MODIS SEMIANNUAL REPORT
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A. PERSONNEL

Personnel supported for the first two quarters of 1998 include:

B. Evans (Jan, Feb, Mar, Apr, May, June)
V. Halliwell (Jan, Feb, Mar, Apr, May, Jun)
K. Kilpatrick (Feb, Mar, Apr, Jun)
Kroger (Jan, Feb, Mar, Apr, May, Jun)
A. Kumar (Jan, Feb, Mar, Apr, Jun)
J. Splain (Jan, Feb, Mar, Jun)
S. Walsh (Jan, Feb, Mar, Apr, May, Jun)
R. Kolaczynski (Mar, Apr, May, Jun)
Wilson-Diaz (Jan, Feb, Mar, Apr, May, Jun)
J. Brown (Jan, Jun)
E. Kearns (Jan)
A. Li (Jan)

Harrington (Jan)

B. NEAR TERM OBJECTIVES

B.1 Processing Development

B.1.1 Pathfinder

B.1.1.1 Continue reprocessing the 1985-1998 AVHRR using version 4.2 algorithms for both the global day/night 9km fields and the new 4km fields.

B.1.1.2 Continue to compare new MAERI SSTs with Pathfinder SSTs (and SSM/I and PATMOS or TOMS data) to improve algorithm and/or cloud detection performance.

B.1.1.3 Reprocess NOAA7 data with new coefficients derived from Matchup analysis.

B.1.2 MODIS

B.1.2.1 Establish Q/A procedures using test MODIS data.

B.1.2.2 Establish MOCEAN web site.

B.2 Matchup Database

B.2.1 Complete correction of NOAA-7 decision discrepancies and produce new set of coefficients. Identify the potential errors and biases associated with the early NOAA-7 AVHRR data.

B.2.2 Continue to develop new ocean color matchup database.

B.3 Systems Support

B.3.1 Complete the new FloridaNET network connection to GSFC.

B.4 Team Interaction

B.4.1 QA testing using SeaWiFS/MODIS products

C. OVERVIEW OF PROGRESS FOR THE FIRST TWO QUARTERS OF 1998

C.1 Processing Development

C.1.1 Pathfinder processing

C.1.1.1 General

As of the first quarter of 1998, near real-time 9km global SSTs derived from AVHRR are available via the RSMAS MPO/RRSL web page. Pathfinder products have also been expanded to include a 4km coastal day and night field.

Pathfinder processing is being used to implement MODIS-like product resolution. Daily SST maps are produced at 4km resolution within 800 km of the coasts using the current Pathfinder algorithm. Cloud masks are maintained separately from the data; masks can be applied at the quality level selected by the user when the images are presented at the web site. Twenty weeks of new coastal Pathfinder AVHRR SST 4km product were calculated in January. Produced scan segregated files for 1991 week 20 to 1992 week 30. The Arabian Sea 4km re-map was recalculated, and an Inter-American Sea/Gulf of Mexico 4km re-map was developed.

Vicki Halliwell has produced navigated and calibrated radiance and brightness temperatures for a sequence of NOAA-14 pass segments defined by W. Barnes for comparison with contemporaneous TRMM retrievals.

Progress is continuing on reprocessing the 1985-1998 AVHRR using the version 4.2 algorithms. Pathfinder v 4.2 SSTs were computed for 1994 and 1985. Version 4.2 pathfinder SSTs for 1996 were delivered to JPL in January. In March, Pathfinder v 4.2 SSTs were sent to JPL for the following years: 1994 through 1995, 1997 week 38 to 1997 week 47, and 1998 week 01 to 1998 week 09. 1985 was completed and sent to JPL for archiving during May.

The DLT tape archive used in the processing was moved from machine *apple* to *monstera* .

Determined new clock drift correction factors for NOAA12, 14, and 15 as a result of clock resets performed by the NOAA satellite operation center. These factors are used in navigation of the AVHRR data during image processing.

Verified and released reprocessed Pathfinder V4.1 GAC data to the general scientific community. These data are available via the NASA JPL DAAC.

During May-July 1998, the MAERI was maintained aboard the R/V *Ronald H. Brown* to collect in situ data to compare with Pathfinder SSTs. Personnel involved in this effort included E. Kearns, A. Kumar, and R. Sikorsky. These data will be processed along with ancillary radiosonde and SSM/I data to identify any discrepancies between the MAERI and Pathfinder fields.

C.1.2 Processing

Set up automatic loading of real-time Pathfinder AVHRR SST files onto the local web site.

The three jobs required for the real-time processing have now been combined, and can be done in one pass: the regular 9km global, the 4km coastal (new), and the 4km MAERI cruise sections.

Dual processing streams/double spoolers/double day processors were implemented and tested.

Current versions of Autosys and auto-processing command files were put into CVS. Ran multiple SSTypes from the same Autosys jobs.

Processed daily scan-segregated files for days 140, 150, 160, 170, 175, 180, 185, 186, 187, 188, 189, and 190 of year 1991.

AVHRR data for 96 MAERI cruise were processed in May, and ship track trace extracted for a number of variables to enable along-track comparisons of Pathfinder and MAERI data.

Supplied 4km imagery for an investigation of Hurricane Opal.

Pathfinder data were supplied to WHOI in June, consisting of 9km data for the dates 9 Apr 98 through 24 Apr 98, for the region defined by the latitude range 5S -> 25 S and the longitude range 40 -> 15 W.

Extracted the median/minimum/maximum of the pixels surrounding the central pixel for channels 4 and 5 (for data that are coincident and contemporary with MAERI cruises).

In July, began to straighten out the 96-97 DLT GAC data.

Real-time processing proceeding more smoothly, and is being used by some internal and external groups.

C.1.3 Algorithm Development

The initial phase of estimating coefficients for NOAA-7 (mid 1981 – 1984) was completed in the first quarter. A trial set of coefficients was developed that serves as a basis for generating a data quality acceptance tree. The tree can then be used to re-estimate coefficients. This procedure is iterated until the coefficients and quality tree are stable.

During the second quarter we continued to pursue retrospective processing and extension of the data set to include NOAA-7 from 1982-1984. The N-7 time period is complicated due both to the use of a different set of wavebands from subsequent AVHRR instrument and to a very limited geographical distribution of *in situ* observations. A preliminary set of coefficients for the NLSST SST retrieval equation has been generated together with a data quality assessment tree. A similar coefficient/quality assessment set was generated for N-14 using an *in situ* data set resampled to coincide with the spatial/temporal distribution of the N-7 *in situ* distribution. We have explored monthly and yearly coefficients estimation using various windows ranging from 5 -12 months. The N-14 sampled results are then compared with the N-14 complete results to quantify the impact of the limited N-7 matchup database. Seasonal and hemispheric errors are larger than those obtained with the complete data set. Several different approaches, varying temporal intervals ranging from months to the entire N-7 period, have been analyzed to determine is an approach exists that significantly minimizes the error field. To date only minimal improvements have been found; a 0.2^{o}C cold bias in the Pathfinder SST value results, irrespective of the windowing method used to compute the coefficients

Extensive evaluation of Pathfinder V4.0 algorithm results is presently being undertaken in regards to understanding trends in the global Pathfinder fields. The analysis makes use of the matchup database, daily and weekly GAC images , comparison to ship and buoy data (using Reynolds OI, AOML drifter, NOAA11 Matchups, and GOSTA plus climatologies), TOMS aerosols, and SSMI water vapor. Any trends which are discovered may be used in modifying the Pathfinder algorithm to minimize residuals in problematic regions of the ocean/atmosphere system.

Comparing Pathfinder to the SST climatologies has shown that the location and magnitude of the residuals is highly variable and in a number of locations the sign of the anomaly is different depending on which climatology is used as a reference. These differences are caused mainly by the temporal/spatial sampling discrepancies in the data between each climatology. This conflict limits the ability to correlate SST anomalies with presence of varying water vapor or presence of aerosols. When using the buoy-satellite matchup database we see a tendency to under-compute SST when water vapor loading is high.

The Pathfinder algorithm was checked for sensitivity to inaccuracies in the relative spectral positions of the AVHRR bands 3,4, and 5. This experiment was driven by similar problems with the new MODIS instrument. After reprocessing NOAA-11 matchup data, no evidence of a significant discrepancy was discovered.

