VISUALISATION, PROCESSING AND STORAGE OF SPECTRODIRECTIONAL DATA BASED ON THE SPECTRAL DATABASE SPECCHIO

A. Hueni, S. Rey, D. Schläpfer, J. Schopfer, M. Kneubuehler

Remote Sensing Laboratories, Department of Geography, University of Zurich, Switzerland

1. ABSTRACT

The bidirectional reflectance distribution function (BRDF) is an intrinsic and important property of remotely sensed objects. Knowledge about the BRDF of objects is of interest for the accurate correction of directional effects in imagery and for the enhanced information extraction from spectrodirectional data.

The BRDF may be either extracted from various models or retrieved from laboratory or in-situ measurements. The dual-view Field Goniometer System (FIGOS) [1] has been built for the latter purpose and provides angularly resolved spectral data of incoming and reflected solar radiance. Collection of a series of hemispheres with changing solar angles over a full day enables the approximation of the true BRDF by the means of interpolation at a later stage.

The collected spectrodirectional datasets must then be stored, visualized and processed in an operational manner with a generic approach that is not limited to a particular goniometer or sampling pattern.

These features are all based on the spectral database SPECCHIO [2]. SPECCHIO is a repository for spectroradiometer measurements and according rich metadata that supports, among a host of other parameters, the storage of both illumination and observation geometries. The underlying database schema stores data in a relational manner and is therefore not restricted to any particular sampling instrument or pattern. The optimized data import routines enable the fast storage of whole measurement campaigns including semiautomatic determination of the sampling geometry. The complexity of the spectrodirectional datasets require specialized software tools for the visual assessment of the collected data before being subjected to BRF retrieval. These tools have been designed to deepen the understanding of the interaction of anisotropic hemispherical irradiance with the observed object and may also by used for educational purposes.

We present operational approaches to (a) the interactive and intuitive comprehensive visual exploration of spectrodirectional datasets, (b) the retrieval of the BRF (bidirectional reflectance factor).

Furthermore, the chosen storage approach for such high dimensional datasets is introduced and discussed with a focus on flexibility, retrieval and processing speed. The data structure chosen to store the BRDF data is critical to the later use in a BRDF correction procedure. Fast processing algorithms are required due to the high data volumes typical for hyperspectral imagery and the data structures must be chosen accordingly. Special attention is given to the application of BRF data in the context of higher-level image data processing on the example of the APEX (Airborne Prism Experiment) instrument [3, 4].

2. REFERENCES

[1] J. Schopfer, S. Dangel, M. Kneubühler, and K. Itten, "Dual Field-of-View Goniometer System FIGOS," in ISPMSRS, 12-14 March 2007, Davos, Switzerland, 2007.

[2] A. Hueni, J. Nieke, J. Schopfer, M. Kneubühler, and K. Itten, "The spectral database SPECCHIO for improved long term usability and data sharing," Computers & Geosciences, Accepted for publication.

[3] K. Itten, F. Dell'Endice, A. Hueni, M. Kneubühler, D. Schläpfer, D. Odermatt, F. Seidel, S. Huber, J. Schopfer, T. Kellenberger, Y. Bühler, P. D'Odorico, J. Nieke, E. Alberti, and K. Meuleman, "APEX - the Hyperspectral ESA Airborne Prism Experiment," Sensors, vol. 8, Special Issue, 2008.

[4] A. Hueni, J. Biesemans, K. Meuleman, F. Dell'Endice, D. Schläpfer, S. Adriaensen, S. Kempenaers, D. Odermatt, M. Kneubuehler, J. Nieke, and K. Itten, "Structure, Components and Interfaces of the Airborne Prism Experiment (APEX) Processing and Archiving Facility," IEEE Transactions on Geoscience and Remote Sensing, vol. Accepted for publication, 2008.