Construction of meteor orbit calculation system for comprehensive meteor observation

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Introduction

Ham-band Radio meteor Observation (HRO) has an advantage of 24-hour continuous data-detection of meteors with low-cost facilities. At Kochi University of Technology (KUT), a 5ch HRO-Interferometer (IF) was developed in 2009 and has been observing the meteor appearance position of every meteor echo (Noguchi, 2009). In 2012, we have developed a system of meteor trajectory measurement by multiple-site observation with GPS time-keeping combining with the 5ch HRO-IF (Yamasaki, 2012). In 2014, we restarted the operation of the whole system. In addition, we tried the multiple-site observation to calculate meteor trajectories. Then, we got the simultaneous meteor echo data successfully by multiple-site observation system in January 2015.

Purpose

A large meteor sometimes generates a very low-frequency sound (infrasound) when it was supersonically entered to the earth's atmosphere. Mostly researchers get the infrasound data, video data and meteor echo data by each independent observation equipment (e.g. Edwards et al., 2008). In Japan, nobody has obtained both of simultaneous meteor parameters and meteorite, yet. Accordingly, we will build the multiple-site comprehensive observation system (fig. 1) and data collection system in order to obtain some meteor parameters if a fireball class meteor comes to earth.

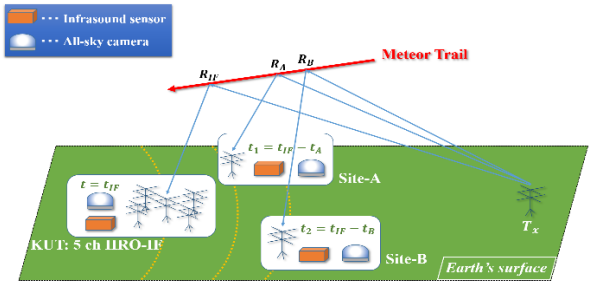

Fig. 1 Comprehensive meteor observation at KUT

Multiple-site observation

We restarted the radio observation of meteors since 2014 at KUT. First, we had to modify the whole operating system. After then we built the multiple-site observation system. The system measures a meteor echo reflection point by 5-channel interferometer with assuming height of 90 km. The multiple-site observation consists of the 5-channel interferometer and the other 2 observing stations. We used time difference between the sites for calculating each meteor velocity and trajectory angle. On December 2015, we observed Geminids meteor shower by the multiple-site radio observation technique. We used 1 PPS signal by GPS receiver for precise time calibration, and used wave extracting software at each observing station. These sites are shown in fig. 2.

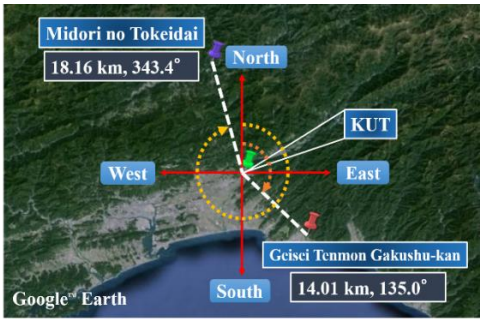

Fig. 2 Positional relation for multiple-site radio observation

Results

We obtained 66 simultaneous meteor echo data by all of the three receiving stations, and we calculated the meteor velocity and trajectory angle from 10 meteor echo data. The remaining 56 meteor echo data cannot be used for calculation of meteor positioning parameters we cannot calculate the meteor positioning parameter because mostly meteor echo data includes noise. And after, we calculated meteor average velocity of 38.8 km/s. Generally, the Geminids meteor shower velocity is about 33 km/s ~ 42 km/s. For this reason, that result seems appropriate.

Future view

We obtained 2015 Geminids meteor shower data, and calculated each meteor velocity and trajectory angle. However, we did not prepare an observation network system yet. Currently we are constructing an observation network system (e.g. File-server and Time-server etc.,) by using Raspberry pi and the most recent IoT technology.

References

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