The Future is Now

Dr. Christoph Aubrecht
European Space Agency (ESA)
Directorate of Earth Observation Programmes
ESA Representative to the World Bank

World Bank HQ | Washington DC, 13 Jun 2019

Global Environment Facility KM Advisory Group Meeting

ESA is one of the few space agencies in the world to combine responsibility in nearly all areas of space activity.

* Space science is a Mandatory programme, all Member States contribute to it according to GNP. All other programmes are Optional, funded 'a la carte' by Participating States.
‘Earth Observation’
... from space

Earth observation is the gathering of information about Earth's physical, chemical and biological systems. It involves monitoring and assessing the state of, and changes in, the natural and man-made environment.

-GEO, 2018

"Data and evidence are the foundation of development policy and effective program implementation."
Mahmoud Mohieldin, SVP, World Bank

Role of EO Data supporting this Revolution

Transforming our World: The 2030 Plan for Global Action

Article 76:
... 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 geospatial information, while ensuring national ownership in supporting and tracking progress.

Commonly stated obstacles to the scaling-up and operational use of EO in the global sustainable development agenda

Restrictive data access policies (including cost)
Lack of standardisation of EO data processing methodologies
Not enough "fit for purpose" products
Lack of analysis ready data
Frequency of observations insufficient to track changes at appropriate scales
Needs for continuity of observations and long-term EO programs
Capacity building and training
Insufficient solid track records of successful case studies
Lack of clear and solid user-oriented methods and guidelines
Difficulties to discover and access EO data

"Collecting rich data on the world’s problems is the first step toward fixing them."
Seth Stephens-Davidowitz, former Google Data Scientist

Mobilizing the Data Revolution for Sustainable Dev.
Copernicus 2.0 – New Monitoring Missions

- **CDM** – Anthropogenic CO₂ Mon. Mission
  - Causes of Climate Change
- **LSTM** – Land Surface Temperature Monitoring Mission
  - Agriculture & Water Productivity
- **CRISTAL** – Polar Ice & Snow Topography
  - Effects of Climate Change
- **CIMR** – Passive Microwave Radiometer
  - Sea: Surface Temp. & Ice Concentration
- **CHIME** – Hyperspectral Imaging Mission
  - Food Security, Soil, Minerals, Biodiversity
- **ROSE-L** – L-band SAR Mission
  - Vegetation & Ground Motion & Moisture

New Space in Europe: Distr. systems/constellations

- **ICEYE** –
  - World’s first full-colour video enabled constellation (15 satellites)
  - launched in batches of 5, from late 2019
  - 3 daily revisits
  - [UK], [Finland], [Netherlands]

- **VividX2** (100kg)
  - launched 1/2018
  - World’s first micro-SAR (<100kg)
  - X1 launched 1/2018
  - X2 end 2018
  - Constellation end 2019
  - Hyperspectral payload on board

- **ESA-sponsored GomX-4B**
  - 5 satellites VHR daily revisits mid-2020s
  - [UK], [Finland], [Netherlands]

How to handle all that data

The Value of EO in Decision Making

- **Availability**, **Accessibility**, **Actionability**

Towards efficient data/product access

Open data portal

Welcome to the ESA Open Data Portal. A single point of entry to ESA data. Open, free and ready accessible.

http://sci.esa.int/data
Earth Observation has moved to the cloud

Towards collaborative big (space) data exploitation

"Bringing the users to the data"
- Simplify the extraction of information from EO data
- Enable large scale exploitation of EO data
- Stimulate innovation with EO data
- Foster collaborative action

Platform as enabling mechanism

Earth Observation
Rocket Science?
Yes – but now at everyone’s fingertips!

EO for People & the Planet

EO Supporting Global Policies

Climate Action
- Paris Agreement
- Monitoring Climate Change & Understanding

Sustainable Development
- UN SDGs
- Measuring Development Status & Progress

Disaster Risk Reduction
- Sendai Framework
- Supporting Disaster Resilient Societies

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Platform as enabling mechanism
**ESA approach to Sustainable Dev. implementation**

- **Global Datasets**
- **Methodological Guidelines**
- **Country Support**
- **Capacity Building**
- **Software Toolboxes**
- **Knowledge Transfer & Platforms**

**Key Stakes**

- Access to global / regional datasets
- Support national statistical offices to develop and implement methods
- Support to build infrastructure and capacity
- Training courses and materials
- Critical mass of technical centers
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- Support custodians in developing partnerships
- EO Best Practices

**Selected ESA agriculture initiatives**

- **Sen4Stat**
  - New project
  - Sentinel for Agricultural Statistics
  - Aims at facilitating uptake of EO in NSOs supporting agricultural statistics

**World Settlement Footprint (WSF) Evolution 1985-2015**

- **Shanghai**

- **WSF**
  - Global Surface Waters, JRC
  - Facilitate access to Sentinel data
  - Access to global / regional datasets
  - EO Best Practices / Showcases
  - Methodological guidelines
  - Visualization and Analysis
  - Online processing
  - Toolboxes
  - Knowledge sharing

**National crop mask (Ukraine 2016)**

- National coverage: 603,500 km²
- Field Scale: 10m resolution
- Overall accuracy: 96%

