GEO SDG Toolkits: A Concept Paper

Background

While Earth Observations (EO) are a critical data source for monitoring and driving progress against the Sustainable Development Goals (SDGs), UN member states do not always recognize or have the capacity to leverage this value. The GEO EO4SDG initiative plans to develop online toolkits, encompassing relevant EO datasets, available tools and platforms, training material, as well as use cases and national experiences per SDG theme, target, and indicator supported by Earth observations (EO). These materials will be presented in an openly accessible manner via the EO4SDG website and leverage existing or planned systems such as the GEOSS portal and the GEO Knowledge Hub. The tooklits may also be linked with other relevant sites (e.g., UN Biodiversity Lab, IOC/UNESCO Ocean Best Practices). The primary purpose for developing these toolkits is to provide methodological advice and practical guidance on EO approaches, and assist governments in designing and applying EO-integrated SDG methodologies and more effective and timely policy responses.

The EO toolkits will complement guidance published by the UN custodian agencies and will be produced in alignment with these efforts, particularly focusing on the integration of remotely sensed and ground-based EO data with national statistics, socioeconomic data, and other ancillary information. Furthermore, these e-materials are intended to facilitate knowledge sharing, interlinking national experiences, and foster understanding between technical analysts and decision makers of the role and contributions of EO in tracking progress, monitoring, reporting, and implementing the SDGs. They will also demonstrate case studies where EO is already used in SDG monitoring.

The toolkits will serve as a guide and first step for countries and relevant stakeholders interested in learning about examples of where others are applying EO to track and drive progress against relevant SDG targets and indicators. Furthermore, these toolkits will provide an innovative form of knowledge and expertise exchange and promote South-South cooperation.

Overall Goal

Provide coordinated and sustained information about the use of, and access to, EO for SDGs at various levels of planning, monitoring, tracking, and reporting.

Who is it for?

National Statistical Offices (NSOs), National Mapping Agencies, line ministries, international statistical agencies, SDG custodian agencies, key national EO players (including GEO offices/structures), and other major groups and stakeholders of relevance.

Why is it needed?

To fill a current gap in value demonstration and practical guidance on using EO for SDG planning, tracking, monitoring, and reporting in a timely manner, with a particular focus on integrating remotely sensed data with ground-based observations and ancillary data sources. The toolkits will complement methodological guidance and metadata published by SDG custodian agencies, and will be produced in collaboration with these efforts.

Which will be the principal toolkit components?

1) **Institutional Arrangements:** Provide overview of key organizations, initiatives and other stakeholders involved in SDG method development, data collection, monitoring, verification, and reporting. *Note: SDSN TReNDS is working on a project titled, Contracts for Data Collaboration, which can contribute to this component.*

2) **Relevant sources of EO data:** Provide information on relevant EO data and their source options and how these can support the SDG theme and related indicator(s), core information products, analysis-ready data (ARD) such as the CEOS ARD for Land (CARD4L) and EO-based ancillary information (including details on frequency of production, coverage, source(s), other). Data formats must be in compliance with the GEO criteria and policy. *Note: CEOS is planning a detailed assessment of satellite data requirements for the production of a number of SDG Indicators, a contribution to this component.*

3) **Practical guidance on methods:** Include methods (e.g., an 'A to Z' guide) to enable end-users to: understand how they can use EO data to inform relevant SDGs, targets and indicators (including indicator refining and disaggregation, baseline setting); identify which services may be useful based on their needs and priorities; which methods or sources can be used to obtain the data; what sources of complementary data are essential (e.g., in situ data from citizen science, modelled data); and how to communicate the results. This component will also include scientific publications as well as links to special issues of scientific journals.

4) **Guidance on methods** for supplementary indicators using EO that indirectly support the monitoring, interpretation, decision making, and ultimate achievement of the official indicators.

5) **Practical guidance on tools and platforms**: Provide information on existing tools and platforms, including guides on how to use these as well as information on any associated requirements (e.g., system specifications, technical capacity). *Note: CEOS is planning a review of EO-enabling infrastructures available in CEOS agencies, which will contribute to this component.*

6) **Guidance on data validation approaches**: Provide guidance on how to customize and test the applicability of data and methods to local conditions. Include information on past, ongoing and planned pilots for validation and testing of methodologies and EO data, including insights on how the data is being assessed for uncertainties (i.e., by comparison with ground reference measurements). Traditional survey data captured by NSOs may offer suitable field validation data in some cases.

