Airborne Hyperspectral Spectroscopy data preparation for Hyytiälä Boreal forest, Finland

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Photochemical Reflectance Index (PRI) is related to plant stress and photosynthetic downregulation. Furthermore, the latter can be estimated by comparing PRI of sunlit and shaded foliage. To calculate PRI, high spectral resolution airborne and field data for Scots pine (*Pinus sylvestris* L.) and birch (*Betula pubescens* Ehrh., *Betula pendula* Roth.) in Hyytiälä, Central Finland (61^0 50'N, 24^0 17'E) have been collected. The goal of the airborne campaign was to collect data with sufficiently high spatial resolution to distinguish sunlit and shaded foliage. The data was collected on 01-07-2015 and 03-07-2015 using an AISA Eagle II line scanner hyperspectral sensor, developed in Oulu by Specim Finland. The sensor was mounted at the rear end of Aalto Skyvan airplane on a tilting platform allowing us to take measurements at nadir and approximately 30 degrees off-nadir. The airborne data has a 0.6m spatial resolution, 4.3nm spectral resolution and a spectral range between 400-1000nm. The airborne data was radiometrically, atmospherically and geometrically processed using the Parge and Atcor software.

Field spectral data was collected at the Hyytiälä SMEAR II flux site. It consists of sunlit and shaded needle reflectance measurements for 2 Scots pine and 1 Birch tree. Needle reflectance was measured at the top of the canopy from 18 meter high towers. The needle measurements were made using an OceanOptics USB4000 spectrometer and a Unispec needle clip which allows the pine needle to be fully inserted. As a light source, we used a 20W tungsten halogen lamp. In total, 2300 needle spectra were recorded distributed across the whole day.

The airborne data will be used to detect change in PRI levels of sunlit and shaded tree canopies. Based on preliminary analysis, the quality of the data is geometrically and radiometrically sufficient to distinguish PRI levels between sunlit and shaded parts of the canopy. For future application, this data will serve to scale up detected PRI variations between satellite measurements, airborne and ground measurements.

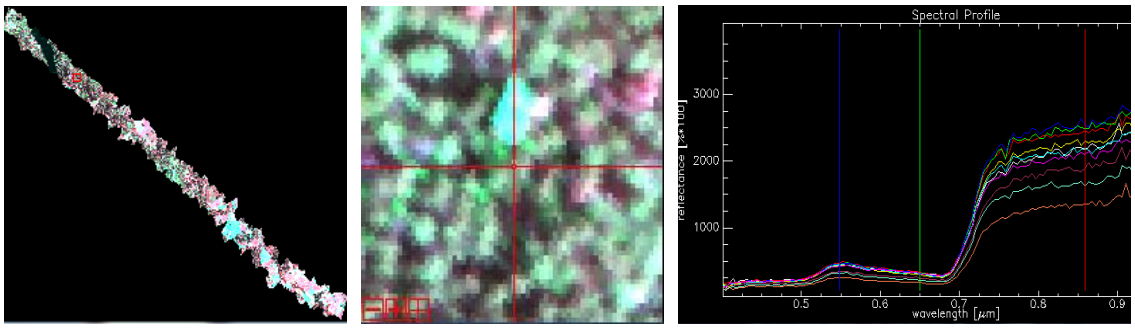

Fig. 1. a) False color airborne image; b) mixed spruce pine Stand; c) Variation in tree appearance reflectance factor