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# *Interactive comment on* "Assessing the dynamics of vegetation productivity in circumpolar regions with different satellite indicators of greenness and photosynthesis" *by* Sophia Walther et al.

**Anonymous Referee #2**

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Summary: This paper analyzes the timing of peak vegetation productivity for high latitude treeless ecosystems based on spaceborne remote sensing observations. Satellite data utilized in the study includes: 1) MODIS-based GPP; 2) MODIS NDVI; 2) MODIS-based APAR; 3) GOME2 SIF; and 4) AMSR VOD. The authors find a consistent ordering of peaks: APAR < GPP < SIF < VIs / VOD. The authors conclude that the consistent differences between photosynthetic activity and greenness is an important consideration when using satellite observations as drivers in vegetation models. Overall, I find this to be a nice paper with some interesting/useful findings. I do however have a number of recommended revisions before I can recommend this paper for publication. Most importantly, I highlight a number of ways to potentially improve the



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analysis and better demonstrate robustness of the findings.

Major Comments: 1. The introduction is very well written and does an excellent job of framing the research questions and establishing the importance of the work. 2. The processing of the various satellite observations is explained very well and done appropriately. 3. The authors use a definition of the timing of peak vegetation productivity as “the timing of the annual maximum is defined as the average day of year (DOY) of all days at which the values exceed the 95th quantile of all valid values of the time series in a year in a given pixel.” I question this method as these different data have inherently different levels of daily variability, which could result in spurious dates being included in the period exceeding the 95th quantile of all valid values. I recommend filtering (e.g., using a Savitzky-Golay filter) and then finding the peak of the time series. This would be a good check on the robustness of the main findings of the paper. 4. Additionally, I find the examination of the peak of seasonal activity interesting, but feel it would be complemented by consideration of the start and end of season. Using the above-mentioned Savitzky-Golay filter (or something similar), start and end of season estimates could be easily derived. I recognize this is a lot of additional work and analysis, but I think it could really strengthen the findings of the paper. I put this forward as a recommendation that could strengthen the paper, but this additional analysis is not necessary needed to warrant publication as the current findings of the paper are still very interesting. 5. I think the study would benefit from comparison at any eddy covariance flux tower sites within the study area. EC flux tower-derived GPP data could be used more effectively than modeled GPP to establish which proxies are capturing peak photosynthesis and which are capturing other aspects of plant dynamics (e.g., changes in water content, changes in leaf area, etc.). In particular, this would be useful in establishing whether SIF observations are providing new information more directly associated with plant physiological function. For instance, the authors may find SIF better matches EC tower-based GPP compared to the modeled GPP used in the analysis. This would be very useful information for the modeling community. 6. Page 16, line 15: “Furthermore, the fact that the SIF maximum is reached in close temporal agreement

with air temperature indicates a benefit for photosynthesis from highest temperatures." Without comparing to actual GPP observations (e.g., from EC flux towers), I do not think this is a valid conclusion. There is nothing in this analysis to conclusively show SIF is actually tracking GPP since it is only compared to modeled GPP.

Minor Comments: Page 7, line 15: time should be corrected to "1:30 AM". Page 8, Line 14: grammar error: "and it using such scaling factor may further amplify noise."

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