

Interactive comment on “Simulating the effects of temperature and precipitation change on vegetation composition in Arctic tundra ecosystems” by H. van der Kolk et al.

Anonymous Referee #1

Received and published: 1 June 2016

This paper is well written and logically structured. It presents a study with many potentially interesting insights on the High Arctic permafrost ecosystem dynamics (vegetation competition and succession) in response to future climate change, permafrost thawing, and lateral interaction in hydrology and thermokarst development. However, some major mechanisms behind the processes associated with the interaction between biotic and abiotic factors haven't been clearly demonstrated.

I suggest the issues the paper should address in the following phase. (1) Nutrient availability and mobility. The N availability is determined by the rate of minimization and fixation of N in response to the extent of climate changes. Their net effects determine the nutrient constraint for different vegetation species. In addition, snow is another

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important aspect to influence the subsurface temperature and then the N cycling. The N mobility can be reflected by how dry ecosystems interacts wet ecosystems through water movement. These two issues have not been well investigated in the current modelling work, but they are fundamental in understanding how growth of plant function types are influenced by environmental changes.

(2) The model needs a thorough evaluation in the performance of simulating soil water, evapotranspiration and soil temperature, active layer depth, water table depth for the period the observations are available. This is the basis to convince the readers to believe the efficiency of the model. Particularly, the simulated soil temperature doesn't look correct in the 40, 80 cm.

(3) I suggest use the percentage of increase to indicate the change of precipitation. For this study site, 45 mm/year, (i.e. 20% increase of annual precipitation) seems much lower than the IPCC CMIP5 prediction for the RCP8.5 scenario. For instance, <http://www.nature.com/nature/journal/v509/n7501/pdf/nature13259.pdf>

Other minor issues:

The rate of biomass increase is suggested to use the unit "g m⁻² yr⁻¹".

How the development stages of thawing pond are evolved in different climate scenarios is suggested to demonstrate. For instance, the time series of water table depth in climate scenario runs.

The title should be catchier. The current one seems quite broad.

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-96, 2016.

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