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Interactive Comment

Interactive comment on "Pre-, co-, and post-rockslide analysis with ALOS/PALSAR imagery: a case study of the Jiweishan rockslide, China" *by* C. Zhao et al.

Anonymous Referee #2

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General Comments Zhao et al. discuss the usefulness of L-band SAR for the study of rockslide in steep and vegetated mountainous areas. The result of the analysis of images before the rockslide is very interesting. Fig.5 is very impressive, since the pre-event deformation is of a rigid block type. I think this is an important result for the understanding of the mechanism of rockslide and the mitigation of landslide disasters.

Specific Comments I have a couple of specific comments concerning technical and geophysical issues. 1) InSAR analysis before the rockslide 1-1) DEM Zhao et al. detected deformation in 2007 using a SBAS InSAR technique. The SBAS InSAR technique is already established and widely used in several geophysical applications. I wonder if the resolution of SRTM3 DEM is enough for SBAS analysis. SRTM3 DEM has a resolution of ~90m. They processed ALOS/PALSAR images with 1 x 2 looks, which means about ~7.5m spatial resolution for SAR images. We process images with 10 looks or so (i.e. >50m spatial resolution) in InSAR analysis for deformation study. Therefore we do not have to care much about the resolution of DEM. In our experience, resolution of DEM should be higher than that of SAR images and we must oversample DEM. If we use SRTM3, we should oversample DEM more than 10 times to meet this condition. I wonder if the accuracy of oversampled DEM is enough for InSAR analysis. Furthermore, the original SRTM3 occasionally has a big hole in mountain regions. I do not know if the present target site has a hole in DEM, but possible. Therefore most people, including present authors, use a gap-filled SRTM3 using some interpolation algorithm. I wonder how accurate it is. Is it suitable for high-resolution InSAR processing? Recently, we use DEM with higher spatial resolution such as ASTER-GDEM whose resolution is 1 arc-second. I recommend that the authors should check their results with such a higher resolution DEM.

1-2) Number of SAR images Zhao et al. use only 5 images before the rockslide. Theoretically it is OK to obtain deformation with a small number of images. However, L-band SAR is often affected by ionospheric disturbances, especially in summer for ascending images. The acquisition by ALOS/PALSAR was made at ~22:30 (local time) on the ascending orbit. Travelling ionospheric disturbances are active during night. The maximum amplitude sometimes exceeds 50 cm in LOS direction in an image. Therefore people must carefully check if such disturbances appear in their interferograms. If such disturbances are dominant and number of images is small, the resultant velocity may be largely biased. Taking a look at Fig.4, I guess such an effect is properly removed or none. The authors, however, do not show all interferograms they processed. Furthermore, they show interferograms only in target area, though one ALOS/PALSAR image covers ~70 km x 70 km area. For the evaluation of analysis, the authors should show interferograms of the whole area that PALSAR image covers.

1-3) Accuracy of deformation According to eqs. (5) – (7) and geometric parameters of SAR and slope, the resultant deformation in the slope direction may be about 5 times as large as LOS displacement. This is mainly due to the fact that the direction of the slope is nearly parallel to the flight direction. Therefore the third term is the most dominant in eq. (7). The incidence angle is varied from near to far range. 38.5 degree may be that at the center of image. In ALOS/PALSAR's case, it varies by up to 5 degree. This may cause up to 5% error in the estimate of deformation in the slope direction. We do not know where the target area is in the whole PALSAR image and cannot evaluate the accuracy. Again, the authors should show the entire image. Of course, I must ask if the assumption that the deformation is only in the direction of slope is OK. Slope may not be uniform and varied locally. The average azimuth and slope angle that they show in the text have some errors. The discussion including such errors is desired.

2) Interpretation of pre-rockslide interferograms The authors say that the deformed zone can be divided into two blocks: driving and resisting blocks. The former has a rectangular shape, while the latter is triangle. Taking a look at Figs. 5 and 6, we can notice that the northern part has the largest displacement of ∼30 cm. If the northern part is resisting block, deformation should be decelerated in this block. Are there any blocks that resist sliding in the shadow of SAR?

3) Comparison of intensity images before and after the rockslide The authors show intensity images acquired before and after the rockslide with their differences in Fig.7. Actually, it is not easy to assess the Fig.7, since the size of (a), (b) and (c) is different. Even referring to the superimposed polygon, it is hard to make sure the changed areas. White and black areas in Fig.7(c) may indicate zones of intensity decrease and increase, respectively, but it is not easy to discriminate from the gray background. They should use color composite and make all figures in the same size.

4) Accuracy of height after the rockslide The authors obtained height changes after the rockslide, but it is not clear what the reference is. If they refer to SRTM3 DEM as the topography before the rockslide, they must take care about the accuracy and resolution

of SRTM3.

Technical Corrections There are several points to be corrected. P.1803 L.7) The name of ALOS is “Advanced Land Observing Satellite”. P.1803 L.7) This is the first appearance of PALSAR. Therefore full name “Phased Array type L-band SAR” should be given here. P.1806 L.2) “line-of-light” should be read “line-of-sight”. P.1806 L.10) “covered by” should be read “covered with”. P.1809 L.6) “35 cm” may be read “30 cm”, since I cannot read 35 cm in Fig. 6.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 1799, 2013.