[EE] Evening Poster | U (Union) | Union

[U-03]Cryoseismology - a new proxy for detecting surface environmental variations of the Earth -

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Several kinds of environmental signals associated with ocean - cryosphere - solid earth systems have recently been detected in bi-polar regions. Ice-related seismic motions for small magnitude events are generally named ice-quakes (ice-shocks) and can be generated by glacially related dynamics. Such kinds of cryoseismic sources are classified into the movements of ice sheets, sea-ice, oceanic tide-cracks, icebergs and the calving fronts of ice caps. Cryoseismic waves are likely to be influenced by variations in environmental conditions, and the continuous study of their time-space variability provides indirect evidence of climate change. As glacial earthquakes are the most prominent phenomena found recently in polar regions, in particular on the Greenland in this 21st century, the new innovative studies from seismology are expected by long-term monitoring under extreme conditions in the Earth's environment.

Taking these issues into account, the conveners are willing to invite many contributions to a special session on "Cryoseismology", which will cover the recent achievements on glacial related seismic events and associated phenomenon observed in polar regions. It is particularly encouraged to have contributions based on seismic signals involving the dynamics of ice sheets, sea-ice, icebergs and glaciers. Although the glacial earthquakes are the most prominent evidence found recently in polar regions, all related topics involving polar seismology are welcome, such as studies of crust and mantle structure in the area, comparison of tectonic and glacier-related seismicity, recent triggered earthquakes and active volcanoes, glacial isostatic adjustment (GIA), harmonic tremor associated with cryoseismic events, etc.

[U03-P03]**Characteristics of ice tremors around Syowa Station, Antarctica, during 2013–2015**

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Tectonic earthquakes and ice tremors have been observed by seismic stations in Antarctica. Ice tremors are known to be excited by collision of sea ice, crack opening and closing, collapse of icebergs and so on (Kanao et al., 2012). In this study, we classify ice tremors around Syowa Station recorded in 2013–2015 into several types based on the features of waveforms and spectra, and discuss those seasonal variation and causes.

We use the waveform data recorded by STS-1 seismographs at Syowa Station and CMG-40T sensors at several field outcrop stations (i.e, Langhovde, Skallen and Rundvagshetta). The analysis period is from January in 2013 to December in 2015. We define here the tremors, of which P-waves and S-waves are not clear and the duration times are longer than five minutes, as the "ice tremors". We identify the ice tremors by visual inspection of seismograms and spectrograms calculated from velocity waveforms using FFT. We also determine the hypocenters of some ice tremors by grid search using the lag times calculated by the cross-correlation function of the velocity waveform envelopes at different stations.

We recognize that three types of ice tremors (type A–C) and T–phase of tectonic earthquakes (type D) in this study. Type A is the ice tremor which shows a long duration (~67000 s) and broad frequency components in 1–8 Hz. Type B is that of which a dominant frequency changes irregularly over the waveform. Type C is that of which a dominant frequency continuously decreases and overtones are recognized. We find 84 ice tremors in 2013, 148 in 2014 and 198 in 2015. For all the types of ice tremors, the number shows the maximum in autumn (February–April) and the minimum in winter (May–September). In autumn, the cryosphere system starts to melt and the condition of fast sea ice around Syowa Station becomes instability. We consider that the instability of the fast sea ice is necessary to cause ice tremors. From summer to autumn, both the seismic and microbaroms amplitudes are large and the majority of observed ice tremors are type A. From winter to spring, the amplitude of microbaroms is large, while ice tremors are less observed. We, therefore, interpret that type A occurs when broken fast sea ices are rubbed with each other in stormy ocean in summer to autumn. The hypocenters of type C are located in the fast sea ice area around Syowa Station. Thus, we consider that type C occurs when fast sea ices flow out to ocean or ice blocks such as icebergs collide with fast sea ice. On the other hand, we cannot specify a cause of type B tremors.