

## 2.3 The Global Human Settlement Layer Concept

The GHSL concept was introduced by the JRC in the years 2010-2011 with the aim of providing improved, ready-to-use or pre-calculated baseline data reporting about the human presence on the globe in support to crisis management applications.

A first experiment tested the use of 75-m-resolution ENVISAT ASAR satellite data for large-area assessment of built-up areas<sup>12</sup>, followed by other experiments aiming to test the capacity to derive consistent information about the presence of built-up areas from heterogeneous set of metre and sub-metre resolution satellite data input (M Pesaresi et al. 2011). More generally, the GHSL concept was born in the frame of research and development of new remote sensing data processing and automatic image information retrieval technologies in support to global crisis management (GCM) and disaster risk reduction applications (M Pesaresi et al. 2010). In this context, detailed, updated and internationally-comparable spatial information about population, built-up structures and infrastructure was mainly used as baseline necessary for post-crisis/post-disaster damage assessment, consequence assessment of the population needs, and reconstruction monitoring. The GCM user context, data scenarios and operating experience were strongly influencing the data processing paradigm implemented in the GHSL concept and largely contributing to the successful design of a system that was able to deliver the first globally complete map of built-up areas using decametric-resolution satellite sensors.

The GHSL data processing paradigm was based on two main assumptions, inherited from the GCM operating experience: i) the necessity to handle real-world input data scenarios including large data volume, unavoidable data gaps, documentation gaps, data abstraction, model gaps, inconsistencies, and heterogeneous sources integration and ii) the necessity to handle real-world information needs and user requirements scenarios including unavoidable level of disagreement on abstract definitions and information priorities in multi-stakeholder international user communities as well as stringent time constraints. The two assumptions above lead to a pragmatic design of the GHSL information production system pushing in two interlaced development areas:

- i) new, more efficient and more robust computational approaches allowing fast, data-driven information extraction, model prototyping and information output in complex, large-volume data scenarios (Martino Pesaresi 2014; M Pesaresi et al. 2016), and
- ii) new, less abstract classification schemas as compared to the dominant land use/land cover classification paradigms in remote-sensing-data-derived products (M Pesaresi and Ehrlich 2009) with the objective to improve semantic interoperability and reusability of the information products derived from automatic classification of remotely sensed data.

Spatial data reporting about the presence of population and built-up infrastructure have a large societal benefit. They are necessary for any evidence-based modelling and informed decision making related to i) human and physical exposure to threats as environmental contamination and degradation, natural disasters and conflicts, ii) impact of human activities on ecosystems and iii) human access to resources.

The mature GHSL concept as used in the *Atlas of the Human Planet 2016* aims to support the post-2015 international frameworks: the UN Third Conference on Housing and Sustainable Urban Development (Habitat III, 2016), the post-2015 framework on sustainable development goals (SDGs), the UN Framework Convention on Climate Change, and the Sendai Framework for Disaster Risk Reduction 2015-2030. Post-2015 international frameworks are accompanied by targets and will be further elaborated through indicators that focus on measurable outcomes. These indicators are action oriented, global in nature and universally applicable. From this perspective, the GHSL is a prototype platform allowing to test and discuss collectively alternative of the indicators. For this purpose, the GHSL information production system is based on a modular hierarchical abstraction

