Earth observations and Geospatial Information for the Sustainable Development Goals

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Workshop for Members of the Caribbean Project and the Americas
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Group on Earth Observations

Intergovernmental organization working to improve the availability, access, and use of Earth obs. to benefit society.

105 Member Countries: A forum for ministerial-level consultation

GEO has convening power and elevates awareness of Earth observations issues from a technical level to a policy level

Maintains a multi-year “Work Programme” as a compendium of projects
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Engagement Priorities

GEO’s global priorities include supporting the UN 2030 Agenda for Sustainable Development, the Paris Agreement on Climate Change, and the Sendai Framework on Disaster Risk Reduction.
What questions do you and your organization have?

- **Discover**
  How do I find Earth observations data and information?

- **Access**
  How do I access Earth observations data and information?

- **Use**
  How do I use Earth observations data and information?
Alignment of Earth Observations to the SDGs

SDGs with most opportunities

2. Zero Hunger
3. Good Health and Well-being
6. Clean Water and Sanitation
7. Affordable and Clean Energy
11. Sustainable Cities and Communities
13. Climate Action
14. Life Below Water
15. Life on Land
17. Partnerships for the Goals
Purpose: Organize and enable the potential of Earth observations and geospatial information within GEO to advance the 2030 Agenda and enable societal benefits through achievement of the SDGs.

Key Emphasis: Collaborations with global statistical community, NSOs, line ministries, custodian agencies. Also, communication role in a federated approach to GEO community.

» Projects
Develop, validate and deploy uses of Earth observations to support SDG tracking and reporting

» Capacity Building
Build skills for accessing and applying Earth observations data

» Data and Information Products
Advance discoverability and accessibility of products

» Outreach and Engagement
Promote the consideration and adoption of Earth obs. for the SDGs
Earth Observations, an essential source of information for the SDGs

- Land Temperature
- Sea Surface Temperature
- Vegetation
- Sea Surface Salinity
- Total Rainfall
- Aerosols
- Fires & Thermal Anomalies
- Chlorophyll
- Sea Surface Height
Argo floats are used to observe the ocean [image from Commonwealth Scientific and Industrial Research Organization]

Space-based Satellites

Airborne

Ground-based

In Situ

The GOES-R Series—a collaborative program between NASA and NOAA.

Ground-based instruments used to observe precipitation include rain gauge tipping buckets, cylinders, and disdrometers & radar systems [top]

A sensor pod from NASA – Jet Propulsion Laboratory

Researchers with the University of Alaska-Fairbanks (UAF) use small aircraft such as the Havilland DHC-3 Otter. Credit: UAF
Alignments of the Goals with specific types of Earth observations and geospatial information.

“Population distribution” and “Cities and Infrastructure Mapping” are important to indicators and decision making related to all 17 Goals.
Health & Cities +2, +3

Sustainable urban planning, and decent and affordable housing support mental health and access to health services, reduce non-communicable diseases and limit environmental impacts.

Directionality: Unidirectional

Food Security & Life on Land +2, +1, -2

Sustainable agricultural systems and practices contribute to ecosystem health. However, increased agricultural production and productivity, if not sustainable, can result in deforestation and land degradation.

Directionality: Mostly bidirectional
What is the EO community’s role in the SDG landscape?

- Country Support (NSO, line ministries)
- Custodian Agencies Support
- EO Toolboxes and Platforms
- Scaling of EO Methods
- Global to National Datasets
- Capacity Building
- Best Practices & Lessons Learned
- Monitoring and Reporting
- Effective Partnerships
Earth Observations and the SDGS

Examples of EO applications for SDGs

NASA Earth Science - ARSET Program
In the context of DANE’s Smart Data strategy, which aims to strengthen statistical production and dissemination by using new sources and methods, efforts are focused on using EO and geospatial information for SDGs.

- **SDG Indicator 11.3.1**: Use of Landsat images to calculate land consumption rate.

- **SDG Indicator 9.1.1**: Use of Landsat images to estimate more accurately the influence area of 2 km of the roads in rural areas, considering obstacles (like water bodies).

- **Proportion of the rural population who live within 2km of an all-season road**

- **Ratio of land consumption rate and population growth rate**
15.3.1. Proportion of land that is degraded over total land area

- Good Practice Guidance produced by UNCCD
- National official data sources, complemented by EO.
- EO Data: Land Cover – NASA (Landsat, MODIS), USGS (Landsat), ESA (Land Cover CCI); Land Productivity Dynamics (LPD) – JRC; Soil Organic Carbon (SOC) - International Soil Reference and Information Centre
- UNCCD - GEO LDN Initiative: regional capacity building, federated collaborative platforms, international standards

Out of the 113 countries that have committed to set LDN targets, 64 countries have already established a baseline
15.3.1 – Land Degradation Monitoring Tool

- GEF-funded project.
- Initial Focus: Senegal, Tanzania, Uganda, Kenya
- EO Data: AVHRR, MODIS (NDVI), GOME-2 (chlorophyll fluorescence), MERRA-2 (soil moisture), Landsat 8, Sentinel 2A & 2B, 50 cm commercial satellite data
- Open source platform, qGIS, GEE

Above: A screenshot of the Trends.Earth tool in use. Provided by Tristan Schnader, Vital Signs Senior Project Manager at CI.

