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# Executive Report of the 3rd GEO Data Providers Workshop



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## Workshop factsheet

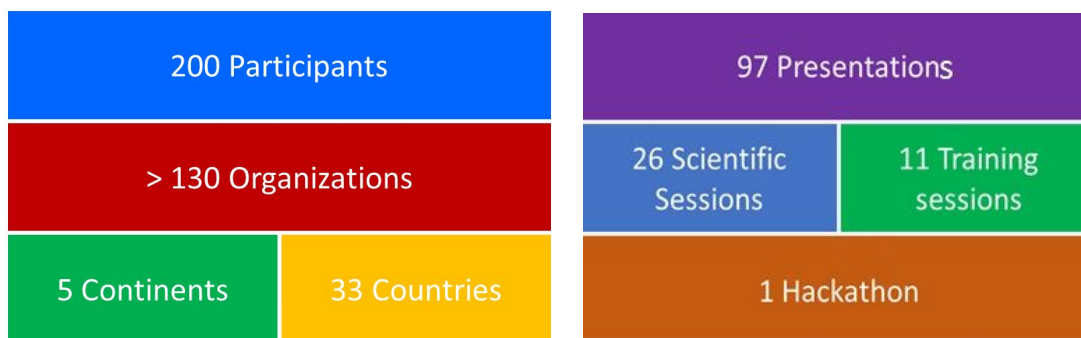
The 3<sup>rd</sup> GEO Data Providers Workshop was held at the ESRIN, the establishment of the European Space Agency (ESA) in Frascati (Italy) from the 2<sup>nd</sup> to the 4<sup>th</sup> of May 2018.

The event was co-organized by the GEO Secretariat, ESA, CNR-IIA (Italy), United States Geological Survey (USGS) and the University of Geneva (Switzerland). The Joint Research Centre of the European Commission contributed to the event report.

The workshop brought together more than 200 data providers and users from more than 130 organizations (see Annex A) from 33 countries and 5 continents and provided a space to share experiences and knowledge that can improve the ways in which Earth observations are managed, communicated, disseminated and used to enhance the Global Earth Observation System of Systems (GEOSS)

The Workshop agenda included 97 presentations and was organized according to: 26 scientific sessions, 11 training sessions, one Hackathon and one arduino sensors do-it-yourself session for citizen science.

At the workshop, several organizations contacted the GEO Secretariat and decided to be engaged in GEOSS –see Annex C.



### Frontal sessions

The scientific sessions covered a wide range of thematic areas (see Annex B), including:

- The GEOSS Platform journey (its evolution, the state of the art, and the ongoing integration with GEO Flagships and Initiatives);
- Data management and sharing principles and processes;
- The role of Regional and National GEOSS;
- User needs and success stories;
- Integration of GEOSS Platform and other infrastructures; and
- Earth observation for decision making across specific international policy priorities (UN SDGs, Sendai Framework for DRR, Paris Climate Agreement).

Presenters introduced and discussed the benefits, opportunities and challenges of using the GEOSS Platform. International initiatives and programs presented their successful integration with the Platform (e.g. AtlantOS and GEO Wetlands), while others introduced their ideas to utilize the GEOSS Platform components e.g. DBAR (Digital Belt and Road) initiative, GNT-H and GCOS.

The main topics that the lively discussions dealt with included:

- The challenges to alleviate the data preparation and processing burden for users;
- The relevance, opportunities and challenges related to regional GEOSS initiatives;
- The increased private sector contributions; and
- The need for further statistical reporting and monitoring to assess GEOSS performance and user satisfaction.

### Interactive sessions, Hackathon and Arduino session

The training sessions provided information on how to get engaged in GEOSS via the latest GEOSS Platform services, dealing with:

- Guidelines for use of the GEOSS Portal;
- Registration via the GEOSS Yellow Pages and Resources Accessibility via the GEOSS Status Checker;
- Connecting User Portals leveraging the GEOSS Mirror and GEOSS Widgets; and
- Enabling GEOSS Interoperability using the GEOSS APIs.

