Author response to comments on "Resolving temperature limitation on spring productivity in an evergreen conifer forest using a model-data fusion framework"

We thank the reviewer for their valuable comments. We have made revisions which are detailed in the point-by-point responses below. The comments from the reviewers are in black regular font, our responses are in blue regular font, and text in the revised manuscript are in *blue italic font*.

Exploring the exist but less studied temperature limitation on spring productivity is an important task to improve the realistic of ecosystem models. The authors applied a model-data fusion framework to discuss the uncertainty in such limitation, mainly for the subalpine evergreen forest in Colorado USA. They found that i) the GPP was gradually inhibited at temperature below 6.0 ^{o}C and completely inhibited below -7.1 ^{o}C. ii) cold temperature limitation has an important influence on spring GPP, while not the case for integrated growing season GPP. Other environmental controls, such as precipitation, play a more important role in annual productivity.

Overall, this study seems to be a nice attempt to address this topic, while the most apparent weakness is that this work solely depends on a single site/tree species, whether the conclusion would be fine for subalpine evergreen forest in another region is unclear.

We intended this study to serve as a starting point for analyzing and modeling temperature limitations on GPP in subalpine evergreen ecosystems. We look forward to testing our cold temperature scaling factor in other regions in the future. While not covered in detail in this paper, Famiglietti et al. (2021) compares different versions of the CARDAMOM model, including the cold temperature limitation version used here, to evaluate how model complexity contributes to the predictive skill of the model. This is discussed briefly in Section 3.2. of our manuscript, and we refer the reader to Famiglietti et al. (2021) for more details.

As expected, the analyzed TBM-MIP models have very different performances regarding the reproduce of spring and annual GPP, see Figure 7 and Table. 2. The authors are recommended to explain whether the parameter sets of these models are optimized using a specialized dataset or the observation of this study.

The TBM-MIP experiment parameters were not optimized using the observations of this study in the same way. Most of the experiments were not optimized and use default parameters, some of the models were optimized using prescribed site-based (US-NR1) characteristics (e.g., CLM), and others were optimized using OCO-2 SIF data (e.g., ORCHIDEE). We have added the following text to Section 2.5. to further clarify how the model parameters are optimized:

Most of the TBM-MIP model experiments were run with default parameters (BEPS, CLM50, SiB3, SiB4, ORCHIDEE-exp1 and exp2). The other experiments were optimized in the following ways: either a) parameters were hand-tuned based on the US-NR1 data (CLM45) or b) the parameters were optimized using OCO-2 SIF data (ORCHIDEE-exp3). For more details on the parameterization of the TBM-SIF experiments, we refer the reader to Parazoo et al. (2020). The use of these models provides insight into the spread in model structures and the use of their default parameters.