National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771

FILE COPY

NASA

Reply to Attn of: 620

March 7, 1990

Dear MODIS Team Member:

Enclosed please find the MODIS Science Team Minutes for the meeting of 31 January - 2 February. Please note that a more extensive set of minutes is on file and may be requested. Also note that numerous attachments, which were passed out at the meeting, are available. These addenda may be requested from: Mr. Harold Oseroff, Code 620, NASA/Goddard Space Flight Center, Greenbelt, MD 20771 (telephone: 301-286-5411).

Also included is a suggested Cost Element Breakdown Structure. This is based upon Announcement of Opportunity requirements, and your special MODIS requirements. It is produced in answer to requests from a number of you, and is a *suggested* guideline only; its use in your April proposal would be helpful to us. Copies are available on Macintosh floppy disc in Microsoft Excel 2.2 from Harold Oseroff.

Please contact Harold or me if you've comments or questions.

Sincerely,

Locke Stuart
MODIS Administrative Support Leader

Attachments: 7

MODIS SCIENCE TEAM

MINUTES

Meeting of 31 January - 2 February, 1990

Plenary Session
Discipline Group Sessions
Data Product Tables

This is an abbreviated set of minutes serving as an executive summary. A comprehensive set of minutes, along with all materials which were distributed during the meeting (see Attachment 7), are on file and can be made available as separate documents upon request. Please contact Harold Oseroff, Code 620, NASA/Goddard Space Flight Center, Greenbelt, MD 20771; telephone: (301) 286-9538 or FTS 888-9538.

MODIS SCIENCE TEAM MEETING

JAN 31 - FEB 2, 1990

NASA/GSFC, GREENBELT, MD 20771

V. Salomonson chaired the MODIS Science Team(MST) Meeting. Seventy nine persons registered for this meeting. Of the Science Team members, only John Parslow was absent. A brief summary of the presentations follows. Further presentation details are available upon request.

WELCOME & MEETING OBJECTIVES : V. Salomonson

V. Salomonson said that he and M. Abbott attended the SEC (Science Executive Committee) Meeting, where applications of EOS, including global change, were presented. Although the wavelength range, and spatial and temporal resolution, of the MODIS data products overlap with some of the corresponding products of other facility instruments, MODIS will generate a number of unique products and will complement other instruments with many other data products.

MODIS SCIENCE TEAM PROPOSALS/FUNDING: V.Salomonson, A. Fleig, J. Soffen

Proposal Content Categories:

A major topic at the MST meeting was the preparation of the members' Execution Phase Proposals. A. Fleig stated that the proposals by the team members should address the issues and funding needed in the categories of (1) Science (J. Soffen); (2) Computing Facilities (T. Taylor); (3) Data Products (V. Salomonson) . He segmented the Data Product category into 13 sub-categories with each of the sub-categories further subdivided. Computing costs can include the cost of using external computers.

Estimating Costs in Preparing Proposals:

The cost of the proposals should include the cost of all phases of the content categories, including validation and ground observations. R. Evans said that for some of the post launch products, a lot of research will have to be done before starting the algorithm development. The cost for such research should be included in the proposal. It was A. Fleig's opinion that if a field experiment and/or scientific analysis needs to be done for developing and/or validation/testing/quality assurance of an algorithm, the cost of such an effort including data purchase should be included in the Science section. However, J. Soffen (on Feb. 2) said that such cost should be included in the Algorithms section. This point needs further clarification.

Algorithm Development:

MST members can subcontract part of their algorithm development effort. Although V. Salomonson would like the MST members and/or their contractors to perform all of the steps (conceptual design to validation in CDHF to documentation), the team members who choose not to be responsible for some of the steps should let V. Salomonson know as soon as possible so that he can make alternative arrangements. V. Salomonson has been instructed that he is responsible for assuring that all products are completed in CDHF, documented, and meet the standards of quality control, regardless of which individual Team Member takes responsibility for the product.

Proposals Deadlines/Page Limit:

The proposals should not exceed the given page limit. These proposals must be submitted by April 30, 1990.

Interfaces to and from EOSDIS:

R. Evans pointed out that the interfaces to and from EosDIS have not been defined clearly. M. Abbott said that the Science Advisory Panel for EOS Data and Information, led by J. Dozier, will release some information related to this subject. V. Salomonson said that this information can be helpful to the team members in writing proposals.

Funding for MST Members:

V. Salomonson said that the money available for this program for FY 90 is rather small but he hoped that the funding will significantly increase in future years. J. Soffen said that before launch, a large portion of the money will be spent on algorithm development. However, after launch, after the system has truely become operational, more money will be available for science.

J. Soffen said that domestic MST members will get an additional fifteen thousand dollars each on or about April 1 for FY 90 in addition to the money (usually ten thousand dollars) that they have already received. There were a lot of questions related to (1) how the rules and regulations related to money are applied to (a) foreign resident MST members; and (b) foreign MST members residing in the U.S.A. for an extended period; and (2) under what circumstances the money received after April 1 can be used to pay off travel and other expenses incurred during FY 90 before April 1. It was affirmed that expenses cannot be incurred before contract approval; however expenses are legitimate following contract approval by NASA, even though this will occur before the funds are actually disbursed.

J. Muller would like NASA to send an official letter to UK indicating the critical need for certain data and resources from his investigation.
Regarding costs for ship time to validate ocean data products, J. Soffen said that team members should include such needs in their proposals, although M. Lewis/NASA HQ did not feel that NASA would cover this expense (about 10 to 15 thousand dollars per day).

