Snow modification due to climate change in southeastern high-accumulation area of Greenland over the last 60 years evaluated by physical properties of firn core.

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Information of ice sheet albedo in the past is necessary for improving climatic models and future prediction. Snow grain size is indispensable property for evaluating surface albedo of ice sheets. The large parts of firn/ice core samples, however, have already lost information of initial snow grain size after densification. It is important to develop indicators to evaluate history of snow grain modification from firn/ice core samples. There is a correlation between specific surface area (SSA) and near-infrared reflectance (NIR). Continuous SSA values of core samples can be obtained by near-infrared reflectance analysis. We collected the firn core from SE-Dome, the southeastern Greenland in 2015. The SE-Dome firn core records the seasonal variations over the last 60 years due to their higher accumulation rate (~1m/year). In the present study, we focused on relationship between density and NIR and reconstructed the relationship between climate change and snow grain modification over the last 60 years.
Density and NIR data from the SE-Dome ice core are negatively correlated in the long-term trend. These negative correlations show SSA values basically decrease with snow densification. On the other hand, there is positive correlation between density and NIR data in the short-time trend. Both density and NIR of summer samples particularly tend to be lower value than those of samples deposited during other seasons in same year. Timing and number of the low-SSA and low-density layers are related to those of the periods in which air temperature reaching over -5 ℃ continued. This relationship shows the formation of low-SSA and low-density layers enhanced even though air temperature was less than 0℃. The low-SSA and low-density layers are caused by density reduction due to snow sublimation on the surface of ice sheet.

Keywords: Greenland, physical property, near-infrared reflectance , firn, snow grain, albedo

