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Mass size distributions and mixing state of individual black-carbon containing aerosol particles observed in situ from 67S to 85N

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Black carbon (BC) is a combustion byproduct that dominates aerosol absorption of visible light and thereby influences global climate. BC's chemical stability means that its only significant loss mechanisms in the atmosphere are wet and dry removal. Hence, knowledge about the coatings on BC that can influence both its light absorption and its atmospheric lifetime are fundamentally important to accurate modeling of BC mass loadings in the atmosphere and their associated climate impact. Since early 2009, the NSF/NCAR GV research aircraft has carried the NOAA single-particle soot photometer (SP2) on three missions (HIPPO 1,2,3) to sample the remote atmosphere over global scales. These flight series have led to an unprecedented data set including black carbon (BC) aerosol concentration, size distribution, mixing state, and dry-optical size determined from observation of millions of individual BC-containing particles by the SP2. On each campaign, lasting only three weeks, the SP2 sampled latitudes from ~85N to ~65S, primarily in the vicinity of the dateline, from near the surface to 14 km altitude. Over one hundred vertical profiles per campaign ensured high vertical and horizontal resolution. In addition to the aged, processed aerosol expected in the clean remote atmosphere, dirty air associated with trans-pacific transport of Asian pollution and with Arctic haze was sampled. Here we present the early results of the BC size, mixing state and optical size analyses from these missions. These results suggest that BC-containing aerosol approaches a single, general microphysical state in remote air masses.