E023-014 Room: 202 Time: May 26 14:00-14:15

New SuperDARN raw time series analysis method and its possible applications to upper and middle atmosphere researches

Akira Sessai Yukimatu[1], Masaki Tsutsumi[2], Hisao Yamagishi[3], Natsuo Sato[2]

[1] UAP, NIPR (SOKENDAI, Polar Science), [2] NIPR, [3] Upper Atmos. Phys., Natl. Inst. Polar Res.

SuperDARN Doppler spectral analysis using unevenly spaced multi pulse technique and the fitted physical parameters (echo power, line-of-sight Doppler velocity and Doppler spectral width, etc.) from the vast fields of view over polar regions in both hemispheres have provided us with abundant (large- and meso-scale) geophysical information on a wide geophysical research targets. However, more detailed physical information (than one obtained from ACFs and fitted physical parameters averaged over each beam integration time (typically several seconds)) is sometimes desired in order to fully understand micro-scale physical processes, to validate theoratical explanations of a variety of phenomena, and to try to deduce new physical parameters, etc. Therefore, we have developed a new raw time series analysis method (of all the receiver I/Q signals) without degrading normal SuperDARN ACF observations in order toinvestigate other physical processes that condition the averaged ACFs. We installed this new code at the SENSU Syowa SuperDARN radars in Antarctica in October 2001.

This new technique was first applied to SuperDARN meteor wind measurements. The unevenly sampled raw time series is processed to detect only underdense meteor echoes to deduce line-of-sight neutral wind velocities and decay time constants. By using diffusion coefficients deduced from the decay time constants as height information, we successfully obtained the structure of a downward phase propagating semi-diurnal tide, which has not previously been achieved by analysing normal SuperDARN ACF data [Yukimatu and Tsutsumi, GRL, 2002]. Applying the new method to all the SuperDARN radars will provide a unique longitudinally extended meteor radar network at high latitudes in both hemispheres, which can effectively contribute to MLT (mesosphere and lower thermosphere) region dynamics, e.g., on tidal and planetary waves.

Moreover, the meteor echo analysis is just an example of many possible applications of our new SuperDARN raw time series analysis method. We can further obtain temporal variation of ACFs and dynamic (moving) Doppler spectra during each beam integration time from all the raw I/Q samples. These new methods can also be applied to other atmospheric physics issues, e.g., polar mesospheric summer echoes (PMSEs) recently detected by SENSU SuperDARN Syowa radars [Ogawa et al., GRL, 2002], and also to ionospheric studies on physical mechanisms of a wide variety of Doppler spectral properties in various geophysical regions, e.g., on physical mechanism of broad Doppler spectra in the cusp region and of double-peaked spectra in outer LLBL region, and on micro-scale physical processes in transient phenomena such as FTEs and

TCVs, in order to shed light on real but hidden physical processes behind ACFs. We'll further discuss the possibility of several new applications of this new technique.