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Interactive comment on "Description and Validation of the Simple, Efficient, Dynamic, Global, Ecological Simulator (SEDGES v.1.0)" *by* Pablo Paiewonsky and Oliver Elison Timm

Anonymous Referee #3

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The paper entitled "Description and Validation of the Simple, Efficient, Dynamic, Global, Ecological Simulator (SEDGES v1.0)" by Pablo Paiewonsky and Oliver Elison Timm describes a simple vegetation model SEDGES that is suitable for coupling to climate models with intermediate complexity. This model builds on SimBA model, but with modifications on representing gross primary productivity (GPP) mainly by including plant regulation of canopy resistance via coupling of light-dependent photosynthesis and transpiration. The SEDGES model also includes the dependency of bare soil albedo on soil organic carbon. Model predictions on the productivities (i.e. GPP and NPP) and properties (i.e. LAI, vegetation carbon) of vegetation, the properties of soil (i.e. soil albedo and carbon storage), and variables relevant to hydrological cycle (i.e.

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ET and runoff) have been evaluated against various datasets. Generally, I found that the model description is clear. Their idea on developing simple Land Surface Models (LSMs) is welcome and should be encouraged, given that the current complex LSMs introduce large computational burden and untraceable to the key processes underlying experimental results.

My major concern is that the improvement of model performances between SimBA and SEDGES is not clearly demonstrated. Since SEDGES builds on SimBA, to emphasize the value of this work, the advance of SEDGES needs to be well manifested. For example, the authors show particularly well-simulated GPP, but it is not clear how much SEDGES improves the representations and simulations of GPP in SimBA. In other words, whether this well-simulated GPP is due to the incorporated processes in SEDGES, or due to the original framework set up in SimBA model? The authors need to prove that SEDGES indeed improves the GPP simulation compared to that from SimBA. Maybe adding the SimBA simulations in those relevant figures is the easiest way to illustrate. It will be even better if the authors could provide a short summary of how GPP is modeled in SimBA.

Similarly, the authors state that SEDGES improves most of the parameterization of SimBA, but again it is not clear whether or not those modifications of parameterization indeed improve SimBA simulation. The lesson we learnt from current LSMs tells us that increasing the complexity not necessarily guarantees a better model performance.

Therefore, I am also concerned about the trade-off between realism and simplicity. To balance this trade-off with the purpose of improving the reliability and robustness of models, the added processes or modified parameterizations need to be proved as necessary for improving the reliability of the model. Otherwise, those modifications on parameterizations follow the same routine as the current complex LSMs being developed. Moreover, the simplifications also need to prove as reasonable. For example, the ratio of ci/ca in Equation (6) is considered as a constant, but has been shown that the optimal stomatal behavior allows ci/ca decreases with VPD, increase with temper-

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ature (e.g. Prentice et al. 2014, Medlyn et al. 2011, Lin et al. 2015). The variation in ci/ca seems quite important in terms of capturing the spatial pattern of GPP (Wang et al. 2014). This simplification needs a justification.

Some minor comments on equations of GPP:

I think it is ci (the intercellular CO2 concentration) that really matters in CO2 fertilization. If you consider ci for water-limited GPP in Equation (6), why not here for light-limited GPP?

Typically, modeled LUE (not only fAPAR) is represented with a dependency on vapor pressure deficit, why the equation here does not include such an effect? Is it implicitly considered via the coupling with water-limited GPP?

References

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