and time, and to maximize access to data and statistics needed to ensure that “no one is left behind”.

Relationship to previous developments and results

The Human Planet initiative builds upon the outcomes of the first Global Human Settlement Workshop hosted by the European Commission, Joint Research Centre, on 21-22 October 2014, summarized in the “Manifesto for a Global Human Settlement Partnership”³ and on the 2017-2019 HPI work program that generated a number of deliverables summarized in section 2. The HPI partner community includes policy makers involved in the post-2015 frameworks and scientists already providing support, advice and datasets to the international negotiation processes. From its onset, the HPI has embraced a paradigm shift in information extraction in two ways: 1) it relinquishes the test-case approach/reasoning in favor of *complete global processing/testing* of technologies and research hypothesis; and 2) HPI also move the focus of the analysis from the *accuracy* of the remote-sensing information extraction to the *fitness-for-purpose* of various spatial sources of information, integrated in support of specific policy goals.

4. Relationships to GEO Engagement Priorities and to other Work Programme

Support to SDG's

At the time of writing the HPI produced datasets are used to monitor at least two SDG indicators:

11.3.1 Ratio of land consumption rate to population growth rate. At the moment of writing the combined HPI products are able to measure the indicator globally. That requires 1) historical population data, 2) historical built up data, and 3) a settlement model that defines urban areas. That is available from HPI.

15.3.1 Land degradation Proportion of land that is degraded over total land area

However, as population is a cross cutting datasets, it is expected to be taken up in a number of indicators.

Support to Paris Agreements

HPI datasets and models for the Paris Agreements have started to be addressed as “Built-up area and population density: Two Essential Societal Variables to address climate hazard impact”.

The essence of the study concludes that human settlements and people living within settlements are susceptible to the impact of climate induced hazardous events in a changing climate. In addition, the consumption patterns that originate in settlements affect emissions and drive land use change not only in the proximity of settlements but also in areas of the globe completely detached from where the demand originates triggering even more emissions. The temperature increase related to a changing climate may affect sea level and thus coastal settlement located in low elevated coastal areas.

Support to Sendai Framework Targets

³ <http://www.earthobservations.org/ghs.php>
<http://www.gdacs.org/>

HPI products are key to “Priority 1. Understanding Disaster Risk” as it addresses the quantification of “...exposure of persons and assets ... knowledge that can be used for risk assessment, prevention, mitigation preparedness and response”. In fact, built-up and population density are used to generate global exposure layers to the main fast on set hazards. In addition, the HPI information layers can be used as “denominators” to measure Sendai Targets to quantifying global disaster mortality, number of people affected by disaster impact.

List of Flagships, Initiatives and Community Activities in the 2017-2019 GEO Work Programme to be continued in 2020-2022 plan.

HPI will benefit by cooperating with other GEO activities. With respect to the measurement and the production of information layers, HPI will benefit in particular from interacting with EO4SDGs as well as the Global Urban Observation and Information and Global Land cover activities. This includes sharing fitness-for-purpose assessments produced by the GHS initiative and by adopting information from available information layers produced.

Thematic initiatives

- Earth Observation in the Service of the 2030 Agenda for Sustainable Development (EO4SDG)
- Earth Observation for Disaster Risk Management
- GEOSS Platform
- POPGRID Data Collaborative
- Data Access for Risk Management (GEO-DARMA)
- Earth Observation for Health
- Global Network for Observation and Information in Mountain Environments (GEO-GNOME)
- Global Flood Risk Monitoring
- Global Urban Observation and Information
- Land Cover and Land Cover Change

Regional Initiative:

