

Guidance for GEO Work Programme 2020-2022 Implementation Plans for GEO Initiatives and GEO Flagships

Implementation Plan Table of Contents

1. Executive Summary

Full title

Global Observation System for Mercury (GOS⁴M)

Proposed category

GEO Flagship

Summary

The Global Observation System for Mercury (GOS⁴M) (www.gos4m.org) is a flagship of the Group on Earth Observation (GEO – www.earthobservations.org) and is part of the GEO Work Programme (2016-2025). GOS⁴M has a strong foundation on the outcomes of the former GEO Task on Health Surveillance [HE-02 “Tracking Pollutants”] established as a part of the GEO Work Plan (2009-2015).

GOS⁴M is aimed to support all interested Parties in the implementation of the Minamata Convention. The core of GOS⁴M business plan’s objective is to support the Nations, Minamata Convention Secretariat, UN Environment and others interested Parties and Stakeholders to contribute to fulfil the COP (Conference of the Parties) decisions and requests related to, but not limited by, capacity-building and technical assistance to developing country Parties (Article 15), research, development and monitoring (Article 19) and Effectiveness Evaluation of the convention (Article 22). The overarching goal of GOS⁴M is to promote actions aiming to provide comparable global monitoring mercury data and validated modelling frameworks. In order to achieve this objective, GOS⁴M’s key goal is to promote the establishment of a federation of existing regional and global monitoring networks that would allow to provide global comparable monitoring data for the purpose of the Minamata Convention on Mercury (MCM). The availability of comparable mercury monitoring data would foster the validation of numerical and statistical models used to assess the fate of mercury from local to global scales with changing emission regimes and climate, and source-receptor relationships. Another important goal of GOS⁴M is to support Nations and all interested Parties in developing their own national or/and regional monitoring programme by providing technical assistance and promoting capacity building initiatives for setting up new monitoring sites in areas where no mercury monitoring facilities and expertise are available.

Planned Activities

Task 1: Establish a governance structure

Task 2: Analysis of current infrastructures and archived information on mercury

Task 3: Harmonization of information and production of metadata following standards.

Task 4: Implementation of GOS⁴M Portal with GEO DAB as core engine

Task 5: Design, creation and implementation of core services

Task 6: Design, creation and release of tools for using and discovering information

Task 7: Testing and updating of services and tools

Task 8: Progress reporting and stakeholder engagement

Point of Contact

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2. Purpose

The **GOS⁴M** Flagship is developing a coordinated global observation network for mercury in the atmosphere as well as in water and biota by promoting a federation of existing networks and initiatives with the objective to support the international conventions on toxic compounds and specifically the Minamata Convention on Mercury, the UNECE-LRTAP conventions and ongoing international programmes (e.g. UNEP Mercury Program). The above coordinated network will serve the mercury modelling community to produce validated tools for assessing the effectiveness of different socio-economic-policy scenarios aiming to achieve the target (indicators) of the MC.

The way to achieve these objectives passes through the development of a Knowledge Hub that will bring data toward a more attractive and comprehensive knowledge.

More specific objectives are:

- To increase the availability and quality of Earth Observation data acquired by in-situ, off-shore and satellite sensors that may well contribute to improve our capability to track mercury releases, establish source-receptor relationships, assess their fate and impact with changing emission regimes and climate.
- To promote the establishment of a federation of existing mercury monitoring networks and programs in order to facilitate the access to available data and knowledge on mercury levels in different environmental matrixes by the scientific community, policy makers and stakeholders.
- To promote the harmonization of Standard Operating Procedures (SOPs) used by existing monitoring networks measuring the concentrations of mercury species in ambient air and precipitation samples as well as in biota.
- To harmonize the metadata description, archiving and data sharing methodologies used by existing mercury monitoring networks and programs.
- To contribute to improve the global coverage of currently available mercury monitoring data by promoting the establishment of new monitoring sites in areas that do not have monitoring capabilities and facilities. The use of Passive Air Samplers (PASs) is considered a cost-effective method for achieving this goal.
- To promote intercomparison and validation of existing modelling frameworks and tools used to assess the fate of mercury within and between atmospheric and terrestrial compartments.
- To contribute to the development of downstream services designed to perform cost-benefit analysis of different policy measures aiming to reduce the level of mercury in environmental media and human exposure.
- To develop advanced web services aiming to facilitate the access and use of state-of-the-art scientific information and data by policy makers and stakeholders.

Expected outcomes are:

- a Governance Structure aimed to assure an efficient day-by-day operation of the flagship, facilitate opportunities for meaningful participation from and input by all interested Parties such as governments, NGOs, UNEP, the scientific community, among others.
- a Knowledge Hub that can enable end-users to assess different mercury reduction scenarios (i.e.: change in mercury emission speciation or different partitioning between industrial sectors).
- a set of tools developed to include stakeholder participation in information discovery (e.g. to help pregnant women to decide how much and which fish to include in their diet).

The main impact of this Flagship is on primary stakeholders, which are parties to the Minamata Convention, the governments, IGOs, NGOs and the scientific community. The latter in specific fields shares the interest within the scope of the Flagship and can contribute to gathering information and mobilizing social groups. The civil society in general, will benefit from communication and discovering information of risks associated with mercury releases, contamination and ingestion through food.

3. Background and Previous Achievements

GOS⁴M is in force since 2017 and its implementation is proceeding following the established timeline. Following the **GOS⁴M** implementation plan, the main activities along these two years were completely oriented to establish the Governance (see for more details the following section 5.). Along the two years of activities, a survey was done to list worldwide monitoring network as well repositories of monitoring datasets. For such information metadata were prepared, each one reporting data source, intellectual property, term of use and consistency among others. This information is published by means of the GEOSS mirror site <http://www.geoportal.org/community/gos4m>.