MODIS COMMUNICATIONS .... B. Conboy

B. Conboy gave a presentation on MODIS electronic and hardcopy communications. "Minutes" of the MODIS Technical Team(MTT) and other small-volume relevant information are sent by GSFCMAIL and other electronic networks including NASAMAIL, OMNET, and INTERNET to the members of the MST and MTT. Large volume documents are generally sent via one of the express mail options. She emphasized that if a person does not use GSFCMAIL for three months, he/she will receive a notice to use GSFCMAIL, failing which his/her name will be removed from the users of GSFCMAIL.

STATUS OF MODIS-N ....W. Barnes

W. Barnes gave a brief status of MODIS-N, including MODIS-N & -T data rates, spectral band characteristics of the 36 MODIS-N channels, required SNR(signal to noise ratio) versus wavelength for oceans as well as land (MODIS-N and MODIS-T), wavelength tolerances, and comparison of key parameters of ocean color sensors(CZCS, SeaWIFS, MODIS-N and MODIS-T).

STATUS OF MODIS-T........................T. Magner

T. Magner gave a MODIS-T instrument status report including critical science requirements given in the Phase-B Study documents of Jan. 24, 1989 and July 13, 1989. Reported were the general status of instrument design and development; MODIS-T overall priorities; and trade-offs considered in the extended Phase-B study. In particular, he discussed in detail the pros and cons of the dual mode (two imaging modes--either land mode or ocean mode) and composite mode (single imaging mode for land and/or ocean). The Land discipline group prefers the composite mode and tried to work out certain compromises on performance requirements of MODIS-T channels with the oceans group. V. Salomonson said that any further comments on the dual versus composite mode should be communicated as soon as possible to him. The key to making the combination mode acceptable is meeting the ocean signal-to-noise requirements as presently stated for MODIS-T. In the event the composite mode is unacceptable, C. Justice wants to know the areas and times that MODIS-T would be expected to be in the land mode of the dual mode configuration, so that his group could develop land applications, including bidirectional reflectances.

SCIENCE DATA PRODUCT DOCUMENTATION ....D. Han

D. Han summarized accomplishments of the MODIS Data Study Team , their future support to the MST, information required of science team members at this time, and unresolved issues. He will help in trying to find the right ancillary data needed by the team members. A. Fleig said that, over the next several months, an effective process needs to be developed to find in detail to what stage of algorithm development each of the team members will subscribe, and what will be the responsibility of V. Salomonson. There were stimulating discussions about the need of different screening algorithms for different disciplines, giving approximate number of lines of code and other related information for each of the data products to EosDIS, documents in EosDIS of interest to the MST, choosing a suitable algorithm out a large number of existing ones for atmospheric corrections, special processing requirements of level-2 algorithms, data rates and format (BIP, BIL, BSQ etc.), data packetization, data broadcast, etc.

CALIBRATION ....B. Guenther

B. Guenther gave statement of purpose of the MODIS Calibration Group and a brief description of prelaunch characterization, in-orbit calibration and performance validation, data product validation, level of validation, flags and calibration requirements-driving derived parameters.

DATA PRODUCT & ALGORITHM PRODUCTION GUIDELINES..V. Salomonson & A. Fleig

W. Esaias said that most of the products will depend upon receiving at-satellite radiances. However, it is not clear yet who will produce those radiances. V. Salomonson said that D. Han and MODIS Data Study Team members will help the MST in the development of the products. V. Salomonson also said that a person can be sponsored by a MST member and approved by the MST Leader to become an "associate member" of the MST. These associate team members may help the MST in the development of data products.

A. Fleig's opinion was that although the team members will get the data belonging to NASA at no cost, they should include their data requirements in their proposals. Any non-NASA data requirements (ancillary, validation data) need to be costed in the proposal. The policy for foreign science team members requires further consideration. He said that if a non-U.S. investigator, for example, wants a high speed communication link for transmitting data, NASA will not pay for such a link. R. Evans said that, to meet accuracy requirements, MODIS data would have to pass three times through the processing system, in which case it will miss the deadline of 24-96 hours turnaround. Thus we cannot meet requirements of both timeliness and accuracy.

V. Salomonson said that algorithms for producing global data products should be tested in CDHF. He emphasized that the requirements of an algorithm (lines of code, memory needed, etc.) should be estimated as accurately as possible. The schedule of algorithm development is given in the handout entitled, " MODIS Team Member Proposals". Conceptual Design and Cost Review, Preliminary Design Review and Critical Design Review should be completed by October of 1991, 1992 and 1993 respectively. It will be much harder to make any changes in the algorithms after 1997; around that time the algorithms will be "frozen". M. King asked what will happen if the required ancillary data (possibly other EOS data) are delayed. R. Evans pointed out that some algorithms are quite complex and extensive, with hundreds of routines and subroutines linked together. It will require extensive effort and resources to perform all of the development steps suggested by V. Salomonson and A. Fleig. Also, some "master program" has to check to make sure that all the inputs are put in the proper sequence. A. Fleig said that he will alert the EOS Project. It is important that EOSDIS system size is not grossly underestimated.

Standard and Special Products Terminology:

What MODIS team members call at-launch and post-launch data products are similar to the standard and special products of EOSDIS. In the future our terminology and definitions should be identical to those of EOSDIS.

STATUS REPORT BY DIFFERENT DISCIPLINE GROUPS

ATMOSPHERES (ATTACHMENT 1): M. King said that he already has working code for a number of algorithms for the MODIS data products. However, this code will be thoroughly tested and documented before it is released for incorporation into CDHF. Team members will include their needs for ancillary data, including a/c data, in their proposals.

