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MODIS REPORT - NAS5-31361

1st QUARTER 1993

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MODIS INFRARED ALGORITHM DEVELOPMENT

A. Near-Term Objectives

A.1 Continue interaction with the MODIS Instrument Team through meetings and electronic communications.

Besides the normal monthly reporting, the Project has requested information in several areas. A “Data Products Plan," prepared by the Project for MODIS, was reviewed and commented upon with respect to SST products. A hardware implementation plan for the MODIS IR Algorithm Development efforts was developed and forwarded to the Project. The P.I. participated in drafting of an ocean color “White Paper” to guide out-year evolution of NASA’s visible ocean remote sensing. The P.I. participated in the first SeaWIFS Science Team meeting in Annapolis. Finally, a long running series of exchanges on MODIS infrared calibration and performance aspects continues.

A.2 Continue evaluation of NOAA and RSMAS non-linear calibration correction approach for satellite borne infrared radiometers using the AVHRR radiometer as a test bed.

The final draft of the RSMAS AVHRR non-linear calibration correction procedure was submitted to the Editor of the Journal of Geophysical Research. In a similar fashion, the NOAA approach to non-linear correction was coded, modifications were made and agreed to by NOAA to improve the implementation, and preliminary products were generated using it and the Miami approach. A preliminary evaluation of the two approaches, using satellite and fixed buoy observations, was completed. This evaluation

suggests that for scene temperatures greater than 250K, both approaches produce similar results. The NOAA approach appears to work better for scene temperatures less than 250K, when errors can rise above 1° in the RSMAS approach.

A.3 Continue algorithmic development efforts based on experimental match-up databases and radiative transfer models.

The NOAA and RSMAS non-linear calibration correction approaches have been implemented for use with the satellite match-up database. Databases have been generated using non-linear correction approach and prototype atmospheric correction algorithms determined from the match-up datasets. Both approaches provide similar levels of performance. A common problem for both approaches is correct identification of outliers within the satellite retrieval fields. About 1% of the retrievals are not identified correctly, which leads to a doubling of the rms error in the match-ups (~0.8K). Removal of these outliers by various techniques is under study. The best approach seems to be use of an evolving surface climatology based on a monthly mean sea surface temperature field. Use of such a field for screening purposes identifies most of the outliers and permits their removal.

A.4 Continue 1988 extractions for global in situ drifting buoy validation database.

This effort is concentrated on performing test extractions of satellite sea surface temperature retrievals in the neighborhood of drifting buoys. A prototype procedure has been implemented and is under test.

A.5 Evaluate different approaches for global SST data assimilation and continue work on statistically based objective analysis approaches.

A. Mariano continues work in this area, principally with NOAA support (at this time). Test fields have been generated for the tropical Pacific (±30° Lat.). As with the other match-up efforts, these efforts are currently demonstrating rms errors of approximately 0.8K. It is expected that this effort will provide 0.4K rms error fields at its completion.

A.6 Continue evaluations of high-speed network interconnection technologies with preliminary effort on ATM.

While local efforts in this area have concentrated on improvements of FDDI networks, it has been clear that higher speed wide area network

connectivity would be needed over the next few years to adequately address several of the algorithm development and modeling issues. Thus, the P.I., in conjunction with Prof. Mark Abbott, initiated discussions with ARPA concerning network retrieval of drifting buoy data as well as improvement of inter-institutional data networks. These discussions have focused on the use of ATM technology at OSU, Miami, and NRL, with higher rates for institutional connectivity. This includes enhancement of buoy data bandwidth to the order of 100K bits per day. Miami and OSU are currently discussing implementation of a DS-3 network with NRL, based on ATM technology

A.7 Provide investigator and staff support for the preceding items.

Efforts at the institution are going forward in a deliberate manner. However, as you can tell from the scope of the objectives and our progress, MODIS resources have served to focus interest in certain areas, but other resources have been necessary to make significant progress in these areas.

B. Overview of Current Progress

B.1 Finalize discussions with DEC concerning use of their GIGASWITCH hub for FDDI and ATM interconnections.

Multiple discussions with representatives of DEC were held concerning beta field test of their GIGASWITCH hub. DEC has agreed to provide Miami with a test unit during the next quarter. Our expectation is that this unit can be upgraded to work with ATM connections. The initial implementation of the GIGASWITCH will permit improvement of work station connectivity at Miami using FDDI connectivity. The principal impact of these improvements should be in accessing of distributed database holding.

B.2 Initiate/continue discussions with FORE concerning use of their hub for ATM interconnections.

NRL proposes that we use FORE ATM switches as a basis for the proposed ARPA wide area network experiments. We have discussed the potential implementation with FORE and they agreed to visit Miami and describe the current and projected capabilities over the next year. It appears that these switches are reliable basis for a wide area computer data network, however, our current view is that they would not work well for a multi-media network.

B.3 Continue discussions with NEWBRIDGE and University Telecommunications concerning use of NEWBRIDGE hub for ATM interconnections.

Our product review activities for high speed networking have included a number of different vendors. NEWBRIDGE was chosen as representative of a high performance switch that would permit diverse multi-media applications as well as computer data networking using ATM switching technology. We have involved the University of Miami Telecommunications in this discussion because it has the potential of facilitating University infrastructure for links between H. Gordon's MODIS efforts in the Physics Department and the Brown and Evans' efforts at RSMAS. The University is currently studying issues involved with implementation of DS-3 links between the campuses.

B.4 Initiate purchase of additional DEC/ALPHA workstations for algorithm development.

Two workstation purchases (DECstation 3000/400) were initiated and completed in this quarter. A third purchase (DECstation 3000/500) was initiated but approval from NASA for purchase was not received in this quarter. These workstations will be used for analysis and visualization activities associated with algorithm development.

B.5 Hire new person to focus on database development and algorithm testing.

A search opened in the previous quarter and was completed for a post doctoral fellow to assist in algorithm development. S. Shenoi (NIO, Goa) has been hired and will report to work in early April.

B.7 Initiate generation of MIAMI and NOAA non-linearity correction based match-up datasets for local and community evaluation.

The MIAMI and NOAA non-linearity corrections are being used to generate large scale global datasets for comparison and evaluation purposes. This activity was started in this quarter and will continue during the next quarter.

B.8 Respond to requests from MODIS Project concerning infrared band dual-use issues.

The MODIS Project, in its continuing discussions with Hughes/SBRC, and the instrument team, is seeking to maximize MODIS instrument performance at minimal cost. Thus, the Project considered dual use of infrared bands for SST, and terrestrial fire and volcanism. While this appears to be a valid approach at the outset, without re-engineering of electronics on the sensor, it does not appear that NEDTs required for SST applications can be sustained with a single dynamic range usable for the terrestrial applications. In the absence of a bi-linear approach which maintains the needed precision and accuracies for SST retrieval, the investigator recommends against this approach.