Reply to editor and the referees

On behalf of my co-authors, we thank editor and the referees very much for giving us an opportunity to revise our paper, we appreciate editor and reviewers very much for their positive and constructive comments and suggestions on the second version of the paper.

Based on these comments from reviewer 1#, reviewer 3# and professor Darve, we have made carefully proofreading again on language, style, grammar and professional terms in English, and the repeats in texts have been summarized and optimized, and the references cited in paper have also been corrected according to reference specifications. Combine the comments and suggestions of the three referees and editor, we focus on the supplement of detail of the geomechanical and FEM model in Section 3, and Section of discussion, especially exploration of deformation and failure mode of the landslide, and Section of conclusion have be also summarized and optimized. Please see the detailed revision of point-by-point reply, and the modified parts are marked in red in the revised manuscript.

Thank you very much for your suggestions and consideration, and we look forward to hearing from you.

Best regards,

Yimin Liu, Guiyun Gao, Pu wang, Chenghu Wang et al.

Detailed revision for the referee's comments

1. *Line 42: Fausto G. et al., 2004; probably Guzzetti et al., 2004*

Modification:

"Guzzetti et al., 2004" has been revised in line 42.

2. *Line 43: "Research on the formation mechanism and deformation mode of a translational landslide is mainly based on two perspectives". To which research are you referring?*

Explanation:

The two perspectives of the research of translational landslide I referred are in line 46 (Kong and Chen, 1989; Matjaž et al., 2004; Yin et al., 2005) and line 53 (Cruden et al., 1996; Emelyanova, 1986). Maybe we should add these in line 43.

3. *Line 46: Kong and Chen, 1989 is lacking in the list of references.*

Modification:

We are very sorry for our negligence of missing this reference, and we have added it in the list of references.

Kong J., Chen Z.: The translational landslide in red stratum located in east of Sichuan in July, 1989. Beijing: China Railway Publishing House, Landslide

Column(9), 1989.

4. *Line 51-52: "…the hard rock layer covered by the upper layer (such as granite and sandstone) has a crushing effect on …the lower weak rock layer". I don't understand.*

Explanation and modification:

What I want to express in this sentence is the upper layer contains hard rock such as granite and sandstone, and we modify it like this, "The second category includes landslides wherein the upper layer contains hard rock (such as granite and sandstone) has a crushing effect on the lower weak rock layer".

5. *Line 56-57: "Sensitive safety factors". What are? Probably you are meaning sensitivity analysis of safety factors or something like that.*

Modification:

As you said, "Sensitive safety factors" in Line 56-57 is the sensitivity analysis of safety factors.

6. *Line 57: Fan Xuanmei et al. (2008) is not listed in the references.*

Explanation and modification:

This reference cited is not by way. This reference is list in references in line 556, and it should be changed to "Fan et al. (2008)".

Fan X., Xu Q., Zhang Z., et al: Study of genetic mechanism of translational landslide, Chinese Journal of Rock Mechanics and Engineering, 27(Supp.2):3753-3759, 2008.

7. *Line 62: Mario et al. (2008): I think that this reference is Floris et al., 2008 (or Floris et al., 2008). Please modify also in the reference list.*

Modification:

We are very sorry for our negligence of missing this reference, and we have revised in the list of references and line 62.

Floris M., Bozzano F.: Evaluation of landslide reactivation: a modified rainfall threshold model based on historical records of rainfall and landslides, Geomorphology, 94(1-2): 40-57, 2008.

8. *Line 66: landslide resurrection. Are you meaning landslide reactivation?*

Modification:

We are very sorry for the lack of language skills, and "landslide resurrection" has been corrected to "landslide reactivation" in line 66.

9. *Line 73: collation. I suppose data collation in the part of the text between line 43 and line 76 is not very accurate.*

Modification:

In the part of the text between line 43 and line 76, we elaborated the research status domestic and international of the translational landslide. We replaced "data collation" with "references collation".

10. *Lines 86-87: "….laboratory physical experiments have been conducted in the to verify the failure model.". Please verify english language.*

Modification:

The references (Xu et al. 2006; Fan et al., 2008) have been conducted laboratory physical experiments to verify the failure model, we added these references in line 87.

11. *Line 90: abtained. Probably obtained.*

Modification:

We are very sorry for our negligence of word spelling, and "abtained" has been corrected to "obtained" in line 90.

12. *Line 77-92: I suggest to summarise. This part of the text is too long.*

Modification:

We have summarized this text from line 77-92. And referee 1# encourage us to add more information (what, where, why) and presentation of the main aim of the paper, so we modify and supplement the purpose and importance of this manuscript in Line 77-92.

