

Fog as a Potential Means of Transport of Methylmercury to Coastal Terrestrial Ecosystems

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Marine advective fog, which is common along the coast of California during the summer season, is an important input to the hydrologic cycle. Many endemic flora and fauna are known to derive a significant portion of their water intake from fog drip. The chemistry of Pacific marine fog is poorly characterized. In particular, the potential for coastal ocean upwelling to contribute volatile organic mercury to the overlying atmosphere where it could be incorporated into cloud droplets as monomethyl mercury (MMHg) is not well understood. Preliminary research by this group has indicated that fog water inputs to certain coastal locations may contribute up to 99% of the MMHg flux to land compared to the MMHg flux in rain. Data from two sites in 2011 in Santa Cruz, California showed that fog water as collected with an active strand collector contained up to 50 pM of MMHg, with MMHg making up 100% of the total Hg in some samples. Oceanographic data during the upwelling season in Monterey Bay in 2012 showed that dimethyl mercury (DMHg) was present at the surface at about 0.1 pM, and increased to 0.5 pM at a depth of 200 m. Because DMHg is sparingly soluble in water, a net flux of DMHg would be expected to the atmosphere. Arthropods collected at Elkhorn Slough near the Monterey Bay in 2012 showed a maximum in their total Hg concentration (~800 ng g⁻¹ in wolf spiders) during August, 3 times higher than levels seen in March and October. Based on these aforementioned findings and the fact that DMHg concentrations in the coastal ocean were highest in the low oxygen part of the profile, we speculate that mercury is methylated in the water column and/or sediments as DMHg and that this water is upwelled seasonally in the coastal zones and contributes organic mercury to overlying cloud banks, which has the potential to deposit onto upland terrestrial ecosystems. Research is ongoing through the establishment of a network of 7 coastal sites from Big Sur to Eureka and through coastal oceanographic expeditions planned for the summers of 2014 and 2015.