Properties of the Ti and Te(h)-profiles in the vicinity of the anomalous layer of the ion-to-electron overheating

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The first experimental evidences of the reality of anomalous effect of the dynamo layer (DL) ion-to-electron overheating were recently published by (Timofeev et al., 2003). The handling of 1740 altitude profiles of the ion (Ti) and electron (Te) temperatures measured by the EISCAT radar in the Tromso zenith and stored for the ERRRIS campaign proved the authenticity of the effect for under the FB-threshold (IEI<30 mV/m) E-fields. It was shown that in a sharp contrast to the well known ordinary effect of the electron-to-ion overheating (valid for above the FB-threshold E-fields: IEI>30 mV/m) the anomalous one has the altitude profile with the pronounced (Ti-Te) maximum near the DL bottom (~105-107 km) and a tendency for an obvious decrease of the difference towards the top DL border (~115 km). The present paper is devoted to further analysis of the Ti and Te typical features in the vicinity of the anomalous heating layer. The (Ti-Te) profiles are studied here two-parametrically: versus the E-field strength and LT bins. For the purpose, we produced: eleven 5 km wide bins between 97.5-122.5 km altitudes, four 10 mV/m wide bins between 0 and 40 mV/m E-fields and seven 1 hour wide bins between 19 and 02 LT values. It is found that: 1) Properties of the Te and Ti(h)-profiles are systematically different within the lower (102.5-107.5 km) and the upper (107.5-112.5 km) part of the dynamo layer. Namely, the temperatures grow monotonically in the upper part but exhibit an apparent “knee” feature in the lower part, i.e. a steep altitude Ti and Te gradients existing within 102.5-105 km altitudes are followed by plateau-like profile within 105-107.5 km altitude range. 2) Standard deviations of the both temperatures achieve their local maxims within the plateau altitudes. 3) The dependence of the (Ti-Te) on the E-field strength seems to be like to the Joule heating type within 19-20 LT bin (the higher strength, the greater the difference) and just opposite within e.g. 21-22 LT bin. Thermal and heating DL plasma instabilities and the neutral atmospheric winds are discussed as the possible physical reasons responsible for the effect.