13. *Line 100: Engineering instead Enginereing This mistake is common in the text. Please verify.*

Modification:

We are very sorry for our negligence of word spelling, and "Enginereing" has been corrected to "Engineering" in the revised vision.

14. *Line 110-111: I suppose that the meaning of the sentence is "the landslide involved sandstone and mudstone belonging to the Penglaizhen Formation of the upper Jurassic". Is it right? If yes, I suggest to revise the text.*

Modification:

You are right, we have revised in the text in line 111.

15. *Lines 120-121: I suppose you are discussing about water filling primary porosity (voids between grains) and water filling secondary porosity (cracks). I suppose that the first characterises weathered rock and the second jointed rock. Is it right? If yes, I don't understand the relevance of this sentence in your description; moreover I don't understand the meaning of "trailing edge".*

Explanation and modification:

"trailing edge" in line 121 is rear of this landslide, maybe in this sentence is not so accurate, we have deleted it in text.

16. *Lines 102-122. In my opinion the content of this part of the text doesn't deal with field survey as the title of the paragraph states.*

Explanation and modification:

We quite agree with your opinion. The title of this paragraph should be

"landslide location".

17. *Line 129: 10^5 instead 105.*

Modification:

We are very sorry for our negligence of superscript spelling, and "10^5" has been corrected to "105" in line 129.

18. *Fig. 2: Please add some geologic data. Outcropping formation/lithology, attitude of the strata in the surveyed area. I have some doubts about your section I-I'. If the trace of the section is right, the building and the highway should be located more or less in the middle of the section? Why they are located on the SW side? The values of the contour lines are lacking in the map. I suggest to deeply revise this figure!*

Explanation and modification:

Your comment is very constructive and significant, we had deeply revised Fig. 2, mainly added formation of lithology information in the Fig.2 based on your pertinent suggestion, and the attitude of the strata is presented in Fig 3, including argillaceous siltstone, mudstone and arkose sandstone. And you said that the position of I-I' is not so accurate, this is because we are not sure about the specific scope of the Wobaoshi landslide during the preliminary field survey, so the I-I' is not in the middle of the topographic map.

