Natural Hazards
and Earth System
Sciences

Discussions

Interactive comment on "Quantification and analysis of geomorphic processes on a recultivated iron ore mine on the Italian island Elba using long-time ground-based LIDAR and photogrammetric data by an UAV" *by* F. Haas et al.

Anonymous Referee #1

Received and published: 20 October 2015

This work present an interesting and potentially useful contribution to the journal, and it offers a new perspective about the comparison between TLS and photogrammetry derived datasets for the analysis of erosion in mining landscapes. I enjoyed the paper and I think that it raised some interesting points and feel that this would make a valuable contribution also for a wider community, working with erosion and DEMs in general. However some further expansion on points that were introduced in the research is required. In the following comments, I suggested some changes and additions to the text, which should help improving the paper.

C2087

1. The authors provide an overview about the issue they are analysing, however I feel like the introduction is too focused on fluvial erosion. Since the journal is Natural Hazards and Earth System Sciences, I would suggest to consider a wider description of the issues related to mining landscapes, and on why this research offers a useful contribution in the field. I believe that the authors should provide an idea of the overall processes on mined/reclaimed hillslopes, not only focusing on pollutants but specifically on erosion, since the latter is the focus of their quantitative analysis. I suggest the authors to consider the paper by Mossa and James (2013) that provides an interesting review about mining and geomorphic processes. As additional literature on minings and erosion, see also the works of Hancock et al. (2006, 2008).

2. High-resolution datasets in general. I would suggest to consider the paper review by Tarolli (2014) that provides a sound overview also about the potentiality of photogrammetry derived topography as well as LiDAR-derived one in numerous environments.

4. Mining landscape and high-resolution datasets. I think the readers might find helpful knowing about other study cases showing the potentiality of high-resolution datasets (e.g. from UAV or Lidar) in mining landscapes, see for example Francioni et al. (2015), Chen et al. (2015) and Hanckock et al. (2015).

5. What version of photoscan was used?

6. Point cloud thinning: what was the selected extent for the neighbourhood considered for the filtering? (L. 5-6, p 6280). Is this an important parameter influencing the quality of the final dataset? I think a reader that is unfamiliar with the technique might wonder about this point.

7. How much is the final density of the UAV derived point cloud? i might have missed it in the text.

8. SPI: I wonder if the authors considered the evaluation of the SPI based on the D-Infinity method (Tarboton, 1997) rather than on the multiflow SCA (Quinn et al. 1991).

C2088

The Quinn method might be too dispersive on hillslopes, so I wonder if the use of the d-infinity SCA might better highlights areas of potential erosion.

9. Chapter 4.4. I would consider to split this chapter, and move the section 4.4.1 as a single chapter at the beginning of the results. As the authors recognize in line 13-16 p. 6290, the comparison of the two datasets is critical to understand the differences in the estimated volumes, as well as to understand the quality of the analysis of the SPI. To this point, for the comparison between the datasets, I suggest a deeper assessment of the differences, rather than just approaching to the point density analysis. It would be worth to analyse the differences in the distribution of elevation values (median value? Mean value? Distribution shape?), and the presence/absence of outliers, see for example the analysis provided by Prosdocimi et al. (2015) based on the work of Höhle and Höhle (2009). This analysis would help in understanding also the results currently described in chapt. 4.4.2. I wonder if it would be possible to analyse the difference in elevation values for the reservoir and the hillslopes, to better understand also the difference in erosion budget, and to highlight better what technique might be more appropriate for either context as a general surveying technique. The authors already hint to this point in their discussion (lines 13 to 24 page 6292).

Furthermore, section 4.4.1 is in my opinion critical and really important, and it deserves to be a chapter on its own, following chapt. 4.1 and 4.2 (and preceding the SPI analysis).

10. Differences in estimated volumes. The overall differences in volumes are really high, and the authors highlight this point in detail throughout the text. Would it be possible to analyse the erosion/deposition budgets also for specific sub-areas? Aside from offering a comparison of the DEM values between the UAV DEM and the TLS DEM (as I suggested above), it would be worth to see and quantify erosion and deposition volumes for the hillslope and for the reservoir separately, and to assess these results. This would help to better understand what technique might be more appropriate for either context for the specific task of multitemporal surveys to monitor erosion. The authors

C2089

also speak about the limitation in the representation of (among others) the constructed channel. Would the overall quantification of erosions/deposition carried out masking the 'critical' features be more similar between the TLS and the UAV?

Technical comments

Please be consistent with the acronyms (e.g. AOI or AoI for Area of Interest). Some sentences are not clear, and should be rephrased (e.g. L. 25 p 6284: 'quantitative and qualitative analyzing': I would change it to 'quantitative and qualitative analysis'; Line 12 p. 6285 'seems to bee': change to 'seems to be'.) Sometimes the authors use exclamation points to highlight out some elements, I think they are not needed.

References

Chen J, Li K, Chang KJ, Sofia G, Tarolli P. 2015. Open-pit mining geomorphic feature characterisation. Int. J. Appl. Earth Obs. Geoinf. 42, 76–86. doi:10.1016/j.jag.2015.05.001

Francioni M, Salvini R, Stead D, Giovannini R, Riccucci S, Vanneschi C, Gullì D, 2015. An integrated remote sensing-GIS approach for the analysis of an open pit in the Carrara marble district, Italy: Slope stability assessment through kinematic and numerical methods. Comput. Geotech. 67, 46–63. doi:10.1016/j.compgeo.2015.02.009

Hancock GR, Grabham MK, Martin P, Evans KG, Bollhöfer A. 2006. A methodology for the assessment of rehabilitation success of post mining landscapes–sediment and radionuclide transport at the former Nabarlek uranium mine, Northern Territory, Australia. The Science of the total environment 354 : 103–19. DOI: 10.1016/j.scitotenv.2005.01.039

Hancock GR, Crawter D, Fityus SG, Chandler J, Wells T. 2008. The measurement and modelling of rill erosion at angle of repose slopes in mine spoil. Earth Surface Processes and Landforms 33: 1006–1020. DOI: 10.1002/esp.1585

Hancock GR, Lowry JBC, Coulthard TJ, 2015. Catchment reconstruction âĂŤ erosional

C2090

stability at millennial time scales using landscape evolution models. Geomorphology 231, 15–27. doi:10.1016/j.geomorph.2014.10.034

Höhle J, Höhle M. 2009. Accuracy assessment of digital elevation models by means of robust statistical methods. ISPRS Journal of Photogrammetry and Remote Sensing 64: 398–406 Mossa J, James LA. 2013. 13.6 Impacts of Mining on Geomorphic Systems. In Treatise on Geomorphology , . Elsevier; 74–95.

Mossa J, James LA. 2013. 13.6 Impacts of Mining on Geomorphic Systems, In Treatise on Geomorphology, edited by John F. Shroder, Academic Press, San Diego, 74-95, http://dx.doi.org/10.1016/B978-0-12-374739-6.00344-4.

Prosdocimi M, Calligaro S, Sofia G, Dalla Fontana G, and Tarolli P. 2015. Bank erosion in agricultural drainage networks: new challenges from structure-from-motion photogrammetry for post-event analysis. Earth Surf. Process. Landforms, doi: 10.1002/esp.3767.

Tarboton D. 1997, A New Method for the Determination of Flow Directions and Contributing Areas in Grid Digital Elevation Models," Water Resources Research, 33(2): 309-319

Tarolli P. 2014. High-resolution topography for understanding Earth surface processes: Opportunities and challenges, Geomorphology, 216, 295-312, http://dx.doi.org/10.1016/j.geomorph.2014.03.008.

C2091