Pilot Country Workshops & Lessons Learned
Guidelines on dataset standardization to allow for valid comparisons • Request for finer spatial res. EO, preprocessed and ready for analysis • Need for further capacity building around indicators & tools • Internet access could limit usefulness of fully online platforms
End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Market Monitor:
Operational monthly bulletin for primary crop types for 49 countries

Four main crops: Rice, Wheat, Maize, Soybeans

EO Data Use
- Satellite baseline datasets - GEOGLAM Crop Calendars and Crop Masks
- Satellite observations of land - NASA & USGS (MODIS, Landsat, SMAP), ESA (Sentinel-1, Sentinel-2, Sentinel-3), CSA (Radarsat-2, RCM), JAXA (GCOM-C, ALOS-2), DLR (TerraSAR-X, TanDEM-X), CNES (Pleiades)
- In-situ & agrometeorological data sets
- Novel crowd-sourced information – GEO WIKI

Crop condition map synthesizing information for all Crop Monitor for Early Warning crops as of June 28th.

https://cropmonitor.org/
End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

Proven value
The Kenyan Crop Monitor will provide early warning of crop failure related to drought and other risks, giving the government time to take preemptive action to protect livelihoods and ensure food security during food crises.

Global support for national agricultural monitoring
GEOGLAM provides national partners with methods and tools to develop and manage national crop monitors, and then transitions the tools to be managed nationally. The information produced by the governments then informs global assessments for food security and markets.

Kenya National Crop Monitor Crop condition map showing crop conditions information in Kenya regions as of 23rd May 2018

https://cropmonitor.org/
Track and Predict the Risk of cholera in Haiti following Hurricane Matthew

Application of Earth observations for connecting large-scale hydro-climatological processes with cholera occurrence in epidemic regions

Types of Data used

TRMM/GPM: Precipitation
NCEP/NCAR: Air Temperature
GPM: Precipitation
GPWv4: Population Density
National Hurricane Center: Track points, wind swath
Grand Valley State University Program of Safe and Sustainable Water for Haiti: Administrative Boundaries, roads, river data

Risk of epidemic cholera is high (red) if heavy precipitation follows persistent warm temperatures in regions with poor or damaged water and sanitation infrastructure. (Credit, Jutla and Colwell)
Population Exposure to Air Pollution: NO$_2$ and PM$_{2.5}$

Global Annual Average PM$_{2.5}$ Grids from MODIS and MISR Aerosol Optical Depth (AOD), 2010: Asia

Satellite-Derived Environmental Indicators

The Global 3-Year Running Mean Ground-Level Nitrogen Dioxide (NO$_2$) Grids from GOME, SCIAMACHY and GOME-2 are part of the Satellite-Derived Environmental Indicators collection. This data set represents a series of three-year running mean grids (1996–2012) of ground level Nitrogen Dioxide that are derived from Global Ozone Monitoring Experiment (GOME), SCanning Imaging Absorption SpectroMeter for Atmospheric Chartography (SCIAMACHY) and Global Ozone Monitoring Experiment-2 (GOME-2) satellite retrievals. This map displays 3-year mean satellite-derived NO$_2$ concentrations measured in parts per billion (ppb) at a spatial resolution of 6 arc-minutes (0.1 degree or approximately 10 km at the equator) for the years 2010 to 2012.

Earth observations, models & technology applied:

- NASA’s Black Marble product suite (VNP46) | Source: NASA-GSFC
- Gridded Population of the World (GPW), v4 | Source: NASA-SEDAC
- Global Urban Footprint Data | Source: DLR
- Landsat 8/OLI and Sentinel 2-MSI Data | Source: USGS/ESA
- In-situ data collected during field experiments | Source: UFS/Puerto Rico
- Open Street Map GIS Layers | Source: OSM


Courtesy: Miguel Roman, NASA
High quality Global Data Sets at high resolution (10-30m)
Monitoring urban development

WSF evolution

Courtesy: Marc Paganini, ESA
CEOS EO Handbook on SDGs
http://eohandbook.com

Part I
role of EO data in support to the SDGs

Part II
Stakeholders’ perspectives on EO for the SDGs

Part III
Examples of EO contribution to SDG Targets and Indicators
EO4SDG

EARTH OBSERVATIONS FOR THE SUSTAINABLE DEVELOPMENT GOALS

http://eo4sdg.org
Twitter: @EO4SDG

Upcoming Events

SDG Training Workshop at UN-GGIM B
This two-day workshop, given in the context of the Eighth session of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM B) on July 30-31, 2018, aims to illustrate the potential and current uses and applications of

Featured Projects

Integration of Earth Observations and National Statistics for the SDGs in Colombia
Several national agencies in Colombia are working to integrate national statistics, household surveys, and routine administrative data with Earth observations, geospatial information, and other data to monitor and implement the SDGs at country level. Colombia has successfully implemented several projects...

