

Development of an automatic echo-counting program for HROFFT spectrograms

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Electronic and Photonic

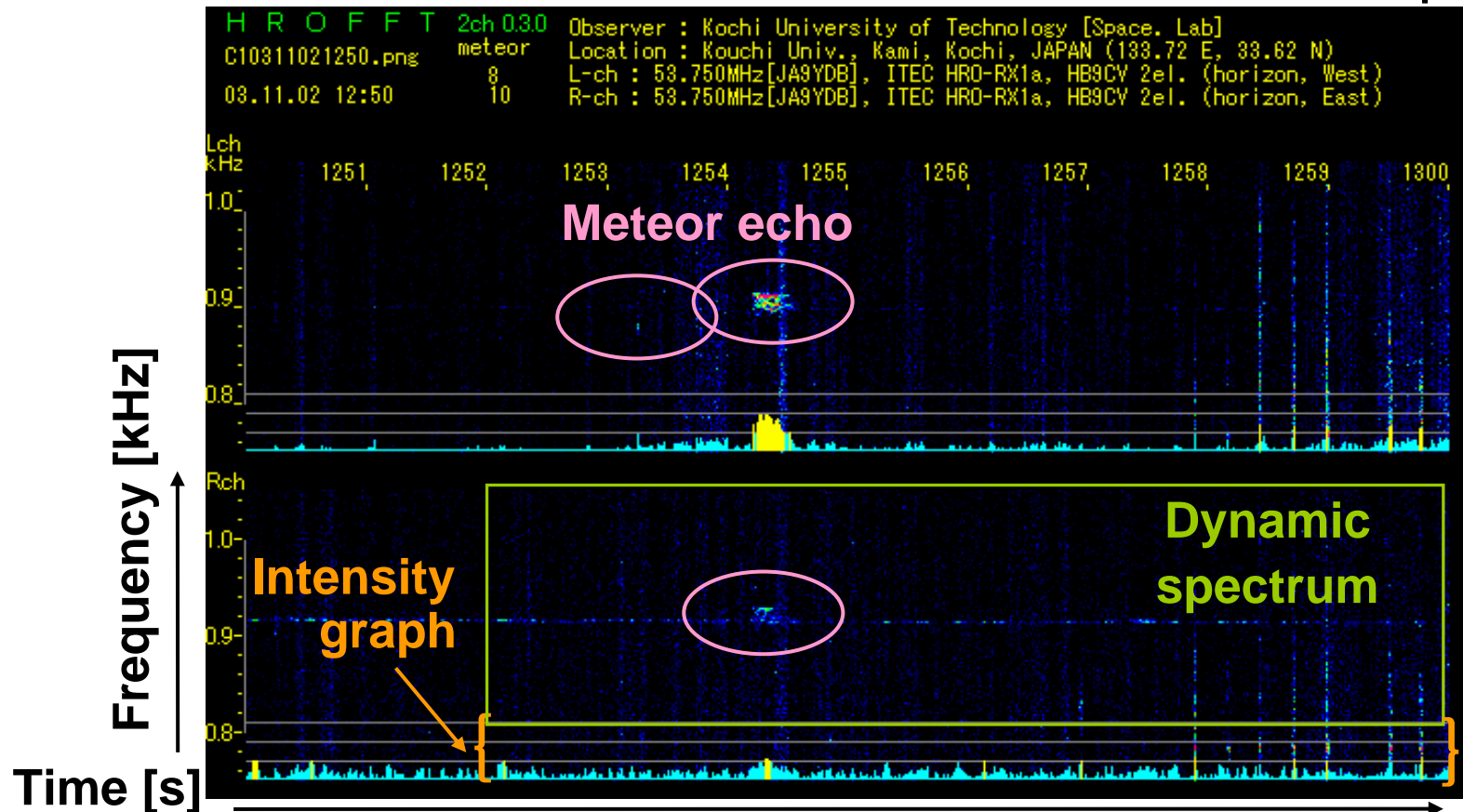
Systems Engineering

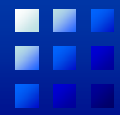


Introduction

■ Observation software “HROFFT”

The HROFFT creates a PNG image per each 10-minutes(4320 images per day). Usually several meteor echoes are found on each HROFFT spectrogram.





