American Society for Photogrammetry and Remote Sensing, Tampa, Florida, May 7–11, 2007

Surface Lithology, Vegetation, and Tephra Characterization Using a Combined Analysis of Optical and Radar Imagery

Marius Necsoiu [2]
Donald Hooper [1,2]
Roland Benke [1,2]

[1] Center for Nuclear Waste Regulatory Analyses (CNWRA)
[2] Southwest Research Institute®
San Antonio, TX 78238
mnecsoiu@swri.org
dhooper@swri.org
rbenke@swri.org

Keywords: ASTER, AIRSAR, vegetation, tephra, data fusion

There is a wealth of literature that demonstrates how the fusion of SAR and multispectral image data can resolve ambiguities in land cover classification. Research at Sunset Crater, Arizona, offers the opportunity to apply data fusion techniques to study the evolution of a 900-year-old tephra deposit in a semiarid climate.

Integrated analyses of Landsat ETM+, the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), and the Airborne Synthetic Aperture Radar (AIRSAR) were employed to map surface lithology, vegetation, and tephra deposits. Field spectral profiles, DEM, band ratios of optical data, and texture measurements were used as a starting point for analyses. Spectral mixing and matched filtering techniques were applied on ASTER data to map spatial occurrences and abundances of specific endmembers. Polarimetric AIRSAR data were synthetized from the complex scattering matrix data, filtered, slant-to-ground corrected, and coregistered to the optical datasets. Radar discrimination capabilities were used to provide preliminary characterization of tephra deposits.

Preliminary analysis of radar data suggests that it will provide additional information on the surface roughness that is not available via optical data. The fusion of radar and optical data is expected to significantly enhance the ability to classify regions of complex lithology, vegetation, geomorphology, and soils. An improved land surface classification will be used to support investigations on relationship between resuspended airborne particle concentrations and the type and extent of resuspendible surface material and vegetation.