R006-62
Zoom meeting B ：11/4 PM2 (15:45-18:15)
16:30〜16:45

Automatic FLR identification in ionospheric and ground/sea back-scatters from multiple SuperDARN radars, and density estimation

#Hideaki Kawano[1],Akira Sessai Yukimatu[2],Nozomu Nishitani[3],Yoshimasa Tanaka[4],Satoko Saita[5],Tomoaki Hori[3]
([1]Dept. Earth Planet. Sci., and ICSWSE, Kyushu Univ.,([2]NIPR/SOKENDAI,([3]ISEE, Nagoya Univ.,
([4]NIPR/ROIS-DS/SOKENDAI,
([5]NITkit

There are several kinds of waves in the solar wind, including those associated with Sudden Impulses. They can propagate into the magnetosphere, and where the wave frequency matches the eigen-frequency of a geomagnetic field line, which runs through the ground, the ionosphere, and the magnetosphere, the FLR (field-line resonance) can excite eigen-oscillations of the field line and the plasma frozen-in to the field line. The FLR can be identified by the combination of the maximum in the power and the steepest change in the phase at the eigen-frequency. From thus identified FLR frequency one can estimate the density along the magnetic field line, because, in a simplified expression, ‘heavier’ field line oscillates more slowly.

SuperDARN radars, which observe VLOS (Velocity along the Line of Sight), are expected to monitor the two-dimensional (2D) distribution of the FLR frequency, from which we can estimate 2D plasma-density distribution on the magnetospheric equatorial plane, including the location of the plasmapause. However, visual identification of the FLR in the lots of VLOS data is time-consuming, and the visual identification could miss FLR events superposed by non-FLR oscillations of VLOS. Thus, we started developing computer codes to automatically identify the FLR.

We have so far developed a set of computer codes to automatically identify the FLR for a beam of a radar by using the amplitude-ratio method and the cross-phase methods; these methods cancel out the superposed perturbations by dividing the data from a Range Gate (RG) by the data from a nearby RG along the same beam, because the FLR frequency tends to depend on the latitude more strongly than the superposed perturbations. Another advantage of applying these methods to the SuperDARN VLOS data is that we can choose any pair of RGs (along the same beam) with different distances, and thus can identify what distance is the best to identify the FLR. This distance reflects the resonance width, which is an important quantity reflecting the diffusion and dissipation of the FLR energy. This set of codes succeeded in identifying FLR events causing oscillations in the beam signals backscattered from the ionosphere, and those backscattered from the ground or the sea.

We are now developing an all-in-one IDL code which unifies the above-stated set of codes and is applied to VLOS data of all the beams of a radar at once. The automatically identified FLR events would include events simultaneously observed at several locations by several radars, increasing the possibility of monitoring the 2D distributions of plasma density distribution on the magnetospheric equatorial plane and identify magnetospheric regions. We intend to show such events at the meeting.