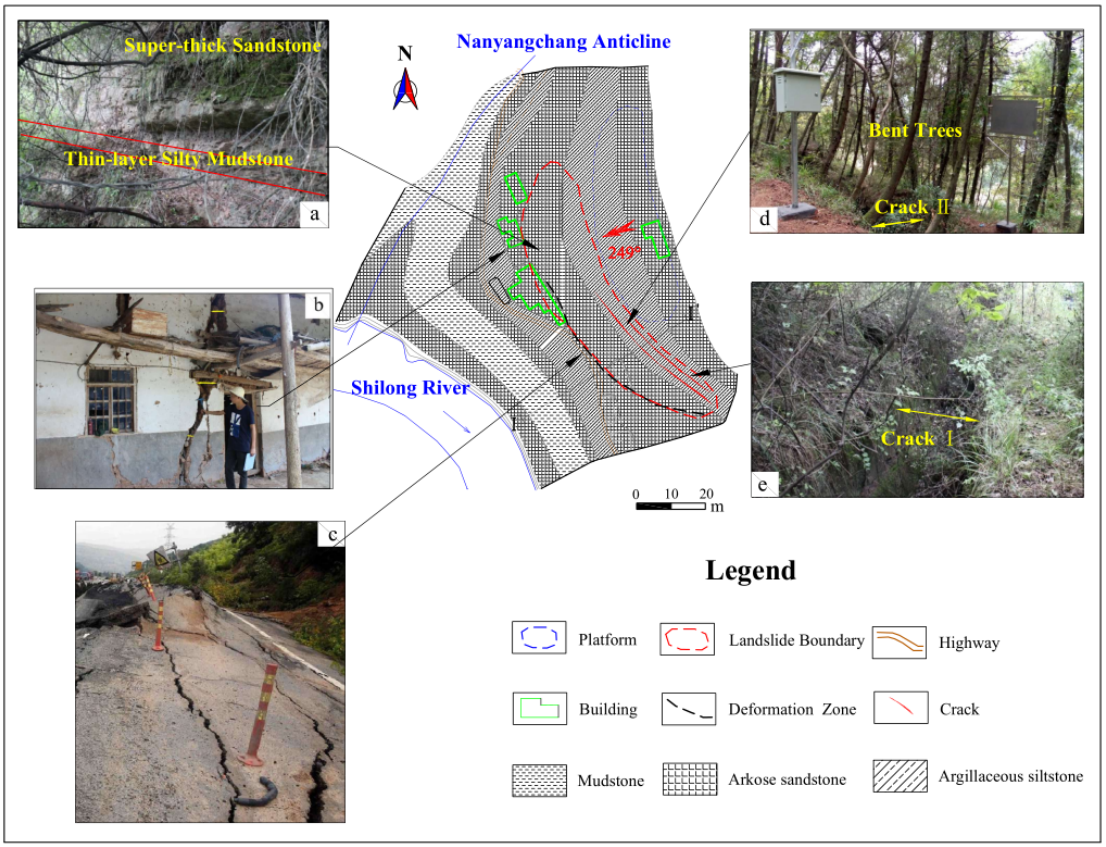


Fig. 2 Topographic map of the Wobaoshi landslide and photographs of observation points: (a) exposed bedrock at the front edge; (b) the houses had cracked at the front edge (c) the roadbed is pushed uplifted at the front edge; (d) crack II and bent trees; and (e) crack I.

19. *Line 126: How exactly you define the landslide boundary? In my opinion in your paper you have to avoid the term "about horizontal" or slide horizontally. The strata are gently inclined downslope and the failure surface too!*

Explanation and modification:

According to the investigation report (Chen et al., 2015), I can exactly define the landslide boundary and calculate its volume, and I (Yimin Liu) also participated in the field investigation. We added this reference in line 126. The term "nearly horizontal" in line 132 represents incline degree of the overall attitude of the rockbed, and the term "slide horizontally" has been deleted in Chapter 1.

19. *Line 145: "multistage dangerous rock mass with dumping deformation". I dont understand.*

Explanation and modification:

This sentence means this landslide looks like collapse. This sentence should be "multistage dangerous rock mass with deformation during disaster investigation".

20. *"the inclination of the landslide is almost erect". What does it mean?*

Explanation and modification:

There is ambiguity in this sentence. We corrected it as "the sliding bodies are almost perpendicular to the potential sliding surface".

21. *"thin plate" probably "narrow plate".*

Explanation and modification:

You are right, we have revised "narrow plate" in the text in line 147.

22. *Line 148: "furthermore, the surface structure of the slope has a certain degree of aperture ". What does it mean?*

Explanation and modification:

There is some ambiguity in this sentence. We corrected it as "the structural surface of the landslide body has a certain degree of aperture".

23. *Line 149: "collapse deposits "; you are meaning debris?*

Explanation and modification:

You are right, and "debris" has been corrected to "collapse deposits" in line 149.

24. *Lines 174-181: From a technical point of view this description is lacking and it anticipated your interpretation of the monitoring data. The title of this section "Forming conditions" doesn't reflect the content.*

Explanation and modification:

You are right, as you said that the title of this section "Forming conditions" doesn't reflect the content. So we revised the title of section 1.2.2 as "Forming Conditions of the sliding bodies", and this section mainly describe forming condition

of the plate-shaped sliding bodies I and II.

25. *Fig. 4: What is "platform" marked by dashed blue line? I suggest to add some technical details of the used instrumentation, especially for pore water instrumentation.*

Explanation and modification:

The "platform" in Fig. 4 represents the platform at the trailing edge of the landslide. After the landslide body slides forward and downward, the slope of the trailing edge surface of the platform gradually becomes platform-like.

As you said the technical details of the used instrumentation, we first included them in the first draft, however, during the discussion, the reviewers and we thought that the focus of this article was to explore the failure mode of this type of landslides and provide measured data to support this view, so some parts about technical details of the instrumentations were deleted.

26. *Lines 204-205. h_s or h_m?.*

Explanation and modification:

We are very sorry for our negligence of proofreading, and "h_m" has been corrected to "h_s" in line 204.

27. *Lines 255-256: Why do you think that the total cumulated displacement (0,2m from Figure 8) is induced by rainfall? From your data set you can infer that the increasing/decreasing width of the two cracks are strictly related to the rainfall. What "plate girder" is?*

Explanation and modification:

From Fig. 6 and Fig. 7 can infer that the increasing/decreasing width of the two cracks are strictly related to the rainfall. We are very sorry for our negligence of proofreading, and "h_m" has been corrected to "h_s" in line 204.

The term "plate girder" in this paper represents the plate-shaped of the sliding bodies, which cut and disintegrated the sliding body into plate-shaped blocks from front to back.

