Response to reviewer #3

First of all, we would like to express our sincere thanks to the reviewer for his/her constructive and positive comments and careful work. We have revised the manuscript, and the amendments are highlighted in red in the revised manuscript. The modifications abided by the reviewer #4's comments are highlighted in blue in this revision.

This paper is a technical note on experiments made in the lab on a new OTDR device. It has nothing to do with "landslide monitoring strategy" as indicated in the title, which has to be changed.

Experimental and technical setups are properly described and the text is clear in general. However the references to previous generations could be simplified to focus on the last one (some corrections are proposed below).

My main concern is about the claim that this device is operational for landslide monitoring. I agree that such device can be used for man-made (concrete) structures, but I am very skeptical about using it for landslide monitoring at this stage. The authors do not mention any real field implementation of their devices. Moreover, monitoring is also about long term reliability and maintenance, points not discussed here.

Then my questions are:

1) For which kind of landslides do you intend to use it? Have you ongoing test sites ?

Answer: Our transducer could mainly be used in the slope stability monitoring by bore-hole based methods, Fig. 1, like Inclinometer (Sargand, et al 2004), Time Domain Reflectometry (Dennis, et al 2006) does. We want to establish a new method for landslide monitoring using optical fiber sensing technology. Now, we are in lab. We plan to improve the monitoring device, as we described in section 5.3. We also want to upgrade the transducer for better performance, as we described in section 5.2 and 5.6. Also, in-site modeling and field tests are in our plan.

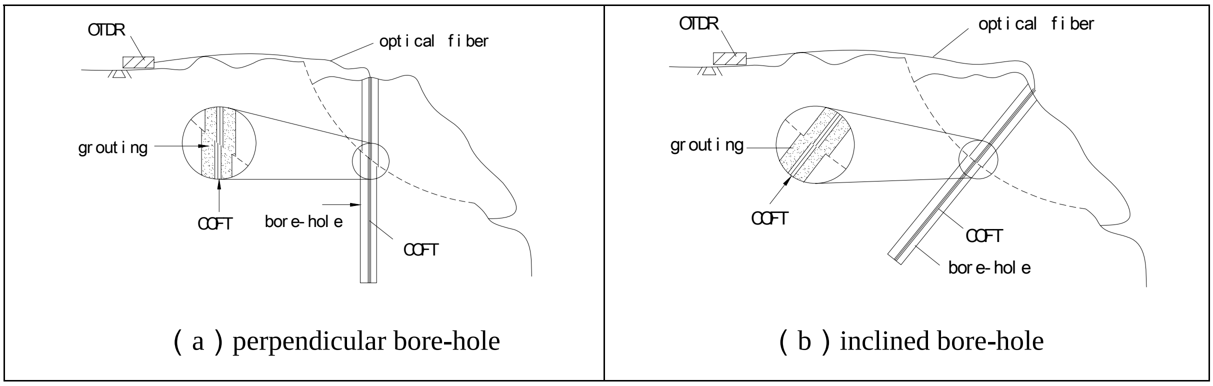

Fig. 1 application mode of monitoring system based on vertical and inclined borehole

2) With such a short dynamic ranges (couple of cm) I can see a potential for large rockslides, where mm-cm displacements matter. But then it requires to be able to monitor several levels of shear zones /sliding surfaces on several tens of meters of depth. Then, how long can be monitoring section? And what about having several shear zones ?

Answer: The maximum monitoring depth can reach several tens of meters. The monitoring device in our test is an OTDR, type TFP2A. Its spatial resolution is low, about meter level. This is passable to our model tests. However, it is not suitable to be used in field monitoring now.

Our transducer can only monitor one shear zone in its current stage. The monitoring device also couldn’t accomplish several shear zones monitoring limited to its spatial resolution. We have found these problems. So we have adjusted the experimental plan in our current and future tests to overcome the drawbacks. The new tests, improvements and findings will be presented in our following papers.

3) For shallow landslides, don’t you think the dynamic range is too short for real monitoring, comapred to other classical techniques ? (Except for some research purposes; I am not talking about using TDR for water content measurement).

Answer: The dynamic range of our transducer in its current stage does be too short compared to other classical techniques. If we don’t consider using or studying on TDR or inclinometer, the reviewer’s comment is right. This could be the limitation of our current studies.

