Evaluating radiometric corrections of multi-spectral drone image data for horticultural applications

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Abstract:
Drones or Remotely Piloted Aircraft Systems (RPAS) are now popular platforms for monitoring horticultural crop's growth and condition. To acquire the most accurate and appropriate image based information for managing and improving horticultural tree crop yields, careful and systematic consideration needs to be given to the RPAS data collection and processing steps. This includes: (1) the data collection spatial, spectral, radiometric and temporal resolutions; (2) the geometric and radiometric corrections and required accuracy and precision; and (3) the algorithms used to deliver spatial data products and information. This paper evaluates radiometric correction approaches and their effects on RPAS derived multi-spectral image data collected at specific flying heights, flight line overlaps and speeds. Our RPAS image data were collected with the Parrot Sequoia sensor (green, red, red edge, near infrared bands) mounted to a 3DR Solo multi-rotor. The RPAS image data used for assessing the different radiometric correction approaches covered a 50 m x 50 m area within an avocado orchard. The image data were collected in a double grid pattern, at 50 m AGL and with 80% side overlap. A bundle adjustment method was applied for geometric correction. Six radiometric correction methods were tested, which included the combinations of BRDF correction, sunshine irradiance calibration, and empirical line DN correction. These methods correct the image digital numbers by eliminating the effects of illumination and observation geometry, and by adjusting the DN to surface reflectance. These corrections are important to get obtained image data that is able to be processed to derive quantitative biophysical information for orchard management. Our findings were used to specify an optimal RPAS image radiometric and geometric correction methodology. This will be applied in a follow-on study to define an optimal RPAS imaging and processing procedure chain for horticultural applications.

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