Public justification (visible to the public if the article is accepted and published):

I like the change in the smoothness analysis to use the difference against the fused mean- the units are much easier to understand, and the results still show that the fused product is performing well. I also appreciate the clarification in the description of the enhancement field.

I would ask that the authors look over the paragraph between lines 241 and 257 and consider how the logical flow could be improved- the text as written circles around the reliability of Sentinel-1 (is it reliable or unreliable over glacier surfaces?) and seems to try to make similar points in different places with variable logic.

Now that the enhancement factor is described a bit more clearly, I would note that the formula used is equivalent to a zero-mean regression of S against F, so it might be more clear to call alpha a scaling coefficient rather than an enhancement coefficient, and to describe it (line 259) as "the ratio between the fused value and Sentinel-1." I would also note that the approach here could come to grief if $|S| << |F|$ over a given window (i.e. over stationary surfaces in an area were F gives noisy results), a problem which could be avoided by taking a non-zero regression of S against F.

Once these changes are made, I think we can move to the next step.

Best

Ben

Dear Ben,

Thank you very much for your careful reading and constructive suggestions. We have revised the manuscript accordingly and have addressed all the issues raised in your comment.

First, we have revised the paragraph describing the role of Sentinel-1 in the gap-filling procedure. In the previous version, the discussion of Sentinel-1 reliability was not sufficiently clear and could give the impression that Sentinel-1 was described as both reliable and

unreliable in different parts of the paragraph. In the revised manuscript, we have reorganized the logic to clarify that Sentinel-1 provides useful complementary information under cloud- and illumination-limited conditions, but that Sentinel-1-derived velocities are not assumed to be uniformly reliable under all terrain and surface conditions. Therefore, Sentinel-1 is now described as an auxiliary velocity field used for locally scaled gap filling, rather than as an unadjusted replacement for missing optical observations.

Second, following your suggestion, we have replaced “enhancement coefficient” with “scaling coefficient” throughout the relevant section and in the workflow figure. We have also revised the definition of α to describe it more explicitly as the local ratio between the preliminary fused velocity and the Sentinel-1 velocity within the moving window. This terminology better reflects the mathematical meaning of the coefficient and avoids implying that the procedure simply enhances Sentinel-1 values.

Third, we carefully considered your comment regarding the zero-intercept nature of the current formulation and the possible advantage of using a non-zero-intercept local regression. We agree that the present scaling formulation is mathematically equivalent to a zero-intercept local regression and that a non-zero-intercept regression could, in principle, reduce potential instability when Sentinel-1 velocities are close to zero while the preliminary fused velocities remain non-negligible within a given window.

To evaluate whether this issue materially affects the present dataset, we conducted an additional sensitivity test using a non-zero-intercept local regression for the Sentinel-1-guided gap-filling step. The resulting velocity fields were very similar to those produced by the current scaling formulation, and the main diagnostic metrics, including the stable-area uncertainty and RMSD-based smoothness assessment, changed only negligibly. This limited difference is likely because the Landsat- and Sentinel-2-derived velocities were subjected to strict outlier removal before fusion, which reduced the occurrence of noisy preliminary fused values that would otherwise amplify the instability noted in your comment.

We therefore retained the current zero-intercept scaling formulation in the final dataset. This formulation is consistent with the intended purpose of the gap-filling step, namely to apply a local multiplicative scaling to Sentinel-1 rather than to introduce an additional additive offset. Changing the formulation at this correction stage would also constitute a substantive change to the data-production workflow and would require regenerating and revalidating the full

dataset and associated analyses. Nevertheless, we agree that your suggestion is methodologically important. We have therefore added a statement in the “Limitations and future directions” section noting that non-zero-intercept or more adaptive local regression approaches should be considered in future applications, especially in regions where Sentinel-1 velocities are weak or where the preliminary fused field contains stronger residual noise.

In addition, we checked the manuscript carefully and corrected the remaining terminology, figure references, repeated wording, and minor formatting issues.

Thank you again for your helpful comments. We hope that the revised manuscript now addresses the remaining concerns and is suitable for moving to the next step.

Best regards,

Daoxun Gao

on behalf of all co-authors