

Raising the profile of in situ data within the Group on Earth Observations (GEO):

It's not all about satellite-based observations!

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GEO: International Collaboration on Earth Observations

- What is the Group on Earth Observations (GEO) ?

- International network of member government institutions, partner organizations, and associate commercial entities
- Working collaboratively to leverage Earth observations, and related data products and services, to improve the sustainable development and management of the environment.

- How does it operate?

- Nominated representatives serve on the GEO Executive Committee, Programme Board, and within Working Groups.
- Work Programme activities and Working Groups address specific topics utilizing EO data



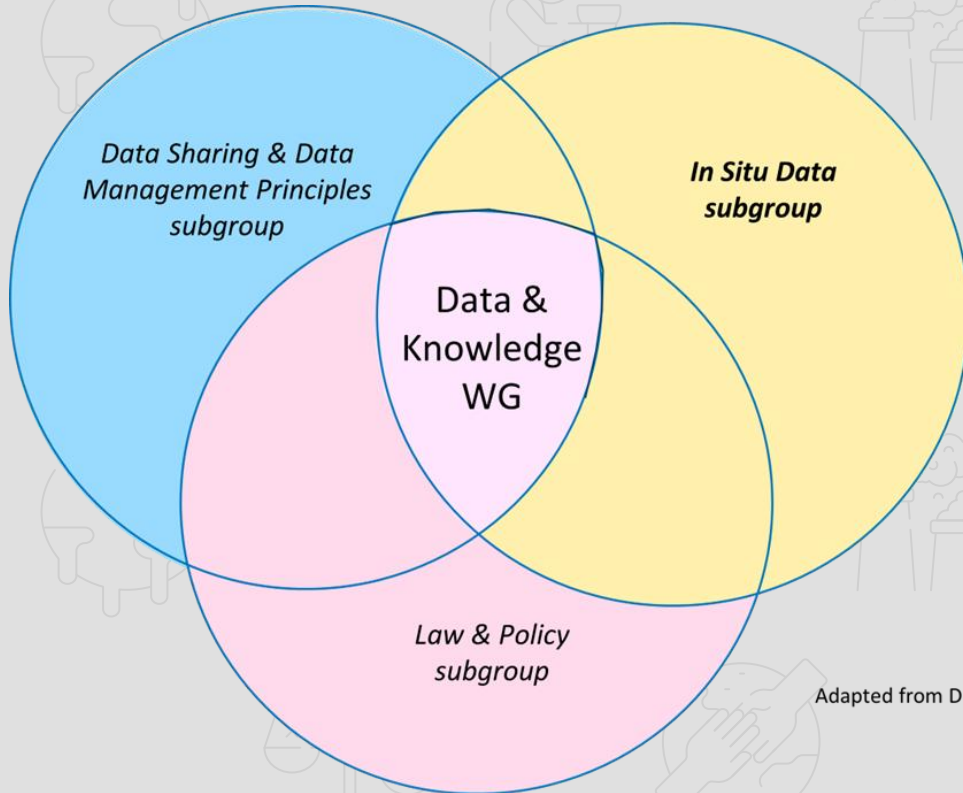
GEO: Data & Knowledge Working Group

Working with community to address data policy, ethics, and governance issues to improve the use of Earth observation data and knowledge by:

- promoting the adoption and implementation of good data management practices including widely adopted practices and principles including FAIR, CARE, TRUST and GEO Data Sharing and Data Management Principles;
- recommending ways to advance interoperability of Earth observation data and associated products and services
- advancing discussions of critical data-related topics with stakeholder communities



