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Ship-borne measurements of black carbon aerosols over northwestern Pacific and Bering Sea

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Black carbon (BC) aerosol can strongly absorb the solar radiation and act as cloud condensation nuclei depending on the mixing state. Therefore, BC abundance and mixing state are key physicochemical properties to estimate the radiative impacts of BC aerosols [1]. Measurements of BC aerosols over the area where BC concentrations are very low are still limited because of the lack of high-sensitivity analytical methods. Single Particles Soot Photometer (SP2), which has been developed by Droplet Measurement, Inc., allows us to quantify the BC mass of single BC-containing particle and measure the BC number/mass concentration even in ultra-clean air [2]. Here we report the concentrations and mixing state of BC-containing particles observed using a SP2 on the research vessel *Mirai* during the research cruise over the northwestern Pacific and Bering Sea (MR13-05 cruise, 8/12-26, 2013).

BC mass concentrations over the sea near Japan ($<145^0$E) were elevated to $\sim$200 ng m^{-3}, whereas they were less than $\sim$40 ng m^{-3} over the northwestern Pacific and Bering Sea. Mixing states as a function of BC-containing particles deduced from SP2 raw data were categorized into three types; bare/thinly coated (type1), thickly coated (type2), and non-core-shell (type3) BC. Over the northwestern Pacific and Bering Sea, the number fractions of type1-BC were ~ 0.13, whereas those of type2-BC were as high as 0.8. We also found the minor but significant presence of type3-BC ($\sim$4%) over the remote ocean.

References
[1] Bond et al., J. Geophys. Res., 118, 5380-5552, doi:10.1002/jgrd.50171, 2013.
[2] Schwarz et al., Geophys. Res. Lett., 37, L18812, doi:10.1029/2010GL044372, 2010.

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