

High-accuracy direction-findings of Meteors and development of an automatic meteor observation system by 5ch radio interferometer

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1. Introduction

Ham-band Radio meteor Observation (HRO) has advantage of 24-hours continuous data detection even in daytime or bad weather conditions. In Kochi University of Technology (KUT), observation by 6-channels HRO began in 2003, followed with development of a 3-channels HRO interferometer (HRO-IF) for direction-findings in January in 2005. The HRO data has been archived as dynamic spectrum images automatically produces by 'HROFFT' software, however, counting of each meteor echo has been treated by manually. It is very hard to keep daily meteor counts for many years by observers, so that, applying an images-processing technology to HROFFT images, an automatic counting software 'meteor echo counter' was developed, resulting 95 % or more accuracy of auto-reorganization of each meteor echo without being disturbed by effects of many types of noises (Noguchi and Yamamoto, 2008).

In this study, a 5-channels HRO-IF was developed for improving accuracy of direction-finding of each meteor echo. After calibrating the interferometer by comparison with optical meteor observations, high-accuracy direction-finding by HRO was realized at KUT, creating an automatic meteor echo observation system with functions of producing data files of: date and time, echo strength, duration, direction of meteor appearances, as well as plotting these data on web in quasi-realtime.

2. Automatic meteor observation system

Observation of meteor echoes was carried out by the both of 'HROFFT' and 'meteor echo counter', producing the data of appearance time, echo strength, and duration time per each echo. Then, based on the appearance time, a direction-finding procedure is operated with datasets of the 5ch HRO-IF. A combination of 5 crossed-Yagi antennae with a 'cross' configuration (with E-W and N-S baselines) of the both 1.0 lambda and 1.5 lambda separations (where lambda means wavelength of observing frequency of 53.750 MHz, i.e., 5.58 m), a pair of two independent phase-shifts of 0.5 lambda and 2.5 lambda could be calculated, resulting direction-findings of meteor echoes with high spatial resolution. The results can be automatically put on a specified web server, so that users can watch meteor activities in quasi-realtime by mapping images as well as text data including: appearance time, azimuth, elevation, longitude, latitude, duration, and strength (S/N ratio).

3. Summary

In this study, a forward-scattering meteor radar system was successfully developed by combining rather compact instruments, together with realizing high-accuracy direction-finding of meteor echo by applying a method of 5ch HRO-IF. Quasi-realtime automatic meteor observation system by 5ch HRO-IF has great advantage of producing quick-look of meteor shower activities.

References:

Noguchi, K., Yamamoto, M.-Y., Development of an automatic echo-counting program for HROFFT spectrograms, Earth, Moon, and Planets, 102, 323-329, DOI 10.1007/s11038-007-9212-0, 2008.

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