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Correction: Responses of deposition and bioaccumulation in the Great Lakes region to policy and other large-scale drivers of mercury emissions

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Correction: Responses of deposition and bioaccumulation in the Great Lakes region to policy and other large-scale drivers of mercury emissions

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Correction for 'Responses of deposition and bioaccumulation in the Great Lakes region to policy and other large-scale drivers of mercury emissions' by J. A. Perlinger *et al.*, *Environ. Sci.: Processes Impacts*, 2018, **20**, 195–209.

In the original article, there were errors in some numerical values in Table 3 and in the text in Sections 3.1 and 4.1. The corrected Table and Sections are shown below. The changes are to the magnitudes of mercury species deposition to the Great Lakes region, the Upper Peninsula of Michigan, and the Adirondack region of the Lakes basin. The changes to the Adirondack values reduce the numerical differences in these magnitudes compared to magnitudes of total mercury deposition to the Upper Peninsula of Michigan. The changes to the mercury species deposition to the Great Lakes region and the Upper Peninsula of Michigan have no implications. The changes do not impact the conclusions of the article.

3.1 Atmospheric deposition of Hg to the GL region, Michigan's UP, and New York's Adirondacks region in the present *vs.* 2050

Changes in total (wet + dry) Hg deposition estimated from GEOS-Chem simulations from the present to the future (2050) are summarized in Table 3, along with % contributions to the policy-in-action scenario from the three policy scales (global, U.S., or Lake Superior). Total deposition is estimated to decrease by 70% due to the aspirational policy change scenario in the GL region (Fig. S1†), while it is estimated to decrease by 65% in Michigan's Upper Peninsula (UP) and 73% in the New York Adirondack region. These large estimated decreases are reasonable given that for the aspirational scenario, all anthropogenic emissions in the 2050 simulation were turned off. Because legacy emissions are held constant, this scenario does not represent pre-industrial emissions.

The combined policy-in-action scenario leads to 20%, 15%, and 22% decreases in atmospheric deposition in 2050 in the GL, Michigan's UP, and New York Adirondack regions, respectively (Table 3). Fig. 2 presents the effects of individual scales of policies (Lake Superior, U.S., and global) on the combined policy-in-action deposition benefit for the GL region. Approximately 85% of the total decrease is due to U.S. Clean Air Act regulations including MATS, while the local (Lake Superior Basin) and global (Minamata Convention) policies each account for 1% and 14% of the total decrease, respectively. Fig. 2B demonstrates the effect of reducing U.S. emissions on GL regional deposition. The 1.5 times greater reduction in deposition in the Adirondacks compared to the UP for this scenario is therefore largely related to differences in the influence of U.S. policies.

Compared to the GL region policy-in-action scenario contributions of 14% from global policies, 85% from U.S., and 1% from Lake Superior, the UP receives 25% of total deposition decrease from global sources, 70% from the U.S., and 5% from Lake Superior (Table 3). In the Adirondacks region, approximately 89% of the total decrease in deposition for this scenario is due to Clean Air Act regulations in the U.S., while local (Lake Superior Basin) and global (Minamata Convention) each account for 0.1% and 11% of the total decrease, respectively. These values clearly show the significant differences in contributions that proximity to up-wind sources make. The global contribution (as a percentage) of emissions reductions to decreased atmospheric deposition is 2.3 times greater for the UP than for the Adirondacks (Table 3). Sources within the U.S. (mostly coal-fired power plants) provide a greater fraction of the deposition to the Adirondacks as compared to the UP.

