

This theoretical paper continues a previously published paper with the same first author (Myrvang et al., 2021). It studies the effect of strong deviations of the electron velocity distribution from Maxwellian in the D region on the electron cooling rates. The deviations from Maxwellian are caused by a high-power radio wave in typical artificial ionospheric heating experiments. The calculated cooling rates are compared with some results (obtained earlier by others) under assumption of the purely Maxwellian electron velocity distribution. The differences are quantified and illustrated by a number of figures. In my opinion, the manuscript has been done on a sufficiently high level with good quality. The theoretical results are new and potentially useful for applications. I strongly recommend this manuscript for publishing.

Generally, I have found no visible major flaws in the manuscript and have only a few suggestions for its modest improvement.

I would suggest adding in the beginning of the Intro section (also in the Abstract) an explicit sentence (or two) on the actual reason for the discussed non-Maxwellian deviations: the strong AC electric field of a high-power radio wave. When this is just hidden somewhere deeply in the text could be easily missed by a reader.

I would also suggest adding somewhere (probably, in the beginning of Sec. 2) a brief explanation that in the weakly ionized collision-dominated lower ionosphere, even for a very strong perturbing AC or DC electric field, the electron distribution function (EDF) remains close to isotropic. The reason is that in electron collisions with much heavier neutrals collisional changes of the electron momentum (angular scattering) have much higher rates compared to the corresponding inelastic energy changes, including predominantly inelastic cooling energy losses, as explained, e.g., in the book by Gurevich, 1978, cited in the manuscript. That is why the EDF is essentially energy dependent with only a weak angular dependence, while the energy dependence of the major isotropic part of the EDF can be significantly non-Maxwellian (Druyvesteyn-type expressions like that in Eq. 3). The efficient collisional isotropization of the EDF due to frequent angular scattering explains, in particular, while results for the non-Maxwellian deviations and their consequences are qualitatively similar, albeit not fully scalable, for any electric field directions, whatever perpendicular or parallel to \mathbf{B} , and regardless of the AC or DC electric-field character (see lines 200-205).

A couple of minor suggestions. I would recommend replacing in Eq. 1 the equality sign with the “ \approx ”-sign because this is not a strict equality (especially if you bear in mind the text explanation that follows Eq. 1). In Eqs. 6 to 8, I would also suggest adding the arguments to “ Q ”, e.g.,

$Q(E_v, T_e)$. The reason for this suggestion is to avoid a potential confusion in Eqs. 6 and 7 of the multiplier in the curly brackets (after Q) with a possible false argument of Q .

Also, a small omission: in the last sentence of the Abstract, there should be “to” between “due” and “changes.” On line 17, I would suggest replacing the singular “gyro-frequency” with the plural “gyro-frequencies.” The electron and ion gyrofrequencies differ by orders of magnitude, but in the D region this sentence applies to all (a different situation takes place in the lower E region, where the ions are usually unmagnetized due to frequent ion-neutral collisions, $\nu_{in} \gg \Omega_i$, but electrons remain strongly magnetized, $\nu_{en} \ll \Omega_e$).