GEO: Data & Knowledge Working Group



Adapted from Downs, 2023

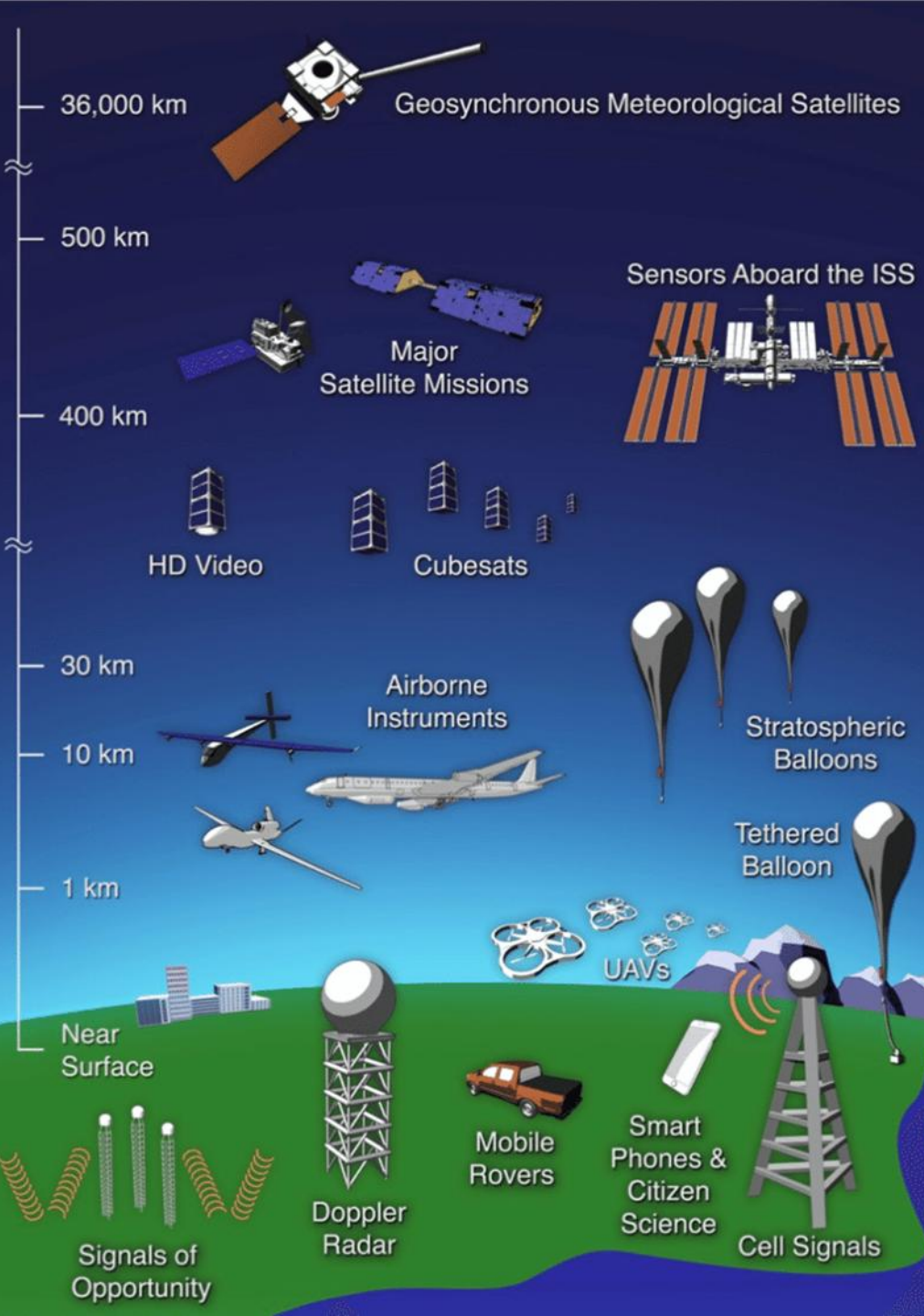
- Newly established Data Working Group (2020) identified key action areas:
 - **In-situ data**
 - **Data ethics/law/policy**
 - **Data sharing and data management principles**
- GEO Mid-Term Evaluation (2021) called for improved availability and integration of in-situ data through the implementation of the GEOSS Data Sharing and Data Management Principles
- Emphasised need for a **GEO in-situ data strategy**

More information on GEO Data & Knowledge Working Group and component subgroups:
https://earthobservations.org/data_wg.php

In-Situ Data subgroup: priorities



- Characterisation of the in-situ data landscape including:
 - Identifying common barriers to data sharing and re-use
 - Mapping/gap analysis of in-situ data providers within GEO community
 - Engaging with existing networks focused on domain level coordination of in-situ data
 - Engaging with GWP activities to identify specific challenges, data gaps and priorities
- Developing a first set of strategic objectives and advancing an in-situ data strategy for GEO



Why are in-situ Earth observations important?

