

Interactive comment on “Annual changes in plant functional types and their responses to climate change on the Northern Tibetan Plateau” by L. Cuo et al.

Anonymous Referee #1

Received and published: 24 March 2016

In the manuscript “Annual changes in plant functional types and their responses to climate change on the northern Tibetan Plateau”, Cuo et al. investigated the changes of plant functional types (PFTs) and foliar projective coverages (FPCs) on the northern Tibetan Plateau (NTP) during 1957-2009 with an improved Lund-Potsdam-Jena Dynamic Global Vegetation Model, where the simulation of temperature and moisture of the top soil layer (0-40cm) were modified in order to better account for the repeated freezing and thawing cycles on the NTP. By comparing the model simulations under different designed scenarios, they also examined the responses of PFTs and FPCs to changes in root zone soil temperature, soil moisture, air temperature, precipitation and CO₂. According to their results, area experiencing increased FPCs was larger than that

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showing decreased FPCs during this period (34% v.s. 13%). Meanwhile, there was an extensive replacement of temperate scrub grass by perennial alpine meadow. Overall, precipitation played a dominant control on the changes, but the dominant drivers and the responses of different PFTs varied regionally, resulting in spatially heterogeneous patterns of vegetation changes on the NTP. Generally, I find the structure and presentation of the manuscript very clear, and appreciate the importance of investigating the changes in PFTs and FPCs on NTP.

However, as necessary model validation, comparisons with observed PFTs and FPCs were weakly presented or missed. The authors compared the modeled spatial patterns of dominant PFTs with observations based on the eco-geographic map compiled by Zheng et al. and the vegetation map of China by CAS, but they did this with the eco-geographic map by visual comparison without anything statistically (Figure 4), whereas with the vegetation map of China, the comparison results were even not presented. Moreover, even though one major analysis was about FPCs, the author didn't carry out any comparison with the observed FPCs to prove the model's reliability in simulating FPCs on NTP. Therefore, I would suggest the authors (1) presenting PFTs comparisons statistically, such as kappa statistic; (2) presenting the results of the comparison with the vegetation map of China; (3) comparing the model simulations with the satellite-based FPCs products.

I also feel disappointed that the entire analysis was based on model simulations, but this is probably a common way for the community of modellers to perform analysis. Therefore, I won't argue more on that. However, I think that it is more accurate to add "model-based" at the beginning of the manuscript's title, and including more discussions with observation-based studies can certainly spice up the manuscript. For example, rather than simply saying that the simulated change patterns in FPCs were largely consistent with previous study on NDVI and NPP (Line 382-385), the authors could have more detailed descriptions on the trends or responses found in NDVI observations, and discussing what changes in NPP would be expected due to the changes

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in their simulated FPCs, whether those expectations are consistent with the existing studies or not.

Minor Comments:

1. Better to keep consistent when using “carbon” (e.g. Line 48, 54, 550) and “C” (e.g. Line79, 146, 176)
2. Line 262: What method is used for the Interpolation?
3. Table 1: According to this table, the upper temperature limit for photosynthesis (TUP) is –1 degree for temperate needleleaf evergreen tree. Such a low temperature doesn't make sense at all. I hope it was a typo, otherwise it would be worrisome because the authors might get the right result for the wrong reason with the parameter calibration.
4. Table 1: Please complete “temperate broadleaf evergreen” as “temperate broadleaf evergreen tree” or “temperature broadleaf evergreen forest”. The same for “temperate needleleaf evergreen” and “temperate broadleaf summergreen”. Not only in this table, but also in the legends of figures 4, 6, 9 and 10. What the authors put there is not misleading, but seriously “temperate broadleaf evergreen” is not a plant functional type.
5. Table 1: What do you mean by “. . . temperature limit for CO₂”?
6. Table 2: In the last second row, “CO₂” should have “₂” as subscribe.
7. Figure 2, 3: It reads better, if the station name could be labeled for each panel.
8. Figure 4-11: why there is a white band at the left corner of those figures?
9. Figure 5: What does the symbol “+” mean? Significance? Better to explain it in the figure legend.
10. Line 900: “. . . (e). In (e), . . .” should be “. . . (f). In (f), . . .”
11. Figure 8: In panel e, CO₂ should have “₂” as subscribe.

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