MSc Topic – Field Spectroscopy: Irradiance Fields, Reflectance Factors and related Uncertainties

Introduction
The accurate measurement of irradiance is a crucial element in field spectroscopy to retrieve reflectance factors of ground targets. Errors in the irradiance estimation impact science applications depending on precise reflectance factors, such as bio-geophysical model development, and airborne and spacebased sensor calibration and validation.

RSL has acquired a new setup that allows the coinciding measurement of white reference panel and target radiances. The advantages, disadvantages and uncertainties of this approach are currently unknown. This MSc will advance field spectroscopy by carrying out field experiments and analysing the data to establish best practices and uncertainty budgets.

Details
Experiments and models to be carried out and established are:

<table>
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<tr>
<th>Practical use and uncertainties</th>
<th>Comparison with usual single spectrometer approach</th>
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<td>Influence of distance</td>
<td>Distance between irradiance base station and target spectrometer will have an influence on the result. To be assessed for a variety of environment scenarios. This will also shed lights on the spatial irradiance regime due to adjacency effects.</td>
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<td>Influence of sky conditions</td>
<td>Answers the question under what circumstances the new setup is superior; includes a correlation with hemispherical camera data (cloud cover) and direct/diffuse ratio measurements.</td>
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<tr>
<td>Reference panel versus cosine receptor</td>
<td>Answers the questions of advantages of reference panel versus cosine receptor for the irradiance estimation. Again, a correlation with sun angles and cloud cover is required.</td>
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Opportunities offered by this MSc
- Learn about measurement uncertainties
- Practical handling of field equipment
- Spectral data and image analysis
- Experimental design

Supervision
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Field Spectroscopy: Irradiance Fields, Reflectance Factors and related Uncertainties
Background – Field Spectroscopy: Irradiance Fields, Reflectance Factors and related Uncertainties

The accurate measurement of irradiance is a crucial element in field spectroscopy to retrieve reflectance factors of ground targets. Errors in the irradiance estimation impact science applications depending on precise reflectance factors, such as biogeophysical model development, and airborne and spacebased sensor calibration and validation.
Aims

- Test the new dual instrument setup under field conditions and define pros and cons
- Assess the radiometric content of the data
- Establish the impact of the dual instrument setup against traditional methods under different environmental conditions (illumination, proximity of adjacent objects)
- Establish an uncertainty model for both traditional and new measurement setups
- Establish a new field protocol and quick field guide for the new instrument setup
Methodology

- **Design and carry out field experiments** under different environmental conditions (illumination, proximity of adjacent objects) to test the impact of the dual instrument setup and pitch it against traditional methods

- Spectral data and metadata analysis

- Hemispherical camera data acquisition and analysis to quantify the sky conditions and link them with measurement errors and uncertainties
Requirements & Benefits

- Matlab programming
- Use of SPECCHIO spectral database to store data and carry out Matlab based analysis

- Learn how design field experiments
- Learn about uncertainty analysis
- Learn about sensitivity analysis
- Learn about the common errors in field spectroscopy
- Learn how to use field equipment
- Be creative!