Seasonal features and origins of carbonaceous aerosols at Syowa Station, Antarctica

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Black carbon (BC) in the atmosphere has strong light-absorption ability. Because of the light-absorption, BC are related closely to atmospheric radiation budget and climate impact. In polar and cold regions, BC can modify considerably surface snow albedo through BC deposition onto snow surface. BC concentrations in the Antarctic regions are lower than the other sites, because of low source strength of BC in the Antarctic Circle. Thus, contribution of BC to atmospheric radiation and change of surface snow albedo is negligible at the moment. Furthermore, the low BC source strength means that BC might be supplied by long-range transport from mid- and low- latitudes to the Antarctic area. In other words, BC can be used as "tracer" of long-range transport to the Antarctic regions. This study aims to elucidate seasonal features of BC in the Antarctic coasts, its potential source, potential source areas, and transport processes.

We measured black carbon (BC) concentrations at Syowa Station, Antarctica since February 2005 to characterize seasonal features of BC concentrations and to monitor long-range transport of aerosols from mid-latitudes to the Antarctic coasts. CHASER model was used to understand potential BC source and potential source area. BC concentrations ranged in below detection limit (0.2 ng m^{-3}) – 63.8 ng m^{-3} at Syowa Station (median, 1.8 ng m^{-3}; mean, 2.7 ng m^{-3} during the measurement). Although seasonal features and year-to-year variations of BC concentrations were observed, long-term trend of BC concentrations was not clear during our measurement. Seasonal features of BC concentrations showed spring maximum in September – October at Syowa Station. To elucidate BC transport processes, origins, and potential source area (PSA), we compared BC data to backward trajectory analysis and model simulation. BC might be transported directly to Syowa Station mainly via boundary layer and lower free troposphere from mid-latitudes. Also, some BC was transported into the Antarctic regions via the upper free troposphere. Biomass burning in South America and southern Africa is the most dominant PSA for BC transported to Syowa Station, and fossil fuel combustion in South America and southern Africa had also important contribution.