Response to Referee 1

We would like to thank anonymous Referee 1 for reviewing our manuscript. These professional comments are really helpful for improving the manuscript. In the following, we address all comments point-by-point according to referee's comments.

This study intends to reveal EDW in the Chinese Tianshan Mountains using a high resolution data that are developed in the previous study based on ERA-I data in combination with topographic correction method. Despite merits such as clear structure and better writing to be easy to follow, I have three comments in the following:

1. My major concern is the accuracy of data used. This paper does not do a detailed introduce to the high-resolution data, which results in that I cannot evaluate its accuracy or reliability. After a look at the reference provided, it shows that the high resolution data are based on ERA-I reanalysis. ERA-I is developed based on model simulation in addition to weather station observations, so it generally has large uncertainties in such a small region, especially for mountainous region. Because ERA-I includes in suit observations at some weather stations, it may be unsurprised there are very seasonable performance for evaluation using observed data from perhaps the same weather stations.

-Answer: Thanks a lot for the comments. The referee pointed out a very important issue on the accuracy of data, which is the foundation of presented study. That is true that we just provided limited information on the data set because we leave more space to EDW analysis. We accept the comment and will add more data set information in the revision.

Here, we would like to introduce the data set briefly. It is true that the data set

is produced based on ERA-Interim data and an elevation correction method. We also agree that the uncertainty is large for original ERA-Interim. Our previous studies revealed that there are around 3-4 °C systematic bias from original ERA-Interim (Gao et al., 2014, 2017). Thus, a correction is necessary before local application. The correction approach based on the internal lapse rates derived from ERA-Interim has been proven to be effective in the mountains. Although, there is still a less than 2 °C bias after elevation correction, the warming trends could be captured very well (Gao et al., 2018, Table 1). 24 meteorological stations are applied for data set validation in the CTM from 1979-2013. The averaged trend difference between observation and CTMD is only 0.07 °C $10a^{-1}$ respects to annual and seasonal temperatures. Although the CTMD tends to underestimate the trends for minimum temperatures, we still believe that CTMD is reliable to capture the EDW trend.

Table 1. Trends (°C $10a^{-1}$) of annual and seasonal temperatures over the 24 sites in 1979-2013.

	Annual	Spring	Summer	Autumn	Winter
observation	0.420	0.664	0.432	0.532	0.018
ERA-Interim	0.378	0.659	0.530	0.448	-0.153
correction	0.349	0.638	0.478	0.443	-0.195

Meanwhile, we would like to emphasize that the CTM is not a small mountain region (larger than 350,000 km^2) which only has less than 30 meteorological stations. Most of them are located in the piedmont plains or valleys. Thus, the validation based on limited surface meteorological station may be not objective. We also know that the analysis of future climate change scenarios relies on model data such as GCM outputs, which have large uncertainties. However, the GCM models are still the most powerful tool for climate change analysis, and the trends modeled by the GCM are still credible. Thus, we believe that although ERA-Interim has errors, it has the ability to reveal regional climate changes after elevation correction. Furthermore, ERA-Interim assimilated

ground observation data, which can more accurately reflect local climate change.

The referee also raised another very important issue that it is unsurprised about the seasonable performance of ERA-Interim at certain stations. Here, we would like to clarify briefly. The ERA-Interim applied ECMWF Integrated Forecast System (IFS) which could assimilate observations in the model. However, only a very small part of observations was assimilated. 9 of 24 sites were possible assimilated by IFS for ERA-Interim in the CTM according to ECMWF assimilation records (Gao et al., 2018, Table 2). Only 4 sites with long-term observations (more than 30 years) while other 5 sites (less than 15 years) were assimilated. In other words, ERA-Interim is a relative independent data set (considering the ratio of ground stations amount to the whole CTM area). We believe the performance of ERA-Interim sometimes is “surprised” in such a complex terrains and it is reliable for regional climate change detection.

Table 2. Possible assimilated sites in the CTM in ERA-Interim.

Name	WMO id	starting date	ending date
Jinghe	51334	1979-06-21	1993-01-21
Qitai	51379	1979-06-03	1985-05-20
Yining	51431	1978-12-31	2011-12-31
Urumqi	51463	1978-12-31	2011-12-31
Qijiaojing	51495	1979-04-07	1993-04-24
Turfan	51573	1981-06-30	1984-08-08
Kuche	51644	1978-12-31	2011-12-31
Kuerle	51656	1979-01-03	1994-12-30
Hami	52203	1978-12-31	2011-12-31

2. This paper discusses the mechanism only, if data can be used to reveal some mechanism in the research region, it will be a better progress. The mechanism discussed may be suitable for other regions, but is not always in the case for the research region in the present study.

-Answer: Thanks a lot for the comments. The referee is definitely right that the mechanism is the key issue for EDW. There are two steps in our research plan.

The first step is detecting EDW phenomenon and selecting typical EDW regions. The second step is the mechanism investigation. We plan to apply WRF model and statistical methods to assess the mechanisms of local physical processes and large-scale circulation, respectively. The WRF model has been widely used for simulating the energy transfer processes at regional scales (~3km). We plan to simulate the surface energy balances under different land surface covers, especially the snow/ice cover effect via WRF model. Besides, we plan to use statistical methods such as SVD, linear regression, lead-lag correlation to assess the impact of atmospheric circulation factors (such as the North Atlantic Oscillation, Arctic Oscillation) on the EDW in typical EDW areas. Thus, we try to comprehensively explore the mechanisms of EDW from large scale (NAO, AO) and local scale (land surface cover). Therefore, the main purpose of this study is to detect the EDW phenomenon, and to prove the existence of EDW in the CTM.

3. Some expressions are not very rigorous. Such as Line 83-85, the author say that satellite data have low spatial resolution, which is questionable. Some satellite data with 1 km resolution are the same resolution as data used in this study. The author also say large system errors with satellite data, which needs analyses or references to confirm.

--Answer: Thanks a lot for pointing this out. We agree that some parts are not very rigorous. We will check the full text and revise them in the subsequent revision.

Gao, L., Hao, L., and Chen, X.W.: Evaluation of ERA-interim monthly temperature data over the Tiberan Plateau, Journal of Mountain Science, 11(5): 1154-1168, 2014.

Gao, L., Bernbardt, M., Schulz, K., and Chen, X.W.: Elevation correction of ERA-Interim temperature data in the Tibetan Plateau, International Journal of

Climatology, 37(9): 3540-3552, 2017.

Gao, L., Wei, J., Wang, L., Bernhardt, M., Schulz, K., and Chen, X.: A high-resolution air temperature data set for the Chinese Tian Shan in 1979–2016, Earth System Science Data, 10, 2097-2114, 2018.