EGU2020-17124
https://doi.org/10.5194/egusphere-egu2020-17124
EGU General Assembly 2020

Integrated Environmental Monitoring of AMD Affected Waters using Hyperspectral Imaging and In-situ Analytics

Hernan Flores, Sandra Lorenz, Robert Jackisch, Laura Tusa, Cecilia Contreras, and Richard Gloaguen
Helmholtz-Zentrum Dresden-Rossendorf, Helmholtz Institute Freiberg for Resource Technology, Exploration Technology, Freiberg, Germany (h.flores-rojas@hzdr.de)

One of the potential major consequences of mining activities is the degradation of the surrounding ecosystems by Acid Mine Drainage (AMD). A high-resolution hyperspectral drone-borne survey provides a useful, fast, and non-invasive tool to monitor the acid mine drainage mineralogy in mining sites. In this study, we propose to integrate drone-borne visible-to-near infrared (VNIR) hyperspectral data and physicochemical field data from water and sediments together with laboratory analysis for precise mineralogical and surface water mapping. The Tintillo River is an extraordinary case of the collection of acidic leachates in southwest Spain. This river is highly contaminated, with large quantities of dissolved metals (Fe, Al, Cu, Zn, etc.) and acidity, which later discharged into the Odiel River. At the confluence of the Tintillo and Odiel rivers, different geochemical and mineralogical processes typical of the interaction of very acidic water (pH 2.5 – 3.0) with circum-neutral water (pH 7.0 – 8.0) occur. The high contrast among waters makes this area propitious for the use of hyperspectral data to characterize both rivers and better evaluate mine water bodies with remote sensing imagery. We present an approach that makes use of a supervised random forest regression for the extended mapping of water properties, using the data from collected field samples, as training set for the algorithm. Experimental results show water surface maps that quantify the concentration of dissolved metals and physical-chemical properties along the covered region and mineral classification maps distribution (jarosite, goethite, schwertmannite, etc.). These results highlight the capabilities of drone-borne hyperspectral data for monitoring mining sites by extrapolating the hydrochemical properties from certain and specific areas, covered during field campaigns, to larger regions where accessibility is limited. By following this method, it is possible to rapidly discriminate and map the degree of AMD contamination in water for its future treatment or remediation.