Community Event 19

Assessing the Impact of EO Solutions and Mapping Future Benefits, Needs and Requirements

"The Earth Talks"

GEO GLOBAL FORUM

ROME, Italy 5-9 MAY, 2025

HOSTED BY

Agenzia Spaziale Italiana

CO-SPONSORED BY

European Union

April 2025

GLOBAL FORUM
"The Earth Talks"

Session 19:
Assessing the Impact of EO Solutions and Mapping Future Benefits, Needs and Requirements

06 MAY 16:00-17:30 CEST

This session proposes a reflection about how to demonstrate the impacts of GEO solutions to improve the uptake of the derived services and the definition of improved services and products for the future

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06 MAY 16:00-17:30 CEST

Wenbo Chu
GEO Secretariat

Alessandra Tassa
European Space Agency

Geoff Sawyer
European Association of Remote Sensing Companies

Mark Dowell
European Commission

Hendrik Hamacher
European Space Agency

**Christina Griffin (Australian National University) excused*

Agenda

- Introduction and context – Wenbo Chu, GEO Secretariat
- An EO Impact Assessment Toolkit for GEO – Alessandra Tassa, ESA
- Panel 1: Using impacts to demonstrate the benefits of GEO initiatives
  Open discussion with representatives from GEO initiatives GEOGLAM, GEO Blue Planet, GEO LDN - Moderated by Geoff Sawyer, EARSC
- Panel 2: Using impacts to assess future needs of GEO
  Open discussion with representatives from GEO Members - Moderated by Mark Dowell, European Commission Joint Research Centre
- Closing remarks

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GIAT
An EO Impact Assessment Toolkit for GEO

"The Earth Talks"

GLOBAL FORUM ROME, Italy 5-9 MAY, 2025

Alessandra Tassa[1], Hendrik Hamacher[1] and Geoff Sawyer[2]

1 European Space Agency; 2 European Association of Remote Sensing Companies

On behalf of the GEOValue team

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GEO PRESENTATION CONTENT

1. GEOValue
2. Rationale and context for the GIAT
3. Toolkit description
4. Next steps

GEOValue

What? What? How?

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GEOValue: What? Why? How?

We investigate the value of Earth Observations to society

What

GEOValue is a multi-disciplinary international community pursuing evidence-based methodologies to assess the use and value of Earth Observations (EO).

EO contributes to the evidence-base for decisions by public sector, business leaders and individuals. Expanding our understanding of the socio-economic benefits of EO will lead to more effective use and promotion of this information.

Why

To improve use of EO towards further benefits

Through workshops, publications, knowledge sharing…

How

GEOValue furthers the use of socio-economic evidence through working groups, case studies, sharing best practices in methodology, peer-reviewed publications and a structured repository to guide practitioners in the assessment of Earth Observation impacts.

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GEOValue

Our Vision: *to establish a widely accepted and broadly-adopted capacity for the assessment of Earth observations impacts, based on technically-valid methods and resources.*

Our Community: *started from efforts of agencies such as CSA, ESA, NASA, NOAA and USGS and open to multi-disciplinary experts and practitioners from all over the world*

www.geovalue.org

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GEOValue and GEO

- An Enabling Mechanism (Community Impact) within the GEO Post-2025 Work Programme
- a GEO Community Activity since 2017
- a regular presence at GEO since 2014

Title	Date	GEO Event	Venue
The value of Earth Observations	November 2023	GEO XX	Cape Town, South Africa
The value of valuing Earth Observations	November 2022	GEO XIX	Accra, Ghana
Advancing the Understanding of the Value of Earth Observations	November 2019	GEO XVI	Canberra, Australia
Identifying, communicating, and delivering the value of EO	October 2018	GEO XV	Kyoto, Japan
Demonstrating the value of EO	October 2017	GEO XIV	Washington DC., USA
The Value of Geospatial and environmental information	November 2015	GEO XII	Mexico City
Understanding socioeconomic benefits (SEB) and impacts	January 2014	GEO X	Geneva, Switzerland

Events that were part of GEO. To see the full list of workshops please visit https://geovalue.org/workshops-and-events/

2

Rationale and context for the GIAT

The IA Toolkit: rationale

The Toolkit aims at supporting the GEO community to provide evidence about its own success, by:

- strengthening capacities to autonomously assess the impacts of the GEO solutions on downstream users and society,
- stimulating a reflection on the value of Earth Observations for different GEO initiatives, and
- increasing awareness of GEO benefits for funders.