LAND (ATTACHMENT 2): V. Salomonson needs to know the lead person responsible for any product being developed by several persons. J. Soffen said that the money available in the future (FY 91 and beyond) for MST will not be necessarily divided equally among the MST members.

OCEANS (ATTACHMENT 3): W. Esaias said that the dual mode of MODIS-T is crucial for determination of Aerosol Angstrom Exponent. Data needed from a large number of other sources, and ancillary & validation data (ship, buoys, aircraft, drifters etc.), were discussed. The MST members of the University of Miami will optimize the code for the MODIS data products on their university computers, but will need help in optimizing it for CDHF.

CALIBRATION (ATTACHMENT 4): Only a handful of people were able to attend this meeting since most were attending other discipline group meetings.

B.Guenther emphasized that the instrument vendor is required to calibrate MODIS-N to meet the specifications. The Calibration Group will test and validate the instrument calibration coefficients and other parameters, and recommend any changes based on their findings. Three to six months after launch, the calibration coefficients may be improved based on analysis of the products. The Calibration Group may also help in radiometric calibration of some of the validation instruments used for "discipline group" applications.

CALIBRATION ....P. Slater

P. Slater said that the image data quality assessment to be done by J. Barker is a key element. P. Slater is going to be involved in pre-launch calibration and cross calibration between different instruments. Studies are being conducted on how to make best use of the moon as a standard for calibration. Slater plans to work closely with each of the discipline groups to respond to their needs for calibration. Other presentations, for which handouts were distributed, are as follows:

DATA CHARACTERIZATION .... J. Barker
TOPOGRAPHIC CORRECTIONS ...... J.-P. Muller
BIDIRECTIONAL REFLECTANCE..... J.-P. Muller
ATMOSPHERIC CORRECTION........ D. Tanre/ Y. Kaufman
THANK YOU FROM NASA/HQ........ M. Lewis

M. Lewis thanked everyone for sharing their work and comments. NASA is evaluating a coordinated effort to study and understand global change. EOS is an important part of the Global Change program, which is the largest program that NASA has ever undertaken.

MODIS SCIENCE TEAM MEETING

31 JANUARY - 2 FEBRUARY, 1990

ATMOSPHERES DISCIPLINE GROUP

MINUTES

The Atmospheres Discipline Group meeting was chaired by Mike King, and attended by Paul Menzel, Yoram Kaufman, Didier Tanre (team members), Mike Andrews, Phil Ardenuy (RDS), and Locke Stuart.

Most of the meeting time involved deliberations on data products. In general, two levels of products were identified: 1) a level-2 product with daily temporal resolution and 5 km spatial resolution; 2) a level-3 product with daily/monthly temporal resolution and 0.5° to 1° spatial resolution. The level-3 products would be gridded data products. Many of the required ancillary products were generally available from AIRS/AMSU, with NMC and MODIS as backups. Team members generally agreed to maintain complete responsibility for their product, but expressed some uneasiness with that decision because of the limited knowledge of the interfaces and documentation required. Tables summarizing the expected at-launch and post launch products were distributed. An updated copy of the complete MODIS product tables, expressing this discipline group's decisions, is attached (ATTACHMENT 5).

The remaining discipline group time was spent discussing data validation responsibilities. A number of instruments and field experiments were identified. A final comment addressed MODIS-T: if adopted, the composite mode would render some bands useful for cloud/aerosol work, but there is insufficient manpower to devote to developing additional algorithms, as required, for example, for BRDF studies.

ATTACHMENT 1

MODIS SCIENCE TEAM MEETING
JAN 31 - FEB 2, 1990
NASA/GSFC, GREENBELT, MD 20770

LAND DISCIPLINE GROUP

The Land Discipline Group meeting was chaired by C. Justice. The group strongly emphasized the need for (1) having a MODIS simulator for algorithm development and testing by 1995; (2) importance of producing global products; and the (3) detecting global change by MODIS.

Updating MODIS Data Products Tables:

Most of the time in the meeting was spent discussing the MODIS at-launch and post-launch land data products. The updated tables of MODIS Data Products are attached (ATTACHMENT 5).

Revised Proposals:

C. Justice emphasized that the proposals of the team members should be coherent and clearly identify the steps (stated by V. Salomonson and A. Fleig) for which a team member will be responsible.

Utility Algorithms:

The utility algorithms needed are: cloud masking, shadow screening, topographic corrections, geometric correction, radiometric correction, atmospheric correction, spatial heterogeneity. C. Justice said that the utility algorithms will use 214 m bands as appropriate. Further information about these algorithms are available in the MODIS Land Data Products tables, which were distributed at the meeting.

Composite Mode for MODIS-T:

The group decided that it is highly desirable to have the composite mode of MODIS-T for applications to snow cover and determination of bi-directional reflectances of land surfaces up to 20 degrees and more. V. Salomonson said that the MISR data will be routinely used to determine albedo every 16 days with an accuracy range of about 3% to 5%.

Radiances and Reflectances:

At-satellite radiances, land leaving radiances and reflectance products (bi-directional reflectance, albedo etc.) are essential to generate accurate land products. Sufficient resources have to be identified to ensure that these products are generated.

Simple Algorithms in EOSDIS Versus Storage:

Y. Kaufman suggested that simple algorithms can be used in EOSDIS to compute "day/night difference" instead of storing "day/night difference".

EOS DTM Data Base:

J. Muller said that an EOS Digital Terrain Model (DTM) Data Base will be needed. Sufficient ITIR data will not be available in a timely manner to satisfy this need. The MODIS Land Group needs to define quantitative requirements for this data base and present it to the EOS Project. If such a data base is listed as a critical requirement for NASA and a memo sent accordingly, the UK may provide some money for it. Also, organizations in the US and abroad which may be able to provide input to such a data base should be identified. J. Muller said that this data base should be incorporated into the same system which does the resampling so that resampling occurs only once in order to retain geometric and radiometric fidelity of the images. D. Han said that routine global application of topographic corrections will be quite expensive.

