RC4: 'Comment on essd-2021-361', Anonymous Referee #4, 10 Jan 2022

This manuscript describes a high-resolution climate projection dataset in central Asia, which could be potentially useful for hydrological or ecological applications. More proofs of its reliability and confidence levels are necessary to present before it could be used in the consequent applications.

(1) The horizontal resolution of 9-km was used in this study. My question is why 9-km? 9-km is an awaked resolution not large as precedent quarter degree, not small as convection-permitting modeling. At this resolution, whether the cumulus parametrization is used or not is still an open question.

Reply: Here, we carried out a study that involves the dynamical downscaling of multiple bias-corrected GCMs for the CA region with an unprecedented horizontal resolution of 9km. The 9-km resolution is much higher than those (≥30km) of the previous regional climate projections in CA. With the limitation of the computational and time cost, we did not use a higher resolution (e.g., 3-5km) that allows convection-permitting modeling.

(2) The bias-corrected GCMs were used as forcing in this study. What does the simulation performance look like if the bias correction was not used? The previous study also claimed that similar performances were obtained in the Tibetan Plateau using either reanalysis or GCMs as forcing in the historical period. Major differences only occur in the temporal changes or linear trends. Almost the same historical simulations were also presented in figures 3-6 using three different forcings GCMs in this study. Therefore, it would be good to present the differences between using bias-corrected GCM or not.

Reply: "In a recent study (Qiu et al., 2021), we conducted the sensitivity experiments of using the bias-correction technique, to quantify its contribution to improving the RCM simulation. The results show that using the bias-correction technique largely reduced the biases in the simulated annual and seasonal precipitation over CA respect to not using it and slightly improved the model's skill in simulating the spatial pattern of precipitation (see Fig. 4 in Qiu et al., 2021)." (L123-127 in the revised MS)

Ref: Qiu Y., Feng, J., Yan, Z., Wang, J., and Li, Z.: High-resolution dynamical downscaling for regional climate projection in Central Asia based on bias-corrected multiple GCMs, Climate Dynamics, 10.1007/s00382-021-05934-2, 2021.

(3) The future changes in 2031-2050 compared to 1986-2005 are studied. It is neither the end of this century 2100 nor the target year of zero carbon emission 2060. It would be better to describe the importance of this period in the future in central Asia. In addition, all the future changes are based on the model. Suggest adding historical changes or linear trends to solid the credibility or reliability of future changes.

Reply: "As reported in the 1.5°C special report of the Intergovernmental Panel on Climate Chane (IPCC), we are on track to exceed 1.5°C warming between 2030 and 2052 based on the current warming rate, and hence the near-term future projection becomes more critical to human development than that for the end of this century. Therefore, this study focuses on projected climate changes over CA in the near-term future (2031-2050). Long-term continuous (e.g., 1986-2100) regional climate projections in CA are more useful for studies in this region and will be conducted in the next stage." (L248-256 in the revised MS) We discussed our findings based on the RCM simulations with the previous studies in a recent study (Qiu et al., 2021). For instance, enhanced warming projected in many mountains in the world is not found in CA, which is consistent with the study based on the reanalysis datasets during the past (Hu et al, 2014). Stronger warming is detected in the north part of Central Asia, consistent with the previous regional climate projections (Mannig et al., 2013;Ozturk et al., 2017;Peng et al., 2019). A comprehensive comparison between the future and historical changes based on multiple methods and multi-source data by our group is in process.

Ref:

Hu, Z., Zhang, C., Hu, Q., and Tian, H.: Temperature Changes in Central Asia from 1979 to 2011 Based on Multiple Datasets, 27, 1143-1167, 10.1175/jcli-d-13-00064.1, 2014.

Mannig, B., Müller, M., Starke, E., Merkenschlager, C., Mao, W., Zhi, X., Podzun, R., Jacob, D., and Paeth, H.: Dynamical downscaling of climate change in Central Asia, Global and Planetary Change, 110, 26-39, https://doi.org/10.1016/j.gloplacha.2013.05.008, 2013.

Ozturk, T., Turp, M. T., Türkeş, M., and Kurnaz, M. L.: Projected changes in temperature and precipitation climatology of Central Asia CORDEX Region 8 by using RegCM4.3.5, Atmospheric Research, 183, 296-307, https://doi.org/10.1016/j.atmosres.2016.09.008, 2017.

Peng, D., Zhou, T., Zhang, L., and Zou, L. J. C. D.: Detecting human influence on the temperature changes in Central Asia, 53, 4553-4568, 2019.

Qiu, Y., Feng, J., Yan, Z., Wang, J., and Li, Z.: High-resolution dynamical downscaling for regional climate projection in Central Asia based on bias-corrected multiple GCMs, Climate Dynamics, 10.1007/s00382-021-05934-2, 2021.