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Geoscientific Model Development Discussions

Interactive comment on "REDCAPP (v1.0): Parameterizing valley inversions in air temperature data downscaled from re-analyses" *by* Bin Cao et al.

Anonymous Referee #1

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The manuscript "REDCAPP (v1.0): Parameterizing valley inversions in air temperature data downscaled from re-analyses" by Cao et al. presents a new technique to downscale temperature data in mountainous regions whereby they develop a land-surface correction factor. They then demonstrate this technique for two mountainous regions: the Swiss Alps and Qilian Mountains. The technique that the authors develop is of interest to GMD readership, but the following comments need to be addressed before the manuscript is considered for publication.

General comments:

I am missing a discussion of how the method that the authors developed in the present manuscript differs from other downscaling approaches that already exist for complex or

mountainous terrain. There needs to be more discussion of how the authors' method improves upon and is better than pre-existing downscaling techniques that also use variable lapse rates and incorporate information about the land surface and topographical characteristics, e.g. the Parameter-elevation Regression on Independent Slopes Model (PRISM) (Daly et al., 2000; Daly et al., 2002), the Daily Surface Weather and Climatological Summary (DAYMET) (e.g., Thornton et al., 1997), and the techniques used in Hijmans et al. (2005).

The temperature lapse rate is defined as decreasing with height and thus a negative lapse rate implies a temperature increase with height. This change needs to be implemented throughout the manuscript.

In Section 3.2, more discussion is required about the meteorological stations that the authors used, e.g., instrument type, completeness of the data sets at these stations within the two study regions, etc. Also, the authors mention in line 3 of page 5 that mean daily temperatures in 1980 or after are used. The total time period of the study needs to be indicated. I am also not sure what the authors mean by "obviously wrong values" on pages 4-5 in this section. More description is necessary here too.

In Section 5.3.1, the authors note that the bias in the Swiss Alps increases with the implementation of the REDCAPP technique, but no explanation is offered as to why this is.

The quality of many of the figures needs to be improved. Figure 1 would benefit from a zoomed out map showing the relative locations of the study areas in the Swiss Alps and Qilian Mountains. In Figures 4, 10, and 11, are these means or medians shown with the red dots? Please include this information in the legends for these respective figures. In Figure 5 and in Figure 11, what time period is being shown for each of the stations? This information should to be included either in a separate table or in the figure captions. Finally, the latitude and longitude should be included directly on Figure 8, Figure 13, and Figure 2, rather than in the caption, in order to improve the figures'

readability.

Specific comments:

Page 1, Line 18: Change “oder” to order.

Page 6, Line 7: Include citation for “degree of valleyness.”

Page 13: Many of the references are missing doi numbers. Please include these.

Page 25: I am unsure what you mean by “a quality of points visual.”

References

Daly, C. G. H. Taylor, W. P. Gibson, T. W. Parzybok, G. L. Johnson, and P. A. Pasteris, 2000: High-quality spatial climate data sets for the United States and beyond. Transactions of the American Society of Agricultural Engineers, 43 (6), 1957-1962.

Daly, C. W. P. Gibson, G. H. Taylor, G. L. Johnson, and P. Pasteris: 2002: A knowledge-based approach to the statistical mapping of climate. Climate Research, 22 (2), 99-113.

Hijmans, R., S. E. Cameron, J. L. Parra, P. G. Jones, and A. Jarvis, 2005: Very high resolution interpolated climate surfaces for global land areas. International Journal of Climatology, 25, 1965-1978. Thornton, P. E., S. W. Running, and M. A. White, 1997: Generating surfaces of daily meteorological variables over large regions of complex terrain. Journal of Hydrology, 190 (3-4), 214-251.

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