Comparisons of trace constituents from ground stations and the DC-8 aircraft during PEM-West B

R. Arimoto,¹ ² R. A. Duce,³ J. M. Prospero,⁴ D. L. Savoie,⁵ R. W. Talbot,⁵ J. E. Dibb,⁵ B. G. Heikes,¹ B. J. Ray,¹ N. F. Lewis,¹ and U. Tomza¹

Abstract. Chemical data from ground stations in Asia and the North Pacific are compared with data from the DC-8 aircraft collected during the Pacific Exploratory Measurements in the Western Pacific Ocean (PEM-West B) mission. Ground station sampling took place on Hong Kong, Taiwan, Okinawa, and Cheju; and at three Pacific islands, Shemya, Midway, and Oahu. Aircraft samples were collected during 19 flights, most over the western North Pacific. Aluminum was used as an indicator of mineral aerosol, and even though the aircraft did sample Asian dust, strong dust storms were not encountered. The frequency distribution for non-sea-salt sulfate (nss SO₄²⁻) in the aircraft samples was bimodal: the higher concentration mode (~1 µg m⁻³) evidently originated from pollution or, less likely, from volcanic sources, while the lower mode, with a peak at 0.040 µg m⁻³, probably was a product of biogenic emissions. In addition, the concentrations of aerosol sulfate varied strongly in the vertical: arithmetic mean SO₄²⁻ concentrations above 5000 m (X̄ = 0.21 ± 0.69 µg m⁻³) were substantially lower than those below (X̄ = 1.07 ± 0.87 µg m⁻³), suggesting the predominance of the surface sources. Several samples collected in the stratosphere exhibited elevated SO₄²⁻, however, probably as a result of emissions from Mount Pinatubo. During some boundary layer legs on the DC-8, the concentrations of CO and O₃ were comparable to those of clean marine air, but during other legs, several chemically distinct air masses were sampled, including polluted air in which O₃ was photochemically produced. In general, the continental outflow sampled from the aircraft was substantially diluted with respect to what was observed at the ground stations. Higher concentrations of aerosol species, O₃, and CO at the Hong Kong ground station relative to the aircraft suggest that much of the continental outflow from southeastern Asia occurs in the lower troposphere, and extensive long-range transport out of this part of Asia is not expected. In comparison, materials emitted farther to the north apparently are more susceptible to long-range transport.

¹Center for Atmospheric Chemistry Studies, Graduate School of Oceanography, University of Rhode Island, Narragansett.
²Now at Carlsbad Environmental Monitoring and Research Center, New Mexico State University, Carlsbad.
³Department of Meteorology and Oceanography, Texas A&M University, College of Geosciences and Maritime Studies, College Station.
⁴Rosenstiel School for Marine and Atmospheric Sciences, University of Miami, Miami, Florida.
⁵Institute for the Study of Earth, Ocean, and Space, University of New Hampshire, Durham.

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