Major outcome is related with the *Report of the ad hoc group of experts on effectiveness evaluation* (UNEP/MC/COP.2/INF/8) a document prepared for the Conference of Parties of the Minamata Convention on Mercury, which includes the GOS4M as global Observatory Network for mercury in air.

Meanwhile the **GOS⁴M** Knowledge Hub (**G-KH**) was planned. The **G-KH** is an integrated solution of high quality observational data, model outputs and digital tools to respond closely to the needs of Minamata Convention on Mercury assessment, addressing major knowledge gaps. It brings end-users into a decision on policy implementation and cost-benefit evaluation in the light UN agenda 2030.

The **G-KH** is based on five knowledge elements:

- Collection/Elicitation
- Formalization/Encoding
- Sharing
- Use
- Generation

4. Relationship to GEO Engagement Priorities and to other Work Programme Activities

The GEOSS Strategic Plan 2016-2025 is based on three strategic objectives: (a) advocacy of EO as the foundation of environmental information; (b) engagement with stakeholders to address day-by-day societal challenges, and (c) delivery of critical data, information and knowledge to inform decision makers. Along these lines, the contribution of GF-04 will be realized through the:

- endorsement of full and open access to EO data;
- promotion of the use of key data management principles, as well as common standards and interoperability arrangements;
- encouragement and actions for increased contribution of regional resources directly to GEOSS Data-CORE and Copernicus data portal;
- engagement with key stakeholders to identify the needs in observations, and environmental and socio-economic data analyses, which can yield advances in several Societal Benefit Areas (SBAs);
- broadening of the GEOSS and Copernicus user base through well-targeted dissemination and exploitation actions;
- ensuring access to data, information and knowledge, while increasingly promoting interoperability among multiple sources of data; and deliver the tools, knowledge and services suitable for a direct-access exploitation by user communities;
- showcasing concrete collaborative schemes (through the strands) relying on integration of regional capacities and skills towards addressing specific challenge priorities.

At the time of this Plan the following SDG indicators can be considered of interest for **GOS⁴M**:

- 3.9.1 Mortality rate attributed to household and ambient air pollution
- 3.9.3 Mortality rate attributed to unintentional poisoning
- 6.3.1 Proportion of wastewater safely treated
- 12.4.1 Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting

- information as required by each relevant agreement
- 12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment
- 12.5.1 National recycling rate, tons of material recycled
- 17.6.1 Number of science and/or technology cooperation agreements and programmes between countries, by type of cooperation

Among the Initiatives that are relevant for the implementation of **GOS^{4M}** the Global Observation System for Persistent Organic Pollutants (GOS⁴POPs) might be of interest because of:

- The well established link between the monitoring network and the policy framework (i.e. the global monitoring plan (GMP) for POPs and the Stockholm Convention);
- The clear policy mandate to the GMP to support the Stockholm Convention monitoring and assessment.

GOS^{4M} and GOS⁴POPs are strictly related as both include activities that are finalized to the integration of real-time monitoring of persistent pollutants derived from different platforms into an advanced interoperable data infrastructure for data sharing and web services release in support of International Conventions implementations. Such tools will allow policy makers and stakeholders to explore and use key information to understand temporal and spatial patterns of pollutant releases, transport and deposition patterns, and risk for human health.

Representatives of GOS^{4M} community are also actively involved in the policy process bringing in the outcomes of GOS^{4M}. In the framework of the last meeting of the Ad-hoc Group of the Effectiveness Evaluation of the Minamata Convention (EEG) that met the last 7-12 April, a clear invitation to Nicola Pirrone (PoC), Representative of the EU in this ad-hoc group, to submit a formal proposal to COP3 (Nov 2019) to propose **GOS^{4M}** as reference program in charge to provide global comparable data for the convention. The EEG includes designated members of the 5 UN Caucus and a number of selected Observers and are in charge to establish the methodologies and indicators to be used in the first Effectiveness Evaluation of the MC that will be submitted to COP in 2023. The GEO SEC that has been already involved in the dialog with MCM SEC to establish a formal MoU.

5. Governance

The following is the current version of Governing Bodies and Rules as accepted by Flagship participants.

[citation]

1. The governance structure

The organisational structure of GOS^{4M} comprises the following two Governing Bodies:

1. A Steering Committee
2. A Scientific Advisory Board

Members of each Governing Body are appointed every three years following rules reported in the Section-5.

*Each Governing Body shall elect among Members a **Chair** and three **co-Chairs**. The election of **Chair** and **co-Chairs** follows the rules reported in Section 5.*

***The co-Chairs** shall support the Chair in her/his activity.*

*The **Chair** shall lead the Body in cooperation with co-Chairs. The Chair shall convene meetings, prepare and send the agenda, prepare and circulate the minutes for approval by all Members.*

2. Steering Committee

The Steering Committee (SC) is in charge to ensure the achievement of goals and objectives of GOS^{4M} as reported in Section 3 of this Membership Agreement.