28. *Lines 269-277. "…owing to the sudden decrease of the pore-water level in the trailing edge crack, the water pressure around immediately following plate-shaped body becomes unbalanced, and new sliding damage is induced…". I don't understand this theoretical explanation. Probably an outline referred to this landslide would help.*

Explanation and modification:

This theoretical explanation is shown in the references (Fan, 2007; Xu, 2008), and which is a theoretical study of the landslide failure mode, and this theoretical explanation is also shown in Fig. 9. Chapter 3 is model calculation and numerical simulation based on the measured data in Chapter 2. We think the interpretation is reasonable.

29. *Line 285: "And soli elastic-perfectly…." ?*

Explanation and modification:

This term “soli elastic-perfectly plastic model” in line 285 is not so accurate, we corrected it as “the soli elastic-plastic ideal model”.

30. *Line 295: h1 and h2 are the height of the water level in the crackI and II respectively. Why pore water level?*

Explanation and modification:

In the geomechanical model of Fig. 9, h_1 and h_2 represent the height of the pore-water level in the crack I and II respectively, and the water in the crack I and II is consider as pore-water, which can be shown in Fig. 3.

31. *Line 300: In fig. 8 h is lacking.*

Explanation and modification:

We are very sorry for our negligence of proofreading, and “Fig. 7” has been corrected to “Fig. 8” in line 300, and the pore-water pressure in Fig. 7 can be converted to *h* in line 300.

33. *Line 304: I suggest “unit weigth of the saturated volume” instead of “saturated gravity”, unit weight of water instead of gravity water.*

Modification:

Your terms are much more accurate and professional. We have corrected them in revised paper in line 304, also in line 311 and line 443.

34. *Line 309: “experimental data of the triaxial confining pressure”. I suppose you are discussing the experimental data of the triaxial test not of the triaxial confining pressure that is a detail of the triaxial test.*

Modification:

Your terms are much more accurate and professional. We have corrected them in revised paper in line 309.

35. *Line 333 and Figure 10: “slippage”. I think you mean the displacement or, better, the variation of aperture of the cracks I and II you call absolute stretching.*

Explanation:

The term “slippage” represents amount of the absolute stretching, especially for the multistage plate girders. We think this term should be reasonable after our discussion.

36. *Line 333: “increase” instead change.*

Modification:

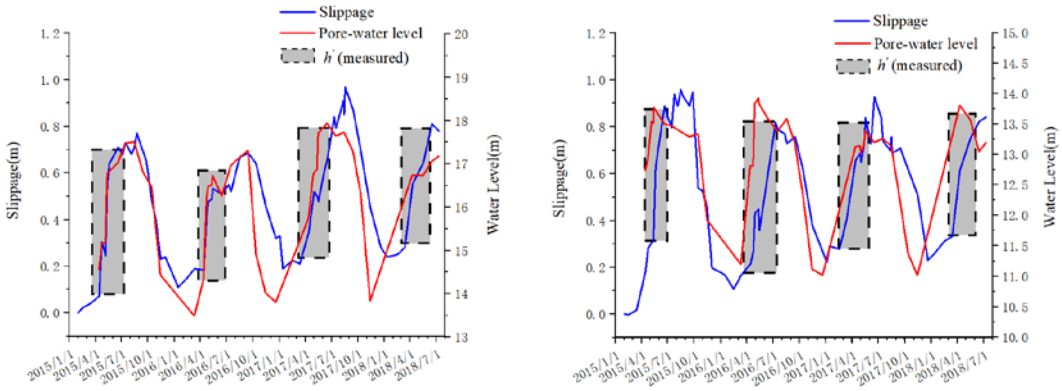
Your terms “increase” are much more accurate. We have corrected them in revised paper in line 333.

37. *Caption of Figure 10: if I understand well (see your text too) you are showing the*

measured h in correspondence of the sudden increase of aperture of the cracks not the maximum values of the measured h.

Explanation:

Your suggestion is reasonable and correct, and we revised Fig. 10, and "$h_{cr}^{'}$ *(measured)*" has been corrected to "$h^{'}$ *(measured)*" in Fig. 10. "$h_{cr}^{'}$ *(measured)*" is selected by the maximum of "$h^{'}$ *(measured)*".



(a) Crack I (b) Crack II

Fig. 10 Determination of the maximum measured pore-water level $h_{cr}^{'}$

38. *Line 342-343: In my opinion in Fig. 10 you didn't show the equation 1 and 3.*

Explanation and modification:

We are very sorry for our negligence of proofreading, and "Fig. 11" has been corrected to "*Fig. 10*" in line 343, the curves of equation 1 and 3 are shown in Fig. 11.

39. *Line 348: "values" instead "frequency".*

Modification:

Your terms "values" are much more accurate. We have corrected them in revised paper in line 333.

