

Geosci. Instrum. Method. Data Syst. Discuss., referee comment RC2
<https://doi.org/10.5194/gi-2021-25-RC2>, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on gi-2021-25

Shin-ichiro Oyama (Referee)

Referee comment on "On the determination of ionospheric electron density profiles using multi-frequency riometry" by Derek McKay et al., Geosci. Instrum. Method. Data Syst. Discuss., <https://doi.org/10.5194/gi-2021-25-RC2>, 2021

This study examined derivation of the electron density height profile from measurements with the multi-frequency riometer, and concluded that the profile cannot be estimated uniquely from the measurement alone. I agree with the conclusion and the mathematical process. However, to improve the article, I think that the text had better clearly write unique points different from previous works in this field.

Estimation of the electron density profile has been conducted by several researchers in this field for more than half century. They also suggested difficulty in estimating unique profile close to the real one. Then some of the previous works proposed model functions to assume the height profile. Since authors also have worked in this field for many years, I think that you know well, but you can refer to, for example, Parthasarathy et al. (JGR, 1963), Hultqvist (PSS, 1968), Stoker (JGR, 1987), McKay-Bukowski et al. (IEEE Trans. Geosci. Remote Sens., 2015), Cheng et al. (JGR, 2006). Comparing with these previous works, an advantage of this work would be the mathematical approach, which presents difficulty in an objective manner. Section 1 (Introduction) should mention this point.

There are some minor comments.

- L66-68: There are two comments on these lines. (1-1) Can the neutral density change be significant for the collision frequency? It is generally hard to measure the density, so

- No solid black line in Figure 8.

- L195: (8-1) There are two curves in Figure 9. The text should mention each line. (8-2) My understanding is that the absorption residual, shown in Fig. 9, was derived from Fig. 8 as differences between values with solid and dashed lines. A simple calculation may provide noisy results but curves in Fig. 9 are very smooth. Why?

- L200 "The two profiles bear no resemblance." The SVD may not give unique solution. Is there any possibility that there is/are other answer(s)? It might be closer to the true data. If this is the case, you do not need to pick up the m_{est} curve as the representative one.

- L213 "s is the shape function parameter." I cannot find "s" in the equation (21). Since the last sentence of this paragraph says "s" is a scalar, do you assume $s = 1$ so invisible in the equation?

- Eq.(22): I cannot follow derivation of the equation 22, in particular, about the relation with the equation 21. What relations are there between G_s and G ?

- Caption of Figure 11: "The residuals are shown in the two top panels." Redundant.

- L265: "which is that" Should remove.