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The relationship between the solar wind activity and Pc3 magnetic pulsations at low latitudes (L~1.3)

Satoko Takasaki[1], Hideaki Kawano[1], Yoshimasa Tanaka[1], Akimasa Yoshikawa[1], Masahiro Seto[2], Masahide Iizima[3], Kiyohumi Yumoto[1]

[1] Earth and Planetary Sci., Kyushu Univ., [2] T.I.T., [3] Geophysical Inst., Tohoku Univ.

It is known that the field line resonance (FLR below) is caused by hydromagnetic waves in the magnetosphere. The fundamental field line eigenfrequency is able to be expressed by the magnetic field line length, the magnetic field intensity and the plasma density at the magnetic field line. We can measure the fundamental field line eigenfrequency by ground-based observation. The field line length and the magnetic field intensity are able to be calculated from some magnetic field model (such as the IGRF model) of the magnetosphere. Then, it is possible that the plasma density at the magnetic field line is determined by these factors.

The final aim of this study is the investigation of the plasma distribution in the plasmasphere. For this purpose, we plan the following three research phases.The first phase is the confirmation of the possibility to identify FLR at low-latitudes (L~1.3). The second phase is the examination of the correlation between FLR and solar wind parameters. The third phase is the calculation the plasma density at the magnetic field line.

In the first phase, in order to investigate features of FLR close to the Earth, we installed three magnetmeters at L~1.3 with Tohoku Institute of Technology and Tohoku University, and observed geomagnetic pulsations in the Pc3 range. Each adjacent stations were separated in latitude by 50~100 km. The magnetic field data from these stations were analyzed by using two techniques, the amplitude-ratio method and the cross-phase method. As a result, we identified FLR events whose frequency decreased with decreasing geomagnetic latitude; we infer that this feature was caused by heavy ion mass loading to low-L field lines.

In the second phase, we studied the dependence of the occurrence probability of the above identified FLR events on solar wind parameters: To investigate the dependence, we used every 20-min of ground data to judge if FLR took place in the 20-min interval. For the same intervals, we recorded maximum values of solar wind parameters such as the dynamic pressure and the IMF (Interplanetaty Magnetic Field) intensity. We then calculated the dependence of the FLR occurrence on each of the solar wind parameters, normalized by the background distribution of each parameter. The result shows that the occurrence probability increases with increasing IMF intensity and solar wind plasma dynamic pressure.

We conclude that when the IMF intensity and the plasma dynamic pressure increase suddenly, hydromagnetic waves at all frequencies are caused by the step-like pressure increase in the magnetosphere. Some of the hydromagnetic waves traveling to the Earth satisfy the FLR condition of low-latitude field lines and thus cause FLRs.

We will present and discuss this and other observed features.