Global Mercury Observation System

Major achievements and highlights

http://www.gmos.eu/

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Produced to mark the occasion of the concluding GMOS meeting held in Brussels at the MCE Conference Centre on 17-18 September 2015

Why Mercury is a Problem

Mercury (Hg) is emitted to the atmosphere mainly as gaseous elemental mercury, $Hg^0(g)$ or GEM, and due to its long atmospheric lifetime (0.5 - 1 year) it is defined as a "global pollutant" and has an impact on ecosystems very distant from the places from where it is emitted.

Atmospheric $Hg^0(g)$ can be oxidized to form $Hg^{(II)}$ compounds (e.g. $HgCl_2$), which is readily removed from the atmosphere by both wet (precipitation) and dry deposition (settling). A part of the $Hg^{(II)}$ that is deposited may be methylated within ecosystems and it is this form of Hg which can enter the food web and is particularly toxic to living organisms. Methyl mercury biomagnifies in the food web and can reach levels which endanger human well-being in some predatory fish species.

The understanding of processes which govern Hg emission from natural and anthropogenic sources, its transport and transformation in the atmosphere, and its eventual deposition and methylation is necessary to quantify its potential impact on human health.

Although Hg monitoring networks exist (Europe, Canada, USA and Asia), many regions still have scarce or no data on atmospheric Hg, particularly in the southern hemisphere.

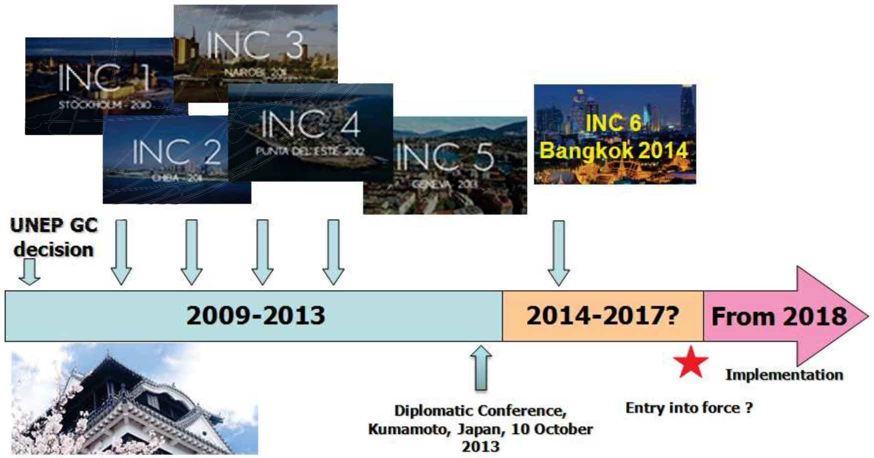
A coordinated global observational network for atmospheric Hg has been established during the GMOS project, to demonstrate that it is possible to provide consistent and high-quality Hg measurements worldwide and validate models for policy scenarios analysis.

GMOS and the Minamata Convention

The Minamata Convention has been signed by over 100 nations in Kumamoto, Japan in October 2013 after a preparatory process carried out by the UNEP Governing Council - INC (Intergovernmental Negotiation Committee) activities started in 2009.

The recent Minamata Convention is aimed at reducing the anthropogenic impact on the global Hg biogeochemical cycle. (http://www.mercuryconvention.org/)

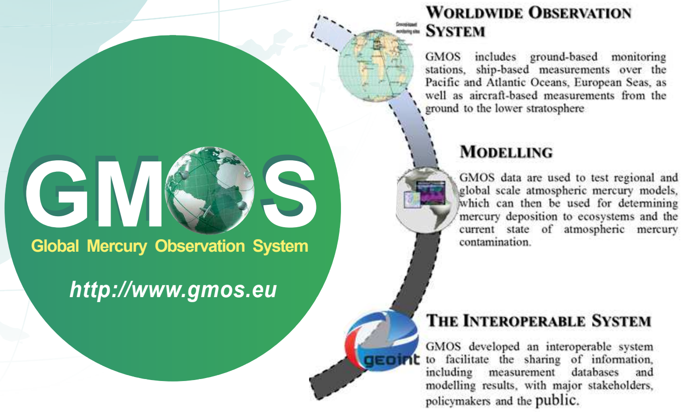
It is foreseen that the Minamata Convention will entry into force from January 2018 – GMOS may play a very important role by providing high quality data on mercury in ambient air, marine ecosystems including biota and human health exposure.



Goals

The specific objectives of GMOS were:

- ✓ **To establish a Global Observation System for Mercury** combining observations from permanent ground-based monitoring stations, and from oceanographic and airborne measurement campaigns.
- ✓ **To validate regional and global scale atmospheric mercury modelling systems** using measured ambient concentrations of atmospheric mercury, and Hg fluxes to terrestrial and aquatic receptors.
- ✓ **To identify source-receptor relationships at country / regional scales** and how they vary in time in order to evaluate the impact for selected projected scenarios of mercury emissions from anthropogenic and natural sources.
- ✓ **To develop interoperable tools to allow the sharing of observational data and models output** produced in GMOS, for the purposes of research and policy development and implementation.



As part of future actions within the Minamata Convention implementation through a close cooperation with UNEP, GEF and existing regional programmes the possibility of transition of GMOS infrastructure to an operational infrastructure is under evaluation.

Bridging Science and Policy

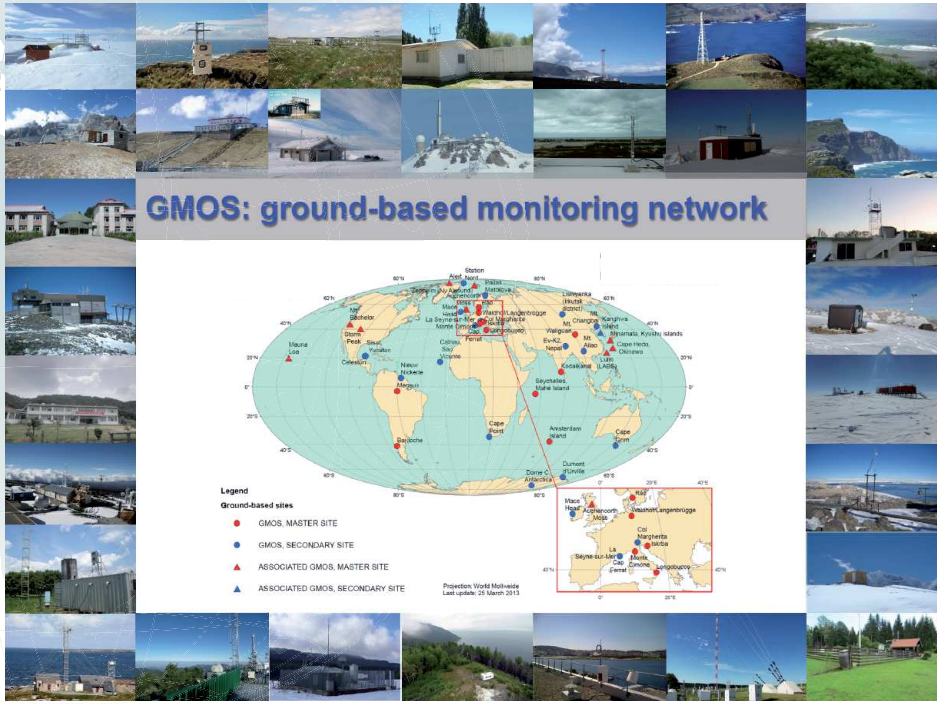
Since 2001 the EU mercury scientific community has plaid a key role in supporting the UNEP Governing Council in the preparation of the Minamata Convention. A strong contribution was provided through the UNEP Partnership Area on Mercury Aim Transport and Fate Research (**UNEP F&T**) since 2006, the Task Force on Hemispheric Transport of Air Pollutants (under the **UNECE-LRTAP**) and the **GEO** Task on Tracking Pollutants since 2008.

