Dear editors,

We would like to submit the enclosed manuscript entitled "*Reduction Evaluation and Management of Agricultural Non-Point Source Pollutant Loading in the Huntai River Watershed in Northeast China*" (hess-2018-339), which we wish to be considered for publication in "*Hydrology and Earth System Sciences* (HESS)*"*.

No conflict of interest exits in the submission of this manuscript, and manuscript is approved by all authors for publication. In this work, we evaluated the manuscript is a part of our present research achievement, and which is a good paper. I hope this paper is suitable for "HESS". The main point our thesis wishes to address is to reflect on the practical application of and the solutions provided by the SWAT models in relation to China's sparse hydrological basin information; to provide point by point model constructions; an explanation of our process; an analysis of our results, and the expansion of the utilization of the SWAT model from an advanced and disciplined perspective. SWAT was used to assess the reduction of agricultural NPS pollutant. Buffer zone of land use type could reflect the natural environment. 21.9% pollutant reduction under the EPS.

We have tried our best to revise the manuscript to hope to meet with approval. The manuscript has been thoroughly checked again and revised as suggested with the help of an English teacher. It is believed that the revised paper will be readable and could meet the standard generally for publication.

Thank you very much for your consideration and help. Looking forward to hearing from you soon.

Thank you very much for your time and consideration.

Yours sincerely,

Dr. Yicheng Fu

E-mail: swfyc@126.com

+86-10-68781880 (office); +86-10-68572778 (fax)

Organization name: China Institute of Water Resources and

Hydropower Research (IWHR)
Organization address: A-1 Fuxing Road, Haidian District, 100038 Beijing

17th, Agu. 2018

Additive list

We have studied the valuable comments from you, the assistant editor and reviewers carefully, and tried our best to revise the manuscript. The point to point responds to the reviewer's comments are listed as following.

Reviewer's Responses to Questions

After careful consideration, we feel that it has merit, but is not suitable for publication as it currently stands. Therefore, my decision is "Major Revision."

（1）General Content: There are numerous spelling mistakes and grammatical errors. This paper requires English editing and proof assistance. Authors should be careful using acronyms. If an acronym appears for the first time in the text, then it should be written in the full form.

Answer: Thanks for your very thoughtful suggestion.

The manuscript has been thoroughly checked again and revised as suggested with the help of an English teacher (AJE, http://www.aje.com/). It is believed that the revised paper will be readable and could meet the standard generally for publication.

The EDITORIAL CERTIFICATE is followed.

EDITORIAL CERTIFICATE

This document certifies that the manuscript listed below was edited for proper English language, grammar, punctuation, spelling, and overall style by one or more of the highly qualified native English speaking editors at American Journal Experts.

Manuscript title:
An Estimation of Agricultural Surface-source Pollutant Production in Huntai River Watershed Based on the SWAT Model

Authors:
Y.C. Fu, J. Zhang, C.L. Zhang

Date Issued:
July 21, 2016

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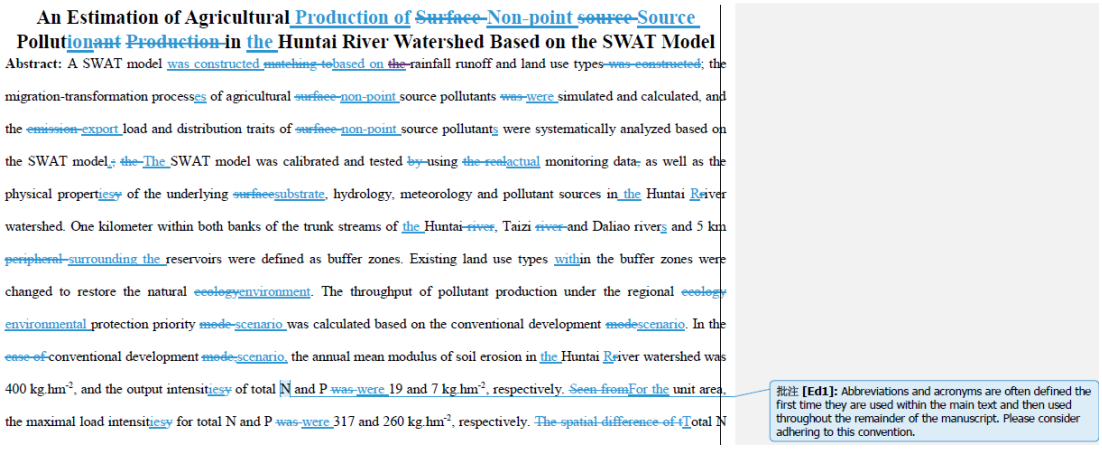

