THE GLOBAL MONITOR OF METEOR STREAMS BY RADIO METEOR OBSERVAITON ALL OVER THE WORLD

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ABSTRACT

In recently, Radio Meteor Observation (RMO) has spread in Japan. Then, to grasp the whole aspect of meteor stream activity accurately, the necessity of unifying the observational data all over the world came out. Then, we tried to collect and integrate them. There are many observational sites in the world. The difference in geographical factor or the observational equipment has to be considered. However, information of them is not enough. Therefore, in this time, data were estimated by relative value. Data were divided by average counts previous two weeks. The Leonids 2000 RMO result at eight sites of the world was unified by this method, and three peaks appeared. This was similar to the result of Visual Observation. Also, the daily meteor activity was caught. Therefore, this meteor monitor was useful for all meteor activity. In this time, however, it was considered without using the radar equation etc, we could get similar result to Visual Observation. Therefore, the more exact result could be obtained if we consider of them.

1. INTRODUCTION

When the meteor appears, the density of electrons in atmosphere increase. Then, the radio wave of high frequency reflects. This observational method is Radio Meteor Observation. Radio Meteor Observation has an advantage in its stable data. In this method, however, only one observational site may lose the maximum by radiant elevation. For this reason, all activity of meteor stream may not be caught at only one site. In addition, observational configuration is different. Therefore, observed data all over the world need to be unified to catch all activity of meteor stream, to research the characteristics of outburst and the history of meteoroids and meteor streams.

Important problems of this observation are next two points. One is “Geographical condition”. The relation of the transmitting and the receiving station is different for each pair. Another is “Observational equipments ”. This problem caused by performances of transmitter, receiver, antenna, etc. To solve these problems, all observational data were unified under the same standard. Then the calculated result each site must be compared. In addition, we defined the background level and removed it from observational data, meteor stream activities finally appeared. Properly speaking, to consider characteristics of each site is the best way. Actually, however, information of observational site is not enough. Therefore, the radar equation cannot be applied. Then, in this time, meteor activities were estimated by relative value.

2. METHODS

The method of unification of the world data is not established now. Therefore, the unification plan was to unify under the same standard. This method was adapted the idea which was shown in the annual meeting of ASJ (Astronomical Society of Japan) in 2001 spring *(H.Ogawa etc, 2001).*

$$\frac{H - H_0}{D} \qquad (2 \cdot 1)$$

“H” means the number of echoes for a certain 1 hour “H”. ”H_0“ is the average of “H” during 2 weeks before the day. “D” is the average of echoes for 1 day during 2 weeks before the day. The result of calculation means that how many times echoes are observed than average echoes during two weeks. Also, the sampling period for “D” is 2weeks. If it is 1 week, the average is influenced by daily radio condition. And if it is more than 3weeks, the average is influenced by long-term trend. Therefore, the sampling period is defined 2weeks.

In addition, by using histograms each observational site, define the background level. This time, the background level was assumed $\pm 2\sigma$. From this background level, detect unusual values and reduce unusual variations from sampling data. By removing unusual data, the overlook toward minus is reduced.

3. OBSERVATIONAL SITES

Stable sites that report observational data every day are needed because unstable sites cannot be defined the background level. In this time, five data in five countries were used. The figure3.1 is the map of using data. And table 3.2 is the detail of observational system.

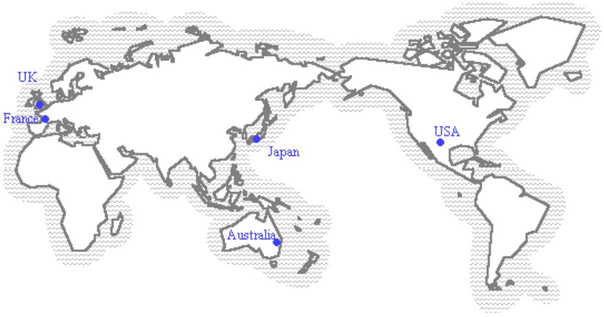

Figure 3.1 the map of using observational data

Country	Frequency	Latitude	Longitude	Observer
USA	88.7 MHz	33.43	-104.5	S. Nelson
UK	55.25MHz	50.47	-1.44	D. Swan
France	96.8 MHz	43.68	3.60	P. Terrier
Australia	88.3 MHz	-27.50	153.70	B. Young
Japan	53.75MHz	34.14	135.41	H. Ogawa

Table 3.2 the detail of using observational data

(ϕ<0:south latitude, λ<0:west longitude)

4. RESULTS

The following figure 4.1 is the result of the calculation in January 2001. Around 3rd January, calculated results in USA, UK, France and Japan recorded unusual value. This unusual result was the activity of Quadrantids. On the other hand, in Australia, this unusual value was not observed because Australia is located in the South Hemisphere. Therefore, the activity of Quadrantids was not seen. Also, unusual value was sometimes observed. However, most of these results are observed by only one site. Therefore, these result could not be decided whether these activities were the error of observation or something meteor streams. Following figures4.2 and 4.3 are some histograms of each observational site.

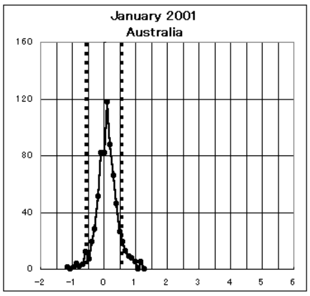

Figure4.2 (Australia)

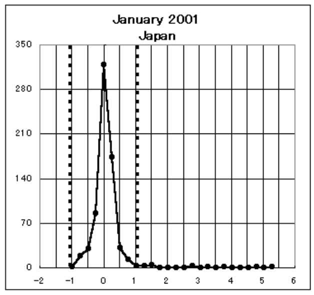

Figure4.3 (Japan)

The horizontal axis is the calculated result. Dotted lines are $\pm 2\sigma$ line. Beyond the limits of these lines are unusual values. Then, these data was reduced from the original sampling data. And within the limits of these lines are background levels. Sigma of each observational site was USA:0.50, UK:0.39, Australia:0.32, France:0.36 and Japan:0.51. In this time, the background level was defined $\pm 2\sigma$.

