

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 #1

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The authors intend to estimate methane emissions associated with marshland conversion to cropland and climate change in Sanjiang Plain of Northeast China for the period from 1950 to 2100 by using two biogeophysical models. The CH₄MOD model was used for simulating methane emission in paddy soils and CH₄MODwetland was used for natural wetland. The main conclusions include that 1) marshland conversion and climate variation resulted in a significant reduction of 1.1 Tg/yr during 1950s-2000s, and 2) future climate warming and wetting would lead to large increases in CH₄ emission in this area. Such a research topic is clearly of interest to scientific community and

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policy makers, but I have a number of significant concerns regarding the models, data and hence the conclusions:

Below are some major concerns:

- 1) The modeling approach used in this manuscript is unable to simulate how marshland conversion processes affect methane emission, which could largely influence direct methane emission during the conversion process as well as indirect methane emission after marshland conversion.
- 2) Marshland may be converted to different types of cropland such as rice, corn, soybean, etc. The magnitude of methane emission is largely dependent on the fate of marshland conversion. For example, methane emission may decrease while marshland converts to corn or soybean. The conversion from marshland to dryland such as corn and soybean cropland needs to be considered for assessing methane emission associated with marshland conversion.
- 3) The spatial extrapolation method used by the authors is county-level simulations, which could lead to large uncertainty. Spatially-explicit process modeling and spatial data with fine resolution are needed to estimate methane emission in this area. I suggest using gridded environmental data as model input.
- 4) The authors did not provide detail description of how their simulations generated the baseline methane emission in the 1950s. Additional details on simulation initialization are needed in order to evaluate model performance
- 5) Estimates on methane emission with CH₄ model are more uncertain than those of the basic carbon cycle. For example, what are uncertainties associated with major parameters, marshland area, and spatial resolution, etc. I strongly suggest performing uncertainty analysis associated with marshland conversion and key parameters.
- 6) For the future projection, I would clearly state the assumptions and caveats of the study. The manuscript leads you to believe that climate change will be the biggest

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driver of methane, where in many instances other anthropogenic drivers such as land-use change and agricultural management could have a far bigger effect.

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