Summary of the Revised Proposal:

A page summary of the proposal from each of the "Land Discipline" member should be sent to all of the other members by March 1, 1990. All the updates to the MODIS Data Product Tables including data needed from other sources, ancillary data and derivative data products should be given to L. Stuart as soon as possible, but no later than March 1, 1990.

Other Topics Discussed:

* Possible saturation of some bands while sensing snow
* Specifications of band-to-band registration
* Accuracy of geodetic & temporal registration
* Resampling the data and converting to specific map projections
* Possible Ground Control Points for registering 214m data
* Brightness temp. determination and surface emissivity accuracy
* Atmospheric corrections: which model, program to use (possibly need a different approach than the "Atmospheric Group"
* Increased modeling complexity associated with assuming non-lambertian characteristics of the surface
* Albedo estimation by measurements in the principal plane
* Improved vegetation index after correcting for polarization effects using EOS-P data
* Determining pure versus mixed pixels using 214 m band for 428m bands, 856m bands and MODIS-T bands
* Channels needed for discriminating between cloud and snow
* Utility of AVHRR LAC, HIRIS and ITIR to improve/complement MODIS products

* Need for passive microwave data for detection of snow under cloudy conditions
* Need for knowing land cover types below the snow surface
* Ancillary data needed including aircraft observations
* Complementing the IDS group in producing data products.

<u>Suggestions for Future MST Meetings:</u>

The Land Discipline Group would like to spend more time in the "discipline group sessions" rather than plenary sessions in the future meetings. One member suggested to have a "four day" meeting instead of a "three day" one. A number of people suggested having a more detailed version of the minutes rather than a condensed version. Some members said that many items of general interest like Proposal Preparation/Funding Outlook, Atmospheric Corrections, Bidirectional Reflectance etc. should be scheduled before the meetings of the "discipline group" sessions so that the information given in these presentations can be used in the working "discipline group" sessions effectively. One person suggested to continue having meetings starting on Wednesday rather than Monday so that if some people want to have a specialized session, they could come a day earlier.

MODIS SCIENCE TEAM MEETING JAN. 29 - FEB. 2, 1990

MINUTES OF THE OCEAN GROUP

Instrument Capabilities/Specification: The latest MODIS-T design is very much improved. However, there is inadequate S/N margin in the near IR (especially at 750 amd 850nm) in the Composite Mode. Therefore the Dual Mode is preferred at this time.

Packetization: For purposes of quick look the Ocean Group prefers that the data be formatted by pixel rather than by spectral band. Algorithm efficiency will also be improved. However, the issues associated with real time processing need to be better understood before the Group offers a recommendation on packetization.

MODIS-T/MERIS Considerations: Because of cost pressures on EOS the MERIS (and OCTS) capabilities need to be assessed. For proposal purposes it will be assumed that MODIS-T will fly on EOS. It was suggested that critical assessments be provided of other EOS instruments whose data the ocean investigators will use.

Calibration/Validation: Calibration accuracy better than 5% is required, therefore the sensor calibration will be "tuned" and augmented by members of the Ocean Group. A volunteer to work with the Calibration Group was suggested.

Validation of the large number of ocean products will require dedicated pre- and post-launch cruises, buoys, drifters and aircraft flights in and over clear and coastal waters throughout the mission. NASA should fund validation cruises or arrange for other agencies to provide dedicated ship time.

A "grand plan" for validation will be developed and will identify requirements, individual responsibilities, locations, number of cruises, duration, costs, etc. Clark will collect the necessary information. Evans will produce a first cut plan. When completed it will be attached to each investigators' proposal as an appendix.

Data Products: Specific data products to be produced by each member of the Ocean Panel needs to be determined. This information will be compared against the Fleig list of data task requirements. One individual will be designated as point of contact for each data product. Data produced immediately after launch should be treated as special data until properly validated. Data obtained very early in the mission will be useless to the general community. It might be possible to distribute products of reduced accuracy for an interim period, e.g., six months, with necessary caveats. Esaias requested that by April 1 each lead person identify the activities enumerated in the Fleig memo that he will take responsibility for completing.

Attachment 3

Ancillary Data Requirements: If a scientist wants ancillary data he will have to get it himself, put it in proper format, document it and provide it to EOSDIS where it will be archived and distributed. Funds for this purpose should be included in each investigators proposal.

EOSDIS Interactions: It was proposed that prior to launch Evans develop integrated, optimized code for all ocean data products. Following launch each Ocean Group member will provide a data stream to Evans and he will generate the output products. However, each team member will still be responsible for his assigned products. Evans will coordinate his activities with EOSDIS and will attempt to develop effective methods to transfer code to EOSDIS as it evolves during its development cycle.

Next Meeting of the Ocean Panel: The next meeting will be held in Miami on April 3rd and 4th.

MODIS CALIBRATION DISCIPLINE GROUP MEETINGS:

This Group was chaired by B. Guenther. Participation at this Group was not broadly representative of the entire MODIS Science Team (MST), with only one MST member attending for the entire meeting, and three other members attending portions of the meeting. The Group agreed on a charter establishing their basic interest in oversight of the Level 1 products, including approaches of maintaining knowledge of instrument performance throughout the entire mission, and further including devising approaches for adjustment of the instrument calibrations on the basis of studies of in-orbit data. The Calibration Group was in concurrence with the Team preference that investigators responsible for products at levels above Level 1 are responsible for the validation of those products. An outline for the MODIS Calibration Management Plan was developed, and the Group accepted responsibility (through the Chairman) to develop that Plan for MST review.