*The **SC** is in charge to:*

- *ensure the efficient management and implementation of the GOS^{4M} Business Plan (BP) [refer to GEO WP (2017-2019)];*
- *revise the BP by considering the suggestions that may be provided by its members and by the SAB;*

- liaise with participating organisations and institutions supporting the gathering and collection of mercury data and information;
- ensure an efficient communication and outreach activities;
- coordinate the sharing of up-to-date information provided by GOS⁴M Members with all interested Parties;
- ensure that GOS⁴M portal provides state-of-the-art information, data, tools in support of Parties of the MC;
- promote the development of joint cooperation activities and projects among its members and between its members and other organisations;
- peer-review the reports and guidance documents produced by GOS⁴M;
- report to GEO Secretariat on the progress of GOS⁴M and its major achievements;

The Steering Committee will consist of:

- One Representative of each participating Network and Programme, and
- One Representative from each UN Caucus

Representatives of each UN Caucus will ensure an efficient liaison between the SC Members and representatives of regional, national and local organizations that coordinate monitoring or capacity building programmes that may provide a valuable contribution to the achievement of the GOS⁴M goals.

3. **Scientific Advisory Board**

The **Scientific Advisory Board (SAB)** is a subsidiary body established to advise the Steering Committee on matters relating to current and future mercury science and technology information.

The **SAB** is composed of nine (9) members plus members of the ad-hoc Expert Group, who are distinguished experts in one or more mercury research and policy domain who have provided a significant contribution to advancement of science and policy related to the global mercury pollution and its effects on human health.

The members of the **SAB** are nominated by the **SC** and is led by two **co-Chairs**.

The co-chairs are nominated by consensus by SAB members and have to be from different UN Caucuses.

Responsibility of the SAB

The **SAB** is expected to provide the scientific guidance and direction to GOS⁴M community on different aspects related to mercury science in the environment and human health as detailed in Section-3 of this agreement. The SAB's members will be engaged by the SC to review all scientific material and products before these became of public domain as well as may be asked by the SC to provide an input to the revision of the Business Plan of GOS⁴M.

The **SAB** can establish an Expert Group (EG) to cover expertise not available among its members. **The Expert Group** would comprise well known experts on emerging topics that might be relevant for the GOS⁴M activities. As preliminary assessment of emerging cross-cutting research topics and technological recent innovations, the EG may involve experts in the following domains:

- Metadata definition and implementation rules, management and integration with the GEOSS Common Infrastructure and data sharing and data management principles;
- Intercomparison and harmonization of QA/QC protocols and standard operating procedures adopted in existing monitoring networks and programmes;
- Atmospheric, marine and ecosystems modelling: intercomparison, testing and upgrade of regional and global models that may be used for assessing different scenarios of policy implementation and policy effectiveness evaluation;
- Biota: preparation and merging of databases on mercury contamination.

4. **Preparation and organisation of meetings**

Meetings of each of the Governing Bodies may be held on annual basis by physical presence, teleconference or others telecommunication means.

It is encouraged to hold joint SC and SAB meetings to the extent possible.

The co-chair of a Governing Body is responsible to convene such meetings. Meetings can also be convened upon request of one or more Members of the Body.

The date and venue of the meetings of a Governing Body are decided by consensus of all members.

The chairperson of a Governing Body shall prepare and send to each Member of that Body the draft agenda no later than 14 days preceding the meeting and ask for further input to the agenda.

Any agenda item requiring a decision by the Members of a Governing Body must be identified as such on the agenda and where necessary provided with a companion document.

Each Governing Body shall report its activity on annual basis and all reports/minutes of the meetings shall be published on the GOS⁴M website.

5. Representation in meetings and voting

Members of the Governing Bodies:

- *are expected to be present or represented at meetings of the Governing Body;*
- *may appoint an authorized substitute or a proxy to attend, take decision and vote at the meetings;*
- *may participate in meetings in person or virtually;*
- *shall participate in a cooperative manner in the meetings.*

Each Member present or represented in the meeting of each Governing Body shall have one vote.

All decisions of the Governing Body should be taken by consensus; in case a consensus is not achieved a quorum shall consist on a majority as follow:

- *simple majority: 50% of the membership + 1 vote*
- *qualified majority: 2/3 (66.66%)*

In the case that the meeting is held via teleconference or other telecommunication means the co-Chairs shall inform the Members of the Governing body on the outcome of the vote and possible prepare a detailed report.

[end of citation]

6. User Engagement and Capacity Building

Engagement with relevant user communities and other stakeholders is of crucial importance for this Flagship, making sure its objectives are in tune with the real-world problems and its results provide adapted and scalable solutions. **GOS⁴M** will share the outcomes, lessons learned and conclusions from a series of roundtable meetings designed to identify stakeholder needs and promote collaboration between science and policy. The roundtables will seek to build up a stakeholder dialogue with exemplary sector-specific user communities to incorporate feedback loops for the products of this Flagship, as well as to develop improvements of existing mercury data workflows.

A co-design activity is the main strategy to engage users in the **GOS⁴M** implementation because the Flagship is fully oriented to support decision-makers in their assessment of the Minamata Convention on Mercury. Effective discussion at Conferences of Parties and within the ad hoc group of experts on effectiveness evaluation is helping co-design of **GOS⁴M** outputs.

