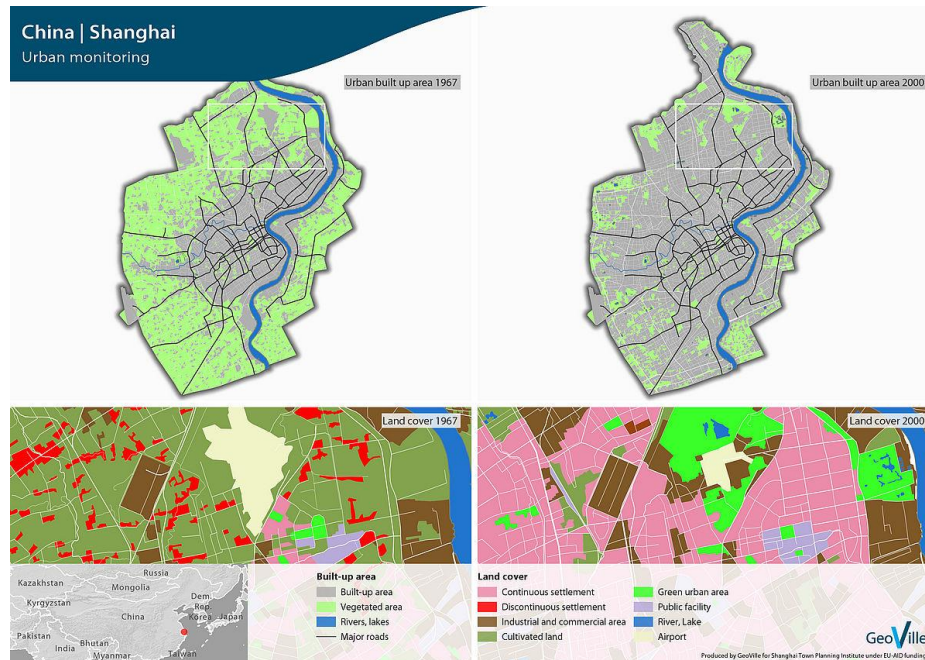


BUILDING AND SETTLEMENT MAP



Urban mapping and monitoring (Source: GeoVille)

PRODUCT DESCRIPTION

Category

- | | |
|---|---|
| <input type="checkbox"/> Topographic information | <input type="checkbox"/> Surface deformation |
| <input type="checkbox"/> Impact assessment | <input type="checkbox"/> Precision ortho-images |
| <input type="checkbox"/> Change detection / continuous monitoring | <input type="checkbox"/> Terrain information |
| <input checked="" type="checkbox"/> Land cover / use | <input type="checkbox"/> Water quantity & quality |
| <input type="checkbox"/> Near surface geology | |

Uses

Building footprints
 Infrastructure mapping
 Infrastructure monitoring
 Logistics planning and operations – Facility siting, infrastructure development

Challenges addressed

Development and Operations – Site Layout Design
 Development and Operations – Illegal Mining
 Closure and Aftercare – Mapping of Infrastructure

Geo-information needs

DO-2: Site design and layout of infrastructure

DO-18: Location of occupied dwellings/sensitive receptors (emergency planning & complaints management). Including informal settlements

DO-28: Mapping of any informal settlements

CA-4: Demonstration of infrastructure removal

Description

To set out infrastructure, to ensure efficient operation and to optimize processing steps within the mine as well as to track the development process, detailed information about site design and layout of infrastructure is needed. Remote sensing can support this need and provide information on infrastructure based on high to very high resolution as well as radar satellite imagery.

This product provides a detailed map showing infrastructure and settlement information on a defined area. Often additional data is required to reference the information based on remote sensing and characterise for example a special use of a building or the hierarchical level of roads. Physical structures – buildings, roads, railways, airports, pipelines – can be detected in form of mapping with a specific thematic focus. Also, additional in-situ data might help here to set out a basic layout of existing infrastructure. A map showing the layout and design of the site with existing structures can be an output here. Also, change detection and monitoring of the layout can be provided.

A complete inventory of building structures (building footprints) is highly important to perform comprehensive damage and vulnerability assessment. Remote sensing can provide detailed information with mapping individual buildings and deriving information on construction properties. Based on high and very high resolution satellite images and in-situ information building footprints can be derived. Additional information such as building height might also be provided using a normal Digital Surface Model (nDSM). A reference satellite data is needed to monitor the infrastructure and compare it with further satellite data over time to get information on changes. Using radar satellite data, detection of ground movement that might indicate changes and deteriorations or directly detect damages or changes is possible.

Furthermore, the progress of the removal of infrastructure can be mapped starting with the inventory of buildings and recording the step-by-step removal. Also, in case a schedule for removal is provided, a progress can be calculated.

The building footprints can also be used as input for the service “Monitoring of Infrastructure”.

Known restrictions / limitations

To guarantee comparability of temporal series and changes images should be possibly from the same sensor and cover the same geographical area. How well a product represents the infrastructure is highly dependent on the quality and resolution of satellite imagery.

Lifecycle stage and demand

Exploration	Environmental Assessment & Permitting	Design, Construction & Operations	Mine Closure & Aftercare
■■■■		■■■■	

Exploration:

- Gather information on existing infrastructure

Design, Construction & Operations:

- Information to set out the infrastructure and ensure an efficient operation
- Optimize and minimize distances between infrastructure
- Track progress of the infrastructure construction

Geographic coverage

Globally available.

