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Segmentation of Moderate Resolution Reflectances Using High Resolution Land Cover Information and a Priory Knowledge on Reflectance Properties

M. Braun, W. Mauser

Department of Geography, University of Munich, Luisenstr. 37, 80333 Munich, Germany, (m.braun@iggf.geo.uni-muenchen.de / fax: +49-89-21806675)

Moderate resolution optical remote sensing sensors bare the potential of imaging the entire Globe multiple times a day. However, their resolution of 250m and above often does not suffice to capture the small scale features of natural and man made landscapes. Using the alternative of high resolution imagery to retrieve information on vegetation dynamics as required for the application in environmental modeling fails due to the low temporal resolution of todays available sensors. Yet, high resolution remote sensing data may be used to retrieve features that are relatively stable in time such as land cover type information. In order to address this dilemma of temporal versus spatial scale a method was developed to segment the reflectance values of moderate resolution remote sensing data. Reflectance information from moderate resolution sensors and a high resolution land cover classification was used in combination with a priori knowledge of vegetation reflectance properties to assign reflectances to the land cover types present on the area of a moderate resolution pixel that contribute to the remotely sensed reflectance of that moderate resolution pixel.

The algorithm presented uses knowledge of the probabilities of individual land cover types to reflect radiation at a certain point in time given by the acquisition date of the moderate resolution image. A procedure using the Newton-Raphson optimization algorithm determines the highest probabilities of each land cover type on a moderate resolution pixel to reflect a certain fraction of the radiance captured by the moderate resolution sensor. The output provides information of the reflectance of each land

cover type of the land cover classification on a sub-scale basis. Each fraction of land cover present on the moderate resolution pixel is assigned a reflectance value while the sum of the land cover types reflectances maintain the moderate scale pixels reflectance as obtained from the moderate resolution image.

The feasibility of the algorithm was tested on a synthetic data pyramid of various resolutions obtained from Landsat TM data and applied to moderate resolution imagery from the MODIS sensor. While the method does introduce considerate error to the land cover types reflectances, especially on the smaller fractions of a land cover type on a moderate resolution pixel, it could be shown that errors were reduced when applying conventional leaf area index (LAI) retrieval schemes to fractional land cover type specific reflectances instead of using the same LAI retrieval algorithm for majority land cover types on moderate resolution pixels. To a large part, the errors observed are due to the heterogeneity of environmental conditions of the test site in southern Bavaria. A refinement and adjustment of the introduced a priori knowledge of expected reflectances of individual land cover types may significantly improve the applicability of the method.