In continuation of the Pathfinder diagnostic analysis for the improvement of existing sea surface temperature residual accuracy, we looked at SST residual and difference between channel 4 and 5 temperatures for various SSMI water vapor conditions. We chose the Northern Indian Ocean as the study region as this region is known to experience a large seasonal water vapor variation due to the monsoons. Also this region was a site of a series of cruises as part of the JGOFS program. We chose five transects; three along each of the coast and one each along the equator and across the center of the Arabian sea. Along each of these transects we extracted and computed residuals (pathfinder - OIReynolds) SST, channel4 - channel5(T45) and SSMI water vapor for 1995. We also extracted data along the JOGFS cruise track's for 1995. There were six cruises along the same cruise track and in this case we calculated the SST residual as the difference between pathfinder and the ships' thermosalinographs. The water vapor values range from about 10 to 70 mm in this region and is distributed seasonally. We observed that during periods of high water vapor (exceeding 45 mm) the error in the SST residuals tend to be negative, i.e. the satellite pathfinder data appears to underestimate the SST. The relative t45 values also appear to decrease.

We also analyzed GOES geostationary data for specific regions including Gulf of Mexico and Gulf of California. The main advantage of GOES is the higher frequency at which it samples compared to AVHRR and therefore more probability for cloud free data. We produced hovmuller diagrams for different time periods along many transects. The cloud free periods showed differential heating of the sea surface during the day and night. This diurnal signal was stronger near the coast and appears to decrease in strength offshore.

We also extracted a time series on a number of Tower Horn positions, expected to be fitted with the MAERI. The MAERI also measures sea surface radiances at very high spatial and temporal resolutions. The diurnal signal obtained from the GOES along with the MAERI will provide new and different aspect of sea surface temperature.

In continuation of the Pathfinder diagnostic analysis, we worked with residuals(satellite SST - in situ SST) greater than 0.5 C. Major observations include the large number of residuals that occur at scan angles greater than 30 degrees(nearly 80 percent). Although some residuals can be categorized in regions of high water vapor the major percentage of residuals always had a scan angle greater than 30. Other reasons for high residuals include the accuracy of in situ data collection(buoys) especially from AOML buoys. A notable observation is that the residual variations are evenly spread throughout the year. In general the residuals followed regions of greater data collection and hence the difference in the variation of different basins.

Pathfinder SSTs and ancillary data were extracted for locations where data were available from Marine Atmospheric Emitted Radiance Interferometer(MAERI). There have now been 3 separate cruises for which this analysis may be undertaken; Pathfinder data for cruises from 1996 and 1997 have already been extracted. The “skin” SST measured at the sea surface by the MAERI is compared to that measured by the AVHRR at the same time and place in the ocean and subsequently rendered in the Pathfinder SST dataset. Other satellite data sources, including SSM/I and TOMS, are being integrated into the analysis to enable some diagnoses to be made concerning the causes for any discrepancies between the two SST measurements. Preliminary results seem to confirm the effects of water vapor on SST retrievals, but also indicate that there may be remaining cloud-masking issues that must be dealt with
as well. Careful analysis of the imagery and the satellite SST quality flags suggest that a number if not all of the ‘cold’ retrievals (Satellite SST – MAERI SST< 0.5C) are most likely unresolved clouds for this data set. Residuals within ± 0.5C can then be associated with sensor response or radiative transfer considerations. Further study is needed to resolve the data quality issue.

Efforts are underway to use aerosol products from the TOMS sensor and the AVHRR visible channels (L. Stowe) to begin to correlate SST anomaly patterns with these ‘aerosol’ fields.

C.1.1.4 Documentation

Continued working on final document containing a detailed description of the processing used for Pathfinder GAC V4.0. Began working on an overview Web page which will coordinated the various documents recently created in regard to Pathfinder SST developments at the University of Miami, including a web-based document which includes a detailed description of the Pathfinder V4.0 sea surface temperature algorithm .

C.1.2 MODIS

C.1.2.1 General

During the first quarter, a vBNS proposal to the NSF was submitted to establish FloridaNET that initially will include UF, FSU and Miami with an OC3 link from Gainesville to Georgia and DS3 links from FSU, Miami to UF. This network, when connected to vBNS and NREN, will provide network capability sufficient to exchange daily MODIS L1A and selected products between GSFC and UMiami. Discussions were held with NSI to provide an additional T1 to serve EOS data requirement. An alternative high speed network option was explored via NREN at cost 27k/month for DS-3.

Processing and archival capability for the MOCEAN SCF were enhanced through addition of 3 DEC 4100 multi-processor computers in March; archival capability will be extended by addition of slave towers to the existing DLT jukeboxes. These units will be served by the existing 4100 computers due to the high I/O rates and the need to serve data to the remainder of the facility. The fiber channel disk arrays have arrived and will be interfaced to the 4100 computers. Integration of the new disks is dependent on receipt of a fiber channel raid controller and appropriate system drivers. Warner Baringer is experimenting with Hierarchical Storage Manager to better manage tapes in the DLT jukebox.

Updated file format description document and prologs to reflect changes made to MOCEAN code during the second quarter.

The efforts of our group were focused on delivering V2 PGEs for testing and integration at the MODIS team and DAAC. All MOCEAN PGEs have been delivered and are undergoing initial testing with the initial focus on the two L2 PGEs (9 and 10). As part of the preparation, emphasis was placed on minimizing needed CPU resources.

Substantial time is saved in the ocean color atmospheric correction through computation of various atmospheric correction parameters on a 4km by 4km grid and interpolating between these points. The atmospheric correction is then executed at each 1km pixel. Once a set of aerosol models is chosen, this model set is then tested at the next along scan pixel. If the selected models remain as the appropriate pair for the current pair, the model selection portion of the atmospheric correction code is bypassed and the correction process continues.

Testing of the ocean color algorithms utilizes two types of input data sets. The first is the synthetic MODIS L1B radiance file and associated meteorological, cloud and navigation files. This set is used only to test compliance with MODIS data flow due to compatibility problems between the radiance provided in the synthetic data and what is expected by the PGE. Science testing is performed using a L!B file converted from SeaWiFS observations and transformed into MODIS radiance units. The associated navigation information is also provided. Meteorological observations and ozone fields are obtained from the NOAA and TOMS analyzed fields using the ancillary data input routines. Resulting L_w outputs are then compared with the same radiance files processed through the SeaWiFS L2 program. Granules are collected for a "data day" and assembled into global files by product. Multiple data day files are then collected to provide fields for longer time periods. To date we have produced fields assembled with one, two and three days of data exercising the L2 and L3 PGEs.

During this period the ocean Q/A draft was circulated to the ocean team member, SDST, GDAAC and EOS Q/A personnel for comment. The Q/A document has been updated following various discussions. Miami will perform product science Q/A in conjunction with the team members responsible for their specific products while run time and an overview assessment will be performed at GSFC. Kay Kilpatrick is the Miami Q/A interface person and will utilize comparison of MODIS products to SeaWiFS and AVHRR derived fields and well as the *in situ* matchup data base to quantify this effort.

The automatic processing environment based on Autosys (production) and Networker (archiving) has been used to process AVHRR Pathfinder, SeaWiFS, and SeaWiFS/MODIS products. These products are being used to generate climatologies as well as test algorithm performance and quality assessment. Processing both real-time and retrospective fields for several projects is providing experience and reliability testing of the overall system. Some of the lessons arising from this exercise concern

network stability and disk management. We are continuing to integrate the fiber channel raid disk array into the SGI and DEC environments and are working with the companies to isolate and remedy problems encountered with their respective device drivers. These systems should be operational in the next month or two. The DEC 4100 computers have proven to be very reliable and have been employed to compute an updated and expanded set of aerosol tables for the ocean color atmospheric correction.

We met the One-on-One group to discuss DAAC and networking issues related to ocean processing. Gordon Noble outlined discussions between NASA and NSF to interface NREN and NSI to vBNS. Miami has a NSF approved vBNS application for networking of EOS data between the university and NASA. The University of Miami connection to vBNS became operational in June although there are unresolved router issues. NREN must agree to support EOS data flows and become a conduit to vBNS; this issue remains to be finalized. Once the permission and routing issues are resolved, experiments will need to be conducted to understand how to effectively assess 15-20 megabits/sec of usable bandwidth. Discussed MOCEAN processing at the DAAC and outstanding issues relating to production rules and PGE testing. Implementation of the "data day" production rule is now scheduled towards year end.

