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LIGHT ABSORBING SNOW IMPURITIES MEASURED AT SIGMA-A, GREENLAND ICE SHEET AND THEIR EFFECT ON ALBEDO

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To clarify the contributions of light absorbing snow impurities (LASI) to recent abrupt melting of snow/ice in Greenland, intensive observations of meteorological and snow parameters were carried out at the site SIGMA-A (78°N, 67°W, 1,490 m a.s.l.) on northwest Greenland ice sheet during the intensive observation period (IOP) from June 26 to July 16, 2012 (Aoki et al., 2014a). The meteorological elements including radiation budget and snow height were measured with an automatic weather station. Snow pit observation and snow samplings for LASI were also performed. The collected snow samples were melted and filtered through a quartz fiber filter and a nuclepore filter, and the same melted water samples were kept with a glass bottle at the site. Mass concentrations of LASI were measured in a laboratory with the Lab OC-EC Aerosol Analyzer (Sunset Laboratory Inc., USA) for elemental carbon (EC) and organic carbon (OC) from the quartz fiber filters, with gravimetric analysis for mineral dust from the nuclepore filters (Aoki et al., 2014b), and black carbon (BC) with Single Particle Soot Photometer 2 (SP2) (Droplet Measurement Technologies, USA) from the melted samples. Although the collection efficiencies of the quartz fiber filter for EC in water samples are reported to be 10-38% (Torres *et al.,* 2013), the averaged ratio of our all measurements of EC and BC at SIGMA-A was 59 %.

During the IOP no precipitation was observed in the first two weeks and a large amount of rainfall with remarkable lowering of snow surface was observed in the middle of July (Aoki et al., 2014a). Mass concentrations of BC (EC) and mineral dust in the topmost layer (0-2 cm) were both increased from 2.6 ppbw to 8.0 ppbw (0.9 ppbw to 4.9 ppbw) and from 102 ppbw to 1327 ppbw during the IOP, respectively. Using these data of snow impurities and snow grain size profiles measured from snow pit work, the snow albedo variation was simulated by physically based snow albedo model (Aoki et al., 2011). Assuming the impurity free condition, the albedo reduction due to snow impurities can be calculated. The maximum albedo reductions due to BC, dust and total (BC + dust) were 0.007, 0.007 and 0.014, respectively. Moreover, assuming the new snow grain size (50 μm) the possible albedo reduction due to snow grain growth from the difference in albedo between new snow case and in-situ measured grain size case (200-600 μm at surface). The estimated albedo reduction was 0.06-0.13 (average 0.10) during the period. We can conclude that snow grain growth effect was much larger than that by snow impurities at SIGMA-A under heavy melting condition such as summer in 2012.

References
Aoki, T., et al., 2011: *J. Geophys. Res.*, **116**, D11114, doi:10.1029/2010JD015507.
Aoki, T., et al., 2014a: *Bull. Glaciol. Res.*, **32**, 3-20, doi:10.5331/bgr.32.3.
Aoki, T., et al., 2014b: *Bull. Glaciol. Res.*, **32**, 21-31, doi:10.5331/bgr.32.21.
Torres, A., et al., 2013: *Aerosol Sci. Technol.*, **48**, 238-249, doi:10.1080/02786826.2013.868596.