40. *Line 357: how did you infer elastic modulus? ; "angle", instead "angel".*

Explanation and modification:

We are very sorry for our negligence of proofreading, and "angle" has been corrected in line 357. The elastic modulus of arkose, silty mudstone and clay are obtained by indoor testing of cores, which is shown in the investigation report of Wobaoshi landslide (Chen et al., 2015).

41. *Line 373: "change period shown in Table 5"? I suppose in five loading steps. Caption of Table 5: Simulated values of h1 and h2. Your simulation is referred to one cycle of increasing and decreasing water level in crack I and II. If you introduce in your simulation some other cycle of increasing and decreasing water level (as it results from your monitoring data) what it happen to the block I and II?*

Explanation and modification:

We simulated 4 cycle of increasing and decreasing water level in crack I and II. Here Table 5 and Fig. 12 just show the typical results of one cycle. The deformation trends of block I and II of other cycles are similar as that shown in Fig. 12 except the difference in amplitude.

42. *Lines 393-400. In my opinion it is a repetition.*

Explanation and modification:

You are right, and we have compressed and deleted this text from line 394 to 396 for concise of discussion.

43. *Line 406: Why did you mention the paper of Zhang et al. 1994? Line 414: Fan et al., 2007*

Explanation and modification:

The paper of Zhang et al. 1994 first proposed the rainfall-triggered failure mode of the translational landslide, and the monitoring results in my paper attempt to validate it. “Fan et al., 2007” has been changed in line 413.

44. *Lines 426-436: I suggest to improve this explanation. Your interpretation is very interesting but it explains 1 cycle of increasing and decreasing water level in crack I and II. What would be the effects of the successive application of some other cycle?*

Explanation and modification:

Your comment about my explanation in lines 426-436 is very constructive and significant. As you said there is 1 cycle of the change of water level, and we discussed that the cracks at the bottom of the slab-shaped sliding body grow larger, and the degree of inclination of the plate girder continues to increase year after year in line 431-435. Actually, when we wrote this paper, there is less monitoring data in only three-and-a-half years, so the exploration of deformation and failure mode is not so accurate and easy. These shortcomings like your comment about deformation and failure mode explanation will be improved in my future research.

45. *Lines 448-456: In this part of the text there is a summary of section 4.1. It is a not useful repetition. Lines 447-455: The position of this part of the text discussing the low value of shear resistance angle is inappropriate; in my opinion, as already suggested, you have to discuss the experimental data before using them for your calculations.*

Explanation and modification:

Your comment about lines 448-456 is also concerned by reviewer 2# (Professor Darve). In our discussion, it is very interesting for the value of friction angle, and it seems too low and unrealistic, so we add the explanation and discussion in Section 4.2 from line 445 to 453. The internal friction angle, θ = 11.2°, is so low for clay, which seems unrealistic. However, the angle θ is obtained by triaxial compression tests of the core, which is taken from the sand-mudstone contact surface in sliding surface, and the internal friction angle θ = 11.2° (Chen et al., 2015). One of the reasons may be

that the clay layer is severely weathered, so its internal friction angle is small. In general, the dilatancy effect obtained by the associated flow law is much larger than the actual observation, especially in the case of laternal infinite (Tschuchnigg et al., 2015a). However, for slope stability analysis, laternal infinite is not considered in most cases, and the dilatancy effect is not significant (Griffiths & Lane, 1999). Therefore, it is reasonable to set the dilatancy angle to be equal to the internal friction angle. Therefore, we should retain the text from line 446 to 454.

We realized that the geomechanical model of landslide in Section 3.2 is relatively simple, which is a purely static method, and it ignores the influence of strain history. Moreover, in the numerical simulation calculation, the boundary conditions are set relatively simple, and the working conditions considered are also less than the actual situation. This shortcoming will be improved in my future research.

46. *Line 452/453: "laternal infinite"?*

Modification:

The term "laternal infinite" in this sentence is not correct. We have corrected them to "laternal confinement" in revised paper in line 451.

47. *Caption of Table 3: In column 2 and 4, values of aperture of crack I and II are reported? If yes I suggest to modify the corresponding title of the two columns (see also the text).*

Explanation:

The column 2 and 4 in Table 3 is the amount of slippage (absolute stretching) of crack I and II, and which are shown in Fig. 10.

48. *Table 4:What is gravity? You report some data about clay. If I consider Figure 2, I didn't find clay. Is it a layer inside the silty mudstone?*

Modification and explanation:

As you said in line 304, "unit weight" instead of "gravity". There is a layer which is potential sliding surface contains clay in Fig. 3.