A figure depicting the interactions of responsibility in performing these tasks for the MODIS Mission was presented to the MST. The described approach was accepted by the MST. The heart of this approach is a Characterization Team, and J. Barker was proposed to head that effort. Barker's basic concepts for implementing this task were presented to the MST on Feb. 2.

MODIS AT-LAUNCH DATA PRODUCTS

These are products that it is conservatively believed can be provided shortly after launch, based on prelaunch experience with precursor airborne and spaceborne sensors. Many other products are expected to be developed as a result of postlaunch research.

Updated: 6 March 1990

PRODUCT/PARAMETER	MEASUREMENT	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Chlorophyll-A Concentration (Case I)	mg/m^3	±30%	±10%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Clark	Typical conditions; OWP
B. Chlorophyll-A Concentration (Case II)	mg/m^3	±50%	±10%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Carder	Typical; OWP (Clark,Parslow,Hoge)
C. Chlorophyll Fluorescence (Line Height)	mW/cm2/sr/µm	±.004	±.001%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Abbott	Chi>.5 accuracy dependant on NEDL;OWP
Chlorophyll Fluorescence (Curvature)	mW/cm2/sr/µm	±25%	±8%	1, 20 km	Daily/Weekly	Regionl/Globa	Hoge	Based on actual airborne active /passive data. OWP.
D. Pigment Concentration (CZCS)	mg/m^3	±30%	±10%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Gordon	OWP (Clark)
E. Ocean Prim. Productivity (Empirically)	mg/m^3	<±35%	<±20%	20 km	Week/Mon/Yr	Regionl/Globa	Esaias	Surface Observations Required, OWP
F. Regional Sea Surface Temperatures	°K	±0.3-0.4°K	±0.1-0.3°K	1,4,20 km	Daily/Week/Mo	Locl/Reg/Glob	Brown	AVHRR type,seas,year,location±4km.Require H2O vapor.
G. Global Sea Surface Temperatures	°K	±0.3-0.6°K	±0.1-0.3°K	1, 4, 20, 50 km	Da/Wk/Mo/Yr	Locl/Reg/Glob	Brown/Barton?	ATSR type; season also,location±4km.Require H2O vapor.
H. Water-Leaving Radiance (Visible)	mW/cm2/sr/µm	±10%	±5%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Gordon	Typical conditions; OWP (Evans, Tanre)
I. Attenuation (Kd) at 490nm, (Case I)	Per meter	±25%	±10%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Gordon	Typical conditions.(Clark)Based on Pigment concent. OWP.
J. Detached Coccolith Conc. (E. huxleyi)	mg CaCO3/m^3	±30%	±10%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Gordon	OWP (Clark)
K. Dissolved Organic Matter Case 1 Globl	mg/m^3	±150%	±30%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Carder	OWP (Parslow)
L. Dissolved Organic Matter, Southern	mg/m^3	±150%	±30%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Parslow	OWP. 30% error with model. (Clark,Hoge)
M. Sea Ice (Maximum Total Extent)	km^2	±5% or less	±5% or less	1, 10 km	Daily/Week/Mo	Regionl/Globa	Salomonson	Accuracy based on March Ice Northern Hemisphere
N. Phycoerythrin Concentration	mg/m^3	±200%	±50%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Hoge	OWP
O. Single Scattering Aerosol Rad., ta<0.6	mW/cm2/sr/µm	±10%	±5%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Gordon	Case I waters. Accuracy depends on SNR. Pixel Averaging.OWP
P. Aerosol Angstrom Exp., Optical Depth	Dimensionless	±15%	±5%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Gordon	Accuracy depends on SNR. Pixel Averaging OWP
Q. Total Suspended Solids	gm/m^3	±50%	±35%	1, 20 km	Daily/Week/Mo	Locl/Reg/Glob	Clark	OWP
R. Callibration Data Sets	varies	N.A.	N.A.	N.A.	Daily/Week/Mo	Locl/Reg/Glob	Evans	Screened in-situ, Satellite & cal. data, error flags. OWP.

II. LAND AT-LAUNCH DATA PRODUCT ANALYSES

PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Level 2 Land-Leaving Radiances	W/m^2/sr/µm	±10%	±5%	0.5, 1, 10 km	Daily	Regionl/Globa	Kaufman/Tanre	Strahler too. (Tanre & Townshend input)
B. Land Cover Type	km^2	5%-10%	±1-5%	0.5, 1, 10 km	Season/Yearly	Regionl/Globa	Strahlr/Huet/Just.	Need Land-Leaving+topographic+214m band cloud cor.
C. Vegetation Indices	Dimensionless	±0.01	±0.01	0.5, 1, 10 km	Daily/Wk/Mo.	Regionl/Globa	Justice/Huete/Tanr	Range: 0-1. Need Land-leaving+topo+214m cloud cor.
D. Surface Temperature	°C	±1-3°C	±1°C	1, 10 km	Daily/Weekly	Regionl/Globa	Wan/Susskind	Range -20 to 50°C. AMSU necessary.
E. Snowcover	km^2	±5% or less	±5% or less	1, 10 km	Daily/Weekly	Regionl/Globa	Salomonson	(Hall) Accuracy based on avr. Jan. snowcover N. Hem.
F. Thermal Anomalies (volcanoes, fires)	°C	±10°C	±5°C	1, 10 km	Daily/Weekly	Regionl/Globa	Kaufman	Day & night data required.
G. Topographic Correction	m?			*1,10 km*	Yearly?	*Regionl/Globa*	*Muller*	*Need info. on Eos database on topographic correction*

OWP=Ancillary data: ozone, winds, sea surface pressure. Italicized inputs were changes made late January; shaded inputs early March.

