Development of an automatic echo-counting program for HROFFT spectrograms

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1. Introduction

HRO (Ham-band radio meteor observation) has been developed as a VHF-band forward-scattering radar since 1996 (Maegawa, 1999) and, at the present time, widely operated all over the world. A powerful and simple software HROFFT (by K. Okawa) on a PC enables us to build an automatic radio observatory for monitoring meteor activities. The HROFFT creates a PNG image per each 10 minutes and usually several meteor echoes are received on a HROFFT spectrograms. However, meteor echoes on the spectrograms are usually counted by HRO observers by themselves. At Kochi University of Technology, a 6-channel HRO system was built in 2003 and automatic radio meteor observation has been continuously operated since then. In order to realize an efficient and unified echo counting for HROFFT spectrograms, an auto-counting program was developed.

2. Program development and performance assessment

The auto-counting program written in IDL is one of the image processing programs specialized for HROFFT spectrograms, applying edge-detection method onto the contour of echo spectra as well as the time trend of received signal power indicated at the bottom of each spectrogram. An assessment of the developed program was carried out for one-day HRO data (144 spectrograms) at the peak time of Geminids 2004. More than 700 meteor echoes were counted manually and automatically. The most recent version of developed program was able to count almost all clear meteor echoes within 5 minutes, instead of 2 and a half hours careful effort of an observer.

3. Discussions

As a product of one-year development by weekly student experimentation, an auto-detection software was created in success; however, several issues are left for future problems. Precise detection of long-lasting meteor echoes is one of the most difficult targets of the program. Line-type noises frequently interfere HROFFT spectra in almost all HRO stations. Fundamental noise elimination procedure was applied, however, it is too difficult to figure out a whole range of noises on HROFFT images. Curved noises by interference of some kind of electrical instruments or confused echoes by airplanes are so difficult to eliminate for the present algorism.

4. Conclusion

In conclusion, an automatic echo-counting program for HROFFT spectrograms was developed by student experimentation at Kochi University of Technology, resulting in effective automatic detection of 96 % of meteor echoes.

Reference: Maegawa, K., HRO: A new forward-scatter observation method using a ham-band beacon, WGN, 27, 64-72, 1999.