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OBJECTIVES

1. Work on vegetation index test site plan.

2. Complete vegetation index validation plan and vegetation index measurement package.

3. Prepare for Chile trip to work on South American test sites.

4. Deliver version 1 algorithm code.

5. Work on integration of BRDF into the level 3 compositing algorithm.

TASK PROGRESS

1. SCAR-B Campaign

We have hired a graduate student to work on and process the AVIRIS images obtained during the SCAR-B campaign in Brasil last summer. AVIRIS images from the Ji-Parana and Porto Velho sites are being radiometrically and atmospherically corrected and compressed into the MODIS land bands for vegetation index studies. These images are being used to investigate the normalized difference vegetation index (NDVI) saturation problem at high densities of vegetation and to analyze the sensitivity of the aerosol resistant component of the soil and atmosphere resistant vegetation index (SARVI). Many of the images contain smoke which is useful in assessing the performance of atmospheric-resistant indices. Furthermore, we have ground-based canopy transmittance measurements in the visible and near-infrared and we'll be able to assess VI-FPAR linkages.

2. TM-Validation Data Set

The manuscript entitled "A Comparison of Vegetation Indices over a Global Set of TM Images" by Huete et al. (1996) came back with favorable reviews, which were corrected and sent back to the Remote Sensing of Environment journal. This manuscript involved the use of a global' set of Landsat TM images, acquired from the Global Land Cover Test Site (GLCTS) initiative and processed to simulate MODIS global vegetation index imagery at 250 m pixel size resolution. The set of images represented a wide range of vegetation conditions including boreal forest, temperate coniferous forest, temperate deciduous forest, tropical rainforest, grassland, savanna, and desert biomes. This manuscript showed significant differences in information content between the NDVI and SARVI with one index being much more responsive to canopy structural variables such as LAI, while the other index (NDVI) being more related to absorbed photosynthetically active radiation (APAR) and %green cover.

3. SDST product development

Level 2 and level 3 version 1 code was written for the vegetation indices and submitted to Eric Vermote for integration with the surface reflectance product. The level 2 code utilizes blue, red, and NIR reflectances to produce vegetation indices at 250 m and

25 km. The level 3 compositing code is currently set at 8 day, 16 day, and 1 month intervals. Different compositing scenarios are being tested with and without an empirical BRDF adjustment and sensitivity analyses are being incorporated to determine the feasibility of a BRDF correction.

4. Validation and Test site plans

Both a validation plan and a test site plan were submitted for integration into the MODLAND validation and test site packages. An outline of each document is provided below:

4.1 EOS- Test Site Program in Support of Vegetation Indices (January 1996)

For VI analysis, we have three objectives in a test site program: (1) spatial and temporal discrimination of vegetation differences; (2) seasonal bidirectional reflectance properties of different biomes; and (3) coupling and translation of VIs to biophysical parameters. The first two objectives are mostly radiometric and require a broad range of global' test sites while the third objective is more rigorous and constrained to a limited number of intensive field campaigns involving biophysical sampling of vegetation.

Through the test site effort we hope to accomplish the following:

1) Test VIs over a wide range of biomes representing the full range of biomass and structural conditions.

2) Establish empirical relationships to vegetation biophysical parameters, primarily fPAR and LAI, but also %green cover and biomass. Establish VI translation(s) to biophysical parameters.

3) Quantify large scale amounts of biomass and temporal growth patterns through combined field measurements, models, and remote sensing methods and relate to climatic and edaphic environments.

4) Intercompare VIs derived from different satellite sensor systems with the goal of establishing scale- and bandwidth-dependent translation and continuity among the sensors, including AVHRR, Landsat TM, MODIS, GLI, SPOT, MISR, etc.

4.2 EOS Science Data Validation, Vegetation Indices (A.R. Huete, C. Justice, W. van Leeuwen) Jan. 1996.

In this report, the MODIS Vegetation Index (VI) product validation plan is presented. Pre-launch validation of VI performance in discriminating spatial and temporal vegetation differences is accomplished through independent means which include surface biophysical measurements, theoretical canopy modeling, and precursor airborne and satellite data sets. Post-launch validation with the MODIS sensor include correlative measurements and emphasize the long term performance and quality of the VI product.

The validation approach and measurements required are related to the science objectives and planned uses of the algorithm. The purpose of this report is to outline a strategy to provide the user an idea of the performance of VI equations over a wide range of vegetation conditions. The reliability, sensitivity, limitations, assumptions, and spatial/ temporal error fields associated with the algorithm would be clearly stated as would the conditions/situations where the algorithm becomes invalid. Measurement and science objectives

Spectral vegetation indices (VIs) are widely used in remote sensing as precise radiometric measures of the spatial and temporal patterns of vegetation photosynthetic activity. VIs are utilized in operational monitoring of the earth's vegetative cover, including phenological studies of the vegetation growing season, land cover classification, land use change, famine early warning detection, and the derivation of biophysical vegetation parameters such as leaf area index (LAI), fraction of absorbed photosynthetic active radiation (fPAR), net primary production (NPP), biomass, and percent green cover. The ubiquitous nature of a global- based VI mandates that it be robust and applicable over all biomes of the earth. The primary science objectives of the VIs involve,

i. Spatial and temporal discrimination of vegetation differences;

ii. Seasonal vegetation profiles of the growing season (phenological).

iii. Coupling and translation of VIs to biophysical parameters.

5. Chile Trip

A trip to Chile was made for the purpose of continued development of the Chilean test sites into the Global Land Cover Test Site initiative. The climatic gradients and associated vegetation gradients present in Chile provide for unique opportunities to test the VI algorithms over as wide a range of vegetation conditions as possible. Furthermore, the Atacama desert has large areas without precipitation nor vegetation, providing an ideal calibration site for long term monitoring of the VI equations at the lower baseline of vegetation activity. Scientists at the University of Chile are also involved in bioclimate models of the entire South American continent providing independent assessments of biomass conditions from which the VI product can be compared with.

Next Quarter Activities

1. ATBD version 2 to be completed.

2. Process TM and AVHRR images of the Chile test sites and continue to develop South American test sites.

3. Work on coordination of GLI with MODIS activities. The GLI proposal to NASDA appears to be funded. The first team meeting will take place near Tokyo on June 26-28.

4. Continue analysis of SCAR-B results.