The Policy Process for Mercury

2001	UNEP *GC at its 21^{st} session*: need for a global assessment of mercury recognized
2003	Study "GMA Report", prepared by UNEP presented to the *GC at its 22^{nd} session*. GC agreed for further international action on mercury
2005	UNEP *GC at its 23^{rd} session* called for Mercury Partnerships between governments and stakeholders: Five Partnership Areas were identified
2005	UNEP F&T published "Dynamics of mercury pollution on regional and global scales" Springer, USA (Pirrone and Mahaffey, Eds.)
2007	UNEP *GC at its 24^{th} session*: "two-track " approach based on voluntary actions and on the path to LBI. An overarching framework for strengthening UNEP Global Mercury Programme partnerships was developed
2008-2009	UNEP F&T published "Mercury Fate and Transport in the Global Atmosphere: Emissions, Measurements and Models" Springer, USA (Pirrone and Mason, Eds.)
2008	AMAP and UNEP published ""The Global Atmospheric Mercury Assessment: Sources, Emissions and Transport"
2009	UNEP *GC at its 25^{th} session*: agreed on an Intergovernmental Negotiating Committee (INC) to prepare a legally binding instrument on mercury
2010-2013	INC's work started in 2010
Oct. 2013	Minamata Convention was signed in Kumamoto, Japan

How did GMOS set about achieving its goals?

The GMOS network was established in part by the integration of existing atmospheric Hg monitoring stations which are part of current regional networks. In addition to this a number of new GMOS sites have been established, with a particular focus on the Southern Hemisphere. These sites include a number of remote sites, both at sea level and at high altitude which through the GMOS project are providing monitoring data from regions where previously there was absolutely no data at all.



To date, there are more than 40 monitoring sites participating in the GMOS network.

How did GMOS set about achieving its goals?

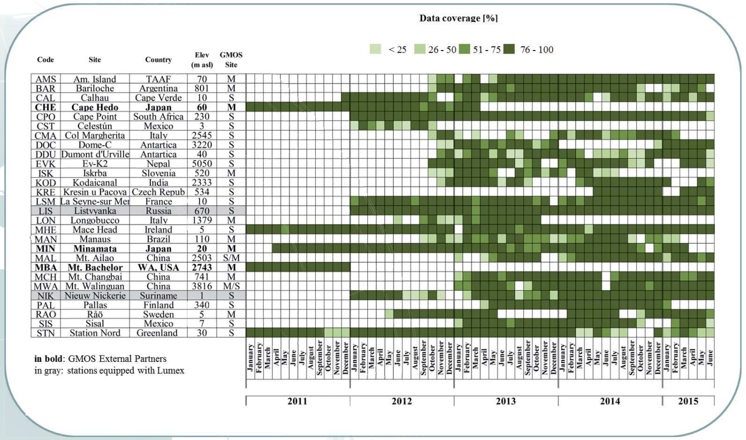
The GMOS network uses high-quality sampling and measurement techniques. At all sites GEM is measured continuously and precipitation samples are collected with a frequency which depends on the site's climate zone. The measurement and sampling techniques used in the GMOS project were chosen to be compatible and comparable with those used in existing regional monitoring programmes.

GMOS has two classes of monitoring stations:

- ✓ Master Stations are those sites where Gaseous Elemental Mercury (GEM), Gaseous Oxidized Mercury (GOM), and fine particulate-bound Hg (PBM2.5) as well as Hg in precipitation are continuously measured;
- ✓ Secondary Stations are those sites where only Total Gaseous Mercury (TGM) or GEM, and Hg in precipitation are continuously measured.

How did GMOS set about achieving its goals?

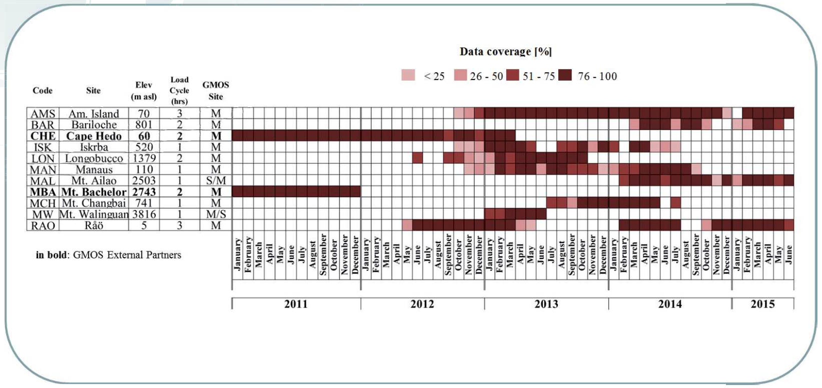
Where possible the monitoring data from the stations is uploaded in near real-time to the GMOS central database. In places where internet access is not well functioning monitoring data is updated by operators on a regular basis.



Code	Site	Country	Elev (m asl)	GMOS Site
AMS	Am. Island	TAAF	70	M
BAR	Bariloche	Argentina	801	M
CAL	Calhau	Cape Verde	10	S
CHE	**Cape Hedo**	**Japan**	**60**	**M**
CPO	Cape Point	South Africa	230	S
CST	Celestún	Mexico	3	S
CMA	Col Margherita	Italy	2545	S
DOC	Dome-C	Antartica	3220	S
DDU	Dumont d'Urville	Antartica	40	S
EVK	Ev-K2	Nepal	5050	S
ISK	Iskrba	Slovenia	520	M
KOD	Kodaicanal	India	2333	S
KRE	Kresin u Pacova	Czech Repub	534	S
LSM	La Seyne-sur Mer	France	10	S
LIS	Listvyanka	Russia	670	S
LON	Longobucco	Italy	1379	M
MHE	Mace Head	Ireland	5	S
MAN	Manaus	Brazil	110	M
MIN	**Minamata**	**Japan**	**20**	**M**
MAL	Mt. Ailao	China	2503	S/M
MBA	**Mt. Bachelor**	**WA, USA**	**2743**	**M**
MCH	Mt. Changbai	China	741	M
MWA	Mt. Walinguan	China	3816	M/S
NIK	Nieuw Nickerie	Suriname	1	S
PAL	Pallas	Finland	340	S
RAO	Råö	Sweden	5	M
SIS	Sisal	Mexico	7	S
STN	Station Nord	Greenland	30	S