EARSC Thematic Domain

DOMAIN	BUILT ENVIRONMENT
Sub-domain	Infrastructure
Product description	Monitor constructions

PRODUCT SPECIFICATIONS

Input data sources

Sampling of available products:

<i>Satellite</i>	Sentinel 2	Landsat 8	Worldview 1, 2 and 3	Pleiades	Standard resolution radar	High resolution radar
<i>Status</i>	In operation	In operation	In operation	In operation	In operation	In operation
<i>Operator</i>	ESA	NASA	Digital Globe	Airbus Defence and Space/CNES	ESA	Commercial providers
<i>Data availability</i>	Public	Public	Commercial,	Commercial,	Public	Commercial,

			on demand	on demand		on demand
Resolution (m)	10 - 60	15 - 100	0.31 - 0.46	0.5 – 2	20x4	1x1 – 3x3
Coverage	Global	Global	Global	Global	Global	Global
Frequency (days)	5	16	< 2	< 1	6	11
Launch year	2015	2013	2007 / 2009 / 2014	2011	2014	2007
Website	link	link	link	link	link	link

Minimum Mapping Unit (MMU)

Variable, depending on source data resolution. A MMU as small as 0.5 pixel size is possible using VHR.

Accuracy / constraints

Thematic accuracy:

>90% for Building Footprints; >95% for Settlement Mapping. Buildings and settlements as well as other sealed structures can be detected; to differentiate different types of buildings additional data is needed.

Spatial accuracy:

Dependent on input pixel resolution.

Accuracy assessment approach & quality control measures

N/A

Frequency / timeliness

Observation frequency:

Every one or more days, depending on satellite.

Timeliness of delivery:

Within five (working) days of sensing.

Availability

Data from all Sentinel satellites are freely available through the open data policy of the operator ESA (Sentinel-2A since 2015, Sentinel-2B since 2017).

Data from Landsat 8 (since 2013) are freely available through the open data policy of the operator USGS.

WorldView and Pleiades data are commercially licenses and must be purchased through the operator/vendor Digital Globe (WorldView) or Airbus Defence and Space (Pleiades). Usually available within hour(s) of satellite fly-over.

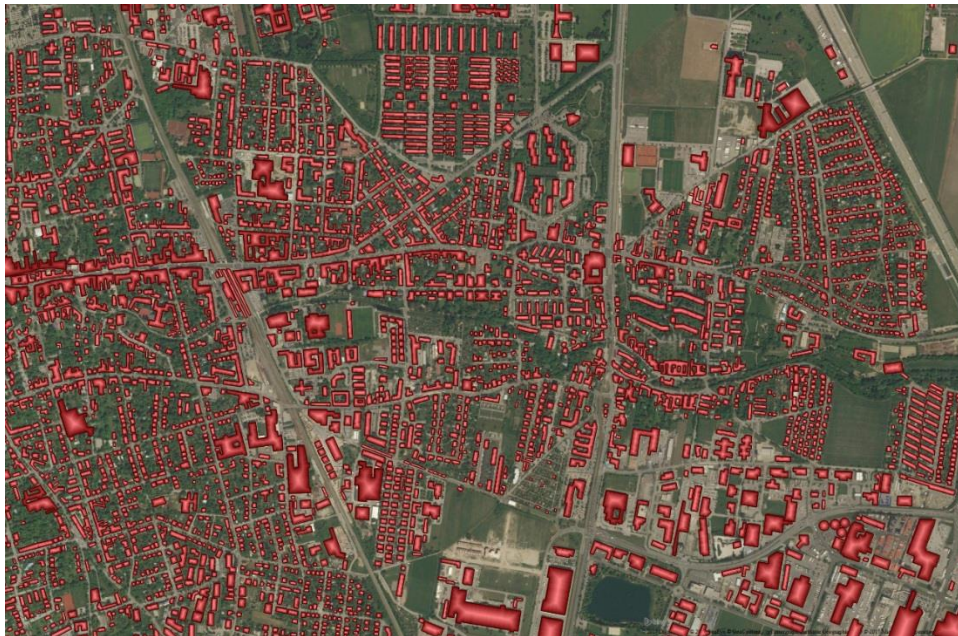
Depending on operator, radar data is available freely or must be purchased through the operator/vendor.

Delivery / output format

Data type: Vector formats, Raster formats

File format: Geotiff, Shapefile

USE CASE



(Source: GeoVille)

Building Footprints

This image shows footprints of the buildings in a defined area. With additional data, these footprints may be combined with other attributes such as building heights or building type. Comparing footprints over time, an analysis of changes is possible. Also, this data may work as an input for other products and services: combined with a Land Use / Land Cover product it may help get a better understanding of the area and surroundings where mining takes place as well as an input for the design and structure of a mine before mining commences.

Author(s): Michaela Seewald
Document Title: Building and Settlement Map
of Pages: 5
Circulation: Internal – Project consortium and industry partners
 External – ESA

REVISION LOG

(to be filled out by authors/reviewers/word processors)

Revision				Description
Number	Date	Revised By	Approved By	
Version 0.1	August 16, 2019	Michaela Seewald		Provision of first version
Version 0.2	August 19, 2019	Arjan Tabak		Added SAR part and an extra user need
Version 0.3	September 24, 2019	Michaela Seewald		Comments from review process included