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Factors influencing the large-scale distribution of Hg° in the Mexico City area and over the North Pacific

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Abstract. Gas-phase elemental mercury (Hg°) was measured aboard the NASA DC-8 aircraft during the Intercontinental Chemical Transport Experiment Phase B (INTEX-B) campaign in spring 2006. Flights were conducted around Mexico City and on two subsequent deployments over the North Pacific based out of Honolulu, Hawaii and Anchorage, Alaska. Data obtained from 0.15–12 km altitude showed that Hg° exhibited a relatively constant vertical profile centered around 100 ppqv. Highly concentrated pollution plumes emanating from the Mexico City urban agglomeration revealed that mixing ratios of Hg° as large as 500 ppqv were related to combustion tracers such as CO, but not SO_2 which is presumably released locally from coal burning, refineries, and volcanoes. Our analysis of Mexico City plumes indicated that widespread multi-source urban/industrial emissions may have a more important influence on Hg° than specific point sources. Over the Pacific, correlations with CO, CO_2, CH_4, and C_2Cl_4 were diffuse overall, but recognizable on flights out of Anchorage and Honolulu. In distinct plumes originating from the Asian continent the Hg°- CO relationship yielded an average value of ~0.56 ppqv/ppbv, in good agreement with previous findings. A prominent feature of the INTEX-B dataset was frequent total depletion of Hg° in the upper troposphere when stratospherically influenced air was encountered. Ozone data obtained with the differential absorption lidar (DIAL) showed that the stratospheric impact on the tropospheric column was a common and pervasive feature on all flights out of Honolulu and Anchorage. We propose that this is likely a major factor driving large-scale seasonality in Hg° mixing ratios, especially at mid-latitudes, and an important process that should be incorporated into global chemical transport models.

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