Evaluation of Normalization Methods Applied to Short-Wavelength Infrared Spectroscopy Mineral Databases from Multiple Instruments and for Vectoring Analysis Exploration

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Over the last decade, significant advances have been made with the application of short-wave infrared (SWIR) spectroscopy to detect subtle variations in the geochemistry of alteration minerals that are used as vectors for exploration of hydrothermal ore deposits. In the context of porphyry deposits, the study of the spectral variations in hydrothermal minerals such as white mica, alunite, and chlorite have provided relevant vectoring information produced by changes in temperature, pH, and/or oxidation state of the fluids towards the mineralized center. Successful application of SWIR spectroscopy as a vectoring tool is based on the instrument precision. However, during data collection most exploration projects may use multiple SWIR instruments with different factory calibration settings. As a result, in cases where no inter-instrument calibration is performed, variability of the value of a spectral feature among SWIR instruments has been identified and the application of data for vector analysis is often difficult. In the present work, we evaluate four of the most common normalization methods: 1) rescaling, 2) mean normalization, 3) Z-score, and 4) kernel density estimation applied to three white mica SWIR spectroscopy datasets collected by two different field instruments (TerraSpecTM and OreXpressTM) in samples presenting phyllic alteration from the study of the Grasshopper porphyry prospect by Uribe-Mogollon and Maher (2020). The outcome of this work is the development of a methodology to compare, quantify and correct the SWIR databases biases for an accurately integration of data from multiple instruments for vectoring analysis application.