Response to Decision Letter

Dear Dr. Paolo Tarolli,

Thank you for your letter and for the reviewer's comments concerning our manuscript entitled *"Dangerous degree forecast of soil and water loss on highway slopes in mountainous areas using Revised Universal Soil Loss Equation model"* (ID: nhess-2017-406). Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have studied comments carefully and have made correction which we hope meet with approval. Revised portion are marked in red in the manuscript.

Thank you for your consideration!

Sincerely yours,

*Corresponding Author: Shi Qi

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Response to review's comments for nhess-2017-406-Editor

Editor's comments

Comment 1: at this stage of the review process, only minor suggestions have been proposed. Please check carefully the feedback of the referee #2. In addition, there are also few comments from my side, mainly related to improvement of the figures.

Response 1: Firstly, all authors wish to express our sincere thanks to you for your positive comments, and thank you for your patience and careful work! Then, we have followed your advice to revised it. Details are in following paragraph and manuscript.

Comment 2: fig. 1 please avoid to write into the figure, simply add a yellow arrow, and then describe it in the caption;

Response 2: Thank you for your comments! We have followed your advice to revise it. Details are in following paragraph and manuscript.

Figure 1. Soil erosion produced by rainwash on a slope after rainfall

Comment 3: for the figures related to rainfall interpolation (fig. 4a, fig.12, fig. 13), please use a gradient of blue color, that is more logic when one is looking at water;

Response 3: Thank you for your comments! We have followed your advice to revise it. Details are in following paragraph and manuscript.

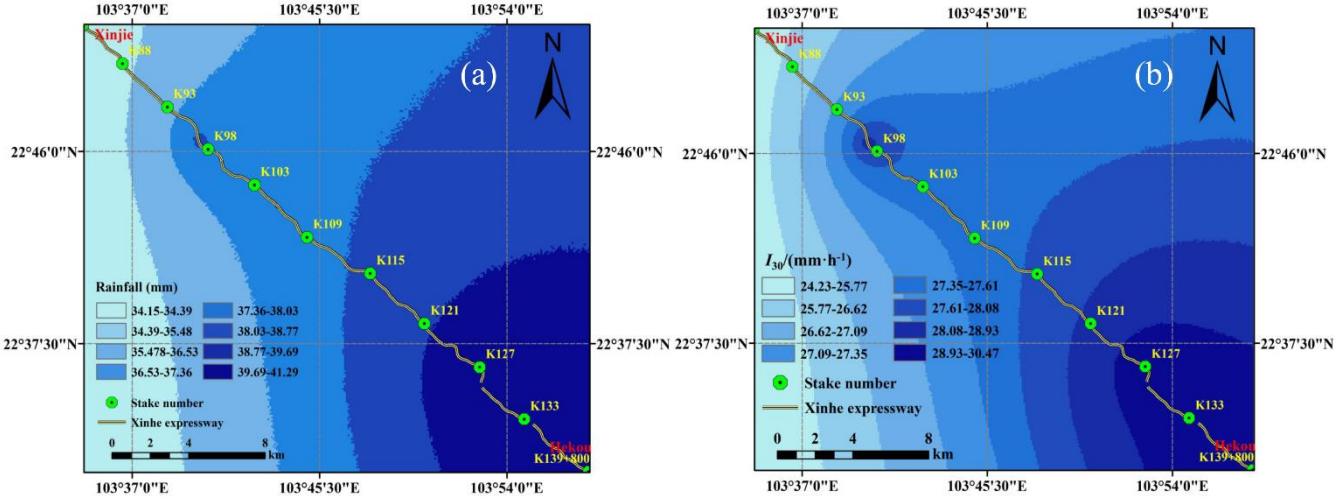

Figure 6(a). Interpolation rainfall results of June 5, 2014

Figure 6(b). Interpolation I_{30} results of June 5, 2014

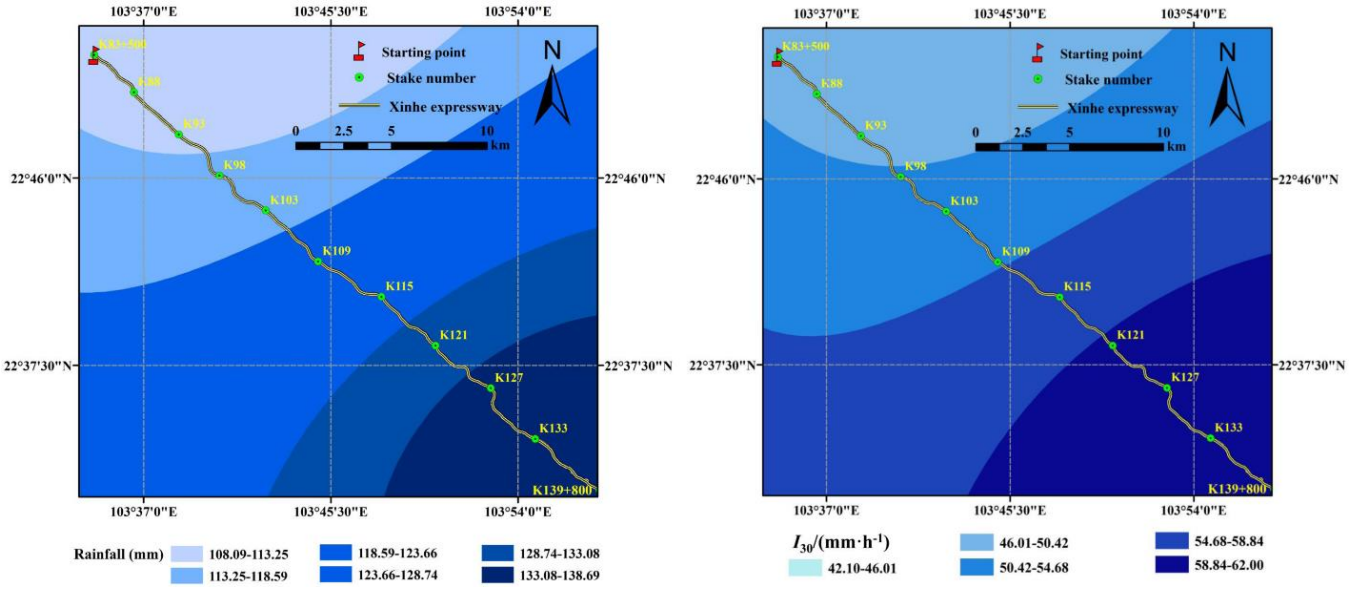

Figure 12. Rainfall interpolation results under 20-year return period

Figure 13. Rainfall intensity interpolation results under 20-year return period

Comment 4: fig. 7 is very difficult to read, since you overwrite some legend and word on the map, can you find a different solution? Maybe also a different range of colors?