- essential for calibrating and validating remote sensing products and Earth system models: the “ground truth”
- provide measurements in locations not accessible by space-based observing systems e.g. the deep oceans, areas affected by clouds, aerosols, etc.
- often measure significant variables in the Earth system directly impacted by human activities
- have a temporal and spatial distribution / resolution allowing more accurate and frequent measurements
- provides longer time series that include historical measurements over decades and centuries
- only legally admissible form of EO data in certain situations e.g. prosecutions relating to damage of natural habitats in some countries

Large range of disciplines with different in-situ data acquisition activities

Current Landscape of Ground-based Earth Observations



Hydrology



Climatology



Oceanography



Biodiversity

Creates a highly heterogenous data landscape

Efforts to create and adopt standards are limited, creating a fragmented landscape with significant gaps in some areas



GEO WEEK 2019
MINISTERIAL SUMMIT
4 - 9 NOVEMBER / CANBERRA, AUSTRALIA / #GEOWEEK19

The Group on Earth Observations (GEO)
Canberra Declaration
Canberra, Australia 8 November 2019

We, Ministers of GEO Members and Ministerial representatives, convened the 2019 intergovernmental Group on Earth Observations (GEO) Ministerial Summit in Canberra, Australia on 8 November 2019. We **note** with appreciation the valuable contributions made by other attendees at our Summit, including representatives of new and existing Members, Participating Organizations and GEO Associates. We:

1. **Reaffirm** the status of GEO as a voluntary and non-legally binding intergovernmental partnership. **Highlight** GEO's unique global role in driving cooperative action and decision making by Members enacting upon our vision of a world where decisions and actions are informed by coordinated, comprehensive and sustained Earth observations.
2. **Welcome** the ongoing work of the GEO community to deliver its mission by developing a Global Earth Observation System of Systems (GEOSS) that connects and integrates the Earth observation efforts of each nation for the benefit of humanity.
3. **Welcome** the progress made to implement the *GEO Strategic Plan 2015-2020*. **Recognise** the progress made to implement the *GEO Strategic Plan 2015-2020* at the 2015 GEO Ministerial Summit in Mexico City. **Recognise** the success of the GEO community in driving progress in the policy areas we highlighted, including the use of Earth observations to address sustainable development, disaster risk reduction and climate change.
4. **Note** that in addition to the priority engagement areas currently being implemented, we maintain our strong support for the broader goal of GEO to ensure that Earth observations benefit to all sectors of society.
5. **Recognise** the *GEO Report on Impact 2016-2019*, which highlights the impact of GEO's activity and impact, including the GEO community's work on issues such as land degradation, urbanisation and disaster risk reduction.



13. **Recognise** the critical role that data collected from the atmosphere, land and water (in-situ data) plays in achieving GEO's mission, but **note** that sharing of such data is limited and there remain significant gaps in the global observing system. **Call upon** the GEO community to develop a strategy to address the challenges in this area and to demonstrate progress in implementation.

In-Situ Data strategy: overarching goals

- Increased **coordination** of in-situ data providers, mobilization of GEO members and Participating Organizations, engage with in situ data users, and **advocate** for in-situ open data and knowledge
- Foster a change in the mindset of the global GEO community (and more widely) by ensuring **in-situ data sharing and management** is an integral part of all relevant research activities
- Support this approach by **delivering the tools, polices and practices** needed to maximise in-situ data sharing and integration



In Situ Data Strategy: objectives

Coordinate with existing national and regional in-situ data networks across different geographical areas and by domains with the aim of:

- **Defining and mapping** the existing in-situ data landscape
- **Identify and monitor** user requirements for discovering, accessing and re-using in-situ data for different applications at a range of scales from the local to the global
- **Determine the barriers** to delivering open access in-situ data that respects the relevant data management principles, e.g., FAIR, CARE etc., and practices
- **Promoting sustainability** and improving existing observing networks
- Identifying **existing gaps** in observing systems and **advocating** for development of new monitoring networks



In-Situ Data strategy: approach

- Foster common data management practices and standards
 - Data standards e.g. OGC, ISO, community
 - FAIR, CARE, TRUST Principles
 - GEO Data Sharing and Data Management Principles (DS&DMP)
- Provide the tools needed to support the access, integration and re-use of in-situ data and knowledge
 - GEO Knowledge Hub
 - G-REQS
 - Libinsitu



