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Interactive comment on "A high-resolution air temperature data set for the Chinese Tianshan Mountains in 1979–2016" *by* Lu Gao et al.

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The presented manuscript introduces a newly established data set of elevation corrected 6-hourly near surface temperatures at a resolution of 1km for the Tianshan mountains. Temperature lapse rates are derived from free atmospheric ERA-Interim data at various pressure levels and are interpolated to high spatial resolution. The ERA-Interim internal lapse rates are subsequently used to correct the near surface temperatures under consideration of a high resolution DEM. The data set is evaluated against observations (24 meteorological stations are considered) and the general characteristics of the spatial temperature distribution over the target domain are presented. In general the target of the study is timely, since high resolution climate data represent an important input for many climate impact modelling applications. However, in my

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opinion the evaluation of the data set needs to be improved in order to better communicate its limitations to potential users. Further I would suggest to better investigate the major characteristics of the temperature distribution over the Tienshan mountains and to propose some potential applications.

In the following I will summarize my major concerns without going into detail:

1. Terminology and Language: The applied methods are presented as a downscaling technique. In the introduction the authors state that important local-scale processes, such as cold-air pooling or snow-melt related processes are not represented by reanalysis products due to their limited spatial resolution. However, the suggested elevation correction technique does not consider such processes and thus should not be termed as a downscaling technique. I suggest to use “elevation adjustment” throughout the manuscript.

In general, the language of the manuscript is somehow unprecise or misleading at some points. I suggest to include a native speaker.

2. Data and methods: The introduction of the utilized data sets is very short and some of the applied techniques are not fully clarified. - Which levels are used for the elevation adjustment of a specific pixel? There is some information given on page 5, l. 15, but unfortunately I cannot follow. Maybe it would be helpful to provide a brief example. In general I suggest to describe the elevation correction technique in greater detail! - Which ERA-Interim data are used? I suppose the authors make use of the fully assimilated data set, however p.4,l22 discusses the 10 days forecast. Please clarify. - For the Evaluation 24 records are used. Are these stations independent of the reanalysis, i.e. they are not used for the assimilation? If they are part of the assimilation procedure, the skill of ERA-Interim might be overestimated.

3. Evaluation: - The Evaluation of the data set is done against 24 meteorlogical stations. Therefor the modelled temperature is derived by averaging (?) the 3*3 gridcells surrounding each climate station. This approach unfortunately leads to a systematic

bias of the modelled temperature data, since the station elevation does not coincide with the mean elevation of the considered grid cell. Further, the spatial averaging generates a smoothened temperature field, i.e. the data set is actually not evaluated at a 1km resolution, but at 3km. I would highly suggest to improve the evaluation methodology. In order to completely overcome the systematic bias, the lapse rates could be used to adjust the temperature directly to the elevation of the meteorological station (without condsidering the DEM). Therefor the ERA-Interim internal lapse rate of the corresponding pixel could be employed. Most likely this will lead to a better skill. A temperature bias of 3°C is still a lot and is probably due to the elevation induced systematic bias. - The evaluation correction is conducted for different periods (p. 6,l15). I would suggest compare the period from 1979 to 2013 only. If the quality of the data set is good enough, the data set can still be extended for the remaining years. - The data set includes 6-hourly values, however the evaluation is only conducted for aggregated measures, such as mean, max and min. It is very likely, that the quality of the data set varies in different seasons and different times of the day. E.g. cold air pooling during winter nights might lead to a strong warm bias of the data set, strong diurnal heating during the day may have opposite effects (see e.g. (Gerlitz 2014)). I suggest to test the quality of the data set for different seasons and times of the day independently, in order to communicate the limitations of such an approach to potential users. - Evaluation of lapse rates: Usually the lapse rates in high mountain regions have typical diurnal and seasonal cycles. However, the free air lapse rates might not correspond with lapse rates at the surface. I would like to see a brief evaluation of the lapse rates which are used for the elevation adjustment. Do they correspond with observations? Do they have any spatial variations? The authors e.g. state that the data set slightly improves ERA-Interim data for some locations, particularly for higher temperatures (p8,l6). Does that mean, that winter lapse rates are not well simulated by ERA-Interim? - The section on the evaluation measures of specific stations is lengthy and difficult to follow. The authors mention the number and the performance measures for each station and mention that the approach does not work well for all sites (p8,l23). Would it be possible, to in-

terpret the differences of the model skill with regard to potential local scale processes, that are not captured by your approach? I could imagine that stations in deep valleys react differently compared with stations located at higher elevations. A comprehensive interpretation of the data quality would inform potential users about the stengthes and limitations of the data set.

4. Application of the data set The authors show very general characteristics of the data set, such as mean, minimum and maximum temperatures, in section 4.3. Most applications, which are mentioned in the introduction, however require both, high resolution temperature and precipitation data. I feel that the potential of such a data set should be better illustrated by showing its unique features. Does the high resolution data set e.g. reproduces elevation depending warming in the Tienshan mountains? (see e.g. (Gerlitz et al. 2014)). Are spatial and seasonal variations of the dirurnal temperature range well captured (Sun et al. 2018; Shekhar et al. 2018)? Such potential applications could be included without much effort and will certainly illustrate the potential of the data set, which stands out due to its spatial AND temporal resolution.

5. Data Availability The structure of the data set seems to be a bit unintuitive to me. Wouldn't it be an option to provide the NCDF files for each year and for the entire domain? This would simplify the usaga of the data set, particularly for users who download the data set via batch scripts.

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