An Estimation of Agricultural Production of ~~Surface~~ Non-point ~~source~~ Source Pollution~~ant~~ ~~Production~~ in the Huntai River Watershed Based on the SWAT Model

Abstract: A SWAT model was constructed ~~matching to~~based on ~~the~~ rainfall runoff and land use types~~ was constructed~~; the migration-transformation processes of agricultural ~~surface~~ non-point source pollutants ~~was~~ were simulated and calculated, and the ~~emission~~ export load and distribution traits of ~~surface~~ non-point source pollutants were systematically analyzed based on the SWAT model. ~~the~~ The SWAT model was calibrated and tested ~~by~~ using ~~the real~~actual monitoring data~~.~~ as well as the physical properties~~y~~ of the underlying ~~surface~~substrate, hydrology, meteorology and pollutant sources in the Huntai River watershed. One kilometer within both banks of the trunk streams of the Huntai ~~river~~, Taizi ~~river~~ and Daliao rivers and 5 km ~~peripheral~~ surrounding the reservoirs were defined as buffer zones. Existing land use types within the buffer zones were changed to restore the natural ~~ecology~~environment. The throughput of pollutant production under the regional ~~ecology~~ environmental protection priority ~~mode~~ scenario was calculated based on the conventional development ~~mode~~scenario. In the ~~case of~~ conventional development ~~mode~~ scenario, the annual mean modulus of soil erosion in the Huntai River watershed was 400 kg.hm^{-2}, and the output intensities~~y~~ of total N and P ~~was~~ were 19 and 7 kg.hm^{-2}, respectively. ~~Seen from~~For the unit area, the maximal load intensities~~y~~ for total N and P ~~was~~ were 317 and 260 kg.hm^{-2}, respectively. ~~The spatial difference of~~ Total N

批注 **[Ed1]:** Abbreviations and acronyms are often defined the first time they are used within the main text and then used throughout the remainder of the manuscript. Please consider adhering to this convention.

Besides, we have made serious changes to the expression of abbreviations in the whole paper, such as NPS (Non-point source), SWAT (Soil and Water Assessment Tool), TN (Total Nitrogen), TP (Total Phosphorus), HTRW (Huntai River Watershed), environmental protection scenario (EPS), DEM (Digital Elevation Model), and BMPs (Best Management Practices scenarios).

The revised contents could be found in the file of "paper revised version (clean)".

（2）Ln 28: What is "pollutant production" mean? Did authors mean by pollutant generation?

Answer: Thanks for your very thoughtful suggestion.

The mean of "pollutant production" is "pollutant generation". We have revised all the expressions in the paper. We have revised 23 places.

The revised contents could be found in the file of "paper revised version (clean)" & paper revised version (with track changes).

（3）Ln 30: modulus? What does that mean, not sure why there is a mean and a modulus both? Again, could be something typo or just something else.

Answer: Thanks for your very thoughtful suggestion.

The expression of "soil erosion modulus" is a proper noun.

In order to improve the readability of the article, reduce ambiguity, we have revised the sentence "the annual mean modulus of soil erosion in the HTRW was 811 kg/ha" to "the soil erosion modulus in the HTRW per year was 811 kg/ha".

In line 20, The systematically analysis contained three parts, which were (1) scenarios setting of SWAT; (2) modelling validation of SWAT in HTRW; (3) NPS

pollutant loading calculation under status quo scenario & EPS.

