MODIS Science Team Member
Semi-Annual Report
(July-December, 1996)

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Dr. E. Vermote is a new team member augmenting the MODLAND activity and as such, his MODIS science team activity on surface reflectance is undertaken in close conjunction with the activities of Chris Justice (Land Discipline Group Leader). The surface reflectance code is combined with the code from the VI (Justice and Huete) and Fire (Justice and Kaufman) to form an integrated processing string. This report provides a summary of Dr Vermotes team member activities undertaken during the reporting period. Further details of the research will be provided on request and in the publication.

a) Focus activities during the reporting period

Emphasis was given to completing the V1 code for atmospheric correction using the MODIS synthetic dataset produced at SDST. A few bugs were found in the software and are being corrected. The validation plan for surface reflectance is being refined. A validation prototyping campaign is being developed for a significant part of the land product chain. Attention has been given to the results of the SBRS instrument testing on behalf of the MODLAND group. Similarly Dr Vermote represents the optical calibration component of the land group at the MCST meetings. A response has written to the comments from the SWAMP Land ATBD review. While revising his own ATBD, Dr. Vermote also participated intensively as a reviewer to the EOS-ATBD reviews.

Vermote also represented the land group at the weekly TT meetings and discipline group meetings.

Surface Reflectance ATBD

A new version of the surface reflectance product ATBD has been written to include comments of the SWAMP review and update the progress made on the products. Special emphasis has been placed on the product validation and assistance in the validation of the MODIS calibration. The instrument characteristics that will improve the accuracy of the atmospheric correction algorithm have been pointed out. Moreover, the sources of error that can arise in the atmospheric correction procedure have been discussed and illustrated with a complete description of the error budget through a sensitivity study obtained witht the 6S radiative code (Second Simulation of the Satellite Signal in the Solar Spectrum). The surface reflectance product has been reviewed in December with other EOS land product. Results of the individual written review were good (2A,2B), the panel seems to be satisfied with the work accomplished and planned but hasn't finished its report yet.

Surface Reflectance Code

After delivering of the Version 1 surface reflectance code and associated test data sets to the SDST STIG, emphasis was put on testing the processing thread using the synthetic data set. Improvements included adding output product metadata to conform to the MODIS V1 MODLAND metadata specification. Several improvements have been made to the code, in particular in the area of interfacing the code MODIS input product (aerosol interim product), optimizing and cleaning up the code for Version 2 delivery, evaluating the CSC recommendations pertaining to MOD09, and formulating a work plan to incorporate their valid suggestions into the V2 code release, delivering code to SDST for pre-processing of the DAO data set used as ancillary data.

Radiative transfer modelling

As it is well suited for various remote sensing applications, the 6S code is intended to be used as the reference to enable the inter-comparison of algorithms and to verify the correct implementation of the MODIS atmospheric correction algorithm, So we try to maintain

6S continuously updated as the MODIS projet evolves (for example to take into account the new spectral response measurements of the filters). Current development also arise with new requests or remarks of the 6S users and result in modification in 6S if necessary. We are currently working on refining version 4.0 in 4.1 of the code and correcting version 0. of the manual to 1.0.

Atmospheric PSF aerosol/retrieval correction prototyping

Vermote contributed to work on the LTER/TM atmospheric correction software as a prototype for MOD# 09 validation. Version 1 of the code has been delivered to the LTERnet facility. The test data set for the LTER atmospheric correction consists of 18 scenes acquired by the NASA Landsat Global Change Data Collection over the following LTER sites (Sevilleta, Hog Island, National Temperate Lake, Bonanza Creek, HJAndrews). A meeting was held in Seattle where LTER investigators presented their results. A paper is being written on the correction code. The next phase will include delivery of an improved code (variable aerosol model) and some AVHRR 1km test datasets. Progress has been made on refining the aerosol retrieval algorithm and QA is done on a additional sample of 10 scenes provided by ESRIN (collaboration with O. Arino)

Vicarious calibration using clouds and molecular scattering

This method of calibration (Vermote and Kaufman, 1995) has been fully automated and new results are being produced; these results (NOAA-9 85-86, NOAA-11 89,90 and NOAA-14 95,96) were presented at the Calibration workshop in Toulouse. Coefficients of calibration for AVHRR channel 1 and 2 are produced automatically every 9 days. The precision of the method (repeatibility) is very good (1% standard deviation over 9 days periods), and exceeded that of other methods presented at the workshop. The method will be tested shortly on POLDER data and is part of Vermote's science team investigation for MODIS.

Atmospheric correction on global AVHRR dataset / aerosol climatologie

AVHRR: we processed globally the GAC dataset for 1 year. We are evaluating the processing, the atmospheric correction (rayleigh/ozone/water vapor), the composite algorithm and CLAVR cloud screening on a large amount of data. We started generating/evaluating a global product of channel 3 reflectance. We are also evaluating an aerosol transport model that may be used to refine aerosol climatology and aerosol product for atmospheric correction. Using that dataset, we are also testing the MODIS approach for production of Level 3 Vegetation Indices (compositing method using a simple model for directional effect correction).

CIMEL Surface BRDF Measurements

We have developed a sampling protocol for obtaining BRDF measurements in cooperation with the CIMEL company (France), and are awaiting delivery of the coded version. The technique will be tested as part of the MODLAND validation prototype campaign planned for 1997. The validation protocampaign will include extensive CIMEL surface sampling, simultaneous PARABOLA sampling, and surface characterization measurements from an ASD (spectrometer 0.40µm to 2.5µm) mounted on an automatic pilotless plane (collaboration with Pat Coronado of Code 935). These tests will occur at a southwestern location to be determined, and later at a deciduous hardwood location.

b)Meetings Attended:

-EOS calibration panel (GSFC) , July 9-11 1996.

-MODLAND/SDST meeting - (GSFC), July 11-12 1996.

- MCST Science Advisory Panel (GSFC) July 19, 1996

- NASA/LTER worksop (Seattle)- August 17-18 1996

-SDST Science Advisory Panel (GSFC) , September 4-5 1996.

-MCST reflective band calibration audit - (GSFC), September 5-6 1996.

- Calibration Workshop (Toulouse, France) September, 18-20, 1996

- Vegetation Science Team meeting (Stockholm, Sweden), November 18-20,1996

Publications

Vermote, E. F., El Saleous, N. Z., Justice, C. O., Kaufman, J. Privette, Y. J., Remer , L., Roger, J. C. and Tanre, D. ,1996, Atmospheric correction of visible to middle infrared EOS-MODIS data over land surface, background, operational algorithm and validation, Journal of Geophysical Research, (accepted).

Vermote, E. F., Tanre D., Deuze, J. L., Herman, M. and Morcrette, J. J. (1996), Second Simulation of the Satellite Signal in the Solar Spectrum: an overview, accepted to IEEE Trans. Geosci. Remote Sens.

c) new hire

Anne Vermeulen (University of Maryland) to assist on the evaluation/implementation of the atmospheric correction algorithm . Anne's background is radiative transfer, aerosol retrieval, sun/sky photometry. She recently got a Phd from the LOA (Laboratory for Atmospheric Optics) in Lille , France.