木星オーロラ電波の長期変動

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Long term variations of Jupiter's auroral radio emissions

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It is known that Jupiter's auroral radio emission (hereafter 'JAR') shows long term occurrence variations with the time scale of about a decade. The variations were first considered to be initiated by the solar and/or solar wind activities since the variations seemed to inversely correlate with the solar activity in 1960's. A longer term analysis were made in 1970's and showed that the variations relate with the Jovicentric declination of the earth (De) rather than the solar and/or solar wind activities. So far, their plausible causalities are considered to be mainly brought by the two geometrical effects; i.e., De relates to amount of reachable rays to the earth from the source regions, and the geocentric declination of Jupiter relates to incidence angle of the radio wave to the terrestrial ionosphere and varies the ionospheric shielding level (see Oya et al., 1984; Kawauchi, 2002, references are there in). However, when we think the solar cycle dependence on the terrestrial auroral radio activity (e.g. Kumamoto et al., 2003), the solar and/or solar wind control may not be negligible for the long term variations. Furthermore, we have not known well long term relationship between JAR and Jupiter's substorm-like process which may be controlled by Io's volcanic activity.

In order to assess the previously proposed causalities and the other effects, we have investigated occurrence features of Jupiter's radio emissions using the radio wave data observed by the WIND satellite for about 20 years. We have derived occurrence probabilities from the data observed in the frequency range of 1 to about 14MHz around Jupiter's occultation periods. The result is controversial; i.e., the yearly occurrence probabilities show almost monotonous decrease from 1995 to 2005, then gradual increase after 2005, but change to somewhat complex nature with increase and decrease for non Io-related components. It does not seem to correspond to variations of De and solar and/or solar wind activities, but implies that some other or multiple causalities control the long term variations. We have extended the occurrence probability analysis to the lower frequency JAR below 1MHz which is known to have both solar wind related and non solar wind related components. In the presentation, we will show the results precisely and discuss causalities of the long term variations including a possibility of the control by Io's volcanic activity.

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