in bold: GMOS External Partners
in gray: stations equipped with Lumex

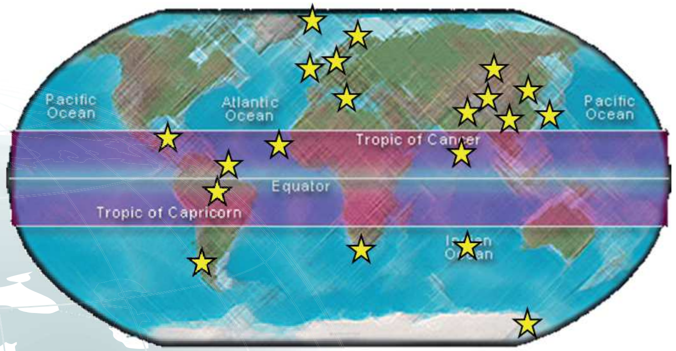
The Figures above show the raw data coverage of both TGM/GEM and Hg speciation data from the start of the project until June 2015. The graphics show the consistency of dataset that actually is in GMOS database on a monthly basis. From the start of the GMOS network some few monitoring sites have changed their location or sampled for short time periods, however, there have been a representative number of continuous 28 core sites maintained during the time that represents the duration of the GMOS project and to date are on-going.



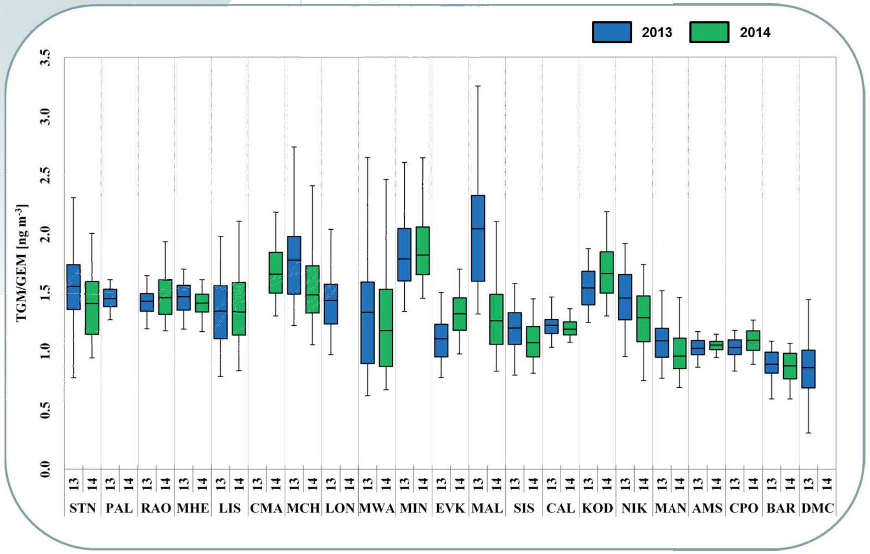
Code	Site	Elev (m asl)	Load Cycle (hrs)	GMOS Site
AMS	Am. Island	70	3	M
BAR	Bariloche	801	2	M
CHE	**Cape Hedo**	**60**	**2**	**M**
ISK	Iskrba	520	1	M
LON	Longobucco	1379	2	M
MAN	Manaus	110	1	M
MAL	Mt. Ailao	2503	1	S/M
MBA	**Mt. Bachelor**	**2743**	**2**	**M**
MCH	Mt. Changbai	741	1	M
MW	Mt. Walinguan	3816	1	M/S
RAO	Råö	5	3	M

in bold: GMOS External Partners

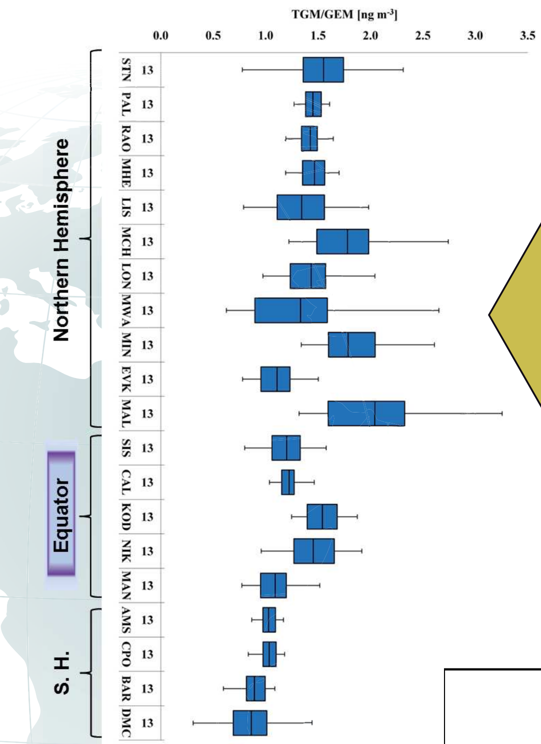
How did GMOS set about achieving its goals?



TGM/GEM yearly distribution for the 2013 and 2014 years that include enough data from the core monitoring stations to support discussion on Hg concentrations, trends and its gradient worldwide. The sites have been organized in the graphic according to their location in the Northern Hemisphere, those in the Equatorial Zone and in the Southern Hemisphere.



How did GMOS set about achieving its goals?



The northern sites had significantly higher median concentrations than did the southern sites. Therefore, a clear gradient of Hg mean concentration for the 2013 & 2014 yrs has been highlighted from the north to the south according to the literature.

	Code	Name	Country	Lat	Lon	Elev. (m a.s.l.)
Northern Hemisphere	STN	Station Nord	Greenland	81.58	-16.61	30
	PAL	Pallas	Finland	68.00	24.24	340
	RAO	Råö	Sweden	57.39	11.91	5
	MHE	Mace Head	Ireland	53.33	-9.91	5
	LIS	Listvyanka	Russia	51.85	104.89	670
	MCH	Mt. Changbai	China	42.40	128.11	741
	LON	Longobucco	Italy	39.39	16.61	1379
	MWA	Mt. Waliguan	China	36.29	100.90	3816
	MIN	Minamata	Japan	32.23	130.40	20
	EVK	Ev-K2	Nepal	27.96	86.81	5050
	MAL	Mt. Ailao	China	24.54	101.03	2503
Equator	SIS	Sisal	Mexico	21.16	-90.05	7
	CAL	Calhau	Cape Verde	16.86	-24.87	10
	KOD	Kodaikanal	India	10.23	77.47	2333
	NIK	Nieuw Nickerie	Suriname	5.96	-57.04	1
	MAN	Manaus	Brazil	-2.89	-59.97	110
Southern Hemisphere	AMS	ımsterdam Islan	TAAF	-37.80	77.55	70
	CPO	Cape Point	South Africa	-34.35	18.49	230
	BAR	Bariloche	Argentina	-41.13	-71.42	801
	DMC	Dome C	Antarctica	-75.10	123.35	3220

