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An evaluation of imagery acquired with the Digital Airborne Imaging Spectroradiometer 7915 for forest research

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Abstract (426 words):
In this paper we describe the processing and analysis of imagery acquired with the 79-channel Digital Airborne Imaging Spectroradiometer 7915 over a forested area in the NE of Spain, and discuss the results in terms of its potential for forest research. An aerial campaign was conducted on July 9th, 1997 from a height of 3200 m above ground, resulting on three images with spatial resolution of 6.5 m at nadir. We conducted a field spectrometry campaign and atmospheric measurements during the flight. We achieved a significant signal enhancement by applying a Minimum Noise Fraction transformation to each detector and keeping only those transformed bands with higher quality for the inverse transformation. We also detected a geometric distortion particular to some channels, which caused apparent shifts of -2 to 2 pixels depending on the position in the image. This problem has a severe impact on ratios that involve affected channels. We applied the Atmospheric Removal Program (ATREM) using data only the 940 nm region, a field-measured value of aerosol concentration and a standard model of atmosphere. With these parameters and a selection of channels that considered both wavelength and image quality, ATREM produced an image of atmospheric water vapor with low spatial variability and values of 1.3 to 1.9 cm - below the value of 2.4 cm measured in the field during the aerial campaign. We used the atmospherically-corrected profiles of selected targets that included the major vegetation types in the area to (i) compute the Water and Photosynthetic Ratio indices, as the ratio of reflectance values in 970 and 900 nm, and as the normalized difference ratio in 550 and 530 nm, respectively and (ii) measure the statistical separability of the targets, plotting them in the canonical plane. The ordination of the targets on the plane defined by the two aforementioned indexes was equivalent when the computations were done from the imagery and when the computations were done with the field spectroradiometry measurements, while the statistical separability indicated that the signal has a very high discriminant power among the major types of vegetation in the area. Although we could not demonstrate the capability of this imagery to sense water stress because of the unavailability of a second aerial campaign under drier conditions, our ordination results represent strong indirect evidence in this direction. Because of its high discriminant power, DAIS imagery can be very useful to interpret satellite imagery, as an intermediate step between coarser imagery and field data, which we illustrate through the integration of this imagery within a multi-sensor approach in our area of study.