

## ***Interactive comment on “A synthesis of research needs for improving the understanding of atmospheric mercury cycling” by Leiming Zhang et al.***

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Received and published: 14 June 2017

We greatly appreciate the reviewer for pointing out this important issue related to data QA/QC. We will add additional information in the revised paper as detailed below.

### Original Comments

This manuscript provides a complete overview of the state of the art in mercury observation. It reports the issues that affect current instruments used to measure mercury speciation and provides recommendations for future research to cope with lack of measures at global level. Advice on passive filtering can be considered as a way to cover

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missing measures and define a method for designing and developing next observation networks. About observation networks, the document highlights the importance of harmonized observations at global level: information should be comparable between data sources within the same network and between different networks.

Even though the needed for Quality Assurance (QA) is cited in the manuscript, the authors should improve the discussion about data validation process. QA and QC are often presented together even if they are two quite different concepts: QA is related to the process regarding data collection, while QC is applied to the final product of monitoring. As data are often collected in near-real time, the importance for QA/QC system can be crucial in order to improve data quality throughput. In the manuscript only QA is cited. Another important aspect is the storage of data collected by the observation network. The authors cite shared databases, freely released. This is very important to improve knowledge of phenomena and to allow policy makers to make better decisions, but there is a difficulty in sharing data openly and freely to the public. In the manuscript the authors cite SOP to collect the data, but the Data Policy within the observation network should also be treated.

Responses: The following information and additional reference will be included in the revised paper: “Consistent quality control of mercury observations after collection is also necessary for consistent observations within and between operational networks. Among the operating Tekran-based atmospheric networks, both the Canadian Atmospheric Mercury Measurement Network (CAMNet) and the Atmospheric Mercury Network (NADP’s AMNet) in the U.S. both have quality control systems in place and in use. The two systems are reasonably comparable (Steffen et al., 2012), making the two network datasets comparable and usable in combination. In both cases, significant amounts of data are invalidated due to many different causes (e.g. Gay et al, 2013), clearly showing that post measurement quality control is necessary. Additionally, the GMOS network also has a quality control system in place (D’Amore et al., 2015). The GMOS system is based upon both the Canadian and NADP systems, and uses the

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majority of flags from each system. A strict comparison between the three QC systems has not been completed, but it is at least reasonable to assume that the three systems and resulting data are generally consistent. A full intercomparison of the three systems is called for, but these systems at least provide a basis for a global QC system for all atmospheric observations, which is needed for global modeling using data from all three networks.” Additional reference: D’Amore, F., Bencardino, M., Cinnirella, S., Sprovieri, F., and Pirrone, N.: Data quality through a web-based QA/QC system: implementation for atmospheric mercury data from the Global Mercury Observation System. *Environmental Science: Processes & Impacts*, 17(8), 1482-1491, 2015.

Finally, many services related to the observation network and data sharing are included in IT infrastructures that pay attention to all data management issues, such as the implementation of data policy, data catalog and interoperability among networks using metadata. See, for example, GEOSS as a system designed to collect data from different observation networks. In session 2.6 may be that a small discussion on these IT systems and data sharing using metadata could be useful.

Responses: The following information will be included in the revised paper: “Each atmospheric network has different data release processes, but one location with a consistent quality assurance and control system, with freely available and timely data would be very valuable for the research community. Perhaps the operating networks will evolve to this combined operation, or perhaps some type of system could be employed, such as GEOSS (Global Earth Observation System of Systems, <https://www.earthobservations.org/geoss.php>), so that a consistent and global dataset would be freely available to all data users.”

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-375>, 2017.