Background and Purpose

Background

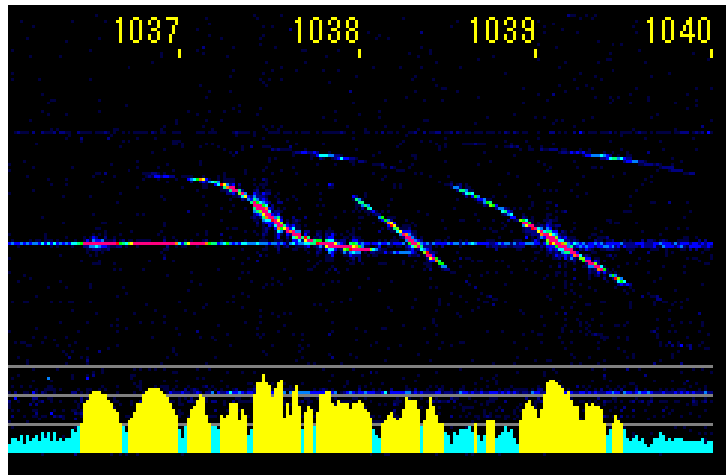
- Observers have many HROFFT images archived in vain.
- Observers have echo-counting procedures different with their own basis.

Purpose

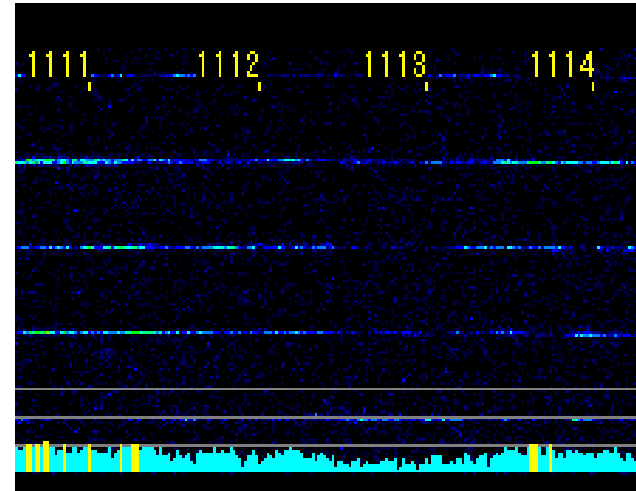
- ➡ Manufacturing of an automatic counting program by applying image processing technique.