The minimal-regulation scenario leads to increases in total deposition of 35% and 34% in the GL (Fig. S2†) and Michigan's UP region, respectively (Table 3). The similarity in these estimates is likely coincidental. Based on the policy-in-action scenario,

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Table 3 Change in total Hg atmospheric deposition from the present to 2050 for the given region and scenario, and % contribution of a given scale region to the policy-in-action scenario

	Region					
	Great Lakes		Michigan Upper Peninsula		New York Adirondacks	
Scenario	Increase (+) or decrease (−) in total Hg deposition (%)	% Contribution to policy-in-action scenario	Increase (+) or decrease (−) in total Hg deposition (%)	% Contribution to policy-in-action scenario	Increase (+) or decrease (−) in total Hg deposition (%)	% Contribution to policy-in-action scenario
2050 aspirational	−70		−65		−73	
2050 policy-in-action	−20		−15		−22	
World		14		25		11
U.S.		85		70		89
Lake Superior		1		5		0.1
2050 minimal-regulation	+35		+34			
2050 climate change	+3.8		+5.2			
2050 land use change	−0.2		+0.7			
2050 biomass burning	+1.9		+2.3			

differences in deposition benefit are largely related to U.S.-scale changes in emissions, and the largely U.S. emissions that comprise the minimal-regulation total deposition estimates happen to lead to similar increases in deposition.

The climate change, land use/land cover change, and biomass burning scenarios lead to smaller total Hg deposition changes in 2050 as compared to the policy scenarios (Table 3). In the GL region, these estimates are 3.8% (Fig. S3†), ∼0% (Fig. S4†), and 1.9% (Fig. S5†), respectively, whereas for Michigan's UP, the changes are 5.2%, ∼0%, and 2.3%, respectively. The climate change increase is primarily due to an increase in Hg(0) dry deposition and total wet deposition fluxes. The negligibly small land use/land cover changes are a result of both increases and decreases in land cover in 2050 that influence the surfaces to which Hg deposits (Fig. S4†). The increase in deposition from biomass burning is a result of higher biomass burning emissions in the boreal parts of North America and Western U.S. These increases are, in turn, a result of greater fire activity caused by more vegetation availability and a warmer climate in 2050.

4.1 Regional nature of deposition responses to policy changes

Mapping of the projected changes in deposition due to environmental changes (climate, land use/land cover, biomass burning) and policy clearly shows that even within the GL region there is spatial variability (Fig. 2 and Table 3). Areas in close proximity to upwind sources show a larger response to controls of those sources than do areas far from sources. In all locations, the majority of the simulated decrease in deposition is due to decreased Hg(II) deposition rather than Hg(0) deposition; for the GL region as a whole, 80% of the decrease is due to Hg(II) and 20% due to Hg(0). However, in the Adirondacks, 79% of the decrease is due to Hg(II) while in the UP 75% is due to Hg(II). This projected outcome results from the short atmospheric residence time of Hg(II) emissions (0.5–2 days[15]) and does not reflect regional differences in availability of oxidants for Hg(0).[16] The projected large decrease in Hg(II) deposition is at odds with the absence of a trend in wet deposition of Hg but an observed decrease in litterfall Hg fluxes in the Adirondacks[37] that are postulated to result from recent declines in Hg(0) deposition. According to our scenario modeling, those areas currently receiving the highest rates of atmospheric deposition show the largest percentage decreases in deposition due to enactment of existing policies in the U.S. In contrast, the UP is not downwind of major Hg emission sources. U.S. policy-in-action changes in emissions still represent the majority of changes in deposition in the UP (70%), but the rest of the world contributes 1.8 times more to UP deposition than to the GL region, and 2.3 times more than to the Adirondacks.

One implication of these regional differences in trajectories of Hg deposition is that it will be easiest to detect system responses to policy in those regions projected to show the largest responses. This study suggests that it will be difficult to detect policy-related changes in lake monitoring data in Michigan's UP over the next 50 years, unless additional policy steps are taken beyond those included in the scenarios of this project. Similarly, because the predicted changes in deposition due to climate- and land-use changes are small relative to those associated with policy changes, the likelihood is small that those changes can be detected in the GL region unless anthropogenic emissions stabilize. Within the GL region, changes will be easiest to detect in northern Illinois, Indiana, Ohio and Pennsylvania (Fig. 2).

The Royal Society of Chemistry apologises for these errors and any consequent inconvenience to authors and readers.

