Dear Yichao Tian,

We are very pleased to learn from your letter about revision for our manuscript which entitled "Dangerous degree forecast of soil and water loss on highway slopes in mountainous areas using RUSLE model".

We greatly appreciate your suggestion concerning improvement to this paper, and it is our honor to get your help to improve us! Thank you for your patience and advises. We have revised the manuscript according to the every single comment which made by the editor. Moreover, we have made some correction so that we hope meet with your approval. We are sending the revised manuscript according to the comments of the reviewer. We have marked the major changes in red in this revised version (See the manuscript).

Thank you for your consideration!

Sincerely yours,

*Corresponding Author: Shi Qi

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Response to reviewer comments for NHESS-2017-406

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Reviewer's #2 comments:

Comment 1: In the introduction, in the third paragraph, in the literature review of the RUSLE model, the applicability of the model in the soil erosion of the expressway should be written, are there any related research results? What are the advantages and disadvantages of the comparison between the model and the traditional slope erosion model?

Response 1: Valuable suggestions! Thank you for your comments! According to your suggestion, we revised the manuscript's introduction carefully. Details are in following paragraph and MS.

We added the following section:

Wu (2014) adopted GIS and Revised Universal Soil Loss Equation (RUSLE) method to analyze the risk pattern of soil erosion in the affected road zone of Hangjinqu highway in Zhuji City, Zhejiang Province. Digital Elevation Model (DEM) data, rainfall records, soil type data, remote sensing imaging, and a road map of Hangjinqu highway were used for these GIS and RUSLE analyses. Chen (2010) according to terrain characteristics of roadbed side slope and through concrete analysis of terrain factor calculation method in Revised Universal Soil Loss Equation (RUSLE), the compatible question of terrain factor computational method of roadbed side slope is appraised and the revision method on the basis of measured data of soil erosion in subgrade side slope of Hurongxi Expressway (from Enshi to Lichuan) in Hubei Province is proposed. The results indicate that: (1) In RUSLE slope length factor can be calculated by formula of $L=\left(\lambda/22.1\right)^m$, but m should not be checked by the original method for the highway subgrade side

slope because its gradient surpasses generally applicable scope of RUSLE; (2) L, slope length factor of highway subgrade side slope can be calculated by formula $L=\left(\lambda/22.1\right)^{0.35}$. Zhang (2016) investigated the spatio-temporal distribution of soil erosion in ring expressway before and after construction process, he used land use/cover map of Ningbo City in 2010, topographic map, map of North Ring expressway and field survey data was collected to derive digital elevation model (DEM). Rainfall data was collected from local hydrological station. Based on the collected data, the spatial distribution of the factors in RUSLE model was calculated, and soil erosion maps of the north ring expressway were estimated. Then, the soil erosion amount was calculated at three different stages by using RUSLE model. The results shows that: Slight erosion was dominant during preconstruction period and natural recovery period, which accounted for 98.53% and 99.73%, respectively. During construction period, mild erosion and slight erosion was the largest, which accounted for 52.5% and 35.4%, respectively. In general, soil erosion during the construction period is mainly distributed in the temporary soil ground.

The references added are as follows:

Wu, Y. L., Yan, L. J.: Impact of road on soil erosion risk pattern based on RUSLE and GIS: a case study of Hangjinqu highway, Zhuji section. ACTA ECOLOGICA SINICA, 34(19):5659-5669, 2014 (in Chinese).

Chen, Z. W., He, F., Wang, J. J.: Revises of Terrain Factor of Roadbed Side Slope in Universal Soil Loss Equation. HIGHWAY, (12):180-185, 2010 (in Chinese).

Zhang, T., Jin, D. G., Tong, G. C., Lin, J., Tang, P., Li, L. P.: Monitoring Soil Erosion in Linear Production and Construction Project Areas Based on RUSLE - A Case Study of North Ring Expressway in Ningbo City, Zhejiang Province. Bulletin of Soil and Water Conservation, 36(5):131-135, 2016 (in Chinese).

The advantages and disadvantages of the comparison between the model and the traditional slope erosion model:

(1) USLE model:

Advantage: The model expression form is simple, provided a model for world's soil erosion model.

Disadvantage: Because it is an empirical model based on the calculation of soil erosion in small watershed, the physical process of soil erosion is not considered, in addition, it is also found that this model is not suitable for planting, contour tillage. At the same time, it does not take into account the effect of surface runoff, which greatly reduces the effectiveness of the equation applied to the interception measures.

