MODIS Science Team Member

Quarterly Report

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A. FOCUS ACTIVITIES DURING THE REPORTING

The most important activities undertaken during this reporting period are the following:

1. Version 2.1 surface reflectance L2/L3 DAAC/SDST delivery
2. Version 2.0 1km and 250m VI product delivery (assist Arizona)
3. Version 2.1 surface reflectance L2 testing vs 6S
4. Land Synthetic data set generator improvements
5. Surface Reflectance error budget generation (SWAMP request)
6. SCF Hardware
7. Aerosols transport modeling
8. Aerosol optical depth retrieval from AVHRR data
9. Aerosol characteristics retrieval from SeaWiFS/AVHRR fusioned data
10. Validation activities

1. Version 2.1 Surface Reflectance L2/L3 DAAC/SDST Delivery

Developed major patch (technically, the 2.1 delivery) for the MODIS L2 surface reflectance algorithm code MOD09. Delivered this patch to MODIS SDST. MOD09 is now in integration phase at the DAAC its status being “green” since the beginning of April, the code is now being “chaperoned” into the GDAAC processing system by Paul Fisher. The first cut ODL production rules for MOD09 were requested by SDST. In doing this work, major deficiencies in the ECS specified production rules were found These deficiencies were passed on to SDST and GDAAC.

Finished 2.1 delivery of the MODIS L3 gridded surface reflectance product to the MODIS Science Data Support Team.

2. Version 2.0 1km and 250m VI Product Delivery (assist Arizona)

Fixed two bugs in the MODIS 250m L3 VI algorithm code and delivered these to MODIS SDST. The first bug involved the correct reading of the HDF-EOS metadata, as the code read the metadata incorrectly. The second bug did not allow the algorithm to process properly when run on 16 days of data. Delivered the MODIS V2.0 1Km L3 vegetation index algorithm to SDST. Worked with MODIS SDST to change the ECS system design for the MODIS 1km L3 vegetation index algorithm. The earlier system design was left over from V1 and was completely inefficient for running the V2 algorithm. Began work with Kamel Didan, the new programmer hired by the University of Arizona MODIS Science Computing Facility. Kamel will be at Goddard for approximately one month. During this time he will be instructed/trained in how the MODIS Vegetation Index code has been put together. This will enable him to handle all future code maintenance and new code development for the MODIS Vegetation Index algorithms working from the University of Arizona.

3. Version 2.1 Surface Reflectance L2 Testing vs 6S

Extensive testing of atmospheric correction part of the algorithm with the improved synthetic datasets and comparison of each correction steps with the 6S reference code. Slight changes and refinements have been made to the algorithm, notably regarding the computation of the spherical albedo for elevated target, the interpolation of the ancillary water vapor and surface pressure data, and the absorption by half of water vapor content in the aerosol layer (WV so far was considered under the aerosol layer). A range of acceptable values for water vapor, ozone, and surface pressure has also been added. The algorithm accuracy is overall satisfactory as it is, but further improvement could probably be made. Example: some error sources (systematic errors of small magnitude) are well identified and come from correction for surface elevation

4. Land Synthetic Data Set Generator Improvements

The computation of top of the atmosphere (TOA) radiance's in the L1B data produced by the synthetic data generator was significantly improved. A better modeling and accounting for atmospheric components, in particular aerosols, was included. Some errors that existed in the SDST code were also fixed and some code enhancements were made to fulfill the land community requirements for simulated data set including adding noise to the

data. A 16-day period of synthetic Level 1B data covering the US and Canada test areas were produced using the improved code.

5. Surface Reflectance Error Budget Generation (SWAMP request)

Documentation of uncertainty sources in the SR retrieval and product accuracy were provided based on the set of simulation done for 6 generic cases in the ATBD.

6. SCF Hardware

The SCF major computer systems are now installed in Building 32. They are interconnected with a high speed ATM link. With the help of the CNE, all systems are now configured appropriately to take advantage of that link in both on and off campus communications.

The on-line storage capabilities were augmented with a networked file system from Auspex which is configured to serve data over ethernet and ATM.

A 2 TB near line storage from ATL has been installed and is now completely operational. Ominstorage, a Hierarchical System Management software from HP is used to manage data migration to and from this library as needed. Some in house software utilities were developed to enhance and facilitate the use of this library.

7. Aerosols Transport Modeling

Continued the process of debugging the algorithm for calculating mass fluxes from wind speed ancillary data (DAO) for an adapted version of the GISS aerosol transport code. The GISS model was adapted to handle the DAO surface pressure ancillary data and to ingest aerosol optical thickness (AOT) data and output AOT data, in order to interface with the Pathfinder II products.

Performed preliminary modeling of the Mt. Pinatubo eruption's injection of tracer in the atmosphere and subsequent aerosol transport. Our adaptation of the aerosol transport program td90n9s shows the aerosol cloud extending primarily southward, while the aerosols from the eruption itself extended southwesterly, with a strong western component (e. g., Volon et al., SPIE, v. 2309, 318-326). Tested the effect of different PU/PV data (from GISS vs. calculated from DAO U/V wind data) on the modeled aerosol plume.