The revised section was as followed, Besides, the loadings and distribution traits of NPS pollutants were also systematically analyzed based on the model (scenarios setting, modelling validation, and pollutant loading calculation under status quo scenario & EPS).

In line 24, The "scenario settings" is the mean of "Land use types differences".

The revised contents could be found in the file of "paper revised version (clean)" & paper revised version (with track changes).

（4）Ln 30-31: output intensities? Why not only output? Or load? Or Concentration? Or flux? Overall this section is also difficult to read.

Ln 31: intensities?

Answer: Thanks for your very thoughtful suggestion.

The expression of "output intensities" is the mean of "output loading".

In order to improve the readability of the article, reduce ambiguity, we have revised the all the expressions in the whole paper, such as intensities.

The Ln28, we revised "output intensities" to "output loading".

The Ln29, we deleted the word of intensities.

The Ln35, we deleted the word of intensities.

The Ln83, we deleted the word of intensities.

The Ln57, we revised "output intensities" to "output loading".

The Ln65,66,67,68, we deleted the word of intensities.

Besides, we also revised some places such as intensity to loading, or deleted these words to make the article more fluent.

（5）Ln 83-85: there is no link between these two sentences. The last sentence may need to be a starting sentence for this paragraph instead.

Answer: Thanks for your very thoughtful suggestion.

We have changed the order of sentences. In order to make the expressions of the paragraph clearer, we have put the last sentence at the beginning of this paragraph.

（6）Ln 86: "The SWAT" of the present study"? Not sure what authors are trying to

relate to?

Answer: Thanks for your very thoughtful suggestion.

We have changed the expression of the sentence. In order to make the expressions of the content clearer, we have revised the sentence as the following,

"The SWAT Model was applied to quantify the output loading of TN & TP in HTRW under different land use types, assess the NPS pollutant loading reduction, and analyze the spatial distribution characteristics on the condition of land vegetation cover change.".

（7）Ln 95: please do not refer readers to go and read literature from database. If there is literature pertinent to this paper, cite them; otherwise please do not direct readers. They can find any articles in Google scholar easily or other sites from libraries.

Answer: Thanks for your very thoughtful suggestion.

We have We have shortened the length of Section 2.1. We only provided the necessary information of study area. The contents could be found as following,

The HTRW (40°27′~42°19′N, 121°57′~125°20′E) is in Liaoning province (Northeast China), and the watershed area is 2.73×104 km2, which takes about 1/5 of the area of Liaoning province (Fig 1). The HTRW is a tributary of Liaohe River Basin (The Liaohe River Basin is one of China's larger water systems) and is consist of Hunhe River, Taizi River, and Daliao River. The Hunhe River, Taizi River, and Daliao River watershed is HTRW's sub-watershed. The HTRW has varied topography, low mountain is located in eastern part, and the other parts are alluvial plain. The elevation of northeast region is high. Loamy soils are mainly distributed in alluvial plain, and the average grade of lower HTRW is about 7%. HTRW area includes the cities of Fushun, Shenyang, Benxi, Liaoyang, Anshan, and Yingkou, most of Panjin city, some portions of Tieling city and a minor portion of Dandong city. The stream flow and nutrient were validated based on the five monitoring stations, Beikouqian, Dongling Bridge and Xingjiawopeng are located in Hunhe River, Xialinzi and Tangmazhai are in Taizi Rive. HTRW has temperate continental climate, the average annual temperature is 7°C, and precipitation is 748 mm.

Besides, we have put the basic information of SWAT model, and the operation & application procedure show in the form of pictures (Figure 2, Figure 3), to reduce the length of the article, and increase the readability of the article. We also cited the relevant literature to add the scientific and readability of the paper, such as Ln 137, L138, L140, and L145, et. al.

（8）Ln 123: Inconsistency is writing proper names? For example, Atrazine is written with capital A, but not other fertilizers/pesticides such as acetachlor and butachlor?

Answer: Thanks for your very thoughtful suggestion.