GOS⁴M activity has been presented at the Conference of the Parties (COP-2) to the Minamata Convention on Mercury - Second meeting held in Geneva, 19–23 November 2018. As main stakeholder, the COP through the nominated *ad hoc group of experts on effectiveness evaluation* (EEG) has reviewed the Flagship as a potential contributor to provide “useful input to the monitoring report for the purposes of the effectiveness evaluation of the Minamata Convention on Mercury”. As follow up of the 2nd meeting of the EEG to define criteria and indicators that will drive the evaluation of the 1st EE at 2023, it was:

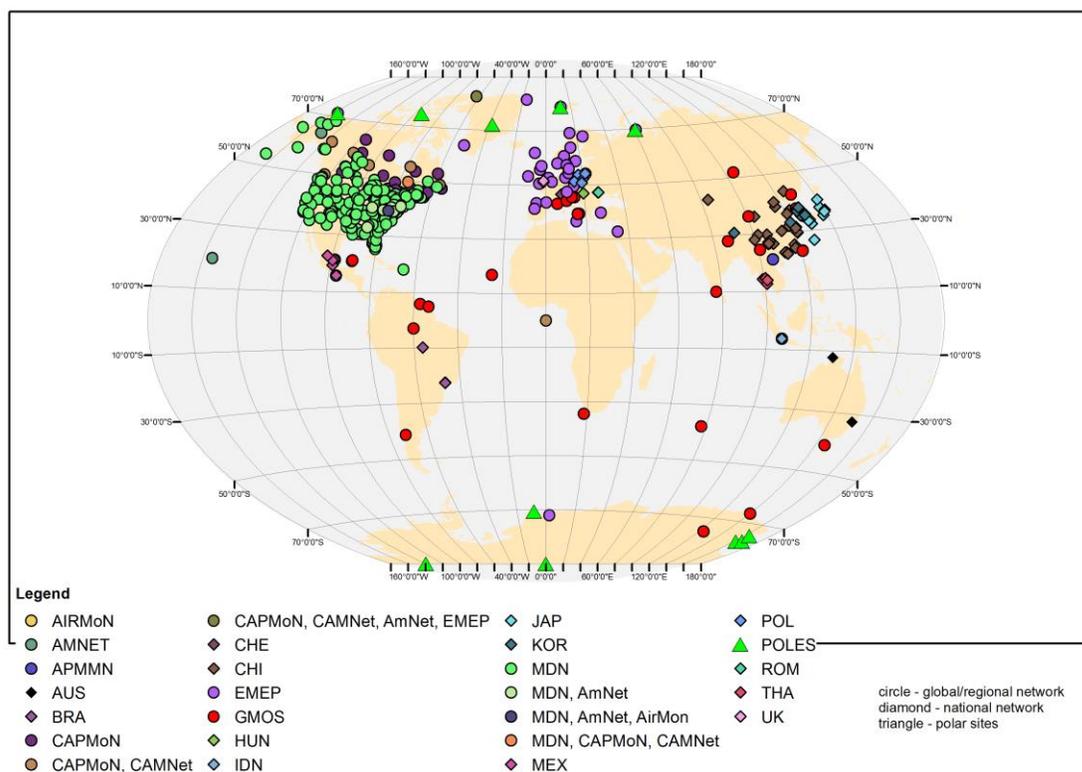
- Recognized the key important of **GOS⁴M** in providing global comparable observational data on Hg and its compounds in ambient air and marine ecosystems;
- Satellite and other in-situ data on atmospheric composition to support the modeling of key mechanisms for assessing the deposition to and re-emission from terrestrial and marine ecosystems of Hg
- Validated modeling tools to establish source-receptor relationships and evaluate the relative contributions of anthropogenic sources
- The EEG invited **GOS⁴M** leader (member of EEG) to submit a formal proposal to COP-3 (Nov. 2019) to become the reference programme for the MC.
- The **GOS⁴M** proposal to COP-3 will be agreed with GEO SEC and will be submitted to MC Secretariat by end of July 2019.

7. Technical Synopsis

The national and regional/global monitoring networks listed currently active are reported in the following Table and Map.

National / regional area	Program/ network/ inventory - dates of mercury measurements	Number of monitoring stations/ sites	Managing Institution	Main URLs
National networks				
Andorra	Andorran Air Quality network - from 2011 onwards	Not available	Department of Environment and Sustainability	
Australia	The Australian National Pollutant inventory (NPI) - from 1996 onwards	2		https://data.gov.au/dataset/np
Austria	Network for Mercury impacts in forest foliage - from 1983 (as bio-monitoring) onwards	Not available	Austrian Federal Research Centre for Forests controls	http://www.bioindikatornetz.at
Brazil	Mercury monitoring sites – Running dates n.a.	Not available	CETESB, the environmental agency of the State of São Paulo	http://www.cetesb.sp.gov.br/2014/10/27/cetesb-realiza-treinamentos-internacionais-sobre-pops-e-mercurio/
Canada	Environment and Climate Change Canada – Atmospheric Mercury Monitoring or ECCO-AMM network – from 1994 onwards	11 for air meas.+ 2 only for wet depositions	Environment and Climate Change Canada	https://www.ec.gc.ca/rs-mn/default.asp?lang=En&n=6C2AD92E-1 http://nadp.sws.uiuc.edu/
China	Mercury monitoring sites (including GMOS sites) – Running dates na	9 for air meas.	Institute of Geochemistry, CAS	
China (Taiwan)	Wet deposition Network - from 2009 onwards	11 + 1 remote	Environmental Protection Administration	
Hungary	Hungarian Air Quality Monitoring Network - from 2010 onwards	1	Hungarian Meteorological Service	
Republic of Korea	Mercury Monitoring Network in Korean Air Pollution Monitoring Network - from 2009 onwards	12 TGM / 1 Hg speciation / 4 Hg precipitation	National Institute of Environmental Research in the Ministry of Environment.	https://seoulsolution.kr/en/content/air-pollution-monitoring-network www.airkorea.or.kr (Korean only)
Japan	Mercury Monitoring Networks - from 1998 onwards	5	National Institute for Minamata Disease (NIMD) and the National Institute for Environmental Studies (NIES)/Ministry of Environment (MOE).	https://www.env.go.jp/en/chemi/mercury/bms.html http://www.env.go.jp/press/104568.html (Japanese only) http://www.env.go.jp/air/osen/monitoring/mon_h27/index.html (Japanese only)
Poland	Polish State Environmental Monitoring programme - from 2000 onwards	5	Inspection of Environmental Protection	http://www.gios.gov.pl/en/state-of-the-environment/state-environmental-monitoring
Indonesia	Mercury Monitoring Site	1		http://apmmn.org
Switzerland	Mercury Monitoring Site	1		https://www.hfsjg.ch
Romania	Mercury Monitoring Network - from 2000 onwards		Ministry of Environment, NEPA and the National Environmental Guard	
United Kingdom	National Metals Network and National Atmospheric Emission Inventory – Running dates na	2	UK DEFRA; CEH	http://www.auchencorth.ceh.ac.uk/node/211 https://uk-air.defra.gov.uk/networks/network-info?view=metals http://naei.defra.gov.uk/overview/pollutants?pollutant_id=15
USA	National Atmospheric Deposition Program's	Several stations in USA		http://nadp.isws.illinois.edu/mdn/ http://nadp.isws.illinois.edu/amm

