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Interactive comment on “Methane emissions associated with the conversion of marshland to cropland and climate change on the Sanjiang Plain of Northeast China from 1950 to 2100” by T. Li et al.

Anonymous Referee #3

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General comments:

This manuscript provides a biogeochemical analysis for an interesting land-use transition in the Sanjiang region of China, during the conversion from wetlands to rice agriculture during the past five decades. While the area and time period in this study are interesting, the paper would greatly benefit from improved clarity in several areas. Although the introduction provides an excellent literature review for why wetlands are biogeochemically important, the authors should introduce some mechanistic hypotheses or questions at the end of the introduction to help motivate their analysis.

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There are also several areas of the Methods section that are difficult to follow and/or overly vague, primarily: 1) The theoretical distinction between what the authors call the “regional” budget in comparison with the “area-weighted” budget, and the motivation for this distinction, 2) The description of the empirical water table model and how this was projected under future climate scenarios, 3) The passing references to calibrating models without a rigorous description of the procedure used to do this, and 4) In what situations the CH4MOD versus CH4MOD_wetland model was used in the calculations. All of these sections must be clarified in order to improve the comprehension of this analysis for readers.

Specific comments:

1. The authors should improve the end of the introduction by introducing some motivating questions for the analysis. They might move the mechanistic descriptions in Section 3.3.1 to much earlier in the paper.
2. The distinction between the “regional” budget and “area-weighted” budget that the authors introduce in Section 2.2.3 is confusing. For example, on line 188, the authors state “the concomitant impact of marshland conversion could not be isolated” and in the next paragraph on line 200, “we sought to isolate the impact of marshland conversion.” This needs clarification.
3. The description of the empirical water table model needs to be much clearer and more specific. Why are the authors using Wetland DNDC, another biogeochemical model, to simulate the water table? The authors mention using both the Priestly-Taylor and Penman-Monteith ET formulae; how did they obtain net radiation or ground heat flux for these calculations? Was this compared to any field data for validation? How was the water table simulated under future climate conditions, where net radiation and ground heat flux might change? The authors mention calibrating the model by “trial and error” but this needs to be much more specific – what criteria were used to determine appropriate parameters?

4. There should be a few more sentences about the field data that the authors are using to validate their model. How were the data collected? On line 312 the authors refer to “273 datasets” but I assume they mean 273 datapoints, or something like that.
5. At the end of Section 3.3.2 of the discussion it is difficult to follow the authors line of reasoning to their conclusions. I think that some of this difficulty stems from the fact that the distinction between the “regional” and “area-weighted” budgets are unclear.
6. In Section 3.4.1, the authors describe a trend in the projected precipitation values that is not apparent, as there appears to be large precipitation variability in the future. If they are comparing the mean precipitation during this time period to the present, the means might not be significantly different, and the authors should think about incorporating some method to analyze future variability in precipitation rather than the mean value.

Technical corrections:

1. Line 136: In the citation “Tayler” should be “Taylor”
2. p. 5894 Equation 3: If the factor of 10^9 is simply units conversion, it might be left out of the equation.
3. Line 248: Should indicate the amount of increase in agricultural area from the cited reference
4. Figure 4: does the category ‘Upland’ refer to agriculture, or just a catch-all for everything else?
5. Figure 6: It would be better to choose a symbol rather than a column to represent the decadal mean
6. Line 417: “meadow” isn’t really a soil type
7. Figure 5a: y-axis has a typo

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