The Hackathon challenged developers to create data discovery and access applications, using the GEOSS Platform services and tools, to address global challenges.

During the Arduino session, participants learned how to build sensors that could be used by citizens to collect local data, e.g. temperature, humidity, air-pressure, smoke, etc., and also connect to GEOSS.

### Main outcomes

The Workshop provided an insight on the current status and the potential evolution of GEOSS.

#### GEOSS Ecosystem growth

The 2<sup>nd</sup> GEO Data Providers Workshop raised the awareness of an emergent GEOSS Ecosystem, dealing with both technological and Community aspects. The 3<sup>rd</sup> GEO Data Providers Workshop demonstrated the strengthening and enlargement of this Ecosystem, its maturity and consistent growth.

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*The 3<sup>rd</sup> GEO Data Providers Workshop demonstrated the strengthening of the GEOSS (community and technological) Ecosystem.*

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#### GEOSS Community Ecosystem

Since its launch (as side event at the GEO XIII Plenary in Russia in 2016), the GEO Data Providers Workshop has doubled its attendance at every meeting. This is a clear sign of the high interest in the GEOSS Platform expressed over the last three years by the GEO Community and in particular, by EO Data Providers and Users. There is the need for the GEO Community to get together around a technical meeting.

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*There is the need for the GEO Community to get together around a technical workshop.*

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While the EO Community is getting more and more engaged, at the same time, GEOSS is opening up to a wider spectrum of data providers and users, ranging from specialists and researchers to non-scientists, including decision makers from the public and the private sector. There is also increased interest from citizens.

On the other hand, the transition from a Common Infrastructure to a modern Web-based Platform, opened the contribution to a wider range of technology and knowledge providers in GEOSS e.g. IT experts, mobile apps developers and AI specialists.

The GEOSS communication and control processes are following this evolution: the governance for becoming a GEOSS Data Provider and sharing resources was consolidated (e.g. a simplified procedure for the registration and brokering of new data systems contributing to GEOSS has been implemented) and the service provision for the development of Community applications and portals was decisively improved.

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*GEOSS Community has evolved including stakeholders from non-EO domains and new user categories.*

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User needs are a clear priority for the GEOSS Platform and will be an essential driver for the future GEOSS evolution – empowered by the ultimate technology evolution. This requires the further engagement of users in the GEOSS Ecosystem.

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*User needs have become a priority for the present GEOSS Platform and are an essential driver for the GEOSS evolution.*

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The main Workshop objective was to “bring together Earth observation data providers and users to share knowledge and best practices in the management and use of Earth observation data, while working together to enhance the Global Earth Observation System of Systems (GEOSS)”. Along this direction, the GEOSS Platform enabled the creation of community tailored views of GEOSS, supporting the development of GEOSS Community Portals –as mentioned in several presentations.

The Workshop highlighted the importance of knowledge generation, management, and sharing for evidence-based science and policy-making. This opens up the GEOSS Community to an increasing role of some stakeholder categories, including knowledge providers (scientists, experts, etc.) and knowledge service managers. As for the future evolution of the GEOSS Ecosystem, the *GEOSS Evolve* initiative is collecting and considering the needs coming from the different GEO stakeholders and the new opportunities offered by a technology landscape in a state of constant evolution.

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*The Workshop highlighted the importance of knowledge generation, management, and sharing for evidence-based science and policy-making.*

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## **GEOSS Technological Ecosystem**

The Workshop demonstrated the effective advancements on the transition from the GCI (GEOSS Common Infrastructure) to a modern GEOSS Platform to provide stakeholders (users and providers) a more complete spectrum of (customizable) services and information. Four main components (i.e. GEOSS Yellow Pages, GEOSS Status Checker, GEO DAB and GEOSS Portal) provided by four different contributing organizations (respectively, UNIGE, USGS, CNR-IIA, ESA) are now integrated in a single and operational virtual system.

