R006-P25
ポスター１：9/24　PM1/PM2 （13:45-18:15）

#城　剛希 1), 加藤　雄人 1), 熊本　篤志 1), 土屋　史紀 2), 笠羽　康正 2), 栗田　怜 3), 笠原　禎也 4), 松田　昇也 4), 松岡　彩子 5), 寺本　万里子 6), 三好　由純 7), 中村　紗都子 8), 篠原　育 9)
(1 東北大・理・地球物理,(2 東北大・理・惑星プラズマ大気,(3 京都大学 生存研,(4 金沢大,(5 京都大学,(6 九工大,(7 名大ISEE,(8IAR&ISEE,(9 宇宙研／宇宙機構

Effects of ULF oscillation on the duct propagation of whistler-mode chorus emissions

#Koki Tachi[1),Yuto Katoh[1),Atsushi Kumamoto[1),Fuminori Tsuchiya[2),Yasumasa Kasaba[2),Satoshi Kurita[3),Yoshiya Kasahara[4),Shoya Matsuda[4),Ayako Matsuoka[5),Mariko Teramoto[6),Yoshizumi Miyoshi[7),Satoko Nakamura[8),Iku Shinohara[9)
(1Department of Geophysics, Graduate School of Science, Tohoku University,(2Planetary Plasma and Atmospheric Research Center, Graduate School of Science, Tohoku University,(3Research Institute for Sustainable Humanosphere, Kyoto University,(4Emerging Media Initiative, Kanazawa University,(5Graduate School of Science, Kyoto University,(6Kyushu Institute of Technology,(7Institute for Space-Earth Environement Research, Nagoya University,(8Nagoya University,(9Japan Aerospace Exploration Agency/Institute of Space and Astronautical Science

Whistler-mode chorus emissions are coherent electromagnetic plasma waves observed in the dawn sector of the inner magnetosphere during a geomagnetically disturbed period. Previous studies suggested chorus emissions play essential roles in the acceleration of relativistic electrons in radiation belts and in the pitch angle scattering of keV electrons contributing diffuse/pulsating aurora. Recent studies showed that the duct propagation of chorus to a high latitude region results in the precipitation of relativistic electrons. However, despite the investigation of the chorus for more than half a century, the condition controlling the generation and propagation of the chorus has not been fully understood. In Ono et al. [2020], the event observed by the Arase satellite on March 27, 2017, was analyzed, and the modulation of the chorus by Pc4-5 toroidal mode ULF waves was discussed. It is understood that the fluctuation of tens of keV electron flux caused by ULF leads to the modulation of chorus intensity. On the other hand, in the same event, the chorus was shown to propagate parallel to the magnetic field lines up to a magnetic latitude exceeding 10 degrees, suggesting the possibility of duct propagation. In the present study, we examine the roles of ULF waves from the point of view of the duct propagation of chorus emissions as well as the generation process of chorus emissions. We also propose a model of the duct propagation of whistler-mode waves due to the contribution of the compressional component of ULF waves.

First, we evaluate the effect of the magnetic field variation on the refractive index of whistler-mode waves. According to Smith et al. [1960], the refractive index depends not only on density but also on the magnetic field intensity. Setting the amplification factor x and y for the magnetic field intensity and electron density, respectively, we obtain a dependence of the refractive index due to the variation of either the magnetic field or number density. The obtained dependence shows that a decrease in the magnetic field intensity leads to a refractive index change corresponding to an increase in the electron density. Under the condition where the range of the variation is less than 10% of the background level, the effects of variations of the number density and the magnetic field intensity to the refractive index are comparable, while the change of the magnetic field is relatively significant.

Next, we examine whether the magnetic field fluctuations observed in the event on March 27th resulted in significant refractive index changes. In the event, during the time interval from 21:30 UT to 22:00 UT, the Arase satellite was located at L˜6.3-6.1, 04:00-04:12MLT, and from -12.7 to -10.1 degrees MLAT. The total magnetic field intensity changed within 10% with respect to the ambient magnetic field under the presence of ULF waves. Here we assume that the number density of the background plasma is constant during the event. The observation result shows that chorus emissions propagating parallel to the background magnetic field appear at timings corresponding to the decrease of the total magnetic field due to the compressional component of ULF waves. The observed property can be explained by the model we propose; chorus emissions are generated around the magnetic equator through the flux enhancement of keV electrons due to toroidal mode ULF waves, and then the generated chorus emissions propagate away from the equator guided by the duct structure produced by the compressional ULF waves. In addition, we evaluate the effect of the density variation on the duct propagation during the event. There is a possibility that density variation also occurred during the event with a magnitude similar to the magnetic field variation. The total magnetic field variation, in this case, was about 3%, corresponding to 2.7% of the density variation. Since the analysis of UHR data includes time periods that are difficult to distinguish, further investigation is necessary. We also report the results of analysis on other events of duct propagation of chorus emissions under the presence of ULF waves.