HOW WE RECOGNIZE THAT WE ARE SUCCEEDING?
Chapter 8, GEO Post 2025 Strategy

3

GIAT, The GEO EO Impact Assessment Toolkit

Group on Earth Observation Impact Assessment Toolkit

Guidelines for Practitioners

To support assessment of impacts of Earth Observation-based solutions on users and society

Proof of concept. Version 0.0 February 2024
Revision 0.1 August 31, 2024
Revision 0.2 December 19, 2024
Revision 0.3 February 3rd, 2025

This document has been prepared by the GEOValue Group.

1

GEO Value

TOOL I	Identify your objectives and scope your impact assessment.
TOOL II	Identify candidate users and cases.
TOOL III	Describe and frame your GEO solution.
TOOL IV	Understand use case benefits and beneficiaries.
TOOL V	Qualify and quantify impacts (across all dimensions of value).
TOOL VI	Contextualize your GEO solution and extrapolate your results for broader application.
TOOL VII	Craft your impact narrative through effective storytelling.
TOOL VIII	Should you undertake in-depth impact assessments?

https://geovalue.org/giat-geo-impact-assessment-toolkit/

TOOL I	Identify your objectives and scope your impact assessment
What is the objective of your impact assessment?	• Reflect about the objectives, the target audience, the intended result
What is the scope of the impact assessment?	• Reflect about the needed scale of the analysis: would user testimonials be enough? Would an accurate analysis be required? What are the key indicators that are meaningful for the analysis?
What resources and expertise are needed?	• Multiple expertise might be needed and so it will be helpful to plan in advance, taking into account the available resources.

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TOOL II	Identify promising candidate users and cases
How to identify a promising case?	• A good case stems from a good Primary User or PU
What is your most promising Primary User?	• Reflect about the experience of the PU with your GEO solution and its potential availability. The usage of the solution at the PU should be enough mature that impacts can be felt and measured.
What is your relationship with the identified Primary user?	• Make sure your PU is sufficiently engaged at hierarchical level since the start of the activity, in order to avoid unpleasant waste of effort on both sides!

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Tool III	Describe and frame your GEO solution
What is the core info provided by the GEO solution?	• A short, concrete, easily understandable description of the GEO output to be used in communications to stakeholders
Why is the GEO solution particularly fit for this application?	• A clear understanding of the key features that make the added value of the solution with regards to alternatives (including e.g. technical or economic viability)
What are the core EO data used and how important are they?	• A clear identification of the role of EO sources for the solution might also help EO providers improve their services

