Using multi-temporal remote sensing for mining area monitoring and management: the Yunnan Province case study (China)

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Abundant mineral resource is the basis for high-speed social and economic development, and huge economic benefits promoted the rapid development of modern mining industry. However, mining leaves the most significant signature on the Earth, by strongly changing and influencing landscapes and eco-systems. Disasters like water/soil pollution, soil erosion, landslides and land subsidence are often induced by mining activities. Multi-temporal remote sensing surveys can offer a basis upon which develop methodologies for better understanding the influences of mining on landscapes and related Earth surface processes. The aim of the study is to monitor a mining area using multi-temporal remote sensing data, for discovering and evaluating the influence of the mining activities on the environment. Our research area is located in Yunnan Province, China, where open-pit mining activities have been going on for about 10 years. For the study area there is the availability of multi-temporal spatial adjusted remote sensing images (2001 TM with resolution of 30m/pix, 2009 TM with resolution of 30m/pix, 2011 WV-II with resolution of 0.5m/pix, 2012 WV-II with resolution of 0.5m/pix). Through photo interpretation, it was possible to collect the evolutions of mining area, and to recognize areas subject to erosion and landsliding. The results have been validated using field surveys carried out in 2011 and 2012. The multi-temporal image interpretation indicates that the mining activities started between 2001 and 2009, with a significant increasing of land degradation between 2009 and 2012. This study represents the first step of a long-term analysis of Yunnan Province mining area. The goal is to arrange a multi-sensor yearly survey using different platforms and technologies (e.g. ground GPS, Structure from Motion photogrammetric technique SfM, UAV, and airborne and terrestrial laser scanner), in order to better understand the landscape evolution of the area, and analyze in detail the Earth surface processes affected and activated by mining activity (e.g. erosion, landsliding, runoff, sediment transport within rivers). The recognition and the analysis of the mining related Earth surface changes represent one of the most interesting challenges for the Earth science community and for our Society. This analysis can help in scheduling a suitable environmental planning for a sustainable development, to mitigate the environmental consequences of mining.