



Remote sensing supported surveillance and characterization of tailings behavior at a gold mine site, Finland.

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The management of vast amounts of tailings produced is one of the key issues in mining operations. The effective and economic disposal of the waste requires knowledge concerning both basic physical properties of the tailings as well as more complex aspects such as consolidation behavior. The behavior of tailings in itself is a very complex issue that can be affected by flocculation, sedimentation, consolidation, segregation, deposition, freeze-thaw, and desiccation phenomena. The utilization of remote sensing in an impoundment-scale monitoring of tailings could benefit the management of tailings, and improve our knowledge on tailings behavior.

In order to gain better knowledge of tailings behavior in cold climate, we have utilized both modern remote sensing techniques and more traditional in situ and laboratory measurements in characterizing thickened gold tailings behavior at a Finnish gold mine site, where the production has been halted due to low gold prices. The remote sensing measurements consisted of elevation datasets collected from unmanned aerial vehicles during summers 2015 and 2016, and a further campaign is planned for the summer 2017. The ongoing traditional measurements include for example particle-size distribution, frost heave, frost depth, water retention, temperature profile, and rheological measurements.

Initial results from the remote sensing indicated larger than expected settlements on parts of the tailings impoundment, and also highlighted some of the complexities related to data processing. The interpretation of the results and characterization of the behavior is in this case complicated by possible freeze-thaw effects and potential settlement of the impoundment bottom structure consisting of natural peat. Experiments with remote sensing and unmanned aerial vehicles indicate that they could offer potential benefits in frequent mine site monitoring, but there is a need towards more robust and streamlined data acquisition and processing. The gathered data and obtained results form the basis for further modelling efforts which aim at better management of tailings storage facilities.