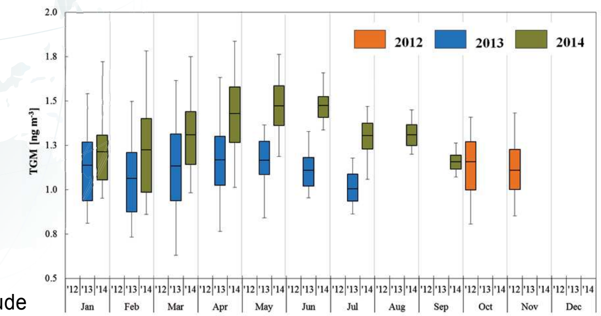
GMOS Global Mercury Observation System

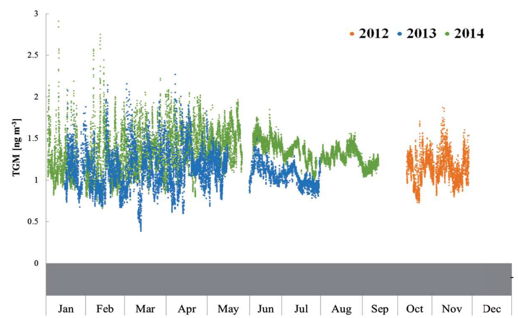
GMOS at High Altitude Locations

Several GMOS sites are at hight altitude locations soch as those in Nepal, China, Alps, India, Antarcrtica, etc., Theses sites provide valuable information for understanding of Hg Dynamics in the mid troposphere.

The EVK GMOS site, located at 5050 m. asl represents the highest altitude monitoring station for atmospheric Hg in the world. The mean TGM/GEM concentration observed at the EVK GMOS is less than the reported background TGM/GEM concentration for the Northern Hemisphere (1.5-1.7 ng m-3) whereas is actually within the range of values expected for background levels of TGM/GEM in the Southern Hemisphere (1.1-1.3 ng m^{-3}).

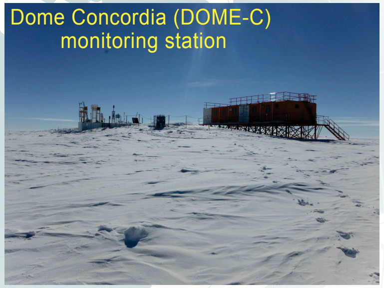
Anyway, the observed range of values is somewhat surprising for a remote high altitude location. The elevated background level of TGM/GEM observed under certain meteorological conditions,and primarily during the non-monsoon period of the year (October to May) could likely be due to strong regional sources in Asia as well as influenced by long-range transport of polluted air mass as which extend from the Indian Ocean into the Himalayan Mountain Range, and occasionally by the weak local emission sources.

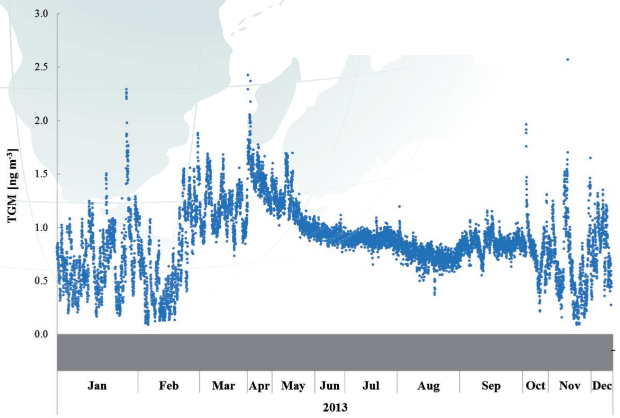




GMOS in Polar Areas

A surprising discovery that provided a great impetus for atmospheric Hg chemistry research in the scientific community was the observation of an unusual phenomenon called Atmospheric Mercury Depletion Events (AMDEs) firstly observed in the atmospheric boundary layer of the Arctic and sub-arctic regions, and secondly in Antarctica during springtime. These phenomena due to a series of photochemically initiated reactions believed to be driven by the release of active halogen compounds, can reduce the atmospheric concentration of TGM/GEM to undetectable levels. GMOS at established monitoring sites in the Arctic and Antarctic.

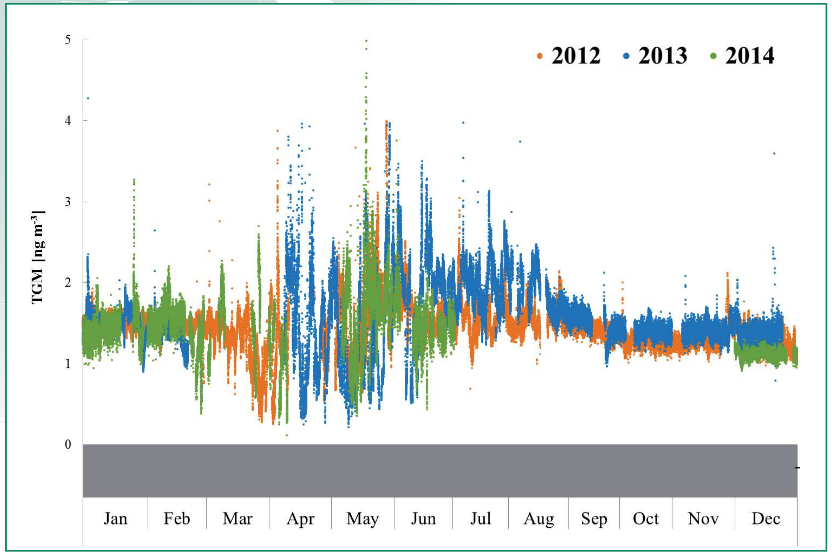




Significant variability in measured TGM/GEM concentrations were observed at the Italian-French Antarctic monitoring site, Dome C. This variability resulting from unique atmospheric chemistry occurring in polar areas particularly during antarctic springtime. The Figure refers to the TGM/GEM concentrations observed during the 2013 year at the GMOS monitoring Station (DOME C).

These types of measurements can yield critical information for a better understanding of the processes involved in the Hg cycle in the polar atmosphere and the mechanisms characterizing the deposition of this pollutant to this fragile environment.

GMOS in Polar Areas



The Figure refers to the TGM/GEM concentrations observed during the 2012, 2013, and 2014 years at the Station Nord Site. During the Arctic springtime, due to a series of photochemically initiated reactions, several AMDEs were depicted each year, and during these events TGM levels fell around 0.2 – 0.3 ng/m^{-3}.

