

## Development of an automatic echo-counting program for HROFFT spectrograms (2)

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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 widely operated all over the world. A powerful and useful software HROFFT (by K. Okawa) 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 manually by HRO observers. 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 has been developed since 2004. An new approach of image processing will be presented in this talk.

### 2. Program development

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 new method of combining multiple peaks on HROFFT images. 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. Line-type noises frequently interfere HROFFT spectra in almost all HRO stations. Fundamental noise elimination procedure was applied to the software.

### 3. Discussions

As a product of two-year development by weekly student experimentation, an auto-detection software was developed in success. Precise detection of long-lasting meteor echoes which was one of the most difficult targets of the program has been solved. In this version of software, confused echo structures by airplanes can be detected as ONE echo count. Several issues are still left for future experiment. Curved noises by interference of some kind of electrical instruments are difficult at present.

### 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 86 % of meteor echoes.

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