Referee #1

[Comment]

The authors carefully addressed the comments and largely clarified the technical details of model development and eliminated some inaccurate statements in revising the manuscript. The added sensitivity analysis and visual comparison to some published yield dynamics are very helpful. Overall, the paper is much improved.

Yet, there is still one key component of the new oil palm model, that is, leaf phenology (initiation and shedding scheme), requiring additional care.

First, just as the authors mentioned natural tree mortality is not applicable for oil palms (L330), the natural leaf shedding scheme implemented for TBE trees in ORCHIDEE from Chen et al. (2020) also does not really apply to oil palms. Trees have numerous small leaves with various timing of initiating and shedding throughout the canopy. But palm's canopy is highly stratified and the ~40 big leaves and their leaflets are highly lignified, which do not shed naturally even after full senescence but are removed by plantation managers with regular pruning at the bottom layer. The big leaves each grows 1.5-2 years in sequence from the top to bottom (note the leaflets of each big leaf are of the same age and phenology). More details about oil palm's monopodial morphology and its difference from tree phenology can be found in Corley and Tinker (2015). Therefore, the leaf shedding scheme of four leaf age cohorts (eq. 2 and 3 in Chen et al.) that pertains to natural trees may not apply to oil palm. It is also not convincing that the instantaneous meteorological drivers (like weekly VPD, L196-198) could drive oil palm's canopy phenology given the long-term development of each big leaf. Instead, the extra leaf loss mechanism (L322-326) at the time when the oldest phytomer is manually pruned (Eq. 10) could be the more proper leaf shedding scheme for oil palm than the Chen et al. (2020) scheme. So in Figure S8, why not test excluding the VPD-triggered leaf shedding mechanism but using only the pruning mechanism (oldest phytomer) for oil palm? That's why I commented about avoiding double accounting of leaf litterfall flux especially when VPD-triggered leaf shedding may not exist for oil palm in the real world.

Similarly, the assumption that new leaf allocation (fleaf) is related to SWdown and the light transmission of old leaves (eq. 1 in Chen et al.) may not be suitable for oil palm, because palm's old leaves are always at the bottom of canopy and do not affect light availability to new leaves which are always at the top. So the authors should at least note in L196-197 (track change file) and/or in discussion the limitation of this leaf allocation mechanism for oil palm.

Although the current model can reasonably capture the multi-site LAI, GPP, NPP, biomass and yield dynamics, it does not yet represent oil palm's unique canopy phenology which governs canopy photosynthesis and transpiration and related water and energy fluxes, though leaf carbon pool is small, and may affect other aspects of the LSM. Since the paper lacks calibration and/or validation on simulated leaf litterfall, it is hard to tell whether the leaf phenology and litterfall flux simulated with the Chen et al. (2020) mechanism matches observations. Parsimonious model development is important, but when some unsuitable mechanisms from trees are used for palms, there may arise additional uncertainties in modeled fluxes at the diurnal, seasonal, or interannual time scales (especially if this model will be evaluated with eddy covariance fluxes in the future). The distinct age classes of oil palm and the age-based parameterizations for photosynthesis and autotrophic respiration dynamics is an important advance in this model, and this feature could perhaps be utilized without including the whole leaf phenology schemes that are designed for nature trees. In sum, the VPD and SWdown triggered leaf shedding and initiation schemes from Chen et al. should be reconsidered for its applicability to oil palm, given its distinction from "trees".

[Response] We thank the reviewer for the careful review again and suggestions on the leaf initiation and shedding scheme. In fact, based on the reviewer's comment in the last round, we already separated the two leaf shedding schemes as independent modules. Thus, it is flexible for the users to activate either scheme.

Accordingly, we added discussion about uncertainty and limitation of the implemented leaf phenology in Section 4.2, Lines 525-533, "In our model, we adopted the leaf phenology scheme from Chen et al (2020), which is preliminarily developed for tropical forests. We also added an extra old leaf turnover at the time of oldest phytomer pruning according to the regular management practice of phytomer pruning. However, whether the leaf initiation and leaf shedding schemes are suitable for oil palm requires further investigation, and more field evidence and control experiments are needed to reveal the mechanism of leaf shedding. Because of the limited understanding of oil palm leaf shedding mechanisms other than leaf removal along with phytomer pruning, these two leaf shedding schemes were both implemented in our model. Either or both schemes can be easily chosen using an external switch (pruning- or VPD-triggered leaf shedding scheme or combined). With more field observations become available in the future, the model is flexible to adapt the emergent mechanism, but some parameter calibrations may be needed."