The words of "diammonium phosphate, potassium phosphate, atrazine and acetochlor" were proper names. We have revised the form of these words in the form of special nouns. Such as

Ln 125-127, The heavy use of chemical fertilizers was mainly urea, DAP (diammonium phosphate) & a small amount of N-P-K (Nitrogen-Phosphorus-Potassium mixed fertilizer).

Ln 127-130, Atrazine & Acetochlor were mainly used on dry farmland, and Butachlor was mainly used in paddy fields. Based on the statistical data for 2006-2012, the quantity of fertilizers and Pesticides (such as Methamidophos & Plifenate) applied in the watershed fluctuated annually.

（9）Ln 127: did the authors mean complete data? Statistics of what?

Answer: Thanks for your very thoughtful suggestion.

We revised the ambiguous expression. The revised sentence is as follows,

"and therefore statistical department statistics (http://www.ln.stats.gov.cn/tjsj/tjgb/, http://www.stats.gov.cn/) are not available.". We obtained these data & information which would normally be inaccessible through the on-site investigation, inquiry visits, case studies, example analysis, expert consultation and material research method.

（10）Model Description:

Ln 132: instead of "calculate", "predict" might be a better word.

Answer: Thanks for your very thoughtful suggestion.

We have revised the word "calculate" to "predict".

（11）Ln 142: the threshold of 0% creates large number of HRUs to capture all heterogeneities. The reason behind using 0% threshold is not well justified.

Answer: Thanks for your very thoughtful suggestion.

We have added 0% as the basis for generating HRUs. The added contents were as follows,

HRU is the minimum unit to predict pollutant output loading, which is automatically generated by the superimposition of land use & soil types within the sub-river basin. Because lots of HRUs were automatically generated based on different combinations，we selected 0% underlying surface data as the initial value to generate HUR that is consistent with the distribution characteristics of HTRW water system.

（12）Model Inputs:

（12）Ln 188: 1:250 000, there is an additional space in 250000, it should be a comma.

Answer: Thanks for your very thoughtful suggestion.

We have revised the space to a comma in 250000.

We also revised the other data in the whole paper.

（13）Calibration and Validation:

Ln 216-218: why only NSE? Using NSE alone, as a performance indicator is not sufficient. It will not indicate any bias in model output. I am assuming that there are more metrics used.

Answer: Thanks for your very thoughtful suggestion.

We have added the relative contents as follows,

We used the open SWAT-CUP software to adjust parameters, then the SUFI-2 algorithm was selected to determine the optimal values of the parameters based on iterative computations. Finally, we manually input the optimal parameters to SWAT model for hydrology series simulation. The E_{NS} (Nash-Sutcliffe efficiency coefficient), Dv (relative deviation), and R^2 (certainty coefficient) can effectively avoid the uncertainty of hydrological sequence (precipitation, water flow, and evaporation),

which was used to evaluate the run-off flow change of hydrological station in HTRW.

（14）Ln 219: what is artificial parameter modification?

Answer: Thanks for your very thoughtful suggestion.

We revised the ambiguous expression. The revised sentence is as follows,

The SWAT for the present study was calibrated and tested using the coupled method of manual & auto-calibration. The uncertainty analysis was carried out by using SWAT-CUP program.

（15）Ln 221-225: What is the difference between “real data” and “monitoring data”? Aren’t they both real?

Answer: Thanks for your very thoughtful suggestion.

In the paper, the “real data” is the “monitoring data”. We have revised the ambiguous expression. The revised sentence is as follows,

The runoff was calibrated and tested using monitoring data from the Xingjiawopeng, and Tangmazai hydrological station (Figure 4).

（16）Ln 243-245: If the authors used SWAT-Cup for automatic calibration, then what is this manual calibration? Sensitivity analysis is included in SWAT-CUP. Did authors conduct a separate sensitivity analysis outside of SWAT-CUP? If so why? There is no need.

Answer: Thanks for your very thoughtful suggestion.

