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Identifying plant species using MIR and TIR (2 – 14 μm) emissivity spectra

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Tittle: Identifying plant species using MIR and TIR (2 – 14 μm) emissivity spectra

Identification plant species using remote sensing is generally limited by the similarity of their reflectance spectra in the visible, NIR and SWIR domains. Laboratory measured emissivity spectra in the mid to thermal infrared (MIR-TIR; 2 μm - 14 μm) shows significant differences. The laboratory emissivity spectra of thirteen common broad leaved species, comprising 3024 spectral bands in the MIR and TIR, were analyzed. For each wavelength the differences between the species were tested for significance using the one way analysis of variance (ANOVA) with the post-hoc Tukey HSD test. The emissivity spectra of the analysed species were found to be statistically different at various wavebands. Subsequently, six spectral bands were selected (based on the histogram of separable pairs of species for each waveband) to quantify the separability between each species pair based on the Jefferies Matusita (JM) distance. Out of 78 combinations, 76 pairs had a significantly different JM distance. Using the selected six wavebands for multiple plant species, overall classification accuracy of 92 % was achieved. This means that careful selection of hyperspectral bands in the MIR and TIR (2.5 μm - 14 μm) results in reliable species discrimination.
Keywords: Spectral emissivity, J-M distance, ANOVA, Tukey HSD, spectral separability, Kirchhoff law