Characterizations of atmospheric mercury deposition on a free tropospheric mountain-top site in Taiwan

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Taiwan is located downwind of the East Asian continent, which is the largest anthropogenic mercury (Hg) source region globally. Speciated atmospheric mercury (Hg) has been measured since mid-April 2006 and weekly rainwater samples have been collected for total Hg analyses since early 2009 at the Lulin Atmospheric Background Station (LABS; 120.87ºE, 23.47ºN, 2862 m a.s.l.) in central Taiwan. Here we report and characterize the wet and dry deposition of Hg on LABS in 2010. Dry deposition was estimated based on a model calculation. In 2010, the annual rainfall at LABS was 3173.2 mm with a total of 36 weekly rainwater samples being collected for Hg analysis. Sample Hg concentrations ranged from 4.1 to 24.9 ng L^{-1}, with an annual volume-weighted mean Hg concentration of 9.6 ng L^{-1}. Seasonal VWM concentrations were 7.3, 12.7, 8.6, and 6.6 ng L^{-1}, whereas seasonal wet deposition fluxes were 4.8, 20.8, 5.8, and 1.4 μg m^{-2}, for spring, summer, fall, and winter, respectively. Seasonal wet deposition flux was higher in summer primarily as a result of elevated amount of rainfall and to a lesser extent, higher rainwater Hg concentration. The high summertime rainwater Hg concentration hints the importance of Hg^0 oxidation and/or scavenging of upper-altitude Hg(II) by deep convection. The annual wet deposition flux was 32.8 μg m^{-2}. On the other hand, the estimated annual dry deposition flux was 26.2 μg m^{-2}, with a contribution of 20.8 μg m^{-2} from GEM and of 5.4 μg m^{-2} from RGM. Dry deposition of PHg was negligible. Wet deposition dominated in summer/fall, but dry deposition dominated in spring/winter. Nonetheless, overall wet deposition was more important than dry deposition at this subtropical free tropospheric mountain-top site because of abundant rainfall, which is different from sites in North America where dry deposition is expected to be higher than wet deposition. Compared with the 2010 values (15.7-63.4 μg m^{-2}) for sites of the Taiwan Wet Hg Deposition Network, the Hg wet deposition flux at LABS is about 52% of the highest value.

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