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Interactive comment on "Spatio-temporal variability in N_2O emissions from a tea-planted soil in subtropical central China" *by* X. L. Liu et al.

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Response to comments of BGD-12-C182-2015

General comments of Referee #2: 1. This manuscript tried to reveal spatio-temporal N2O emission from tea field in central China. I agree the topic is important and the intensive field measurements are worth to publish. But, also, I think the topics and methods (empirical approaches) are not entirely enveloped in GMD scopes. In addition, there are not enough information for material and methods. And I found some fatal flaws and misunderstandings in your statistical analysis manner. So, I cannot recommend publishing in GMD. 2. This manuscript concluded the range of spatial dependency of N2O emission was 0.41 m (by the sum-metric model according to Abstract and Discussion), however, the intervals of spatial sampling was 1.0 m. This result sug-

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Discussion paper

gested just "don't apply interpolation by kriging to N2O emission in this field" in your best model. And, I have a particular concern about how to fit and choice the semivariogram models (i.e., spherical, Gaussian, exponential, linear...). We need an objective criterion for the selection of the semivariogram models. There are no detail descriptions in this manuscript. For example, in figure 5 (a), it seems to use zero-nugget parameter model (we are not sure about how to do here.). But, the fitted line obviously failed to trace the variogram both in the original and residual. Even in the residual of linear model, the assumption of zero-nugget model is too strong for any models especially in this insufficient resolution in sampling scheme (especially for spatial). I think any models (separable, metric, product-sum, sum-metric) didn't work here. 3. From the other aspect, the linear model (i.e., M(s, t)) have a bigger issue to apply this framework. The covariate Position had a storing spatial information and structure, even though this is (may be) categorical variable. Since it seems not to apply simultaneous inference for M(s, t) and V(s, t), so M(s,t) unintentionally includes much spatial structure. In addition, there no information for explanatory variables (what is full model? What is "Position") for the linear model in material methods. You have to consider autocorrelations in the regression model (eq. 22). In this paper, authors revealed spatial and temporal dependencies in N2O emissions by geostatistics. So, the degree of freedoms in your regression models are overestimated, compared to actual values. The sample (N = 2880) is not independent. 4. For the model comparison, you should use 'information criteria' instead of goodness of fits (i.e., RMSE, ME, R-square). Simply, the goodness of fits increases with increase of number of parameters. 5. P17L9 and Figure 4 cannot support the decision for the transformation of data. The residual of linear models is key information for whether to transform data or not.

Authors' Response: We highly appreciated the comments made by the referee #2. 1. No, we disagree. This study contains the comparison of four spatio-temporal semivariogram models (e.g., the separable, product-sum, metric and sum-metric), and the application of spatio-temporal regression kriging method, and fits well within one of the aspects of the scope of GMD: technical aspects of running models. 2. We find the ref-

eree made a wrong statement about the intervals of spatial sampling used in our study. Actually, the Euclidean distances between each point and its nearest neighbors ranged from 0.15 to 0.27 m, and please see Page 8, Line 20-24 in the manuscript for details. Therefore, some interrogative assumptions in the application of spatio-temporal semi-variogram models made by the referee are not correct. 3. “position” denotes chamber placement positions or gas sampling positions, including the inter-row position, fertilization point, under the tea tree and in the tea tree row. Please see more detailed information in Page 8, Line 17-24 in Materials and Methods and in Fig. 1e in Page 37 in our manuscript. 4. Yes, we agree. “information criteria” will be used in the revised manuscript. 5. Yes, we totally agree. In this study, the residual of linear models is approximately normally distributed, which was not described in our manuscript.

Individual comments of Referee #2: 1. P2 L13 Log-transformation cannot deal negative values. There is no information for the treatment of Negative values in this procedure. 2. P2 L14 "Position" is not defined in this abstract and material & methods. 3. P9 L5-10 2 time’s gas sampling is not recommended for flux estimation in closed chamber methods from the view to "chamber effect". This resulted in the underestimation of N2O emissions. 4. Table 3 RMSE and ME are not "dimensionless". 5. Table 3 ME in Metric may be a wrong value. 6. Fig 3 Not appropriate visualization for spatial temporal data.

Authors’ Response: 1. In this study, the original data of N2O fluxes range from -2.99 to 487 mg N m-2 d-1 and are positively skewed. To avoid the negative flux, when applying the log-transformation, each value is leveled up by 3. In the end of data analysis, the spatial-temporal regression kriging predictions are back-transformed and leveled down by 3 as well. 2. We implicitly describe the term “position” in the text. Please see more detailed information in Page 8, Line 17-24 in Materials and Methods section and in Fig. 1e in Page 37 in the manuscript. 3. Yes, we agree theoretically. However, our pre-experiment of gas sampling has proven that the twice gas sampling has little impact on the N2O concentration gradients during a short incubation time period of 30-min. 4.

No, we disagree. RMSE and ME are calculated from data with the log-transformations. 5. After double-check, we are sure the value of Metric is correct. 6. No, we disagree. Fig. 3 is used to illustrate the dynamic temporal variations of N2O fluxes at the four positions (inter-row position, fertilization point, under the tea tree, and in the tea tree row). In terms of the visualization for spatial data, they are presented in Fig. 9 and other figures in Supporting information.

Author's Changes to the Manuscript: Changes will be made in the text when the editor calls the revision.

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