RADIOMETRIC NORMALIZATION OF MULTI-TEMPORAL VISIBLE AND NEAR INFRARED IMAGES ACQUIRED WITH LIGHT AIRBORNE SYSTEMS

A. Bégué [a], S. Labbé [b], V. Lebourgeois [a], B. Roux [c], B. Mallavan [a]

[a] CIRAD, French Agricultural Research Centre for International Development, 34 093 Montpellier, France - (begue, mallavan, valentine.lebourgeois)@cirad.fr
[b] Cemagref, Agricultural and Environmental Engineering Research, 34 093 Montpellier, France – sylvain.labbe@teledetection.fr
[c] L'Avion Jaune Company, Innovative start-up specialized on multispectral acquisitions, 34 093 Montpellier, France – info@lavionjaune.fr

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ABSTRACT:

To study the structure and dynamics of environmental targets, light airborne systems are more and more used as a complement to usual satellite or aerial acquisitions. These systems are composed of small-format digital frame cameras mounted on an ultralight aircraft or an unmanned aerial vehicle. Standard and modified cameras measure the reflected radiation in the visible, the red-edge and near-infrared bands. The whole system and the geometric and radiometric pre-processing of the images are described in details in the paper "An operational solution to acquire multispectral images with standard light cameras: spectral characterization and acquisition guidelines" submitted for approval to this symposium.

This paper deals with the radiometric processing of images time series. Multiple images of the same region captured under different conditions are difficult to compare. This is due to changes in illumination, atmospheric conditions, and flight parameters. Without radiometric normalization, changes between two images are difficult to interpret: they can be linked either to real changes of the surface or to non-scene–dependent changes. In this paper, we propose to compare three methods of radiometric normalization:

- The invariant targets: This method consists in uniformly minimizing the effects of non-scene–dependent changes according to a reference date. A given date (image) is chosen as a reference and linear regressions are established, for each of the spectral band between the digital count of invariant points at this date and at all other dates. These linear regressions are then applied to the whole images to normalize them relatively to the reference image.
- The spectral indices: ratio-based indices are calculated using the digital counts. This type of indices normalizes by construction the incident radiation.
- The calculation of the incident radiation: we use an atmospheric radiative transfer model to calculate the incident radiation at the Top Of the Canopy (TOC) in each spectral band. The model atmospheric inputs come either from meteorological measurements (visibility) or from mean climatic values (water content). The incident radiation values are then used to normalize the digital counts for each acquisition date. In order to evaluate the sensitivity of the model to the accuracy of the atmospheric inputs, a sensitivity analysis will be first performed.

The methods will be compared using a time set of airborne multispectral images (blue, green, red, red-edge and near-infrared bands) acquired over agricultural land on Reunion Island.