Measurement of infrasound generated by three rocket launches

Toshifumi Suzuki[1]; Masa-yuki Yamamoto[1]; Yoshiaki Ishihara[2]; Takumi Abe[3]

[1] Kochi University of Technology; [2] RISE, NAOJ; [3] ISAS/JAXA

The infrasound is known as sound waves whose frequency is lower than our lowest audible limit (20 Hz). Since attenuation in low frequency range is not effective on propagation in atmosphere, the infrasound has a character of long distance propagation. The application of infrasound measurement would be widely expanded because it can include the feature of artificial explosion phenomena like nuclear bomb tests or large-scale chemical explosions as well as drastic geophysical events such as earthquakes and thunder storms coming from over 1000 km distance. However, in order to detect the direction of incoming infrasound waves, it is necessary to install many sensors per one observatory. It derives serious amounts of costs because one of the existing sensors that detect infrasound precisely is now very expensive. It costs over several 100,000 yen per one sensor.

In the previous research by Nishiyama (2007), we successfully developed a prototype of low-cost infrasound sensor with a capability of measuring sound waves in the frequency range from 0.01 Hz to 100 Hz. In order to obtain comparison data and calibration, we measured the booming roar of three rocket launches by the existing sensors and the newly developed ones. Namely, we set-up 4 infrasound sensors at Uchinoura Space Center (USC) of JAXA for the S-520-23 sounding rocket launch and measure the infrasound generated by the rocket (on Sep. 2, 2007), the S-310-38 rocket (on Feb. 2008), and H2A-13 (on Sep. 14, 2007). In the S-520-23 experiment, infrasound by rocket-engine burnings was successfully detected. Moreover, infrasound from Tanegashima to Uchinoura coming from 100 km distance was detected by H2A launch. There has a lot of advantages for investigating the propagation characteristics of infrasound in the atmosphere when we detect infrasound signals during certain periods of the rocket-engine burnings because of given sound sources of the rocket in motion along their precisely calibrated trajectories with precise timing procedures.

In the experiment, detection time and absolute intensity were investigated in the comparison between the existing sensors and the low-priced version. In this paper, details of the experiment and future plan will be discussed.

Reference:
Y. Nishiyama, Graduation research report of Kochi University of Technology (2007).