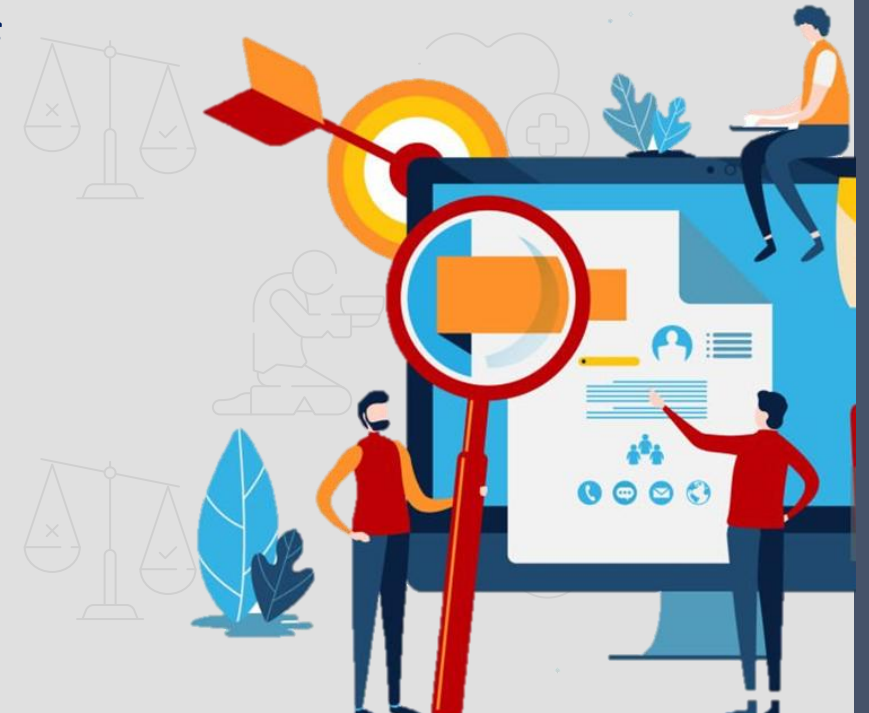
GEO Knowledge Hub

- Part of the GEO infrastructure supporting the advancement of open data and knowledge
- Cloud-based digital library providing knowledge packages derived from various GEO Work Programme and Working Group activities
- Knowledge Packages include all the resources used to create individual products and applications
- Includes functionality to support version control and assign DOIs
- Designed to allow end users to fully understand the available products and applications, and support appropriate re-use



G-REQS: Geospatial in-situ REQuirementS tool

- Tool and methodology to:
 - collect user needs for in-situ data, especially related to GEO Work Programme (GWP) activities
 - connect user requirements with potential data providers
 - highlight barriers to the discovery, access and use of in-situ data, services and products
 - identify potential gaps in existing ground-based observing system
 - provides basis for development of GEO policies and practices e.g. in-situ data strategy



Libinsitu:

- open-source Python library to transform heterogeneous raw in-situ time series measurements into binary CF convention compliant NetCDF files
- Provides CLI utilities and Python functions to:
 - Explore and query NetCDF files
 - Export data to various formats (CSV, JSON, etc)
 - Provide quality flags
 - Graphical data representation for quality control



In Situ Data Strategy: implementation

- Adoption and endorsement by GEO Programme Board (October 2025)
- Planned actions to raise awareness and foster adoption
- Leverage the GEO infrastructure, and promote adoption of common data management practices
- Community engagement at national, regional and global level
- Requires range of actors including GEO members, Work Programme (GWP) activities, regional and national GEOs etc.
- Wider community engagement to encourage alignment of data management practices



Final thoughts.....

- Significant data management efforts are essential to support standardization, harmonization, and integration of in-situ data with the aim of:
 - effectively consolidating different datasets to fulfil the needs of users
 - responding to new and emerging technologies e.g. artificial intelligence (AI), machine learning etc.
- Diversity of in-situ data necessitates considerable investment of resources in curation and archiving to ensure its availability, usability and accuracy
- Wider implementation of standardised data management practices are essential to maximize re-use of in-situ data



Final thoughts.....

As an intergovernmental organization, GEO is uniquely placed to:

- foster open and equitable sharing of in-situ data from the national to global scale
- reduce and remove the barriers to sharing of Earth observation data
- maximise the potential benefits that EO data can deliver for science and society, ensuring.....

Earth Intelligence For All!



Thank you!

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Working Group



*For more information
about GEO*