Response 4: Thank you for your comments! We have followed your advice to revise it. Details are in following paragraph and manuscript.

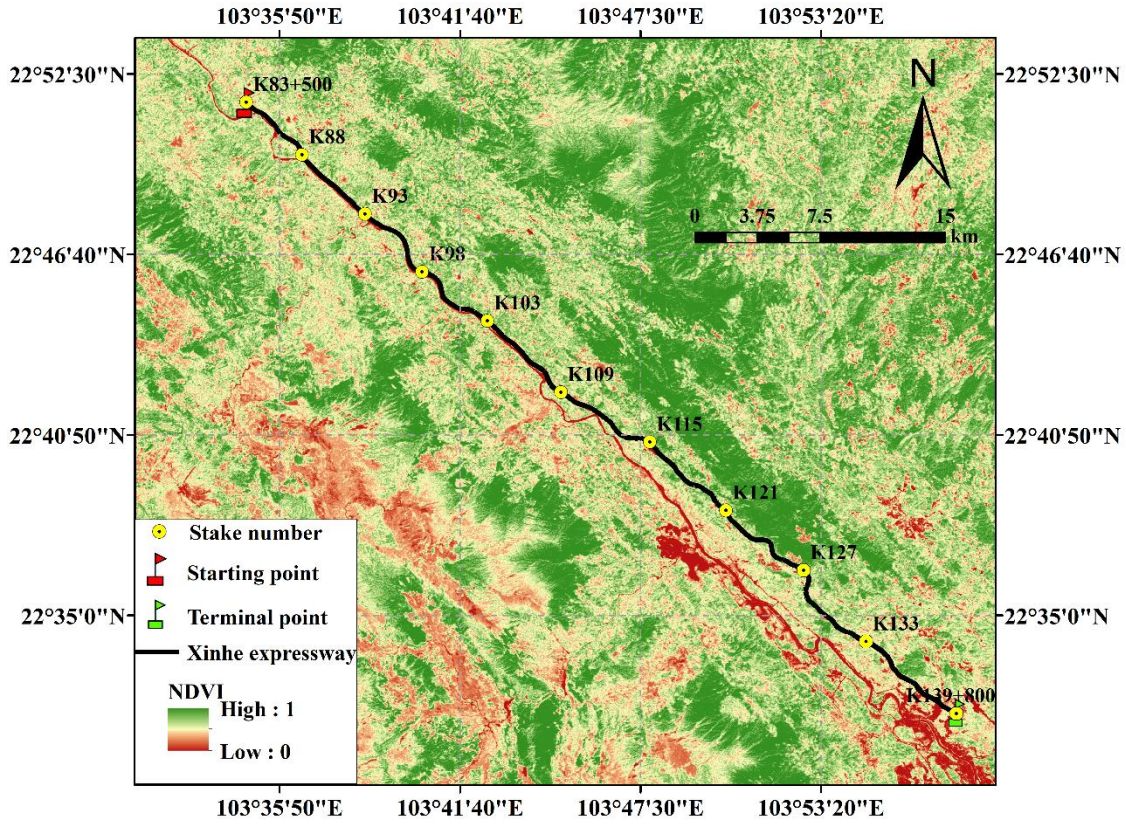

Figure 7. Vegetation coverage along Xinhe Expressway

Comment 5: can you merge fig. 12 and 13 in one figure? In addition, what do you mean for "rainfall" and "rainfall intensity"? Please clarify. What do you mean for "20-year return"? Do you mean "return period"?

Response 5: We greatly appreciate your valuable suggestion concerning improvement to this paper. We have followed your advice to revised and explained it. Details are in following paragraph and manuscript.

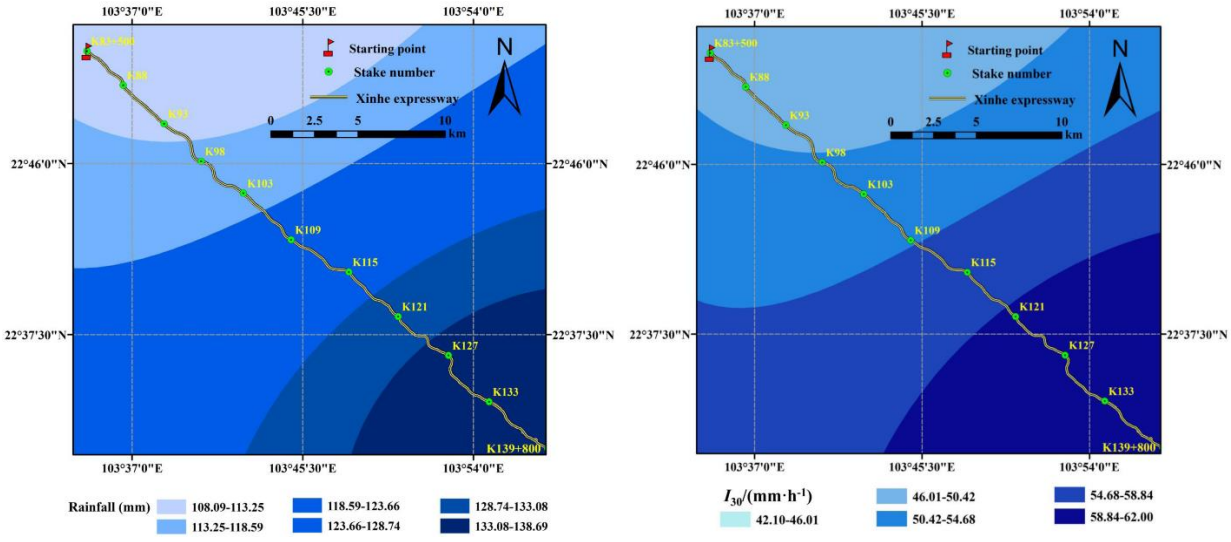

Figure 15. Rainfall interpolation results under 20-year return period

Figure 16. Rainfall intensity interpolation results under 20-year return period

Explain:

