R006-11
Zoom meeting B ：11/1 PM1 (13:45-15:30)
14:00〜14:15

Contribution of magnetospheric pressure inhomogeneities to SAPS Wave Structures: Arase and SuperDARN conjugated observations

#Takehiro Fukami[1)],Atsushi Kumamoto[2)],Yuto Katoh[1)],Nozomu Nishitani[3)],Tomoaki Hori[3)],Yasumasa Kasaba[4)],Fuminori Tsuchiya[2)],Mariko Teramoto[5)],Tomoki Kimura[6)],Yoshiya Kasahara[7)],Masafumi Shoji[3)],Satoko Nakamura[8)],Masahiro Kitahara[3)],Ayako Matsuoka[9)],Shun Imajo[10)],Satoshi Kasahara[11)],Shoichiro Yokota[12)],Kunihiro Keika[13)],Yoichi Kazama[14)],Shiang-Yu Wang[15)],ChaeWoo Jun[16)],Kazushi Asamura[17)],Yoshizumi Miyoshi[3)],Iku Shinohara[18)],Simon G. Shepherd[19)]
([1]Dept. Geophys., Grad. Sch. Sci., Tohoku Univ.,([2]Planet. Plasma Atmos. Res. Cent., Tohoku Univ.,([3]ISEE, Nagoya Univ.,([4]Tohoku Univ.,([5]Kyutech,([6]Tokyo University of Science,([7]Kanazawa Univ.,([8]ISEE,([9]Kyoto University,([10]ISEE, Nagoya Univ.,([11]The University of Tokyo,([12]Osaka Univ.,([13]University of Tokyo,([14]ASIAA,([15]Institute of Astronomy and Astrophysics, Academia Sinica, Taiwan,([16]ISEE, Nagoya Univ.,([17]ISAS/JAXA,([18]ISAS/JAXA,([19]Dartmouth College

Contribution of magnetospheric pressure inhomogeneities to SAPS Wave Structures (SAPSWS) is investigated on the basis of the case analyses of conjugated Arase satellite and SuperDARN observations.

Erickson et al. (2002) reported substructures with a scale size of tens of km within SAPS. Mishin and Burke (2005) called them ”SAPSWS”, and reported that high-temperature ions were transported into the inner magnetosphere and showed energy dispersion (ion nose structure) when the electromagnetic field fluctuations of SAPSWS were observed. Using the numerical simulation of hot plasma dynamics in the inner magnetosphere coupled with the ionosphere, Ebihara et al. (2009) showed that hot plasma with a complex pressure distribution could contribute to variations of SAPS.

Further detailed comparisons among electromagnetic field and hot ions in the magnetosphere and flow in the ionosphere are important for understanding the mechanism of SAPSWS. So, We analyzed data from conjugate Arase and SuperDARN Christmas Valley East (CVE) radar observations during 2:30 to 3:00 UT on 9 July 2017.

From the CVE radar observation, we obtained 2-dimensional flow distributions of SAPSWS with velocity fluctuations of 200 m/s near the ionospheric footprint of Arase, assuming that the flows are zonally-directed. These structures extended over at least 0.5 h MLT azimuthally, separated latitudinally at intervals of ˜230 km, and moved equatorward. Near the magnetic equator, Arase encountered electric field variations with an amplitude of 2.5 mV/m and a period of 5-6 minutes in the ion nose structure, during an outbound pass from L = 3.2 to 5.4 around 20 h MLT. The isotropic pressure of hot ions was derived from ion flux in an energy range of 10-180 keV. Variations of the eastward magnetic field and the ion pressure were roughly in phase and had a close period to that of the electric field variations. The phase relation and flow distribution in the ionosphere suggested that earthward hot ions with fine pressure inhomogeneities generate field-aligned currents in the inner magnetosphere and thereby cause SAPSWS.

We consider substorm-related plasma sheet flow channels [e.g. Lyons et al. (2012)] and interchange instability in the inner magnetosphere [Sazykin et al. (2002)] could generate such pressure inhomogeneities in the magnetosphere. In conjugate Arase and SuperDARN observation event, GOES-13 observed dipolarization and an increase of proton flux around 21 h MLT at 2:19 UT. Equatorial projection of ionospheric flow structures along the magnetic field given by the Tsyganenko 04s model (T04s model; Tsyganenko & Sitnov, 2005) moved earthward from L˜6 to ˜4 during 2:30 to 3:00 UT. The movement may reflect earthward transportation of hot plasma driving fine-scale ionospheric flow. These results imply that substorm injection possibly contributes to the formation of pressure inhomogeneities in the inner magnetosphere and SAPSWS.