- EuroGEOSS
- AmeriGEOSS
- ArticGEOSS

5. Stakeholder Engagement and Capacity Building

Key organizations and stakeholders

HPI includes remote sensing specialists, applied scientists, practitioners and policy makers (Appendix IV). The Policy makers from the international community include UN Agencies such as Habitat, UNDP, UNEP, UNSDR; the World Bank; and the European Commission Directorate General for Regional Policy (EC DG-REGIO). EC-REGIO supports the development of Global spatial baseline data on built-up areas from Sentinel sensors as well as the “New Degree of Urbanization” activity and a model used to generate a new classification of Human settlements globally. The “New Degree of Urbanization” developed in cooperation with Food and Agricultural Administration, UN Habitat, World Bank, Organization for Economic Co-operation and Development (OECD), and the European Commission Services, is considered by the UN Statistical Division as a new way to classify urban and rural areas. International charitable foundations as the Bill & Melinda Gates Foundation are

actively supporting specific activity streams included in the Human Planet initiative, such as the Global high resolution age-structured population maps 2000-2020 coordinated by the WorldPop Project. New end-users are actively linked through the open data sharing principles, the digital platform, and the organization of special events in international conferences.

The HPI is engaging with a number of international institutions including on issue related to urbanization. One of the partners, European Commission – Regional Development (EC-DG REGIO), is coordinating the process of engaging with the international institutions.

The definition of urban and rural settlements is also relevant to FAO that focuses on rural settlements. JRC has engaged with FAO and have consolidated a procedure of settlement classification that fits the New Degree of Urbanization, where FAO focuses on the rural settlements.

Stakeholder engagement

Stakeholders are engaged through the HPI itself, as some stakeholders including EC-DG REGIO, are partners of HPI. There are a number of bi- or multi-lateral cooperation taking place between partners and international institutions. For example, University of Twente, Joint Research Centre are cooperating with the UN Habitat led “Climate Resilience and the Urban Poor initiative”.

Individual Capacity building.

Capacity building in countries is organized by HPI partners in cooperation with other stakeholders. For example UN habitat in cooperation with European Commission, services are running workshop to introduce the New Degree of urbanization concept and datasets in countries of the world. Workshop are planned throughout 2019 and 2020.

6. Governance

In the time frame 2017-2019 the HPI was chaired by Martino Pesaresi. The 2020-2022 the HPI will be co-chaired by Martino Pesaresi and Robert Chen. Currently HPI is structured in twelve expert groups organized by thematic areas (Annex V) and governed by a steering committee. Each expert group benefits from access to all common datasets including pre-release of the baseline data. The experts of the thematic areas will provide advice in selecting input data sources (collect), in designing and implementation specific indicators; in reviewing the results (test); and in providing advice in the outreach activities.

The steering committee for 2020-2022 needs to be reviewed and participation confirmed. In the 2017-2019 time frame the steering committee included representatives of institutions involved in the post-2015 frameworks; experts on Human Planet data sources, testing and outreach actions; and the chairs of the Human Planet Expert Groups. The chairs are subject to a mechanism of rotation (tbd) allowing an adequate representation of all the involved institutions. The confirmed leaders of the Human Planet Scientific Steering committee are listed below in alphabetical order:

ALAN BELWARD
ANDREW J TATEM

European Commission, JRC, Copernicus Global Land Services
University of Southampton

| | |
|----------------------|---|
| BENJAMIN BECHTEL | Univ. of Hamburg, Center for Earth System Research and Sustainability |
| DEBORAH BALK | City University of New York, Institute for Demographic Research |
| ROBERT CHEN | Center for International Earth Science Information Network (CIESIN) |
| LEWIS DIJKSTRA | European Commission, DG Regional Development (REGIO) |
| EDUARDO LÓPEZ MORENO | UN HABITAT - Research and Capacity Development |
| ELLEN HAMILTON | The World Bank (WB) |
| EUGENIE L. BIRCH | University of Pennsylvania |
| GORA MBOUP | Global Observatory linking Research to Action (GORA) |
| MARK R. MONTGOMERY | Population Council |
| MARTINO PESARESI | European Commission, JRC, GHSL |
| PAUL C. SUTTON | University of Denver |
| RICHARD SLIUZAS | University of Twente |
| SHAROLYN ANDERSON | University of South Australia |
| STEFFEN FRITZ | International Institute for Applied System Analysis (IIASA) |

The two co-chairs will maintain contact with expert group leaders, call meetings, define strategic priorities, engage with customer and users, with GEO secretariat and engage with GEO other GEO activities leaders.

