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Interactive comment on “TopoSCALE: deriving surface fluxes from gridded climate data” by J. Fiddes and S. Gruber

Anonymous Referee #1

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General Comments:

This paper describes the topographic scaling method to scale the atmospheric forcing from ERA Interim at regional scale (0.75°) to hill-scale ($<100\text{m}$). The scaled forcing data (2D or 1D) is supposed to improve the simulation of the offline land surface model (LSM), which is not shown in this paper. But, the results from this method is compared with a reference method and observation data. The objective of this paper has the potential to provide long-term climate data at high spatial resolution to force the LSM, and could be an important contribution for the land-surface community. However, at present there are several short-comings in the paper in terms of concepts, methods and overall presentation (structure and language), which needs to be addressed for possible publication.

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Specific Comments:

1) The structure of the paper is confusing in terms of contents of Background, Methods, Data and Experiments. At present, the structure is very unprofessional and does not have a flow. A restructuring of the contents is absolutely necessary.

2) The 'TopoScale' method used in this paper simply interpolates temperature, relative humidity and wind at sub-grid scale (SUB) topography based on the given grid-scale (GRID) atmospheric forcing data at pressure levels (from 1000mb onwards). First, the pressure level forcing data below the GRID topography should be masked for analysis. Then for SUB topography higher than the GRID, the interpolation may be done, but it is still a very very crude assumption. The mountain valley circulations in these complex terrains generate their own diurnal cycle, which can be completely disconnected from the synoptic scale weather above the ridges, depending upon different weather conditions. Bottom line, the use of this method needs to be justified and discussed theoretically.

3) It is not clear, how and why the 'Reference method' described in Section 3.2 was chosen, the use of this reference method needs to be explained. Why not use some existing statistical schemes to compare?

4) The focus of the result section is on the daily means. The 3hourly scaled data are again aggregated to daily means to compare with observation data (available at 10mins to hourly resolution). Diurnal cycle is essential for forcing LSM, so it would be more convincing if the statistical comparisons are presented on sub-daily time scales, rather than daily mean time scale where diurnal cycle is averaged out. Especially it is important for complex terrains which has series of ridges and valley. Section 6.3 alone is insufficient.

Other Comments:

1) Page 3382, Ln 1-5: This sentence needs to be rephrased. 'Heterogeneous' or 'Com-

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plex' terrain? What kind of lateral variability? 'At the site or scale', please elaborate. Maybe breaking the sentence into two would be more appropriate.

2) Page 3382, Ln 15: Expectations should be removed from the abstract, and focus should be on the content of the manuscript.

3) Page 3382, Ln 8: What does it mean by good description of the atmospheric column ?

4) Page 3382, Ln 20-25: Explain the problem with examples rather than just citing other works.

5) Page 3383, Ln 26: Explain lumped model simulations.

6) Page 3385, Ln 4: 'Complex products ?' Rephrase.

7) Page 3385, Ln 24: What do the authors mean by 'impact model' ?

8) Page 3386, Section 2.3: Sub-grid scale issue is the most important issue in the context of the downscaling study presented in this paper. But, this section is poorly discussed. Especially, discussion on the scaling of soil moisture due to topography and its effect on the partition of surface energy fluxes is left out. This needs to be further addressed.

9) Page 3387, Section 2.4: Data at pressure levels below model surface should be masked.

10) Page 3388, Ln 2: Describe Tgrid and Rhgrid. And at what height Tsub, Rhsb and Wsub are calculated from the subgrid surface height ?

11) Page 3388, Ln 15: Appendix B2: Explain the wind sub model with diagrams and example.

12) Page 3388, Eq. 1, Explain pV and T notations,, grid suffix missing in emissivity? Eq. 2, Explain Tgrid, is it the 2m air temperature here ?

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- 13) Page 3389, Eq. 3, Should be LW sub ?, and what is Tsub, 2m temperature ?
- 14) Page 3391, Section 3.1.3, Appendix A should be Appendix B5 ? Explain how this 'pf' factor is estimated. Also explain the inversion of 'non-linear lapse rate of Liston and Elder (2006). This section is not comprehensible. Explain with clarity.
- 15) Page 3393, Eq. 14 is missing bracket.
- 16) Page 3396, Ln 3: 'No missingness ?'
- 17) Page 3399, Ln 17: Should be Figure 7b
- 18) Page 3400, Ln 7: Figure 10 (Please explain the abbreviations in the Figure in the caption)
- 19) Page 3403, Ln 16- 27: Remove.

Interactive comment on Geosci. Model Dev. Discuss., 6, 3381, 2013.

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