The MOCEAN team met at GSFC to discuss Q/A and adaptive processing as well as team issues such as cruise activity, algorithm progress. A major result was discussion with C. McClain (SYMBIOS) to explore how MODIS can benefit from the experience gained from the SeaWiFS and SYMBIOS programs. This interface will be explored over the coming weeks. A role for Miami a part of "adaptive processing" was discussed. A desirable approach is for Miami to provide Q/A, special processing related to production of special assessment products, generation of climatologies and algorithm evolution and to act as a production backup to L2 and L3 processing at the MODIS team facility. Miami has the production capacity to provide either routine L2 and L3 processing or it can provide the functions listed above for the AM mission. It does not have the capacity to do both the evaluation processing (*e.g.* multiple passes though the data set for algorithm evaluation or calibration) and routine, daily processing in other than a backup mode or to handle the PM mission.

The following week, mid June, the EOSDIS panel met in Woods Hole to discuss adaptive processing and federation. It was interesting to hear

how other teams planned to deal with processing. For example. The CERES team will use the LATIS system to do both processing and distribution and has no plans to utilize ECS functions. This is in contrast to MODIS where the team facilities will provide L2 and L3 products but will utilize the GDAAC for distribution. The impact and relationship of "adaptive processing" to the federation is unclear.

The following week provided an opportunity to meet with P. Cornillon to discuss progress and plans for DODS. His federation team is interested in providing community access to Pathfinder and MODIS products. I observed that they will need to provide a server for EOS-HDF products for this to be feasible as well as provide a web accessible interface (browser or JAVA based). They already have a capability to serve Pathfinder fields.

C.1.2.1.1 MODIS Version 2 (at-launch algorithms)

Current versions of PGE09 (ocean color), PGE10 (SST), PGE20 (L3 interim daily) were submitted to SDST on March 31 for acceptance testing. This delivery contained bug fixes, additional and improved diagnostic messages, and support for processing SeaWiFS data converted to MODIS format.

PGE20 was expanded to include the production of global maps of each data product in HDF-EOS gridded format (GCTP Geographic projection) at 36km and 9km resolution.

Also included with this delivery were programs and procedures developed to automate testing of level 3 processing.

Final versions of the L3 PGES (PGE20, PGE49, PGE50, PGE53, PGE54) were submitted to SDST on May 6th the for acceptance testing. Also included with this delivery were programs and procedures developed to automate testing of L3 processing.

Updated versions of L2 PGES (PGE09, PGE10) were also included. These versions contain only fixes for problems found during the testing of earlier versions. No new functionality is included.

This represents the final scheduled V2 code delivery.

C.1.2.1.1.1 Product File Specifications (EOS-HDF file format)

SDST requested separate ESDTs for each product and resolution due to the limited utility of product-specific metadata to discriminate between the various products and resolutions. These ESDT specifications have been delivered.

C.1.2.1.1.2 PGEs/ESDTs

Testing of the MODIS PGEs continued. During the first quarter, a 240 GB (2 days) data set of simulated MODIS data was generated using the L1A simulator developed by SDST, and archived to DLT tape. This data set was used for testing PGE49 (interim weekly/tbin) and PGE50 (reference file/mfill). We planned on creating a week of simulated data, but due to the processing time (over a week on the 16 processor SGI Origin to produce the 2 day dataset) and the storage requirements we created only two days. SeaWiFS data converted to MODIS L1B format was used for additional testing.

During the second quarter we continued to develop programs and procedures to support automated processing of synthetic MODIS data and expanded to include PGE20. These procedures manage the staging of synthetic level 1 data and ancillary data, the creation of PCF and MCF files, and the execution of the MODIS PGEs (PGE09/PGE10 and PGE20).

C.1.2.2 Processing

During the first quarter of 1998, Jim Brown was developing a program, CALEPS, to compute Rayleigh, aerosol, and water leaving radiances for SeaWiFS and MODIS. This program will permit calculation of radiances from matchup database L1 data for comparison with *in situ* observations. A separate program is now operational to extract L1 data at a specified (Lat, Lon, Time) location.

A SeaWiFS to MODIS L1 converter has been updated to work with MODIS V2 format files.

Updated file format description document and prologs to reflect changes made to MOCEAN code during the first quarter. Began the task of documenting all OCEAN PGE error code messages listing the error code, associated string, source file or function, message meaning, and action to be taken by the DAAC. This document is required for PGE certification. Verified scaling and unit consistency for all 36 ocean color products. Units were traced through each of the routines which derive ocean color products

to certify that the dimensions of coefficients and scaling factors used within the routines were consistent. Several problems were detected and these have been corrected.

During the second quarter we continued to develop programs and procedures to support the automated processing of synthetic MODIS data as well as converted SeaWiFS data.

C.1.2.3 Algorithm development

During the first quarter it was discovered that the MODIS infrared channels have a problem with cross talk. In order to find the extent of this cross talk interfering with the actual signal, we analyzed a relatively clear AVHRR image of full swath width(2048 X 512) and included in it a 6 pixel noise at temperature of 290k and calculated a new channel 4 temperature that has a cross talk of 0.01 percent from channel 5. We analyzed the difference between the cross talk affected channel 4 temperature and the original channel 4 temperature. The results showed that the cross talk does introduce noise that effects channel 4 temperature.

Jim Brown is investigating improvements in PGS run times using SGI 7.2 compilers. Has encountered a number of bugs in new compiler, requested patches. Jim has implemented a number of science code efficiencies to reduce PGE run time requirements. These changes involve analysis the rate of change of various coefficients calculated and used within the atmospheric correction codes. Where these coefficients change slowly relative to the 1km MODIS pixel spacing, results are carried between pixels and recomputed as necessary. The present version of the code computes coefficients on a 5x5 grid assuming 1 km pixels. Another enhancement assumes the aerosol type is uniform over a local neighborhood. Before all possible aerosol types are tested, the choice made for the previous pixel is checked to determine if it remains valid. If this assumption is valid, only 2 aerosol models are needed for the pixel, otherwise the complete suite of models (currently 12) is examined. The run time for to produce a typical L2 granule is now about 27 minutes.

The SeaWiFS/MODIS converter is being used to process a series of days, 97-265 to 97-267 to check the MODIS PGE for L2 and L3 by comparison with equivalent SeaWiFS results. This includes both space and time binning programs. This capability will be used to generate reference fields for comparison to the same products derived using MODIS observations.

An agreement with H. Gordon has been reached to generate SeaWiFS sensor tables compatible with the MODIS MODCOL PGE. This will permit generation of MODIS color products, except for fluorescence related products, using the MODIS PGE, SeaWiFS radiances and full ancillary input data. The MODIS PGE will be modified to include SeaWiFS out-of-band and 765mn O_2 corrections. Generation of the new MODIS and MODIS/SeaWiFS tables requires the processing of approximately 200,000 radiative transfer simulations. These runs will be processed on the new DEC 4100 processors controlled by an AUTOSYS script authored by Warner Baringer and supervising data scripts produced by H. Gordon's group.

C.1.2.4 Documentation

Kay Kilpatrick has developed a draft MOCEAN Q/A plan and delivered to Wayne Esaias for comments. The document describes an initial version of the MODIS OCEANS (MOCEAN) quality assurance plan.

C.1.2.5 Quality Control

The MODIS OCEANS quality assurance plan is still in a process of development. The plan is currently being reviewed by the MOCEANS science team. The plan incorporates experiences gained with run-time and post runtime QA for CZCS global processing, SeaWiFS , and AVHRR SST Pathfinder. This effort follows a meeting at GSFC with W. Esaias, Mike Jones, A. Fleig and others to discuss finalizing a MOCEAN Q/A plan. The Q/A activities will involve a combination of activities, near real-time tracking of PGE status at GSFC, comparison of L2 and L3 granules with a running climatology at UMiami and more detailed algorithm performance checks at the individual algorithm developer's SCF. Briefly, this work will include monitoring for failed PGEs, checks for whether all available granules have been processed and included in L3 and comparison of L3 product files with reference fields. The reference fields initially will computed using input from other sensors (SeaWiFS and AVHRR) with future comparisons including MODIS AM and PM.

MOCEAN QA procedures will be performed operationally during product generation at the MODIS Processing Center (run time science QA) and some period after product generation at the MOCEAN RSMAS SCF and team member institutions (post run time science and validation QA). A MODIS OCEAN QA facility (MODAT) will be formed to provide a coordination mechanism for MOCEAN's QA activities. The goal of MOCEAN QA activities is to understanding differences due to instrumental, code/algorithm, geophysical, and biological effects.