	(NADP) Mercury Deposition Network (MDN) and NADP's Atmospheric Mercury Network (AMNet) – from 1996 onwards			
Vietnam	- from 2014 onwards	1	Vietnamese Centre for Environmental Monitoring (CEM) of the Vietnam Env. Admin. (VEA)	
Regional/Global networks				
Global network	Global Mercury Observation System,(GMOS)	Many stations in both hemispheres	CNR-IIA Division of Rende, Italy	www.gmos.eu
Regional Network	European Union Network under EU Directive 2004/107/EC	Many stations in Europe	European Environment Agency (EEA)	http://cdr.eionet.europa.eu/ https://www.eea.europa.eu/publications/92-9167-058-8/page010.html
Regional network	European Monitoring and Evaluation Programme (EMEP)	Several stations in Europe	EMEP Organization	http://emep.int/index.html
Regional network	National Atmospheric Deposition Program , (NADP)	Many stations in USA, Canada	NADP Program, Winsconsin	http://nadp.sws.uiuc.edu/mdn/
Regional network	Asia-Pacific Mercury Monitoring Network, (APMMN)	Several stations in the Asia-Pacific Region	APMMN Organization	http://apmmn.org/
Regional network	Arctic Monitoring and Assessment Programme,(AMAP)	Several stations across the circum-Arctic Region	AMAP Organization	https://www.amap.no/about/the-amap-programme



When available QA/QC data have been stored in a central archive by means of open source software (i.e.: PostgreSQL). In addition, metadata were produced and harvested by the GEODAB. Most available data derive from the Global Mercury Observation System (GMOS) but the Steering Committee of **GOS^{4M}** will decide the preparation and release of Data Core.

8. Data Policy

The following Membership Agreement prepared by the participants to the Flagship has been finalized and will be approved at the first Steering Committee Meeting.

[citation]

Section 1 – Parties to this Agreement and scope

The scope of this Membership Agreement is to build a partnership of Institutions that carry out activities related to the Minamata Convention, be research- or policy-oriented activities, which include, but not limited to, monitoring mercury contamination in air and terrestrial ecosystems and impact on human health, modelling the fate of mercury between and within environmental compartments, and carrying out capacity building and transfer of knowledge programmes.

Membership is open to any existing mercury monitoring and research network and consortia as well as to universities, research institutions and government organizations.

Section 2 – Association and disassociation of Applicants

An Organisation that has signed this Agreement becomes a Member of the Steering Committee.

A Member may disassociate itself from this Agreement by addressing a written request to the Steering Committee.

Section 3 – Rational and Objectives of GOS⁴M

The Global Observation System for Mercury (GOS⁴M) (www.gos4m.org) is a flagship initiative of the Group on Earth Observation (GEO – www.earthobservations.org) and is part of the GEO Work Programme (2016-2025). GOS⁴M has a strong foundation on the outcomes of the former GEO Task on Health Surveillance [HE-02 “Tracking Pollutants”] established as a part of the GEO Work Plan (2009-2015).

GOS⁴M is aimed to support all interested Parties in the implementation of the Minamata Convention. The core of GOS⁴M business plan’s objective is to support the Nations, Minamata Convention Secretariat, UN Environment and others interested Parties and Stakeholders to contribute to fulfil the COP (Conference of the Parties) decisions and requests related to, but not limited by, capacity-building and technical assistance to developing country Parties (Article 15), research, development and monitoring (Article 19) and Effectiveness Evaluation of the convention (Article 22). The overarching goal of GOS⁴M is to promote actions aiming to provide comparable global monitoring mercury data and validated modelling frameworks. In order to achieve this objective, GOS⁴M’s key goal is to promote the establishment of a federation of existing regional and global monitoring networks that would allow to provide global comparable monitoring data for the purpose of the convention. The availability of comparable mercury monitoring data would foster the validation of numerical and statistical models used to assess the fate of mercury from local to global scales with changing emission regimes and climate, and source-receptor relationships. Another important goal of GOS⁴M is to support Nations and all interested Parties in developing their own national or/and regional monitoring programme by providing technical assistance and promoting capacity building programmes for setting up new monitoring sites in areas where no mercury monitoring facilities and expertise are available.