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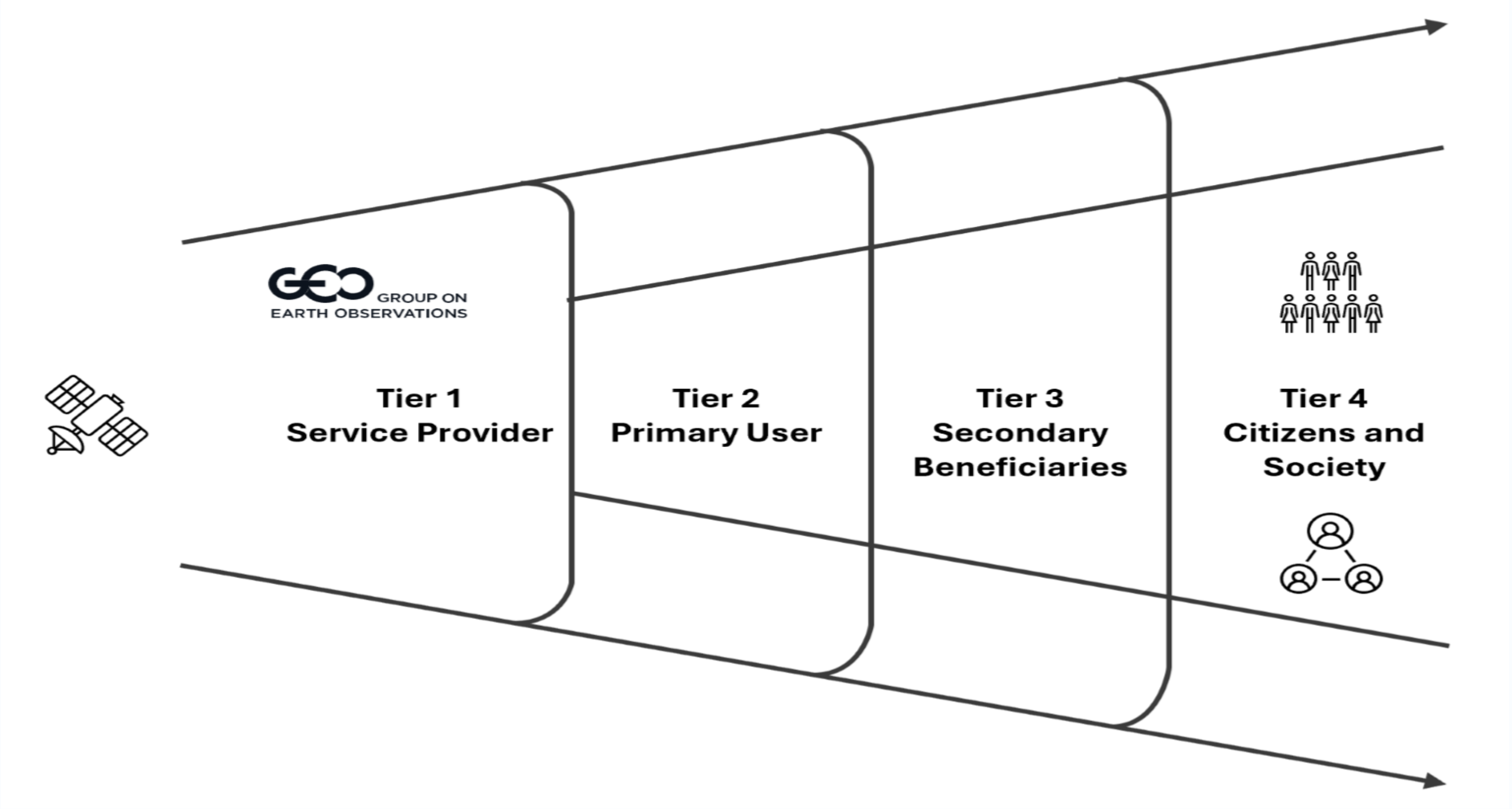
Tool IV

Understand use case benefits and beneficiaries

What are the core beneficiaries of the GEO solution?

- A concise and clear description of benefits and beneficiaries down a full chain of value

Sketch your own value chain



Tool V	**Qualify and quantify impacts (across 6 dimensions of value)**
What is the decision or the action undertaken by the Primary User?	• Understanding how the Primary user exploits the solution is the key piece of information for any impact assessment.
What are the alternative solutions for the Primary User?	• Delineating a counterfactual is the basis for assessing the value of the GEO solution for the Primary User
Assess all impacts, including down to citizens and society	• **Screen through a comprehensive list of predefined benefits to identify the ones that are most relevant for your case!**

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GIAT Parameter — Tips and Practical Examples for 30 parameters

Avoided costs (monetary value)	Costs avoided can generally be easily calculated based on information from the PUs, but this requires a clear picture of the change in the process which can be attributed to the GEO solution.	• By replacing the use of helicopters on-board the icebreakers with satellite data, the ice-breaker captains could save up to €2.3m p.a., which was computed as the operational cost of the helicopters. Additionally, the satellites provide a wide, synoptic view of the Baltic, enabling more efficient route planning and saving time for the icebreakers and the ships they are guiding leading to an overall benefit of at least €24m for the Finnish economy (SeBS case Winter Navigation in the Baltic).\ • By relying on the information from the fertiliser company, it was possible to estimate that savings associated to variable-rate fertilizers techniques for farmers can help save up to 1.5M p.a. (SeBS case Farm Management Support in Poland).
Reduced Pollution (in pollutant measurement units or percentage of reduction)	Reductions in fuel consumption (due to e.g. optimized routes) or reduction in fertiliser spreading (thanks to more careful agricultural practices) can be modelled based on information from the key users. Derivative modelling (e.g. calculation of avoided emissions) might not be necessary.	• By choosing more effective routes, ice breakers and vessels can reduce emissions and pollution. Based on the routes records and their estimated improvements, estimates could be made of fuel saved to which avoided emissions could be linked (see SeBS case Winter Navigation in the Baltic) • By identifying the areas in need, farmers using the Grupa Azoty service in Poland can reduce the amount of fertilizers by, on average, 12Kg/hectare. This amounted to an average reduction of up to 10-15% in the quantity used in the 2nd application and 5-10% reduction in the 3rd application (SeBS case Farm Management Support in Poland). • The wide area coverage offered by Sentinel-1 SAR imagery allows oil slicks to be detected in the marine environment. Illegal oil spills can be detected and the ship tracked so enabling prosecution of the owners. Knowing this is possible, fewer cases of tank washing take place so reducing polluting oil in the marine environment (SeBS case Oil Spill in the Mediterranean Sea).
Improved common oversight (examples)	By allowing a common operational picture, digital EO-based platforms often contribute to stakeholder coordination, shared platforms and improved governance. This aspect is often neglected because it is very difficult to quantify. Yet, it should not be neglected as it is regarded of utmost importance to improve social cohesion and build a better society. Invite your PU to reflect about this aspect and take care to capture its considerations in this respect, even if only qualitatively!	• In Belgium, the use of a common digital platform allowed all the actors of the flourishing "pommes frites" industry to coordinate and share information, including on the growth rate of the delicate potato crop. This allows farmers and food processing factories to improve yields and better plan their operations. Sharing the data brings trust and transparency to both players (SeBS case Growing Potatoes in Belgium). • In Sweden, the maps generated by SFA were used by other national departments (SeBS case Forest Management in Sweden). • The Irish Civil Protection Agency used the Copernicus maps to communicate and coordinate operations with the regional authorities (SeBS case Flood Management in Ireland).

