Investigation of the relationship with infrasonic wave and auroral activity in the polar region

Haruka Ohata[1], Masa-yuki Yamamoto[1]
[1] *KOCHI UNIVERSITY OF TECHNOLOGY*

A comparative analysis of the auroral activity and infrasound was conducted from the data obtained from the infrasound sensors installed at Syowa Station in the Antarctica and its surroundings with an all-sky camera installed at Syowa Station. In this presentation, we will discuss about the possibility that infrasound was generated from the aurora in a frequency range between 0.01 Hz and 0.03 Hz.

When a sound is generated from the aurora in the upper atmosphere, it is highly considered that very low frequency sound (infrasound) that is difficult to attenuate with respect to the sound in various frequency ranges can be propagated on to the ground. Therefore, by using the infrasound sensor installed at Syowa Station (69 ° 0 '22 "S, 39 ° 35' 24" E) and its surroundings located beneath the aurora belt, there is possibility to observe the infrasound generated from the aurora. In this research, in order to identify the infrasound that is generated from aurora. we conduct a case study on the relationship between infrasound observed at Syowa Station and auroral activities in the sky.

Data of three cases satisfying the condition of large scale auroral activity and satisfying the condition of wind velocity of 5 m/s or less were extracted, then among these data of infrasound sensors capable of observing frequencies of 0.1 Hz or less were used. As a result, comparative analysis between the dataset of visible wavelength all-sky camera image and the infrasound sensors was performed on June 10 to 11, 2016 which satisfy the above conditions. For comparative analysis, we created and used a program to derive the rate of change of images for all-sky camera images, and we will convert win format infrasound data into plain text of csv format and some filters were applied to identify infrasound signal in a specific frequency band.

From the data obtained from the infrasound sensor from June 10 to 11 2016, it was possible to identify a specific infrasound waveform around 0:02. In addition, by using the all-sky camera images, changing from a static aurora to a dynamic aurora at around 23:50 on June 10 was confirmed. It takes about 5 minutes from the 100 km altitude where the aurora occurs to the ground before the infrasound reaches the ground [1], and the infrasound wavelength considered to be generated from the aurora is from 0.01 to 0.1 Hz [2]. Since the large amplitude change of the infrasound was seen at around 0.02 Hz when the auroral explosion (break-up) occurred on June 10, 2016, there is a possibility that the observation data of the infrasound was generated from the aurora.

In addition, we tried to elucidate the ultra-low-frequency sound generated from the ramming of the shirase from the video of continuous observation with the time-lapse camera in the Ongul Strait at Syowa Station, which started in November 2018.

We will also report on the relationship between the aurora observed in Norway in November 2019 in time-lapse images taken with a 360-degree camera and the ultra-low frequency sound measured with a nanobaro installed in the field.

References

[1] CHARLES R. WILSON, Auroral Infrasonic Waves, journal of geophysical research, space physics, 74, pp. 1812-1836, 1969.
[2] CHARLES R. WILSON, Infrasonic wave generation by aurora, Journal of Atmospheric and Terrestrial Physics, 37, pp. 973 – 988, 1975.