**Contact:**

- mattia.marconcini@dlr.de

**Average building height (120x120m) derived from TanDEM-X IDEM**

- Dongying, China

**World Settlement Footprint (WSF) – 3D**

- Shanghai

**National crop mask (Ukraine 2016)**

- Contains modified Copernicus Sentinel data [2016], credit Sen2-Agri project

**Ukraine 2016**

- Updated mask 2016, data from TanDEM-X IDEM

- Contains modified Copernicus Sentinel data [2016], credit Sen2-Agri project
Winter-Spring Rice 2015/16
- March 2015: 1.7 Million ha rice
- March 2016: 1.4 Million ha rice
- 16.5% loss in rice area due to drought & salt water intrusion caused by El Nino
- 976,000 people affected, 67 Mil.$ estimated damage (UN estimates)

The Mekong Delta, Vietnam
300 km x 300 km, 20 m resolution

Soil Moisture for Drought Monitoring
Anticipated crop failure can be used to predict & prevent famine

"Earth Observation provides [...] an unbiased, consistent and timely perspective that can inform data-driven decision-making. It therefore helps us to achieve our core mission at the World Bank [...] and to better serve our clients.”

Laura Tuck, VP, World Bank

EO for Sustainable Development
Promoting geo-data literacy and use in international development
- 65+ small-scale demonstrations of EO services in support of IFI projects during 2008-2016
- World Bank, ADB, IADB, IFAD, IFC, EIB, EBRD
**Demonstrations linked to International Waters:**
Analyzing drivers of coral degradation

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

EO contribution: Unique capability to combine oceanographic and land cover data to understand coral degradation dynamics

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**EO for Sustainable Development**
Current collaborative IFI initiatives
2016-2022 | 2019-2021

- **Phase 1** (3 years | 2016-2020 | 25 m€): Consolidate Requirements, engage stakeholders (IFI & Client States) via regional demonstrations of EO
- **Phase 2** (5 years | 2020-2024 | tbd m€): Mainstream & transfer EO into operational working processes & financing of ODA/development aid as ‘best-practice’ source of geo-information (M&E, safeguards, etc.)
- **Thematic priority areas & strategic agreements:** Urban Development, Agriculture/Rural, Water Resources, Disaster Risk Reduction, Climate Resilience, Fragility, Marine/Coastal, Forests, Ecosystem Services
**Key findings for the Al Eis irrigation scheme, southwest of Aleppo**

- Cultivated area: reduced by 64%
- Agricultural productivity: reduced by 36% (winter) and 47% (summer)
- Irrigation: in 2016 only 4% of irrigation scheme was used for irrigated summer crops

**Main Thematic Issues**

- Increased productivity of key agricultural commodities, land degradation neutrality, climate-smart agriculture.

**Geographical focus areas**

- Africa (e.g. Sahel, E. Africa Highlands, Horn of Africa, Southern Africa)
- SE Asia (e.g. Vietnam, Hekong Basin, China Hunan)
- Latin America (e.g. Brazil, Nicaragua, Honduras, Brazil, Argentina, Uruguay).

**Main stakeholders**

- IFAD, GEF, World Bank Group, IADB, ADB, UNCCD and their DMCs (Developing Member Countries).

**Existing Initiatives and Platforms**

- WB Sahel & West Africa program (SAWAP),
- UN Land degradation Neutrality (LDN) project,
- WB Global Agriculture and Food Security program,
- Comprehensive Africa Agriculture development program,
- Global Alliance for climate-smart agriculture.

**_baseline products**

- Urban and peri-urban land use / land cover
- Vegetation status
- Water level time series
- Land degradation

**Detailed change**

- Baseline products
- Building footprint
- Population density
- Waste flow
- Informal settlements
- Flood risk
- Landslide risk
- Terrain motion

**EO4SD: Implementation for Agriculture & Rural Dev.**

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**EO4SD: EO Products for Urban Development**

- Green Areas/Networks
- Extent, Imperviousness and Change
- BuildingFootprint
- Population Density
- Waste Flow
- Informal Settlements
- Flood Risk
- Landslide Risk
- Terrain Motion

**EO4SD: Fragility, Conflict, Violence**

- Land degradation
- Informal settlements
- Population density
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Promoting geo-data literacy and use in Intl. Dev.

Why is ESA working with Development Banks?

- Significant investment has been made by Europe in space and associated ground processing infrastructure resulting in massive step change in observing capabilities
- At present this is mainly focused on addressing European stakeholders
- Design and capability of infrastructure ensures capability to acquire large volumes of data over entire Earth and support wide range of monitoring and analyses
- At the same time, ICT developments are supporting step change in processing and analysis capabilities and easier mechanisms to access and analyze satellite data
- In parallel, the international development community is addressing a wider range of new challenges where comprehensive and timely information is becoming more critical
- European countries are the largest donors overall to international development actions – satellite derived information can contribute to ensuring effectiveness of these funds
- ESA is working to integrate the identified technology developments within the Int. Development Banks efforts to address these new development challenges

From Piloting to Mainstreaming

Space for International Development Assistance

Official Development Assistance (ODA) compliance confirmed by the OECD DAC in 6/2018

1. Global Development Assistance
2. Space Partnership
   - Resources
   - Capacity Building & Skills Transfer

Data? Naw, I just trust my gut.
THE DINOSAURS BECAME EXTINCT BECAUSE THEY DIDN'T HAVE A SPACE PROGRAM.

Larry Niven