Derivation of the vertical distribution of Jovian decametric S-burst sources based on ground-based observations for verification of the Jovian ionospheric Alfven resonator model

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Vertical distribution of Jovian decametric (DAM) S-burst was studied based on the analysis of S-burst events simultaneously found in multiple frequency range in the ground-based observation. Using the determined repetition frequencies of the S-burst elements, scale height of the Jovian ionosphere has been estimated from Jovian ionospheric Alfven resonator (JIAR) model.

JIAR hypothesis was proposed by Ergun et al. [2006] and Su et al. [2006]. According to these studies, eigen-frequencies of JIAR are expected to determine the repetition frequency of S-burst elements. The ionospheric Alfven resonator (IAR) model has been investigated through the theoretical studies and observations of the Earth's ionosphere. In the IAR model, the fundamental and higher harmonic eigen-frequencies were analytically derived from parameters such as the Alfven speed at the plasma density peak of the ionosphere, and the scale height of the topside ionosphere [Lysak, 1991; 1993].

In this study, we have observed Jovian decametric S-burst in a frequency range from 20 MHz to 40 MHz with a logperiodic antenna and a wideband receiversince 2012 at Yoneyama observatory of Tohoku University. These observations were performed mainly in Io-B source condition, in which Previous studies reported high occurrence probability of intense S-burst events.

We especially focus on a simultaneous S-burst event in two different frequency bands (~23.5 MHz, hereafter DAM1, and ~27.0 MHz, hereafter DAM2) found at 15:56 on 24 November 2014. With assumption that emissions are radiated at the local electron cyclotron frequency, the geometric distance of the DAM1 and DAM2 sources are respectively estimated to be ~1.085 Rj and ~1.040 Rj based on the VIPAL magnetic field model [Hess et al., 2011] and the location of Io UV footprint [Bonfond et al., 2009]. The determined repetition frequencies of DAM1 and DAM2 were 22.3 Hz and 28.5 Hz, respectively.

The two emission sources are considered to be in the same magnetic field line or in the different magnetic field lines which are close to each other. In the both cases, we can assume that the repetition frequencies are equal to the fundamental and high harmonic eigen-frequency of JIAR, and that the ionospheric scale heights for DAM1 and DAM2 are common or quite similar. Therefore the Jovian ionospheric scale height is estimated to be ~1400 km and ~1800 km.

In the presentation, we will discuss the comparison results of the S-burst source altitude derived from the emission frequency and vertical distribution of the standing Alfven waves in JIAR estimated from the eigen-frequencies of JIAR, also.

