Surface Reflectance Mapping using Interferometric Spectral Imagery from a Remotely Piloted Aircraft


1 Ames Research Center, Moffett Field, CA; 2 Washington University, St. Louis, MO

Objectives:
- General: Evaluate the feasibility of using RPA platforms to collect remotely sensed data in support of Earth systems science missions
- Specific: In-flight characterization of sensor, derivation of surface albedos, comparison of sensor derived quantities with ground measured quantities

Background:
- Location: Pacific Missile Range Facility (PMRF), Kauai, Hawaii
- Date/time: 10/24/97, 13:20 local time
- Program: NASA’s Environmental Research Aircraft & Sensor Technology (ERAST)
- Platform: Pathfinder - a Remotely Piloted Aircraft (RPA)
- Sensor: Digital Array Scanned Interferometer (DASI) hyperspectral imager

Analysis:
- 20 regions were selected from DASI image of PMRF (Fig. 7). Comparisons of DASI and ground measurements were made near region 1, a concrete runway with uniform spectral properties.
- Surface albedos measured on ground (Fig. 5, 6) were transformed to effective DASI at-sensor radiance values using an atmospheric model (MODTRAN) together with radiosonde measurements. Comparison with DASI at-sensor radiance (adjusted with a spectrally independent multiplier) is shown in Fig. 8. This multiplier was applied to DASI laboratory calibration to compensate for radiance scale errors caused by in-flight malfunction of the adjustable entrance aperture.
- Surface reflectance values for all regions were derived from adjusted DASI at-sensor radiance measurements using the above model (Fig. 9).

Conclusions:
- There is quantitative agreement between the airborne based and ground based measurements after adjusting for DASI radiance scale errors as described above (Fig. 8). The fine spectral discrepancies are attributable to saturation onset of the DASI for region 1.
- Based on laboratory radiometric calibrations and the above adjustment factor, reflectance spectra could be derived using MODTRAN for other regions of the image (Fig. 7, 9).
- The capability to obtain hyperspectral imagery from a remotely piloted aircraft has much future potential to support NASA’s Earth science missions.

Future work:
- Mechanical and optical design improvements of DASI to enable stable radiometric calibration
- Upgrade detector array to improve dynamic range and signal-to-noise of sensor
- Improvement of in-flight operational procedures
- Carry out further airborne tests