Updated 6 March, 1990.

Attachment 5

MODIS AT-LAUNCH DATA PRODUCTS

III. ATMOSPHERE AT-LAUNCH DATA PRODUCT ANALYSIS

PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Cloud Optical Thickness (0.66µm)?	Dimensionless	±20%	±10%	5 km 1°	Daily Daily/Monthly	Global Global	King King	Daytime. Coakley. Requirs clear sky radiance (surf.reflctnc) Daytime. Coakley. Requirs clear sky radiance (surf. reflctnc)
B. Cloud Fractional Area	per cent.	±10%	±5%	5 km 1°	Twice Day/Mo. Daily/Monthly	Global Global	King King	Barker.Look at flags for cld test.w/CERES (Coakley,Wielicki). (Barker). Need clear sky radiance & surface temperature.
C. Cloud Effective Emissivity	Dimensionless	±0.10	±0.05	5 km 1°	Twice Daily Daily/Monthly	Global Global	Menzel Menzel	Averaging of samples. CO2 algorithm. Requires "B" & temperature profile.
D. Cloud Top Pressure	mb	±50mb	±20mb	5 km 1°	Twice Daily Daily/Monthly	Global Global	Menzel Menzel	CO2 algorithm. Requires temperature profile.
E. Cloud Top Temperature	°C	±2°C	±1°C	5 km 1°	Twice Daily Daily/Monthly	Global Global	Menzel Menzel	CO2 slicing.
F. Cloud Particle Effective Radius	µm	±0-40%	±5%	5 km 1°	Daily Daily/Monthly	Global Global	King/Menzel King/Menzel	Daytime. Menzel:Verification & Ancillary Data Requires clear sky radiance (surface reflectance).
G. Cloud Water Thermodynamic Phase	Ice or water	N/A	N/A	5 km 1°	Daily Daily/Monthly	Global Global	King King	Daytime. Requires clear sky radiance (surface reflectance).
H. Spectral Aerosol Optical Thick.(Ocean) Spectral Aerosol Optical Thick.(Land)	Dimensionless Dimensionless	±0.05 ±0.1	±0.02 ±0.05	0.5° 0.5°	Daily/Monthly Daily/Monthly	Global Global	Tanre/Kaufman Kaufman/Tanre	Daytime. W/Gordon. Bands 1-8. Level 3 only. Separate algorithm from ocean. Daytime. Level 3 only.
I. Mean Radius and Dispersion of Aerosol	µm/dimensionle	±10-30%	±10%	0.5°	Daily/Monthly	Global	Tanre/Kaufman	For radii 1-5µm. Daytime. Speciallized level 3 Prod.
J. Aerosol Mass Loading (Dry)	gm/m^2	±30%	±10%	0.5°	Daily/Monthly	Regionl/Globa	Kaufman/Tanre	Daytime. Level 3 product. Requires temperature profile
K. Atmospheric Stability (lifted index)	°C	±2°C	±1°C	5 km 0.5°	Twice Daily Twice Day/Mo.	Global Global	Menzel Menzel	Cloud free area. Requires "B", surface temperature, temperature & moisture profiles.
L. Total Precip. Water(H2O Vapor Profile)	mm	±10 mm ±5 mm	±5 mm ±3 mm	5 km 5 km	Twice Daily Daily	Global Global	Menzel Kaufman/Tanre	Therm. bnd D&N. Cldfree areas. Reqs surf. temp.&temp. prof. NIR Daytime; cloudfree areas.
M. Total Ozone Content	Dobson Units(DU	15-20 DU	10 DU	5 km 5km 0.5°	Twice Daily Daily Daily/Monthly	Global Global Global	Menzel Menzel Menzel	Needed for Cappius band correction by Oceans. Requires surface temperature & temperature profile.

IV. GENERAL: AT-LAUNCH DATA PRODUCT ANALYSIS

PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. At-Satellite Radiances <3µm At-Satellite Radiances >3µm	W/m^2/sr/µm W/m^2/sr/µm	5% 1%	RMS<NEdL RMS<NEdL	856,428,214m 856,428,214m	Daily Daily	Global Global	*Salomonson* *Salomonson*	(Barker).Reflectance calibration:2%(MODIS-N Aug 4,89 Specs) *(Barker)*
B. Surface Directional Reflectance	*dimensionless*			*856,428,214m*	*Daily*	*Global*	*Kaufman*	*Also;Strahler,Muller,Justice,Huete,Vanderbilt,(Hall,Barker)*
C. Cloud Masking/ Shadowing (MODIS-N) Cloud Masking/Shadowing (MODIS-T)	*Dimensionless* Dimensionless	30, 15, 5% 10%	N/A N/A	*856,428,214m* 1.1 km	*Daily* Daily	*Global* Global	*Salomonson* Salomonson	(Barker).Accurcy fr. bin. cld mask.Selectd Lvl-3 products also. (Barker).Acc. fr. binary cld mask.Selectd Lvl-3 products also.
D. Radiomet. Spatl Hetrogneity(MODIS-N) Radiomet. Spatl Hetrogneity(MODIS-T)	W/m^2/sr/µm W/m^2/sr/µm	NA,50,20% 30%	N/A N/A	856,428,214m 1.1 km	Daily Daily	Global Global	Justice/Strahler Justice/Strahler	(Barker).Varianc meas. of hetrogneity used.2nd moment of rad (Barker).Varianc meas. of hetrogneity used.2nd moment of rad

OWP=Ancillary data: ozone, winds, sea surface pressure. Italicized inputs were changes made late January; shaded inputs early March. Updated 6 March, 1990.