Tool VI	Contextualize your GEO solution and extrapolate your findings for broader applicability and services improvements
What is the context of the GEO solution?	• What is the relevance of the issue that you are addressing with the GEO solution? How wide and impactful is the addressed topic? Is this also relevant for other communities?
What is the specificity of your findings?	• What are the boundaries of applicability of the GEO solution? In what other contexts could the solution be applied?
Extrapolate your findings	• Could your findings be extrapolated with regards to wider geographic or administrative areas? Wider user uptake? Improved technical solutions? Suitable proxies should be identified that allow sensible extrapolation

Tool VII

Craft impact narrative through effective storytelling

What are the key findings?

- Concise, concrete messages should be elaborated to condense your findings for your audience

Can you effectively summarize your user story?

The Challenge	Here we set out the problem that the satellite derived data is helping to address. It will set the context and help the audience understand the issues faced by the PU.
How satellites can Help	Describe the technical aspects of the case including the data sources and how it is presented to inform the PU and secondary users. Consider describing the satellite source as well as a short description of the service provider role. This latter could also be part of the next section depending on the style of presentation.
Who is Concerned?	Describe the various actors concerned and the role that they are playing. How does the PU fit into the national picture? If any private actors are involved what do they do?
What are the Benefits?	Layout the findings from the analysis using the framework of the 6 dimensions. Describe the value chain and what is happening at each step (tier). Set out benefits by dimension if this framework is being used.
Extended Impact	This looks at the wider picture and expands the analysis from the specific context of the case to look at a wider geographic, technological or market extension if appropriate. The boundaries will depend on the case and on the perspective of the PU. It includes the possibility to look at the future evolution of the service.

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Tool VIII

Should you pursue in-depth impact assessments?

What type of in-depth analyses are available and what would be the most appropriate for your analysis?

