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Ice Core Records of Black Carbon Fluxes to Antarctica A.D. 1800-2000

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Black Carbon (BC, soot) aerosols are emitted during biomass burning and fossil fuel combustion and have an atmospheric residence time of up to several weeks. Emitted at low latitudes of the Southern Hemisphere, BC is transported and deposited to the Antarctic ice sheet where it preserves a record of past emissions and atmospheric transport. We present six high-resolution ice core records of BC fluxes for the A.D. 1800-2000 period from various Antarctic locations: Dronning Maud Land, West Antarctic Ice Sheet, Law Dome and Antarctic Peninsula. BC particles < 500 nm in diameter were determined using a continuous ice-core melter system coupled to a liquid-to-aerosol, single particle soot photometer (SP2). BC fluxes varied from ∼5 to ug.m-2.yr-1 to the Antarctic Plateau, 15 to 35 ug.m-2.yr-1 to the West Antarctic Ice Sheet and Law Dome and up to 200 ug.m-2.yr-1 to the Antarctic Peninsula. Trends in BC fluxes between 1800 and 2000 were observed from Dronning Maud Land and the northern Antarctic Peninsula (increasing) and at Law Dome (decreasing). Periodicities in the record were also investigated through spectral and multiple regression analysis. Sodium measurements from the same cores were compared against BC measurements to determine the importance of transport in the observed variability. Finally, the records were compared with recently published modeled southern hemisphere anthropogenic and natural biomass burning emissions (IPCC AR5). Coupled with a good understanding of modern atmospheric transport to Antarctica; BC could potentially be used as a biomass burning proxy.