The role of ionospheric O^+ ions in triggering substorms

Yumi Ono[1]; Masahito Nose[2]; Stephen P. Christon[3]

[1] Earth and Planetary Sci., Kyoto Univ.; [2] DACGSM, Kyoto Univ.; [3] Focused Analysis and Research

In the literature the role of ionospheric O^+ ions in triggering substorms has been discussed. Some of them insisted that plasma sheet instabilities, which trigger a substorm, are likely to arise when the O^+ ion density is high.

The purpose of this study is to investigate the role of O^+ ions in the plasma sheet by examining whether or not a substorm occurs in the region where O^+ ions are dominant components. In this research we used energetic ion flux data collected by the energetic particles and ion composition (EPIC) instrument on board the GEOTAIL spacecraft. We analyze 5-year data (from 2000 to 2004) in the plasma sheet (X_{GSM}= -8 to -23R_E, Y_{GSM}= -15 to 15 R_E). Substorm events are selected from the IMAGE/FUV substorm onset list (Frey et al., JGR, 2004).

We examine the MLT distribution of substorm onsets (auroral brightnings) when the ion number density ratio (O^+/H^+) is high at a given region. Then, we compare the distribution with that when the ratio is low at the same region. From this analysis we obtain the following results:

1)Substorm onsets, viz. auroral brightenings, are likely to occur in the dusk (dawn) side when the ion number density ratio of O^+/H^+ is high in the dusk (dawn) side.

2)The abovementioned property is predominantly observed in the near-Earth plasma sheet (especially where X= -8 to -11R_E).