Type of Report: Quarterly, January - March 1994

Alfredo R. Huete
University of Arizona
Contract Number: NAS5-31364

OBJECTIVES

1. Initiate level 3 compositing routines for the VI, including BRDF considerations with concurrent error and accuracy analyses.

2. Finish second iteration of the MODIS Vegetation Index ATBD.

3. Prepare a research agenda and validation process for the vegetation index products.

TASK PROGRESS

1. Vegetation Index Manuscripts

The second MODIS vegetation index sensitivity study, entitled "An error and sensitivity analyses of the atmospheric- and soil-correcting variants of the NDVI for MODIS-EOS', by A.R. Huete and H. Liu, was formally accepted for publication in the July issue of Transactions of Geoscience and Remote Sensing (TGARS-IEEE). This study utilized the SAIL model for an error analysis of vegetation indices caused by environmental noise (atmosphere and soil) and instrument characteristics (calibration, band-to-band coregistration, and filter stability). The accuracy of plant biophysical parameter derivation was significantly improved through the implementation of atmospheric and soil correction coefficients inserted into the NDVI equation. The soil adjusted and atmospherically resistant vegetation index (SARVI) had an absolute error of ±0.06, relative error of 10%, and VEN of ±0.33 LAI. By contrast, the NDVI had absolute and relative errors of ±0.12, 20%, and ±0.82 LAI respectively.

A follow up manuscript to the above study, entitled "A feedback based modification of the NDVI to minimize soil and atmospheric noise" was submitted to IEEE in March. This utilizes a systems approach to optimize the atmospheric and soil calibration coefficients developed in the SARVI. The modified NDVI or MNDVI utilizes a soil and atmospheric feedback loop and atmospheric feed-forward loop, which reduced the noise and uncertainty reported in the above study to ±0.11 LAI units with a relative error of 4%.

2. Vegetation Index ATBD

A revised iteration of the vegetation index ATBD was completed in February. There were no significant additions made to the ATBD, however, there was more attention placed on the possibility of utilizing the MNDVI for the MODIS Vegetation Index product. Also, level 3 VI products were further discussed. Although the level 2 VI-ATBD was of primary importance, the manner in which VI images are "composited" and gridded is crucial to an effective, cloud-free VI product. In contrast to the level 2 VI, the level 3 VI will have to consider the strong bi-directional reflectance profiles of most vegetated surfaces. Both view and sun angle conditions will simultaneously vary in day to day VI images. The compositing routine must standardize such variations either through an emperical optimal' selection process (over the 10 day compositing cycle) or through the use of BRDF models and inversion techniques, which would extend off-nadir measurements to nadir view angles and to some standard sun angle.

3. Vegetation Index Workshop

A second VI workshop, organized by Chris Justice, was held at NASA-GSFC from January 31 to February 2, 1994. The purpose of the meeting was several-fold and included (1) establish a research agenda for 1994; (2) coordinate atmospheric correction issues which impact on the VI; (3) coordinate BRDF-related issues (sun angle and view angle) which impact on the VI; and (4) hold preliminary discussions on the land beta delivery and prototyping plans. Alan Strahler presented the MODIS BRDF plan and Eric Vermote and Yoram Kaufman presented the MODIS Atmospheric correction algorithm. Forrest Hall, Ranga Myneni , and Scott Goetz discussed their experiences with view and sun angle problems. Dan Kimes and Shunlin Liang were also present to help out with VI-BRDF-ATMOS. interaction - related issues. Ed Masuoka and Al Fleig discussed what they expected in the way of the beta delivery and prototyping.

4. Research Progress:

TM images and ASAS imagery are being processed into MODIS VI imagery in order to test the various NDVI-variant equations, including the MNDVI, for anomalies and unusual situations which may require special processing or flagging. Also being analyzed is the VI sensitivities to a wide range of vegetation conditions from deserts to pine forests. Preliminary results show that some VI's, such as the NDVI, saturate at lower vegetation covers than other indices and thus the NDVI is unable to differentiate certain vegetation differences. Other indices, on the other hand show quite clearly the differing vegetation covers. The ASAS imagery include the Walnut Gulch site, the OTTER site, and the HAPEX-Sahel site. The TM imagery being analyzed include many of the LTER sites.

NEXT QUARTER ACTIVITIES

Most of the work for this next quarter involve preparation for the ATBD Peer Review in May and the IGARSS'94 Symposium in August. Also plans are being initiated for the summer field camapaign season, including BOREAS activities and continuing field studies in Mexico, Portugal, and Israel. Further plans are also being made to pursue the Chinese test site network for MODIS validation and change detection work. In the laboratory, we will continue work in implementing BRDF models into the level 3 VI compositing studies.