

This manuscript presents a dynamical downscaling framework (DReaMIT) that combines reanalysis data (ERA5 and/or JRA-3Q) with digital elevation models (DEM) to improve the prediction of surface-based temperature inversions (SBI) in high-latitude complex terrain (mountainous) regions. DReaMIT is essentially an extension of an earlier version of the framework by Porzsgay and Gruber (2025), but in which the hypsometric position, a dimensionless parameter ($0 \leq h \leq 1$) that measures elevation relative to surrounding topography, rather than the actual elevation is used for modeling the SBI.

The work provides a welcome contribution that addresses an important gap in the understanding of high latitude mountainous climatology, where measurements are sparse and the complex topography renders reanalysis data fairly uncertain. Some aspects of the manuscript warrant improvement before it can be published.

Comments

- 1) The authors mention that a 50 km radius yielded the best empirical fit for calculating hypsometric position, but the physical explanation of this aspect (beyond synoptic vs. local scale) remains unclear and poorly discussed. Specifically, the paper would benefit from a more explicit justification of why the 50 km radius works best for features that actually often operate on a much localized valley scale (e.g., 5 km, which hit a local minimum in performance). Does this large 50 km radius reflect the imprint of the reanalysis grid cells? or is it more indicative of the synoptic-scale boundaries of regional cold-air drainage systems? This distinction would strengthen the physical basis of the model.
- 2) I wonder if the authors can discuss (or even better, propose) a threshold of hypsometric range beyond which DReaMIT breaks down? This is motivated by the limitations in flat river dominated regions.
- 3) It would be useful to define SBI in a sentence for a non-specialist reader. One sentence goes a long way.
- 4) Related to comment 3, the model by Porzsgay and Gruber (2025) is insufficiently summarized. I think adding a paragraph explaining it would provide the reader with a better background to value the present work more.
- 5) The abstract is not self-contained, referencing aspects such as “Exponentiation of the elevation variable” without sufficient background or context. Perhaps revise for completeness. Also, is it really an exponentiation of the “elevation” variable or the hypsometric position?
- 6) Introduction (Line 17): define the acronyms ERA5 and JRA-3Q. Also, in Line 19, perhaps use “multiple atmospheric pressure levels”
- 7) Introduction (Line 21): “hydrological processes”?

- 8) Line 42: what is mean by “normal” lapse rates? Is this meant to say “linear”, “dry adiabatic”, “moist”, etc..
- 9) Line 94: correct “since since 1947”
- 10) Line 215: “second column” not second row
- 11) Line 266: “lapse” not laspe