Run time science QA results will be derived within the product generation code by:

1) analysis of selected L2 granules
2) examination of the input data and its associated QA data
3) monitoring the computational stability of the code
4) documentation of the code processing history
5) science decision making performed within the code
6) application of computational analysis of the 40 daily L3 products
7) comparison of L3 products to climatologies when available.

Post run time science QA results will be derived by:

1) application of visualization and statistical analysis procedures to generated products
2) examination of run time QA results stored in generated data products
3) analysis of temporal, zonal, meridional, secular, and regional trends of L3 generated products.

Post run time validation QA results will be derived by:

1) comparison of L3 products to in-situ observations
2) long term trend analysis of the L3 products
3) cross validation studies with SeaWiFS and AVHRR data.

The results of QA procedures will be stored within the MOCEAN standard data products following a MOCEAN protocol described in Section 6.0 of the MOCEAN QA Plan. MOCEAN QA procedures will focus on analysis of pixel level QA which contain science and quality level information.

The QA protocol developed is adaptive enough to accommodate a changing QA data stream over the life of MOCEAN while satisfying the needs of the algorithm developers, personnel performing routine QA of generated products, and the data users. The protocol includes examination of both production information and pixel level QA results stored in science data sets (SDS) generated at the time of execution (non-searchable) to perform run-time processing and post run-time science QA. The status of QA results for a granule/product will be communicated by frequent updates to searchable granule/product level ECS QA metadata as a granule/product moves end-end through the QA procedures.

During the first quarter, progress started on the MOCEAN Strawman Test Plan for DAAC System Certification. In conjunction with Mike Jones at the Goddard DAAC, we worked on the test plan for MOCEAN system

certification. This test plan covers 3-5 days in the life of MODIS Oceans and involves:

1.0 System certification plan
  1.1 System certification to test PGEs
  1.2 GSFC DAAC test production
  1.3 GSFC DAAC test production schedule
  1.4 Test data requirements
2.0 MOCEAN testing of ECS QA interfaces
  2.1 Data order / browse test schedule
  2.2 Subscription test schedule
  2.3 QA metadata update test schedule

During the second quarter, we continued working on final version of MOCEAN's quality control plan. Began discussions with Bob Lutz on MOCEAN's need to have the capability to automate the process for updating the QA metadata. The present design of the system has the QA metadata being updated manually using the QA Metadata Update Tool (QA MUT) and JEST to perform batch updates. The method of communicating updates is via e-mail and was not designed for the possibility of thousands of metadata updates that MOCEAN's is anticipating performing in the future. We have presented the following scenario for automated QA of MOCEAN's products:

1) A running climatology produced by MODIS/AVHRR/SEAWIFS will be compared to the respective MODIS granule. This activity is likely to be on the order of one month behind real-time to permit assembly of the needed climatology.
2) Where feasible, the MODIS granule will be compared with the expected vales and placed into a reasonable/unreasonable category. The range of conditions that can be tested is expected to increase with time. As we gain experience we should be able to characterize product/algorithm/sensor calibration and accuracy.
3) Since a large number of granules will be involved, we would like to be able to prepare a list of needed metadata updates and transmit this list from the SCF to the DAAC or appropriate party for insertion. This process need not be totally automatic but must be automated at a reasonable level to be feasible. Given this eventual scenario we are working with the parties involved to add this functionality in the future.

In conjunction with Mike Jones at the Goddard DAAC, we continued to work on revisions to the test plan for MOCEAN system certification tentatively scheduled for later this fall. This test plan covers 3-5 days in

the life of MODIS Oceans. Clarified issues in regard to timing of files for data days and the need for attitude and ephemeris files in the schedule.

In conjunction with Richard Buss at the DAAC, SAC began working on test plan and resource requirements for testing the existing metadata update interface. This test is intended to verify that the Instrument teams and the Goddard DAAC can jointly perform QA checks and perform QA metadata updates to the MODIS data.

C.1.3 SeaWiFS

C.1.3.1 General

During the first quarter we continued to develop programs and procedures to support automated processing of SeaWiFS data and expanded processing to include the generation of daily maps. These procedures manage the transfer and archiving of files from the DAAC, staging of data and ancillary data and the execution of the SeaWiFS programs.

During May-July 1998, Jim Brown participated in a joint US-British cruise (AMT-6) on the RRS *James Clark Ross* with NASA scientist Stan Hooker. They deployed a number of optical instruments (including winch lowered profilers and free fall rockets) to collect daily optical profiles. They also deployed a hyperspectral instrument to collect instrument characterization data. Jim assisted in the design and development of the data acquisition systems, and also in the day-to-day collection of data from the various instruments. The data collected by these instruments will be used both in algorithm development and in SeaWiFS calibration.

C.1.3.2 Processing

The SDST SeaWiFS-to-MODIS l1a converter was added to the standard processing stream to generate additional test data for the MODIS PGES.

During the second quarter we continued to develop programs and procedures to support automated processing of SeaWiFS data. These procedures manage the transfer and archiving of files from the DAAC, staging of data and ancillary data and the execution of the SeaWiFS programs.

C.1.3.3 Algorithm Development

Following the SeaWiFS Initialization cruise in January/February 1998, Dennis Clark provided normalized water leaving radiances for the SeaWiFS wavebands obtained from both the MOBY mooring and the MOCE cruise. Jim Brown developed an extraction program, CALEPS, for the SeaWiFS instrument based on the atmospheric correction program ANLY. This program computes water leaving radiances for the available aerosol models which is then compared with the observed radiances. Differences between the radiances are used to compute adjustments to the sensor calibration.

Howard Gordon produced a calibration correction vector. Jim in turn modified the SeaWiFS and SeaWiFS/MODIS L1 converter program to utilize the correction vector. Two geographical area shave been chosen to validate the correction vector, Hawaii and the Arabian Sea. For these areas, pseudo tracklines across scan, track directions and image features are used to extract sets of water leaving radiances (L_w 443, 510, 555), aerosol radiance (L_a 765), epsilon and the selected aerosol models. In addition, an option has been added to the ANLY program to based the atmospheric correction on either the $765/865_{nm}$ band pair (normal mode) or the $670/865_{nm}$ band pair (alternate mode). This addition allows comparison to be made to assess the relative band calibrations together with the O_2 correction to the 765_{nm} band.

Analysis performed to date suggests that the $765/865_{nm}$ band pair atmospheric correction produces relatively low values for epsilon and L_a765 which results in elevated L_w 555. Similar calculations using the alternate atmospheric correction mode produces a more consistent L_w 555 field. Discussions are underway to resolve these differences.

C.2 Matchup Database

C.2.1 Historical Matchup Database

During the first quarter, we continued to assemble near real time in situ buoy data from 1997 for the archive SST Matchups. Began analysis of NOAA-7 matchups to develop cloud tests. Decision trees developed using the same input parameters as NOAA-14, and NOAA-11 did not perform well (misclassified ~20%) for NOAA-7. We are exploring the use of other

input parameters in NOAA-7 tree models and attempting to understand the differences in the response of this sensor.

During the second quarter, we assembled and processed all in situ data for the archive 1997 matchup database. Created 1997 extraction lists to obtain the associated co-spatial and temporal AVHRR data from NOAA-14. Extraction of the satellite quantities is currently in progress.

Developed scripts and began collection of matchups for the recently launched AVHRR aboard NOAA15.

C.2.2 Real-time Matchup Database

Real-time matchup creation and analysis continued to operate smoothly.

Continued collecting and monitoring real-time matchups for stability of coefficients being used in real time processing of the GAC pathfinder data.

C.2.3 Ocean Color Matchup Database

Continued to collect in situ optical data from validation sites and develop scripts for processing and analysis of in situ data. We are presently processing the SeaWiFS L1A LAC collected over the MOBY site in Hawaii with MODIS algorithms. When this is complete, a matchup data set with the in situ data from the MOBY buoy will be created and analyzed.

C.3 Systems Support

C.3.1 Systems/COTS

C.3.1.1 Autosys

Added procedures to process SeaWiFS/MODIS and MODIS-simulated data sets.

C.3.2 Networking

Planning and preparations for the DS3 circuit to VBNS via FloridaNet are in progress. Cisco Lightstream ATM switch and 7507 router have been installed. An OC3 link between the campus ATM network and the Lightstream is up and communicating over PNNI-0 (IISP). We have started testing with LANE and RCF1577 ATM on the 7507.

At the end of the second quarter, DS3 circuit to VBNS via FloridaNet is up and in operation. We are in the process of testing the available bandwidth via this link to GSFC.