4) For information, none of the top instrumented landslides in the world from the review of Baron & Supper 2013 (in NHESS) are using TDR. Any comment ?

Answer: Compared to other classical techniques, TDR and optical sensing technology are so young technologies that need many deep studies before they are used to field slope stability monitoring.

As stated in Baron & Supper's paper, 'Classical and automated inclinometers, …… were ranked as the most reliable sensors of displacement and deformation monitoring with the highest early warning potential.' However, the price of the guide casing in mainland China ranges from 2.7 \$ to 9.2 \$ m^{-1}, which is cost about 8-25 times higher than that of our transducer. We aimed to invent a new transducer using for landslide pre-warning using optical fiber sensing technology, which could simultaneously have higher initial measurement accuracy (about couple of mm), larger sliding distance (up to about 10 cm), judgment of landslide movement direction, lower cost (less than 0.4 \$ m^{-1}), real-time and long distance telemetry. We are in progress.

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TITLE : the tittle is misleading and has to be changed. This paper is not about "landslide monitoring strategy" but about the technical improvement of a TDR device. Something like "New improvement of OTDR device for landslide monitoring" would be more correct.

Answer: Thank you. We have modified the title as 'New improvement of the combined optical fiber transducer for landslide monitoring'.

Page 6850: Line 22: GIS is not a technology to monitor landslides, and the reference mentioned is about landslide mapping, not monitoring.

Answer: We have deleted this reference.

Page 6851: Lines 6 to 14: it is not clear what these generations are. Moreover the paper Zhu et al 2011 mentions only two generations, and Zhu et al 2009 is in Chinese.

Reformulate this paragraph in way that the reader can understand without having to read these papers. For instance, you can say that the first generation required a too high minimal initial displacement; that the second generation improved this feature, but , ..and so on.

Answer: We have modified those sentences as the following,

In our previous studies, firstly, we reviewed the application of some electro-optic technology, such as TDR, OTDR, BOTDR, et al, in slope stability monitoring, and we point out that the electro-optic technologies are to become a new choice for slope stability monitoring (Zhu et al., 2009). Then, we designed a serial combined optical fiber transducer (COFT) try to make this idea into reality. The first and second generation COFTs were put into public in 2011 (Zhu et al., 2011). We employed the spatial construction principle of reinforced beams, the optical fiber micro-bending loss mechanism and OTDR technology. We used a base material, some capillary stainless steel pipes and optical fiber as the sensing element. Bending resistance tests were performed on the first and second generation transducers. Results showed that the performance of the first-generation COFT was poor. Its initial measurement precision and dynamic range were 5mm and 0-7mm respectively. The performance of the second-generation COFT was better than those of the first-generation. Its initial measurement precision, sliding distance and dynamic range were 1.2mm, 21.8mm and 0-20.6mm respectively. However, the second-generation COFT cannot measure the movement direction of loadings. So we designed the third-generation COFT. Bending resistance tests performed on the third-generation transducer grouted with concrete C40, and proved that such sensor has higher initial measurement precision, larger sliding distance, and dynamic range.

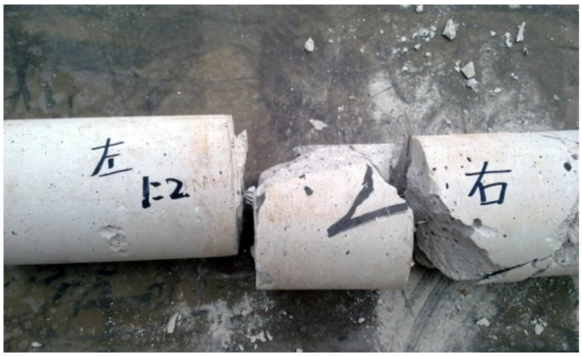
Page 6852: Line 6: explicit phi = diameter In the whole text: sometimes the #1, .. refer to pipes and sometimes to models. In the Figures, pipes are indicated as 1#,: : : . Keep the format #1 for pipes and Model 1 for models.

Answer: Thank you. We have modified these.

Page 6853: Line 8: what does “grouting integrity “ mean ?

Answer: Shown in Fig. 2, we have modified ‘grouting integrity’ as ‘test model integrity’ to make the statement more clear. We also added these two photos in the paper.

(a) model 1



(b) model 2

Fig. 2 model test completed