- Rainfall refer to a weather phenomenon in which condensed water vapor in the atmosphere descends to the earth's surface in different ways.
- Rainfall intensity refer to the average amount of rainfall over a period of time. It can be expressed by the depth of rainfall per unit time or by the volume of rainfall per unit area of time.

Comment 6: fig. 14 and fig. 15: are necessary the maps of elevations? The investigated road sections are already showed in the figure 1. Maybe you can improve the figure 1, making the topographic map larger, and the symbol/number of the investigated sections bigger

Response 6: Thank you for your comments! We have followed your advice to revise it. Details are in following paragraph and manuscript.

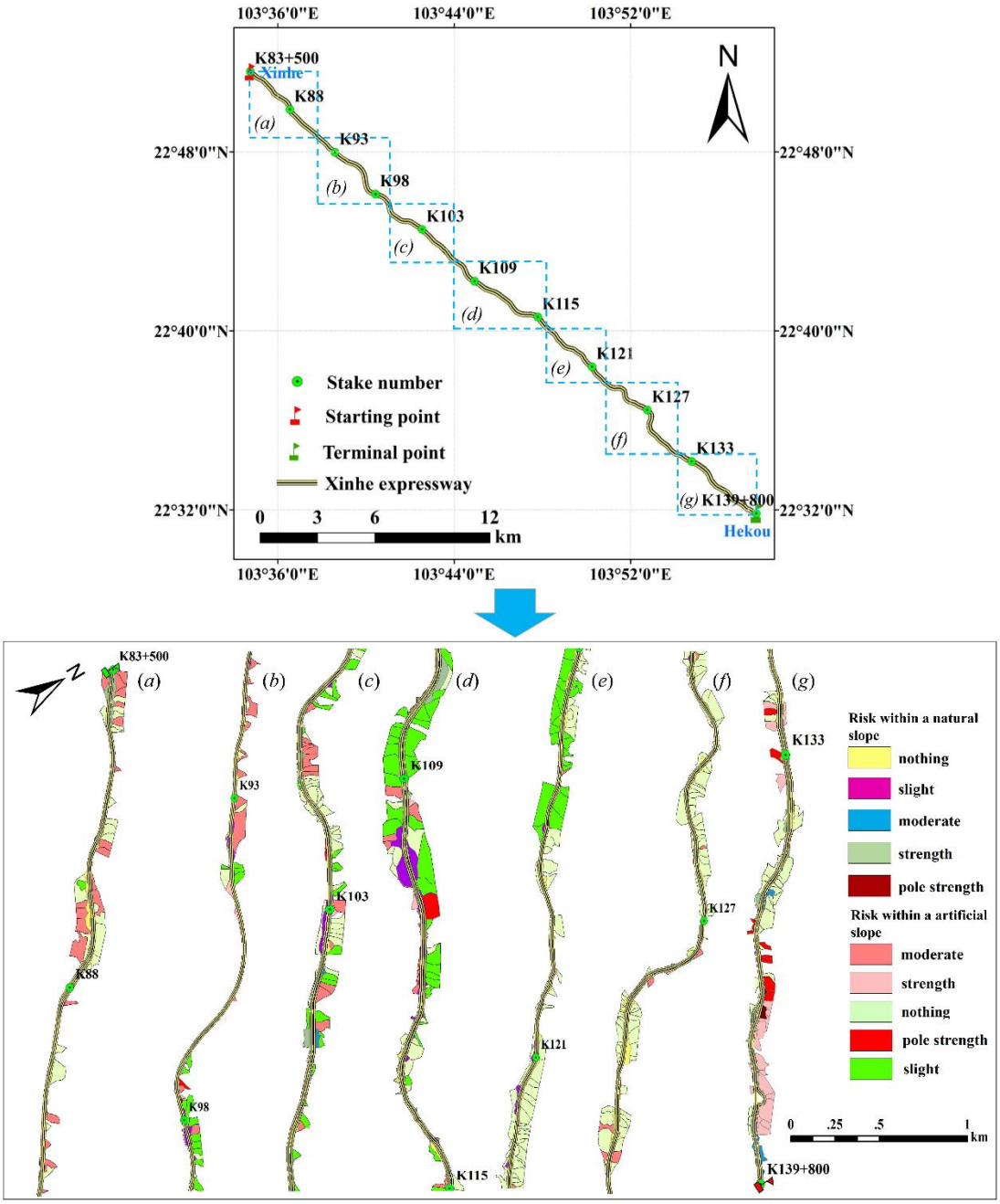

Figure 14. Risk analysis of soil and water loss under 20-year rainfall conditions

