Determination of the Near-Earth Neutral Line location with Geotail data

Daisuke Nagata[1]; Shinobu Machida[2]; Shin-ichi Ohtani[3]; Tsugunobu Nagai[4]; Yoshifumi Saito[5]; Toshifumi Mukai[5]

[1] Dept.of Geophysics,Kyto Univ.; [2] Dept. of Geophys., Kyoto Univ.; [3] JHU/APL; [4] Dept.Earth & Planet. Sci.; [5] ISAS

http://www-step.kugi.kyoto-u.ac.jp/~nagata/

A primary characteristic of the plasma sheet boundary layer(PSBL) is the presence of one or two hot proton components with high magnetic field-aligned flow speeds.Onsager et al. [1991] proposed a mechanism which explains the observed features of the electron and ion velocity distribution in the PSBL by a combination of adiabatic motion and time-of-flight effects.Elphic et al. [1995] utilized Onsager's model to estimate the downtail distance of the neutral line and to reconstruct the plasma distributions just earthward of the neutral line.The estimated locations ranged from 60 Re to 220Re tailward of the Earth,which seem to correspond to the distant neutral lines(DNL).

In this study, We determine the location of the near-Earth neutral line(NENL), which is thought to be formed during substorms, by applying Onsager's model to the PSBL ion beams observed by Geotail/LEP.

At 1446 UT on September 9,1996, the Geotail was located at (-11.4, 1.0, 0.3)Re in the GSM coordinates and observed the earthward plasma flow.Based on their ion distribution characteristics,we identified these ion beams as field-aligned beams.Corresponding to the presence of these beams,there are(1) Pi2 in the magnetogram obtained at Kakioka.(2) Auroral brightenings in the Polar UVI data.These indicates that this event is associated with a substorm or pseudobreakup.

The required parameters for Onsager's model are:(a) The low-speed cutoffs of both earthward and tailward directed beams.(b) The distance from the observer to the near-Earth mirror point.(c) The location of the observer.

(a) are determined from the lowest speed above which distribution falls to below the oneicount level.(b) is obtained by calculating a single-particle motion in the T96 and IGRF model magnetic field.

In the best case,we can determine the location of the NENL with an accuracy of 10%(i.e. from 21Re to 24Re).The values range from 20Re to 60Re downtail of the Earth, and is consistent with previous studies.In contrast with previous statistical studies that determine the average location of NENL,Our new method enables us to determine the NENL location at each time for each event.