Communicating

HPI communicates through e-mails and by participating in international fora. The HPI organizes biannual Human Planet Forum (HPF). The first HPF was held in Enschede in September 2017 (<https://ghsl.jrc.ec.europa.eu/HPIForum2017.php>). The second HPF is planned for October 2019 ahead of the 2019 GEO Ministerial meeting.

The JRC has allocated human resources to assure a good communication flow within HPI.

User engagement

User engagement occurs at different levels. First, it occurs within the HPI as HPI members are also users of the products. The evaluation occurs within the HPI initiatives. Evaluation also occurs through a process of scientific reporting through special issues in Journal. One special issue hosted in the International Journal of Digital Earth focuses on settlement and a number of papers are already available on-line (Appendix II).

Risk assessment

The technical risks are low. The baseline data and the production of indicator based on the data were produced within the JRC GHSL team and the future work is to improve on that methodology.

The Financial risk is medium, as the project for large number of participants is mostly an in-kind support from public organizations having different procedures and timing for budget approval. However, partners like CIESIN receive support from funding agencies including NASA and the Bill & Melinda Gates Foundation.

The political risk is low, as the project involves multi-lateral international partnership, supporting internationally agreed frameworks.

The engagement risk is low, according to the feedbacks received so far the partners are engaged and interested in the results of the initiative.

According to the above, the whole project can be ranked as low-medium risk and no additional resources are needed for the implementation of a risk mitigation plan.

The risk management procedure will be to re-evaluate the above assessment parameters by the steering committee at the end of the first period of the project (2018) and decide accordingly if and how a new risk mitigation plan may be drafted.

7. Resources

Estimated resources

The initiative is largely based on the in-kind support of the partner organizations. The partners have expressed interest to coordinate their work with the Human Planet initiative and benefit of pre-release access to the new data and indicators developed by the community. The partners will also benefit to from web based data visualization tools mad available to the HPI partners. A selected number of partners benefit from funding of projects that in part contribute to the HPI, these include:

NASA GEO Human Planet projects:

- Population and Infrastructure on Our Human Planet (CIESIN, University of Louisville, and ImageCAT).
- Refugee camp mapping (Oregon State University).
- Black Marble (NASA Goddard Space Flight Center).

Gates Foundation projects:

- POPGRID Data Collaborative (CIESIN, SDSN, GPSDD).

A more complete description will be made available at a later stage.

8. Technical Synopsis

Data

Earth Observation: Landsat image archives, Copernicus Sentinel Image archives, MODIS

Earth Observation derived datasets: MODIS urban, GRUMP, Global Urban Footprint, Global Settlement footprint.

Ancillary data: Census Data CIESIN population gridded data,

Additional: Building footprints
Open Street Map data layers

Methods

Earth Observation extraction procedures, as well as data integration procedures are described in scientific papers and that are available from the web site of participating institutions (i.e. <https://ghsl.jrc.ec.europa.eu/>). A succinct list is available in Appendix II.

Issues to be addressed/resolved

The validation of global information products is an open issue for HPI. This specifically for the data historical data layers. There is a call of intent to define validation protocols and reference datasets that can support the validation process.

9. Data Policy

The Human Planet initiative promotes open and free data access policy. It discloses the complete data production and dissemination cycle (open input, open processing methods, open outputs, open sharing platforms), with the mission to improve the public and scientific control of the evidences supporting the monitoring of the post-2015 international frameworks. It aims to improve the integration and the quality of global open and public baseline data describing human settlements, facilitate multi-lateral convergence on facts and figures assessing the human presence in the planet, and maximize the access to data and statistics to ensure that no one is left behind in the information gaps.

The data are uploaded on the GEOSS server and are also available for download from the web site of the two leading organizations JRC and CIESIN. For 2020-2022 the HPI plans to develop a dedicated HPI web site for data dissemination and data exploration.

Description of the key datasets used or created by the activity.

Prior to 2019

Global historical baseline data on population and built-up areas 1975-1990-2000-2015.

Sources: Landsat data (60, 30, 15m-res) and census data (GPW4)

2020-2022

Global spatial baseline data on built-up areas from Sentinel sensors (10m-res).