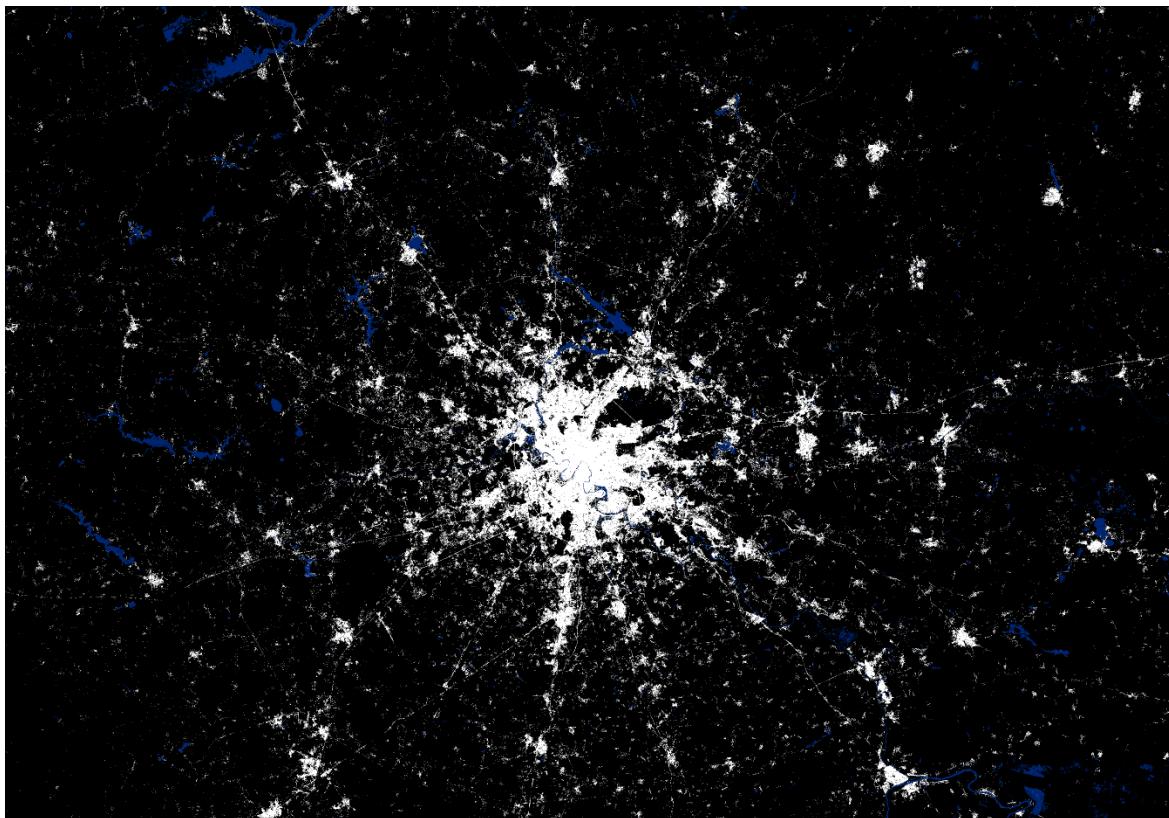
<sup>12</sup> <https://ec.europa.eu/jrc/en/news/mapping-human-settlements-globally-8276>

schema facilitating the knowledge sharing and the conceptual convergence in case of complex, multi-lateral, multi-stakeholder international processes.

From the general point of view, the GHSL information production paradigm is based on the processing and integration of three main data sources: generalized multi-sensor and multi-temporal remote sensing image data streams, population census data and crowd sources as voluntary geographic information. The data processing methods implemented by the GHSL privilege automatic and reproducible methodologies, allowing public scientific control of the results and of the intermediate results. Moreover, allowing the consistent and systematic process of large masses of fine-scale global data with a cost-effective approach.

The rationale behind the automatic data mining and analytics as implemented in the GHSL it is consistent with the aim of moving the human intelligence efforts from the information gathering to the analytics. The decrease of the information production costs thanks to the efficient algorithms designed in the GHSL information production workflow aims to facilitate the information sharing and the multilateral democratization of the information production, and consequently aims to the facilitation of the collective knowledge building.

The GHSL operates in an open and free data access policy including the full data production and dissemination cycle (open input, open processing methods, open outputs, open sharing platforms), with the mission of improving the public and scientific control of the evidences supporting the monitoring of the post-2015 international frameworks, 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.



**Image 1 GHSL built-up 2015 – Moscow, Russia Fed.**