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*The Workshop demonstrated the GEOSS transition from adopting a Common Infrastructure approach to a more mature Web-based Platform one –i.e. the GEOSS Platform.*

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The need to respond to diversified user categories, highlighted at the Workshop, implies the importance of customizable tools. In this regard, the characteristics offered by the GEOSS Platform were much appreciated: the GEOSS Platform re-usable components have been enhanced with tools and functionalities to better serve user needs. These include: GEOSS Views, GEOSS APIs, GEOSS Widgets and GEOSS Mirrors.

The GEOSS Platform has a mid-term plan of sustainability and evolution through initiatives and programs funded by GEO members, such as: FGDC.gov (USGS) and the H2020 co-funded project EDGE (ESA).

Several technological solutions have been presented in the three days of the Workshop, supporting: data management and sharing, data access (e.g. Data Cubes and Analysis Ready Data), effective (big) data exploitation to avoid local downloads, and knowledge generation (e.g. Machine Learning). These technologies raise opportunities and pose a challenge for their inclusion in the GEOSS Technological Ecosystem. The transition from data to knowledge was one of the main topics raised by several presentations and by the discussion, requiring a specific attention on the design and implementation of the GEOSS Platform interaction with knowledge generation systems and services.

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*The GEOSS Platform Ecosystem must continue its evolution in response to evolving user requirements and include the most recent innovative technologies for data analytics to generate knowledge from data.*

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## The Regional Hubs

Recently, in GEO, an important change was the introduction of Regional Hubs. This was reflected in the Workshop where the status and achievements of existing Regional Hubs (i.e. AmeriGEOSS for Americas, AOGEOSS for Asia and Oceania, AfriGEOSS for Africa, and EuroGEOSS for Europe) were presented. Moreover, other infrastructures, such as DBAR (Digital Belt and Road) and China GEOSS, were introduced as regional data hubs.

The different conceptions and scopes characterizing the Regional Hubs, as well as their possible integration and interaction with the GEOSS Platform, bring significant opportunities and challenges.

Several participants expressed their interest in being informed on and contributing to the presented regional hubs initiatives. On the other hand, there were many comments and questions about the need to avoid replication of efforts and to implement a uniformity of GEOSS users experience with the different Hubs. To this end, coordination is essential to maximize synergies and prevent unnecessary overlaps. In addition, it is important to further improve the coordination between regional programs and the GEO Flagships, Initiatives and Community Activities, to make sure that the best contributions are exploited and put to use for common goals.

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*The raising of the Regional Hubs initiatives poses significant opportunities (e.g. engagement) and challenges (e.g. effort replication) for GEOSS in the next years*

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## New breed of interoperability tool/science to leverage GEOSS

The increase of shared resources in terms of volume and variety raises significant challenges to GEOSS. While GEOSS in the past had only to make data systems interoperable, presently (and even more in the next future), it is asked to connect diverse systems handling the different services they offer – e.g. IaaS, PaaS, DaaS. There is the need of supporting new interoperability approaches and tools.

Many providers are already following the general trend of exposing data and services through customized Application Programming Interfaces (API). It is necessary to understand whether and how harmonizing them. A compromise between a top-down approach (i.e. standardization providing full harmonization) and bottom-up one (i.e. providers freely defining their APIs) is likely necessary. The experience gained with the GEOSS brokering approach will provide useful insights and important lessons learned.

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*The increase of shared resources volume and variety raises significant challenges to GEOSS that is asked to connect diverse online platforms, handling their services. There exists the need of supporting new interoperability approaches and tools – see for example APIs and standards.*

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## A focus on the GEO Global priorities: Climate, Disasters and SDGs

The GEO Work Plan recognizes as Global Priorities the UN 2030 Agenda for Sustainable Development, the Paris Agreement on Climate Change and the Sendai Framework for Disaster Risk Reduction. The workshop highlighted the need for GEOSS to put a focus on these challenges and consider them as drivers of the specification and prioritization of the GEOSS Platform evolutions.

