Comment on egusphere-2022-291
Anonymous Referee #2

Referee comment on "Climate Response to Severe Forestation: A Regional Climate Model Intercomparison Study" by Olivier Asselin et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-291-RC2, 2022

In this paper, the authors applied three regional climate models to simulate the biophysical climate response to severe (full forest minus grass) forestation in North America and Europe. It is found that the temperature and other physical variables response is largely consistent between North America and Europe by using the same model – CRCM5. The winter warming in high latitudes has been primarily attributed to the snow masking effect of increased tree cover in needleleaf, while the summer cooling in lower latitude has been found to be related to the increased evaporative fraction (i.e., ratio of latent heat to total turbulent heat flux) due to increased broadleaf fraction. The authors also made detailed comparisons across three different models. I believe the idea is not new, but the authors did provide reliable results and conclusions. The conclusion may provide basis for potential forestation over the North America. Below lists my comments.

1. Parameter uncertainty might directly affect the biophysical climate response to forestation across the models. In particular, the authors show that the WRF-NOAH model is lack of snow masking effect and has a quite different minimum stomatal resistance for Needleleaf and Grasses as compared to the CRCM-CLASS model. I’d like to push the authors one more step to at least discuss the fidelity of the stomatal conductance parameter in these models.
2. The minimum stomatal resistance for Needleleaf in WRF-NOAH is only half of that in the CRCM-CLASS. What is the possible true value or range of the Needleleaf stomatal resistance in the observations? It looks like that the low stomatal resistance in WRF-NOAH directly contributes to the increased latent heat fluxes and precipitation in boreal North America during the summertime. Therefore, discussion on the possible true value of the Needleleaf minimum stomatal resistance parameter is necessary as it may make large influence on the biophysical climate effects.

3. The simulations were analyzed over 1986-2015. The climate initial conditions are different among these 30 years. Does this affect the air temperature and rainfall response signal? What is the inter-annual variability in the air temperature and precipitation response to severe forestation?

4. The winter biophysical climate response to severe forestation over North America has been repeatedly shown for CRCM5 in Fig. 2 and Fig. 5, and the same for summer climate response in Fig. 3 and Fig. 8. Is there a way to reduce this redundancy?