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GLACIAL EARTHQUAKE ACTIVITIES AND ICE SHEET DYNAMICS IN GREENLAND

Masaki Kanao (*National Institute of Polar Research, Japan*)

Seiji Tsuboi (*Japan Agency for Marine-Earth Science and Technology, Japan*)

Genti Toyokuni (*Tohoku University, Japan*)

Tetsuto Himeno (*Seikei University, Japan*)

Yoko Tono (*Japan Agency for Marine-Earth Science and Technology, Japan*)

Kent Anderson (*Incorporated Research Institutions for Seismology, United States*)

kanao@nipr.ac.jp

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 last decade, over 200 glacial earthquakes were detected, but 95% occurred on Greenland with the remaining in Antarctica. Greenland glacial earthquakes are considered to be associated with major outlet glaciers at the margins of continental ice sheet. Temporal patterns of the 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. Seismicity around Greenland including tectonic events was investigated by applying a statistical model to the globally accumulated data. The detection, enumeration, and characterization of smaller glacial earthquakes were limited by the propagation distance to global stations of GSN. Glacial earthquakes have been observed at stations within Greenland, but the coverage has been sparse. In order to define 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. The “Greenland Ice Sheet Monitoring Network (GLISN)” was initiated for identifying the dynamic response of Greenland ice sheet to climate change. The Japanese team has a significant task to maintain the Ice-S station (69.1N, 39.6W, altitude 2930m) on the ice cap of the large Island from 2011, in order to provide precious data to the global involving communities.