グリーンランド氷床のダイナミクスと氷河地震活動

金尾政紀[1]、坪井誠司[2]、東野陽子[2]、姫野哲人[1]、豊国源知[1]
[1] *国立極地研究所*
[2] *海洋研究開発機構*

Greenland Ice Sheet Dynamics and Glacial Earthquake Activities

Masaki Kanao [1], Seiji Tsuboi [2], Yoko Tono [2], Tetsuto Himeno [1], and Genchi Toyokuni [1]

[1] *National Institute of Polar Research*
[2] *Japan Agency for Marine and TECnology*

The Greenland ice sheet and its response to climate change have potentially a great impact upon mankind, both through sea-level rise and modulation of fresh water input to the oceans. Monitoring a dynamic response of the Greenland ice sheet to climate change is a fundamental component of long-term observations in global science. “Glacial earthquakes” have been observed along the edges of Greenland with strong seasonality and increasing frequency in this 21st century by the data from Global Seismographic Network (GSN). During the period of 1993-2006, more than 200 glacial earthquakes were detected, but more than 95% have occurred on Greenland, with the remaining events in Alaska and Antarctica. Greenland glacial earthquakes are considered to be closely associated with major outlet glaciers at the margins of the continental ice sheet. Temporal patterns of these earthquakes indicate a clear seasonal change and a significant increase in frequency after 2002. These patterns are positively correlated with seasonal hydrologic variations, significantly increased flow speeds, calving-front retreat, and thinning at many outlet glaciers. The glacial earthquakes in the magnitude range 4.6-5.1 were modeled as a large ice mass sliding downhill several meters on its basal surface over the duration of 30-60 s. These long-period surface waves generated by glacial earthquakes are incompatible with standard earthquake models for tectonic stress release, but the amplitude and phase of the radiated waves can be explained by a landslide source model. The seismicity around Greenland including tectonic/volcanic events was investigated by applying a statistical model to the globally accumulated data. Calculated *b* values, the Magnitude-frequency-dependence parameter, indicated a slight increase from 0.7 to 0.8 in 1968-2007, implying that the seismicity including glacial earthquakes around Greenland become higher during the last four decades. The detection, enumeration, and characterization of smaller glacial earthquakes were limited by the propagation distance to globally distributed stations of the GSN. Glacial earthquakes have been observed at stations within Greenland, but the coverage has been very sparse. In order to define the fine structure and detailed mechanisms of glacial earthquakes, a broadband, real-time network needs to be established throughout the ice sheet and perimeter. The International Polar Year (IPY 2007-2008) was a good opportunity to initiate the program with international collaboration. Then, the “Greenland Ice Sheet Monitoring Network (GLISN)” was initiated for the purpose of identifying the dynamic response of the Greenland ice sheet to climate change.