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Interactive Comment

Interactive comment on "Landslide dynamics and coupling revealed by L-band InSAR in central Georgia" *by* E. Nikolaeva et al.

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Referee Comments

This paper can be a valuable contribution to NHESS, because the topic should be of interest to wide international audience, the authors present new data and interpret them in a rather original way. However, some descriptions and interpretations of the results need to be clarified. This, together with editing and careful English revision is necessary to improve the paper quality and make this work more easily understandable by readers who may not be very familiar with radar interferometry. Below are my specific suggestions for the paper improvement.

Introduction It seems long and could be condensed. In particular, section 1.2 could be shortened (e.g. the first sentence is not needed). Further, the title “Landslide classification and hazards” does not really reflect the content – I suggest “Landslide mechanisms” or similar. Regarding section 1.3 (Landslide detection…), your work is focused on a single slope failure and, therefore, some comments (and references) on broad-area landslide investigations and generating landslide inventories could be omitted. What does InSAR work by Perski et al (2009) on mining subsidence have to do with landslides? Section 3.2 InSAR – some parts and terminology used could be hard to understand to landslide scientists unfamiliar with radar interferometry and “sending” the readers to very technical literature alone may not be the best solution - you can consider making a reference to works on InSAR written for landslide people (eg Colesanti, 2003, 2006).

Data interpretation Section 4.1 InSAR – interferograms like those in Fig. 4 are most often used for qualitative-type interpretations. Since you interpret them in a quantitative way (velocity profiles in Fig. 4 and, especially, velocity changes in Fig. 9), it seems necessary to explain the quality/reliability of these results in terms of precision (displacement velocity results) and errors involved (I can see some noise in the results). Also, the sites G, B, R and M should be explain in Fig. 4 caption. Further, are you considering polygons including several pixels?

Section 4.4 Slide volume –exponent 1.3 applicable for both shallow soil and deep bedrock landslides? From the descriptions of the slope geology and morphology it seems you have a deep slide involving bedrock. Some explanation is desirable here. Section 5.1 Impacts – the landslide directly affected 4 villages? This is an important statement, but while understandable for Itskisi, it remains unclear in the case of the other 3 villages. Please clarify. Fig. 10 alone, though nice, is not enough. Further, Fig. 10 deserves some more explanation. To what period refer the presented InSAR LOS displacements? In addition, the displacement vectors on the profile would indicate that the predominant mechanism is rotational with significant away from the sensor movements occurring more than 200 m further upslope from the inferred “headwall fault” position (red dashed line in Fig. 10). This need to be explained.

Section 5.2 Triggering factors – should explain the spatial resolution/quality of the precipitation information from ECHAM5. Further, the interpretation of rainfall data in terms influence on changes in landslide movement velocity is a bit simplistic. Average monthly precipitation alone may not necessarily be significant in case of deep landslides that are often characterized by very complex hydrogeologic regime (some such slides "respond" to multi-month or annual variations in precipitation). And you deal with a large, deep landslide complex and have no information about groundwater levels in the slope and their variations. Thus your conclusion about rainfall and landslide acceleration is weak and speculative. Considering the July 2007 earthquake parameters (and the general magnitude-distance relations – cf. Keefer, 1984 GSA Bull., 2002 Surveys in Geophysics), it is very unlikely that this event could have resulted in the increase of the landslide displacement rate. The above interpretations are illustrated with the aid of Fig. 9, which, however, needs to be improved: need to select other colors, because your choice of red, magenta on top of magenta bar graphs simply does not work well.

Section 6 Conclusions You invoke a possible catastrophic scenario in reference to future earthquakes. However, deep pre-existing landslides are rather rarely reactivated by earthquakes (cf Keefer, 1984 GSA Bull., 2002 Surveys in Geophysics), though some cases of delayed post-seismic reactivations are known (eg Wasowski et al, 2002, Surveys in Geophysics). It would appear, however, that landslide toe mining represents a more immediate and concrete threat in your case. Last paragraph – a bit vague (complex remote sensing techniques for early warning) – differential InSAR could help, especially considering the shorter re-visit time (and resolution) of new generation radar sensors (cf. Bovenga et al, 2012, Remote Sensing of Environment).

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