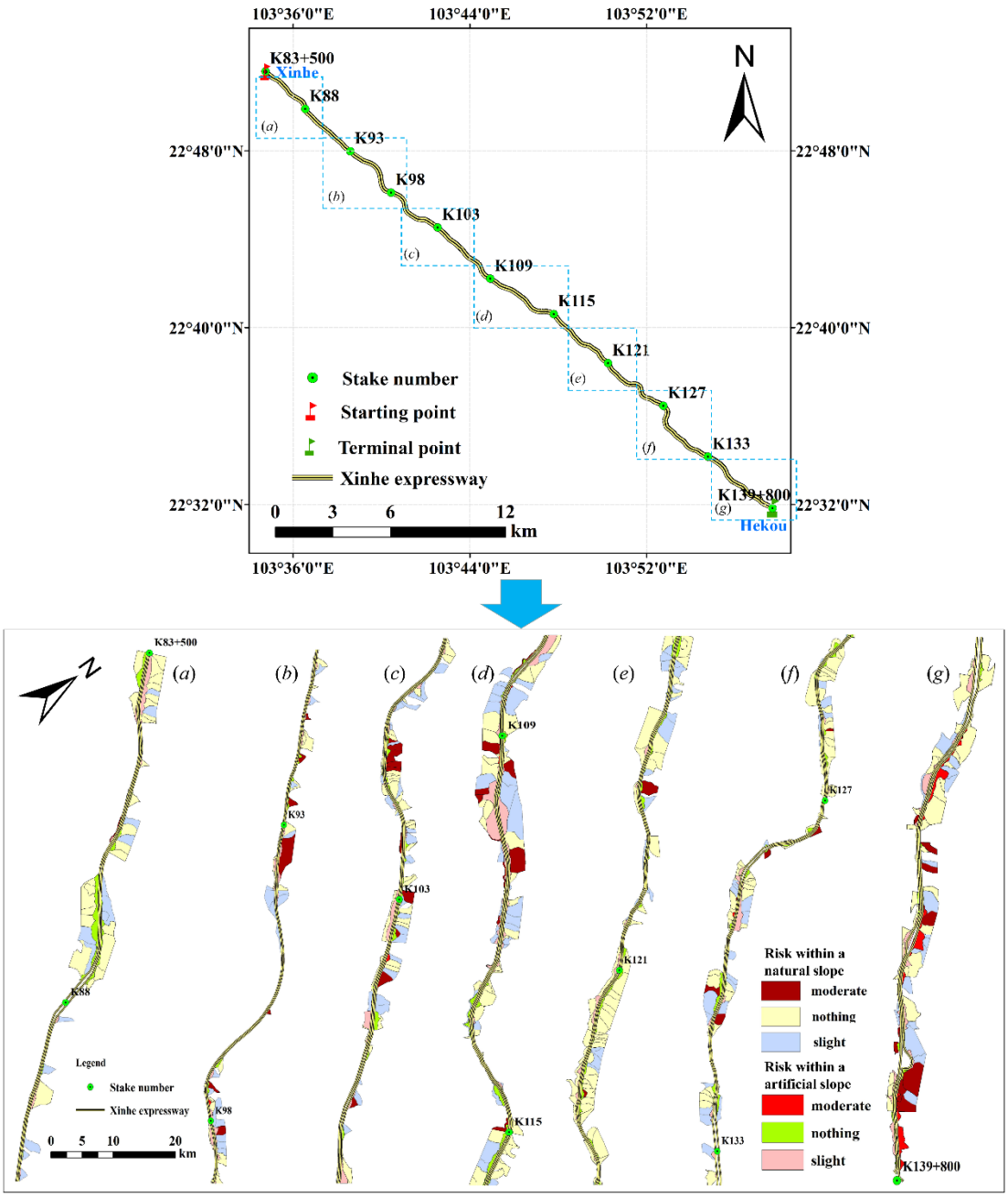

Figure 15. Risk analysis of soil and water loss for the 1-year rainfall amount

Comment 7: a general comment for all the figures: can you select a different north arrow? Maybe one very simple? Delete the word "legend" in all the figures, since everyone knows what is the legend.

Response 7: Thank you for your patience and careful work! We have followed your advice to revise it. Details are in the manuscript.

Response to Decision Letter

Dear Dr. Paolo Tarolli and referee,

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 reviewer's thoughtful suggestions concerning improvement to our paper. These comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches.

Thank you for your consideration!

Sincerely yours,

*Corresponding Author: Shi Qi

P.S.

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Response to review's comments for nhess-2017-406-Reviewer

Reviewer's #2 comments

Comment1: Some of the descriptions or discussions in the manuscript may be simplified. For examples: Point (2), Lines 180-190. You may give a topic sentence with the general idea of the point at first, and then give a concise explanation of the idea. Presently the description here is too complicated and chaotic.

Response 1: Thank you for your comment! We have followed your advice to revise it. Details are in following paragraph and manuscript.

Previous studies have shown that the spatial interpolation method of precipitation is unsuitable for the study of the spatiotemporal distribution of precipitation in mountain areas (Liu and Zhang, 2006). The problem involves two aspects. From the timescale perspective, the characteristics of rainfall distribution and the influencing factors are not fully considered. From the spatial scale perspective, the spatial heterogeneity of the region is ignored. Furthermore, many studies have limited the factors that affect precipitation to altitude factors, leading to low interpolation accuracy

(Zhao et al., 2011; Liu et al., 2010). Thus, in this study, we consider the spatial heterogeneity of linear engineering of the expressway. The rainfall factor is spatially interpolated to compensate for the following limitations: shortage of rainfall data on mountain areas, difficulty of representing the rainfall data of an entire expressway by using data from a single meteorological station, and uneven spatial distribution and strong heterogeneity of rainfall in mountain areas (Li et al., 2017).

Comment 2: Lines 230-256. All of the titles of level 3, e.g., 2.1.1 Meteorological data, may be erase, and the last paragraph from lines 255 to 256 may be merged to the above paragraph.

Response 2: Thank you for your comment! We have followed your advice to revise it. Details are in following paragraph and manuscript.

According to your comment, we deleted all of the titles of level 3, e.g., 2.1.1. We merged line 255-256 to the above paragraph.

2 Materials and methods

2.1 Data sources

Rainfall data from 2014 were obtained from Hekou Yao Autonomous County, Pingbian Miao Autonomous County, Jinping Miao Yao Autonomous County and the meteorological department of Mengzi. The rainfall data were obtained at 5 min intervals. Meanwhile, two automatic weather stations were established along Xinhe Expressway to gather weather data during the 2014 experiment. Meteorological data, which were provided by the China Meteorological Data Network, covered the period of 1959–2015 (http://data.cma.cn/site/index.html).

