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Interactive comment on "Influences of calibration data length and data period on model parameterization and quantification of terrestrial ecosystem carbon dynamics" *by* Q. Zhu and Q. Zhuang

Anonymous Referee #2

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GENERAL COMMENTS

The selection of the length and information content of the experimental data series used in model evaluation is a critical step since it has strong influence on the model performance. Thus, methods for identifying critical time periods in the observations, which contain most of the information for parameter identification, can provide useful guidance when selecting the evaluation data series. However this issue is not new and has been explored in some detail in previous studies including recent work (Bárdossy and Singh, 2008; Bennett et al., 2013; Singh and Bárdossy, 2012). From the

conceptual understanding of the model calibration framework (ultimately reducing the error between observed and predicted values and the uncertainty of the parameter estimation), it becomes clear that the issue at play is not the length of the data series as presented by the authors (and contained in the title), but rather the variance (information) contained in the observation period used for calibration. It follows that for sites (i.e. ecosystems) with high intrinsic inter-annual data variability the requirements of data length are different than for sites with relatively low variability. The paper aptly illustrated these expected results and their limited site-specific value. However. It does not seem to significantly advance the core issue of "when is enough enough?". I was hoping to find a more general analysis of observed variance thresholds that could serve as the basis to identify the data length needed for a specific site (e.g. the variance contained in each period length for a specific site would be compared to the required variance threshold to identify the minimum length required for each site). As mentioned above, there are recent and more quantitative treatments of this problem in the recent literature that the authors missed in their review, and that should serve as a starting point for this work (Bárdossy and Singh, 2008; Bennett et al., 2013; Singh and Bárdossy, 2012). Without this, in the opinion of this reviewer the novelty (scientific significance) of the work in the context of general model development is in question.

Another important issue of this study is the dissimilarity in length of experimental records available for the different ecosystem monitoring sites analyzed (from 4 to 17 yrs). These differences will likely hinder the representativity of the results and the comparisons across these ecosystem types. Again, the observed variance captured at each site can grossly vary with the length of the monitoring record, and in turn this will depend on the intrinsic characteristics of each ecosystem type (some ecosystems exhibit larger variability in canopy and productivity than others). If so the comparisons presented among the ecosystem types are questionable, and possibly misleading. In the absence of a more generalized treatment of the data sufficiency problem, the specificity of the results presented, and the grossly different data records available across the ecosystem monitoring sites studied, I find difficult to support the authors claim that

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"the study shall also benefit the ecosystem modeling community in using multiple-year data to improve model parametrization and predictability".

I also find The selection of the RMSE as a calibration performance statistic of limited value without the use of a complementary relative value statistic. While RMSE provides a magnitude based error between the observed and predicted quantity, its minimization it does not ensure that the end point of the calibration is satisfactory. Instead, this requires a benchmark or minimum error threshold that is considered acceptable for the particular output. For example, in this study (Fig. 2) minimum RMSE across sites vary between 4 and 8 gC/m2-min and the maximum 14-25 gC/m2-min. These values are quite different and so, what would be an acceptable calibration and why? Many studies suggest that this magnitude-based indicator (RMSE) be complemented by a relative statistic that compares the model error to the variance of the observed data, or against a desirable/accepted benchmark (see for example recent discussions of Bennett et al., 2013 ; Ritter and Muñoz-Carpena, 2014).

In summary, in the opinion of this reviewer the content of the paper does not match the expectations raised by the title, as presented is of limited novelty and general application compared to existing modeling work in other fields, and contains methodological issues (length of records and incomplete performance statistics).

SPECIFIC COMMENTS

Pg. 5, ln. (6847+)23, change "potion" to "portion". Pg.8, ln. (6849+)3, remove "the" in "we provided the both mean" Pg.8, ln. (6849+)11, re-write "performance... were mainly resulted from..." Table 2, figures and text. For consistency refer to the sites by the ecosystem type as in Fig. 6-7, rather than by site type (rest of figs. and parts of text). Table 2 contains the correspondence between them.

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