MODIS POST-LAUNCH DATA PRODUCTS

These are products that it is conservatively believed can be provided after launch. Many other post launch products are expected to be developed as a result of post launch research.

Updated: 6 March, 1990

I. OCEAN POST-LAUNCH DATA PRODUCT ANALYSES

PRODUCT/PARAMETER	MEASUREMENT	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL o VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Primary Productivity, Case I Waters	mg C/m^2/day		50-100%	1km, 50 km	Day/Wk/Year	Regionl/Globl	Abbott	OWP, MLD, CS (Esaias input). Need CERES surface incident fluxes.
B. Chlorophyll-A Conc. from Fluoresc.	mg/m^3	±50-100%	35%	1, 4, 20 km	Day/Wk/Mon	Loc/Reg/Glob	Abbott	>0.5mg/m^3; Accuracies will increase by spatial averaging. OWP.
C. Instant. Surf. Prim. Prod. from F.L.H.	mg C/m^2/day	TBD	TBD	1km, 20 km	Daily/Weekly	Loc/Reg/Glob	Abbott	>0.5mg/m^3; Errors unknown at present. OWP; FLH=Fluorescence Line Height.
D. Fluorescence Efficiency	dimensionless	±15%	±5%	1km, 20 km	Daily/Weekly	Local/Regionl	Abbott	OWP
E. Surface Incident PAR (h nu), Keb	Quanta/m^2/s	±10%	±5%	1km, 20 km	At overpass	Local/Global	Gordon	OWP; Needed for fluorescence. to chlorophyll relationship. Need AIRS, K@490nm.
F. Attenuation of PAR (K)	per meter	±35%	±10%	1km, 20 km	Daily/Weekly	Global	Clark	OWP
G. Pigment Concentration (Curvature)	mg/m^3	±35%	±15%	1km, 20 km	Daily/Weekly	Regional	Hoge	Coastal & Estuarine; OWP (Esaias)
H. Beam Attenuation Coeff. c,520nm	per meter		±35%	1km, 20 km	Daily/Weekly	Global	Clark	OWP
I. Particulate Scattering	per meter		±30%	1km, 20 km	Daily	Global	Parslow	Based on simulated lab data. OWP. (Gordon)
J. Organic Fraction	dimensionless	±15%	±10%	20 km	Daily/Weekly	Global	Clark	OWP
K. Daily PAR	Quanta/m^2/s		TBD		Daily	Global	Esaias	Adapted from other EOS data. OWP. (Tanre, King)
L. Currents, Fronts, Eddies	meter	214-856m		214-856m		Regional		Location implicit to most products. No further analysis by team. OWP.

II. LAND POST-LAUNCH DATA PRODUCT ANALYSES

PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL o VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Level-1 Topographic Corrections	meters	±100m	N/A(Towns	Pixel size	N/A	Regionl/Globl	Muller?	Input for Vegetation Indices. MODIS T Digital Terrain Model? Strahler help.
B. Incident PAR	MJ/m^2	±200	5 to 20%	1 km	Daily/Weekly	Regionl/Globl	Tanre	Townshend, Justice, Ardanuy inputs.
C. Bidirec.Reflect/Albedo/Surf. Rough.	dimensionless	±15%	5 - 8%	1, 10 km	Daily/Weekly	Regionl/Globl	Tanre/Muller	Strahlr&Huet too. Changble w/tim of dy. Hemis.& nadir refl. rqd. Atmos&topo cor. rqd.
D. Soil Brightness Index	dimensionless	±0.09	±10%	1 km	Weekly	Regional(arid	Huete	For vegetation index refinement.(Huete input)
E. Length of Growing Season	Days	±10 days		1, 10 km	Annual	Global	Justice	Need NDVI.
F. Surface Emissivity	dimensionless	±0.01	±0.01	1, 50 km	Daily/Weekly	Regionl/Globl	Barton	Accuracies optimistic? (Barton input)
G. Primary Production	Mg/km^2/yr	±100	±5-30%	1 km	Week/Mon/Yr	Regionl/Globl	Running	Huete:questionable.Need veg. indices&land cover type/biome area.Townshend input too.
H. Leaf Area Index	dimensionless	±0.1-0.25	±5-20%	Pixel size	Daily/Weekly	Loc/Reg/Glob	Running	Running:0.5 abs. acc.;Townshnd:±2% rel.0.04-.39SE ranges(Ardenuy).Huete:questionable
I. Vegetation Stress	sec/m	200-1000	±5-30%	Pixel size	Daily/Weekly	Loc/Reg/Glob	Runnng/Huete	*Need MODIS-N, bands 1-7 MODIS-T.GIS/soils data*
J. Day/Night Temperature Difference	°K	1°K	1°K	856 m	Daily	Regional	*Huete*	Under favorable conditions. Barton input.
K. Data Characteriz. (goemetry, jitter)	Dimensionless	30,10, 5%	N/A	1,10,50 km	Daily	Global	Justc/Strahlr	(Barker).Strahler prefers pixel size res.To be used for Level-3 products.Activity?Prod?
L. Spectral/Spatial mixture modeling	Dimensionless			Pixel size	Daily	Global	Huete	Barker wants 1,10,50km spatial resolution w/accuracies of 30,10,&5%,resdpectively
M. Mixture Modeling/Polarization enhanc	Dimensionless			Pixel size	Daily	Global	Vanderbilt	(Barker)

