Geoscientific
Model Development
Discussions

Interactive comment on "Modelling methane emissions from natural wetlands: TRIPLEX-GHG model integration, sensitivity analysis, and calibration" *by* Q. Zhu et al.

Anonymous Referee #1

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General comments: This manuscript is very interesting because the authors have developed a CH4 emission rate model for wetland, based on the main biogeochemistry processes including CH4 production, oxidation, and transportation processes reported by other previous studies. Several important factors that control CH4 emission processes, such as soil temperature, redox potential, and pH, were incorporated into the model. Sensitivity analysis was carried out using the data collect at Stordalen and BOREAS SSA sites and the results indicated that the release ratio of CH4 to CO2 (r) and Q10 for CH4 production were two major controlling factors in CH4 emission modelling. The data derived from the literature at 19 sites across different geographical regions were used for model validation. The results showed that the model developed

in this study was successful in capturing temporal variations in CH4 emission even though daily details or emission peaks were poorly caught. The authors also pointed out some factors (methanogenic microbe population and a large data set from site specific observations) should be taken into account in the future study. Thus, the CH4 emission model developed in this manuscript can be applied to different wetlands under varying conditions and used to improve the capacity of CH4 emission prediction in wetlands systems. However, there are some spaces for improvement in the current form of this manuscript. For example, the advantages and disadvantages of the model in this study should be specified when comparing with the previous studies. It would be better if more description of model equation, unit of variables, and time scale of modeling were given. I recommend a minor revision before acceptance for publication. I present my specific comments below.

Specific comments: Abstract Line 1-7 on page 5425: please describe the CH4 emission model directly rather than TRIPLEX-GHG, because CH4 emission model development, sensitivity analysis and model test are the main content of the study.

Introduction Line 4 on page 5426: add "past" or "last" before "decades". Line 5 on page 5426: add "across different scales" after "wetland emission".

Model description and key processes Line 16-23 on page 5430: please give the unit of all variables in the equation (1), also other equations. Line 11-12 on page 5431: please add a formula to express the CH4 emission or flux. Line 15-19 on page 5431: the sentence is redundant. Could please merge it into the next sentence. Line 21 on page 5431: please specify "hydrological regimes". Line 7 on page 5432: add "when temperature is" before "below zero".

Results Line 9 and 15 on page 5439: please add references after "pervious studies". Line 15-16 on page 5439: change the "Two sites were selected (Stordalen and BOREAS SSA, Table 1) for sensitivity analysis testing" into "Two sites (Stordalen and BOREAS SSA, Table 1) were selected for sensitivity analysis testing". Line 17 and 22

on page 5439: please use symbols consistently, such as r for the release ratio of CH_4 to CO_2, I for sensitivity index. Line 7 on page 5441: add reference after "these two regions". Line 9 and 10 on page 5441: add "annual" before "CH_4 emission". Line 9 on page 5445: change "was" into "were".

Discussion Line 2 on page 5447: please present details in advantages and disadvantages, or difference compared to other models. Line 8-12 on page 5450: please move the paragraph to the end of data input section, where explain this study mainly concentrated on CH_4 emission simulation.

Table Table 3 : please explain why r values were set a large range to 1.5, which is about 8 times than baseline (0.2). Table 4: "Q10 parameters" for what? CH_4 production?

Figure Figure 3: please give the definition in X coordinate, I think they are sensitivity index? Figure 4-8: please give legend of line and explain RMSE in the text.