A second T1 to NSI was installed and is in operation.

C.3.3 Tape library

The two original TL893 tape jukeboxes were moved from Alpha 200's to the 4100's in order to accommodate an additional two slave jukeboxes. Each master and slave combination will function as one virtual jukebox with a storage capacity of 20 TB.

During the second quarter, two additional TL893 tape slave jukeboxes have been installed the on the Alpha 4100 servers. Each master and slave combination functions as one virtual jukebox with a storage capacity of 20 TB.

We continue to have an unacceptably high number of failures with tape leaders on the new 7000 DLT drives and have escalated this issue with the vendor.

C.3.4 Software Support

Angel Li is implementing EOS/HDF support for mapped L3 files, and will support Plate Carree projection.

Updated algorithms and coefficients files were received and integrated into the MOCEAN PGEs. Sue Walsh has tested the V2 PGEs using both simulated MODIS L1b (V2) data files and the converted SeaWiFS L1 data. The MODIS input is used to verify format compliance and the SeaWiFS data used to verify execution times and functionality of the various product algorithms. The V2 code base has been delivered to SDST.

C.3.4.1 Modifications/Additions to DSP

MSPC: MODIS version of pathspc.
LOCATE8D: Determine scan/element for lat/lon (SeaWiFS).
CALEPS8D: Displays radiance info for given scan/element (SeaWiFS).
DIVC: New program to divide files using calibrated values.

C.3.4.2 DSP Problems Fixed

BINSHR/STRIPANDAPPEND: Correct string constants (‘ ‘ should be “ “).

BINSHR/SETUPL3B: Fix size of level 3 bands (3 bytes of flags are really in a 4 byte field).

BINSHR/MAKETIME: Remove extra parameter. Fix time string.

Change date part of string to be yyyyddd. Make date part: yyyy-mm-dd

BINSHR/SETTBINMETA: Move routine from mtbin since all other level 3 programs use it. Change metadata value geolocation to Geolocation. Fix dataday string in metadata.

BINSHR/PGS-UTIL: Use version properly.

BINSHR/OPENMASK: Reference functions as functions.

BINSHR/L3IN,L3OUT,MAKEFILE,LEN_STR: Move len_str.f from atmcorshr. Change attribute “L2 Flag Usage” to “Common L2 Flag Usage”. Change 3 byte flag fields to 4.

BINSHR/L3IN,L3OUT: Put both “L2 Flag Names” and “Common L2 Flag Names” attributes in all L3 files.

BINSHR/L3IN: Fix prologs. Put more info in error messages.

BINSHR/L3OUT: Don’t write out ‘orbit’.

BINSHR: Add quality bit flag descriptions. Remove orbit, just use start and end orbit numbers.

BINSHR: Move some constants from sum_structure to bindefs so sum_structure doesn’t conflict with the mspc version.

BINSHR/BINDEFS: New include file for common constants so sum_structure doesn’t have to be included in library routines.

BINSHR/BIN9KMF: Move common block initialization into block-data routine.

BINSHR/SUM_STRUCTURE: Some structure changes so msbin can bin all bands in a file at the same time.

MCLOUD: Use common level 3 i/o routines. Use parameter constants for pcf LUNs.Change program name from mSSTcloud to mcloud. Use commoninout include file. Remove unused variables. Use v2 metadata stuff. Fix prologs.Trim spaces from the end of the flag names. Fix use of PGS_SMF_*. Use both common and l2 flag strings. Fix check for end of file. Fix quality value change (MODIS values are backwards, 0 is good, not bad). Library hdfeos must be before Gctp. Fix use of orbit numbers. Correct string constants (change ‘ ‘ to “ “).

MFILL: Use common level 3 i/o routines. Use parameter constants for pcf LUNs. Use commoninout include file. Remove unused variables. Use v2 metadata stuff. Add new flag bands. Comment out code that is ifdef’d out. Use WATBINS for assumed output size (global, water only). Fix use of

PGS_SMF_*. Fix end of file handling; fix array parameters for forcheck. Library hdfeos must be before Gctp. Change input and output LUNs so can run in same PGE as mtbin. But mmap can't input mfill output (reference image) in same PGE as mfill. Fix use of flag_names. Remove debugs.
MMAP: Use common level 3 input routines. Add calculation of missing pixels for QA metadata. Update metadata. Allow mapping of new flag bytes. Use commoninout include file. Remove unused variables. Add new flag bands. Comment out code that is ifdef'd out. Use proper pcf lun for input. Fix prologs and some little stuff for the fortran checker. Some silly changes to quiet the MODIS forcheck. Initialize file identifier. Only close file if it was opened. Use both common and l2 flag strings. Fix handling of lunin; and fix check for quality level. Fix use of orbit numbers. Use HDFEOS grid for output file type. Library hdfeos must be before Gctp. Fix use of LUNs so can run mmap in same PGE as mtbin and most other L3 programs (except mfill). Fix use of orbit numbers. Use temp file to find LUNs for input, output, and parameter files. Use parameter file to specify which value to output, and the pixel and line size of the output map. Don't scale the data (output reals instead of bytes) if the equation is zero. Fix sds name in output file; fix declaration of qualdesc. Output WQ.
MODCOL: Make sure the output to iaddr is defined as PTR. Change attribute name to "Common L2 Flag Usage". Properly reference the geolocation information. Call ascdscsub with the correct line number. Fix use of land/sea mask. Add code/input variables to allow pixels to be unprocessed (common flag bit 1). Add pixel subsampling code. Still have to fix FLH/CFE averaging section. Use PGS_SMF_* as functions not subroutines. Make cldmsk (MOD35) optional. Add comment indicating 'aersol' array is not used. Change MAX_INPUT to MAX_INPUT_L2 because of compiler complaint somewhere else. Use ftrim as a function, not a subroutine. Put Carder chlorophyll in DR2 file. Finish implementing value check when reading data file. Correct spelling of contributor. Implement changes to work with SGI F90 7.2. Correct parameter to PGS_IO_GEN_OPENF (recordlength) for formatted file. Correct internal reads. Move libanc into source tree. Modify options for F90 7.2. Correct error in calling PGS_IO_GEN_OPENF (must initialize RECORD_LENGTH). Move initialization of common block variables into BLOCK DATA module. OZONE2 and OZONE3 entries in mice table had incorrect OZONE#_LUN constants. Add flags3/flags4/flags5 pixel summary variables (for various debugging tests). Add saturated pixel test. Set bits in flags5 as needed. Disable setcolqual routine (not finished). Correct text in output messages. Change subroutine to function. Declare un-typed variables. Move input count tests earlier in sequence. Don't do aerosol calculations if 765 or 865 is invalid. Change way GOODLWX/GOODLWY are computed. Add more parameterization of array

sizes/loop bounds on such arrays. Use f90 btest/ibset functions (if f90 compilation) instead of iand/ior. Fix initialization of some flag arrays (index variable wasn't being used in array reference .. was a constant subscript). Remove or comment out unused code. Upgrade bit setting to use f90 functions. Use f90 bit set function. Set B_Lw_Counts_Lw when input counts are negative. Set all 3 B_*_Cloudy at the same time. Set B_Dr2_Carder_In. Use setcolqual to set quality values. Set B_Dr1_Base_In. Fix the L2_flag bit names for the Dr1 (MODOCL2A) file. Add Cloudy to dr1 and dr2. Pass a parameter to exit. Move local function declarations to remove C compiler warnings. Change cosd(x) to cos(rad(x)) to remove compiler warnings. Optimize rad(x)/ang(x) ASF functions. Make Aer_Model* names consistent between L2 and QC files. Change metadata value geolocation to Geolocation. Use constants for units - U_* from commoninout. Move LUNs to start of common area. Library hdfeos must be before Gctp. Change value of reprocessing metadata from "none" to "processed once". Correct calibration/units of output products. Correct conditionalization of bit testing. Detect SeaWiFS input file, pass flag to atmospheric correction. Correct FLH/CFE calculation (scaling problems). Added functions to correct SeaWiFS 765 data. Add SeaWiFS specific calculations enabled by input flag SeaWiFSinput. Use SeaWiFS aerosol files with SeaWiFS input data; MODIS with MODIS. Add additional diagnostic output for certain errors. Use SeaWiFS Rayleigh tables with SeaWiFS input data. Improve error messages. Add missing call arguments (SeaWiFSInput) to Rayleigh routines. Add additional diagnostic message. Add comments on 13L/13H and 14L/14H band order in L1A file. Correct string constants in calls ('.' should be "."). Correct a# string format in format statement (was too small). Remove part of a compiler work-around. It was only needed for f90. Don't print statistics if exiting due to error, just close files. Fix generic descriptions of units.
MODSST: Use PGS_SMF_* as subroutines, not functions. Change the attribute "L2 Flag Usage" to "Common L2 Flag Usage". Put bad pixel count into QA % missing data, instead of QA % out of bounds data. Fix use of land/sea mask. Fix calculation of ascending/descending lines. Add code to not process every other line and/or pixel. Make cldmsk (MOD35) optional. Use PGS_SMF_* as functions. Use list directed reads, and fix error message handling. Fix subroutines/functions and bit handling to satisfy forcheck. Fix a day/night check. Set the common flags B_Hi_Sat_Zen,B_Hi_Sol_Zen. Fix check for ok pixels. Fix setting of QA %'s. Fix record length for fortran formatted read. Pass a parameter to exit. Add subsample[xy] parameters. Add comment in mice table to show that subsample[xy] are taken from the mice table and not the params file. Change metadata value geolocation to Geolocation. Use constants for units - U_* from commoninout. Library hdfeos must be before Gctp. Add coefficients for

