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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Canopy-scale biophysical controls of transpiration and evaporation in the Amazon Basin" *by* K. Mallick et al.

Anonymous Referee #1

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Review Mallick HESS Major comments My main concern is that the manuscript does not present any new theory (and on top of that uses an approach (STICS) that in my opinion is misguided, despite the fact that it has been published). STICs is misguided because it ends up with an aerodynamic conductance that does not depend on wind-speed and introduces a soil moisture stress term that only depends on atmospheric variables. The paper then uses Amazonian micrometeorological data to compare a range of gA and gC terms. No measurements of gC are used to provide verification. A large number of plots are then presented where STICS variables are plotted against meteorological variables in a host of different ways. I am not surprised to see that these dependencies exist as all of them are intrinsic to the model. Also, because all of them

are interdependent I am not sure how much realism there ultimately is in the findings. Furthermore STICS assumes that T0=TR and yet the manuscript does not mention the potential implications of this assumption, nor the fact that considerable errors can be made when measuring TR. In the end I feel I have learned little new and what has been presented is tentative and therefore potentially misleading. This is underlined by sentences (line 325-329) such as "The evaluation of the conductances and surface energy fluxes indicates some efficacy for the STIC derived fluxes and conductance estimates ..... As a result we feel some justification for exploring the canopy-scale biophysical controls on λET and λEE generated through the STIC framework".

Detailed comments Line 81-82: "An intensification of the Amazon hydrological cycle was observed in the past two decades characterised by increased temperatures and more frequent droughts and floods" How are increased air (?) temperatures directly linked to hydrological cycle? If it is surface temperatures then say this, but this would mean a decreased ET (hence the floods?) Line 86: "the Amazon forest may become an increasing carbon source". Should this be " increasingly become a net source of carbon? Line 97-104: I disagree with the final point made in this section: GC does not include the conductance relating to bare soil. If you would have called it the surface conductance instead and defined it via the PM Big leaf equation I would have agreed. Line 111-126 are stating the obvious. Where is this going? Line 136: Why is the partitioning between soil evaporation and transpiration deemed so important in the Amazon? Soil evaporation must only make up a small part of total ET. Will this soil term affect flooding, atmospheric circulation etc. I highly doubt this. Line 141-143: "Given the persistent risk of deforestation, the ecophysiological changes of different plant functional types (PFTs) are expected to be reflected in gA and gC and λEE and λET". I really do not understand what is meant by this sentence. Line 154-157: The surface temperature is already implicit in the PM equation as it combines the energy balance with bulk transfer equations. Line 179-181: "The retrieval of gA, gC, and λE are based on finding a 'closure' of the PM equation using the STIC framework". In my opinion, the PM is already closed, see my point above. It calculates ET from Rn-G, and

H is implicitly in there. Please study books such as those by Hamlyn Jones to see how PM equation is derived. Line 184: This should be 'radiative temperature'. Line 203: You have now tacitly assumed that T0 = TR. There is a host of literature references that will tell you otherwise. Line 204-205: PM equation is already closed. This assumption of energy balance closure is implicit in its derivation. But maybe I do not understand what you mean by this statement. Line 225-227: "The estimates of λEE in the current method consists of aggregated contribution from both interception and soil evaporation, and no further attempt is made to separate these two components". This is a considerable weakness in the approach seeing leaf area index and hence interception is so large for large parts of the Amazon and soil evaporation will be negligible. You are making this point yourself a few sentences later (line 232) Also: these two types of evaporation fluxes take place at very different source heights, so their GA will be very different, further weakening your approach. Line 285: "The conductances showed a marked diurnal variation expressing their overall dependence on net radiation, vapor pressure deficit, and surface temperature". What conductance are you referring to here? gA or gC? Or both? Note that gA generally does not depend on net radiation or VPD etc., although it does in STICS.

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