Mercury wet deposition to a remote island in the west Pacific Ocean and a high-elevation site in central Taiwan

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Weekly rainwater samples have been collected at Pengjiayu and Lulin Atmospheric Background Station (LABS) for total Hg analyses since late 2008 and early 2009, respectively. Pengjiayu is a small remote island in the west Pacific Ocean, with an area of 1.14 km^2 and about 56 km distance to the north of Taiwan. Rainwater is sampled at Penjiayu Weather Station (25º37'46"N, 122º4'16.5"E, 101.7 m a.s.l.). On the contrary, LABS is a high-elevation background site in central Taiwan (23º28'8.4"N, 120º52'12"E, 2862 m a.s.l.). Here we reported the results of Hg wet deposition sampled in 2009 and 2009/04-2010/03 for Pengjiayu and LABS, respectively. A total of 35 rainwater samples were collected at Pengjiayu. Sample Hg concentrations ranged between 2.25 and 22.33 ng L^{-1}, with a volume-weighted mean (VWM) concentration of 8.85 ng L^{-1}. Seasonal VWM concentrations were 7.23, 11.58, 7.82, and 9.83 ng L^{-1} for spring, summer, fall, and winter, respectively. A total of 27 rainwater samples were collected at LABS; however, no samples were collected in 2009/08-09 due to road damage and electricity failure caused by a powerful typhoon. Sample Hg concentrations ranged between 3.17 and 37.84 ng L^{-1}, with a VWM concentration of 8.06 ng L^{-1}. Seasonal VWM concentrations were 7.64, 9.47, 9.15, and 5.12 ng L^{-1} for spring, summer, fall, and winter, respectively. These annual VWM concentrations were comparable to the 2009 values reported by the Mercury Deposition Network (MDN) for the Southeastern and upper Midwestern states in USA. High rainwater Hg concentrations in summer were also observed at some MDN sites. Since there is no major anthropogenic Hg emission source at or near Pengjiayu and LABS, the observed high summertime rainwater Hg concentration hints the importance of Hg^0 oxidation and/or scavenging of upper-altitude Hg(II) by deep convection. Direct anthropogenic Hg(II) emissions from the East Asian continent may not contribute significantly to the measured rainwater Hg concentrations; however, anthropogenic Hg^0 emissions may be transported to the upper troposphere or marine boundary layer where it can be oxidized to produce Hg(II), which will then be effectively scavenged by cloud water and rainwater.

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