Discrimination of various noises and elimination

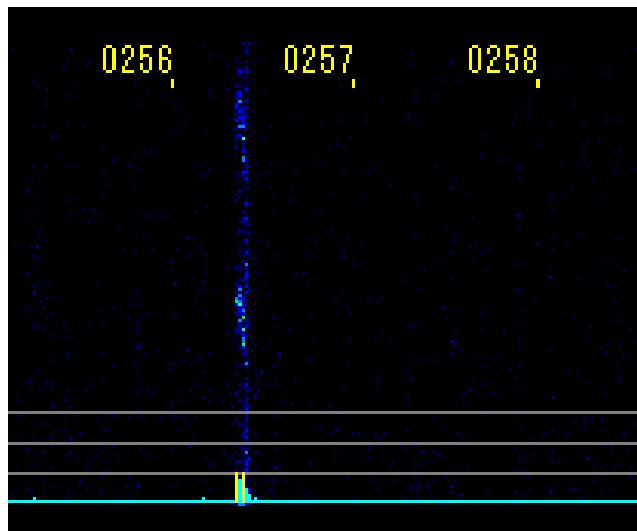
Airplane echoes



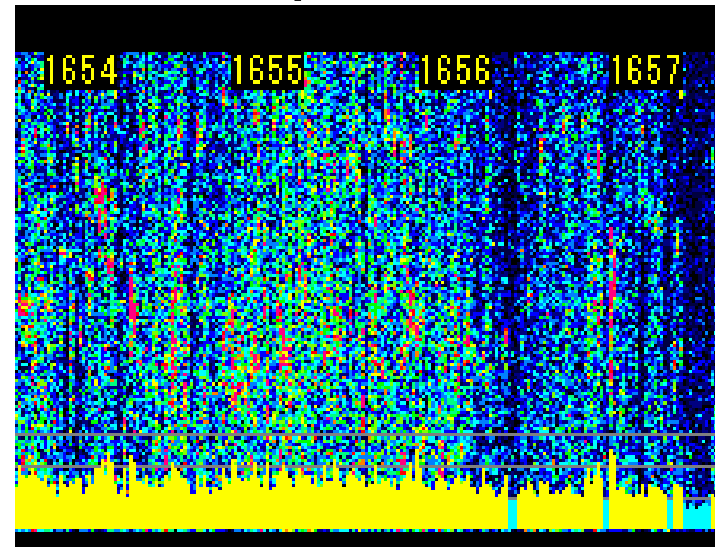
Line noises

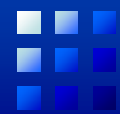


Thunder noises



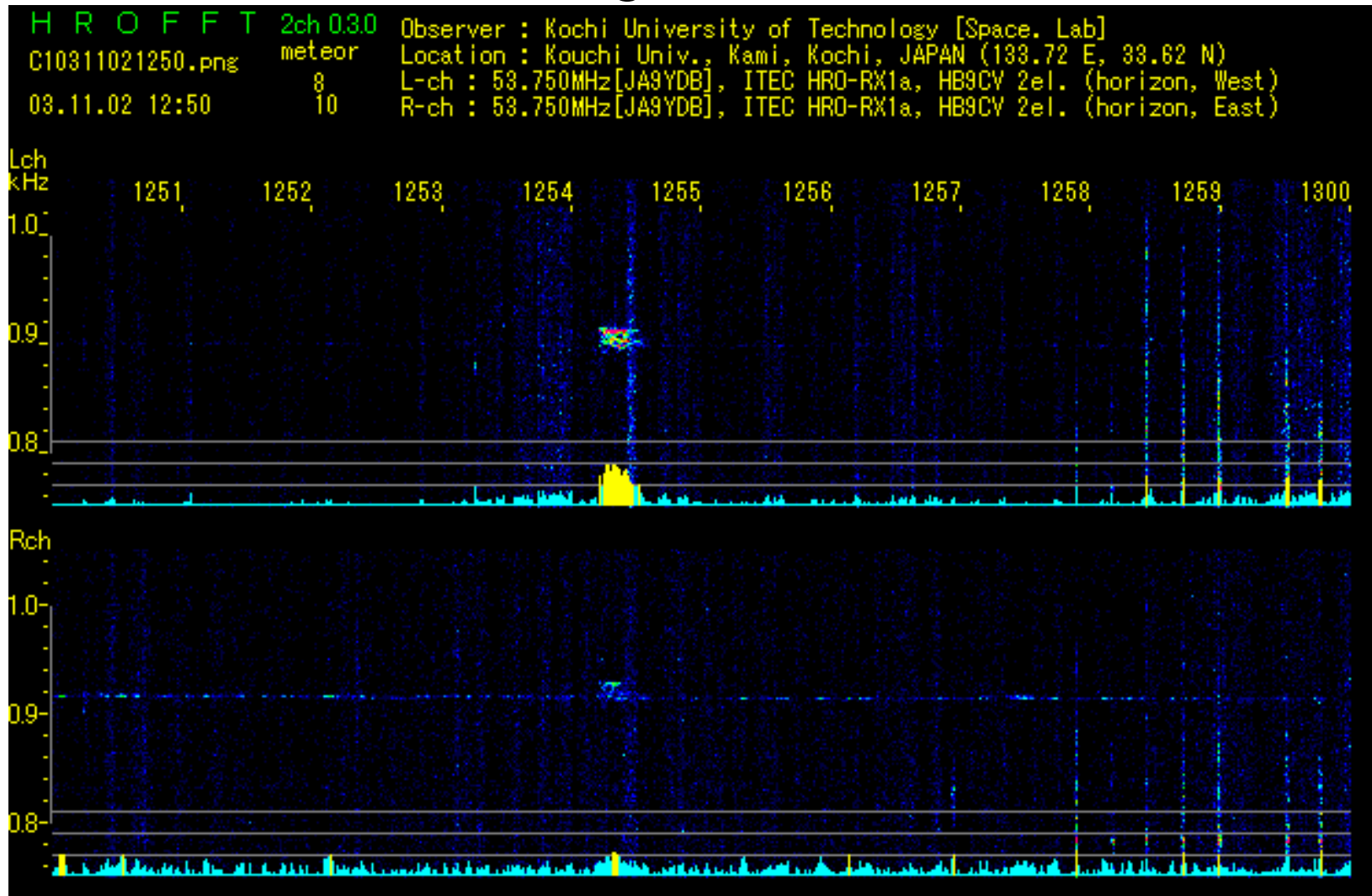
Ionospheric noises





An example of processed result

- Each place of surrounded by gray color is treated as one echo, distinguished from the noises





GUI (Graphical User Interface)

Meteor Echo Counter ver.1.0 (in Japanese)

The screenshot shows the 'meteor echo counter' application window. It features a top bar with window controls and a title bar. Below the title bar, there are several input fields for file paths and a 'パス指定' (Path Selection) section. A central panel contains a table of settings for 1ch and 2ch channels. At the bottom, there are buttons for '設定読み込み' (Load Settings), 'COUNT START', and a message display area.

3) Channel selector # (check here for 2-ch. ver.)

3) Successive processing

3) Writing parameters at the end of result text

3) Adding updated results on the end of result text

3) Creating processed image files

3) Creating activity graphs

1) Push first

4) Count start

Processing information indicator

Echo counting indicator (HR)

2) File path of raw images

2) File path of processed images

2) File path of activity graphs

2) File path of result text file

2) File path of 1-hour result text

Setting parameters of each channel version are shown corresponding to channel selector #

Input parameters with left-aligned without blank

(Default setting parameters are available here with no action)