Harmonization of Monitoring Procedures

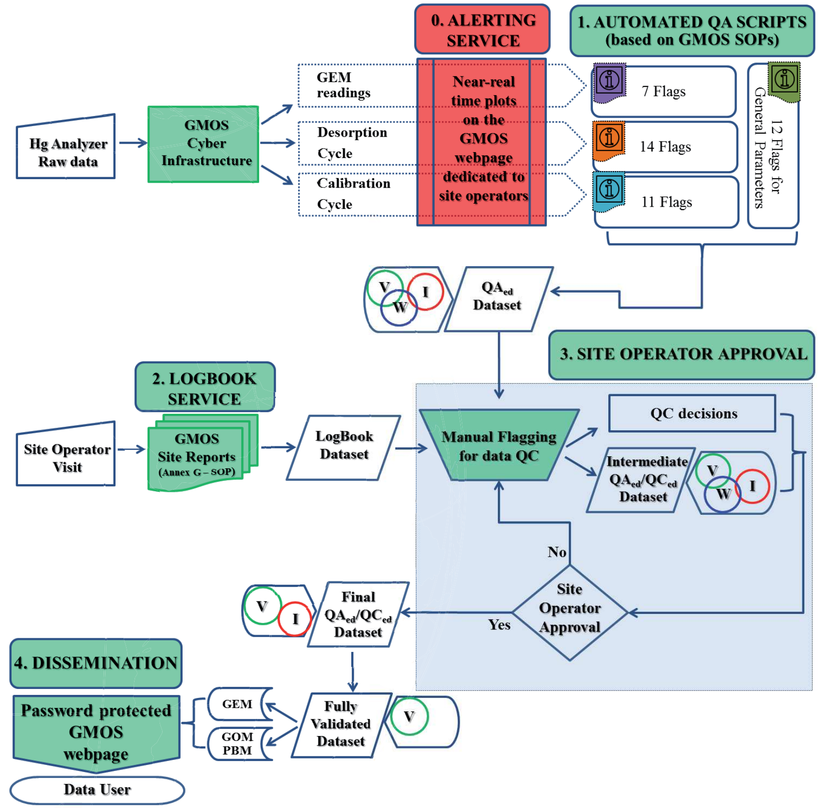
During the planning and implementation stage of GMOS, particular attention was paid to set the protocols governing measurement and sampling techniques and harmonization. This is fundamental to being able to provide high quality data and ensure that data management complies with international standards of data interoperability and to guarantee full comparability of site specific observational datasets.

Harmonized Standard Operating Procedures (SOPs) were developed and adopted by the GMOS partners, and common Quality Assurance/Quality Control (QA/QC) protocols designed and implemented at all sites. The SOPs and QA/QC protocols have been based on current SOPs adopted in other regions/networks, on most recent literature as well as on the experience gathered from continuous measurement programs in Europe, US, and elsewhere.

The QA/QC protocols do not apply only to the measurement data but also to the performance parameters of the instrumentation as described later.

A great effort was in particular made to implement a centralized system (termed GMOS-Data Quality Management, G-DQM) able to acquire atmospheric Hg data in near real-time and, furthermore, to assure and control quality of collected Hg datasets following the GMOS SOPs and measurements parameters of the instrumentation.

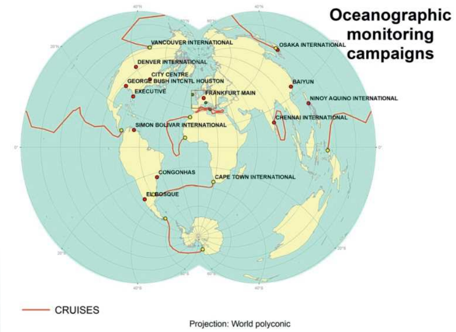
GMOS-Data Quality Management system



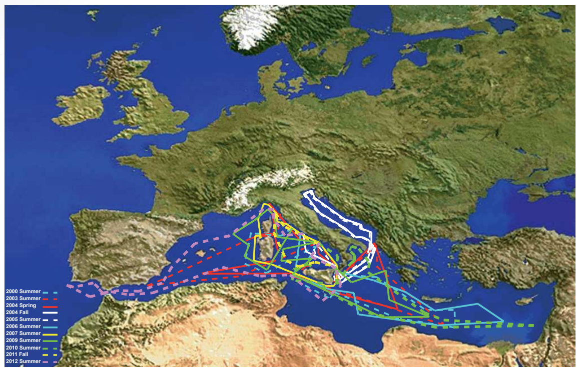
The Figure shows G-DQM Workflow with the main step processes on which it is based. The big novelty introduced by G-DQM system consists in the service approach that facilitate real-time adaptive monitoring and ultimately support real-time decisions based on the SOPs. The implementation of the G-DQM system can prevent the production of poor-quality data as well as can provide a thorough consistency of globally-based data that can be thus effectively used for international negotiations and global models of atmospheric mercury.

The World's Oceans play a crucial role in the global biogeochemical cycle of Mercury

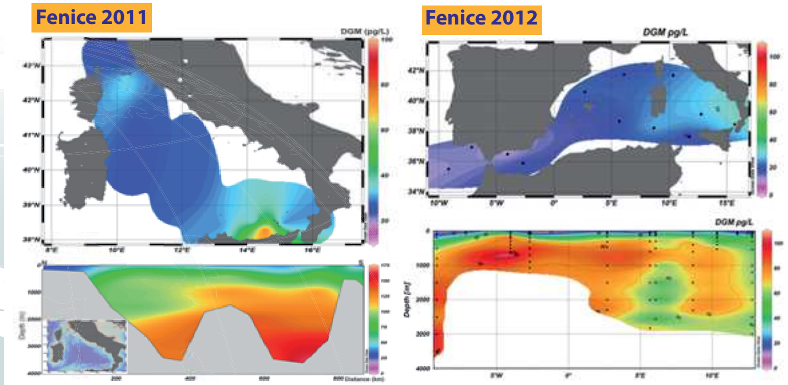
Most Hg emitted to the atmosphere is deposited to the marine environment. Within the oceans Hg can be methylated and then bioaccumulate, and indeed biomagnify within the food web. As the most prevalent form of human exposure to Hg is via the consumption of seafood it is vital to understand the processes that govern the exchange of Hg between the atmosphere and the ocean and the transformations which Hg undergoes in the water column.



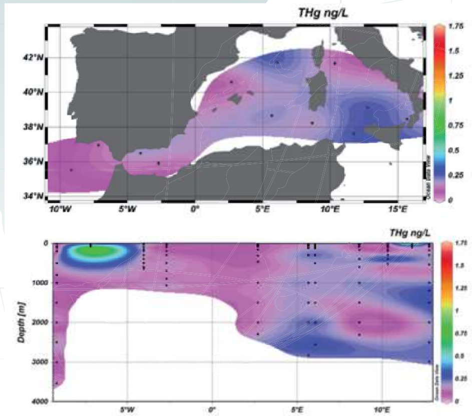
A number of oceanographic measurement campaigns were undertaken during GMOS over the Oceans (i.e., Atlantic) and regional Seas (i.e., Mediterranean Sea Basin) these campaigns were carried out within ad-hoc programs as well as part of on-going national and international initiatives (i.e., GEOTRACERS, MED-OCEANOR).