7) **Use cases, good practice examples:** Include stories and testimonials at local, subnational, national, regional, and global levels. Provide information on level of maturity (in terms of method maturity, EO usability in SDG processes, institutional maturity, adoption, sustained use). Describe the relevant involvement of national statistical office, line ministries, and other key stakeholders.

8) **Training Material**: This will include tutorials, online videos, outputs from panels, workshops, massive online open courses (MOOCS).

9) **A Data to Decisions Framework**. Develop an adequate framework to support countries in addressing their national priorities and international (2030 Agenda, other regional or global policy frameworks) commitments.
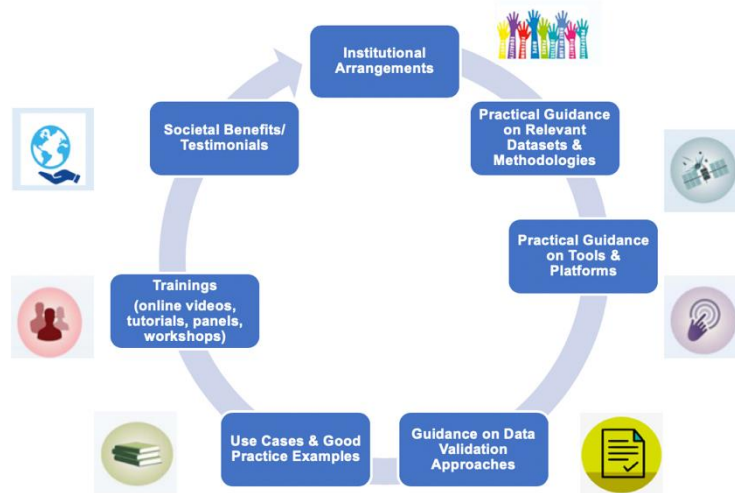

Figure 1. Schematic Representation of EO Toolkits for SDG themes, targets, and indicators

Who can get involved?

EO4SDG is initiating the development of the GEO SDG toolkits in close collaboration with SDG custodian agencies, GEO thematic and regional Work Programme Activities, the GEO Secretariat, GEO members (via PIs, national GEO structures), GEO Participating Organizations, and other stakeholders interested in getting involved. We are seeking GEO member countries interested in piloting the development of these toolkits for specific targets and indicators, tailored to their needs and priorities. Lastly, we invite the GEO community to share good practice examples of EO uses to inform SDG monitoring and reporting, and support relevant decision making.

What are key web site elements for these toolkits?

1. A landing page that explains the purpose of the toolkit and search capabilities. This will include:
   - Search by SDG target, indicator, thematic area (e.g., water, forest, coastal), country (list and clickable map), success stories (list and clickable maps). We will also consider interconnected themes and how EO can help monitor and manage SDG links more holistically (e.g., by identifying EO products (e.g., land cover, land use change maps) that can serve multiple SDG targets and indicators. *Note: CEOS has proposed and offered to develop and provide a list of multipurpose EO products.*
   - Additional resources such as links to: 2017 Report on Earth Observations for Official Statistics, Compendium on EO Contributions to SDG Indicators, RSE and RS Special Issues, AGU Book on Earth Observation Applications and Global Policy Frameworks, among others.

