R006-25
Zoom meeting B ：11/2 AM1 (9:00-10:30)
09:45-10:00

Toward automatic identification of FLR simultaneously observed by multiple SuperDARN radars

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The FLR (field-line resonance) can take place where the frequency of waves coming into the magnetosphere matches the eigenfrequency of a geomagnetic field line, which runs through the ground, the ionosphere, and the magnetosphere. The FLR causes field-line eigen-oscillations having the maximum in power and the largest changing rate in phase (as functions of L or the latitude) at the resonance point. From the FLR frequency one can estimate the density along the corresponding magnetic field line, because, in a simplified expression, 'heavier' field line oscillates more slowly.
Since the FLR oscillates the ionospheric plasma, too, the SuperDARN radars could monitor the two-dimensional (2D) instantaneous distribution of the FLR frequency, from which one could estimate the 2D plasma-density distribution on the magnetospheric equatorial plane, including the location of the plasmapause. However, visual identification of the FLR in the SuperDARN VLOS (Velocity along the Line of Sight) data is time-consuming, and the visual identification could miss FLR events superposed by non-FLR oscillations of VLOS (which could be called 'hidden' FLR events). In addition, there are lots of VLOS data to be analyzed.
Thus, we have been developing a computer code to automatically identify the FLR by using the Gradient method (a general name referring to both the amplitude-ratio and the cross-phase methods). This method cancels out the superposed perturbations by dividing the data from a Range Gate (RG) by the data from a nearby RG along the same beam, since the FLR frequency tends to depend on the latitude more strongly than the superposed perturbations. Another advantage of applying the Gradient method 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.
We have been developing a computer code to do the above. So far we have developed a subroutine to be applied to one beam, and tested it: The code successfully identifised all the visually identified FLR events in a few tens of beams of a few radars. The subroutine has also identified FLR events which were missed by the visual identification. In addition, the subroutine has identified possible 'hidden' FLR events.
We are now developing a code to automatically apply the subroutine to all the beam-aligned RG pairs (with all the RG-RG distances) of all the beams of a SuperDARN radar. By using the code we expect to identify much more FLR events than by visual identification; the automatically identified FLR events would include events simultaneously observed at several locations by several radars, enabling to monitor the 2D distributions of the plasma density. We will present such a case.