Stable carbon isotopic composition of carbonaceous aerosols from the high Arctic: Comparison between winter and spring

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Lower tropospheric aerosols collected during dark winter (February) and light spring (April-May) at Alert were subjected to stable carbon isotopic (delta13C) measurements to better understand the sources of the carbonaceous materials in the high Arctic. The mean delta13C values of total aerosol carbon were found to increase from lighter values (-25.7 per mill) in winter to heavier values (-23.7 per mill) in spring. The seasonal shift of the delta13C values can be best explained by a decreased atmospheric transport of anthropogenic/terrestrial carbon from the mid-latitudes and an enhanced sea-to-air emission of marine organic matter to the high arctic troposphere in spring. This is supported by a strong negative correlation observed between the delta13C values and the concentration ratios of carbon to Na+. Enhanced emission of marine organic matter to the atmosphere is most likely interpreted by a melting of sea ice, expansion of leads, and retreat of sea ice in the Arctic Ocean in spring.