

Seasonal and Spatial Air-sea Exchange of Hg in the East China Sea

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The East China Sea (ECS) is a marginal sea that receives tremendous mercury (Hg) inputs through the Changjiang discharge. Some of the Hg discharged may subsequently emit through air-sea exchange and be further transported. However, the air-sea exchange flux of Hg in the ECS has not yet been evaluated on a seasonal basis previously, since the water masses here change temporally via mixing of Changjiang diluted waters (CDW) and Kuroshio Current waters (KW). In this study, we had carried out the spatiotemporal distribution of dissolved elemental mercury (DEM) of surface seawaters and its air-sea exchange flux during six cruises from 2003 to 2010 in the ECS. Seasonal mean DEM concentrations positively correlated with sea surface temperature in all water masses and differed between CDW (100-200 fM) and the KW (60-170 fM) in each season. Furthermore, particularly high DEM concentration (250-300 fM) were observed in the coastal region in summer, possibly reflecting the Hg source from Changjiang discharge and coastal upwelling of subsurface waters. Corresponding air-sea exchange flux showed a significant seasonality with a high in warm seasons (summer, $670 \pm 360 \text{ pmol m}^{-2} \text{ d}^{-1}$; following fall, 250 ± 140), and a low in cold seasons (winter, 20 ± 60 ; spring, 100 ± 60). This finding suggested higher net DEM production and tendency to emit took place in warm seasons. Annually, ca. 48 kmole of Hg is emitted from the ECS ($\sim 0.4\%$ of global emission in $\sim 0.1\%$ of global ocean area), suggesting high regional Hg pollution impacts.