Latest News

CEOS Earth Observation Handbook
The Committee on Earth Observation Satellites (CEOS) released the CEOS Earth Observation Handbook for the

Using satellite-based Earth observations to monitor SDG 6 indicators
In collaboration with GEO and space agencies such as NASA, ESA and JRC, the UN Environment has initiated efforts to provide countries with Earth observation products that can be used with
Earth Observations and the SDGS

Examples of EO applications for SDGs

NASA Earth Science - ARSET Program
Basic and applied research to advance knowledge about the Earth system

Innovative and practical uses of Earth science data to inform decisions and benefit society
NASA Earth Science
Current Operating Missions

- CYGNSS (8)
- NISTAR, EPIC (DSCOVR / NOAA)
- QuikSCAT
- Landsat 7 (USGS)
- Terra
- Aqua
- CloudSat
- CALIPSO
- Aura
- SMAP
- Suomi NPP (NOAA)
- OSTM/Jason-2 (NOAA)
- Landsat 8 (USGS)
- GPM
- OCO-2
- SORCE, TCTE (NOAA)
- ISS: LIS, SAGE III, TSIS-1
- InVEST/CubeSats
- RAVAN
- IceCube
- MiRaTA

02.21.18
ARSET
Applied Remote Sensing Training

http://arset.gsfc.nasa.gov

» Professional-level trainings
» Online webinars and In-person events
» Hands-on, guided computer exercises
» ~18 trainings throughout the year
ARSET

Applied Remote Sensing Training

http://arset.gsfc.nasa.gov

» International audiences
» Basic and Advance level courses
» No prior remote-sensing or Earth observations knowledge needed
» Past trainings archived
ARSET: 2018 Training

PAST

Tools for High Resolution Air Quality Datasets, January
Accuracy Assessments, February
Introduction to Hydrological Modeling Using Remote Sensing, February
Advances in Remote Sensing for Scenario-Based Ecological Forecasting, March
NASA Remote Sensing for Air Quality Applications, March
Monitoring Tropical Storms for Emergency Preparedness, May
Satellite Remote Sensing of Dust, Fires, Smoke, and Air Quality, July
Techniques for Wildfire Monitoring & Detection, July

UPCOMING

Applications of Synthetic Aperture Management, August
NASA Remote Sensing for Urban Flooding, August
Air Quality Measurements for Geostationary Platforms, August
Advanced Change Detection with Google Earth Engine, September
Water Quality Monitoring Using Remote Sensing Observations, September
WEBINAR TRAINING

Satellite Derived PM2.5 Data Sets in Support of SDGs 3 & 11

March 2017; English, Spanish

Three-session training:
Satellite observations of air quality associated with SDG Indicators 3.9.1 and 11.6.2; WHO PM2.5 data set; case study and mapping exercise.

Satellites & sensors: Aqua, CALIPSO, MISR, MODIS, Terra

WEBINAR TRAINING

Remote Sensing of Land Indicators for SDG 15: 15.1.1 & 15.3.1

June 20-22, 2017; English

Three-session training:
Satellite observations of land cover; image classification, change detection, and techniques for developing accuracy assessments.

Satellites & sensors: Landsat, MODIS, Sentinel 3, Suomi NPP/VIIRS
International: Trainings on Earth Observations & SDGs

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391 attendees; 298 organizations; 61 countries

“I work in the science division at an NGO, identifying natural habitats that will help communities and countries meet their SDGs. My interest in these datasets are to look at any potential linkages between habitat degradation and air quality. One of our areas of interest is Singapore, whose air quality has been affected by deforestation in Indonesia.”

“[I] assist in coordination of SDG 11 related events: Workshops, review of metadata, development of training toolkits (SDG 11 indicators). The webinar is important in terms of development of training toolkits, alternative methods of data collection.”

https://arset.gsfc.nasa.gov/
Applied Remote Sensing Training

http://arset.gsfc.nasa.gov

EO4SDaaG

http://eo4sdg.org
Thank you!

Lawrence Friedl, NASA & EO4SDG Initiative, Lfriedl@nasa.gov
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Earth observations can contribute to progress on many more Targets than Indicators

11.4: Strengthen efforts to protect and safeguard the world’s cultural and natural heritage

11.4.1: Total expenditure per capita spent on the preservation, protection & conservation of all cultural and natural heritage

13.3: Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

13.3.1: Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
DeMo-Wetlands Project

**Project key facts**
- 400,000 EUR budget
- 3 years duration (starting from 1. April 2016)
- 2 partners – cooperation with African partners
- Free and open data policy
- Development of tools and national demonstrator

- Demonstration of satellite-based **wetland monitoring on national level** in Rwanda
- Development of **Wetland EO Tools and Products**
- Automated wetland EO processing chain

**DeMo-Wetlands team:**

**Contact:** Adrian Strauch (astrauch@uni-bonn.de)
DeMo-Wetlands Project, Rwanda

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