Statistical feature of Jovian non-Io DAM responding to the solar wind variation

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Abstract:

Since the first discovery by Burke and Franklin in 1955, Jovian decameter radio emissions have been one of the most interesting planetary phenomena for plasma physics as well as comparative planetary magnetosphere physics. Since the early period of research, many workers have tried to evaluate the solar wind effects on the decametric radio emissions, because solar wind energy driven into the Jovian magnetosphere is possibly one of the major energy source for the strong electromagnetic emissions in addition to the fast rotation energy of the planetary body and intense electrodynamics generated by the interaction between Jovian magnetosphere plasma and satellites such as Io and Ganymede. Carr (1965) first reported the direct correlation between the occurrence of DAM and Kp indices of the Earth. He reported well coincidence by considering the delay of about 9 days that was attributed as the arrival time of the solar wind disturbance to the Jovian magnetosphere. There have been several attempts to confirm the solar wind effect on DAM, especially, non-Io-DAM emissions. Their studies, however, has been carried out only within a short time periods of several months. Then it is needed to evaluate the solar wind effect based on the long-term data analysis of the DAM emissions. In such a background, purpose of the present study is to evaluate the solar wind effect as the energy source of non-Io-DAM.

We analyzed long-term radiometer data obtained at Zao observatory of Tohoku University (Oya et al., 1979), which have been continuously operations since 1974.

In order to estimate contribution of solar wind on non-Io-DAM, we carried out one-dimensional fluid simulation that is able to deduce solar wind parameters near the Jovian magnetosphere based on the solar wind data obtained near the Earth. We compared variation of dynamic pressure of solar wind near the Jovian magnetosphere and occurrence of the non-Io-DAM emissions. We have found that this simulation model is accurate enough to obtain the solar wind variation at the Jovian magnetosphere within accuracy of +/- 1 day.

We carried out the cross correlation analysis between the dynamic pressure of solar wind and the power flux of non-Io-DAM, the results showed that the variation of dynamic pressure of solar wind has not clear relationship to the occurrence of the non-Io-DAM emissions. We concluded that the solar wind control on the non-Io-DAM emissions is much weaker than it has been expected.