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Inhomogeneities of plasma density and electric field as a source of electrostatic noise in auroral zone

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The theory of the generation of broadband electrostatic waves by inhomogeneous transverse quasi-static electric fields is normally used for explanation of broadband electrostatic noise. Inhomogeneous electric fields can destabilize the kind of electrostatic ion-cyclotron waves, which can be obtained as an unstable solutions of the nonlocal dispersion equation for ion-cyclotron perturbations and their properties differ significantly from the classical ion-cyclotron waves. Such instabilities can lead to heating of ions in the Earth's ionosphere and the subsequent outflow of ions into the magnetosphere. However, until now the possibility to generate instabilities owing to the non-uniform plasma concentrations which in turn can also lead to heating and outflow of ions from the ionosphere was not considered. It is known that the auroral ionosphere and the Earth's magnetosphere are inhomogeneous media, where there are concentration gradients and inhomogeneities of the plasma density. In this work we study the effect of inhomogeneity of the plasma density on the generation of electrostatic noise. Comparison of the two generation mechanisms in the presence of density gradients and electric field is performed.