Agenda

Topic: SENSECO WG4 - Applied Uncertainty Analysis Workshop

Time: Apr 26, 2021, 11:00 CEST, 09:00 UTC, 10:00 BST

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Presentations

11:00 – 11:10 / Short introduction (Laura, Aga, Andy)
11:10 – 11:40 Andreas Hueni (UZH / Dept. of Geography Remote Sensing Laboratories)
„Uncertainty budget of field spectroscopy reflectance"

Abstract: Field spectroscopy is a seemingly easy measurement process but can be hard to do right. In this work we examine a few sources of uncertainty that are related to the measurement setup and protocol used by RSL for the estimation (sic) of reflectance factors using radiometrically calibrated fieldspectroradiometers. The elaboration of an uncertainty tree diagram allows us to inspect the various contributions of uncertainty and suggest which parameters are most critical to achieve reliable data.

11:40 – 12:10 Niall Origo (NPL)
"Satellite surface reflectance product validation under the Fiducial Reference Measurements for Vegetation (FRM4VEG) project".

Abstract: This presentation describes our efforts at creating FRM-level data for surface reflectance validation of satellite products. The FRM concept aims to ensure that validation data are collected which are independent of the satellite retrieval process while also having uncertainty estimates and traceability to SI. We describe a field campaign undertaken in the summer of 2018 which utilised a manually operated field spectrometer to collect this data, the validation results, as well as methodological improvements (such as the use of UAVs) that we will be implementing in the second phase of FRM4VEG."

12:10 – 12: 40 Fanny Petibon (UZH/ Department of Geography/ Soil science and Biogeochemistry)
„Disentangling the biological information and measurement uncertainties from field spectral reflectance of beech leaves".

Abstract: Uncertainty is an essential indicator of the quality of the biological information retrieved from field spectral measurements. However, establishing the uncertainty budget associated with field spectral measurements may be challenging as some sources of uncertainty remain poorly characterised, especially in field conditions. We developed a method based on error propagation to approach the uncertainty budget practically as an overall envelope calculated directly from measurements, rather than a detailed budget.

Using fabrics as standard material we first show that measurement uncertainties associated with leaf clip (0.0001 to 0.4 reflectance units) and integrating sphere measurements (0.0001 to 0.01 reflectance units) vary across the spectral range (350-2500 nm) and depend on the optical properties of the fabric in the case of leaf clip measurements. We then show that the measurement uncertainty associated with leaf reflectance, estimated using a field spectroradiometer with attached leaf clip, represents on average a small portion of the spectral variation within a single individual sampled over time (2.7 ± 1.7%), or between individuals (1.5 ± 1.3% or 3.4 ± 1.7%, respectively) in a set of monitored beech trees located in Swiss and French forests.

12:40 – 13:40 – Long Break

13:40 – 14:10 Pieter de Vis (NPL)

"*Hyperspectral in-situ surface reflectances from HYPERNETS*"

Abstract: The H2020 Hypernets project has developed a new hyperspectral radiometer integrated in automated networks of water and land bidirectional reflectance measurements for satellite validation over a wide range of surface types. In order to generate the reflectance products a software ground processor, called the hypernets_processor, automatically processes the acquisitions through data transmission and conversion, application of calibration, evaluation of reflectance and other variables and archiving for web distribution. Furthermore, to achieve fiducial reference measurement quality, measurement uncertainty is propagated through the full processing chain, including treatment of temporal and wavelength error-covariance, a level of detail unique for any such satellite validation network. The HYPERNETS system has now been deployed at various test sites. We will present the results and current uncertainty budget for a number of examples.

14:10 – 14:40 Carmen Meiller (UZH / Dept. of Geography Remote Sensing Laboratories)

„*Operator and Setup Related Uncertainties in Field Spectroscopy: An Experimental Approach to Isolate a Measurement Influencing Parameter*"

Abstract: Field spectroscopy measurements are often used for calibration and validation purposes of hyperspectral sensors or as a research tool in its own right. Such in-situ measurements are not as easy to acquire correctly as it might deceptively appear. When collecting field spectroscopy measurements, many small operator and set-up errors can be introduced unintentionally, that however affect the certainty of the data. In this study, the influence of a varying height of the sensor entrance of an ASD FieldSpec instrument above a Spectralon reference panel has been assessed. Depending on the distance of the tip of the fibre optic bundle to the panel, different radiance intensities are measured. To obtain uniform and comparable data sets, measurements from different heights above the panel need to be normalised to a standard height using a correction model. The latter mentioned correction model is presented as well as its associated combined standard uncertainty.

14:40 – 15:10 Simon Trim (UZH / Dept. of Geography Remote Sensing Laboratories)

"Spectral calibration, spectral response function shapes and related uncertainties"

Abstract : A key characteristic of a spectroradiometer is the instrumental spectral response function (ISRF), which is determined during spectral characterisation and calibration. The response shape of the ISRF is commonly assumed to be Gaussian, though this is known to not always be the best description. We show that in the context of laboratory calibration, the largest source of uncertainty lies in the ISRF assumption. We perform the spectral calibration of laboratory measurements obtained with four ASD field spectroradiometers using several different ISRF "modes" to investigate their respective fitting performance, and examine the impact of choosing an ISRF that differs from a Gaussian when calibrating a MODTRAN6 spectrum. Finally, we conduct the uncertainty analysis of our calibration by propagating uncertainty via a Monte Carlo method.

15:10 – 15:30 Conclusions of the meeting