

Interactive comment on “Radiative forcing by forest and subsequent feedbacks in the early Eocene climate” by U. Port et al.

Anonymous Referee #1

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The paper of Port et al. describes modeling experiments designed to put forward the effect of vegetation on global climate. To describe the dependency of their results on initial boundary conditions, they perform the same experiments but starting from the modern climate or from a hypothetical Eocene climate. I did not know this feedback analysis method developed by Gregory, which, I suppose, has been developed in the framework of the global warming experiments. Indeed, the analysis was based on the first 150 years of the simulation (here the authors push the limit to 250 years) and no attempt is done to run the model up to 400 years. As a deep time modeler, it took me times before understanding why they use such short simulations, the reason being tighten to the study of Gregory in which they analyzed global warming experiments. The IPCC climate runs are not defined to be representative of a globally warmer steady state climate as the atmospheric CO₂ concentration is constantly increasing through

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the human activities. Oils and coals production are supposed to stop in the next centuries, meaning that the CO₂ increase should stop in 200 years. During the Eocene, atmospheric CO₂ was probably higher than today but for thousand of years and at the same value. A major question concerns whether the tendencies seen in the experiment as run would have been maintained had the experiment been run to equilibrium, say for 2000 years. Having put their study in context, I would say that the way they simulate the Eocene is misleading. The authors should be more cautious and warn the reader of what they want to do. The paper is well written and well organized except for the part 4.2, which has to be rewritten. As it stands, the cooling effect of the forest when compared to a dark desert world is not at all explained. This is my main major comment. I list my other comments below.

Part 2/ The authors perform three experiments, a forest world, a bright desert world and a dark desert world. They do the same three runs for a) modern conditions and b) Eocene conditions. Main changes are the prescribed ice-sheets, the atmospheric CO₂ level (from 1 to 2 times PAL) but I am not able to say what are the initial conditions? For the PI run, I suppose it is from a CTRL run with 280 ppm and modern vegetation distribution, but for the Eocene, what are the initial conditions, in terms of SST in the ocean? In terms of vegetation distribution? Please modify the text to give those details. Also, are the set of three experiments run from the SAME initial conditions? These details are important as they analyze transient and not equilibrated runs! Hence, the initial conditions are important. P. 1002, l. 17, it seems that the Eocene runs start from an equilibrated run with savannah? Any reference to an already published article

Table 3, how do you calculate the equilibrium temperature change?

P.1008, Fig. 7, While the model generate a warming trend over the latitudes north of 15°N, large cooling trends are visible in the southern hemisphere when replacing a bright desert by a forest, can you comment on this unexpected result?

P.1008 from line 18 to the end, the text is hard to follow, please give more details or

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remove this part. The sentence, line 24-25, is completely enigmatic. At the end, we are left with another paragraph putting into question the hypothesis of a time invariant cloud feedback. And so what . . . I would say?

Part 4.2 – I would suggest to the authors to take more time and to provide the reader with explanations explaining why forest cools the climate when compared to a dark desert. As it stands, no explanations are provided. I found that part really frustrating.

I.13-15, this sentence is strange, I thought that we would see the real effect of the forest on the cloud cover and on the cloud radiative effect as now, there are no difference in terms of albedo. However, the authors affirm that changing from desert to forest does not impact the cloud cover.

P.1010, L.18-26, again, I do not understand. It is related to the poorly written part 4.2 which leaves the reader with no explanations for the cooling effect of forest.

Interactive comment on Clim. Past Discuss., 11, 997, 2015.