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A Diagnosis Analysis to inter-annual variation of air-sea Hg flux in global ocean and the “seesaw” effect in equatorial Pacific

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The inter-annual variation of mercury(Hg) was spotted in monitoring stations, like the Alert and Mace Head. Nevertheless, the potential reason still lacks of studying. With periodic disturbance like ENSO, air-sea exchange flux, the largest flux between Earth system reservoirs, might greatly contribute to the inter-annual variation of Hg. Therefore, this study intended to explore the inter-annual variation of Hg^0, a dominant evasion form of Hg, driven by MITgcm (ocean model). In general, the inter-annual variation of Hg evasion from global ocean was relatively stable in mid and high latitude, but a violent fluctuation was found in the tropical sea areas, especially equatorial Pacific. A distinct latitudinal difference was spotted that the fluctuation of Hg^0 evasion was mainly attributed to wind speed in tropical sea areas, while in temperate zones were correlated with precipitation. Besides, air temperature variation seems to control the Hg^0 evasion in the sea areas of South Temperate Zone (STZ) as well as South Frigid Zone (SFZ). Furthermore, an evident “seesaw” effect of Hg^0 evasion anomaly was observed in equatorial Pacific, especially within Nino 3.4 and Nino 4, between El Niño(EN) and La Niña(LN) events. The increasing (decreasing) evasion anomaly in Nino 3.4 during the LN(EN) mainly attributed to the increase (decrease) of wind speed induced by stronger Walker circulation. While the increasing (decreasing) evasion anomaly in Nino 4 during EN(LN) was likely accounted for the rising (reducing) precipitation caused by the collapse of Walker circulation as well as the eastward shifting upward motion. Subsequently, the increasing anomaly of Hg^0 evasion was simulated by GEOS-Chem model to further explore the potential impact. Results showed that countries, like American, China, India and Brazil. have occupied a large proportion of crops farming, but there spotted a relatively higher THg deposition anomalies, which might increase the human exposure to Hg. Finally, based on limited information, a hypothesis was put forward that there might be an indirect impact of ENSO-driven MeHg variation on the mass mortality of marine mammals.