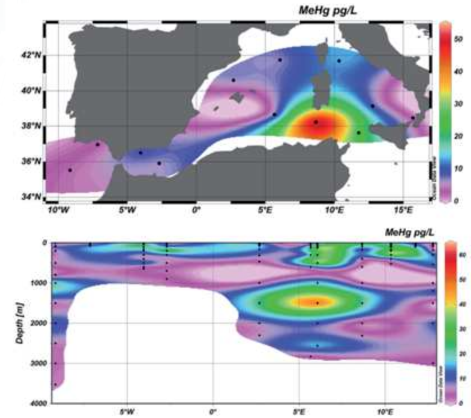
The World's Oceans play a crucial role in the global biogeochemical cycle of Mercury



Spatial and vertical distribution of dissolved gaseous Hg (DGM) in water column in the Tyrrhenian Sea and in the W-Mediterranean Sea during Fenice 2011 and 2012 cruises, respectively in the framework of the MEDOCEANOR program as support to the GMOS.

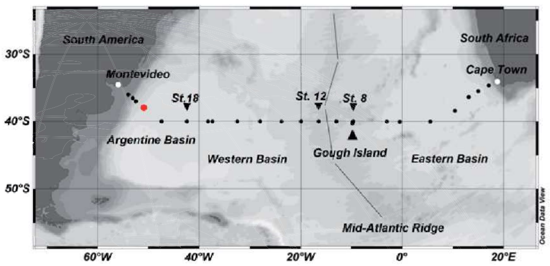


Spatial and vertical distribution of Total Mercury (THg) in water column in the Western Sector of the Mediterranean Sea Basin during Fenice 2012 cruise campaign.



Spatial and vertical distribution of methyl mercury (MeHg) in water column in the Western Sector of the Mediterranean Sea Basin during Fenice 2012 cruise campaign.

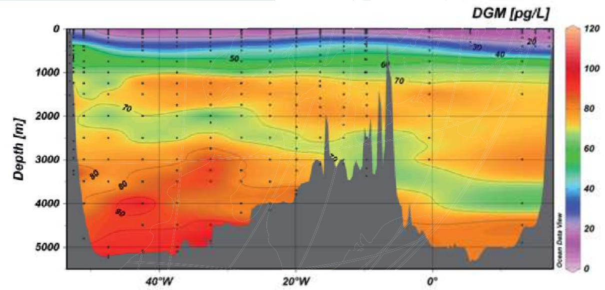
The World's Oceans play a crucial role in the global biogeochemical cycle of Mercury



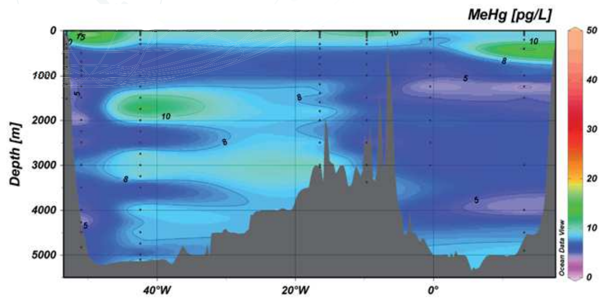
GEOTRACERS 2011-2012

Representation of the stations occupied during GA10 GEOTRACES cruise from 24th December 2011 until 27th January 2012. Ship sailed from Cape Town, South Africa and landed in Montevideo, Uruguay (white dots). Red dot represents Station 20, which was devoted to Hg speciation sampling and was the only station where DMeHg was determined.

Black triangle points to location of Gough Island (Station 9) (40.32°S 9.94°W). Black lines indicate the approximate position of the Mid-Atlantic Ridge central axis. See text for discussion on stations 8, 12 and 18, indicated by inverse black triangles.



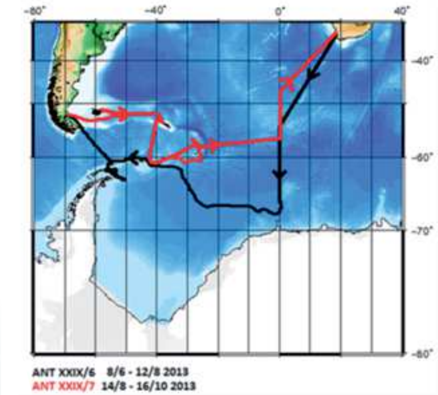
DGM concentrations for the whole water column from JC068 South Atlantic cruise (40 °S parallel). Black dots represent sampling depths. Distinct layering of DGM can be observed. Deep waters in the Argentine Basin were characterized by the highest DGM values measured during the cruise.



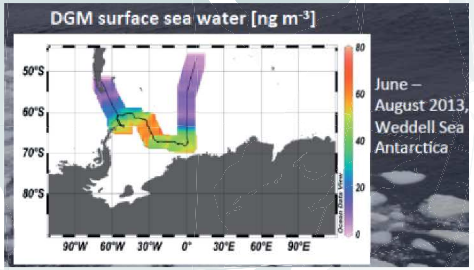
Depth profile for MeHg concentrations during South Atlantic cruise along the 40°S parallel. Grey dots indicate sampling depths. The values were generally very low and no strong variation was observed; however, the western basing has slightly higher concentrations than the eastern.

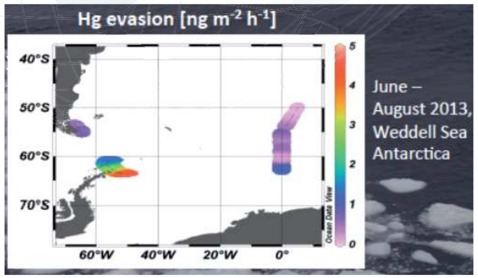
The World's Oceans play a crucial role in the global biogeochemical cycle of Mercury

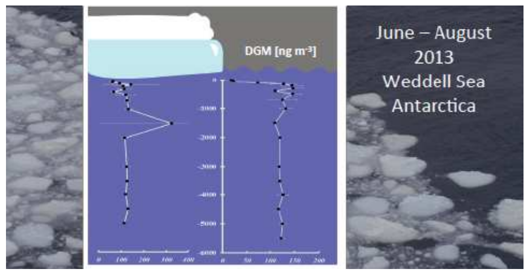
Routes of two cruise campaigns (a winter campaign, ANTXXIX/6, from 8th June to 12th August 2013, and a spring campaign, ANTXXIX/7, from 14th of August to 16th of October 2013) performed onboard the German research vessel Polarstern in the Weddell Sea.The winter campaign started in Cape Town, South Africa and ended in Punta Arenas, Chile. The spring campaign, started in Punta Arenas, Chile and ended in Cape Town, South Africa.



