

Review of “Automated Detection of Low-altitude Isolated Mesospheric Radar Echoes Using YOLOv8: Evidence for an ionospheric “C layer” Phenomenon below 60km Altitude?” by Krishnakumar, Renkwitz, and Ahrens

First, congratulations to the authors for significantly improving the article since my initial review. I’m supportive of the paper being published after addressing the issues outlined below.

Issues and suggestions:

- As mentioned in my initial review, the paper does not substantiate a causal link between LIME and GCRs. As such, I suggest line 17 is rewritten to say something like “suggests **that GCRs may play a role** as an ionisation source for the observed layers”.
- Line 64, I’m unsure what the authors mean by “solar proton events, which are likely the most extreme scenarios.” Do they mean “in the most extreme scenarios where EPP are observed”, or something else?
- Some of the object detection algorithm terminology is still not clear. For example, in Table 1, what does “batch size” and “learning rate” mean. Similarly, line 268 discusses “loss” - what is this?
- Lines 225 to 227 talks about TP, FP and FN, but there is no mention of True Negatives (TNs). Are TNs incorporated into TPs?
- Table2, the physical mapping extrema are listed as -0.7 and 0.7 . However, line 149 mentions a total spectral coverage of 1.5 Hz, suggesting extrema of -0.75 and 0.75 . Why is there a discrepancy here?
- Line 284, “The detections above 70 km appear to be outliers, which can be faint EPP-related echoes without substantial absorption above”. Could introducing another detection class (i.e. “typical D-region”) and then requiring Target_Signal, Void and typical D-region avoid this problem?
- Line 292 refers to “thickness”, but this has not been defined. I assume this is the difference between the upper and lower altitudes of the bounding box? This should be defined around line 273 where Spectral width is defined.
- Line 405, “With the enhanced solar activity during 2024 and thus a reduction in GCR, we would also expect a reduced occurrence of LIME”. Again, as the paper does not substantiate a causal link between LIME and GCRs, I suggest you replace “would” with “may”.
- Line 427, “The fine-tuned YOLOv8 model achieved 89.4% mAP50”. I realise you have defined mAP earlier, but I suggest you reiterate what this means at this point.

Other minor issues and suggestions:

- Line 4, “Previous studies introduced an ionospheric C layer...”. I suggest this is reworded to say something like “Previous studies **suggest the presence** of an ionospheric C layer....”
- Line 6 refers to the “the typically continuous D region”. Given the authors mean continuous in altitude, I suggest they use “the typically altitude-continuous D region” or something similar.
- Line 10 “an automated deep learning approach was employed”. Suggest this is reworded “an automated deep learning approach was **developed and** employed”

- Abstract, line 13, suggest “is found at 58.5 km” changed to “is found to be 58.5 km”
- Line 14, suggest replace “radar spectrum” with “power spectrum” or “radar power spectrum”
- Line 28, suggest replace “actual condition of” with “electron density in”.
- Line 30, remove comma after “is used”
- Line 36, I suggest that sounding rockets are limited in both temporal **and spatial** coverage
- Line 44, Remove the closed bracket after “2001” and open bracket before “Reid”.
- Line 50, it may not be clear to some readers what is meant by “but these often belong to the D region structure”. In other places in the paper (e.g. abstract line 6) the authors refer to “the typically (altitude) continuous D region”, which I think is a much clearer description than what is stated in line 50.
- Line 62, “Saura PR” should be “Saura PR radar”, or “Saura PRR” as used in the following sentence – but noting that Saura PRR hasn’t been defined in the text at this point. At otehr points (e.g. Figure 1 caption) “Saura radar” is used. I recommend consistent terminology is used throughout the paper.
- Line 63, I suggest “we removed solar proton events “is replaced with “Renkwitz and Latteck (2017) removed solar proton events”.
- Line 64, “In Renkwitz and Latteck (2017) also demonstrated – i.e. remove “we”
- Line 65, replace “that are called” with “known as”
- Line 65, replace “which was continued” with “which was followed up”
- Line 83, replace “interferences” with “interference”
- Line 87, “clearly isolated to the normal D region.” On line 80 the authors use the term “clearly separated”. I suggest the authors use consistent terminology – and given “isolated” forms part of the LIME acronym, it may be best to use “isolated”.
- Line 88, “the consistent D Region” again, similar to the above point, I suggest the authors use consistent terminology. Earlier the authors used the “continuous” or “typical” D region, which I think is clearer than “the consistent D Region”
- Line 95, suggest this is rewritten as “Other possible detections might be shown in Hocking and Vincent (1982) and Holdsworth and Reid (1997); however, these detections may be regular D region noontime echoes rather than the echoes investigated in this paper.”
- Line 101, suggest add comma after “observations”.
- Line 103, suggest use “identify LIME, providing an...”
- Line 130, suggest the authors indicate when the “major upgrades” took place. Also, suggest the authors say “transmission and reception of coded signals”.
- Line 139, “extraordinary **component**”
- Line 150, “Savitzky-Golay filter is applied for smoothing”. I assume this is applied across the Doppler dimension? The authors should make this clearer.
- Line 166, “object corners and dimensions, thus allowing...”
- Line 170, I suggest it is sufficient to say “Interferometric Synthetic Aperture Radar measurements” without needing to say what these measurements are for.
- Line 268, For consistency, Yolo should be YOLO
- Line 269, Similarly, Target Signal should be Target_Signal

- Line 292, I assume the authors mean “we found a total thickness of 6 to 10 km, **with the largest values** originating from events formed by two adjacent layers”?
- Line 322, “upper D **region**”
- Line 330, suggest “ordinary” is replaced with “typical” as is used earlier. Ordinary may be confused with “ordinary polarisation”. Similarly line 331.
- Line 331, replace “lesser” with “smaller”
- Line 340, replace “little” with “weak”, which is a much more concise term typically used in the context of describing correlation.
- Line 345, replaced “changed” with “changes in”.
- Line 357, remove comma after “events”.
- Line 375, replace “noteworthy” with “notworthily”
- Line 385, I assume “distortion” should be “disturbance”?
- Line 386, replace “So, very” with “Therefore, it is very..”
- Line 390, “we are uncertain **if these detections are related to the LIME** we...”
- Line 411, replace “let us” with “we”.
- Line 451, “Furthermore, it will be worth investigating...”