Earth Observations are of utmost importance in achieving the SDGs and GEOSS must be instrumental in integrating Earth Observation data into the methodology of measuring and achieving SDG indicators; machine learning - it was highlighted at the workshop, could play an important role here.

GEO makes available EO data in support of effective policy responses for climate change adaptation and mitigation, working with partners to enhance global observation systems in order to strengthen resilience and adaptive capacity to climate-related hazards. The GEOSS Platform is able to provide ad-hoc discovery and usage tools for climate-related data.

EO data contributes to disaster preparedness and better mitigation and response. GEO supports disaster resilience by increasing coordination of EO data to forecast and prepare for disasters, to reduce damage and to better manage and recover from disasters. Private sector representatives at the workshop (e.g. Airbus, Digital Globe and Planet) mentioned the possibility to open access to VHR data, in particular in support to major disasters or crises. Agreements will have to be discussed to have free access to data for disaster management and ease access for other applications.

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*The workshop highlighted the need for GEOSS to focus on the GEO Global Priorities and consider them as drivers of the specification and prioritization of the GEOSS Platform evolutions.*

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## An increasing demand for easily usable EO data

One of the main outcomes of the workshop was the recognized need to reduce time spent by users on data preparation, so to better focus on the study subject itself. Data Cubes and Analysis Ready Data (ARD) facilitates addressing this need.

More in general, participants mentioned the need to improve the present EO data usability by better documenting them with descriptive and data-derived metadata and legend graphics, as well as by providing data inspection methods, including the possibility to download subsets of data. A greater attention must be paid to data quality and integrity, EO data timeliness, and provenance tracking.

To this end, the advancement brought by the filtering capabilities (offered by the GEOSS Platform) was recognized. As for the future improvements, user profiling might significantly help: by better tracking and profiling data users, and, consequently, incentivizing users to share their knowledge on data use.

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*Attendees recognized the need to reduce time spent on data preparation, so to better focus on the study itself.*

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## User and Data Metrics

Data providers require information on their data use (who discovers what, who downloads what, where they end up in the ranking, performance assessment, etc.) and feedbacks on user satisfaction, on a regular basis. This is important to improve their service –e.g. service portfolio, coverage, etc. CEOS is developing a user metrics best practice in this respect. In addition to the present one, advanced services are needed to monitor the overall use of the GEOSS Platform dealing with the types of data accessed, the metadata consulted, etc.

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*The GEOSS Platform needs to consider enhanced mechanisms to monitor user interests linked to resources discovered and accessed.*

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Picture of some Workshop participants



## ***Annex A: List of Organizations by Country represented at the workshop***

<b>Organization</b>	<b>Country:</b>
AdviceGEO	Germany
AEWC	USA - Alaska
AIR Centre	Portugal
Airbus Defence and Space	UK
Alaska Eskimo Whaling Commission	USA
Aristotle University of Thessaloniki, Laboratory of Forest Management & Remote Sensing	Greece
AtlantOS / MARUM - University of Bremen	Germany
Austria Climate Data Center	Austria
AWS	Germany
BKG	Germany
BLB	Norway
Canadian Space Agency	Canada
Catapult	UK
CEDARE	Egypt
Central European University (CEU), Systems Laboratory (Syslab)	Hungary
Central European University / ISEPEI Project	Hungary
CEOS	International
China HEAD Aerospace	China
Chinese Academy of Sciences (CAS), Institute of Remote Sensing and Digital Earth (RADI)	China
CIESIN (Center for Earth Science Information Network), Columbia University	USA
CLIMATE-KIC	UK
CloudSigma	Switzerland
CNES	France
CNR-Institute of Atmospheric Pollution Research	Italy
Consiglio per la Ricerca in Agricoltura	Italy
CREAF	Spain
Deimos Imaging	Portugal
Deutscher Wetterdienst	Germany
Development Seed	USA
D-GEO Germany	Germany
Dias Japan	Japan
DigitalGlobe	UK
Dotphoton	Switzerland
EARSC	Belgium
ECMWF	UK