In the paper, we used the coupled method of manual & auto-calibration to analyze the parameters sensitivity. The revised sentence is as follows,

Sensitivity analysis of the parameters is an effective means to reduce the uncertainty of the hydrological model and increase effectiveness of SWAT model. The sensitivity evaluation indicators are different among SWAT and SWAT-CUP. The "T-test (Student's t test)" used by SWAT-CUP is part-sensitive. We draw on manual calibration analysis to make necessary adjustments to the SWAT-CUP sensitivity analysis. To improve the accuracy of model calibration & verification results, we used SWAT-CUP and SUFI-2 algorithm to analyze the parameters sensitivity.

（17）Ln 244-250: Did the authors separate baseflow from total streamflow and calibrate runoff and baseflow separately? If so, the method needs to be clearly stated on how it was done? Manual or SWAT CUP? What is the point of using LOADEST program during the calibration. I understand that LOADEST could be used to calculate pollutant load, but what is unclear it the program used during calibration.

Answer: Thanks for your very thoughtful suggestion.

In the paper, we have revised the ambiguous expression. The revised sentence is as follows,

(1) Direct runoff is surface runoff resulting from rainfall, which includes surface and return flows. Baseflow is part of groundwater recharge to river runoff. It is impossible to measure or directly divide the base flow from the total runoff. Most of the base flow and direct runoff segmentation are performed by mathematical methods. We used Digital-Filter-Equation to divide the base flow (Lyne & Hollick, 1979).

$$\begin{cases} q_t = \beta . q_{t-1} + \alpha(1+\beta)(Q_t - Q_{t-1}) \\ b_t = Q_t - q_t \end{cases} \quad (1)$$

Here, q_t is the surface runoff at time t; Q_t is the total runoff at time t; b_t is the base flow at time t; α & β are filter parameter.

According to the following steps. (1) The first filter made the second record points as a starting point forward calculate one by one. We calculated q_t according to equation (1), and $b_t \geqslant 0$, $q_t \geqslant 0$, $Q_t \geqslant b_t$, $Q_t \geqslant q_t$. If $q_t<0$ at time t, we assigned $q_t=0$, $Q_t=b_t$; If $b_t<0$ at time t, we assigned $b_t=0$; If $b_t> Q_t$ at time t, we assigned $b_t= q_t$. (2) The second filter made the penultimate record points as a starting point backward calculate based on the calculation result of first filter. (3) The calculation of third filter following the positive operation. According to the above calculation rules, we divided the base flow until getting the smooth base flow process line. Digital filtering is an objective & effective method of base-stream segmentation, we assigned α =0.5, β =0.925 in HTRW (Arnold & Allen,1999).

(2) We used the Auto-Calibration & Uncertainty module (SWAT-CUP) of SWAT to automatically calibrate 10 sensitive parameters, then we applied the Manual

calibration helper of SWAT to make small & targeted adjustments to the calibration results to improve the simulation accuracy based on auto-calibration results. The contents could be found in Ln 247-250 (paper revised version (clean)).

The reference as following,

Arnold, J., Allen, P.: Automated Methods for Estimating Baseflow and Ground Water Recharge from Streamflow Records. Journal of the American Water Resources Association, 35, 411-424, 1999.

Lyne, V.D., Hollick, M.: Stochastic Time Variable Rainfall-Runoff Modeling: Proceedings of Hydrology and Water Resources Symposium. Perth, Australia: National Committee on Hydrology and Water Resources of the Institution of Engineers,1979.

(3) We have revised the expression in Ln 249.

During calibration, we used R^2 & correlation coefficient of residual sequence (*SCR*) to eliminate the uncertainties caused by the differences in sampling & testing methods of water quality (Yang et al.,2014).

(18) Ln283-299 In the preceding section, the authors mentioned that CN2 has no role. But it appears that runoff curve data was used for calibration. Please clarify.

Answer: Thanks for your very thoughtful suggestion.

