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Applications Involved in Earth Science Remove Sensing

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Abstract

With an external integrating sphere with a 30 mm sampling port to allow measuring large, inhomogeneous samples and quantitatively compare the laboratory results to airborne and space borne remote sensing data. During the processing to directional-hemispherical reflectance values, a background radiation subtraction is performed, removing the effect of radiance not reflected from the sample itself on the detector. This provides more accurate reflectance values for low-reflecting samples. Repeat measurements taken over a 20 month period on a quartz sand standard show that the system is very high, with a standard deviation ranging between 0.001 and 0.006 reflectance units depending on wavelength.

Keywords: Earth science; Sensing; Mercury cadmium telluride; Earth

Introduction

A new spectrometer setup intended to measure typical samples in earth science applications. Contrary to similar existing instruments, this new design allows for full range acquisitions (near infrared to thermal infrared) on the same measurement spot, permits two types of calibration modes and has a large sample port of 30 mm for good averaging on inhomogeneous samples. We explain the instrument modifications and the standard measurement parameters used, and evaluate the performance of the system [1].

The spectrometer needed to be adjusted so that the resulting spectra could be compared to thermal infrared emission spectra from remote sensors. This requires either emissive or directional-hemispherical reflectance (DHR) measurement geometry with an integrating sphere. Since the former contains the extra complexity of measuring samples at a controlled and stabilized temperature, we decided on a design with an integrating sphere. The purpose of the sphere is to produce an angularly averaged measurement, integrating all reflection directions in the hemisphere above the sample [2].

The sphere is connected to the spectrometers external ports by a connecting funnel. The energy coming from the interior of the spectrometer is nearly collimated (convergent at 4 degrees) and enters the sphere through an entrance port at the left equator. A folding mirror re-directs the radiation through a port at the South Pole onto the sample with an incidence angle of 10 degrees from normal. The Mercury Cadmium Telluride (MCT) TIR detector is positioned at the top of the sphere in a way that the folding mirror acts as a baffle and prevents the first reflection from directly entering the detector. The Indium Gallium Arsenide (In GaAs) SWIR detector at the right equator is unbaffled but slightly set back from the sphere wall, which prevents most of the first reflected energy from entering the SWIR detector.

By using a laboratory jack below the integrating sphere, sample material can be raised to the sample port at the sphere's South Pole. As a consequence, this design allows for large rock samples to be measured without weighing down the instrument-sphere connection, prevents lose material from falling into the sphere without the use of throughput-reducing window material and allows for measuring soils in Petri dishes. When measuring soil samples in the near-infrared a typical setup is to place a Petri dish with soil material on a sample port at the top of the sphere and measure through the dish. Petri dishes are opaque in the TIR and thus cannot be penetrated by TIR radiation if placed on top of the sphere [3].

The substitution calibration method used in our standard measurement method, which was also used in the other instrument set-ups at JPL, JHU and USGS, creates small radiometric inaccuracies. This is because the sample is part of the sphere wall, so that the average sphere wall reflectance is lower when the sample, instead of the reference material, is in the sample port. This effect makes low reflection samples appear even darker than they are. The substitution error for a simple integrating sphere. When their equation is applied to our system the substitution for a sample of 40% reflectance results in an underestimation of more than 11% relative.

Their design uses a lower hemisphere that is separated from the upper one at the equator and rotates on the vertical axis. If with the current design the substitution method is to be used in the future, a partial mathematical correction of the substitution error should be developed [4]. Since some of the necessary parameters, for example sphere wall reflectance and the assumption that total energy absorption at detector ports is correct, are not known accurately for our sphere, parallel tests on an absolute diffuse reflectance system should be undertaken for calibration.

Comparison with other laboratory revealed that at low reflectance values the UT-ITC spectra are offset to lower values. Since port reducers are frequently used in the UT-ITC laboratory to measure samples smaller than the full sample port, the processing chain to absolute reflectance values requires background radiation removal to correct for the energy that bounces back into the sphere from the edge of the sample port rather than the sample itself [5]. The long term stability measurements proved that background radiation removal is effective and that there is no statistical difference between measurements with and without port reducers.

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Conflicts of Interest

None

References

1. Juping L, Shiju W, Xin W (2021) A Review of Remote Sensing Image Dehazing. Sensors (Basel) 7:3926.
2. Gisela de AU, Tracy KC (2019) Environmental science and pollution research. Environ Sci Pollut Res Int 26(27):27555-27557.
3. Philippe S, Louise J, Nadaya C (2020) Earthquake statistics changed by typhoon-driven erosion. Sci Rep 10(1):10899.
4. Eva K, Elizabeth S, Aldo FP (2021) Approaches to interdisciplinary mixed methods research in land-change science and environmental management. Conserv Biol 35(1):130-141.
5. Sudhanshu SJ, Manohar K, Rama RN (2020) Multi-platform optical remote sensing dataset for target detection. Environ Sci Technol 55(16):10895-10907.