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The Minamata Knowledge Hub: from data to knowledge supporting Minamata Convention on Mercury

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Abstract. Atmospheric mercury (Hg) emissions are a significant component of the global Hg cycle. As the Minamata Convention on Mercury comes into effect, controlling atmospheric mercury emissions has become a compulsory goal. Decision-maker initiatives process the scientific data and information within a milieu encompassing many economic, political, social, and cultural concerns. A knowledge platform oriented to support decisors aims to answer questions on how will change the Hg deposition fluxes over one/some/all of the receptor regions following the alteration of Hg anthropogenic emissions, and which is the impact on the marine food. In this paper we present the knowledge platform in order to support Minamata Convention and stakeholders to take better decisions from data. The process to learn from data are discussed and presented from an user point of view, proposing features and tools to be included in a knowledge platform oriented to earth observation.

1. Introduction

Mercury (Hg) is a global pollutant transported over long distances by air and water, crossing borders and deposited far away from the source. The Minamata Convention on Mercury, adopted on 2013 is a global treaty aimed to protect human health and the environment from the adverse effects of mercury. The Convention draws attention on controlling the anthropogenic releases and even more on coordinated set of actions that are required for the Hg emissions control to be effective [1]. The Convention establishes that an effectiveness evaluation of its implementation is required and lay on comparable data on global basis and their availability through interoperable systems for discovery and use. However data themselves cannot be interpreted by end-user and often require a sophisticated modeling activity. Advanced tools that support decision-makers in their effectiveness evaluation of abatement scenarios and trends of Hg in the environment are therefore required: tools that add knowledge to data are strongly required by end-users. Such tools use numerical models that track the fate of Hg from emission point to deposition. Apart from appropriate formation and training, classical modeling approach requires days to weeks for input pre-processing, running, and output post-processing for visualization, making the process far away from an interactive use: this is the challenge to get over in order to support stakeholder during decision making.



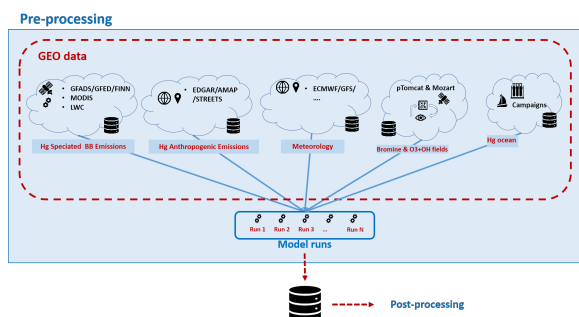


Figure 1. Pre-processing in HERMES.

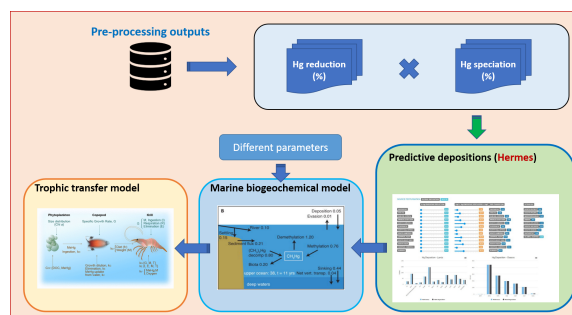


Figure 2. Minamata Knowledge Hub processing.

2. The Minamata Knowledge Hub

To overcome the above identified critical points, a very few approach exists, such as the metric-based one proposed by [2], however with evident limitations. In this work we present a web-based-tool, HERMES, which is a statistical emulator built on appropriate designed set of outputs from ECHMERIT Hg model [3]. It allows for the assessment of deposition scenarios based on emission perturbation, limited to short-term effects (one year nominal). The integration with a global biogeochemical model further allows for long term (up to 35 years) assessment of deposition change. HERMES provide the capability of a scientifically robust and validated model to assess changes in Hg deposition, circulation in the oceans and uptake in the trophic net. It helps decision-makers to answer, for example, the following questions:

- What are the possible scenarios of anthropogenic emission reduction by source type?
- What would be the benefit of anthropogenic emission reduction in terms of reduction of Hg bioaccumulated in biological endpoints such as fish and marine mammals?
- What would be the time lag between reductions in anthropogenic emissions reduction and reduction in mercury bioaccumulated in fish and marine mammals?

The pre-processing activity runs ECHMERIT for different deposition scenarios, covering Hg fate from emission to deposition & re-emission from ocean. More than 130 runs are made available to the statistical model for the analysis (Figure 1).

The post-processing activity enables the real-time emulation of scenarios that can help assessment on Hg emission reduction from 0% to 100%, and even chemical speciation perturbation. Results of this reduction and perturbation are transferred to a biogeochemical model for, which delivers results to a trophic transfer model enabling assessment of trends of Hg in marine biota (Figure 2).

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