Ecopotential	Greece
EGI Foundation	Netherlands
Environment Agency Austria	Austria
EOMAP	Germany
ESA	Italy
Esri Inc.	USA
Esri Italia	Italy
Eurac Research	Italy
Euroconsult	France
EuroGeographics	Belgium
European Commission (DG RTD)	Belgium
European Commission, DG Joint Research Centre	Italy
European Union Satellite Centre	Spain
Evenflow SPRL	Belgium
Eversis	Poland
FAO	Italy
Federal Geographic Data Committee	USA
Friedrich Schiller University Jena	Germany
GBIF Secretariat	Denmark
GEANT	UK
GEO BON	Germany
GEO Secretariat	UK
GEOCRI -Institute of Remote Sensing and Digital Earth	China
Geoscience Australia	Australia
Geosys	UK
Global Healthsites Mapping Project	France
Global Partnership for Sustainable Development Data (GPSDD)	USA
Global Runoff Data Centre (GRDC) at Federal Institute of Hydrology (BfG)	Germany
GMV	Spain
GTNH	Germany
HCP international	Netherlands
Helmholtz Centre Geesthacht, Institute of Coastal Research	Germany
HZG	Germany
Igor Sikorsky Kyiv Polytechnic Institute, National Technical University of Ukraine	Ukraine
Infrastructure de Recherche Système Terre	France
Institute of Geodesy and Cartography	Poland
INSTITUTO GEOGRAFICO NACIONAL	Spain
International Centre for Integrated Mountain Development (ICIMOD)	Nepal

IPTSAT	Italy
IRD - Institut de Recherche pour le Développement	France
ISMN - International Soil Moisture Network	Austria
Istituto Nazionale di Geofisica e Vulcanologia	Italy
Jaxa/GEO SEC	Japan
Jozef Stefan Institute, Department of Environmental Sciences, Slovenia	Slovenia
Legos	France
MINES ParisTech	France
Ministry of Higher Education and Research, France	France
Mountain Research Initiative	Switzerland
Museum für Naturkunde, Berlin	Germany
Namibia Statistics Agency	Namibia
NASA	USA
National Authority for Remote Sensing and Space Sciences	Egypt
National Institute for Space Research - INPE	Brazil
National Institute of Advanced Industrial Science and Technology Research Institute of Geology and Geoinformation, Geological Survey of Japan Remote Sensing Research Group	Japan
National Institute of Statistics, Ministry of Planning	Cambodia
National Observatory of Athens, NOA	Greece
North Slope of Alaska	USA
OGC	Belgium
PCI Geomatics	USA
Planet	Germany
Radiant.Earth	USA
RED Pavia	Italy
Remote Sensing Centre Institute of Geodesy and Cartography, Poland	Poland
RHEA	Italy
SANSA	South Africa
Sapienza Università di Roma	Italy
Satellite Surveying and Mapping Application Center, National Administration of Surveying, Mapping and Geoinformation of China	China
Serco	Italy
SMHI	Sweden
Space Research Institute of National Academy of Sciences of Ukraine and State Space Agency of Ukraine	Ukraine
Spacemetric	Sweden
Statistics Sweden	Sweden
Sysdeco ItaliaIta	Italy
TeamDev Srl	Italy
The Institute of Remote Sensing and Digital Earth (RADI), Chinese Academy of Sciences (CAS)	China