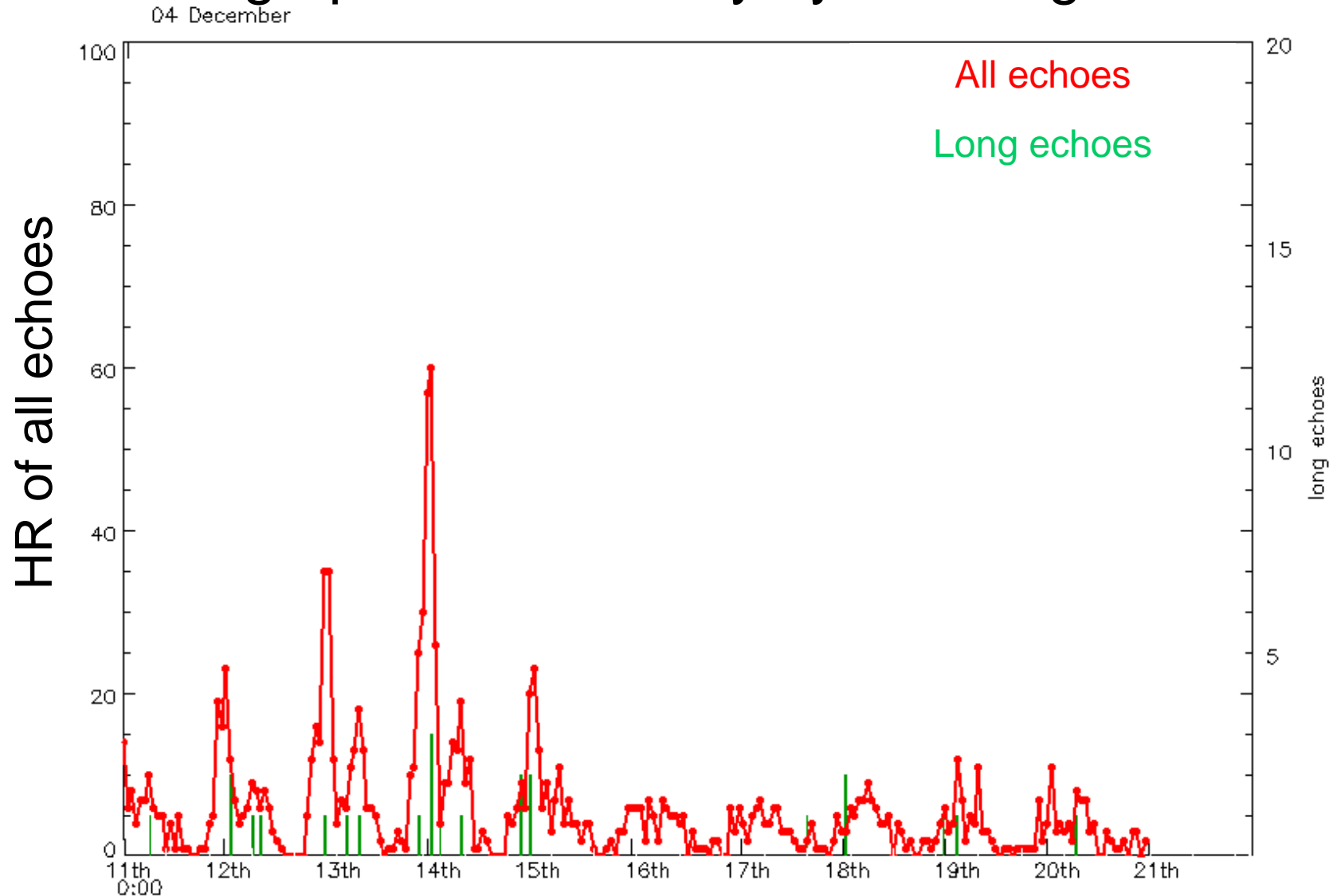
	1ch用	2ch用
1	全体ノイズの閾値	100000
2	2値化の閾値	6
3	横ラインノイズの閾値	260
4	縦ラインノイズの閾値	150
5	飛行機エコーの幅の長さ	7
6	飛行機エコーの傾きの閾値	-0.4
7	飛行機エコーの中間軸許容	0.17
8	飛行機エコーの周波数帯域	5
9	他のエコーの探索範囲	7
10	周波数帯域限定個数	10
11	周波数帯域上下範囲	25
12	Xの始め位置	20
13	Xの終わり位置	619
14	Yの始め位置	44
15	Yの終わり位置	294
16	強度グラフの2値化閾値	9
17	強度グラフのOdBの位置	-1
18	ロングエコーの長さの閾値	10
19	傾きエコーのノイズ認定数	2
20	前回のラスト処理画像	0606100350
21	限定周波数位置	191

