Geophysical Research Abstracts
Vol. 12, EGU2010-1005, 2010
EGU General Assembly 2010

Electromagnetic Land Surface Classification by Integration of Optical and Radar Remote Sensing Data

Jin Baek (1), Wei Gu (1), Jeong Woo Kim (1), Xin C. Wang (1), Gye Jae Lim (2), and Dong Cheon Lee (3)

(1) Department of Geomatics Engineering, University of Calgary, AB, CANADA (jbaek@ucaglary), (2) Department of Information and Communication Technology Engineering, Kwandong University, Kangneung, KOREA, (3) Department of Geoinformation Engineering, Sejong University, Seoul, KOREA

Remotely sensed images, such as optical and radar (Synthetic Aperture Radar (SAR)) images have been playing important roles to retrieve crucial physical and chemical information on the land surface. With noticeable improvements of spatial, temporal, spectral, and radiometric resolutions of these satellite observations as well as with recent remarkable technical advances, it has been possible to observe and classify the land surface more accurately. By integration of satellite multi-spectral high-resolution optical and polarized radar images of central Alberta near Saskatchewan border, we present a non-hierarchical electromagnetic land surface classification method.

We first adapt a conventional supervised land surface classification method using a commercial software ER-Mapper and also implement a Principal Component Analysis method (PCA) to the optical image to extract artificial facilities, such as access road and borehole site that are too small not to be recognized in the classification by any commercial software. The 11 electromagnetic (EM) properties suggested by Döttling and Wiesbeck (1999) on the basis of the U.S. Geological Survey (USGS) Level I and II land use classes are then assigned to the classified surfaces to produce hierarchical EM (e.g., dielectric constant, permittivity, etc) land classification maps. To further classify the hierarchical EM surface map, especially for dielectric constant, we calculate surface roughness with SRTM-3 Digital Elevation Model and at-sensor temperature from thermal band of Landsat-5. We also calculate backscattering coefficients and depolarization ratio from the polarimetric properties of the ALOS PALSAR images. Using these estimated values, we compute intrinsic weighting factors by Dubois (1995) model for less vegetated (NDVI <0.55) land area and Ulaby (1986) model for open water area. By multiplying these weight factors to the hierarchical EM surface, we generate a non-hierarchical higher-resolution EM surface map of the study area.

To investigate the utility of the derived EM surface, we analyze the distribution of wildfire caused by lightning in the extended area of Alberta including study area provided from Canadian Wildland Fire Information System (CW-FIS). We implement a GIS data mining method to the optical image to locate areas with higher risk of lightning in terms of surface class, temperature, and roughness generating the lightning risk evaluation map for extended area. To extract positively correlative features from the risk evaluation map estimated from the extended area and the EM map, we implement Wavenumber Correlation Filter (WCF). By correlating the risk evaluation map with the non hierarchical EM surface in the spectral domain and integrating by the Local Favorability Index, we present a new lightning risk evaluation map of the study area.