Assessing the impact of non-linear responses of field spectroradiometers on the estimation of biophysical parameters and light use efficiency

Javier Pacheco-Labrador a), Tommaso Julitta b), Micol Rossini b), M. Pilar Martín a) and Alasdair MacArthur c)

a) Environmental Remote Sensing and Spectroscopy Laboratory (SpecLab), IEGD-CCHS-CSIC. Albasanz, 26-28, 28037, Madrid, Spain.
b) Remote Sensing of Environmental Dynamics Laboratory, University of Milano Bicocca, Piazza della Scienza, 1, 20126, Milan, Italy.
c) NERC Field Spectroscopy Facility, University of Edinburgh, Grant Institute, King’s Buildings, West Mains Rd, Edinburgh EH9 3JW, United Kingdom.

1. Methodology

1) Non-linearity calibration (Ocean Optics method)

- Light Source
  Hoffman Engineering LS-65-8D Luminance/reflectance standard

- Spectroradiometers
  Unispec Dual Channel
  Ocean Optics HR4000
  Ocean Optics STS

- Sampling
  100 levels: 100 – 1000 fL
  Fixed IT
  30 spectra/level

- Modeling
  DDNSCorrect adapted

2) Non-linear reflectances simulation from solar irradiance, ProSAIL HDRF and Non-linearity model inversion

1) Solar Irradiance (DN)
2) ProSAIL HDRF: Ca+b/LAI for different LAD
3) Non-Linear ProSAIL HDRF Simulation

3) Assessing impact on estimation of biophysical parameters and LUE through spectral indices

Variable | Range
---|---
Ca+b/µg/cm² | [0,100]
LAI | [0.5,6.5]
LAD | Planophile, Erectophile, Plagiophile, Extremophile, Spherical, Uniform

3. Conclusions

- Radiative Transfer Model are a suitable tool to estimate instrumental uncertainties in the estimation of biophysical parameters and LUE estimators using SVIs
- Non-linearity effects depend on:
  - Spectral irradiance
  - Spectral reflectance
  - Sensor’s Quantum efficiency
  - Estimator – Estimate relationship
- Non-linearity impacts are usually low, but these are more usually biases rather than noise in the estimations
- Non-linearity can be more relevant in the estimation of LUE, since both variables are related with the irradiance levels

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