Space for Sustainable Development
ESA’s contribution to the Where, What, and How of Data

Dr. Christoph Aubrecht
Directorate of Earth Observation Programmes
Science, Applications and Future Technologies Department
European Space Agency ESA/ESRIN
Senior Geospatial Specialist | ESA Representative at the World Bank

UN-GGIM 7th Session | New York, NY, 1 August 2017
UN-GGIM Forum on the 2030 Agenda for SD “Where is the Data?”

www.esa.int
Resolution adopted by the General Assembly on 25 September 2015
[without reference to a Main Committee (A/70/21)]

70/1. Transforming our world: the 2030 Agenda for Sustainable Development

The General Assembly
Adopts the following outcome document of the United Nations summit for the adoption of the post-2015 development agenda:

Transforming our world: the 2030 Agenda for Sustainable Development

Preamble

This Agenda is a plan of action for people, planet and prosperity; it also seeks to strengthen universal peace in larger freedom. We recognize that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development.

All countries and all stakeholders, acting in collaborative partnership, will implement this plan. We are resolved to free the human race from the tyranny of poverty and want and to heal and secure our planet. We are determined to take the bold and transformative steps which are urgently needed to shift the world on to a sustainable and equitble path. As we embark on this collective journey, we pledge that no one will be left behind.

The 17 Sustainable Development Goals and 169 targets which we are announcing today, demonstrate the scale and ambition of this new universal Agenda. They seek to build on the Millennium Development Goals and complete what they did not achieve. They seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls. They are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental.

The Goals and targets will stimulate action over the next 15 years in areas of critical importance for humanity and the planet.

... We will promote transparent and accountable scaling-up of appropriate public-private cooperation to exploit the contribution to be made by a wide range of data, including Earth observation and geo-spatial information, while ensuring national ownership in supporting and tracking progress.
Earth Observation’s potential contribution to the SDG Targets and Indicators

SDGs with most opportunities for EO data

Analysis performed by the GEO EO4SDGs initiative
In the complex and evolving SDG environment, the new **CEOS AHT SDG** will

- **take stock of the UN processes** in place for the SDG implementation and of the existing participants and stakeholders,
- **focus its activities around the unique role that CEOS should play as coordination body of the Space community efforts** to support the integration of satellite EO in support to the full realisation of the SDG’s.

CEOS AHT will **align its engagement with the UN SDG agenda** in the context of **GEO** (GEO Programme Board, GEO Engagement Strategy, GEO initiative EO4SDGs) and **build on established relationships** the CEOS Agencies have with the **custodian agencies** and **individual countries**.
Long-term (decadal) continuous, consistent data
A new era: The space r/evolution

0 days 00 hours 00 minutes
Sentinel-2 constellation: summer solstice
### The European Copernicus Initiative
Securing satellite data access on the long term

<table>
<thead>
<tr>
<th>Mission</th>
<th>Description</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentinel 1 – SAR imaging</td>
<td>All weather, day/night applications, interferometry</td>
<td>2014 / 2016</td>
</tr>
<tr>
<td>Sentinel 2 – Multi-spectral imaging</td>
<td>Land applications: urban, forest, agriculture,... Continuity of Landsat, SPOT</td>
<td>2015 / 2017</td>
</tr>
<tr>
<td>Sentinel 3 – Ocean and global land monitoring</td>
<td>Wide-swath ocean color, vegetation, sea/land surface temperature, altimetry</td>
<td>2017 / 2018</td>
</tr>
<tr>
<td>Sentinel 4 – GEO Atmospheric Chemistry</td>
<td>Atmospheric composition monitoring, trans-boundary pollution</td>
<td>2019</td>
</tr>
<tr>
<td>Sentinel 5 &amp; Precursor – LEO Atmospheric Chemistry</td>
<td>Atmospheric composition monitoring (S5 Precursor launch in 2016)</td>
<td>2017 / 2019</td>
</tr>
<tr>
<td>Sentinel 6 Jason-CS – Altimetry Mission</td>
<td>High precision measurements of global sea-level (continuation of Jason ocean topography missions)</td>
<td>2020</td>
</tr>
</tbody>
</table>

The European Copernicus Initiative
Securing satellite data access on the long term

