The Forward Scattering Meteor Radio Echo Observation using a GPS-synchronized Multiple Receiving Stations. Hideto YOSHIDA[1], Toshio TERASAWA[2], Hideaki MIYAMOTO[2], Takashi USUI[3], Noriyuki YAGUCHI[3], Ichiro YOSHIKAWA[1], [1]The University of Tokyo (School of Sciences:yoshida@eps.s.u-tokyo.ac.jp),[2] The University of Tokyo (Institute for Cosmic Ray Research: terasawa@icrr.u-tokyo.ac.jp), [3]The Nippon Meteor Society

Introduction: We are developing an instrument for teaching purpose to determine the trajectory of a meteor by radio waves. On the other hand, the Advanced Meteor Orbital Radar on New Zealand, with which the authors come to a far-reaching assertion that at least 1% of radio meteors have extra-solar system origin [1]. However, independent confirmations on this assertion seem necessary before its general acceptance. Toward these goal, we present a new method to determine the parameters of the meteor (radiant azimuth angle, zenith angle and velocity) using a forward scattering meteor radio echo observation with GPS-synchronized multiple receiving stations. This work was supported by JSPS KAKENHI (19500727).

The principle of the multiple receiving stations method: An observation use underdence echo. We observe the meteor echo arrival time interval to each observation point. An unknown parameter is 6. (The starting point of calculation [X0,Y0,Z0], azimuth ϕ ,altitude θ and velocity v) Since one parameter can be determined except for velocity from a geometric consideration, an unknown parameter is 5. Because one of the observation points is the starting point of time, the observation point of at least 6 points is needed. It is important to coincide the time of each observation point. We tuned the time of each observation point with GPS. We search for a parameter set with a least-squares method so that the observed meteor echo arrival time interval and the calculated meteor echo arrival time interval may become equal.

Data acquisition system: In observation, we use an amateur radio beacon [2].

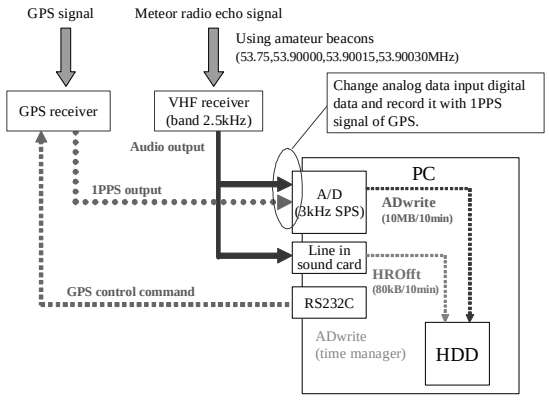

Fig.1 Data acquisition system

The output signals of the receiver divide into two line. One line input into the line-in of PC, and analyze it by HROfft. HROfft is the software which confirms the existence of a meteor radio echo. Another line input into the analog to digital converter with 3 kHz sampling, and record it by ADwrite. At this time, 1pps signal of GPS also record simultaneously. ADwrite is the software which carries out digital data acquisition and manages the time of PC (Fig.1).

Observation results: The example as a result of the observation in 2009 is shown in Fig. 2. We used four amateur radio beacons and nine observation points.

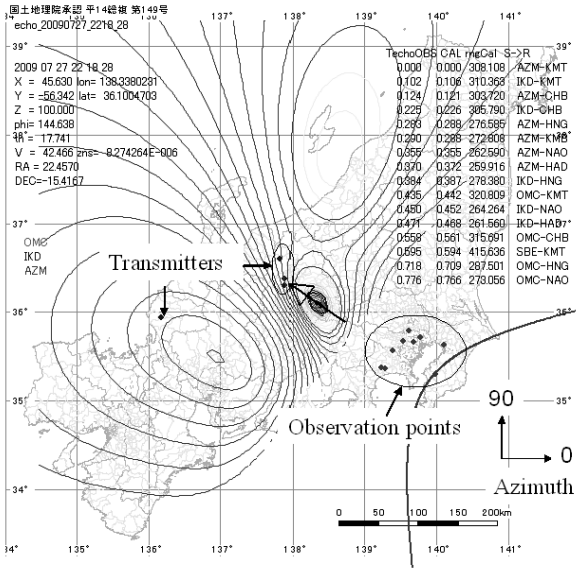

Fig.2 The example of result

Contour lines show residual. The vector of the meteor is shown to the smallest value of the residual by the arrow. The first echo reflective point is in long. 138.3° E , lati. 36.1° N and 100km height. The velocity is 42.5 km/s. Radiant point positions are R.A. 22.5h and Dec. -15.4° . This time has active the South. Delta Aquarrids(SDA). Then, we compare with the parameters of the SDA. The radiant point and velocity were almost in agreement with the parameters of the SDA. Therefore, we succeeded in detection of the SDA by this method.

References: [1] Taylor,A.D., et al., (1996) *Nature* ,*380*,323-325.[2] Maegawa, K. (1999) *WGN*, *27*, 64-72.