Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-411-RC2, 2020

Hydrology and Earth System Sciences
Discussions

Interactive comment on "The trajectory of landcover change in peatland complexes with discontinuous permafrost, northwestern Canada" *by* Olivia Carpino et al.

Anonymous Referee #2

Received and published: 7 December 2020

The manuscript entitled "The trajectory of landcover change in peatland complexes with discontinuous permafrost, northwestern Canada" by Olivia Carpino et al. focuses on the Taiga Plains of Northwest Canada, where rapid climate warming has significantly reduced the area underlain by permafrost in peatland complexes. A massive landscape shift has occurred in recent years, from a forest-dominated landscape to a wetland-dominated landscape. The authors explore the current trajectory of land cover change in a 300,000 kmˆ2 area of discontinuous permafrost in northwestern Canada by presenting spatiotemporal variability using a 600-km latitudinal span of this region. By combining extensive geomatics data with ground-based meteorological and hydrological measurements, a new conceptual model of landscape evolution was developed.

This model explains the observed patterns of land cover change caused by permafrost thawing and provides a basis for predicting future changes. This is a very interesting paper and provides deep insights into how future permafrost loss may change the Taiga forest. The conceptual model and the discussion of water and energy balances are also interesting. However, I feel that the paper is somewhat disorganized and needs a more unified structure. I also think the conceptual model needs to be validated, and I would recommend that the validation be described in terms of the results and discussion. Overall, the authors need to revise the manuscript before its publication. Although there are some issues, I recommend that this paper be published after revisions are made.

Specific comments (1) Sections 3.1 and 3.2 of the Results and Discussion in Chapter 3 are in a completely different vein, making it difficult to read. Section 3.1 discusses the latitudinal distribution of forest cover and permafrost. I feel it would be better to show the percentage of peat areas and wetlands along with latitude in Figure 3. Similarly, the spatial distribution of forests and wetlands can be shown in a figure similar to Figure 2. Also, the spatial distribution is clearly shown in Figures 2 and 3, but the valuable aerial photos and data of IKONOS are described in the method of Chapter 2, which have been analyzed since 1947. I would like to see a figure similar to Figures 2 and 3, one that shows the changes over time based on the data analysis.

(2) At the beginning of Section 3.2, a conceptual model of landscape change associated with the thawing of frozen ground is provided in Figure 4. The conceptual model is introduced so abruptly that it feels as though it has not been validated. Therefore, I would like to see the conceptual model validated on the basis of the analytical data in section 3.1. I would like you to show the results of the verification of the proposed model on the whole study region, using the data from Section 3.1, although it is valid for Scotty Creek. In addition, the purpose of this study was to characterize end members and intervening stages of the landcover transition. Please indicate the end members in Figure 4.

(3) There is no single designation for Scotty Creek; please clarify if Scotty Creek Research Station (SCRS) is the same as Scotty Creek, Scotty Creek basin or Scotty Creek watershed. I recommend that Scotty Creek be unified with SCRS or others. In addition, I feel that there needs to be a map of the meteorological and hydrological observations that are being made at SCRS. In particular, a description or table of the four component radiation observations is needed. In Figure 5, it is difficult to understand the changes in the four radiative components without a description of whether they are observations above the vegetation canopy or on the forest floor. Additionally, please show which stage of the conceptual model each letter (a)-(d) corresponds to.ãĂĂ

(4) Lines 106-113: Here the characteristics of the energy balance of the forest canopy are described. However, the difference between wetlands and forests is also evident in the water balance. For example, the amount of precipitation reaching the ground due to rainfall and snowfall interception is smaller in forests, making them more prone to drying out than in wetlands. I think it is important to describe this point as well.

(5) Line 135: Dry peat has been mentioned, but I think it is necessary to mention rainfall interception by mosses and other factors as a cause (e.g., Price et al., 1997, J. Hydrol, Suzuki et al., 2007, HYP). The reason for the dryness of the peat layer is that mosses are thought to play a major role in blocking rainfall. It would be useful to describe the underlying vegetation of the forest, and such descriptions should be added.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-411, 2020.