Also, especially, the figure 4.4 is the calculated result of one active period of meteor stream. This meteor streams is Leonids in 2000. Observational data are 10 in eight countries (UK, France, Spain, Belgium,

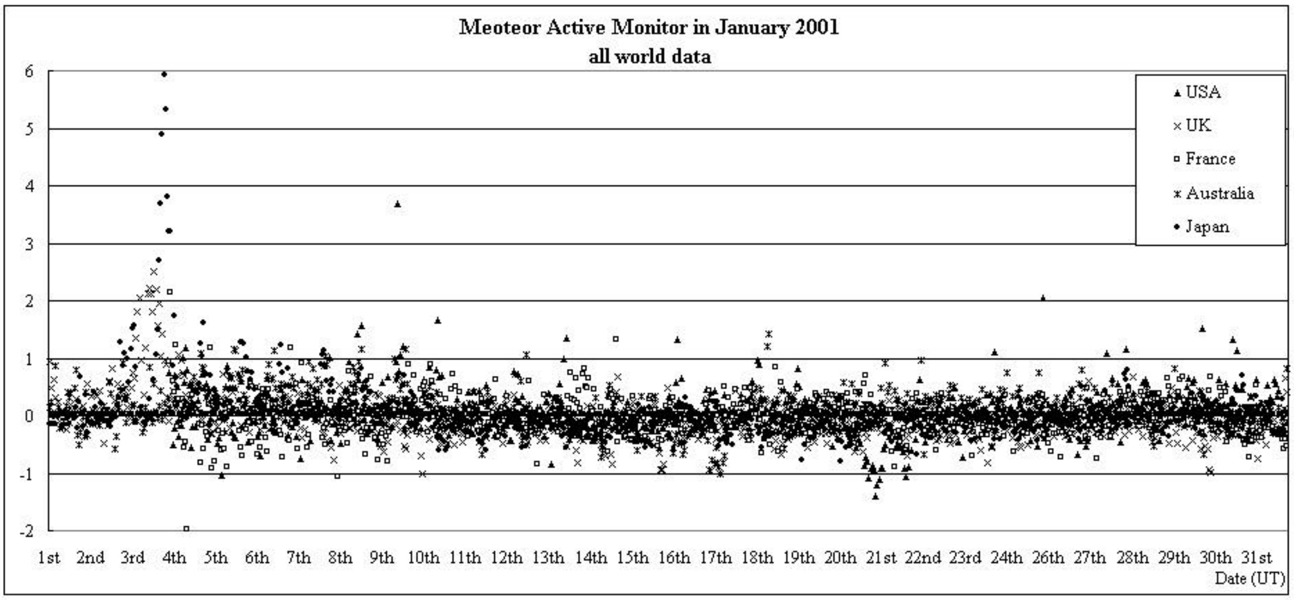

Figure 4.1 the result of calculation in January 2001

Australia, Taiwan, Netherlands and Japan). Three vertical lines are dust trails that were calculated by D. Asher. This result was similar to the result of Visual Observation and the forecast by D. Asher. But Leonids has the fastest incident speed in all meteor streams. In order to investigate the slower speed stream, the same analyses for Gemnids, 2000 was carried out. The activity caught by Radio Meteor Observation method indicates the similar curve of visual observation**.** Therefore, this method is useful for the activity monitor of all meteor streams.

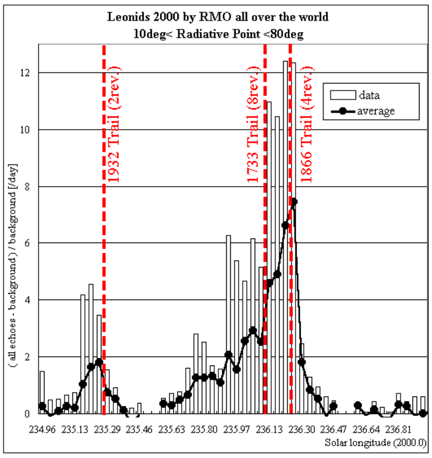

Figure 4.4 the results of Leonids 2000

5. CONCLUSIONS

By unifying all observational data all over the world, the active monitor of meteor streams were made. And to unify data all over the world has some clues to know whether the local appearance or the possibility of something as meteor stream. In addition, this monitor has the possibility of the discovery of new meteor streams. Especially, this monitor is useful for daylight meteor streams (for example, Arieids, omicron-Perseids, etc.). Also, Radio Meteor Observation is more stable than Visual Observation. Therefore, this monitor is the best method for catching all activity of meteor streams.

In this time, this result indicated similar to the result of Visual Observation without consideration of the radiant elevation, radar equation, etc. From this result, however, this monitor worked as "the daily meteor active monitor" enough.

6. FUTURE WORKS

In this time, calculated value under the same standard solved some problems of difference of observational site's condition. Therefore, the research of the better unifying method with the consideration of Geographical conditions and Observational equipments is needed. In addition, the consideration of the radiant elevation, and the characteristic of meteor stream (for example, velocity, size, etc) are needed.

Also, to observe the long-term variation that is larger than a few hours or a few days, we have to extend the period of sampling time up to one year by stable observation.

Finally, to obtain the fine density distribution map of meteoroids, we need the fine observational network of this kind of activity monitor in the world.

7. REFERENCES

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