Pacific Exploratory Mission in the tropical Pacific: PEM-Tropics B, March-April 1999

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Abstract

The Pacific Exploratory Mission - Tropics B (PEM-Tropics B) was conducted by the NASA Global Tropospheric Experiment (GTE) over the tropical Pacific Ocean in March-April 1999. It used two NASA aircraft, a DC-8 and a P-3B. Its central objective was to improve knowledge of the factors controlling ozone, OH, aerosols, and related species over the vast and remote region defined by the tropical Pacific. Both aircraft were equipped with extensive instrumentation for measuring numerous chemical compounds and gases. The geographical coverage ranged from 38N to 36S in latitude and 148W to 76E in longitude. Major deployment sites included Hilo, Hawaii; Christmas Island; Tahiti; Fiji; and Easter Island. PEM-Tropics B was a sequel to PEM-Tropics A, conducted in September-October 1996. The latter field study encountered considerable biomass burning indluence over the South Pacific associated with the dry season in the southern tropics. PEM-Tropics B, conducted in the wet season of the southern tropics, observed an exceedingly clean atmosphere over the South Pacific but a variety of pollution influences over the tropical North Pacific, including long-range transport from industrial sources in Eurasia and North America as well as from seasonal biomass burning in Southeast Asia. Photochemical ozone loss over both the North and the South Pacific exceeded local photochemical production by about a factor of two, implying the need for a major inflow term to balance the tropospheric budget over the region. Dedicated flights investigated the sharp air mass transitions at the Intertropical Convergence Zone (ITCZ) and at the South Pacific Convergence Zone (SPCZ). Extensive OH observations, many involving diurnal profiles at several different altitudes, permitted the first large-scale comparisons with photochemical model predictions. High concentrations of oxygenated organics were observed ubiquitously in the tropical Pacific atmosphere and may have important implications for global HO_x and NO_x budgets. Extensive equatorial measurements of DSMS and OH, some of which were recorded in coincidence with exceptionally high levels of the oxidation product DMSO, suggest that important aspects of marine sulfur chemistry are also still poorly understood.