(2) RUSLE model:

Advantage: The generality of the computational factor is strengthened. For the rainfall erosivity factor (*R*), the meteorological data in the wider region are used, and the accuracy is greatly improved. For soil erodibility factors (*K*), the RUSLE model further considers seasonal variations, such as freezing thawing, soil moisture and consolidation. For the topographic factors (*LS*), a new equation is added to the RUSLE to reflect the relative proportion of the rill erosion and the inter ditch erosion, and the complex changes of the slope are involved. For vegetation coverage factors (*C*), RUSLE considers

their variation patterns and interactions in the whole year, as well as the effect of climatic conditions on the decomposition of mulch, and the effect of farming system. For the management measures of soil and water conservation factors (*P*), RUSLE not only considered the above hydrological and geomorphic characteristics in detail, but also analyzed various soil and water conservation measures in detail, such as the influence of equal tillage and strip farming on erosion. The application range of RUSLE is extended from the original two-dimensional field to three dimensional, which can simulate the spatial evolution characteristics of geomorphic landscape. In addition, the reliability of the forecast is also greatly strengthened.

Disadvantage: The application of RUSLE has the problems of difficulty in computing and inefficiency.

(3) WEPP model:

Advantage: The WEPP model (slope version) is a new generation of computer models for prediction of soil erosion, it can predict the amount of soil loss and its dynamic change at any moment on the slope in the rainfall process, the application range is very wide, and it is the soil erosion model which describes the most related parameters of water erosion so far.

Disadvantage: The WEPP model needs more input parameters, and the acquisition and correction are difficult. In particular, the determination of some important parameters can not be experimentally determined. The non measured "estimation" method must be adopted, and sometimes the default value of its modification is also needed. The WEPP model can only be used for the prediction of rill, interrill erosion and shallow gully erosion, and can not be used for trenches, river erosion and ditch erosion, it can not be used for gully erosion, stream erosion and ditch erosion, in particular, gravity erosion and sediment deposition and re-handling process in the slope and channel are ignored, or only for simplification. At present, the slope version has been widely used in other countries, and the results of the simulated forecast are better, while the basin version is still limited to the last stage subbasin.

(4) EUROSEM model:

Advantage: The biggest advantage of this model is dynamics, it is a dynamic formulation model. it can be simulated as small as a single field, and can be large to a small watershed. It has a good physical basis, and the erosion can be divided into rill erosion and interrill erosion.

Disadvantage: The accuracy of the model is limited by field or experimental conditions.

(5) ANSWERS model:

Advantage: The degree of structurization of the model is high.

Disadvantage: The model's erosion module is largely empirical and only simulates the migration process of the total sediment.

Comments 2: The value of *C* factor and *P* factor is almost referenced by previous research results, there are some defects in the accuracy of the data, but the author only modifies the *P* factor in solving the problem. How does the correction of *C* factor be reflected?

Response 2: We are grateful to the reviewer for pointing out this comment. According to your comment, we will explain the problem, details are in following paragraph.

In this study, we modified the *C* factor. The NDVI was used to calculate the vegetation coverage. After that, the *C* factor was estimated. Then, the vegetation coverage data were corrected by selecting a sample plot every 2 km along the study area for investigation. Finally, accurate vegetation coverage data were obtained.

Comment 3: In the research area, since we are studying soil erosion, we should introduce several factors related to soil erosion, such as rainfall and soil types in the study area.

Response 3: We completely agree with your comment! We have followed your advise to adjusted it. Details are in following paragraph and MS.

Xinhe expressway is located in Honghe Prefecture, Hekou County. The climate type belongs to the humid and hot climate of the subtropical monsoon forest. Due to the monsoon activity, the climatic characteristics of the study area are dry and wet seasons change clearly, among them, the wet season (also known as the rainy season) starts from May to mid October every year, the rest of the time for the dry season, the wet season has the characteristics of heavy rainfall, concentration of precipitation, etc. The difference in precipitation is about 400mm-2000mm, and most of the regions are between 800-1800mm.

The soil types along the Xinhe expressway are mainly red soil, leached cinnamon soil, gray forest soil and gray cinnamon soil. The plant division of the southern part of the Xinhe expressway is a tropical rainforest and a tropical seasonal rain forest, the vegetation division in the northern part of the region belongs to the south subtropical monsoon evergreen broad-leaved forest. In recent years, the original vegetation is mostly cultivated land, mainly planting rubber, bananas, pineapple, pomegranate and so on, and the tropical rainforest is fragmentary.

Comment 4: As a result, only the extraction results can be retained on the extraction of natural slope catchment area, and the specific extraction method can be deleted.

Response 4: Thank you for your comments! We greatly appreciate your valuable suggestion concerning improvement to this paper. We will explain the problem. Details are in following paragraph.

In this study, the revised universal soil loss equation (RUSLE) is used as a prediction model for soil and water loss on slopes, combined with GIS and remote sensing technology. The methods of field survey and runoff observation are used, on the basis of fully considering the differences between the model parameters of the artificial slopes and the natural slopes of the expressway. The catchment area is considered a prediction unit. The prediction units of the artificial and natural slopes are classified, and the soil and water loss of each slope is predicted in real time, thus reflecting the soil and water loss of expressway slope accurately. The method of slope element division it is the focus of this study, so it needs to be in detail.