Dear Editor,

We would like to express our sincere gratitude for your detailed and insightful comments. Your feedback, particularly regarding the precise physical interpretation of the microwave channels, has been immensely helpful in improving the rigor and clarity of our manuscript. We have carefully studied your suggestions and made the corresponding revisions.

Below is a point-by-point response to your comments.

**Editor Comment 1:** *Lines 229 and 328 - the 118.75 +- 1.2 GHz channel is described as being sensitive to temperature gradients. This is not specific - are these horizontal or vertical gradients? ... I think a better phrase would be "temperature distributions" instead of "temperature gradients" in these sentences.*

**Response:** We completely agree with your assessment. You are absolutely correct that describing a single channel's Jacobian as sensitive to "temperature gradients" is physically inaccurate in this context. As you accurately pointed out, the Jacobians reflect the sensitivity to the state variable itself at specific pressure levels, rather than its spatial derivatives (which would require channel differencing for vertical gradients or spatial feature analysis for horizontal gradients). We highly appreciate you pointing out this conceptual ambiguity.

**Editor Comment 2:** *Table A1 - the units of the AR-CNN results are incorrect (and inconsistent with the other rows, which are correct).*

**Response:** Thank you for catching this oversight. We apologize for the typo in the formatting of the AR-CNN results. We have thoroughly checked Table A1 and corrected the units for the AR-CNN row to ensure complete consistency with the rest of the table.

Furthermore, inspired by your focus on physical rigor, we conducted a thorough review of the manuscript and made two additional proactive refinements to ensure our interpretations of the deep learning model's behavior are fundamentally sound:

1. We revised a sentence regarding the relationship between the 118 GHz channel and humidity. We replaced the original explanation involving "dynamical coupling" and "vertical advection" with a more accurate description of the "thermodynamic correlation."
2. We changed the term "radiometric observations" to "radiance observations" when discussing deep convection areas, as "radiance" is a more precise term for the physical quantity interacting with atmospheric hydrometeors.

**Modifications in the Manuscript:**

- **Line 229 (Revised):** "This highlights the model's utilization of the oxygen absorption line near 118 GHz, a spectral feature with significant sensitivity to mid-to-upper tropospheric **temperature distributions** (500-200 hPa) and..."
- **Line 328 (Revised):** "In contrast, the 118.75±1.2 GHz channel is primarily sensitive to mid-to-upper tropospheric **temperature distributions** (500-200 hPa) via..."
- **Table A1:** The units for the AR-CNN row have been corrected to perfectly match the baseline formats.
- **Additional Revision 1 (Line 332):** "This apparent discrepancy can be attributed to the **thermodynamic correlation** between temperature and humidity profiles." *(The unsupported second half of the sentence regarding vertical advection was removed).*
- **Additional Revision 2 (Line 287):** "These processes, especially in areas with deep convection or liquid water droplets and ice crystals, obscure the direct link between **radiance** observations and humidity, challenging the model's ability to accurately retrieve humidity values solely from TBs."