WP23_25: Global Observation System for Mercury

1270,256

Basic Information

Full title of the Initiative

Global Observation System for Mercury

Short Title or Acronym

GOS4M

Current category in the 2020-2022 GWP

GEO Flagship

Proposed category in the 2023-2025 GWP

GEO Flagship

Points of Contact

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Purpose

Objective

The GOS4M was designed to support nations, UNEP and all interested parties to support the evaluation of the impacts and effect of mercury contamination of Earth system on human health and provide EO data sets and validated interoperable tools

Please provide a short description of the Initiative

GOS4M developed the GOS4M-Knowledge Hub which includes tools to discover and access to available in-situ Hg data sets, satellite observations used in regional and global scale chemical models, the HERMES emulator of modeling outputs for different anthropogenic emission scenarios and scientific references to the adopted methodology.

Why is this Initiative needed?

Mercury is a harmful substance for people exposed to its organic compounds. It is released by anthropogenic sources and natural-driven emission processes, can be transported long distances from the emission region/source and be deposited to terrestrial and aquatic receptors. Once deposited to marine and fresh water ecosystems may partly be deposited to sediments and partly be bioaccumulated in biota. In marine and freshwater biota can be found at concentrations that increase with trophic levels. The impact on human health may occur through different patterns of exposure such as ingestion of Hg-contaminated food such as fish and sea food. Once bioaccumulated in human body it may have toxic effects on the nervous, digestive and immune systems, as well as on lungs, kidneys, skin and eyes, causing serious health problems. The growing perception of nations on the strategic importance of using EO data sets to better characterize the magnitude and spatial distributions of Hg pollution contamination led to the creation of the GEO Flagship on Hg (GOS4M, www.gos4m.org) (as part of the GEO WP 2016-2025).

What evidence is there to support this need?

The UNEP Global Mercury Fate and Transport Partnership (UNEP F&T) was launched in 2006, with the objective to provide state of the art knowledge on different aspects related to mercury releases to the atmosphere, its long range atmospheric transport and deposition patterns to aquatic and terrestrial ecosystems and its potential impact on human health and ecosystems.
There is a current effort form various parties in EU, USA, Canada, South Africa and other countries to make the GOS4M Knowledge Hub as reference instrument to provide data and services to all interested Parties of the MCM and to MCM Secretariat.

Is this Initiative open to participation by representatives of any GEO Member, Participating Organization, and GEO Associate?

Yes

Are you aware of other projects or initiatives at a global or regional scale (both in GEO and externally) that provide similar products or services?

Yes

Please describe.

No other projects or initiatives provide similar products or services.

How is this Initiative unique?

No real competitors have been identified but a list of complementary solutions can be reported:
Competing Solution / Products / Data Sources
MapX, UN Environment / • Online platform for managing geospatial data on natural resources • Maps on Artisanal Small-scale Gold Mining activities / • Satellite • Inventories
EDGAR, JRC / • Global mercury emission inventory • Publications / • International economic data • Chemical transport model
EMMMA-Environmental Mercury Mapping, Modeling, and Analysis, USGS / • Tools for Mapping, Modeling, and Analysis of mercury data / • Publications • In situ instruments • Statistical analyses
AMAP / • Global mercury emission dataset / • Inventory • Socio-economic data
EMEP-European Monitoring and Evaluation Programme, EEA / • Global mercury emission dataset / • Data reported by Parties under LRTAP Convention
ECCAD / • Databases on emissions of atmospheric Compounds and Compilation of Ancillary Data / • All databases already available (GFED, GFAS, AMAP, etc.)
Global Mercury Pollution visualizer / • Data visualization and mapping / • Global Mercury Assessment

Please identify the most important actual and/or intended outputs (products, services, etc.) produced by the Initiative, along with their intended and/or actual users. This list does not need to be comprehensive but should identify the outputs which are most used and are expected to have the greatest potential impact.