2. Within each SDG thematic area or indicator, include sub-page with a list of available datasets, methodologies, tools, and platforms. These sub-pages will include:
   - Links to available datasets, methods, and tools. Some examples of tools and platforms include, among others: Trends.Earth, Global Forest Watch, SDG661.App, Global Mangrove, WatchGFOI methods and guidance, Collect Earth, Google Earth Engine Forest Monitoring Toolkit, Notebooks for CEOS Open Data Cube (existing for 3 indicators), SMURBS/ERA Planet platform.
   - Summary information about the tools including who developed these; the EO data used; the associated evaluation and validation processes; the extent of current uses; as well as guidance on how these tools and methodologies can be used for SDG planning, monitoring, reporting, and implementation. Here, we plan to include the level of feedback from custodian and partner agencies.
   - Discussion of differences and/or added value of respective tools and platforms when addressing the same target(s) or indicator(s), including information on approach particularities, such as data availability, unique country aspects.
3. The country and success stories sub-pages will include good practice examples of methods for SDG targets and indicators. These pages will link to:
   - Good practice examples of methods and case studies driven by GEO Flagships, Initiatives, Community Activities. Some examples include but are not limited to the following efforts:
     - The *GEO Human Planet* initiative, including a number of partners from the European Commission's Joint Research Center (JRC) and Columbia's Center for International Earth Science Information Nerwork (CIESIN), has agreed to make available existing tools developed within the initiative to support SDG monitoring and reporting. These include: the Global Human Settlement Layer (GHSL) tools and datasets; documentation on the use of these tools; and license agreements or other permissions clarifying usage rights. In addition, the JRC will contribute knowledge and share experiences from trainings they have conducted with UN Habitat and in collaboration with officials representing statistical departments from 85 countries on the new definition of cities and rural areas. One component of this definition provides the spatial outlines of all cities in the world and can be used to inform the denominator of SDG 11, Sustainable cities and communities, indicators.
     - The *Global Forest Observations initiative* (GFOI) has offered to develop one or more pilots in Latin America on institutional arrangements for the development of data for different applications, including SDG and Nationally Determined Contributions (NDC) reporting. These pilots will provide case studies for the GFOI methods and guidance and their applicability in support of related SDG targets and indicators, and will serve as a contribution to the toolkits.
     - The *GEO Blue Planet* initiative is working with UN Environment to develop a methodology for measuring coastal eutrophication. GEO Blue Planet is also working with Esri to analyze and visualize satellite chlorophyll-a data in support of indicator 14.1.1, Index of coastal eutriphication and floating plastic debris density, monitoring and reporting.

- o The *GEOGLAM* initiative is working to identify essential agricultural variables (EAVs) including ones with a clear policy link (or multiple links). A recent publication "No pixel left behind" provided a mapping of existing SDG indicators to GEOGLAM and related activities, including a characterization of the status of the indicator in the UN system and its inclusion/exclusion of satellite-based EO, as well as the potential use of satellite-based EO. Additional contributions may include the development of a pilot (or pilots) to enable broader EO use for SDG targets and indicators (examples include SDG indicator 2.4.1, sustainable agriculture, 6.4.1, water use efficiency) by working with agricultural statistics groups (including several NSOs) and in collaboration with SDG custodian agencies (e.g., FAO).
  - o The *GEO Wetlands initiative* will support the development of GEO SDG toolkits based on their work in developing knowledge hub on wetlands, including coordinated efforts on monitoring mangroves.
  - o Additional GEO Work Programme Activities contributing to the GEO SDG toolkits will include, among others: *GEO LDN, EO4HEALTH, EO4EA, GEOVENER, GEO CRADLE*
- Case studies and lessons learned from projects led or supported by EO4SDG and broader GEO contributors (e.g., Principal Investigators (PIs), national GEO offices/structures)
  - o Example of SDG indicator 11.6.2 (annual means of PM2.5 in cities) platform developed through the SMURBS project utilizing EO data from the Copernicus Programme (http://apcg.meteo.noa.gr/sdg1162/)
  - o Case studies and lessons learned from 12 NASA-funded projects on SDGs 14 (life below water) and 15 (life on land).
  - o Other case studies
- Examples shared by GEO member countries and Participating Organizations (POs)
  - o Use cases collected from GEO Survey on EO for SDGs (e.g., New Zealand, Germany, Australia, Canada, Colombia, others)
  - o Use cases or examples collected by GEO SDG Awards Programme
  - o Good practice examples from CEOS agencies (through the work of the CEOS SDG Ad Hoc Team)
  - o Other examples
- Examples of where EO data is already integrated in global SDG methodologies and official reporting

Some Examples of Operational Tookits

1. SDG Monitoring and Reporting Toolkit for UN Countries: https://unstats.un.org/sdgs/unct-toolkit/
2. REDDcompass: https://www.reddcompass.org/frontpage
3. SDG Toolkit tailored to European NGOs: http://sdgtoolkit.org/
4. SDG Helpdesk – UNESCAP: http://sdghelpdesk.unescap.org/toolboxes
5. USAID Monitoring, Evaluation, and Learning Toolkits: https://usaidlearninglab.org/mel-toolkits
6. Ocean Best Practices System (OBPS) – IOC UNESCO: https://obpsystem.org