Concentrations and size distribution of black carbon in Northwest Greenland during the past 350 years reconstructed from an ice core

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An ice core to the depth of 225 m was drilled at the SIGMA-D site, Northwest Greenland, in 2014 under the SIGMA (Snow Impurity and Glacial Microbe Effects on Abrupt Warming in the Arctic) project (Matoba et al., 2015). We analyzed the core to the depth of 113 m. The top 6 m of the core was cut at a ca 5 cm interval, melted and analyzed for black carbon (BC) together with stable isotopes of water, microparticles and six elements (Na, K, Mg, Ca, Fe, and Al). Between 6 and 113 m depths, we used a Continuous Flow Analysis (CFA) system developed at the National Institute of Polar Research (NIPR). The NIPR CFA system allows high resolution analysis of black carbon (BC) together with stable isotopes of water, microparticles, electric conductivity, and six elements (Na, K, Mg, Ca, Fe, and Al). For BC analysis, we used a recently developed Wide-range SP2 (Single Particle Soot Photometer, Droplet Measurement Technologies). While a normal SP2 detects BC particles in the size range between 70 and 800 nm, the Wide Range SP2 enabled us to detect BC particles in the size range between 70 and 4000 nm (Mori et al., 2016).

Here we report the variability of BC concentration and size distribution over the past 350 years. BC concentrations started to increase in the 1890s, reached its maximum in the 1930's - 1940's, and decreased again since then. The increase is likely due to anthropogenic input. We find anthropogenic changes in size distribution of BC: the mode diameter of mass concentration became larger. We also find anthropogenic changes in seasonality of BC concentration: Annual concentration peak shifted from summer to winter.

References

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