Output	Status	Users	Additional info
In-situ Hg measurements	Regularly updated	scientists	Global monitoring network
Hg deposition scenarios	Occasionally updated	policy-makers, citizens	Model outputs
Antropogenic Hg emissions	Occasionally updated	policy-makers, citizens	Derived from Global Mercury Assessments
Hg concentration in oceans	Regularly updated	policy-makers, citizens	As resulteing from deposition changes
Hg concentration in biota	Regularly updated	policy-makers, citizens	As resulting from Hg concentration in ocenans change
Hg reduction costs	In development	policy-makers, citizens	As resulting form implementation of Best Available Technologies
Risk reduction on population	Planned	policy-makers, citizens	Estimated on fish consumtion

If needed, please provide additional comments or explanation to accompany the outputs table

The GOS4M-KH provides widgets that operationalizes integrated multi-model and multi-domain computations

What kinds of decisions are the outputs of this Initiative primarily intended to support?

To support policy makers in co-designing policy-driven scenarios that nations may implement for achieving the objectives of the Minamata Convention on Mercury (MCM).

How will these decisions benefit from the outputs of this Initiative?

To provide comparable EO data sets including in-situ global monitoring mercury data as well as validated modelling frameworks that may allow policy makers and all interested parties to co-design policy scenarios for achieving the objectives of the MCM

What kinds of impacts (for example, reduced loss of life, monetary savings, conservation of biodiversity, etc.) are anticipated as a result of the use of the outputs of this Initiative?

Reduce the risk for public health caused by the exposure to mercury-contaminated food chain and ecosystems and monetary saving.

Has this Initiative been asked to provide specific information (for example, reports, data, services) on an ongoing basis to an international convention, organization, or other multilateral body?

No

Technical Synopsis

Please provide a brief description of the methods used by the Initiative to produce its (actual or planned) outputs.

The application connects a statistical emulator of a Chemical Transport Model (CTM) with a Biogeochemical

Model (BGCM) and downstream to a trophic model as well as ad-hoc designed socio-economic model components. The CTM can simulate in high resolution the fate of Hg in the atmosphere from emission source to the final receptors, and therefore allow for a source-receptor (S-R) assessment. However, simulations of the Hg atmospheric cycle by CTMs have a temporal limit (few years), due to the fact Hg exchange at the interface of atmosphere with other compartments (soil and oceans), and is poorly characterized. Therefore, a CTM is simply not designed to simulate long-term Hg perturbation scenarios, beyond the temporal validity of the Hg exchange approximations. On the other side, a BGCM is designed to simulate the exchange of Hg between Earth System compartments on time scale of decades and centuries. Currently available BGCMs have of course limitations (e.g. the exchange rates between compartments are considered to be static over millennia, despite we know that the exchange between compartments are Hg concentration gradient-driven, and therefore they are dynamic), however they represent the current best modelling solution used to calculate the effect of an Hg emission perturbation over long time scales. A limitation of BGCM, in relation with CTM, is the lack of horizontal resolution, and therefore it is impossible to consider the effect of perturbation within a S-R framework. For these reasons, we exploited the power of coupling CTM and BGCM. The first was used to establish the short-time "horizontal" S-R relationship under anthropogenic emission control scenarios, the latter was used to simulate the long-term effect of Hg emission scenario perturbations.

If you would like to provide further details on the technical methods, you may upload one or more documents here.

- hermes_atmospheric_component_of_gos4m_knowledge_hub.pdf (link)

Are there any significant scientific or technical challenges that need to be resolved by the Initiative during the 2023-2025 period?

Yes

Please describe these challenges and the steps being taken to solve them.

To integrate in the GOS4M Knowledge Hub economic evaluation of emission reduction technologies and the human risk assessment based on fish diet. These challenges will be tackled by reviewing available reports on cost effectiveness of options for mercury abatement from anthropogenic emissions and working to the integration of fish catch database and fish consumption.

Does the Initiative expect to complete any key new outputs, improvements to existing outputs, or improvements to the methods of producing outputs, in the 2023-2025 period?

Yes

Please describe these new outputs or improvements.

