Supporting GPSC Cities with Satellite Earth Observation for Sustainable Urban Development

Global Platform for Sustainable Cities – African Regional Workshop
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European Space Agency: Activities

ESA is one of the few space agencies in the world to combine responsibility in nearly all areas of space activity.
Earth Observation at ESA
ESA-DEVELOPED EARTH OBSERVATION MISSIONS

2010
Proba-1
SMOS
CryoSat
GOCE

2015
Sentinel-1A
MetOp-B
Sentinel-2A
Sentinel-3A
Sentinel-4A

2020
Sentinel-5A
Sentinel-6A
Sentinel-7A
Sentinel-8A

2025
Sentinel-9A
Sentinel-10A
Sentinel-11A
Sentinel-12A

2030
Sentinel-13A
Sentinel-14A
Sentinel-15A
Sentinel-16A

Science
Copernicus
Meteorology

www.esa.int
European Space Agency
A Strong European EO Service Portfolio

• Services with formal specifications, standards, validation
• Developed in collaboration and agreement with over 400 national user organisations
• More than 450 suppliers (typically small companies), with 7800 highly skilled staff
Earth Observation and the Global Agenda

**Sustainable Development**
- UN SDGs
  - Supporting Smart Decision-Making

**Climate Action**
- Paris Agreement
  - Monitoring & Understanding

**Disaster Risk Reduction**
- Sendai Framework
  - Providing Key Infrastructure
Supporting Sustainable Development
Earth Observation and the SDGs

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SDGs with major opportunities for EO data

Earth Observation potential contribution to the SDG Targets and Indicators

Analysis performed by the GEO EO4SDGs initiative
ESA Collaboration with IFIs in EO

- Since 2008, 65 small-scale demonstrations of EO-based environmental information in support of multilateral bank development projects
- Responding to specific geospatial information needs
- MoUs and secondments in place with the World Bank and Asian Development Bank

Reports available at www.vae.esa.int ➔ Documents
A Dedicated Programme of Work: EO4SD

• EO4SD – Earth Observation for Sustainable Development – An ESA initiative for wide-scale exploitation of satellite data in support of international development

• Engaging various IFIs and their client states, and flagship global/regional programmes

• Key questions:
  • What EO-based information is most needed?
  • How can it be used in international development activities and working practices?
  • What benefits does this information deliver to stakeholders (IFIs and their client states)?
  • Do the benefits justify the costs?
  • How can EO-based information be established on a long-term, sustainable basis?

• Currently running (2016–2019):

• More thematic areas about to start or in preparation.

http://eo4sd.esa.int
The ESA EO4SD-Urban Project
EO Products for Urban Development

Green Areas/Networks
Extent, Imperviousness and Change
Building Footprint
Population Density
Waste Sites
Transport Infrastructure
Informal Settlements
Flood Risk
Landslide Risk
Terrain Motion

Baseline Products
Urban and Peri-Urban Land Use / Land Cover
EO4SD-Urban: Geographic Spread

• Approx 40 cities distributed globally
• Including mega-cities and small to medium sized cities
• Covering a multitude of urban planning and development issues
Achievements:

- All cities received products
- Eight GPSC cities received urban extent and imperviousness products for 2015
  - Meanwhile, these are ready for all GPSC cities!
- DLR now working on an urban extent temporal evolution product!
Examples of Input Imagery

VHR example: WorldView-2
- 0.5 m resolution
- normally available a few times per year
- commercial

HR example: Sentinel-2
- 10 m resolution
- available every 5 days
- free and open
Example: Land Use/Land Cover 2010

Arusha, Tanzania
Example: Land Use/Land Cover 2015

Arusha, Tanzania
Residential densification is more dominant in peri-urban zone
Residential extension is more dominant in core urban zone
Example: Transport Network 2010–2015
Example: Urban Green Areas 2010–2015

- Not an urban green area
- Permanent urban green area
- Loss of urban green area
- New urban green area

Dodoma, Tanzania

- Unchanged Population Distribution
- Up to -100% decrease
- Up to 200% increase
- 201% - 400% increase
- 401% - 600% increase
- 601% - 800% increase
- 801% - 1000% increase
- More than 1000% increase

Dodoma Core Urban Districts
Example: Informal Settlements

Land Use and Land Cover (February–March 2017), based on Pléiades (0.5 m resolution) in the city centre and Sentinel-2 (10 m resolution) for periurban areas

Delineation of informal settlements
Example: Flood Risk

Requires:

- precise Digital Terrain Model
- adequate EO archive data coverage
Example: Terrain and Infrastructure Motion

Semarang, Indonesia

- > 1 - 4 cm/year
- > 4 - 6 cm/year
- > 6 - 8 cm/year
- > 8 - 10 cm/year
- > 10 - 12 cm/year
- > 12 cm/year

0 1 2 4 km
Example: Urban Extent

Abidjan, Côte d'Ivoire

2015
Example: Degree of Imperviousness

See poster outside!
EO4SD-Urban: Value of the EO Products

Product generation is based on:

- Verified user requirements
- Harmonised and standardised state-of-the-art methodologies
- Comprehensive and transparent documentation
- Application of statistically sound accuracy assessment
- Stringent Quality Control to ensure:
  - transparency
  - repeatability
  - completeness
  - validity
- User feedback needed (and some already given) to improve the services
- Geospatial products can be used to monitor SDG 11 Indicators
EO4SD-Urban: Outlook to Phase 2 (2018–2019)

- Processing of geo-spatial products for additional urban projects in the different geographical regions will continue
  - Stepping up the support to GPSC!

- Emphasis will be put on spatial analytics for urban planning

- Stakeholder feedback at the end of the project will provide the overall utility for urban planning
  - This should support mainstreaming EO into urban development programmes
New Activity in 2018: *EO Clinic*

- ESA’s present collaboration with the MDBs is of a longer-term and larger-scale character, responding to flagship activities, like GPSC
  - Ad-hoc requests in many, short-term and speculative requests for EO support coming from Banks and their client countries in many thematic areas (including urban)

- EO Clinic: new 24-month activity starting in Q4 2018 to:
  - fill the gap to address the above enquiries
  - raise interest in EO further across banks, with new bank projects with no or very little previous contact with satellite-based EO

- Through the EO Clinic, development projects will be able to get help with their geospatial information problems
  - ESA will fund small work orders with a pool of pre-qualified European EO service providers to investigate/demonstrate the use of EO towards solving the issue
  - Work orders will be small-scale and of exploratory nature, not replacing larger-scale procurement of commercial EO services

- Regional development banks (e.g. AfDB, DBSA) and new GPSC cities welcome!
Our Special GPSC African Workshop Posters!

Imperviousness
Print-ready resolution, 280 MB:
https://we.tl/nFhT56QY9W
Low resolution, 5 MB:
https://we.tl/jJcrwW7V3w

Abidjan
Print-ready: 195 MB:
https://we.tl/nQUkPotFF6

Johannesburg
Print-ready: 139 MB:
https://we.tl/7z2hpv6Uc5

Dakar
Print-ready: 244 MB:
https://we.tl/nUbwThMXJT

All three at low resolution, 20 MB:
https://we.tl/8mIabNIzbd
Thank You!

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