南極・昭和基地周辺域でのインフラサウンドモニタリング観測
－ 微気圧変動シグナルの長期トレンドと震源の推定 －

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Infrasound monitoring observation around Syowa Station, Antarctica
- Long-term trend signals and their source estimation -

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Infrasound is sub-audible sound whose frequency range is about 3 mHz to 20 Hz. Since the frequency is common between atmospheric, oceanic and solid earth vibrations, those waves are interactive to each other and generates internal infrasound. In polar region, cryosphere play an important role for generation and propagation of the infrasound. Last decade, for the purpose of monitoring nuclear tests, a global infrasound network has been constructed by the CTBTO. The CTBT-IMS infrasound network has 47 working stations (as of September 2014) and each station consists at least 4 infrasound sensors (arrayed observation), they can detect a some-kiloton TNT level atmospheric explosion in range of some 1000 kilometers. The network is almost enough for monitoring nuclear tests, but much sparse for detecting and analyzing in detail of natural infrasound phenomena. Especially at Antarctica, CTBT-IMS has only two stations and is most insufficient observation area.

The infrasound observation in the Antarctic by the Japanese Antarctic Research Expedition (JARE) started at April 2008 by using a sensor as pilot observation. A Chaparral-type sensor was installed at Syowa Station (SYO) in the Lützow-Holm Bay (LHB) of East Antarctica, as a part of the International Polar Year (IPY2007-2008). Afterthat, following the success of pilot observation, in austral summer in 2013, we extended one-sensor observation at SYO to 3-sensor arrayed observations, and installed a few number of field stations along the coast of the LHB.

In this presentation, a long-term trend of infrasound signals observed at SYO until recent years are demonstrated. Characteristic infrasound waves observed at SYO represent physical interaction involving environmental changes in the Antarctic. Continuous recording of infrasound, from April 2008 to present, clearly indicate existence of the background atmospheric vibration generated by ocean-atmosphere interaction (microbaroms) with peaks of 0.1 to 0.25 Hz observed during entire period. Because larger amount of sea-ice extending around the LHB near SYO suppress ocean wave, the microbaroms become weak during austral winter. Newly established SYO array clearly detected the propagating directions and frequency

contents of the microbaroms from Southern Ocean. In addition, the harmonic signals around lowermost human audible band are identified, however, currently unclear how and what generating hamonic signals. Those signals are recorded under windy condition. Since our system has no mechanical resonance at those frequency ranges, we speculate that the characteristic harmonic signals are probably related to local surficial phenomena such as ice sheet vibration generated by katabatic winds.

In austral summer 2013, several field stations with infrasound sensors were established along the coast of the LHB. Two infrasound arrays of different diameters were set up: one at SYO (with a 100 m spacing triangle) and one in the S16 area on the continental ice sheet (with a 1000-m spacing triangle). In addition to these arrays, isolated single stations were deployed at two outcrops in the LHB. Until now, these arrays clearly detected the propagation direction and frequency content of microbaroms from the Southern Ocean. In addition to detecting the microbaroms, several other remarkable infrasound signals were detected in the array dataset in 2014-2015, including local earthquakes, calving of glaciers, discharge of fast sea-ice, smal ice shocks, and so on. In this presentation, we would introduce these detected infrasound signals recently recorded.

Detailed and continuous measurements of infrasound waves in Antarctica could be a new proxy for monitoring regional environmental change as well as temporal climate variations in high southern latitudes.