- **Productivity Improvement:** Measures how Earth observational data and derived products enhance efficiency and output in societal sectors. This can be measured by quantifying increases in production, reductions in production costs, or improvements in resource utilization.
- **Benefit-Cost Analysis (BCA):** A core method for assessing the socioeconomic value of Earth observations. It systematically compares the benefits of an Earth observation program or project (quantified using methods like productivity improvement, consumer surplus, and value of information) to its associated costs (development, operation, maintenance). Within the US, the Office of Management and Budget outlines an excellent benefit-cost approach in its Circular A-4 and includes a focus on environmental benefits
- **Real Options Analysis:** This approach values the flexibility and future decision-making options provided by access to Earth observation data. For example, the ability to adapt land use planning based on real-time monitoring of environmental changes represents a valuable option. This is particularly relevant for long-term investments.
- **Consumer Surplus:** Measures the difference between what users are willing to pay for Earth science information products or services and what they actually pay. This is crucial for understanding the value placed on improved decision-making by various stakeholders, such as farmers, businesses, and government agencies.
- **Decision Analysis:** A framework for making informed choices under uncertainty, heavily reliant on Earth observation data. This involves evaluating the potential outcomes of different decisions, considering the associated risks and uncertainties, and selecting the most advantageous course of action.
- **Contingent Valuation:** A survey-based method for estimating the value of environmental goods and services, such as improved air quality or reduced flood risk, derived from Earth observations.
- **Cost-Effectiveness Analysis:** Similar to a BCA , but compares the costs of different options for achieving a specific environmental or societal goal, often utilizing Earth observation data. This focuses on identifying the most efficient and cost-effective approaches to address challenges such as climate change adaptation or disaster risk reduction.
- **Benefit Transfer:** Applies existing valuation studies from one location or context to another, often relevant for estimating the value of similar Earth observation applications in different regions. This can significantly reduce the cost of conducting new valuation studies while still providing valuable insights.
- **Stated Preference:** A broad category of methods, including Contingent Valuation and Choice Experiments, that elicit individuals' preferences for environmental goods and services through surveys. These methods are valuable for understanding public values and preferences related to Earth observation applications.
- **Revealed Preference:** Methods that infer values from individuals' observed choices and behaviors. For example, analyzing property values near areas with improved air quality monitoring can reveal the value that residents place on reduced pollution.
- **Econometrics and Other Statistical Methods:** A suite of techniques used to analyze economic data related to Earth observations, such as regression analysis, time series analysis, and spatial econometrics. These methods are essential for quantifying relationships between Earth observation data and economic outcomes.
- **Input-Output Analysis and Computable General Equilibrium (CGE):** Economic modeling frameworks that analyze the interconnectedness of different sectors of the economy. By incorporating Earth observation data as inputs or outputs, these models can assess the broader economic impacts of changes in environmental conditions, such as the effects of droughts on agricultural production and the subsequent ripple effects throughout the economy. This is also referred to as "Economic Impact Analysis."

4

Next Steps

Next steps

- Continue validating GIAT with GEO and other experts
- Test and refine GIAT with 2-3 candidate GEO initiatives

2025

Publish first fully functional and robust toolkit
(GIAT V2)

2026

Promote GIAT uptake and sharing of related findings

2027

An open collaborative approach to GIAT

I found this <part on extrapolation of benefits> very useful and in our work we have not formalised this.

I find the report with the new toolkit very interesting and useful for the assessment of our applications. I will definetly consult it in my future applications.

Table 9 IS SO HANDY! I love it!

it would make enormous sense to combine efforts to create a single knowledge base incorporating EO and Geospatial communities.

The development of this toolkit is highly valuable, particularly in promoting the importance of conducting evaluations. It offers practical and comprehensive guidance, covering the key steps involved in impact evaluation. One of its major strengths is its flexibility: users can adapt the tools to suit their specific needs, resources, and objectives. The toolkit also emphasizes effective communication of impact through data, storytelling, and narrative techniques. The collaborative approach proposed for its development—centered on continuous feedback and stakeholder engagement—is especially commendable. Moreover, its accessible design ensures usability beyond technical experts, making it a useful resource even for those without a background in economics or statistics.

This is an impressive and very comprehensive definition of benefits

Any comment on GIAT? Wish to be involved in GIAT testing?

https://geovalue.org/giat-geo-impact-assessment-toolkit/

Email to: info@geovalue.org

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GEOValue conversations

How?	• 1-hour semi-structured interviews with various GEO initiatives since July 2024
Aim	• Learn more about the interest and experience of GEO initiatives related to socio-economic impact assessments • Insights are being used to build the GIAT

GEOGLAM Global Agricultural Monitoring

GEO BLUE PLANET

GEO Land Degradation Neutrality

ARCTIC GEOSS Global Earth Observations for the Arctic

Global Wildfire Information System GWIS

GEO BON

GEO AQUA WATCH

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Conversation outcomes

- Heterogenous situation, but overall GEO initiatives have limited experience and resources to independently perform impact assessments
- The ability to undertake robust qualitative assessment, especially for soft benefits (non-monetized vs. monetizable) is a key concern for all GEO initiatives
- Generally, GEO initiatives have user participation that could be exploitable for a preliminary impact analysis
- GEO initiatives acknowledged the value of performing benefit analyses and showed a keen interest in having a structured, easy-to-use, supporting toolkit

Agenda

- Panel 1: Using impacts to demonstrate the benefits of GEO initiatives

Open discussion with representatives from GEO initiatives:

GEOGLAM, Sven Gilliams
GEO Blue Planet, Audrey Hasson
GEO LDN – Ante Hecheltjen

Moderated by Geoff Sawyer, EARSC

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