- S-1 A/B/C/D
- S-1 A/B 2nd Generation
- S-2 A/B/C/D
- S-2 A/B 2nd Generation
- S-3 A/B/C/D
- S-3 A/B 2nd Generation
- S-4 A/B (on MTG)
- S-5 Precursor
- S-5 A/B/C (on MetOp-SG)
- S-6 (J-CS) A/B
Towards efficient data access
Towards efficient data exploitation

"Bringing the people to the data"

- Simplify the extraction of information from EO data
- Enable large scale exploitation of EO data
- Stimulate innovation with EO data
- Maximize impact of European EO assets

**Exploitation platforms**

- EO software
- ICT resources
- EO data
- In-situ data

**Community**

**Collaboration**

**Themes**

- Hydrology
- Urban
- Coastal
- Polar
- Geohazards
- Forestry
- Food security
ESA approach to SDG implementation

**Global Datasets**
- Access to global / regional datasets
- in the absence of or to complement and enhance, national data sources
- countries which face major difficulties in collecting national data

**Methodological Guidelines**
- Support custodian agencies to develop methodological guidelines to countries
- EO Best Practices
- Scientifically sound algorithmic approaches
- Product validation
- Show cases

**Country Support**
- Targeted activities to support NSOs and governmental ministries to report on SDG indicators
- Support country level efforts to apply EO to track, monitor and achieve SDGs

**Capacity Building**
- Build capacity to exploit EO
- Training courses
- Training material on EO best practices
- Mainly in developing and emerging economies
- Critical mass of technical centers

**Software Toolboxes**
- Free of charge
- Open source
- Easy to use
- EO Processing Toolboxes (SNAP)
- Thematic Toolboxes (WOIS, GWA, S2Agri)

**Knowledge Hub & Platforms**
- Facilitate access to Sentinel data
- Access to global / regional datasets
- EO Best Practices/show cases
- Method. guidelines
- Visualization and Analysis
- On-line processing
- Toolboxes
- Knowledge sharing

**Custodian Agencies**
- National Statistical Offices
- Governments / Agencies

**Key Stakeholders**
- Access to global / regional datasets
- in the absence of or to complement and enhance, national data sources
- countries which face major difficulties in collecting national data

- GUF
- Global Surface Waters, JRC

- Sentinel-2
- EO for SDG Africa

**EO4SD**
- Earth observation for sustainable development

- TIGER AFRICA
Global products in support of SDGs

**SDG 15.3 Land Degradation Neutrality (LDN)**

**Target 15.3** By 2030, combat desertification, restore degraded land & soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

**Indicator 15.3.1** “Percentage of land that is degraded over total land area”

**Land Cover**
- GLOBAL LAND COVER MAP, EPOCH 2010
- ENVISAT MERIS FRS, 300m
- **ESA Land Cover CCI**

**Custodian Agency:**
- UNCCD (secretariat and Global Mechanism)

**Other Involved Agencies**
- FAO, UNEP/WCMC, CBD, UNFCCC

**Land Productivity Dynamics**
- LPD derived from 1999-2013 NDVI phenological analyses
- SPOT VEGETATION, 1km
- **EC Joint Research Center (JRC)**

Monitoring 15.3.1. on the status & trends in land degradation is based on sub-indicators:

1. **Land Cover and Land Cover Changes**
2. **Land Productivity**
3. **Soil Organic Carbon**
Promoting geo-data literacy and use in international development

- 65 small-scale demonstrations of EO services in support of IFI projects since 2008
Project objective: Conduct systematic assessment of status and rate of change of coastal erosion in West Africa to support climate resilience planning

EO contribution: Unique opportunity to combine oceanographic trends with land use change and coastline change information to understand pressures and dynamics of coastal erosion
ESA-WB partnership: Analyzing coral degradation in Tuvalu

Project objective: Support Tuvalu in assessing pressures and drivers on coral reef degradation

EO contribution: Unique capability to combine oceanographic and land cover data to understand dynamics of coral degradation
Project objective: Improve management of West African EEZs and reduce levels of IUU fishing

EO contribution: Cost effective surveillance tool to detect vessels engaged in fishing and integrate with transponder and license data; additional capability to detect pollution highly appreciated
ESA-WB partnership:
LULC dynamics | platform development
**EO for SDG 11 on sustainable cities and communities**

