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Biogeosciences Discussions

Interactive comment on "Seasonal variations in metallic mercury (Hg^0) vapor exchange over biannual wheat – corn rotation cropland in the North China Plain" *by* J. Sommar et al.

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We thank Referee #2 for notifying about a potential source of evading Hg0 not mentioned and overlooked in the discussion. Q1. Unfortunately, we did not measure either THg or dissolved Hg0 in the irrigation water being pumped from aquifers. Q2. A literature search proves very limited data on Hg0 in groundwater worldwide. There are only a few reported data on bulk Hg concentrations in ground water of the NCP region and none of these cover measurement of dissolved Hg0. For example, Wu and Cao (Mercury and Cadmium Contamination of Irrigation Water, Sediment, Soil and Shallow Groundwater in a Wastewater-Irrigated Field in Tianjin, China, Bulletin of En-

vironmental Contamination and Toxicology, 84, 336-341, 2010) reported a mean THg concentration of ∼16 ng/L in shallow groundwater of an agricultural area with ppm-level of Hg in surface soils (due to sewage water contamination). We estimated the potential role of irrigation water by conservatively assuming a similar THg level in ground water of YCES (only ∼45 ppb THg in surface soil). When investigated, the fraction of Hg0 present in Hg content of groundwater is low with a high extent being bound to particulates rather than existing as free dissolved Hg0 that can be volatilized during the flood irrigation (Richard, J. H., Bischoff, C., Ahrens, C. G. M., and Biester, H.: Mercury (II) reduction and co-precipitation of metallic mercury on hydrous ferric oxide in contaminated groundwater, Science of the Total Environment, 539, 36-44, 2016; Wang, Y., Li, Y., Liu, G., Wang, D., Jiang, G., and Cai, Y.: Elemental Mercury in Natural Waters: Occurrence and Determination of particulate Hg(0), Environmental Science & Technology, 49, 9742-9749, 2015). Setting the fraction Hg0(aq) conservatively to 10% in the irrigation water (column depth of ∼100 mm) would yield a flux potential of ∼0.16 μg m-2 which is far smaller than the observed Hg0 flux pulse of ∼1 μg m-2.Q3: Our hypothesis is that the majority of observed Hg0 evaded from the field stem from the soil matrix rather than from the irrigation water. Support for this statement can be derived from previous studies with low-Hg water irrigation of air-dry soil (Lindberg et al. 1999; Song & van Heyst 2005) documenting a significant Hg0 evasion pulse as response. The lack of direct Hg0(aq) measurement at YCES precludes the possibility of deterministic conclusion regarding the role of irrigation water as a source of atmospheric Hg0. Since the assessment given above does not trigger any substantial alarm, it appears presumptuous to discuss this matter in the paper without any observational evidence.

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