地上磁場観測とGPS TECのデータ統合によるプラズマ圏密度推定に向けて

河野 英昭 [1]; 才田 聡子 [2]; 上野 玄太 [3]; 樋口 知之 [3]; 中野 慎也 [4]; 湯元 清文 [5]; MAGDAS/CPMN グループ 湯元 清文 [6]
[1] 九大・理・地球惑星; [2] 新領域融合研究センター; [3] 統数研; [4] 統数研; [5] 九大・宙空環境研究センター; [6] -

Toward estimating the plasmaspheric plasma density by data integration of ground magnetic field and GPS TEC

Hideaki Kawano[1]; Satoko Saita[2]; Genta Ueno[3]; Tomoyuki Higuchi[3]; Shin'ya Nakano[4]; Kiyohumi Yumoto[5]; Yumoto Kiyohumi MAGDAS/CPMN Group[6]
[1] Earth and Planetary Sci., Kyushu Univ.; [2] Research Organization of Information and Systems; [3] ISM; [4] The Institute of Statistical Mathematics; [5] SERC, Kyushu Univ.; [6] -

The plasmasphere is the region of corotating plasma, close to the Earth. It is important to monitor three-dimensional plasma distribution in and near the plasmasphere; for example, the plasmasphere can affect the progress of magnetic storms via plasmasphere-ring current interactions.

Measures to monitor the three-dimensional density in and near the plasmasphere includes ground magnetometers and GPS satellites, as follows. From ground magnetometer data one can identify the eigenfrequency of the field line running through the magnetometer. From thus identified frequency (so-called FLR frequency, where FLR stands for "field line resonance"), one can guess the plasma mass density distribution along the field line. Ground coverage by magnetometers is getting thicker day by day toward two-dimensional ground coverage, from which one can guess three-dimensional plasma density in the region threaded by the field lines running through the ground surface.

Each GPS satellite provides TEC (total electron contents) along the line of sight from the satellite to a ground GPS receiver; from the TEC one can guess the electron density distribution along the line of sight. There are 24 GPS satellites, and the ground coverage by GPS receivers is getting thicker day by day, from which one can guess three-dimensional electron plasma density in the region covered by the line of sights from the GPS satellites to the ground GPS receivers.

In this paper we invent a method to evaluate the ground-magnetometer information and the GPS-TEC information at the same time and obtain a unified plasmaspheric plasma density distribution. In essence, the method calculates the differences between the observations and the corresponding quantities calculated from the estimated plasma distribution, and minimizes the sum of the differences for the two types of observations. Details will be given at the presentation. We will first realize this method by using iterative methods such as the quasi-Newton methods, and test it with simulated data and sample data.