Continuous measurements of dissolved gaseous mercury (DGM) were performed during the two Antarctic campaigns and also depth profiles were analysed. Deep sea water profiles were measured at 19 stations during ANTXXIX/6, at 25 stations during ANTXXIX/7. At ice stations, samples of sea ice, snow, under ice water, brine and frost flowers were sampled and analysed. Sea ice and snow samples were sampled at 9 ice stations during ANTXXIX/6, at 3 stations during ANTXXIX/7.







DGM (ng m-3) surface water, DGM profiles and Hg evasion (ngm-2h-1) during the Antarctic winter cruise campaign (ANTXXIX/6).

Measuring Vertical Profiles in the Troposphere

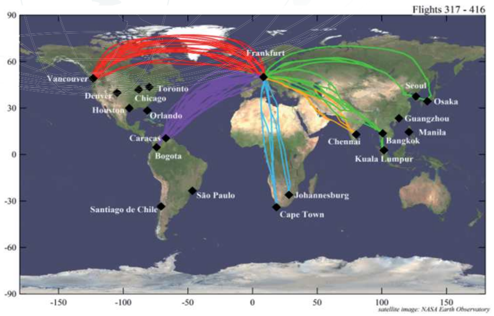
Perhaps the first question to be answered here should really be, "Why?"

Most Hg transport in the atmosphere occurs above the planetary boundary layer (PBL), the part of the atmosphere directly influenced by the Earth's surface. The distribution of atmospheric compounds which can oxidise elemental Hg to form more water soluble $Hg^{(II)}$ compounds also differs significantly with altitude. Data concerning the vertical distribution of Hg is particularly useful for validating chemical transport models because it aids understanding of Hg transport and transformation in the atmosphere.


(a)


(b)

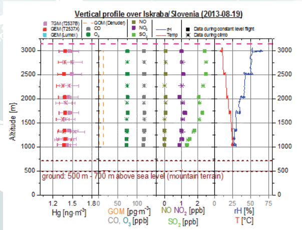
Thanks to GMOS we have better data on the vertical profiles of mercury compounds carried out during Regional scale flights (ETMEP) up to the mid Troposphere over industrial areas of EU and over natural sources like volcanoes.



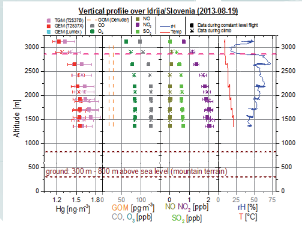
In conjunction with and as part of other national and international programmes (i.e., CARIBIC), a number of intercontinental flights have been performed in the Upper Troposphere/Lower Stratosphere.

Measuring Vertical Profiles in the Troposphere

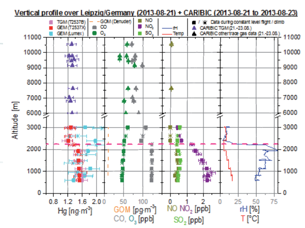
Results on vertical profile, measured on August 19, 2013 over the GMOS master site "Iskraba, Slovenia (45.561°N, 14.858 °E, elevation: 530 m a.s.l.; mountain terrain) during the ETMEP-2 tropospheric campaign. Squares represent 300 s averages with horizontal flight leg; stars indicate 150 s averages during climbing between two neighbouring flight legs.



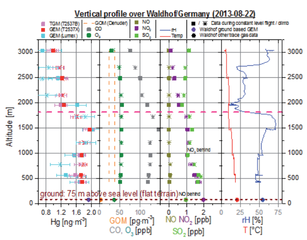
Data indicated as squares are more reliable than the data indicated with stars. GOM was sampled onto a denuder during the whole profile. The pink dashed line indicates the boundary layer top. All measurements were performed below the boundary layer top. All concentrations are given at standard conditions (p=1013.25 hPa, T=273.15 K).



Observations during on regional scale flights over the former mercury mining area "Idrija" (45.000°N, 14.022 °E, elevation: 330 m; mountain terrain up to 800 m). The profile was measured on August 19, 2013. The boundary layer top (pink dashed line) was determined to be at 2850 to 2900m a.s.l..



Vertical profiles, measured within the ETMEP-2 on August 21, 2013 over the city centre of Leipzig/Germany (51.353°N, 12.434 °E, elevation: 125 m, flat terrain) and from August 21-23, 2013 over Western Europe (east of 0 °W; CARIBIC). While the ETMEP-2 data were averaged for 300 s (squares) and 150 s (stars), the CARIBIC data (triangles) represent 600 s averages. The boundary layer top (pink dashed line) was determined to be at 2200 to 2250m a.s.l..

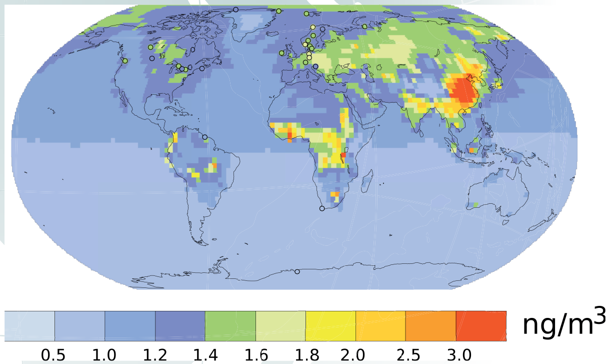


Flights carried out over the GMOS master site of Waldhof/Germany (52.801°N, 10.756 °E, elevation: 75 m, flat terrain). The profile was measured on August 22, 2013. The boundary layer top (pink dashed line) was determined to be at 1750 to 1850 m a.s.l.

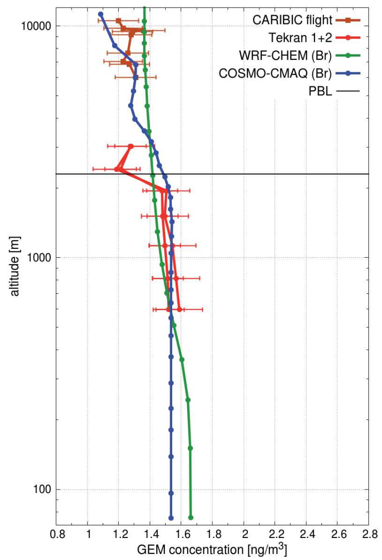
Models to Support the Policy Process

Regional and global models can be used to simulate atmospheric mercury concentrations and deposition fluxes and thus to estimate mercury impact on locations where measurements are unavailable. They are used to investigate atmospheric transport patterns and transformation processes. Models give researchers the possibility to investigate the relative importance of the emission, exchange, transformation and deposition processes which influence the atmospheric mercury cycle. They can be used to estimate the impacts of future emission scenarios.

They can also be used to investigate the possible consequences of future emission scenarios, for example “Business as Usual”, “Maximum Feasible Reduction” to assess the effectiveness of measures aiming to reduce the emissions (Art. 22 of the Minamata Convention) and their socio-economic costs.