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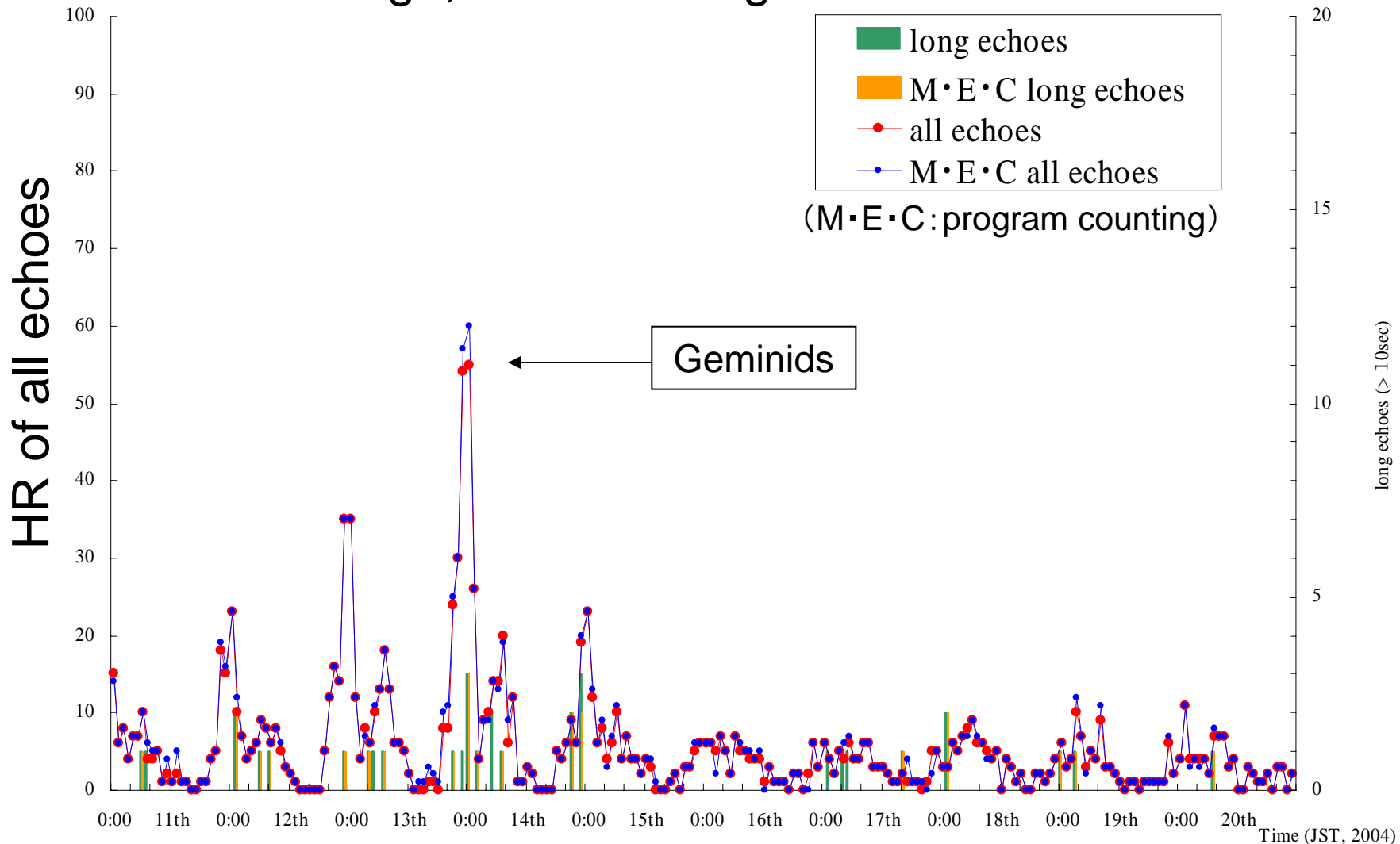
Automatic counting graph

■ Make a graph automatically by counting result



Comparison between manual counting and program counting

Assuming an error range between the both counting as less than 2 for one image, the rate of agreement becomes 99%



Example data of December, 2004. (Geminids period)



Conclusion

- There exist some errors in processing the spectrograms. However, almost 90% of coincidence was realized.
- By applying the software to the archived data in Kochi University of Technology more than 2 years, the meteor activity graphs were automatically produced.
- Future plan: automatic alert of meteor storms!



