ＭＵレーダーを中心としたＧＰＳ衛星電波同期によるマルチスタティック流星レーダー観測の展開

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Multi-static meteor radar observation around the MU radarwith the synchronization using GPS satellite signal

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The MU radar meteor echo observation with 1 MW transmission power has been used for deriving precise horizontal wind velocities and temperature information in the MLT region (80 - 100 km), as well as meteor flux and shower activity. A new receiving system with a 29 channels digital quadrature detection at 5 MHz intermittent frequency (IF) signal was developed for the MU radar in 2004. This ultra-multi-channel receiver system enables to carry out imaging observation in both frequency domain and spatial domain for studying small-scale structures such as turbulent scattering layers in the troposphere and stratosphere, field-aligned irregularities in the ionosphere etc. We have applied the new MU radar system for meteor echo observation. Coherently integrated 25 channel receiving signals improved the SNR of meteor echoes significantly, and meteor echo number became as large as 50,000 per a day, which is about five times of previous meteor observations with the MU radar. Utilizing high-rate meteor echoes, detailed structure of horizontal and vertical distribution of wind velocity field over Shigaraki in the area of 300 - 400 km diameter is being studied. Simultaneous optical observations such as a sodium lidar and a set of imagers (OMTI: Optical Mesosphere Thermosphere Imagers) have been carried out and wave propagation, breaking and instabilities are being studied.

Another new function of the upgraded MU radar system is a capability of synchronization of transmission pulse to the GPS satellite signals with an accuracy of 2-3 us. This enables to operate remote receiving systems to be synchronized with the MU radar and to measure range and Doppler frequency shift of meteor echoes with a good accuracy. Such external receiving systems are useful in observing meteor orbit as well as more detailed observation of wind velocity fields. Development of the receiver equipment used in the remote sites is on going with two research groups. Both are characterized with low cost and high performance with significant efforts by amateur meteor researchers. We plan to distribute six receivers around the MU radar within a distance of 60 - 70 km. Preliminary observations with two external receivers with a distance of about 10 km has been carried out in December 2006, and from time difference of the rising edge of received signals among the three sites, meteor orbits have been successfully determined, showing concentration of the radiant around that of the Geminids. Further experiment is planned this summer, and the results will also introduced in the paper.