Vertical profiles of elemental mercury above Liepzig, Germany



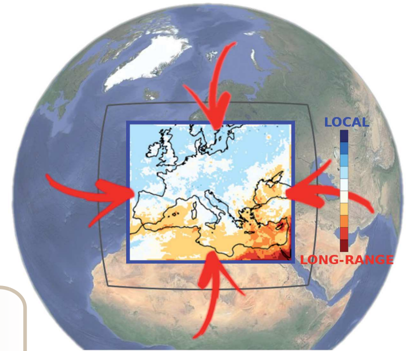
However, measurements are necessary to ensure that models are providing realistic estimates of mercury concentrations and fluxes. This is where the GMOS project has had a major impact, particularly as a result of measurements in the Tropics and Southern Hemisphere where data was desperately scarce.

Models to Support the Policy Process

The most significant changes in Hg deposition (both increase and decrease) during the next 20 years for all considered emission-reduction scenarios are expected in the Northern Hemisphere and, in particular, in the largest industrial regions, where the majority of regulated emission sources are located.

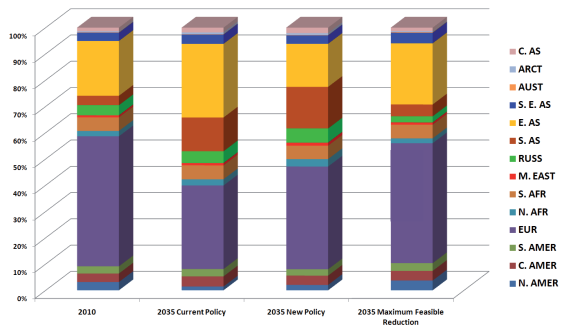
The ‘Current Policy’ scenario (CP2035) yields considerable decrease (20-30%) of Hg deposition in Europe and North America and a strong increase (up to 50%) in South and Eastern Asia.

The ‘New Policy’ scenario (NP2035) shows a moderate decrease in Hg deposition (20- 30%) everywhere except for South Asia (India), where some deposition increase (10-15%) would be expected.



Model predictions based on the ‘Maximum Feasible Reduction’ scenario (MFR2035) demonstrate consistent global Hg deposition reduction. In the NorthernHemisphere by 35-50% and by 30-35% in the Southern Hemisphere.

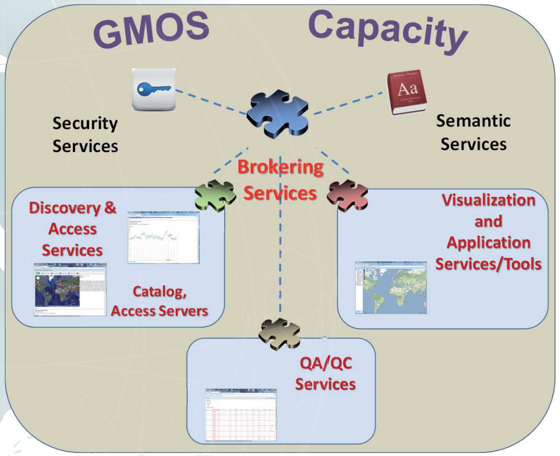
Hg Total Deposition Attribution over EUROPE



Hg Data products in GMOS

GMOS is a key project of GEO and is the foundational activity of the GEO Task on Tracking Pollutants. Following the GEO data sharing principles a cyber(e)-infrastructure has been developed within GMOS to handle, coordinate and provide access to the data from the project and make them available to policy makers and stakeholders as well as to the general public.

This includes the current monitoring data, the historical data from past programmes and measurement campaigns and emissions data as well as model output from the project's regional and global modelling groups.



The cyber(e)-infrastructure is however much more than a simple data repository, it provides key information including the:

- ✓ Near real-time data acquisition and visualisation
- ✓ Automated data QA/QC
- ✓ Real-time instrument diagnostics including performance and maintenance alerts
- ✓ Historical measurements database
- ✓ Modelling data
- ✓ Geospatial data tools and web-based tools for analysis, visualisation and dissemination
- ✓ Conformity with international data interoperability standards

What comes next?

In the future GMOS can play a key role in terms of:

- ✓ **Continuous monitoring of mercury** in atmosphere, marine and terrestrial ecosystems in cooperation with UNEP, GEF, WHO and major national programmes;
- ✓ **Technological development of advanced sensors** aiming to reduce the investment and running cost of long-term monitoring programmes;
- ✓ **Assist nations** in preparing and implementing their National Implementation Plans (NIPs);
- ✓ As part of UNEP F&T GMOS may **support the implementation of several articles of the Minamata Convention** that may range from the Effectiveness Evaluation (Art.22) to capacity building, information and public awareness (Art.14, 17, 18, 21).
- ✓ To ensure a **continuous engagement of the scientific community in the policy making process** and make sure that decisions will be taken on the state-of-the-art knowledge of different aspects related to emissions, monitoring and exposure evaluation.

	GMOS and UNEP F&T's contribution	Main foreseen activities
Art.8 Emissions and Annex D. List of point sources of emissions of mercury and mercury compounds to the atmosphere	✓	To take measures to control emissions, Inventories of of emissions, Reporting on Implementation of art.8
Art.9 Releases	✓	To take measures to control releases, Inventories of releases, Reporting on Implementation of art.9
Art.12 Contaminated sites	✓	To develop strategies for Identifying and assessing contaminated sites
Art.14 Capacity-building, technical assistance and technology transfer	✓	To provide timely and appropriate capacity building, technical assistance and technology transfer to developing country Parties
Art.17 Information exchange	✓	To facilitate the exchange of scientific and technical Information, with particular regard to information on the reduction or elimination of the emissions and releases of mercury
Art.18 Public Information, awareness and education	✓	To promote and facilitate the results of Research, Development and Monitoring activities
Art.19 Research, development and Monitoring	✓	To cooperate to develop and improve: Inventories, modelling and monitoring, Information on the environmental cycle, transport, transformation and fate of Hg, etc.
Art.21 Reporting	✓	To report on the measures to be taken to Implement the provisions of the Minamata Convention
Art. 22 Effectiveness evaluation	✓	To evaluate the effectiveness of the Minamata Convention through, inter alia, comparable monitoring data on the presence of mercury in the environment

Partners

GMOS involved over 50 research institutions worldwide, part of which funded by European Commission (Partners) and a part (External Partners) by national governments and other funding agencies.

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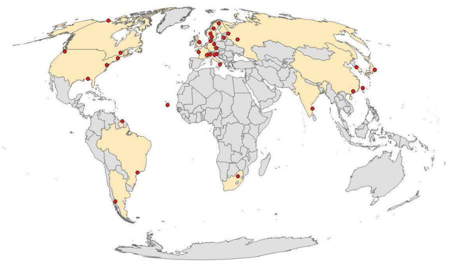
Partners



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