SST4 product. Fix equation for SST4. Only check asc/desc at normal end (not after an error). Only output statistics at normal end. Add coeffs for SST4. Change reprocessing metadata from “none” to “processed once”. Change comment in mice table about parameter file and pcf. Check in routine to set the quality values. Fix bit checking and setting. Correct string constants (‘ ‘ should be “ “).
MSBIN: Change the attribute “L2 Flag Usage” to “Common L2 Flag Usage”. Remove output filenames from the mice table. Remove unused variables. Fix 3 byte flag fields, since they are actually stored in 4 bytes. Use PGS_SMF_* as subroutines, not functions. Convert %loc(x) to iaddr(x). Make sure iaddr and things receiving its value are declared as ‘PTR’. *.rin files shouldn’t be checked in. Fix size of flag bands. Try to fix dateline/pole/data-day splitting problem. Don’t declare subroutines. Remove some debug print statements. Fix subroutines to declare array parameters properly. Fix time string parsing. Fix looping problem to bin all bands correctly. Fix some old, incorrect changes in the grid calculations. Fix grid point calculations. Don’t bin ‘unprocessed’ pixels. Write pieces to correct output file. Reference functions correctly. Add more info to error messages. Fix loop bounds for reading l2_data. Make internal reads compatible with SGI 7.2 F90 compiler. Fix usage of RECLENGTH parameter in call to PGS_IO_GEN_OPENF. Fix integer*2/integer*4 problem. Fix compiler complaint. Move local declaration. Indicate variable is static. Work around bug in SGI F90 7.2 (can be restored later). Fixes so iand() call arguments are of same type (kind). Update for SGI F90 7.2. Fully optimize program. Handle variant input data for time. Improve checking for value sizes. Fix metadata for split pieces. Pass a parameter to exit. Bin all bands in a file at the same time. Fix string length logic. Cache last result (gets re-used several times). Check for put_l3b_recordf errors correctly. Fix use of sums array. Comment out some old ifdef’d out code. Put both “L2 Flag Names” and “Common L2 Flag Names” attributes in all L3 files. Change metadata value geolocation to Geolocation. Describe use of quality bits in output file. Change units for sum_squared band to show they’ve been squared. Library hdfeos must be before Gctp. Change metadata value for reprocessing from “none” to “processed once”. Fix bit handling; fix dataday stuff. Correct strings in certain calls (‘ ‘ should be “ “).
MTBIN: Use PGS_SMF_* as subroutines, not functions. Use common level 3 i/o routines. Fix C style comments. Fix format statement. Move settbinmeta.rat to binshr. Fix prolog (again?!?). Use temp file with output and input LUNs and versions. Fix 3 byte flag fields, since they are actually stored in 4 bytes. Remove unused variables. Fix QA % calculations. Convert %loc(x) to iaddr(x). Make sure iaddr and things receiving its value are declared as ‘PTR’. First attempt to read temporary

list file with which inputs and output to use from pcf. Read temporary list file for input and output luns and versions. Reference functions properly. Convert ftrim to a function. Change read to list directed. Correct reclength parameter value. Fix bit handling. Put both “L2 Flag Names” and “Common L2 Flag Names” attributes in all L3 files. Change input parameters for start and end datadays. Library hdfeos must be before Gctp. Fix use of orbit numbers. Add quality bit flag descriptions. Begin and end dataday are now strings, not integers. Update prolog. Use binning period for file start time. Fix use of single and double quotes. Input was changed from yyyymmdd to yyyyddd. Fix use of single and double quotes. Use $COMSIZ for the length of qualdesc.
SCRVERIFY: Handle end-of-year rollover.
IO/DSPLIB: Release memory allocated by MakeOneLine.
MODISIO/OCEANS_SMF_SetDynamicMsg: Use PGS_SMF_* as functions not subroutines.
MODISIO/L1B_Geo_Cld_Interface: Make MAPI optional (default without). Fix comment delimeter. Add check for error from Vend.
MODISIO/mod_get_l1b_attr_v2: Changed calculation of yearday and msec to account for leapsecs. Fix smsec and emsec calculation (they are int not short int).
MODISIO/V2_META: Changes to work with new mcf files. Add values to failure print statement. Fix string lengths to be long enough for any PSA name. Fix some metadata values. OrbitNumber is no longer in level 3 files.
Fix string for ReprocessingPlanned metadata, and update a comment.
MWRAP: Use PGS_SMF_* as functions not subroutines.
MOCEAN/MOCEANCLOSE: Fix spelling in comment.
MOCEAN/MOCEANREAD: Return unique error values.
MOCEAN: Add HDFEOS grid file type.
ANC/GETANC: Add clarifying error message. Return additional diagnostic information to caller in qc vector.
ANC/JULIAN: Change from f77 to f90. Use parens to emphasize result. Define variables, instead of relying on implicit statement. Put type declarations before data statement.
VMSFORLIB/EXIT: Upgrade makefile to conditionally compile module for SGI 7.2 compilers. Add parameter to exit, even though it isn’t used, to satisfy MODIS fortran checker. Fix variable declaration.
MSPC: Use proper lun for output file. Fix use of pgs_smf_*. Change use of sx and sxx to be like binner. Library hdfeos must be before Gctp. Fix use of byte, short int, and integers. Use parameter file instead of pcf forcommand line variables. Use temp file to get input and output and parameter file LUNs and versions. Use $COMSIZ for the length of qualdesc.
Check for end of input file (don’t process bin zero). Stop at last populated bin.

DAYBOUNDS: Fix lun for Reynolds file. Fix use of PGS_SMF_*. Pass a parameter to exit. Library hdfeos must be before Gctp.
MCOLSHR8/GET_CLIMATOLOGY: New version of hdfio/Anc_Files requires changes in get_ancillary parameters.
MCOLSHR8/COLORSUB8: Don't call hmf8 routine. Results not used by caller of coloop. Keep good humidity values. Correct format of output value. Add diagnostic prints. Fix calculation of ianchr. Ifdef out debugs.
MCOLSHR8: Update location of ancillary include files.
MCOLSHR8: SGI F90 7.2 doesn't like ',' except in list context.
MCOLSHR8/CALLCW: Put return statment inside error test conditional.
ATMCORSHR: Don't build hmf8.f. No longer used by colorsub8.c.
ATMCORSHR/COLORIN1: Restore pixel subsampling (MULT > 1).
ATMCORSHR/ACOSS,ASINN: Fix prologs.
MSSTSHR5/AVHRRSUB5: Remove subroutine hmf8. Stop using arrays AERSOL and AERMLT. Correct conditional compilation. Pass a parameter to exit.
MODINC/OCEAN_LUN*: Add more luns to include files. Parameters must be typed.
MODINC/COMMONINOUT: Change flag names to upper case. Use first common flag to mark unprocessed pixels. Change MAX_INPUT to MAX_INPUT_L2 because of
compiler complaints. Fix BD_Dr1_# comments. Add Cloudy flag in output files. Add size for cloud flag array. Add flag name for Dr1's, L2_flags, Chl_a_in bit (B_Dr1_Chl_a_In). Make Aer_Model* names consistent between L2 and QC files.
MODINC/CVTCOMGOE: Add filler to common area to match other include file.
MODINC: Fix prologs. Save common areas.
PATHDR: Use correct type for variables holding an address.
Correct format of subimagepassdate value (YYYYMMDD instead of YYDDD).
L3M2MIA: Set the start time and dates in the subimage header and nav block.
MOSAIC9: Increase number of input bands.
PATHQUAL: Handle 3 bit quality values.
PATHREF: Handle 3 bit quality values.
PATHLOAD: Handle 3 bit quality values.
PATHNLC: Change bands for allb == 6. Fix tree test for noaa14.
Check in Arthur's (old) stuff. Add -Nn option for SGI.
PATHBIN: Increase optimizer table size.
PATHBINANG: Add 3 bit quality values. Change some of the output bands for various allb's.
STATS: Increase maximum lines in internal array (from 1024 to 2048).
PATHBIN4K: Larger value of AABINS for 4k binning.
PATHSPC4K: Larger value of AABINS for 4km binning. Use the include file from pathbin4k for all *4k programs so there is only one copy.