Source Sentinel 1 and Sentinel 2 data

Global settlement classification schema including urban-rural characterization and indicators

Source: GHSL

Global high-resolution age-structured population maps 2000-2020

Sources: Census data, WorldPop, CIESIN, GHSL, other satellite data

Contributions to the GEOSS Data CORE, and Interoperability with the GCI (GEOSS Common Infrastructure). The data created by the initiative are fully adherent with the GEOSS Data Sharing and Data Management Principles⁴.

⁴ GEOSS Data Management Principles Prepared by the GEO Data Management Principles Task Force
Approved by Data Management Principles Task Force on April 28, 2015
https://www.earthobservations.org/documents/dswg/201504_data_management_principles_long_final.pdf

All outputs may be available through the planned HPI web site. The partners are evaluating the best way to assure the longer-term preservation of data and information products.

Annexes

I. Acronyms and abbreviations

| | |
|------------|--|
| AmeriGEOSS | America component of GEOSS |
| CAS/RADI | Chinese Academy of Sciences/Remote Sensing and Digital Earth |
| CIESIN | Center for International Earth Science Information Network |
| DG REGIO | Directorate General for Regional Policies |
| EC | European Commission |
| EO | Earth Observation |
| EO4SDG | Earth Observation for Sustainable Development Indicators |
| EuroGEOSS | European component of GEO |
| FAO | Food and Agricultural Organization |
| GEO | Group of Earth Observation |
| GEOSS | Group of Earth Observation System of Systems |
| GHSL | Global Human Settlement Layer |
| HPI | Human Planet Initiative |
| INPE | Instituto Nacional de Pesquisas Espaciais |
| JRC | Joint Research Centre |
| NASA | National Aeronautic and Space Administration |
| OECD | Organization for Economic Cooperation and Development |
| SANSA | South African National Space Agency |
| SDGs | Sustainable Development Indicators |
| WorldPOP | High Resolution age-structured population distribution maps |

II. List of Key references describing the basis for the work of the initiative

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III. Brief CV of Project Leader(s)

Martino Pesaresi

Martino works at the European Commission, Joint Research Center (EC JRC), contributing to programs dealing with the use of space technologies for automatic image information retrieval and decision support systems in the areas of post-natural-disaster and post-conflict damage assessment, conflict-related resource monitoring, risk and exposure mapping. In 2005-2007 he was the chair or

of the Global Monitoring for Security and Stability (GMOSS) Network of Excellence. From 2007 to 2013, he was the leader of the team “Information Support for Effective and Rapid External Action” (ISFEREA) of the EC JRC. From 2014 to 2016, he was initializing and leading the Global Human Settlement Layer (GHSL) project activities of the EC JRC, establishing new geospatial analytics technologies for assessing the human presence on the planet supporting post-2015 international frameworks. He is the chair of the “Human Planet” international initiative in the frame of the Group of Earth Observation (GEO) work program 2017-2019. He is co-chair of the "urban working group" in the Digital Belt and Road (DBAR) program set by the Chinese Academy of Sciences.