Thank you very much



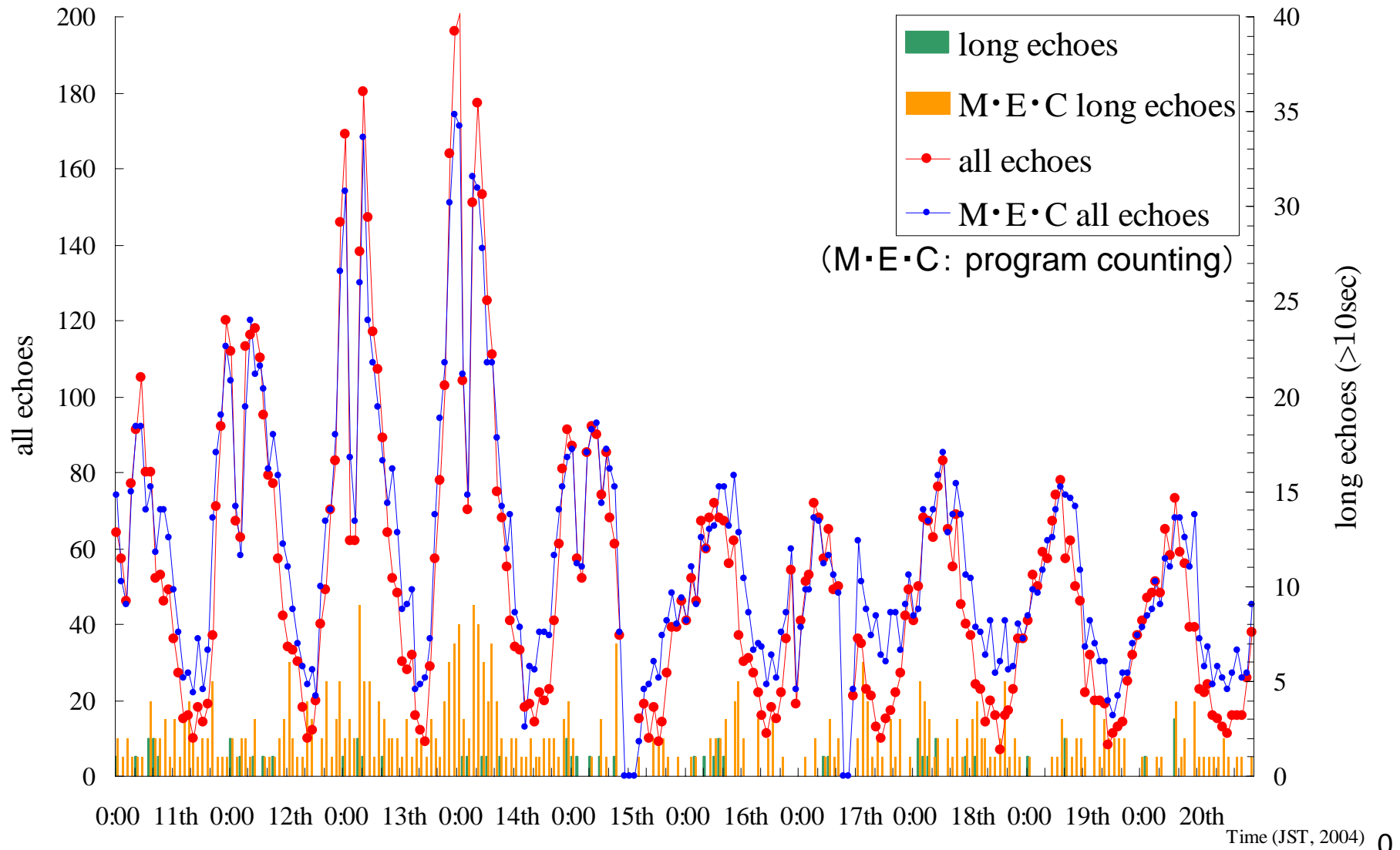
「meteor echo counter ver.1.0」

<http://www.gs.kochi-tech.ac.jp/115073w/index.html>



Observation site with many noises

■ The rate of agreement becomes 81% that with many noises



Example data of December, 2004. (Geminids period)