S3−O1

A unified view of the Greenland flow distortion and its impact on barrier flow, tip jets and coastal oceanography

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Abstract: A new diagnostic is developed that allows for a more complete view of the atmospheric flow distortion that arises from the high topography of Greenland. This flow distortion results in the frequent occurrence of high speed surface wind events, known as tip jets and barrier winds along the southeast coast of Greenland. Unlike previous diagnostics, it is able to partition the occurrence frequency of easterly and westerly tip jets that form in the vicinity of Cape Farewell, the windiest location on the ocean's surface. In addition, the diagnostic clearly identifies the 2 locations along the southeast coast of Greenland where barrier flow is enhanced and confirms previous work that indicated that these locations are collocated with regions of steep coastal topography. It also results in the identification of new regions, the northeast and southeast coasts of Greenland as well as the southeast of Iceland, where tip jets and barrier flow exist. Along the northeast coast, these high speed wind events are proposed to be associated with the formation of the North East Water Polynya as well as contributing to the southward advection of sea ice. Along the southwest coast, the high speed wind events, which result in a reversal of the wind direction, may contribute to the enhanced oceanic eddy activity in the region that plays an important role in the oceanography of the Labrador Sea.

S3−O2

BIOGENIC IMPURITIES DARKENING THE GREENLAND ICESHEET

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Studies have revealed that a part of the bare ice surface of the Greenland Icesheet appeared to be dark coloration compared with those in the surrounding surface. The area, dark region, is likely to melt greater because the dark-colored surface can absorb more solar radiation compared with the white clean ice. The possible causes of the darkening are impurities on the ice, such as mineral dust, black carbon, and organic matter. In particular, organic compornent derived from snow algae, cyanobacteria, and bacteria, may have significant effet of darkening since they usually contain substantial amounts of dark-colored humic substances. However, it is still unknown that where the impurities came from and how they appear and distribute on the surface. To understand dynamics of impurities and formation process of organic matter on the glacier, we investigated characteristics of impurities on Qaanaaq Ice cap located in the north-westen part of the Greenland in melting season of 2012.

Substantial amounts of impurities were found on both snow and ice surfaces. Microscopy revealed that the impurites consisted of mineral dust, snow algae, and other organic matter. In the ice area, they formed granular aggregates: cryoconite granules. The amount of impurities (dry weight) was greatest on the bare ice surface at the middele part of the ice cap, while that was smallest at the lowest site close to the terminus. In the snow area, red snow algae were blooming and visibly recognized. The red algal blooms were comfirmed from the snow line to the top of the ice cap, indicating that the algae appeared on the entire surface of the ice cap. Results suggest that organic matter deribed from snow algae plays a substantial role to darken the surface of the glacier.

S3−O3

ICE MASS LOSS IN NORTHWESTERN GREENLAND

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Greenland is losing ice mass under the changing climate conditions. Not only at the Greenland ice sheet which is currently drawing widespread attention, ice is rapidly decreasing at glaciers and ice caps that are physically separated from the ice sheet. Overview of the changes have been monitored by satellite observations, but further investigations including field measurements are required to capture the details and mechanisms of the changes.

To better understand the recent ice volume change and its drivers in Greenland, we have initiated a research project as a part of GRENE Arctic Climate Change Research Project. The goal of the project is to quantify the mass change of an ice sheet drainage basin and peripheral glaciers and ice caps in northwestern Greenland. Field and satellite data will be collected to accurately evaluate ongoing changes, and the data will be utilized to improve future prediction by numerical modeling. Our field base is Qaanaaq, a small village in the northwestern coast of Greenland. In the summer 2012, we performed field observations on an ice cap and reconnaissance of calving glaciers in the region. In this contribution, we present the overview of the research project and initial results of satellite data analyses and field activities in 2012.

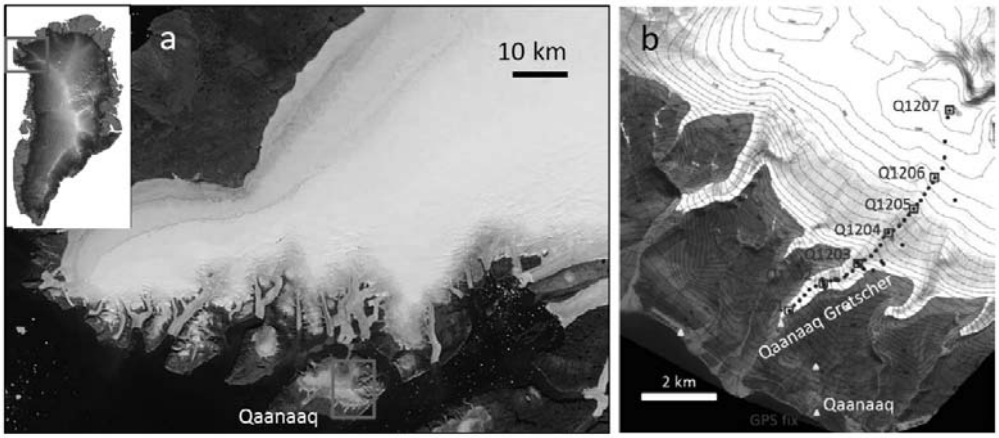

Figure 1. (a) Satellite image of the study area, northwestern Greenland. (b) The ice cap studied in the 2012 field campaign. Locations of survey stakes, GPS and ice radar measurement sites are indicated.

S3–O4

SENSITIVITY OF RESPONSE OF GREENLAND ICE SHEET TO GLOBAL WARMING ON SURFACE MASS BALANCE PARAMETERIZATION AND REFERENCE CLIMATE STATES

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We present a series of numerical experiments of Greenland ice sheet under global warming condition using Ice sheet model for Integrated Earth system Studies (I_CIES). In this study, influence on the simulation from the difference in the method to compute the surface mass balance is focused. Typically, ice sheet simulation is driven by a *reference-anomaly* method, in which the surface temperature and/or the accumulation are decomposed into the reference terms (e.g., observation), the anomaly (e.g., climate scenario from climate models). Then the surface melting is computed using parameterization such as positive degree-day (PDD) method with the temperature. These decomposed terms have own uncertainties, which may influence the ice-sheet simulation. In this study, impact of these properties to the present-day control case, as well as the response under uniform warming condition are discussed, which is thought be a useful and basic information of the property/sensitivity of the Greenland ice sheet.