Geophysical Research Abstracts
Vol. 12, EGU2010-6579, 2010
EGU General Assembly 2010

Magneto-gravity waves caused by auroral electrojets instability

Nikolay Barkhatov (1), Oksana Barkhatova (1), and Gennadiy Grigor'ev (2)

(1) Nizhniy Novgorod State Pedagogical University, Nizhniy Novgorod, Russia (nbarkhatov@inbox.ru), (2) Radiophysical Research Institute, Nizhniy Novgorod, Russia

Auroral electrojets s probable sources of wave disturbances in ionosphere, including travelling ionospheric disturbances (TID), are frequently considered. According to current opinion, disturbances from auroral region to middle and low latitudes by acoustic-gravity waves (AGW) of different spatial scales are carried. However there are difficulties to explanation of the large spatial scales AGW propagation with high speeds (exceeding 1300 m/s) connected to insufficiently high ionospheric temperature. This complexity is connected with theoretical consideration of AGW propagation in neutral gas. At the same time ionosphere ionized component as a small component of an atmosphere is taken into account. In the equations of AGW propagation it is accepted that the gravity plays a leading role and the magnetic field plays a second role and in first approximation it is not taken into account.

The ionosphere is stratified medium on density and ionization degree therefore in wave propagation can be involved not only neutral, but also ionized component. The account of magnetic field and a gravity combined influence in the equations of magnetic hydrodynamics (MHD) is carried out. It shows that in ionosphere can propagate magneto-gravity waves (MGW) which velocity is higher then AGW but is lower than MHD wave velocities. A transfer from AGW to MGW is possible if magnetic pressure is higher than hydrostatic pressure, frozen magnetic field in plasma exist and frequency of investigated waves is much less than collision frequency of neutrals with ions. These frameworks in an ionosphere since heights about 250 km are carried out.

In work the ground of MGW existence is produced on the basis of ionosphere oblique sounding data on traces Inskip – Rostov-on-Don, Cyprus – Rostov-on-Don, Irkutsk – Rostov-on-Don and Noril'sk – Rostov-on-Don and the data of index AE which characterizes disturbances on auroral region. For search of connection between index AE and maximum observed frequencies (MOF) on the specified traces correlation research is carried out. Time shifts between index AE and MOF for considered traces at which high correlation is marked are determined. These time shifts answer times necessary for magneto-gravity waves propagation from auroral region to radio-waves reflection points.

Among received values of time shifts cases (5-10 min) answering to increased velocity (2000 – 5000 m/s) of disturbance propagation in comparison with usual AGW velocities for investigated paths are marked. Comparison of dynamic spectrum of index AE variations and MOF on specified traces for cases of their increased correlation for 5-10 min shifts shows similar spectrum features. It confirms an opportunity of auroral disturbances propagation to low latitudes with velocity higher than AGW. Such cases can be connected with MGW propagation. Similarity of spectrograms of index AE disturbances with spectrograms of magnetic field horizontal component disturbances at three ground stations located close to reflection points of paths Inskip – Rostov-on-Don, Cyprus – Rostov-on-Don is founded. It also proves MGW existence and their propagation from auroral regions to low latitudes.

The analysis of the dispersive equations for fast «+ mode» and slower «– mode» MGW has allowed to execute an analytical estimation of MGW frequencies and velocities for conditions of a real ionosphere. As a result MGW frequencies (1–2)•10ˆ(-4) Hz and velocities about 6500 m/s are received which are in accord with experimentally founded values.

We are grateful to Uryadov V.P., Vertogradov G.G. and Vertogradov V.G. for ionosphere oblique sounding

data granting.

Work is executed at partial support under grants of the RFBR 08-05-12051-OBR and 09-05-00495, and also program Ministry of Education and Science «Development of higher school scientific potential (2009-2010, project N 1623)».