GEOS 654 – VIS and IR Remote Sensing

Lab 2: Field Reflectance Spectroscopy

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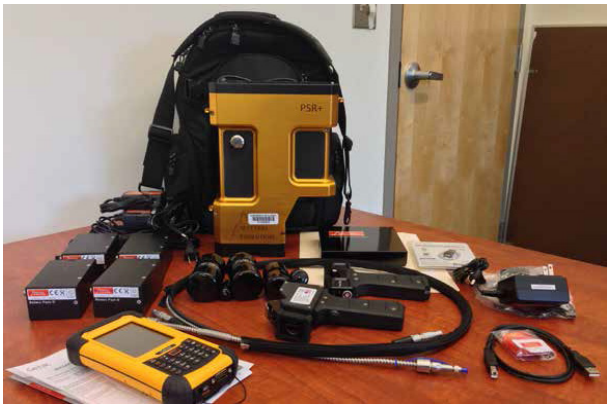
1. Introduction:

Field reflectance spectroscopy is a key component in airborne and satellite multispectral and hyperspectral remote sensing. It provides critical in-situ measurements of radiance and reflectance of earth surface materials that is important for calibration, validation, analysis and processing of remote sensing data. This lab session will provide a brief overview of the PSR+ High Resolution Field Portable Spectroradiometer, the associated data acquisition software, and how to acquire field spectra in 'white reference mode'. You will get some hands-on experience in the use of the PSR+ for acquring field reflectance spectra. The lab will also introduce you to the usage of the Microtops II Sunphotometer, which will be used to measure atmospheric parameters during data acquisition.

Please Note: Both instruments are expensive and certain parts are delicate and costly to repair. So, please treat the systems with care. Also, field spectroscopy is at the minimum at two-person job.

2. Overview of the PSR+ Spectroradiometer

The PSR+ system is comprised of:



- Handheld Spectrometer unit
- Backpack containing batteries
- Rugged PDA which provides GPS, photo tagging, and voice notes
- For this lab we will use the bare fiberoptic cable without any fore-optic lenses.
- In addition for this lab we will use a Spectralon white reference panel held in a tripod for easy use.
- Also, we will use the Microtops II Sunphotometer for measuring atmospheric parameters.

3. Setting up the PSR+ for Field Measurements

It is recommended that the PSR+ Field Spectrometer is warmed up for ~30 mins prior to use: this will ensure uniform spectral response across the 3 sensor arrays. For this lab we will not warm up the unit.

Specific instructions on how to set up the PSR+ unit will be provided to groups of 6 students during the lab session.

4. Collecting reflectance spectra in 'White Reference Mode'

Prior to acquiring spectra it is necessary to perform several steps to configure the instrument:

- **Optimization**: adjusts the instruments detectors to the specific illumination conditions at the time of the measurement. It is therefore important to optimize regularly given varying illumination conditions. We will use a white Spectralon highly lambertian reference panel for this step. You will be instructed on how to acquire reference spectra.
- **Dark Current (DC)**: there is always some amount of electrical current generated by the sensors in the instrument that will be added to recorded spectra. You will learn how to correct for dark current sensor distortion.

Once the sensor was calibrated, we will acquire reflectance spectra. We will do this using 'White Reference Mode' that performs division of target by reference panel on the fly and enables the viewing of reflectance spectra directly on the screen. Before collecting data you will need to perform a scan of the Spectralon white reference panel:

- Point the PSR+ at the white Spectralon panel and acquire reference measurements.
- Now point the PSR+ at your target and acquire the target's spectrum. Also record the name and other information of the acquired data set in the data log.
- Acquire multiple spectra of your target as appropriate for characterizing its reflectance properties.
- Regularly check the white reference spectrum by pointing the PSR+ at the Spectralon panel and checking that its reflectance is recorded as 100%. If it is not then you should re-acquire the white reference spectrum.
- For each target you should re-acquire the white reference: a suggested approach for each target is:
    - Acquire white reference spectrum
    - Acquire spectrum of target
    - Acquire spectrum of target
    - Acquire spectrum of target
    - Acquire spectrum of target
    - Acquire spectrum of the white reference panel (to check 100% line)
- For each target you should record a variety of other metadata and other observations using the data log.

5. Exercise – Acquire Some Spectra!

Now that we have demonstrated the use of the system it is up to you to acquire some field data. As though you were in the field please acquire reflectance spectra and associated metadata/field observations using the data log for the following surfaces:

- Fresh snow
- Buried snow
- Pavement
- Soil
- …