RATF90: Add blank between “include” and “’filestring’”. SGI f90 7.2 gets confused. Underscore is an allowed name character. Don’t split line inside an identifier.
RATFOR: Add whitespace between “include” and “’filename’”.
COLORSHR8/COLORSUB8: Correct prolog.
IMG2BIT: Update documentation.
MINMAXS: Correct program name.
STBIN-HDF: Correct SeaWiFS library paths.
SMAP9-HDF: Correct SeaWiFS library paths.
SSBIN-HDF: Update SeaWiFS library paths.
ANLY8D: New land mask support routines. Update SeaWiFS l1/l2 i/o interfaces. Misc. corrections and changes. Replacement chlorophyll routines (replaces swf*.c). Merge newest parameter changes. Merge in newest functional changes. Fail pixels that have Lt-Lr <= 0. Flag any pixel with any corrected total radiances <= 0 with atmos corr fail. Change hightau1 default to match operational default. nLw670 was computed wrong (2 divides by tstar) this is fixed. Remove logic that sets the cloud flag if there is negative nLw and not shallow. Use the SeaBAM pigment instead of the older algorithm’s pigment in determining the turbid regions. The change marginally increases the # of turbid flagged pixels in the data. 02Mar98 SeaWiFS project change. Use new diffuse transmittance files. Change sign of second parameter (sense different in new files).
RECLEN: Remove limit on record scanning.
CALEPS8D: Add logic to select area of interest. Fail points that have Lt - Lr <= 0. Add bit flags variable to mirror flags2_pc. Disable more output code. Add pixel summing variables. Disable more output code. Add initial tabular output. Add rms calculation. Revise output formatting. Add position and geometry data to output. Merge changes from anly8d: nLw670 was computed wrong (2 divides by tstar) this is fixed; Remove logic that sets the cloud flag if there is negative nLw and not shallow. Use operational default for hightau1. Output uncorrected L_t values. Exchange ZPHISA and ZPHI. Had them mixed up. Add comments to source. Use new diffuse transmittance files. Change sign of second parameter (sense different in new files).
TROUTC: Pass output image size to drawing routine (call VBUFSZ). Add new entry point VBUFSZ. Add code to check for line segment wrapping horizontally from right image edge to left image edge when start/end points are close to their respective edges. When this happens break the line into two pieces (start,first-edge) and (second-edge,end).
LOCATE8D: Took out too much. Restore sensor calibration file logic. Missed another initialization. Outputs more reasonable now. Enhance printouts. Additional debugging output. Construct matrix of closest points and determine relative weights. Solve for (fractional) line/pixel of specified

location. Correct matrix filling. Add more fill cases. Test for too much data. Correct indexing for np>nl case in find_pct. Disable some outputs. Add result line. Script to generate extractions from images given date/locations/images. Add test for no intersections (point not found). Add more output to shell script. Fix syntax error in echo command. Summarize output of generate.pl. Some images return 4 pairs of points. Clean up output. Test for error condition. Add missing header item. Add delta-phi calculation. Rename delphi to satphi. Compute delphi. Adjust precision of outputs to keep everything within 80 characters. Adapt to new output format from locate8d. input files moved.
IMG2HDFBIT: Library hdfeos must be before Gctp.
IO/VAX_EXTRACT: Solve problem with extract_float accessing data unaligned—use extract_long as a model of how to fetch input data.
VHRR: Set Variable INRDLY to TRUE for read-only input file (was wrong).
DISPLYSHR: Explicitly initialize note() signal handling routine from cc_comint.
CALLER: Improve diagnostic messages for process termination.
MAKE-BSD: Change status from wait_t to pid_t. Modify conditionalization. Fix entry for DEC OSF. Adjust include paths.
ANLY6F: Merge in appropriate pieces from other directories (the other source areas are diverging from what anly6f expects). Remove unnecessary items from makefile. Add sources from other directories so we have known versions. Add missing arguments to coloop calls (alon, alat).

2nd Quarter

Add support for Linux and f2c.
SREMAPN-HDF: Remap SeaWiFS level 2 files into dsp format.

Problems fixed:
MODCOL: Fix prologs. Use formatted writes for debugs. Correct L_a <= 0 error.
MCOLSHR8: Reduce whitecap reflectance by 75% (found by SeaWiFS project).
BINSHR: Fix metadata constants. Fix call to metadata routine. Declare extra bits in L2 flags as "Unavailable". Fix comments in prologs. Remove unused variables. Put all bit flag names in "L2 Flag Names".
MSBIN: Fix handling of pixels near the dateline. Declare extra bits in L2 flags as "Unavailable". Put pieces in the correct data-day. Add names of all 32 bits to "L2 Flag Names". Use "UNAVAILABLE" for the bits that don't exist in the L2 file.
MTBIN: Add checks to make sure input files have valid counts values. Fix handling of input file which is outside of binning period.
MFILL: MODIS quality values are the opposite of pathfinder.

MSPC: "wq" input parameter is in mice table, not param file. Variable was declared twice.
MMAP: Map specific quality value, not whole byte. Fix call to settbinmeta - remove orbit. Variable was declared twice.
MCLOUD: Put all messages in proc_log. Fix use of quality bits.
MICE: Add special case code for MODIS environment.
MODISIO: Fix offset to radiance bands. Fix error message. Fix prolog. Return with error value after errors.
MODINC/COMMONINOUT.*: Add U_* strings for products' units. Correct DR2 bit 13 output strings (high albedo). Add unit strings for Conc_g, Conc, FLE. Eliminate duplicate field name. Fix Dr2 flag bit 13 for high 865.
MODINC/OCEAN_LUN.*: Add luns for mspc and mmap.

ANLY8D: Correct generation of diffuse transmittance file name.
Apply calibration correction factors [alpha(i)] to L_t [given by HRG].
Check for zero before divide. Add use670 input variable to select between 765/865 and 670/865 corrections. Add 670/865 version of rho_a_sub_quartic and logic to call it properly. Add debug printout for input calibration data. Add link libraries. Add missing variable declaration. Merge in SeaWiFS project changes for last few months.
CALEPS8D: Improve labels in output. Add ozone to L_w value.
Correct output item. Make file executable. Change output header. Remove HIGHLT1 option (warn, don't abort). Summarize output files. Add HRG alpha(i) calibration correction. Disable some aborts on bad pixel data.
COLORSHR8: Reduce interpolation grid size. Apply 0.25 multiplier (estimated) to whitecap calculation -- result too large.
L22MIA: Update to work with latest SeaWiFS stuff.
SREMAPN-HDF: Change calibration. Add ability to read bands from the qc file. Routine to set up the calibration info and validate the band name.
SSBIN-HDF: Yet another change to the dataday split algorithm.
L3M2MIA: Fix image date. Update to work with latest SeaWiFS stuff.

PATHSST: Fix f77 compiler options.
PATHNLC: Fix f77 optimization options. Add Noaa-15 support. Still need to add specific decision tree. Add allb=8: medians, mins, and maxes for channels 4 and 5.
PATHBINANG: Fix f77 optimization option.
Use "renamefile" instead of "rename" on Unix.

PATHBIN: Add allb=7. Fix handling of pixels on the seam. Put pieces in proper data day. Add support for f2c on Linux. Add allb=8: medians, mins, and maxes for channels 4 and 5.
PATHMAP: Add statistic U to output quality values as a bit mask.
PATHMAP4K: Use a larger value of AABINS for 4k binning.