The National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"	Ukraine
THINKlab, University of Salford	UK
Tor Vergata University	Italy
TU Delft	The Netherlands
UK Government Earth Observation Service	UK
UNEP GRID-Geneva	Switzerland/United Nations
UNESCO	France/United Nations
University of Bayreuth	Germany
University of Calabria	Italy
University of Geneva	Switzerland
University of Ghana, Center for Remote Sensing and Geographic Information Services (CERSGIS)	Ghana
University of Oxford	UK
University of Surrey	UK
University Suez, Egypt	Egypt
UNOOSA	Austria/United Nations
UNOSAT	Switzerland/United Nations
USGS	USA
VisioTerra	France
VITO	Belgium
WFP	Italy/United Nations
World Resources Institute	Germany
WWF-Tanzania	Tanzania

# Annex B: Matching of the Workshop sessions against the meeting focus areas

Workshop sessions/Objectives	Connecting data providers with users, including:	Uncovering user needs	Highlighting data user and application impact stories;	Optimizing data for decision and policy making;	Engaging with citizen observatories;	Presenting data potential;	Entering in discussions.	Presenting user-centric GEOSS Platform enhancements;	Building strategies for strengthening user and provider outreach and expanding the user base.
1: EO for Decision Making and GEOSS for Users	■		□	□			□	■	
2: The GEOSS Platform Journey	■							■	
3: Lightning talks: Disasters	■		□			□		■	
4: GEOSS Platform User & User Needs Stories	■	□	□				□	■	■
5: The role of Regional and National GEOSS	■						□		
6: Technical discussions: analysis and application ready data	■			□			□		
8: User-Centred GEOSS: The customized dynamic approach	■						□	■	
9: GEO Data Management Principles & the GEOSS Platform	■			□			□		
1: GEOSS Platform benefits for GEO Flagships and Initiatives	■		□			□	□		■
2: The Future of the GEOSS Platform	■						□		■
3: Lightning talks: Climate	■		□			□	□		
5: Sub-regional GEOSS and other thematic entities	■						□	■	■
6: Technical Discussions: User Metrics	■						□		
7: Lightning talks: Climate / Water	■		□			□	□		
8: Other Infrastructures & the GEOSS Platform	■						□		■
1: How Commercial sector can benefit the GEOSS Platform in support of Users	■						□		■
2: How the commercial sector can work with GEO and the GEOSS Platform	■						□		■
3: Lightning talks: Sustainable Development Goals	■		□			□			
5: Other Organizations & Initiatives: Benefits for and from the GEOSS Platform	■						□		■

## ***Annex C: Important Engagements immediately resulted from the 3rd GEO Data Providers workshop***

- Integration to the GEOSS Platform GEO Flagships and Initiatives
- 27 New Data providers added to the pipeline
- 6 New Community Portals using GEOSS Platform re-usable components
- 2 Planned major advancement in the Platform evolution

Organization	NEW Data / Service/ Knowledge Provider	Community Portals		Platform Evolution
		Use GEOSS VIEW	Use GEOSS Mirror	
UNESCO (2 catalogues)	x			
Jaxa open data Catalogue	x			
Radiant.Earth	x			
UNOOSA Knowledge Platform	x			
Copernicus services	x			
TEP – Thematic Exploitation Platforms	x			
Austria Climate Change Center	x			
Citizen Science, CtiSci	x			
GTN-H Global Terrestrial Network of Hydrology (14 Data Providers)	x	x	x	
GCOS customized Portal with ECVs	x	x	x	
GEO FS: GEOGLAM / GEOBON	x		x	
AfriGEOSS	x	x	x	
EPOS – European Volcano Portal	x	x	x	
H2020 GEO Essential project	x	x	x	

<b>PREP, The Partnership for Resilience and Preparedness</b>	<b>x</b>	<b>x</b>	<b>x</b>	
<b>The GEOSS Platform towards a Knowledge Platform</b>				<b>x</b>
<b>Data Providers will benefit from Peer Review of GEO DMPs WP</b>				<b>x</b>

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