final response

Michael Kempf

Author comment on "Monitoring landcover change and desertification processes in northern China and Mongolia using historical written sources and modern vegetation indices" by Michael Kempf, Clim. Past Discuss., https://doi.org/10.5194/cp-2021-5-AC13, 2021

The Editorial Board *Climate of the Past*

Dear Prof. Reyes, dear Reviewer,

In the following, I would like to briefly answer all the suggestions and comments, which were raised during the review process. However, please let me first thank you for your active participation in this open and transparent discussion period! As you can see from the uploaded material and the partly revised figures, a huge number of new data has been acquired, which considerably changed the outlook, methodology, and the results of the paper. A revised version has already been prepared according to your suggestions and the fresh datasets and I am looking forward to the editor's decision on the manuscript.

To trace vegetation behaviour in the study area, a temporal series was created from MODIS/Terra Vegetation Indices Monthly L3 Global 0.05Deg CMG V006 imagery. This new dataset was then compared to long-term precipitation and temperature records over the period 2000-2018. Because the NDVI dataset provides global cloud-free images, the correlation was enlarged to the entire part of the reconstructed route sector of 1688. That allowed for a more significant statistical analyses, which now shows strong correlation between vegetation condition and increasing precipitation and vegetation condition and increasing maximum temperature. Furthermore, the dataset was analysed for yearly NDVI anomalies compared to the long-term record from 2000-2020 for entire China and Mongolia. For this reason, the mean total NDVI value and the yearly average NDVI values were calculated from the cumulated monthly MODIS datasets. The standard deviation was calculated for all values and subtracted from and added to the multiannual mean value to create the range of the standard deviation for the period 2000-2020. Consequently, annual NDVI anomalies were calculated by distinguishing into positive or negative deviation from the standard deviation range. The anomalies were plotted for each year and the histograms were calculated with density ranges (see supplementary data). From this data, the trend of positive NDVI anomalies can be observed – at least after the year 2015. This is an important result because it shows that with increasing total precipitation and temperature, the vegetation growth behavior is enhanced locally and that the Chinese governmental restrictions to fight degradation could have contributed to this development. It also implies that increasing desertification processes during the LIA can be attributed to decreased temperature and precipitation totals, which further emphasizes the very short-

term response time of the climate-sensitive grasslands in China's Inner Mongolia region and Mongolia. The combination of modern (remote sensing) data and historical written source to understand past climate and landcover change and to draw conclusions about current environmental processes is promising and adds an important aspect to past climate research.

Thank you again for considering this paper for publication in *Climate of the Past* and I am looking forward to additional comments and suggestions.

Michael Kempf

Brno/Freiburg, 06th of May 2021