ANLY6F: Add aerosol optical thickness output value (Tau670).
DCBIN9: Use allb=3 for files with Tau670. f2c doesn't support "-check". Use "renamefile" instead of "rename" on Unix.
COLORSHR: Reduce interpolation grid size.
COLORSHR7: Don't use calfixit.

UTILS/MAKE-BSD: Check in the correct version. Fix declaration of wait status.
Fix up directory reading code.
LIB/TABLE: Rename reference from "XtInheritFocusMovedProc" to "XmInheritFocusMovedProc".
INGEST/LIB: Add debugging.
SCRIPP: Process modified Noaa-15 calibration file format.
TIRPACK: Modify debugging output.
VHRR: Fix syntax error in makefile.
DATADAY: Change "type" to "print".
LOADDB: Move "data" statement after variable declarations.
IMG2PST: Use "renamefile" instead of "rename" on Unix.
OA2PST: Use "renamefile" instead of "rename" on Unix.
2CHAN: Add better check for AVHRR RESP. area.

C.4 Team Interactions

Attended SeaWiFS meeting Baltimore during the first quarter. Discussed upcoming SeaWiFS initialization cruise and subsequent calibration procedure.

Participated in SST Miami SST workshop. Observed calibration and comparison of radiometers and standards utilized by various laboratories.

Will be providing more Pathfinder SST data to William Barnes.

Started to set up procedures during 2nd quarter for the transfer of 4km data to Oregon State University - set up accounts and an easy transfer method.

Discussions with DAAC for SeaWiFS and MODIS data delivery via DLT tapes. GDAAC personnel agreed to distribute SeaWiFS L1 data to Miami via DLT tape for bulk reprocessing; ongoing data deliveries will utilize the NSI T1 link. Miami will copy and return the DLT tape to the GDAAC.

Miami staff (Warner Baringer) met with representatives from the ECS Architect's Office and SDST in Landover June 17th to discuss open issues with ocean data processing. Steve Marley (ECS Architect's Office) proposed reducing the number of data types (ESDTs) by use of a granule-level measured parameter. The L3 ocean ESDTs would become a multi-granule ESDT with single-parameter granules. The L3 PGES would require code changes to set a granule-level parameter name attribute. The exact syntax for this will be specified by ECS in the near future.

Dennis Clark, H Gordon and R Evans met at NESDIS to discuss SeaWiFS initialization. Dennis provided station (MOCE) and buoy (MOBY) observations. C. McClain has arranged for the corresponding SeaWiFS LAC passes to be transferred to Miami. Jim Brown has developed an extraction procedure to acquire satellite pixels that correspond to the surface observations. Jim has created a program CALEPS that computes surface, Rayleigh and aerosol radiances for each of the aerosol models. These radiances are then compared to the surface observations to help determine sensor calibration adjustments.

Following discussions with MOCEAN team members and Ed Masuoka, we have defined required channels for ocean product processing based of L1A input. Discussed reduced number of channels for L1A data, will need 19 channels: 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 20, 22, 23, 26, 30, 31. In addition, we will need PGEs to compute cloud mask, geolocation since is will be less expensive to recompute these fields as needed rather than archive on tape.

NOAA Ron Brown cross-Atlantic MAERI cruise along 24N during January was supported by computation of daily 4km SST fields for the subtropical Atlantic.

Set up exchange with Italy for Emanuele Bohm to work part time at RSMAS, Viva Bazon will work with H. Gordon and us to review ocean color products produced using CZCS and SeaWiFS data. The data sets will be processed using equivalent algorithms to produce a baseline time series. These fields will complement the MODIS fields produced using the SeaWiFS/MODIS converter.

Several presentations were made at various meetings the second quarter. Dick Reynolds chaired a session at a meeting at GFDL to analyze the implications of the accuracy of data fields used as either inputs or references for model predictions of coupled air-sea problems such as El Niño. One interesting outcome is the desire of the NOAA/CAC group to use Pathfinder SST fields as the input to the Reynolds' OI analyzed weekly, one degree SST fields. Since the Reynolds' fields serve both as the reference SST for the NLSST equation and as the comparison field to compute Pathfinder SST anomalies, the impact of this change will need to be analyzed.

A paper was presented at the Boston, AGU meeting comparing Pathfinder SST to various SST climatologies and MAERI skin temperature observations obtained 1996 during a Hawaii to western tropical Pacific cruise (P. Minnett).

Working with L. Stowe of NOAA to use his PATMOS aerosol estimates with UMiami Pathfinder SST to identify aerosol correction problems in the SST algorithms.

During the second quarter we met with the One-on-One group to discuss DAAC and networking issues related to ocean processing (including MOCEAN processing at the DAAC and outstanding issues relating to production rules and PGE testing).

In June, the MOCEAN team met at GSFC to discuss Q/A and adaptive processing as well as team issues. The following week, mid June, the EOSDIS panel met in Woods Hole to discuss adaptive processing and federation. The next week provided an opportunity to meet with P. Cornillon to discuss progress and plans for DODS. The month ended with the MODIS team meeting.

D. FUTURE ACTIVITIES

D.1 Processing Development

D.1.1 Pathfinder

Search and display capabilities on the RSMAS Pathfinder AVHRR SST page will be enhanced over time to include selected-area movie loops and the

ability to display SST at a selected quality level. This approach will be expanded to include MODIS products.

Modify SST retrieval algorithm to extend into higher water vapor concentrations.

D.1.2 MODIS

Continue testing MODIS PGEs (using SeaWiFS input fields), interact with MOCEAN PIs to analyze product fields.

Submission of final version of MOCEAN Q/A plan.

Integration of next generation ocean algorithms (from Carder and Gordon). The Carder algorithm utilizes SST to select absorption coefficients in the chlorophyll algorithm. The new Gordon algorithm includes code to discriminated between absorbing and scattering aerosols.

Making sample MODIS day, week fields, distribute to MOCEAN PI's. Following confirmation from Pi's, then generate weekly climatology for a year. Test q/a exchange by delivering MODIS fields to ocean PI's

Continue hardware integration.

Update PGE's to reflect algorithm changes.

D.1.3 SeaWiFS

Testing SeaWiFS La fields for correlation with Pathfinder –Reynolds anomaly.

Processing of available SeaWiFS L1 data through MODIS PGEs. Produce first version of reference fields.

D.2 Matchup Database Future Work

Finalize first version of SeaWiFS calibration derived from initialization cruise and MOBY mooring data.

D.3 Systems Support

Startup of FloridaNet/vBNS; startup of second NSI T1 circuit.

Complete integration of fiber channel raid controller, fiber channel system driver and disk system.

E. Problems Encountered

E.1 Processing Development

E.1.1 Pathfinder

Equipment problems affected real-time data transfers in January.

Orbital elements have not be automatically updating (September-January), so real-time files were recalculated.

Tried to add two new processing machines - failed to behave properly - later found that their names were too long.

The determination of SST algorithm coefficients for NOAA7 and cloud detection tests has been hampered by the limited temporal and geographical distribution of the in situ data available during for NOAA7.
It is proving difficult to estimate coefficients that do not result in a biased SST estimate.

Experienced disk problems on processing machines, and a series of repeated disk crashes on the machine that runs the "event_demon" which controls the processing. Frequently, the event_demon would not start correctly after these crashed.

Having serious problems with indexing on the DLT machine. Also, the tapes for 1996 and 1997 include many duplicates and some omissions., and at least one tape that had to be dumped (because the nsr software could not access the files individually). A number of other tapes will mount, and then repeatedly run through the "verify" procedure.

The 2nd quarter saw the continuing sad story of DLT - all years may need to be scanned in again (at some point).

Started to collect NOAA-15, and it caused multiple problems. Warner was out of town the week we started to collect the orbits, which overloaded the disk resources assigned to archiving the GAC data.

E.1.2 MODIS

MODIS ocean processing as specified over 1700 L3 ESDTs. It is unclear whether the PDPS could handle this number of ESDTs. The DAAC also has concerns over maintaining such a large number. We have recognized from the start that such a large number of ESDTs might stress the system and are predisposed to respond favorably to changing the PGE's. However, until ECS provides concrete information on the use of single-parameter granules and demonstrates the capability to support it, we will concentrate our programming time on testing the PGE's for scientific validity, especially now that SeaWiFS data is available to serve as a geophysically relevant input.

E.2 Matchup Database

Decision trees developed using the same input parameters as NOAA-14 and NOAA-11 did not perform well for NOAA-7. Production of NOAA-7 coefficients is proving to be difficult due mostly to low matchups data density.

E.3 Software Support

None reported separately.