Data on soil types were provided by Yunnan Traffic Planning and Design Institute. Data on soil texture and organic matter were obtained via field surveys, data sampling and processing methods. Soil samples were initially collected at each 1 km range of the artificial and natural slopes on both sides of the highway. Five mixed soil samples were obtained from one slope by using the ‘S’-shaped sampling method (Shu et al., 2017). Then, the method of coning and quartering was adopted (Oyekunle et al., 2011), and half of the mixed soil samples were brought to the laboratory for analysis. Finally, 186 soil samples were obtained. After the soil samples were dried and sieved, soil texture and organic carbon content were measured via specific gravity speed measurement and potassium dichromate external heating, respectively.

The topographic map and design drawings of Xinhe Expressway were provided by the Traffic Planning and Design Institute of Yunnan Province. The 1:2000 scale of the topographic map coordinate system was based on the 2000 GeKaiMeng urban coordinate system, the elevation system for 1985 national height data and the format for the CAD map in DWG. The remote sensing

images used in this study were derived from 8 m hyperspectral images produced by the GF-1 satellite (http://www.rscloudmart.com/).

Comment 3: 5 Conclusions: The sentences from lines 564 to 571 may be erased because they all discuss methods instead of conclusions.

Response 3: We are in complete agreement with your comment. We have followed your advice to revise it. Details are in the following paragraph and manuscript.

The error analysis of the actual observation data showed that the overall average absolute error of each monitoring area was 38.65 t·km−2·a−1, the average relative error was 31.18%, the root mean square error was between 20.95 and 65.64 and the Nash efficiency coefficient was 0.67. The method of soil and water loss prediction adopted in this work generally has a smaller error and higher prediction accuracy than other models, and it can satisfy prediction requirements. The risk grades of soil and water loss along the slope of Xinhe Expressway were divided into 20- and 1-year rainfall conditions based on simulated predictions. The results showed that the percentage of slope areas with high and extremely high risks was 7.11%. These areas are mainly located in the K109+500–K110+500 and K133–K139+800 sections. Therefore, relevant departments should strengthen disaster prevention and reduction efforts and corresponding water and soil conservation initiatives in these areas.

Comment 4: There are many language errors throughout the manuscript. Numerous sentences are strange and unreadable. Some long terms are composed a series of nouns. I am afraid they are translated from the Chinese-English dictionary words word.

Response 4: We greatly appreciate your valuable suggestion concerning improvement to this paper. We have followed your advice to revised it. Details are in the manuscript.

Comment 5: Line 22. What is the meaning “the linear highway rainfall” ?

Response 5: Thank you for your comment! We have followed your advice to revise it. Details are in following paragraph and manuscript.

The partition of the prediction units of soil and water loss on the expressway slope in the mountainous area and the spatial distribution of rainfall on a linear highway are studied.

Comment 6: Line 23: “…the model parameter factor”. You may erase any of the words,

parameter or factor.

Response 6: Thank you for your comment! We have followed your advice to revise it. Details are in following paragraph and manuscript.

the model parameter is modified, and the risk of soil and water loss along the mountain expressway is simulated and predicted under 20- and 1-year rainfall return periods.

Comment 7: Lines 55-56. What' the meaning of the word measure? Do you want to say that in the next 20-30 years, the expressways in China will BE INCREASED BY 40, 000 km?

Response 7: We are in complete agreement with your comment. We have followed your advice to revise it. Details are in the following paragraph and manuscript.

Statistics further indicate that in the next 20-30 years, the expressways in China will have a total length of more than 40,000 km.

Comment 8: Line 56. The unit of the erosion rate is normally tons/km2.a.

Response 8: Thank you for your comment! We checked the relevant literature carefully and then revised it. Details are in following paragraph and manuscript.

The annual amount of soil erosion is 9,000 g/m^3, which can cause 450 t of soil loss annually (Chen, 2010).

Comment 9: Line 70. The word applicable may be replaced with the word applied.

Response 9: We are in complete agreement with your comment. We have followed your advice to revise it. Details are in the following paragraph and manuscript.

RUSLE was derived from the theory of erosion processes and has been applied to more than 10,000 plot-years of data from natural rainfall plots and numerous rainfall-simulation plots.

Comment 10: Line 78. The word scientists is preferable than the word scholars.

Response 10: We are in complete agreement with your comment. We have followed your advice to revise it. Details are in the following paragraph and manuscript.

many scientists have conducted useful explorations to modify the model's parametric values and improve its simulation accuracy.

Comment 11: Line 235. The term rainfall data type is strange.

Response 11: Thank you for your comment! We have followed your advice to revise it. Details are in following paragraph and manuscript.

The rainfall data were obtained at 5 min intervals.

Comment 12: Line 241. The sentence is strange and unreadable.

Response 12: Thank you for your comment! We have followed your advice to revise it. Details are in the following paragraph and manuscript.

Data on soil texture and organic matter were obtained via field surveys, data sampling and processing methods.

Comment 13: The definite article THE is always absent when it is needed in the manuscript.

Response 13: Thank you for your patience and careful work! We have followed your advice to revise it. Details are in the manuscript.

Comment 14: The font size of the text in the figure should be clear and unified. The texts in Figure 2 are too small. So do Figures 4a and b. Some sequence numbers of the figure titles are not right, e. g. Figures 5 and 5a. The representation methods of the titles of Figures 4a and b are not right.

Response 14: Thank you for your patience and careful work! We greatly appreciate your valuable suggestion concerning improvement to this paper. We have followed your advice to revised it. Details are in the following paragraph and manuscript.

- We revised and typesetted Figure 2 to make it look clearer.