S. J. Lin (GSFC Data Assimilation Office - DAO) provided us with the aerosol transport subroutine "tpcore" (versions 4.0 and 4.5) which is part of the DAO's chemistry transport model/general circulation model. We developed a software which reads DAO surface pressure, temperature and horizontal wind files, calculates aerosol mixing ratios, and calls “tpcore” to compute aerosol transport. This software was tested using a point-source of aerosols (a Pinatubo-like simulation) for 30 simulated days at different resolutions (2 by 2.5 degrees, 4 by 5 degrees) to address implementation and performance issues.

Developed a new set of horizontal winds (UWND, VWND) and temperature (TMPU) data from the DAO for 1991. This dataset will be used as input to the transport model described above to test it in a similar way as the GISS model.

8. Aerosol Optical Depth Retrieval from AVHRR

Work was done on validation of AVHRR optical thickness retrieval using AERONET sunphotometer measurements for the September-December 1997 period. The 1 deg x 1 deg statistics database described in the July-Dec 97 report was used in concert with 6S and coincident sunphotometer observations to improve the retrieval algorithm over land. This is achieved by using variable surface reflectance in the 0.67 mic channel as a function of the 3.75 mic channel. Analysis of retrieved optical thickness over water is still on-going.

9. Aerosol Characteristics Retrieval from SeaWiFS/AVHRR Fusioned Data

A software to process SeaWiFS level 1A data was developed. It produces atmospherically corrected bands (or top of the atmosphere) over land and ocean as well as the smoke and aerosol index product which is a prototype for the aerosol product. This software will be modified and used for the development of an enhanced aerosol retrieval software which combines AVHRR and SeaWiFS data to produce optical depth and size parameters over land and ocean . About 6 months of SeaWiFS data will be analyzed over the next reporting period.

10. Validation

A meeting was held at USDA with Surface Reflectance Validation Pi’s (S. Liang (UMD), J. Privette (GSFC)) and Co-PI’s (January 13, 1998). Points covered during the meeting: (1) discussion of instruments involved, (2) plans for directional reflectance’s

measurements, (3) soil/vegetation and atmosphere characterization, (4) short-term/mobile and/or long-term towers and airborne measurements have been considered, (5) description of sites of validation

B. MEETINGS ATTENDED

- Surface Reflectance Validation Coordination Meeting, January 13, 1998, USDA
- EDC DAAC Science Advisory Panel Meeting, February 3, 1998, Raytheon, Landover
- MODLAND / SDST, GSFC, February 11-13. Presentation of the preliminary approach for MOD09 Quality Assurance Analyses.
- MIT course : Lecture on radiative transfer modeling, and computer exercises with the 6S Radiative Transfer Code (GSFC, January 30, 1998)
- MIT course : Lecture on AVHRR and SeaWiFS global product (January 29, 1998)
- SeaWiFS Science Team Meeting, January 6-9th,1998: Presentation on aerosol product from SeaWiFS data.
- MODLAND / SDST, GSFC, February 11-13,1998
- Aerosol Working group meeting, GSFC , February 19,1998, March 17,1998
- Attended weekly SCF status meetings. Recorded and distributed minutes of these meetings to all SCF members.
- Attended weekly Technical Team meetings.
- Attended weekly MODIS SDST transfer group meetings,
- Attended MEBS demo and MEBS scheduler training, March 11 and March 18
- Attended ECS V0 ordering tool demo

C. PUBLICATIONS

Wolfe R.E., Roy D.P., Vermote E.F., “MODIS Land Data Storage and Gridding and Compositing Methodology: L2G”, submitted to *IEEE transaction on geoscience and remote sensing.*

Ouaidrari H., Vermote E.F. “LANDSAT TM Software for Atmospheric Correction”, submitted to *Remote Sensing of Environment.*

Justice C. MODIS Land Discipline Leader (University of Virginia), Hall D., Salomonson V., Privette J., (NASA/Goddard Space Flight Center), Riggs G., (RDC), Strahler A., Lucht W., Myneni R., Knjazihhin Y., (Boston University), Running S., and Nemani R., (University of Montana), Vermote E., Townshend J., Defries R., Roy D., (University of Maryland), Wan Z., (University of California at Santa Barbara), Huete A., and van Leeuwen W., (University of Arizona), Wolfe R., (Hughes, STX), Giglio L., (SSAI), Muller J-P., Lewis P., (University College, London), Barnsley M., (University of Wales)."The Moderate Resolution Imaging Spectroradiometer (MODIS): land remote sensing for global change research" edited by C.O. Justice, submitted to *IEEE transaction on geoscience and remote sensing*.

Asner G.P., Bateson C.A., Privette J.L., El Saleous N.Z. and Wessman C.A., "Vegetation Structural Effects on Ecosystem Carbon Flux from Multi-satellite Data Fusion and Inverse Modeling", to be submitted to J.G.R.