New outputs will provide cost evaluation for mercury reduction form anthropogenic emission and assessment of population risk

Please identify the key tasks that must be implemented to ensure delivery of these changes, with target dates for completion.

Task	Task description	Expected completion (month/year)
1 - In-situ data collection and catalog	Collection of Hg concentration in ambient-air by analyzers and passive samplers. Metadata production	12/2025
2 - Modelling cost reduction and population risk	Implementation of cost assessment for different policy options & Integration of fish consumption and assessment of population risk	10/2023
3 - Increasing number of scenarios	Release of new deposition scenarios based on different models and emission databases	04/2024
4 - Knowledge Hub update	Improvement of the Knowledge Hub	06/2024
5 - Sustainability and governace	Attracting new partners and securing external funds	12/2025
6 - Dissemination and communication	Activity on disseminatiton and communication	12/2025

Resources

Have all resources required to implement the Initiative's planned work in the 2023-2025 period been secured?

- Gap in human resources

What are the essential skill sets needed by the Initiative but are not currently resourced?

IT developer

What actions is the Initiative taking to obtain the required resources?

Searching among participants for needed skills

Please list all financial and non-financial contributions to the Initiative (other than in-kind, voluntary participation by individual contributors) having a value of more than USD 50,000.

Contributing Organization	GEO Status	Type of Resource	Value	Currency
CNR	Italy	Financial	1600000	EURO
CNR	Italy	Data	n.v.	
CNR	Italy	Equipment	10000	EURO
FMI	Finland	Data	n.v.	
INIBIOMA-CONICET	Argentina	Data	n.v.	
GET	France	Data	n.v.	
IPREM	France	Data	n.v.	
IFREMER	France	Data	n.v.	
LIENSs	France	Data	n.v.	
TU	China	Data	n.v.	
MIO	France	Data	n.v.	
IGE	France	Data	n.v.	
ECCC-AMM	Canada	Other	n.v.	
SAWS	South Africa	Data	n.v.	
NADP	United States	Other	n.v.	
IJS	Slovenia	Data	n.v.	
IG, CAS	China	Data	n.v.	
CzechGlobe	Czech Republic	Data	n.v.	
HEREON	Germany	Data	n.v.	
UoY	United Kingdom	Data	n.v.	
LIN SB RAS	Russian Federation	Data	n.v.	
IBIW	Russian Federation	Data	n.v.	
LUMEX	Russian Federation	Equipment	50000	EURO

Lessons from the 2020-2022 Period

Were all planned activities for the 2020-2022 period implemented as expected?
Yes

Were there any key challenges faced by the Initiative in the 2020-2022 period?
Yes

Please describe.

During the last four years GOS4M contributed to the policy process of the MCM through the participation to ad-hoc policy and scientific expert groups, COP events, policy- and scientific-focused meetings, and built partnerships for science- and policy-driven projects funded by major international programs (i.e., H2020, UNEP-GEF, NSF, national programs). GOS4M activity and its outcomes contributed to increase public awareness on the importance of reducing the risk for public health caused by the exposure to mercury-contaminated food chain and ecosystems. One priority goal of the Flagship was to establish governing bodies composed by associated Organizations (details can be found at www.gos4m.org). The organisational structure of GOS4M comprises the following three Governing Bodies:
A Steering Committee (SC)
A Scientific Advisory Board (SAB)
Focal Points (FPs)

In summary the following planjned activities were carried-out:
Planned activity >> Completion and justification
Establish a governance structure >> Governing bodies established (http://www.gos4m.org/management-and-governance/) and kick-off held on 07 Oct 2020
Analyze current infrastructures and archived information on mercury >> Review of current global and regional mercury monitoring networks completed.
Harmonize information and production of metadata following standardsMetadata for monitoring sites realized
Implement a GOS4M Portal with GEO DAB as the core engine Metadata catalog implemented (https://sdi.iia.cnr.it/gos4mcat) and linked to the GEO Portal (https://www.geoportal.org/community/gos4m)
Design, create and implement core services Services to share in-situ datasets, scenario results and expected trends of mercury in biota implemented in the Knowledge Hub (https://sdi.iia.cnr.it/hermes/)
Design, create and release tools for using and discovering information Metadata catalog implemented (https://sdi.iia.cnr.it/gos4mcat) and linked to the GEO Portal (https://www.geoportal.org/community/gos4m)
Test and update services and tools Services and tools tested
Progress reporting and stakeholder engagement Reporting to GEO Sec realized

Were there any impacts or changes to operations due to COVID-19?