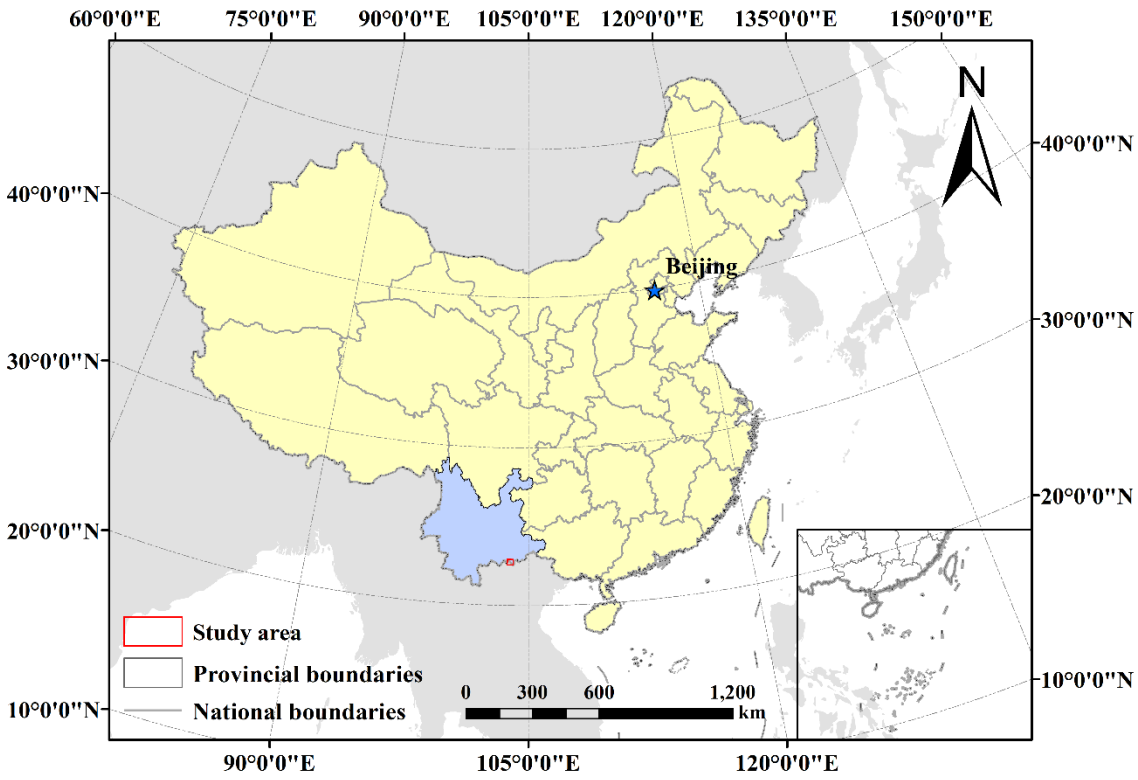

Figure.2 The location of study areas in China

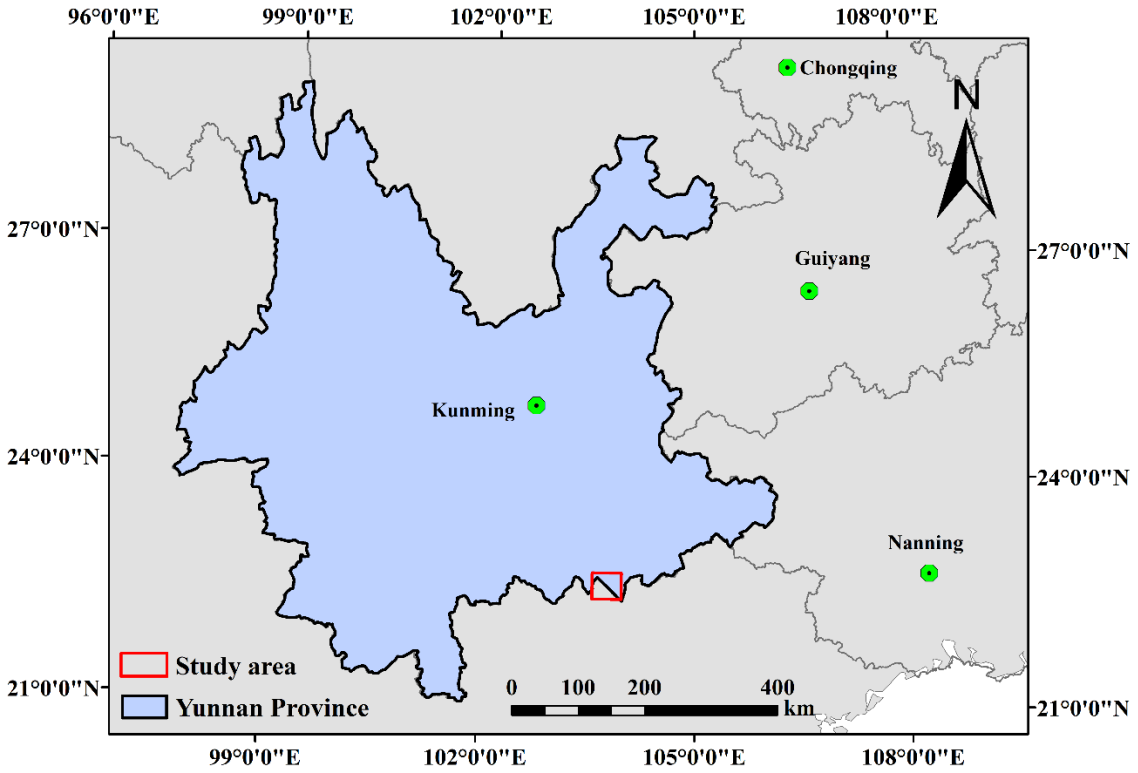

Figure.3 The location of the study areas in Yunnan Province

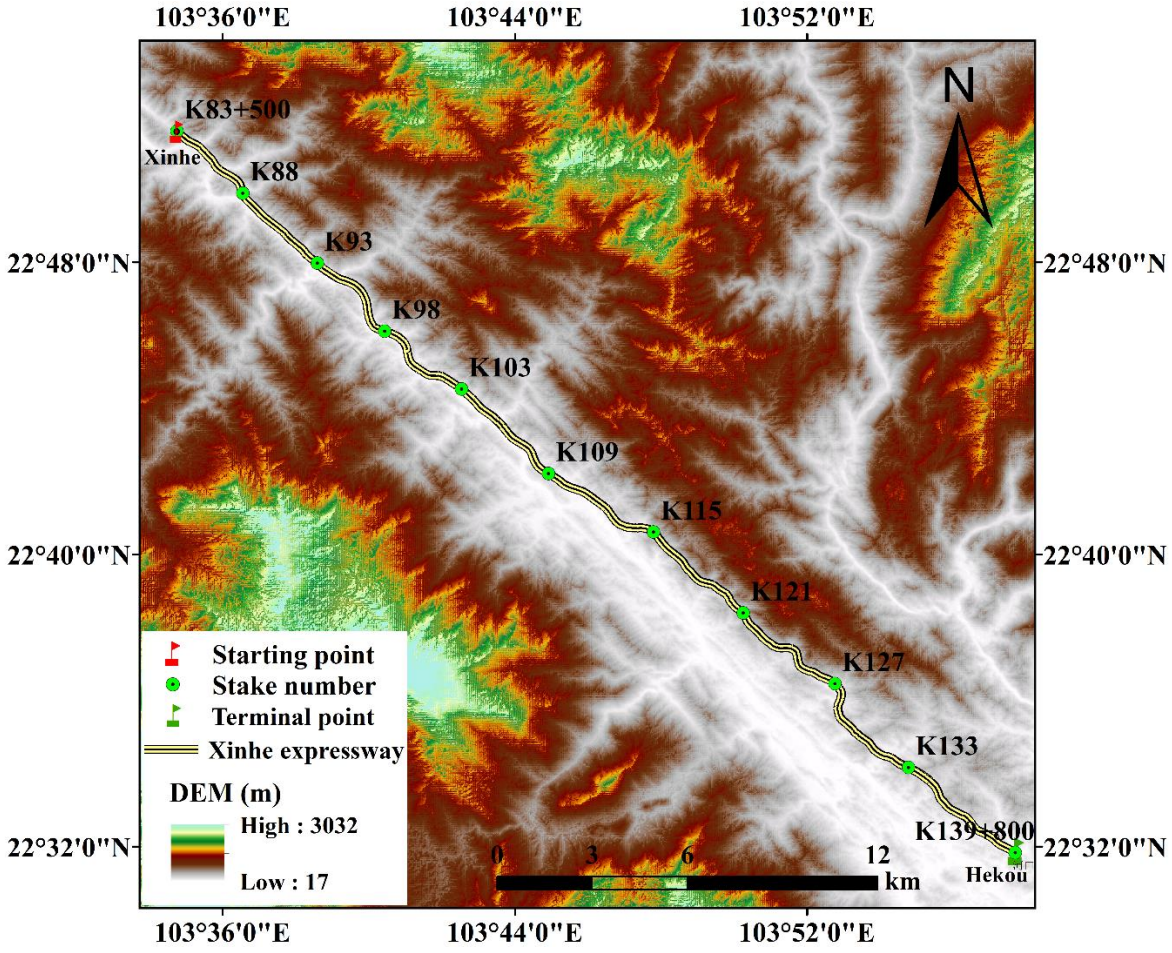

Figure.4 Overview of the study region

➢ The layout style of Figure 4 was revised according to the requirements of the editor. At the same time, we have revised the representation methods of the titles of Figures 4a and b.

