Establishment of investigating methods for clarifying the correspondence between infrasound in the polar regions and natural phenomena such as the aurora

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This study focuses on infrasonic wave, which is the sound wave below 20 Hz, and investigates the relationship between infrasonic wave and natural phenomena using some sensors installed in and around Syowa station in Antarctica.
Among natural phenomena, when sound is generated from aurorae in the upper atmosphere, there is high probability that infrasonic wave, which is more difficult to attenuate than the higher frequency ranges, will reach the ground. Therefore, the infrasound sensor at Syowa station (69°0' 22" S 39°35' 24" E) located in the auroral zone could be used to observe the infrasonic wave generated by the aurora.
Ultimate goal of this study is to identify vertically propagated infrasonic sound waves that may be originating from the aurora.

In order to observe infrasonic wave, we need to use observation data at a time and date when the local wind speed is less than 5 m/s to avoid wind-induced noise. We need to observe infrasonic wave at the lower limit of 0.01 Hz, based on the results of previous studies, so we can only use a Nanobarometer (6000-16B) to observe the infrasonic wave for the frequency range. We analyze some data sequences obtained at multiple dates and times that meet these conditions. As an analysis method, a degree of temporal variation of the aurora borealis taken in allsky image sequences is compared with the infrasonic waveform at the corresponding time, and an algorithm to determine a changing ratio of the sequences images was derived and programmed for the allsky images. For the infrasonic wave data, we converted the win data to csv format and tried several bandpass filters and applied them to the frequency range from 0.01 Hz to 0.03 Hz in order to verify in the specific frequencies.

In our previous study, we observed N-type waveforms of infrasound with a frequency of about 0.03 Hz associated with auroral pulsations for June 2016 dataset, indicating that these low-frequency sounds may have been generated by the aurora. However, another analysis of the dataset obtained with the infrasound sensors on Syowa station, which began observations in February 2019, have been buried in wind noise throughout the whole period, and we have not yet found any significant correlations. Since the sensors have resumed their observations in 2019, we mainly analyzed the dataset obtained in 2019 at Syowa station. In this context, we have been investigating three N-type waveforms recorded in the dataset since July 2019, when auroral activity was active and the wind speed was consistently below 3 m/s, so as to determine the source of the sound waves and related phenomena. Here, we will show present status of these waveforms.