Robert Chen

IV. Participant organizations

As of February 2019, the partner contributors list includes more than 220 individual scientists and policy makers belonging to more than 120 different organizations, including academies, international stakeholders, governmental bodies and private firms. These organizations include: ACCUWEATHER.COM;ASAU;BILL & MELINDA GATES FOUNDATION, USA;BROWN UNIVERSITY; CESBIO (BUREAU 123) CHINESE ACADEMY SCIENCES, RADI; CHINESE UNIVERSITY OF HONG KONG;CIMA FOUNDATION;CITIESALLIANCE;CITY UNIVERSITY OF NEW YORK, INSTITUTE FOR DEMOGRAPHIC RESEARCH;COLUMBIA UNIVERSITY, CIESIN; COMMUNICATION, NETWORKS AND CONTENTION RESEARCH GROUP, DEPARTMENT OF POLITICS AND PUBLIC ADMINISTRATION, UNIVERSITY OF KONSTANZ;COMPETENCE CENTER FOR URBAN AND REGIONAL PLANNING (CORP);CONSERVATION SCIENCE PARTNERS; CONSULTANT TO THE CHIEF ECONOMIC ADVISER TO THE GOVERNMENT OF INDIA; DEPARTAMENTO ADMINISTRATIVO NACIONAL DE ESTADISTICA (DANE);DEPARTMENT OF GEOGRAPHY, UNIVERITY OF KANSAS;DEPARTMENT OF GEOGRAPHY, VICTORIA UNIVERSITY; DEUTSCHES ZENTRUM FÜR LUFT- UND RAUMFAHRT – DLR (GERMANY); DEVEX;DIPARTIMENTO DELLA PROTEZIONE CIVILE; ENVIRONMENT AND PRODUCTION TECHNOLOGY DIVISION, INTERNATIONAL FOOD POLICY AND RESEARCH INSTITUTE (IFPRI), CGIAR CONSORTIUM FOR SPATIAL INFORMATION;ERASMUS UNIVERSITY ROTTERDAM, HIS; EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT; EUROPEAN COMMISSION, DGREGIO; EUROPEAN COMMISSION, EUROSTAT; EUROPEAN COMMISSION, JOINT RESEARCH CENTRE; EUROPEAN SPACE AGENCY; FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA); FEDERAL UNIVERSITY OF CAMPINA GRANDE IN BRAZIL; FONDAZIONE ENI ENRICO MATTEI; GEOADAPTIVE LLC; GÉOGRAPHIE-CITÉS LAB. CNRS - PARIS 1 PANTHÉON SORBONNE UNIVERSITY; GEOINFORMATICS DIVISION OF THE KTH UNIVERSITY, STOCKHOLM SWEDEN; GLOBAL OBSERVATORY LINKING RESEARCH TO ACTION (GORA); GROUP ON EARTH OBSERVATION; HELMHOLTZ ZENTRUM GEESTACHT; IMAGECAT INC; INSTITUT DE RECHERCHE POUR LE DÉVELOPPMENT; INSTITUTE FOR DISASTER MANAGEMENT AND RECONSTRUCTION, SICHUAN UNIVERSITY; THE HONG KONG POLYTECHNIC UNIVERSITY; INSTITUTE FOR TRANSPORTATION & DEVELOPMENT POLICY; INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS (INPE); INTERNATIONAL CENTRE FOR EARTH SIMULATION FOUNDATION;INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS (IIASA); INTERNTIONAL ORGANISATION ON MIGRATION; IREVOLUTIONS.ORG; KING'S COLLEGE LONDON, DEPARTMENT OF GEOGRAPHY; KTH ROYAL INSTITUTE OF TECHNOLOGY; LABORATOIRE IMAGE, VILLE, ENVIRONNEMENT, UMR

