

Earth Syst. Dynam. Discuss., referee comment RC2
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Comment on esd-2022-51

Anonymous Referee #2

Referee comment on "The response of the regional longwave radiation balance and climate system in Europe to an idealized afforestation experiment" by Marcus Breil et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2022-51-RC2>, 2023

This study used regional climate model to simulate the biogeochemical (change in atmospheric CO₂) and biogeophysical (change in land surface characteristics) effects of afforestation over the whole Europe continent. The authors found that the biogeophysical effect dominates biogeochemical effect in regulating surface temperature, and idealized afforestation would lead to a net warming over Europe. This study focused on the analysis of longwave radiation budget change due to afforestation, and found that changes of temperature and water vapor due to biogeophysical effect play an important role in the regional greenhouse effect. I have the following comments:

Lines 79-81: This description is not accurate. For example, the modeling study of Bala et al. (2007) considered the complex biogeophysical effects including changes in longwave radiation, but just did not focus on the longwave radiation budget.

Line 110: Please elaborate a bit on how the spun-up simulation is performed.

Lines 114-115: When the reduced CO₂ concentration is applied to FOREST and GRASS simulations, is CO₂-induced climate change feedback considered?

Line 147: How about climate change induced by CO₂ change? It seems the atmospheric boundary condition does not change with CO₂ change here. This issue should be discussed in detail.

Lines 271-272: '...whether afforestation has in general a warming or a cooling effect on the regional climate in Europe. In order to investigate that, the energy balance at the top of the atmosphere (TOA) is analyzed'. It should be noted that regional climate change also

depends on lateral heat transport.

Lines 332-335: The interpretation of the finding of Donohoe et al. (2014) is not right, and actually does not apply to the lack of CO₂-induced feedback here.