Specific objectives of GOS⁴M are:

- *To increase the availability and quality of Earth Observation data acquired by in-situ, off-shore and satellite sensors that may well contribute to improve our capability to track mercury releases, establish source-receptor relationships, assess their fate and impact with changing emission regimes and climate;*
- *To promote the establishment of a federation of existing mercury monitoring networks and programs in order to facilitate the access to available data and knowledge on mercury levels in different environmental matrixes by the scientific community, policy makers and stakeholders;*
- *To promote the harmonization of Standard Operating Procedures (SOPs) used by existing monitoring networks measuring the concentrations of mercury species in ambient air and precipitation samples as well as in biota.*
- *To harmonize the metadata description, archiving and data sharing methodologies used by existing mercury monitoring networks and programs;*

- To contribute to improve the global coverage of currently available mercury monitoring data by promoting the establishment of new monitoring sites in areas that do not have monitoring capabilities and facilities. The use of Passive Air Samplers (PASs) is considered a cost-effective method for achieving this goal;
- To promote intercomparisons and validation of existing modelling frameworks and tools used to assess the fate of mercury in and between atmospheric and terrestrial compartments.
- To contribute to the development of downstream services designed to perform cost-benefit analysis of different strategies aiming to reduce the level of mercury in environmental media and human exposure.
- To develop advanced web services aiming to facilitate the access and use of state-of-the-art scientific information and data by policy makers and stakeholders.

Section 4 – Objectives of the Agreement

The Applicant agrees to provide access to mercury monitoring data produced by the monitoring network and program that are part of this signed Agreement (Annex - I).

The Applicant may decide to provide access to raw data or/and QA/QC internally approved data sets in agreement with the internal policy and business plan of the network or/and programme that has been proposed as contributor to GOS⁴M.

The Applicant has no obligation in continuing to be part of GOS⁴M if the Applicant decide to discontinue its membership.

The Applicant will be a Member of the GOS⁴M Steering Committee and as such will be invited to Steering Committee meetings with right to express one vote.

Section 5 – Description of monitoring station(s) and/or network and/or database

The Applicant will share information on the data produced by its network/programme by providing the information requested in Annex-I.

The Applicant will inform the Steering Committee on any change that may occur in its programme and information reported in Annex-I.

Section 6 – Collaborative Data Analysis and Publication

The Applicant agrees to collaborate within the GOS⁴M community, if interested, in the data analysis, inter-comparison of new methods/technologies and setting up the data catalogue.

The Applicant agrees to collaborate to publish data in brochures, reports, scientific journals and in public presentation like for example meeting and workshops.

Section 7 – Intellectual property rights

Applicable Law

Nothing in this Membership Agreement should be read to alter the scope and application of Intellectual Property Rights and benefit sharing agreements as determined under relevant laws, regulations and international agreements of Participants.

Access to Data

To the greatest extent possible, the GOS⁴M portal is an open-access facility. All users whether GOS⁴M Members, end-users or others, should have equal access to databases and reports that are part of GOS⁴M.

Intellectual Property Rights

Being GOS⁴M part of GEO WP, the Members agree on the GEO data sharing principles and promotes the free dissemination and access to data sets provided directly or indirectly (through ftp or a dedicated link) through the GOS⁴M portal.

Attribution

GOS⁴M seeks to ensure that the owner/publisher of data is acknowledged and requests that such attribution be maintained in any subsequent use of the data as reported in the metadata description of the data set.

Any other issues related to the intellectual property rights that is not clearly mentioned in this agreement is regulated by the appropriate international law.

Section 8 – Acceptance of Annexes

The Applicant declares to accept the content of the following annexes:

- Annex-I: GOS⁴M - Information shared by the Applicant
- Annex-II: GOS⁴M - Governing Bodies and Rules

Section 9 – Modifications to this Agreement

This Agreement can be modified by the Steering Committee upon a written request submitted by one or more members of GOS⁴M to the Steering Committee.

[end of citation]

Tables

A. Flagship Participants

First Name	Last Name	Organizational affiliation	Country	Roles	e-mail
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B. Contributions (excluding in-kind labour)

- Resources for implementing **GOS⁴M** derives from:
 - the European network for observing our changing planet (**ERA-PLANET**) project aimed to strengthen the European Research Area in the domain of Earth Observation in coherence with the European participation to Group on Earth Observation (GEO) and the Copernicus initiative. ERA-PLANET will support **GOS⁴M** implementation through cash resources around 3 M€;
 - the EuroGEOSS Showcases: Applications Powered by Europe (**E-SHAPE**) aimed to implement a coordinated and comprehensive EO data exploitation initiative through collaboration amongst the European GEO Members and Participating Organizations in order to accelerate the users' uptake of open EO data and information for the benefit of Europe; E-SHAPE will support GOS4M implementation through cash resources around 1.5 M€;
 - the Metrology for oxidised mercury (**MercOx**) is aimed to develop traceable on-line measurement procedures, for the monitoring and control of Hg in gas emission sources and in the atmosphere, in its various species, in order to improve the measurement comparability and uncertainty of Hg measurements. MercOx will support GOS4M implementation through cash resources around 1.8 M€
 - the Italian National Project on Antarctic (**PNRA**). PNRA will support GOS4M implementation through cash resources around 120 K€.
- The global expected resources for implementation of **GOS⁴M** are near 6.4 M€.
- Such resources are sufficient to complete the implementation of the Flagship, considering also that several contributors have not been accounted in this phase of the Implementation Plan.

