

**Cooper McCann: Physics**

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***Semi-automated creation and classification of high-resolution multi-swath hyperspectral data using Landsat 8 surface reflectance data as a reference target and a novel histogram based unsupervised classification technique to determine natural classes from***

Flight-based hyperspectral imaging systems have the potential, due to their low-cost and high coverage area, to provide important information for ecosystem and environmental studies as well as aid in land management. In order to realize this potential, automated methods must be developed to provide large-area calibrated data allowing for temporal data sets at the mesoscale. A semi-automated method of producing a high-resolution, large-area, radiometrically-calibrated hyperspectral data set using the Landsat surface reflectance (L8SR) data product as a reference target is presented, along with a histogram based unsupervised classification scheme. The radiometric calibration method uses standard hyperspectral processing techniques that are extended to include removal of uneven illumination conditions between flight passes in order to create large-area radiometrically consistent data. Additionally, through spectral and spatial resampling Landsat 8 surface reflectance data are used as a radiometric reference target. Advantages of the calibration technique include the need for minimal site access, no ancillary instrumentation, and automated data processing and can be extended to arbitrarily large areas. The classification technique uses a mathematical model based on biophysically relevant parameters to fit the hyperspectral data on a pixel-by-pixel basis thus achieving a degree of noise reduction and data compression. Histograms of these fit parameters can be selectively split in order to naturally classify the data for anomaly detection of other class specific analyses. Data from hyperspectral flights acquired 06/21/2014, 06/24/2015, and 06/30/2016, covering 18.5M m<sup>2</sup> (4500 acres), are presented.

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