**Tier 1:** established methodology and data available

**Tier 2:** established methodology but data not regularly produced by countries

**Tier 3:** no established methodology and standards or being developed/tested.


<table>
<thead>
<tr>
<th>SDG #</th>
<th>Urban Indicators</th>
<th>Custodians</th>
<th>Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.1.1</td>
<td>Slums and informal settlements</td>
<td>UN-Habitat</td>
<td>I</td>
</tr>
<tr>
<td>11.2.1</td>
<td>Access to public transport</td>
<td>UN-Habitat</td>
<td>II</td>
</tr>
<tr>
<td>11.3.1</td>
<td>Sustainable urbanisation</td>
<td>UN-Habitat</td>
<td>II</td>
</tr>
<tr>
<td>11.6.2</td>
<td>Urban air pollution</td>
<td>WHO</td>
<td>I</td>
</tr>
<tr>
<td>11.7.1</td>
<td>Urban green public areas</td>
<td>UN-Habitat</td>
<td>II</td>
</tr>
</tbody>
</table>
Target 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

Indicator 11.1.1 “Proportion of urban population living in slums, informal settlements or inadequate housing”
Target 11.3  By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management...

Indicator 11.3.1  “Ratio of land consumption rate to population growth rate”
**Target 11.6** By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

**Indicator 11.6.2** “Annual mean levels of fine particulate matter (e.g. PM2.5 and PM 10) in cities (population weighted)” 

EO-derived parameters

- Annual mean levels of coarse particulate matter (PM10)
- Annual mean levels of fine particulate matter (PM2.5)

Typical Sunday

Typical Tuesday

Aerosol thickness, e.g. optical depth of PM10 and PM2.5 (an indicator of the overall pollution).

Typical spatial resolutions: 1–10 km on a daily basis, with local improvements down to street level when adequate in-situ information and/or modelling is available.

Data: MODIS/Aqua. Processing: Carlo Gavazzi Space / ISAC-CNR.

Fine particulate matter concentrations (2.5 and 10) over cities are estimated through numerical modelling, integrating satellite data (LEO/GEO through AOT assimilation) and in-situ data.
**Target 11.7** By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.

**Indicator 11.7.1** “The average share of the built-up area of cities that is open space in public use for all disaggregated by sex, age and persons with disabilities.”

- Population Distribution and Density
- Transport Infrastructure
- **Urban Green Areas**
- Urban Built-up Extent
- Urban and Peri-Urban Land Cover/Use

---

**Accessibility to green areas | Swedish pilot study, Statistics Sweden and Landmäteriet**

Access to public green areas based on mapping of urban green areas areas and controlled disaggregation of national census data.
• Mainstream & transfer EO into operational working processes of international development – in countries & Multi-lateral Development Banks

• EO as ‘best-practice’ source of environmental information in Environmental Impact Assessment (EIA), Monitoring & Evaluation (M&E) methodologies

• 10 thematic priority areas:
  Urban, Agriculture, Water, Disaster Risk Reduction, Fragile States, Climate Resilience & Proofing, Marine, Forest, Ecosystems, Energy

Longer-term vision
Promoting geo-data literacy and use in international development
New ESA project on “EO for SDGs”

Support GEO, CEOS, ESA/EC and their Member States and the EO community to play a leading role in the full realization of Earth Observations in the 2030 agenda for SDGs.

- Analyze in depth the Metadata Repository of all SDG indicators (169 targets, 230 indicators) and assess the current and potential contribution of EO/Copernicus to the SDG Global Indicator Framework.
- Review the Tier 2 and 3 monitoring/reporting guidelines produced by the custodian agencies for a number of key SDG indicators and propose areas of EO improvements.
- Perform a country demonstration, by partnering with the NSO and the relevant national governmental authorities (for the indicators selected) to support implementation of a number of SDG indicators (at least two).
- Study how the GEO/CEOS/EC/ESA/MSs developed EO collaborative platforms and big data initiatives (data cube) can serve the EO data and information needs of the large community of SDG stakeholders (UN-GGIM, Custodian Agencies, National Statistical Offices, etc.).

EOEP-5, 400 KEUR, 18 months, ITT in 2017 Q3
Earth Observation: A Necessity

Christoph Aubrecht | caubrech@worldbank.org | christoph.aubrech@esa.int
ESA/ESRIN – World Bank

Input from M. Paganini to this presentation is acknowledged and much appreciated