

Interactive comment on “Seasonal variations in metallic mercury (Hg⁰) 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-

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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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