In the paper, we have added the related contents as follows,

CN2 is a comprehensive parameter that reflects the characteristics of watershed before rainfall. It is mainly affected by the hydrology & soil types, land use types, pre-soil moisture and tillage management measures. CN2 directly affects the surface runoff. The larger the CN2 value, the larger the runoff yield. With the same type of land use, the greater the permeability, the smaller the CN2 value. With the same type of land use, the lower vegetation coverage & rainfall interception ability, the greater the CN2 value. Different regions have different CN2 values, the moist area is the highest, the range of 60~96, while other regions vary greatly. With the same soil types, CN2 value of cultivated land was the highest, followed by grassland and woodland was the lowest.

（19）Results and Discussions:

Similar observations could be made to TP and TN results and discussions. What are the common fertilizers used in the farmlands? Are there pastures and cattle feeding lots? What are the initial soil nutrients content? Did the authors use this information for model parameterization? It is unclear from the methods and discussion.

Answer: Thanks for your very thoughtful suggestion.

In the paper, we have added the related contents as follows,

(1) Considering land pattern, rainfall and source of pollutants, the HTRW faces a high risk of pollution from agriculture. Heavy use of fertilizers and soil erosion in the upper of HTRW has led to serious NPS pollution in HTRW.

Fertilization in the HTRW is predominantly with nitrogen, followed by phosphorous and potassium. The heavy use of chemical fertilizers was mainly urea, DAP (diammonium phosphate) & a small amount of N-P-K (Nitrogen-Phosphorus-Potassium mixed fertilizer). Atrazine & Acetochlor were mainly used on dry farmland, and Butachlor was mainly used in paddy fields. Based on the statistical data for 2006-2012, the quantity of fertilizers and Pesticides (such as Methamidophos & Plifenate) applied in the watershed fluctuated annually.

These contents could be found in the Ln 121-129 in the revised version (clean).

(2) Brown soil is widely distributed in the HTRW. We supplied the characteristics of N & P loss under different land use types and fertilization, as shown in Table 2. The thickness of brown soil was 30-50cm in HTRW. The content of organic, TN & TP decreased significantly with the increment of soil depth. Nutrients were mainly found in soils of 0-30cm depth, where TN & TP reserves reached more than 50% of the total reserves in the soil.

Table 2. The loss characteristics of N & P under different land use types & fertilization

Land use type	Soil thickness (cm)	Organic matter content (g/kg)	Unit weight of soil (g/cm^3)	Soil particle composition			TN (g/kg)	TP (g/kg)
				Cosmid ø≤0.002	Powder 0.002<ø≤0.005	Sand 0.005<ø≤2		
cultivated field	0-5	24.58	1.42	21.05	57.35	21.6	0.96	0.47
	5-30	18.45	1.48	24.71	24.71	18.84	0.88	0.38
Grassland	0-5	27.6	1.18	15.97	15.97	14.58	1.25	0.58

5-30	21.75	1.25	20.36	20.36	21.5	1.02	0.42

Reference：Hao, L.P.: Characteristics of nitrogen and phosphorus losses of rainfall runoff in Liaoning Hunhe Basin, Shenyang Agricultural University, 2012.

The large-scale use of fertilizers (DAP, N:46.4% & N-P-K, N:15%; P2O5:15%; K2O:15%) & livestock and poultry excrement (N:0.5-0.6%; P:0.45-0.6%; K:0.35-0.5%) were the important sources of agricultural NPS pollution. In HTRW, the numbers of pastures and cattle was little, and the excretions of cattle were collected and processed by the farmer.

The excessive or unreasonable application of fertilizers, and the fertilizer utilization rate was not high (the utilization rate of nitrogen is 30% to 60%, and phosphorus is 2% to 25%), resulting in a large number of fertilizer loss. The nutrient content (mainly from agricultural production activities) of soil in HTRW was 1.21t/ha.

The information of initial soil nutrients content & fertilizers was used for model parameterization.

We tried our best to improve the manuscript and made some changes in the manuscript. These changes will not influence the content and framework of the paper. And here we did not list the changes but marked in red in revised paper (Revision, changes marked).

We appreciate for Editors/Reviewers' warm work earnestly, and hope that the correction will meet with approval.

Once again, thank you very much for your comments and suggestions.