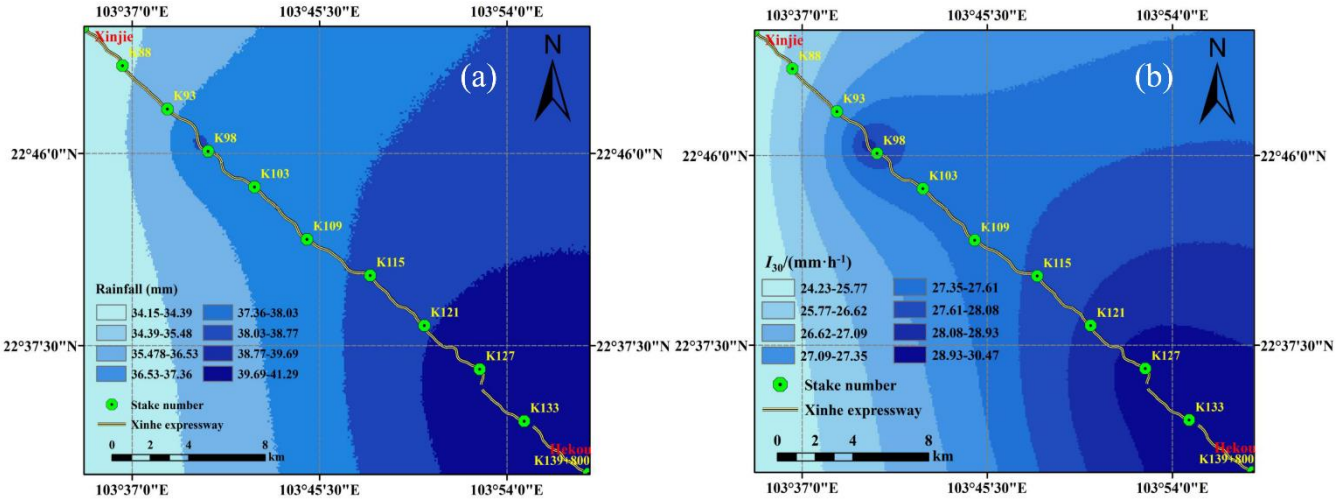

Figure 6(a). Interpolation rainfall results of June 5, 2014

Figure 6(b). Interpolation I_{30} results of June 5, 2014

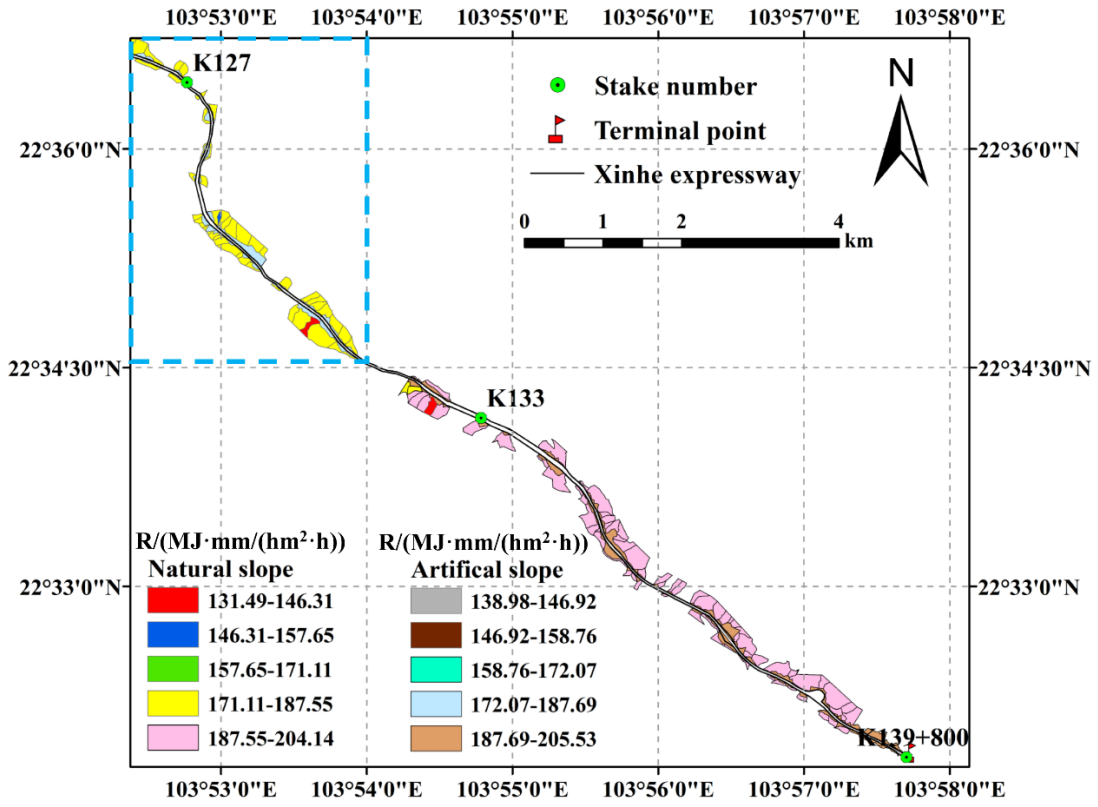

Figure 7. Spatial distribution map of rainfall erosivity factors (K127–K139+800)

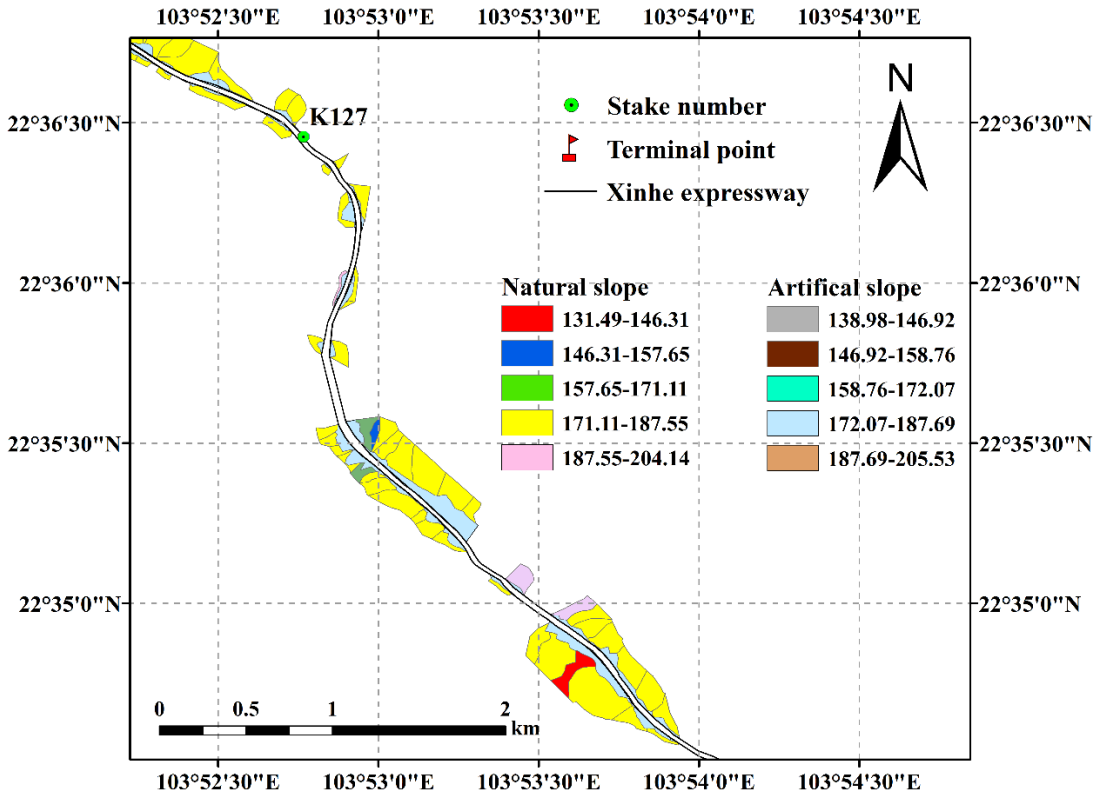

Figure 8. Spatial distribution of rainfall erosion factor in typical a section of a highway

Comment 15: Still there are many other minor errors which have not been written here. I strongly suggest you carefully check the whole paper sentence by sentence before you submit the revised version again.

Response 15: Thank you for your patience and careful work! We greatly appreciate your valuable suggestion concerning improvement to this paper. We have followed your advice to revised it. Details are in the manuscript.