



Remote sensing of Northern mines: supporting operation and environmental monitoring in cold conditions

Anne Tuomela (1), Corine Davids (2), Sven Knutsson (3), Roger Knutsson (3), Anssi Rauhala (1), Pekka M. Rossi (1), and Line Rouyet (2)

(1) Water Resources and Environmental Engineering Research unit, University of Oulu, Oulu, Finland (anne.tuomela@oulu.fi), (2) Norut Northern Research Institute AS, Tromsø, Norway (Corine.Davids@norut.no), (3) Department of Civil, Environmental and Natural Resources and Engineering, Division of Mining and Geotechnical Engineering, Luleå University of Technology, Luleå, Sweden (Sven.Knutsson@ltu.se)

Northern areas of Finland, Sweden and Norway have mineral-rich deposits. There are several active mines in the area but also closed ones and deposits with plans for future mining. With increasing demand for environmental protection in the sensitive Northern conditions, there is a need for more comprehensive monitoring of the mining environment. In our study, we aim to develop new opportunities to use remote sensing data from satellites and unmanned aerial vehicles (UAVs) in improving mining safety and monitoring, for example in the case of mine waste storage facilities. Remote sensing methods have evolved fast, and could in many cases enable precise, reliable, and cost-efficient data collection over large areas. The study has focused on four mining areas in Northern Fennoscandia. Freely available medium-resolution (e.g. Sentinel-1), commercial high-resolution (e.g. TerraSAR-X) and Synthetic Aperture Radar (SAR) data has been collected during 2015–2016 to study how satellite remote sensing could be used e.g. for displacement monitoring using SAR Interferometry (InSAR). Furthermore, UAVs have been utilized in similar data collection in a local scale, and also in collection of thermal infrared data for hydrological monitoring of the areas. The development and efficient use of the methods in mining areas requires experts from several fields. In addition, the Northern conditions with four distinct seasons bring their own challenges for the efficient use of remote sensing, and further complicate their integration as standardised monitoring methods for mine environments. Based on the initial results, remote sensing could especially enhance the monitoring of large-scale structures in mine areas such as tailings impoundments.