SUPPORTING A RESILIENT & SUSTAINABLE WORLD

GEO WEEK 2018

29.10-2.11 • KYOTO, JAPAN • #GEOWEEK18
GOS$^4$M – from research to user-driven applications

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The Global Observation System for Mercury (GOS⁴M)

Scope

It is aimed to support the UN Global Partnership on Mercury Fate and Transport Research (UN F&T) of the UN environment in the implementation of the Minamata Convention by providing a knowledge platform on mercury in environment and the human health. It will support UN environment and Nations to assess the effectiveness of measures that will be undertaken.
2. Governance

- Very light governance structure
- Under review by interested parties
The conceptual framework & its implementation

From data to knowledge
- Data collection & model simulations (scenarios)
- Archiving information
- Understand environmental behaviours
- Give answers to policy maker

3. Conceptual framework design

Knowledge Platform (KP) workflow
Based on:
- Data Collection/Elicitation
- Information Formalization/Encoding
- Information Sharing
- Information Use
- Knowledge Generation
Knowledge Collection/Elicitation

- Hg in environment and the humans (emissions, air concentration, water concentration, biota)
- Model (transport, fate)
- Scenarios

Concentrations

Emissions/evasion

METEO
Hg reactants

WRF
ECHMERIT

Scenarios
Scenarios development

Hg emissions perturbation experiment design

- Control
- Hg tagging
- Hg reduction (%)
- Hg speciation (%)

10 runs
13 regions
Total 130

Hg reduction (%)
Hg0-HgR ratio

Model obtained point
Gap filling

Deposition change

Prediction model (Hermes)

This curve is the sum of the two bottom curves = total costs

Economic model(s)
Social model(s)

13 regions
Total 130

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Knowledge Use

What if....

- Emissions by regions/sectors
  - -20%
  - -15%
  - -10%

- Depositions
  - -20%
  - -15%
  - -10%

- Hg conc
  - -10%
  - -15%
  - -20%

- Time

Ecosystem

From Data to Knowledge
- Business Process refinement
- Gaps recognition
- Community consensus
- Sharing culture

From FAQ to (automatic) advanced
- Business Processes Discovery & Access
- (abstract) Business Process realizations and executions
- Human interaction
- Unstructured text
- (semi-)Structured encodings
Knowledge Generation

- C/B Analysis
- DSS systems
- Gap analysis
  - MCM
  - Monitoring
  - Modelling

**Knowledge Collection/Elicitation**

- From Data to Knowledge
- Business Process refinement
- Gaps recognition
- Community consensus
- Sharing culture

**Knowledge Use**

- From FAQ to (automatic) advanced Business Processes Discovery & Access
- Business Process realizations and executions
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**Knowledge Generation**

- C/B Analysis
- DSS systems
- Gap analysis
  - MCM
  - Monitoring
  - Modelling

**Investment ($)**

**Emission/Deposition reduction (%)**

Graph showing investment levels for BAT 1, BAT 2, and BAT 3.
Capacity Building Activities for data QA/ QC
Implementation of SOPs

This has included one-on-one training sessions at the CNR-IIA Laboratories in Rende, as well as a training workshops in Rome on measurements of TGM/GEM, Hg speciation in ambient air, and Hg in precipitation.

Several Training workshops for site managers and laboratory analysts to assure correct implementation of the SOPs and QA/QC protocols at each GMOS site have been performed;

Standard Operating Procedures (SOPs), and QA/QC protocols developed in GMOS for TGM/GEM, Hg Speciation and in precipitation, which are consistent with existing techniques in other regional networks, employed at all GMOS sites to ensure the collection of harmonized, high quality, and comparable Hg measurements worldwide.
Training workshop on Data Quality Management System - GDQM

G-DQM Workflow

0. ALERTING SERVICE
- Near-real time plots on the GMOS webpage dedicated to site operators
- GEM readings
- Desorption Cycle
- Calibration Cycle

1. AUTOMATED QA SCRIPTS (Flagging Criteria)
- 7 Flags
- 14 Flags
- 11 Flags

2. LOGBOOK SERVICE
- Site Operator Visit
- GMOS Site Reports (Asset C - GOM)

3. SITE OPERATOR APPROVAL
- Manual Flagging for data QC
- QC decisions
- Intermediate QA/QC dataset
- Site Operator Approval

4. COMPUTATION & REPORTING
- GEM dataset
- GOM (bottom)
- Fully Validated Dataset

5. DISSEMINATION
- Password protected GMOS webpage

Flagging Criteria
- Raw Data
- Raw Data

OK
Invalid
Analytical Laboratory inter-comparison for Hg precipitation analysis methods

Hg in precipitation measurements at all GMOS sites are organized and assigned to three GMOS reference analytical laboratories: CNR-IIA, IJS and IVL.
Field intercomparison exercises

Over water intercomparison exercises of manual and semicontinuous methods for DGM measurements
Training workshops

In the framework of the UNEP-GEF project, training workshop for national coordinators and laboratory analysts have been performed to ensure the collection of high quality, comparable Hg measurements at all monitoring sites using new sensor technologies (Passive Air Samplers – PASs) for mercury.
Field Intercomparison in UNEP-GEF Project

Inter comparison seasonal campaigns between new sensor devices (Passive Air Samplers – PASs) for mercury and conventional instruments employed across the GMOS monitoring sites have been performed to ensure the collection of harmonized, high quality, and comparable Hg measurements at all sites using PASs.
Planned field Intercomparison exercises in iGOSP for GOS4M

CNR-IIA Passive Sampler and nanoparticle film preparation

Part of GMOS and UNEP-GEF activities

The body of the sampler is a cylindrical glass vial (inner diameter of 2.04 cm, length 2.54 cm) with a screw cap at one end.

To avoid turbulent diffusion inside the vessel during exposition, the open end is protected using a fine microporous nylon screen.

TGM is collected on a quartz filter coated with nanofibers of titanium oxide properly functionalized with gold nanoclusters through electrosprinning technology.

The filter is placed at the bottom of the vial and held in position by a supporting ring.

Experiences from development and application of innovative techniques

IVL Passive Sampler

The diffusive sampler

The sampler consists of a disk of 25 mm diameter and 15 mm thickness. Gaseous mercury is diffused into the device via a gas permeable membrane and is adsorbed onto an absorbent in the bottom.

Development of a badge-type diffusive sampler for TGM

PET protective shield & storage and transport container

Radial diffusive housing

Sulfur-impregnated Activated carbon

Univ. of Toronto and Env. Canada Passive Sampler
Capacity Building on the use of the GOS4M Knowledge Hub
The adaptive Knowledge lifecycle