General comments:

This manuscript investigates the long-term dynamics of permafrost in fire scars using a space-for-time approach at several representative locations across the North American permafrost region. I highly appreciate the attempt to extend the spatial scope beyond previous studies using same approaches in order to highlight interregional differences. It is also a clear strength of the work that InSAR data from different wavelengths, backscatter intensity, and various environmental factors are comprehensively compared and cross-validated. The background and methodology are generally well motivated, and the necessary information is presented in a concise and accessible way.

However, some of the interpretations of key results, particularly those related to annual deformation and seasonal backscatter behavior, appear to rely on implicit assumptions that are not clearly stated. This raises concerns about attributing the observed patterns solely to temperature or climatic conditions. In several places, relative differences are discussed as if they were absolute signals, or regional contrasts are interpreted primarily in terms of fire-scar properties without fully accounting for differences in the reference (unburned) areas. I therefore recommend that the authors revisit and refine the interpretation of these results, taking into account the points raised in the comments below.

1. Interpretation of annual deformation and "uplift"

I am concerned about the interpretation of the annual deformation differences as "uplift" within the fire scars. By definition, author's metric is the difference between the fire scar and its unburned surroundings, so a positive value can also arise when the fire scar simply subsides less than the surrounding area, rather than actually uplifting in an absolute sense. Figure A4 (a) shows that the unburned surroundings themselves exhibit subsidence signals, which makes this distinction important. This implicit "positive deformation difference = uplift" assumption also seems to underlie the discussion in Section 6.3, including the conclusion that the apparent uplift signal in the Yukon–Kuskokwim Delta is related to its warmer conditions.

To avoid over-interpretation, I suggest (i) clearly distinguishing between relative differences with respect to the surrounding areas and relative differences with respect to the reference points, (ii) more explicitly describing the reason of selecting reference points in each region, and (iii) explaining how annual changes in the unburned surrounding areas may affect the inferred trends.

2. Interpretation of backscatter differences and climate effects

I have some concerns about the way the seasonal backscatter differences ($\Delta\gamma^0$) are interpreted solely as a climate-driven response of the fire scars. The contrasts between summer-winter $\Delta\gamma^0$ in IN and in the YKD (Figure 4f) are discussed as reflecting the response of fire scars to warmer versus colder climatic conditions. However, the reference γ^0 in the surrounding undisturbed areas is expected to vary between regions due to differences in vegetation type and surface conditions. Indeed, Figures A5 and A6 show that the γ^0 levels of the unburned surroundings are not uniform across regions. Consequently, the interregional differences in the seasonal contrast of $\Delta\gamma^0$ may not only reflect how fire scars respond to climate, but also how they respond relative to different types of

surrounding reference areas. In Section 6.4 (around lines 493–494), the differing temporal trends in warm versus cold regions are likewise attributed primarily to the properties of the fire scars.

Overall, it seems problematic to interpret the seasonal contrast in $\Delta\gamma^0$ purely as a response of the fire scars to temperature conditions, without more explicitly considering the role of region-specific reference backscatter levels.

Specific comments:

L14-18: In the abstract, the authors only state the cause of increased summer backscatter in warmer regions. It remains unclear why initial backscatter decreases in the colder regions. I think the abstract should briefly mention the authors' interpretation of this contrasting behavior, rather than only describing the pattern.

L370: Figure 8 demonstrates that the deformation patterns broadly correspond, but because the units of the two quantities differ, I find the figure to be a rather weak basis for the statement that it "supports the validity of the results" (around line 396 in Discussion). I would suggest repositioning this comparison as a qualitative consistency check of deformation patterns, or alternatively converting the ABoVE subsidence values to $-\alpha_{DDT}$ for a more direct comparison.

L378-379: I do not fully understand why a broad spread would persist although the higher-resolution DTM data have been downsampled. Could this broad spread rather be attributed to systematic differences between the InSAR and ΔDTM approaches?

L391-392: The number of selected fire scars is reported in the manuscript, but there is no information on their individual areas. From Figures A1 - A4, it appears that some very small fire scars and a few very large fire scars dominate the sample. If the areas of the selected fire scars are biased toward a specific size range, then relying solely on the R^2 values in Table A8 for statistical assessment may be problematic.

L416: This comparison seems to rely on the assumption that the seasonal deformation behavior of the reference regions remains constant over the long term. Do you have any data showing that the seasonal deformation in the reference regions is indeed stable, or is this assumption simply imposed?

L448: Is the wet condition in the depressions only a short-lived feature immediately after snowmelt, or does it persist throughout the thawing season?

L449: Do you have any evidence that the CCI Permafrost thermal model realistically represents fire-induced changes in soil and surface conditions at the scale of individual fire scars? Also, the resolution of the ground temperature information is 0.01°. At this scale, individual fire scars and their 5 km surroundings are often contained within only a few grid cells. Therefore, I think it is inappropriate to conclude, based on this model product alone, that ground temperature differences between fire scars and the surrounding undisturbed areas are small.

L526: The wording in the first sentence is ambiguous. You should remind the reader what "all regions" refers to in the context of this study.

Figure A3-A4, A5-A7: The lines indicating the extent of the fire scars are too thick, and in sub-plot (d) in particular it is difficult to discern the deformation values. Could you thin the lines, or, for large fire scars, show only an outer outline instead?

Technical corrections:

L171: “2024)))” should be “2024))” Figure A2 caption has same issue.

L395-396: Should refer to Figure 8 here.

L462: alanlyzed should be analyzed

L481: “5d” should be “4d”

L529: “about only about” should be “only about”