Geophysical Research Abstracts
Vol. 21, EGU2019-8718, 2019
EGU General Assembly 2019

The generation of up-going whistler-mode waves that can accelerate electrons to high energies in the Jovian polar cap region

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One mechanism to explain the acceleration of upward-traveling energetic electrons in the Jovian polar cap region is acceleration via whistler-mode waves [Elliott et al., JGR – Space Physics, 2018]. These waves are similar to upward-propagating terrestrial auroral hiss, but are typically not propagating along the resonance cone [Tetrick et al., GRL, 2018]. The whistler-mode waves are thought to be generated by upward-traveling electron beams (inverted-Vs) via the Landau resonance. The electron beams are produced by a downward parallel electric field in Jupiter's upper ionosphere. In this study, we provide computed growth rate calculations using model distribution functions based on inverted-V observations from the Juno JADE-E instrument. We explore a range of wave normal angles by using the general expression for the linear temporal growth rate of magnetoionic modes, as derived by Yoon et al. [1996, JGR]. We find that the highest growth rates occur for wave propagation near zero degrees (approximately parallel to the magnetic field). We also find that quasi-parallel whistler-mode waves are largely transverse and right-hand circularly polarized. For more oblique wave propagation, the mode becomes increasingly longitudinal. The maximum growth rates as a function of altitude are also analyzed. Both the electron cyclotron-to-plasma frequency ratio and the electron beam parameters change as a function of altitude, both of which will be explored in order to understand how each affects the maximum growth rates. We explore whether the calculated growth rates are sufficient to produce the observed wave amplitudes, based on the estimated time the waves spend in inverted-V regions.