

## ***Interactive comment on “Harmonizing plant functional type distributions for evaluating Earth System Models” by Anne Dallmeyer et al.***

**Anonymous Referee #3**

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As requested, I have reviewed the article entitled “Harmonizing plant functional type distributions for evaluating Earth System Models” by Anne Dallmeyer, Martin Claussen and Victor Brovkin for “Climate of the Past”.

In this study, the authors have developed a new method for the biomisation of simulated plant functional type (PFTs) distributions with different global vegetation models. They have tested this method for the pre-industrial, mid-Holocene and Last Glacial Maximum time-slices. This approach, named “PFT-based biomisation” is compared with biome distributions inferred from the classical approach based on the biome model BIOME1 (Prentice, 1992), and with pollen-inferred biomes (0 ka, 6 ka and LGM) and estimates of the potential natural vegetation (0 ka). They evidenced some mismatches between simulated and reconstructed biomes but the results also suggest that the method works

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well for all models and is comparable to the other biomisation techniques used here (Prentice et al. 1992, 2011).

I think that the paper of Dallmeyer et al. is a serious work and presents interesting findings in terms of method and results. The choice of Climate of the Past is, for me, appropriate: even if this paper mainly focus on vegetation models, it is also based on general circulation models. I think this paper is clear, well written and can be published in Climate of the Past with minor changes, which are listed below:

- abstract: must be reworked, it should be more informative on the methods, the results and more precise (method, key results, conclusions) : how many models are used, which is the principle of the method. . .

- introduction: this point concerns the originality of this paper, you need to better justified the objective and the questions of your paper given that at least two biomisation methods exist and work well (Prentice et al., 1992, 2011). The new biomisation method must be more clearly defined.? What is “natural” PFTS (line 36)? Line 44, the ref Prentice et al., (1996) is needed.

-methods -biomisation: line 91: what is mean growing degree days? GDD0 or 5? Please define it. Could you also define the “multi-year mean PFT cover fractions”. Why don’t you use the alpha parameter classically used in Prentice et al (1992, 1996). Line 109: GDD0 exceeds 800°C or to the biome ‘tundra’, if GDD0 is below 800°C: could you explain the choice of these values? -simulations: line 121 “Simulations from nearly all state-of-the-art global dynamic vegetation models”: the exact number of models is needed here as the name of the models. “Overall, eight simulations for the pre-industrial climate (PI) and vegetation, four for mid-Holocene (6k) conditions and five for Last Glacial Maximum (LGM) conditions have been used (Tab.4)”: if I look at tab4, I find 6 simulations for PI, 3 for 6 ka, and 4 for LGM: please check; the format of tab 4 is not easy to read: correct it. Line 140: what is CRUNCEP? -preparing the reference datasets: OK for the 6 ka and LGM but I have a problem with the comparison for the PI

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Period. The comparison with the Preindustrial changes is an important point to validate the results. However, the models use the pre-industrial period as a baseline whereas the pollen-inferred biomes use the late 20th century (modern pollen data used for the 0 ka in biome 6000 have been collected from 1960 to present day, so they don't correspond to preindustrial period). On the same way, in the RF99 dataset, Ramankutty and Foley used a global representation of permanent croplands in 1992, which not represent the PI period. This points of the discussion must be added and discussed in depth (CO2 bias and human impact).

-results: -lines 350-3522: you forget to discuss the increase of the temperate forest in Europe at 6 ka

-discussion -caveats in the method: line 401: the biome warm mixed forest is not only subtropical but also appears in Europe: please correct. Line 432: could you define the "anthropogenic plant functional types"? line 446: you state that the procedure of reconstructing paleovegetation often include modern analogue technique. I don't agree with that. The MAT is used to reconstruct the climate, not the biomes. The biome procedure using pollen follows the biomisation defined by Prentice et al 1996, and Peyron et al 1998. . . using a pollen-taxa -PFT assignment and a PFT-biome assignment which is done on modern samples (0 ka), and fossil samples (6 and LGM) independently. Please correct the text. - biases in the PI. . . , line 455: the classical method of biomising.. a ref is needed here. line 468: could you give more details on the sensitivity study performed by Dallmeyer et al 2017? line 479: NPP ratios, not the acronym. line 483: what do you mean by low score? Its not clear on the fig.

- figures: too many figures! I strongly recommend to group the figures 2 and 3, and also the figures 9 and 11 ; the figures 4 and 8 can be moved to suppl. Material (not discussed in depth and not very useful).

-references : please check carefully your references, some are missing (Dallmeyer et al., 2017; Tian et al., 2017. . .) or not homogenized.

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other points: -in the text, you often write "pollen-based reconstructions" or "reconstructions"; I don't like this terminology because the pollen also is used to reconstruct climate or other : could you replace in the text by pollen-based (or inferred) biomes which is more precise and used. -homogenize in the text: pi, PI, Pi -figures: -fig.1: Could you replace on the fig. "climate limits" by "bioclimatic limitation" and refer in the caption to tab.1 (climate limits) and tab 3 (Min cov. and Climate limits); the 4 simulated PFTs doesn't correspond to the text (p3: desert, forest, wood, grass and total vegetation): please check! -fig.2 and others: could you change the color of grass? The green one is not very clear and can be confused with the temperate forest, orange will be better and commonly accepted by the biomisation community. This fig. must be group with fig 3. -fig.12: Not clear: what is the range of the climate factor? Could you explain better how they are calculated and not just refer to Dallmeyer et al 2017? -fig.15: even if it's explained in the text, its strange to see the biome savanna in Europe and Medit. Area (may be explain better in the fig. caption).

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