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Effects of cold electron number density variation on whistler-mode wave growth

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We examine how the growth of magnetospheric whistler-mode waves depends on the cold (background) electron number density N_0. The analysis is carried out by varying the cold-plasma parameter $a = (\text{electron gyrofrequency})^2/(\text{electron plasma frequency})^2$ which is proportional to $1/N_0$. For given values of the thermal anisotropy A_T and the ratio N_h/N_0, where N_h is the hot (energetic) electron number density, we find that, as N_0 decreases, the maximum values of the linear and nonlinear growth rates decrease and the threshold wave amplitude for nonlinear growth increases. Generally, as N_0 decreases, the region of $(N_h/N_0, A_T)$-parameter space in which nonlinear wave growth can occur becomes more limited, i.e., as N_0 decreases, the parameter region permitting nonlinear wave growth shifts to the top-right of $(N_h/N_0, A_T)$-space characterized by larger N_h/N_0-values and larger A_T-values. The results have implications for choosing input parameters for full-scale particle simulations and also in the analysis of whistler-mode chorus data.