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OBJECTIVES

1. Complete version 2 of the vegetation index ATBD.

2. Conduct validation prototype campaign in Chile.

3. Continue level 3 BRDF integration into the level 3 compositing algorithm.

TASK PROGRESS

1. Version 2 ATBD

The second version of the vegetation index ATBD was completed and is available via anonymous ftp at brazil.agshantz.arizona.edu. The revised ATBD is considerably larger due to the addition of a level 3 compositing approach and a validation document. The second vegetation index presented is primarily oriented toward improved vegetation biophysical analysis, rather than a reduction in the noise of vegetation indices. Much emphasis was placed on making the new vegetation index linear and in reducing the 'saturation' problems encountered in the NDVI. As stated in the document, it is difficult to monitor vegetation and detect seasonal and inter-annual changes in vegetation in a "saturated" mode.

We also investigated the relatively 'narrow', MODIS red bandwidth to determine if chlorophyll absorption sensitivity would render the MODIS NDVI too sensitive to vegetation, thus saturating earlier or at lower amounts of vegetation. We found that the MODIS red band is superior in performance to that of the TM and AVHRR and that it will present no problem in vegetation monitoring with the MODIS instrument. Saturation problems in the NDVI are attributed to the non-linear transform in deriving the NDVI from the simple ratio (NIR/red) and to improved atmospheric correction algorithms. The new indices proposed are named 'enhanced' vegetation indices due to its linearity over a wider range of vegetation conditions from deserts to dense forests.

2. Chile - Validation Exercise

A two week field campaign was conducted in the arid and humid zones of Chile in September 1996. Both sites are MODIS test sites and part of the Global Land Cover Test Sites (GLCTS) initiative being coordinated by Ken McGwyer. Brent Holben joined the exercise at the northern site, named Coquimbo, and installed a Cimel sun photometer at the Las Cardas Experimental Station , University of Chile. The area lies in an arid/ semiarid transition zone and is dominated by grasses. Wim van Leeuwen, myself, and participants from the University of Chile conducted ground based and light aircraft radiometric and biophysical measurements. Four-band exotechs were utilized on the ground as well as in the airplane to make simultaneous measurements.

At the southern, Osorno site. We conducted the experiment within Puyehue National Park, again with simultaneous light aircraft and ground-based measurements. The site is an old growth, evergreen broadleaf rainforest in the Andes Mountains. Ground-based measurements consisted of canopy transmittance measures and ceptometry readings.

Jeff Privette from MODland participated in the experiment and investigated some of the BRDF issues posed by the test sites. Aircraft data included surface reflectance measurements. At both sites stereo color photos were taken to document the test sites.

3. NDVI continuity relationships

AVIRIS data was processed to simulate the NDVI of the MODIS, AVHRR, and Landsat TM sensors to establish preliminary translations between the AVHRR-NDVI data series with that of the d MODIS NDVI. When the NDVI was computed from equivalent data sets, e.g., using atmospheric corrected data or atmospherically uncorrected data, the relationships between the MODIS and AVHRR - NDVIs were quite linear and easily translatable. However, when the AVHRR NDVI is computed from Rayleigh and ozone corrected reflectances (current processing) and the MODIS NDVI is computed from atmospherically corrected reflectances (anticipated processing), then the relationships for continuity purposes become more complex and there is much more deviation in the respective values, with the MODIS NDVI always yielding higher values than that of the AVHRR. This will be the focus of more study, not only for continuity purposes but for 'saturation' issues as well.

4. Compositing scenarios

The simplified and empirical Walthal BRDF model continues to do an adequate job in normalizing the NDVI to nadir-equivalent surface reflectance values. The BRDF approach yields considerably improved composite values in relation to the maximum value compositing approach (MVC). The MVC is much more difficult to use and becomes very unpredictable when atmospherically-corrected input data are utilized. Since it is the surface anisotropy that becomes dominant rather than atmospheric anisotropy, the MVC nearly always selects off-nadir, large solar zenith angle pixels. These pixels contain maximum distortion in a spatial sense and they have the least reliable atmospheric correction (longest path lengths), hence the MVC was found to be highly unreliable. The likelihood of a maximum value approach to select residual cloud data was also very high, since an off-nadir pixel with some cloud may have a larger NDVI than a nadir and clear pixel. Much emphasis is being placed in looking for anomalies, discontinuities, or situations where a BRDF compositing approach breaks down.

5. MODIS Simulations

The Fourier transform program, 'TM to MODIS' and a CCRS 'dark object subtraction' program were utilized in simulating MODIS-like imagery, corrected for atmosphere over a wide range of global vegetation types. More than 30 images have been processed, including 17 from Chile, 12 from Brasil, and 4 from Africa. Both 250m and 500m MODIS bands were simulated.

Next Quarter Activities

1.Presentation of the ATBD version 2 at the ATBD review, December, 1996.

2.Work on biophysical translations from vegetation index to LAI, biomass, and fAPAR.

3. Process MAS data for the compositing algorithm.

4.Process a season’s worth of AVHRR data for the compositing algorithm.

5. Error budgets for the vegetation indices and for the validation.