Spectro-polarimetric BRF measurements of the desert sand with multispectral LCTF camera

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Earth observation satellites have the ability to calibrate their radiometric characteristics of space-borne cameras and optical sensors on-orbit when traveling on Pseudo Invariant Calibration Sites (PICS). PICS are located mostly in deserts with high spatial homogeneity and high time-related stability of canopy optical properties. On the other hand, modern satellites are able to take images to alongside using attitude control. The light reflected from the sand is not only indicated by the intensity, but also by the phenomenon of polarization of light. The polarized light reflection of the earth’ s canopy begins to be a new strong method of earth observation. A polarization camera can be on flight devices or satellites to explore atmospheric chemistry or to detect hidden objects. If we study further efficiently the spectral signature of sand as well as the light reflection and polarization, we can do more precise calibration on polarization camera in space. This study aims to investigate the polarization properties and spectral relations of the sand Bidirectional Reflectance Distribution Function (BRDF) by separating specular and diffuse reflectance. For this purpose, the sands BRDF was measured in a laboratory by Liquid Crystal Tunable Filter (LCTF) camera in the wavelength range of 460-780 nm with a polarization intensity. The imaging with the multispectral LCTF camera has a great advantage that an arbitrary angle of the field of view can be selected in a specific area. Hundreds of combinations of light illumination and camera view direction are considered in this study, due for this reason we built a fully automatic goniometer with LCTF camera at Hokkaido University. The room window is closed by a dark curtain and the darkroom has built inside the room, which means it’ s ideal entirely dark. The laboratory and its equipment, including the automatic goniometer, control system, and sensor instruments covered with black absorbing materials for minimizing diffuse irradiance scattering. We have classified sand by grain size, and its properties are more accurate than in previous studies.

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