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Analysis of open-pit mines using high-resolution topography from UAV

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Among the anthropogenic topographic signatures on the Earth, open-pit mines deserve a great importance, since they significantly affect the Earth's surface and its related processes (e.g. erosion, pollution). Their geomorphological analysis, therefore, represents a real challenge for the Earth science community. The purpose of this research is to characterize the open-pit mining features using a recently published landscape metric, the Slope Local Length of Auto-Correlation (SLLAC) (Sofia et al., 2014), and high-resolution DEMs (Digital Elevation Models) derived from drone surveyed topography. The research focuses on two main case studies of iron mines located in the Beijing district (P.R. China). The main topographic information (Digital Surface Models, DSMs) was derived using Unmanned Aerial Vehicle (UAV) and the Structure from Motion (SfM) photogrammetric technique. The results underline the effectiveness of the adopted methodologies and survey techniques in the characterization of the main geomorphic features of the mines. Thanks to the SLLAC, the terraced area given by multi-benched sideways-moving method for the iron extraction is automatically depicted, and using some SLLAC derived parameters, the related terraces extent is automatically estimated. The analysis of the correlation length orientation, furthermore, allows to identify the terraces orientation respect to the North, and to understand as well the shape of the open-pit area. This provides a basis for a large scale and low cost topographic survey for a sustainable environmental planning and, for example, for the mitigation of environmental anthropogenic impact due to mining.

References

Sofia G., Marinello F, Tarolli P. 2014. A new landscape metric for the identification of terraced sites: the Slope Local Length of Auto-Correlation (SLLAC). ISPRS Journal of Photogrammetry and Remote Sensing, doi:10.1016/j.isprsjprs.2014.06.018