No

Please describe the key changes proposed for the 2023-2025 period, for example, new projects, new areas of focus, or adjustments to the activity governance.

New areas of focus are economical assesment of reduction scenarios and integration of population risk exposure

Does the Initiative have outputs (products, services, etc.) available to users now, even if only on a pilot or testing basis?

Yes

Please provide any available information describing this usage (for example, user statistics, results of user testing) and/or feedback from users (for example, user comments, evaluations).

The GOS4M Knowledge Hub (GOS4M-KH) (available at gos4m.org/kh) is a platform that is delivering services to support the effectiveness evaluation of the Minamata Convention on Mercury. The platform is sharing high quality observational data, model outputs and evaluation tools co-designed with policy-makers to assess mercury reduction scenarios. It will support selection of cost-effective strategies that would allow a Nation or Regions to achieve the target(s) of environmental legislation on mercury.

Please provide supporting documentation if available.

- no supporting documents provided -

Do you have evidence of any impacts that have occurred in part as a result of using the outputs of the Initiative (for example, policy decisions taken, behaviour changes by

users, risks mitigated)?

Yes

Please provide examples, with evidence where available.

GEO has been accepted as Observer at the Minamata COP3. The GOS4M has been officially reported among main activities in monitoring mercury in ambient air.

Please provide supporting documentation if available.

- unep_mc_cop_3_inf_15_eemonitoring_advance_reading.pdf (link)
- unep_mc_cop_3_inf_27_observersenglish.pdf (link)

Have there been any internal or external reviews or evaluations of the Initiative since 2019?

Yes

Please provide a copy of the report, if available.

- geo_17_17a_mid_term_evaluation.pdf (link)

Please indicate any GEO Work Programme activities with which you have ongoing collaboration.

Please indicate any additional GEO Work Programme activities with which you would like to establish new collaborations.

Stakeholder Engagement and Capacity Building

Are there specific countries or organizations that your Initiative would like to engage?

Yes

Please list these countries, regions or organizations.

To be contacted by GOS4M Focal points:
African countries (AfriGEO), Central and Southern America (AmeriGEO)

What are your plans to engage them?

Deliver passive samplers to extend monitoring networks

Does your Initiative engage users in the work of the Initiative (for example, consultation, testing, co-design)?

No

Does the Initiative have a user engagement strategy or similar kind of document?

No

Are there categories of users that are not represented at this time, but you would like to engage?

No

Does the Initiative have a documented capacity development strategy?

No

Please describe the approach to capacity development that is being implemented by the Initiative?

- no answer given -

Are there any commercial sector organizations participating in this Initiative?

Yes

Please list the commercial sector organizations.

Organization name	GEO Member/PO/...	Country in which the organization is based	City in which the organization is based
Lumex-marketing LLC	Russian Federation	Russian Federation	St. Petersburg
Tekran	Canada	Canada	

Are there opportunities for commercial sector uptake of the outputs of the Initiative?

Yes

Please describe these opportunities.

Develop applications based in in-situ data measurments and scenarios output

Is there already commercial uptake occurring?

No

Are there opportunities for further commercial sector participation in the Initiative?

Yes

Please describe these opportunities.

Bring expertise on application development

Does the Initiative have a plan for commercial sector engagement?

No

Governance

Please describe the roles of each of the key leadership positions, as well as any team structures involved in day-to-day management.

Leadership positions are:
Chair of the Steering Committee
Co-Chairs of the Steering Committee

Is there a steering committee or other governance bodies that advise the Initiative but are not involved in day-to-day management?

