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Interactive comment on "The carbon cycle in Mexico: past, present and future of C stocks and fluxes" *by* G. Murray-Tortarolo et al.

Anonymous Referee #2

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The paper addresses a set of straightforward questions and goals within a modelling and data assimilation framework regarding the Carbon cycle in Mexico. It aims at providing nationwide estimates of carbon stocks (vegetation and soils) and investigates how gross primary production is affected by land and climate changes relaying on the experience of a robust modelling and data assimilation community. It is very appealing to see an effort for estimating nationwide values of gross primary production as it invokes mechanistic comprehension between land processes and climate variability; however the paper fails on giving confidence on how land data information for parameterization was utilized. Despite that several data sources are acknowledged, I have a hard time understanding how such information was implemented in the data assimilation scheme and in particular how Mexico's unique features where considered. I believe the reader will be benefited if the authors give a brief but significant description

C7034

of Mexico's singularities regarding carbon cycling (i.e. orographic features and strong seasonality to mention some). This would be of value to construct a stronger discussion that lays out paths to constrain this initial numbers in further efforts and might poise the study as an example useful to generalize on C Cycle processes in complex and dynamic terrains (i.e. expand arguments on Page 12505 L14-21). Two issues are of particular concern: 1) For the Model Tree Ensemble (MTE) authors need to specify what type of flux data was used since this is central to this product and gives mechanistic description, while Mexico's flux data is just starting to arise in the literature. 2) Since an important argument in the manuscript is the effect of temperature on C cycle via effects in heterotrophic respiration (Rh) the authors need to be more specific on how Rh is calculated and incorporated in the MRT estimates since this parameter is central to assess variation through time. Although the numbers presented in the discussion for particular land covers are somewhat consistent with the very little field evidence that they compare with, the uncertainty due to the coarse resolution of the modelling scheme remains significant and the paper itself provide little information on the particular strengths and weaknesses of their approach. Insights to pay attention to this issues comes when we see the discrepancies in the estimates for the "drylands" (a term preferred over grassland for this cover type) which accounts for a large portion of the land cover in the country, for almost half of the GPP, that is very sensitive to drought as expressed in this study). As such the paper will be benefited by arguments on means for improvement, for example the use better data sources that are certainly available in Mexico (i.e. INEGI/CONABIO cartography to establish land covers among others). I celebrate the effort to zoom in into Mexico's unique and relevant role in the C cycle with this modeling scheme and invite further efforts to constrain the dimension of stocks and fluxes with new and available country's since, no doubt, knowledge to generalize in carbon cycle processes for tropical, subtropical and drylands would benefit our understanding of global patterns as we face climate change.

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