

Redox dynamics of atmospheric mercury at Maido Observatory in the tropical Indian Ocean

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To fill important data gaps on atmospheric mercury in the Southern Hemisphere and to address uncertainties in mercury redox dynamics, we measured GEM during a nearly one-year-long field campaign (from August 2017 to June 2018) at Maido Observatory on La Réunion island, located at an altitude of 2154 masl on the slope of an inactive volcano. During most of the measurement campaign, auxiliary information on CO₂, CH₄, CO, O₃, SO₂, radon, water isotopes, and meteorological variables is also available. Located about 680 km east of Madagascar, La Réunion island is dominated by easterly trade winds and thus mostly exposed to air masses of marine origin, with limited seasonal variability in air mass transport. With a standard deviation (SD) of 0.05 ng/m³ for monthly averages, GEM concentrations showed little seasonal variation around the overall mean of 0.85 ng/m³ (SD for hourly data: 0.12 ng/m³), and the only notable feature of the seasonal cycle were moderately enhanced GEM concentrations during the Southern Hemisphere biomass burning season (mean of 0.93 ng/m³, SD: 0.11; during October - November). Diel GEM cycles at Maido exhibited a remarkable regularity, with higher GEM concentrations during daytime (0.88 ng/m³, SD: 0.11; between 6 AM and 8 PM), when the observatory tends to be under the influence of the marine boundary layer (MBL), and lower GEM concentrations during nighttime (0.81 ng/m³, SD: 0.12; between 8 PM and 6 AM), when a mix of free-tropospheric and boundary layer air can be sampled. However, during cyclonic storms, this diel variation diminished and the diel cycle flattened, probably due to a less pronounced vertical stratification in the lower troposphere and the expansion of the MBL. With the goal of exploring local sources and sinks, as well as redox dynamics of atmospheric mercury at this marine site, we group diel cycles into

qualitatively different types, compare their behavior to that of auxiliary variables, and investigate the conditions leading to their appearance. We furthermore present one GEM depletion event which was clearly linked to an eruption of the islands' sporadically active volcano.

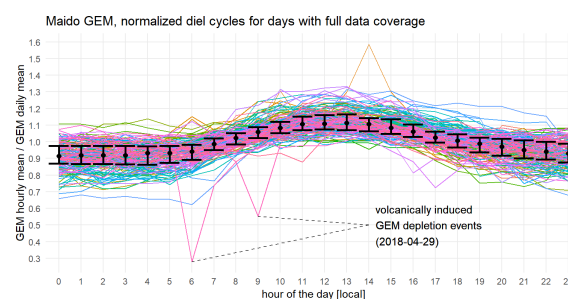


Fig. 1: Normalized diel cycles. Each colored line corresponds to one diel cycle. Shown in black: Ensemble 25th percentile, median and 75th percentile.