Yes

Please describe the roles of each body. If there are multiple governance bodies, please describe the relationships among them (such as through a governance structure diagram).

Governing bodies are:

The Steering Committee (SC) that will:
• ensure the efficient management and implementation of the GOS4M Business Plan (BP) [refer to GEO WP (2020-2022)];
• 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 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 and tools in support of Parties of the Minamata Convention on Mercury (hereafter MCM);
• 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 Scientific Advisory Board (SAB) that is a subsidiary body composed of distinguished scientists and technical experts covering different domains of fundamental and policy-oriented research. The SAB is established to advise the Steering Committee on matters relating to current and future mercury science and technology information.

The SAB is composed of nine distinguished well recognised experts covering one or more mercury research and policy domains who have provided a significant contribution to advancement of science and environmental policy related to global mercury pollution issues including human health.

The SAB is expected to provide an independent scientific and technical guidance and advice to the SC, including providing input and review various scientific materials and products developed by GOS4M before distribution to the public domain, and other activities that the SC may identify. The SAB members may be asked by the SC to provide an input to the revision of the Implementation Plan of GOS4M.

The SAB can establish an Expert Group (EG) to cover expertise not available among its members. The EG would comprise well known experts on emerging topics that might be relevant for the GOS4M activities.

Focal Points (FPs) to ensure close cooperation between the GOS4M activities and the Regional GEOs. FPs will be established according to the current GEO Regional Initiatives: AfriGEO, EuroGEO, AmeriGEO and AOGEO. FPs' role is to facilitate communications, information and knowledge sharing, and identifying regional priorities or needs for the GOS4M. The FPs members that will link GOS4M and Regional GEO activities by facilitating the exchange of knowledge between the two groups to help inform and develop regional policy needs that can be implemented into the GOS4M-KH as part of the overall GEO Knowledge Hub. The FPs established will serve as the primary contact of the SC with regional end-users, policy makers and national stakeholders with respect to the implementation of the MCM and other related multilateral environmental agreements.

- gos4m_governance_diagram.pdf (link)

What methods does the Initiative use to communicate with its participants?

- Email / e-newsletters
- Website
- Regular events

Please describe the key risks that could delay or obstruct the completion of the planned activities and outputs of the Initiative, along with any actions taken to mitigate these risks.

Description of the hazard	Description of the possible impacts	Scale of impact	Likelihood of occurrence	Mitigation measures
Delay in modelling activity	Unavailability of scenarios outputs	Moderate	Possible	Extend the modelling community
Delay in Knowledge Hub development	Knowledge Hub not fully implemented	Moderate	Possible	Involve participants in the development

What methods are used by the Initiative to monitor its effectiveness?

- Informal discussions with users / beneficiaries
- Consultations or events

Would the Initiative be interested in assistance from the GEO Secretariat for developing an impact plan?

Yes

How are the results of the monitoring and evaluation activities shared with participants and the wider GEO community?

Distributed by e-mail

Are any monitoring or evaluation activities required by funders/contributors?

No

Participants

Please list the active individual participants in the Initiative

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Other information

Please provide any other comments or information that was not included in the previous sections, but you would like to appear in the Implementation Plan.

The GOS4M is freely participated by research institutes, universities and agencies on the basis of their expertise on various aspects related to mercury pollution, health impact and policy evaluation. Access to the Steering Committee (SC) is open following the procedure established by the Executive Board and rules are reported on the GOS4M portal.
GOS4M is contributing to the GEO Knowledge Hub.
As stated in the general comments above, the GOS4M has been developed thanks to the financial contributions of various national, regional and global scale projects. In the coming years financial contributions will be provided by ongoing H202 projects and also by national funding (i.e., South Africa is developing its national hub in cooperation with other African countries, expansion of monitoring global networks promoted by Canada, GMOS, South Africa, Chile, Argentina, Brazil are ongoing).

- no supporting documents provided -

Co-Editor Management

List of co-editors for this initiative

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