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Interactive comment on "Assessing the large-scale plant-water relations using remote sensing products in the humid subtropical Pearl River Basin in south China" *by* Hailong Wang et al.

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SC1: Water is one of the critical resources to sustain the rapid socioeconomic development. Vegetation cover is high and most of them is evergreen subtropical species, which means there could be substantial water consumption by plants throughout the year given the favourable climate. Water and ecological management faces increasing challenges because of the rapid population growth, high urbanization and industrialization, etc. Therefore, this is a timely study to investigate the intensive changes and interactions between vegetation and water. The most interesting part of this study, to me, is the identification of the 'hotspot' of changes and determination

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of water-limiting-vegetation even in this rainfall-abundant region. The m/s is well structured, the wordings are fine, and method/analysis are appropriate. In my view, this study is meaningful and worth publishing. Having said these, I do still have a few concerns listed below for the authors to address: AC: We thank Prof. Zhang for the encouraging comments on our manuscript, and we are glad to know that the main points of our manuscript were recognized. SC1: 1. I find the summary of the water-plant relationships in Line 61-69 is quite interesting. Vegetation consumes water and causes reduction in water resources on the one hand, and water availability will restrict vegetation establishment and growth on the other. Indeed, plant-water relations are examined mostly in arid and semi-arid regions for the purpose of water and ecological conservation. Are there such studies in humid and semi-humid regions investigating the controlling factors – energy vs. water - of vegetation growth? It is important and is the authors responsibility to ensure a thorough literature review on this subject. AC: The possibility of different vegetation-water relationships under contrast climate conditions is the motivation of this study. Since most such studies focus on drylands because of the water scarcity, we would like to know what the relationship is like in wet/humid areas. Although there have been studies in humid areas investigating environmental controls on plant water use (as you may find in other part of Introduction and Discussion 4.3), they focused on plot/stand scale mainly, not a catchment scale. SC1: 2. A brief paragraph should be added before Line 74 for an introduction of relevant studies that have been carried out in the Pearl River Basin. Without this, it is a bit out of blue to see the next paragraph suddenly mentioning something in this basin. AC: Thanks for the suggestion. A short paragraph has been added, please refer to Line 73-80 in the revised version, and the Study area section in 2.1 has been edited accordingly. SC1: 3. Regarding the data: I see a comparison between GLDAS precipitation and the ground truth data over a number of pixels given in Fig. 11. GRACE data from different processing centers are also compared. No comparisons/discussions are given for ETp and other variables. Can you find some studies in this basin or a basin with similar vegetation cover and climate that use GPP

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from MODIS? If there is any, it'd provide more confidence in the results of this study. AC: Data uncertainty is a concern indeed, and some discussion has been given in section 4.1. Here we did not compare ETp, NDVI and GPP from variable sources, but just chose ETp from GLDAS, NDVI from GIMMS3g and GPP from MODIS, because during literature review, we found these three data are applied widely and commonly among studies, which would benefit comparisons between this study and others. Additionally, we provide two supplementary figures to show the comparisons of GPP based on multiple datasets. Justification is described in Line 130-139 and 261-275. SC1: 4. The current m/s is a complete story by overlooking the water-vegetation relationships in the entire basin in space and time. It is good to locate the hotspots of changes and interactions because these areas would usually be the 'focus' of land/water management and for risk control, etc. I recommend the authors to take a further step to investigate the reasons behind the changes and interactions right in these hotspot areas. AC: Thanks for the comment and suggestion. We are actually taking this hotspot out as an individual project in order to investigate in depth what drives the intensive changes of vegetation index and productivity in these areas. This study explains it from the perspective of water resources and climate dryness, and we will further explore the role of planting structure, agricultural management (including irrigation and fertilization), droughts, etc. Therefore, we decided not to extend further in this manuscript. SC1: 5. Paragraph ends with Line 279: This is a good argument that vegetation relies on water because of the lags of vegetation parameters after water input & storage dynamic change. However, there seems a lack of support to the opposite standing, i.e. vegetation growth does not result in excessive water reduction. So this part of discussion needs a further expansion. AC: From the phase shift between water (P & TWS) and vegetation growth (NDVI) at the monthly scale, we concluded that water limits vegetation growth in this region because the latter varies following the change in the former. The opposite possibility, i.e. vegetation water uptake leading to storage reduction cannot be detected at the investigated time scale but might be more evident at a shorter time scale like sub-daily in Kirchner et al., (2020) and Shen et al.,

(2015), who found decline in groundwater level/soil water content with increase in sap flow rates. Statement has been given in the relevant location in the text. Kirchner, J., Godsey, S., Osterhuber, R., McConnell, J. and Penna, D.: The pulse of a montane ecosystem: coupled daily cycles in solar flux, snowmelt, transpiration, groundwater, and streamflow at Sagehen and Independence Creeks, Sierra Nevada, USA, Hydrol. Earth Syst. Sci. Discuss., 1–46, doi:10.5194/hess-2020-77, 2020. Shen, Q., Gao, G., Fu, B. and Lü, Y.: Sap flow and water use sources of shelter-belt trees in an arid inland river basin of Northwest China, Ecohydrology, 8(8), 1446–1458, doi:10.1002/eco.1593, 2015. SC1: 6. Fig. 2-5, 7: the spatial distributions of these variables/trends are shown for all pixels. How would it be like if only the ones with $p<0.05$ are shown? AC: We meant to show the pixels with $p<0.05$ initially, but eventually decided to show all. In the revised manuscript, we have labelled the pixels with NDVI to show clearly the hotspot of change. The reduced number of pixels with $p<0.05$ can be a result of spatial resampling of data from a finer resolution to the current 0.5-degree resolution.

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2020-242/hess-2020-242-AC1-supplement.pdf

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