

Triggered Glacial earthquake by Ocean tide

ITO, Takeo^{1*} ; FURUMOTO, Muneyoshi¹

¹Graduate School of Environmental Studies, Nagoya University

1. Introduction

Recently, global warming melts make glacier melting in Greenland, and increase the spillage of the glacier. We are concerned a rise in sea-level, and relation between the glacier earthquake and the outflow of the glacier. The glacial earthquake occurred around the outlet of the glacier, and activity of the glacier earthquake is increasing in recent years. These phenomena may reflect the climate change. However, it is not completely understood that the relationship between the glacial earthquake and the outflow of the glacier.

2. Changes of frictional force and coefficient due to a glacier earthquake and sea-level change

Tsai and Ekstrom (2007) researched seismic wave generated by a glacial earthquake, and reported that the surface wave magnitude of almost the glacial earthquake in Greenland was about five. Source time function of the glacial earthquake is almost 50 seconds, which is longer than a typical tectonic earthquake. It means that the glacial earthquake is similar to slow earthquake. In order to understand the dynamics of the glacial earthquake, we attempt to estimate the change of the frictional coefficient between the glacier and bedrock. As a result, the change of the frictional coefficient due to the glacier earthquake is around 1.6×10^{-4} . The glacier earthquake may occur by triggering of a small perturbation.

On the other hand, we attempt to estimate the effect of sea-level change due to ocean tide. The change of sea-level makes the change of pore pressure between the glacial and bedrock. If we assume that the thickness of glacier and sea-level change are 700m and 1.5m, respectively, the ratio of the change of frictional force due to induced sea water to the effective frictional force of the steady state became about 2.1×10^{-3} , which is the same order as the change of the frictional coefficient due to the glacier earthquake.

3. The ocean tide triggers the glacier earthquake

In order to statically evaluate the triggered glacier earthquake by ocean tide, we check the relation between sea-level change and the occurrence of glacier earthquake. As a result, we find 3% of the whole glacier earthquake is affected by sea-level change. Our estimated situation of frictional state from sea-level change and the glacial earthquake is consistent with the observed glacial earthquake triggered by the ocean tide.

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