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Interactive comment on "Ducting of incoherent scatter radar waves by field-aligned irregularities" *by* Michael T. Rietveld and Andrew Senior

Anonymous Referee #2

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The paper proposes a qualitative explanation for a phenomenon where an apparent increase in electron density is observed with EISCAT UHF incoherent scattering radar during HF heating experiments. In the proposed explanation, the radar signals are ducted by HF-induced field-aligned ionospheric irregularities resulting in increased backscatter. The results presented in the paper are an important contribution to ionospheric and radio science, and important for the current and future use of incoherent scattering radars. The paper is concise and to-the-point, but it is unfortunately rather clear that the authors did not properly proofread the manuscript or check the style guides of the journal before submission. Overall, I recommend that this manuscript should be accepted after addressing the comments given below.

Specific comments:

L86: From the residual panel of Figure 1, it looks like the residual values are mostly close to two. Is two close to one in this context? Would three still be close to one? The meaning of the residual and its values need to be given some context or additional clarification.

L96: Citation needed for "... since X-mode pumping results in rather weak Ohmic heating".

L145-179: A schematic should be added to visualize the geometry of the suggested mechanism, i.e., the layout of the irregularities, the different angles, the parameters of the irregularities, and possibly idealized ducted and not-ducted beams. Without any kind of visualization, the geometry of the suggested mechanism is very difficult to understand from the text. A schematic showing the geometry would also make it easier to follow the rest of the discussion about the proposed ducting mechanism.

L158-160: What are these assumed values based on and how do they compare with possible previous observations?

L227-L229: Extremely difficult sentence to understand. This description of the more realistic raytracing scenario should be clarified and reworded.

L232-233: What were the tests that were done? A short description is needed.

Technical comments:

Throughout the manuscript: Define abbreviations at the first instance.

L12 and throughout the manuscript: En dashes should be used when writing ranges.

L15 and throughout the manuscript: Units should be written out when not in conjunction with numbers.

L25: Missing degree symbols.

L40: "but seems" should be "but seem"

L43 and throughout the manuscript: Use of Figure and Fig. not following the ANGEO style

L43 and L44: Citation missing dot and misspelled “et al.”

L51: “. . . maximum, the apparent. . .” should this be “. . . maximum, where the apparent. . .”?

L53 and elsewhere: Different spellings of ion line

L75: Whitespace missing in “30s integration time”.

Figure 1: The red lines indicating the HF on times are very thin and can be difficult to notice.

Figure 1, residual panel: The sparse logarithmic color bar ticks make it very difficult to gauge what the actual values of the residual are, especially with the used color scale. Tick marks should be added to the color bar.

L86 and elsewhere in the manuscript: Cardinal numbers less than 10 should be spelled out.

L90: Missing whitespace in “above220 km”.

L96: Missing dot at the end of the sentence.

L96 and elsewhere: Spell out ordinal numbers.

L100: Wrong date format.

Table 1: Caption should be above the table, horizontal lines not following ANGEO style

L151 and elsewhere: Different spellings of F region.

L155 and elsewhere: Mathematical symbols should be in italics.

L160 and elsewhere: Units in square brackets.

L165: Whitespace missing in “therefore14%”.

L181 and elsewhere: Different spellings of raytracing.

L209-L210: Variables missing from the text.

L214: Should the text say “. . . is simpler than THE transmitted beam . . .”?

L242: No dash should be used in “32-m diameter”.

Figures 6 and 7: The variable L should be defined in the caption as it is listed in the figure legend.

L328: DEMETER

L331: Remove “then” from “. . . and then they were. . .”.

L342: Remove “the” from “Not all the radars. . .”.

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