

# Response to Editor on "Co-registration and residual correction of digital elevation models: A comparative study"

Comment received: 18 Oct 2023

5 Key:

Editor comment (black)

Response (blue)

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10 Thank you for the further improvement. The manuscript has further improved, but I was expecting more effort in improving the discussion. The points I raised were examples and there were more. However, as I do not want to be too critical and your work clearly deserves publication, I am accepting the manuscript after the following minor issues have been addressed (Note that the line numbers refer to the track change version):

15 General comment on the discussion: You provide twice a recommendation to use the RT method (L375 and L382). It would be better to provide one recommendation after you discuss all three methods at the end of the discussion.

Thanks for your suggestion. The sentences have been revised as follows:

20 To sum up, the three analytical algorithms for the DEM co-registration problem, i.e., NK, NH, and RT, have a strong theoretical relationship, despite being presented in diverse forms in the original literature. Taking into account both the algorithm accuracy and ease of use in practical applications, we recommend to apply the RT method instead of the NK and NH methods in glacial studies.

L343: Cite the original publication which introduced the methods (as you did in the intro) and not Paul et al. (2015). Moreover, clarify the term "grid search method". It was not introduced as such in the introduction.

The literature has been updated according to your suggestion.

25 The grid search method was introduced in Section 1 (Lines 55-58), and we have further elaborated on it in the revised manuscript.

"The grid search methods search for the best alignment result by stepwise shifting the secondary DEM a little bit, alternatively along x and y directions in a predefined window (e.g.,  $5 \times 5$  pixels). However, these methods have been rarely used in the recent literature because their brute-force search process comes with a huge computational cost."

30 It is worth noting that there is no universally accepted name for the grid search method in the literature. For instance, Berthier et al. (2007) referred to it as "planimetric adjustment," while Paul et al. (2015) named it "brute-force iterative minimisation of difference residuals."

Reference:

35 Berthier, E., Arnaud, Y., Kumar, R., Ahmad, S., Wagnon, P., and Chevallier, P.: Remote sensing estimates of glacier mass balances in the Himachal Pradesh (Western Himalaya, India), *Remote Sens. Environ.*, 108, 327–338, <https://doi.org/10.1016/j.rse.2006.11.017>, 2007.

Paul, F., Bolch, T., Kääb, A., Nagler, T., Nuth, C., Scharrer, K., Shepherd, A., Strozzi, T., Ticconi, F., Bhambri, R., Berthier, E., Bevan, S., Gourmelen, N., Heid, T., Jeong, S., Kunz, M., Lauknes, T. R., Luckman, A., Merryman Boncori, J., Moholdt, G., Muir, A., Neelmeijer, J., Rankl, M., VanLooy, J., and Van Niel, T.: The glaciers climate change initiative: Methods for creating glacier area, elevation change and velocity products, *Remote Sens. Environ.*, 162, 408–426, <https://doi.org/10.1016/j.rse.2013.07.043>, 2015.

L344: Replace “it” by “therefore the NK method...” (or rewrite the sentence incl. the NH method as suggested above).

45 L375: “replace” is not the best term here. I suggest to write “Based on our theoretical analysis and experimental results, we recommended to apply the RT method instead of the NK method also in glacial studies.” (or rewrite the sentence incl. the NH method as suggested above).

L444: Similar as mentioned above: “Thus, we recommend applying the RT method also in glacial studies.”

Modified as suggested.

50 Thanks for your detailed review.