CNRS 7362 - UNIVERSITÉ DE STRASBOURG, FACULTÉ DE GÉOGRAPHIE ET D'AMÉNAGEMENT; LINCOLN INSTITUTE OF LAND POLICY IN CAMBRIDGE; LITOGRAFIA ARTISTICA CARTOGRAFICA SRL (LAC); MCGILL UNIVERSITY: SCHOOL OF ENVIRONMENT AND ECONOMICS; MIT DEPARTMENT OF ECONOMICS; MIT MEDIA LAB; MONASH UNIVERSITY; NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA); NATIONAL CENTER FOR ATMOSPHERIC RESEARCH; NATIONAL OBSERVATORY OF ATHENS; NEW YORK UNIVERSITY; NOSDRA; NYU STERN URBANIZATION PROJECT; OAK RIDGE NATIONAL LABORATORY; OREGON STATE UNIVERSITY; ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT; PBL NETHERLANDS ENVIRONMENTAL ASSESSMENT AGENCY; POPULATION COUNCIL; REINER LEMOINE INSTITUT; RISK MANAGEMENT SOLUTIONS (RMS); SCHOOL OF ENGINEERING - UNIVERSITY OF BASILICATA; SOUTH AFRICAN NATIONAL SPACE AGENCY (SANSА); STATE UNIVERSITY OF NEW YORK COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY; STEP, WOODROW WILSON SCHOOL, PRINCETON UNIVERSITY; SWISS AGENCY FOR DEVELOPMENT AND COOPERATION, BERN; THE WORLD BANK; THE WORLD BANK/ UNIVERSITY OF AMSTERDAM; TURKISH STATISTICAL INSTITUTE (TURKSTAT); UN HABITAT - RESEARCH AND CAPACITY DEVELOPMENT; UN POPULATION DIVISION | DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS; UNITED NATIONS DEVELOPMENT PROGRAMME; UNEP WORLD CONSERVATION MONITORING CENTRE; UNHABITAT, GLOBAL URBAN OBSERVATORY; UNICAR MYANMAR - WASH; UNITED NATIONS INTERNATIONAL CHILDREN EMERGENCY FUND; UNITED NATIONS ENVIRONMENTAL PROGRAMME; UNIV. BROWN UNIVERSITY CIDR; UNIV. OF BOSTON; UNIV. OF PRINCETON; UNIV. OF TUFTS; UNIVERSIDAD DE LOS ANDES, BOGOTA, COLOMBIA; UNIVERSITY COLLEGE LONDON(UCL); UNIVERSITY EBERSWALDE, GERMANY; UNIVERSITY GEORGE WASHINGTON; UNIVERSITY OF AMSTERDAM; UNIVERSITY OF ARIZONA STATE; UNIVERSITY OF ARKANSAS; UNIVERSITY OF BRISTOL; UNIVERSITY OF BRUSSELS; UNIVERSITY OF COLORADO, BOULDER; UNIVERSITY OF COLUMBIA, CIESIN; UNIVERSITY OF COLUMBIA, EARTH INSTITUTE; UNIVERSITY OF DENVER; UNIVERSITY OF EXETER; UNIVERSITY OF FLENSBURG; UNIVERSITY OF HAMBURG, CENTER FOR EARTH SYSTEM RESEARCH AND SUSTAINABILITY; UNIVERSITY OF LOUVAIN, BELGIUM; UNIVERSITY OF MEXICO; UNIVERSITY OF MUNICH; UNIVERSITY OF NORTH CAROLINA WILMINGTON; UNIVERSITY OF PENNSYLVANIA; UNIVERSITY OF SALZBURG; UNIVERSITY OF SOUTH AUSTRALIA; UNIVERSITY OF SOUTHAMPTON, WORLDPOP PROJECT; UNIVERSITY OF THESSALONIKI ARISTOTLE; UNIVERSITY OF TOKYO; UNIVERSITY OF TSINGHUA; UNIVERSITY OF TWENTE; UNIVERSITY OF VENEZIA, ITALY; UNIVERSITY OF WISCONSIN-MADISON; UNIVERSITY OF SOUTHAMPTON; US ARMY CORPS OF ENGINEERS; VALECTUS, MUMBAI, INDIA; WORLD HEALTH ORGANIZATION; WORLD RESOURCES INSTITUTE; YALE UNIVERSITY.

V. Human Planet Expert Groups

| | Human Planet Expert Group | Institutions |
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| 1 | Global harmonized definition of cities and settlements | European Commission, DG for Regional and Urban Policy |
| 2 | Global Settlements in Disaster Risk Reduction | UNOOSA, UN-SPIDER Program |
| 3 | Global Urban Climate and Mitigation Planning | University of Dublin, World Urban Database and Access Portal Tool (WUDAPT) |
| 4 | Global updated and historical baseline data on built-up areas | European Commission, Joint Research Centre |
| 5 | Global high resolution age-structured population maps 2000-2020 | Univ. of Southampton, WorldPop Project, Flowminder Foundation |
| 6 | Global Settlements, Infrastructure, and Population Data Inter-comparison | Columbia University, Center for International Earth Science Information Network (CIESIN) |
| 7 | Global future population grids including demography and migration | City University New York, Demographic Research |
| 8 | Global urban metabolism | University of Denver, Geography & Environment |
| 9 | Urbanization dynamics in China and the “one belt one road” region | Chinese Academy of Sciences, Institute of Remote Sensing and Digital Earth |
| 10 | Capacity building and trainee-ships | University of Twente, Faculty of Geo-Information Science and Earth Observation |
| 11 | Poverty Mapping | George Washington University, Center for Urban and Environmental Research |