C. Task / Work Package Structure

The activity under **GOS⁴M** is running throughout the following Tasks:

Task 1: Establish a governance structure

This Task is establishing a governance structure that includes the major governments and institutions supporting the collection of mercury pollution information, to coordinate the work of partnership, to guide and report on the process and deliverables.

Completion  **80%**

Task 2: Analysis of current infrastructures and archived information on mercury

The objective of this Task is to analyse the state of the art of mercury infrastructures to discover strengths and weaknesses that will better help design and implementation of the Portal carried out in Task 4.

Completion  **100%**

Task 3: Harmonization of information and production of metadata following standards.

Through this Task, necessary information to be collected by the core engine have been harmonized and made available through the GEO Mirror Portal of the Flagship.

Completion  **100%**

Task 4: Implementation of the Flagship Portal with the GEO DAB as core engine

The main access to information related to monitoring networks have been made available through the GEO mirror Portal established with support of ESA and the GEOSEC. The Portal is available at <http://www.geoportal.org/community/gos4m>

Completion  100%

Task 5: Design, creation and implementation of core services

Specific core services oriented to support policy implementation are in the planning phase. They will produce simple and up-to-date technical reports on trends of mercury in the environment as well as give necessary information on mercury in the environment. A user can evaluate the benefit of a reduction policy on the global and regional trend of mercury in the environment.

Completion  10%

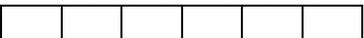
Task 6: Design, creation and release of tools for using and discovering information

Task 6 will create specific tools for end-user to discover and use key information. A strong co-design activity will support planning of tools that will help decision-maker in their evaluation.

Completion  10%

Task 7: Testing and updating of services and tools

Task 7 will serve to test and update services and tools through the end of the GEO Work Plan. Feedbacks from stakeholders will be elaborated to establish a really useful and operative system in support of effectiveness evaluation of the Minamata Convention implementation.

Completion  0%

Task 8: Progress reporting and stakeholder engagement

Finally, Task 8 serves to report progress to GEO on annual basis and provide routine communication to partners. A strong dissemination and co-design activity in connection with stakeholder is under

Completion  20%

Three to five years are necessary to start-up and make operational the Flagship (Task 1 to 8). Remaining time will serve to make adjustments and to better calibrate services considering policy maker and stakeholders requirements and needs (Task7).

D. Deliverables / Milestones

Task 1: Establish a governance structure

D1: Report on Governance structure

M1: Completion of Governance Body (Jun 2017)

Task 2: Analysis of current infrastructures and archived information on mercury

D2: Report on Analysis of current infrastructures and archived information on mercury

M2: Completion of analysis (Sep 2017)

Task 3: Harmonization of information and production of metadata following standards.

D3: Report on harmonization of information and production of metadata

M3: Completion of analysis (Sep 2017)

Task 4: Implementation of **GOS⁴M** Portal with GEO DAB as core engine

D4: Flagship portal

M4: Portal installed (Dec 2017)

Task 5: Design, creation and implementation of core services

D5: Report on analysis of user needs and design of core services

M5: Publishing of core services (Jun 2018)

Task 6: Design, creation and release of tools for using and discovering information

- D6: Report on analysis of user needs and design of tools
- M6: Publishing of core services (Jun 2019)
- Task 7: Testing and updating of services and tools
 - D7: Report on bug and updates
- Task 8: Progress Reporting and Partner Engagement
 - D8: Regular guidance from the steering committee and consultation with Initiative Partners primarily utilizing electronic means such as quarterly web conferences

Task	Time	2017	2018	2019	2020	2021	2022	2023	2024	2025
1: Establish a governance structure										
2: Analysis of current infrastructures										
3: Harmonization of information										
4: Implementation of GOS ⁴ M Portal										
5: Design, creation and implementation of core services										
6: Design, creation and release of tools										
7: Testing and updating										
8: Progress Reporting and Partner Engagement										

Annexes (additional annexes may be added as required)

- I. ~~Acronyms and abbreviations~~
- II. ~~List of key scientific references describing the basis for the work of the Initiative~~
- III. I. Brief CV of Project Leader(s)

Appendix 1 – SDG Targets and Indicators Relevant to Earth Observations

Source: GEO and UN-GGIM (2017), Earth Observations and Geospatial Information: Supporting Official Statistics in Monitoring and Achieving the 2030 Agenda.

Goals and targets (from the 2030 Agenda for Sustainable Development) to which Earth Observations may contribute to the achievement of the target	Indicators for which Earth observations may be able to provide a direct measure or indirect support
Goal 1. End poverty in all its forms everywhere	
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.2 Proportion of total adult population with secure tenure rights to land, (a) with legally recognized documentation, and (b) who perceive their rights to land as secure, by sex and type of tenure
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	
2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	2.4.1 Proportion of agricultural area under productive and sustainable agriculture
2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility	
Goal 3. Ensure healthy lives and promote well-being for all at all ages	
3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	
3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	
3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	3.9.1 Mortality rate attributed to household and ambient air pollution
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks	
Goal 5. Achieve gender equality and empower all women and girls	
5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws	5.a.1 (a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure
Goal 6. Ensure availability and sustainable management of water and sanitation for all	

Goals and targets (from the 2030 Agenda for Sustainable Development) to which Earth Observations may contribute to the achievement of the target	Indicators for which Earth observations may be able to provide a direct measure or indirect support
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated
	6.3.2 Proportion of bodies of water with good ambient water quality
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (0–100)
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time
6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	
6.b Support and strengthen the participation of local communities in improving water and sanitation management	
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all	
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Proportion of population with access to electricity
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	
7.3 By 2030, double the global rate of improvement in energy efficiency	
7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	
7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support	
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead	
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	9.1.1 Proportion of the rural population who live within 2 km of an all-season road

Goals and targets (from the 2030 Agenda for Sustainable Development) to which Earth Observations may contribute to the achievement of the target	Indicators for which Earth observations may be able to provide a direct measure or indirect support
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO ₂ emission per unit of value added
9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	
9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States	
Goal 10. Reduce inequality within and among countries	
10.6 Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions	
10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies	
10.a Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements	
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing
	11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.2 Annual mean levels of fine particulate matter (e.g. PM _{2.5} and PM ₁₀) in cities (population weighted)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities

Goals and targets (from the 2030 Agenda for Sustainable Development) to which Earth Observations may contribute to the achievement of the target	Indicators for which Earth observations may be able to provide a direct measure or indirect support
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels	
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	
Goal 12. Ensure sustainable consumption and production patterns	
12.2 By 2030, achieve the sustainable management and efficient use of natural resources	
12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	
12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	
12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production	12.a.1 Amount of support to developing countries on research and development for sustainable consumption and production and environmentally sound technologies
12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	
Goal 13. Take urgent action to combat climate change and its impacts²	
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population
13.2 Integrate climate change measures into national policies, strategies and planning	
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	
13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	

Goals and targets (from the 2030 Agenda for Sustainable Development) to which Earth Observations may contribute to the achievement of the target	Indicators for which Earth observations may be able to provide a direct measure or indirect support
14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations
14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	14.4.1 Proportion of fish stocks within biologically sustainable levels
	14.5.1 Coverage of protected areas in relation to marine areas
14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation ³	
14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	
14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries	
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area
15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management
15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	15.3.1 Proportion of land that is degraded over total land area
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	15.4.1 Coverage by protected areas of important sites for mountain biodiversity
	15.4.2 Mountain Green Cover Index
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	
15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	

Goals and targets (from the 2030 Agenda for Sustainable Development) to which Earth Observations may contribute to the achievement of the target	Indicators for which Earth observations may be able to provide a direct measure or indirect support
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance	
Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	
17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries	
17.3 Mobilize additional financial resources for developing countries from multiple sources	
17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	17.6.1 Number of science and/or technology cooperation agreements and programmes between countries, by type of cooperation
17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	
17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	
17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation	
17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships	
17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	17.18.1 Proportion of sustainable development indicators produced at the national level with full disaggregation when relevant to the target, in accordance with the Fundamental Principles of Official Statistics

Appendix 2 – Five Pillars of Earth Observations Support to the Paris Agreement

Adaptation

Adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. In Article 7 of the Paris Agreement, Parties recognize the importance of support for and international cooperation on adaptation efforts. Each Party shall, as appropriate, engage in adaptation planning processes and the implementation of actions, including the development or enhancement of relevant plans, policies and/or contributions, including the process to formulate and implement national adaptation plans (NAPs).

Loss and Damage

In Article 8 of the Paris Agreement, Parties recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage. Areas of cooperation and facilitation to enhance understanding, action and support may include: (a) Early warning systems; (b) Emergency preparedness; (c) Slow onset events; (d) Events that may involve irreversible and permanent loss and damage; (e) Comprehensive risk assessment and management; (f) Risk insurance facilities, climate risk pooling and other insurance solutions; (g) Non-economic losses; and (h) Resilience of communities, livelihoods and ecosystems.

Capacity Development / Technology Transfer

According to Article 11, capacity-building under the Paris Agreement should enhance the capacity and ability of developing country Parties, to take effective climate change action, including, inter alia, to implement adaptation and mitigation actions, and should facilitate technology development, dissemination and deployment, access to climate finance, relevant aspects of education, training and public awareness, and the transparent, timely and accurate communication of information.

Technology transfer includes a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change among different stakeholders. According to Article 10 of the Paris Agreement, Parties share a long-term vision on the importance of fully realizing technology development and transfer in order to improve resilience to climate change and to reduce greenhouse gas emissions.

National Reporting / Global Stocktake

According to Article 4 paragraph 2 of the Paris Agreement, each Party shall prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions. Each Party shall communicate a nationally determined contribution every five years. Article 13 outlines the framework for transparency of action. Parties need to regularly provide (a) a national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases, prepared using good practice methodologies accepted by the IPCC and agreed upon by the COP and (b) information necessary to track progress made in implementing and achieving its nationally determined contribution.

According to Article 14, Parties shall periodically take stock of the implementation of the Paris Agreement to assess the collective progress towards achieving the purpose of the Agreement and its long-term goals (referred to as the "global stocktake"). It shall do so in a comprehensive and facilitative manner, considering mitigation, adaptation and the means of implementation and support, and in the light of equity and the best available science.

Mitigation

In the context of climate change, mitigation refers to human interventions to reduce the sources or enhance the sinks of greenhouse gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to solar energy or wind power, improving the insulation of buildings, and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere. Article 5 of the Paris Agreement calls on Parties to take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases, including forests (reducing emissions from deforestation and forest degradation).

Appendix 3 – Global Targets of the Sendai Framework for Disaster Risk Reduction

- A. Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality rate in the decade 2020-2030 compared to the period 2005-2015.
- B. Substantially reduce the number of affected people globally by 2030, aiming to lower average global figure per 100,000 in the decade 2020 -2030 compared to the period 2005-2015.
- C. Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.
- D. Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.
- E. Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
- F. Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this Framework by 2030.
- G. Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.