OWP = Ancillary data: ozone, winds, sea surface pressure
MLD = Mixed Layer Depth Model
CS = Coupled Simulation Model
F.L.H. = Fluorescence Line Height
PAR = Photosynthetically Active Radiation

Italics indicate changes made prior to the MST Jan-Feb '90 meeting. Shaded blocks indicate changes made 6 Mar '90. Updated 6 March, 1990

III. ATMOSPHERE POST-LAUNCH DATA PRODUCT ANALYSIS

PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Aerosol Single Scattering Albedo	Dimensionless	±0.06	±0.03	0.5°	Daily/Monthly	Regionl/Globa	Tanre/Kaufmn	Land only. Level 3 product. Daytime.
B. Cloud Area and Perimeter - Geometry	km^2 & km	N/A	N/A	1°	Monthly	Global	Kaufman	214m pixel count data needed. Level 3 statistics.
C. Cloud Joint Probability Density Funct	Dimensionless	N/A	N/A	1°	Daily/Monthly	Global	King/Menzel	Level 3 only.
D. Cloud Emissivity	Dimensionless						Menzel	

OWP = Ancillary data: ozone, winds, sea surface pressure
MLD = Mixed Layer Depth Model
CS = Coupled Simulation Model
F.L.H. = Fluorescence Line Height
PAR = Photosynthetically Active Radiation

Italics indicate changes made prior to the MST Jan-Feb '90 meeting. Shaded blocks indicate changes made 6 Mar '90. Updated 6 March, 1990

I. REQUIRED ANCILLARY DATA:

ATMOSPHERE -- AT LAUNCH

Updated: 6 March, 1990

MODIS DATA PRODUCT	ANCILLARY PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Cloud Optical Thickness	Surface Directional Reflectance, or Land or Water Leaving Radiances	Dimensionless W/m^2/sr/µm	±10%	±5%	Pixel size 0.5,1,10 km	Daily Daily	Global Regional/Glob	Kaufman Kaufmn/Tanre	MODIS Near.clear neighbor 0.63,1.6,2.1,3.7µm MODIS.Either(above)/or Isotropc or Lambertia
B. Cloud Fractional Area	Surface Temperatures								AMSU or NMC
C. Cloud Effective Emissivity	CO2 Data & Algorithm Cloud Flags Temperature Profiles				0.5°	Daily	Global	Menzel?	Menzel input. MODIS AMSU or MODIS or NMC. Clear areas.
D. Cloud Top Height	Temperature Profiles								AMSU or NMC
E. Cloud Top Temp.	Cloud Top Pressure Cloud Eff. Emissivity				2-50 km 2-50 km	Twice Daily Twice Daily	Global Global	Susskind? Menzel?	King input. MODIS Ardanuy input. MODIS
F. Cloud Droplet Effective Radius	Surface Reflectance (Albedo) Land or Water Leaving Radiance								MODIS Near.clear neighbor 0.63,1.6,2.1,3.7µm MODIS. Either (above)/or .
G. Cloud Water Therm.Phase	Surface Reflectance (Albedo) Land or Water Leaving Radiance								MODIS Near.clear neighbor 0.63,1.6,2.1,3.7µm MODIS. Either (above)/or .
H. Spectral Aerosol Optical Thickness (Ocean)	Previous Level 1 Radiances Previous Aerosal Optical Thickness Surface Reflectance (Albedo) Optical Thickness				214/418 M	3/7/16 days			MODIS MODIS MODIS. 16 days previously. MISR
H. Spectral Aerosol Optical Thickness (Land)	Previous Level 1 Radieances Previous Aerosol Optical Thickness Surface Reflectance (Albedo) Optical Thickness				214/418 M	3/7/16 days			MODIS MODIS MODIS. 16 days previously. MISR
I. Mean Radius & Disp. Aerosol	Spectral Aerosol Optical Thickness Corrected Radiances								MODIS. Either / or below MODIS. Either (above)/ or
J. Aerosol Mass Loading (Dry)	Spectral Aerosol Optical Thickness Aerosol Mean Radiance & Dispersion Total Precipitable Water Temperature Profile								MODIS MODIS MODIS AMSU or NMC. Lower Troposphere
K. Atmospheric Stability	Forecast Cloud Flags Surface Temperatures	Degrees C			10 km	Twice Daily	Global	Susskind?	NMC MODIS utilities AMSU or NMC or MODIS.
L. Total Precipitable Water	CO2 Data & Algorithm Cloud Flags Temperature Profiles Surface temperature				1-50 km	Daily	Global	Menzel?	MODIS utilities AMSU or NMC AMSU or NMC
M. Total Ozone Content	Forecast Cloud Flags Temperature Profiles Surface Temperature	Degrees C			10 km	Twice Daily	Global	Susskind?	NMC MODIS utilities AMSU or NMC AMSU or NMC

Italics indicate changes made prior to the Jan-Feb MST meeting. Shaded blocks indicate changes made 6 Mar '90

Updated 6 March, 1990

LAND -- AT LAUNCH

MODIS DATA PRODUCT	ANCILLARY PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
D. Surface Temperature	AMSU				1-10 km	Daily/Weekly	Global/Region	Susskind?	King input.

OCEANS -- AT LAUNCH

MODIS DATA PRODUCT	ANCILLARY PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Chlorophyll-A Concentration-Case I	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
B. Chlorophyll-A Concentration-Case II	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
	Airborne Laser-Induced Chlorophyll Phycoerythrin and DOM Fluorescence	mg/m^3 ("after truth")	±15%	± 8%	0.001 km	Each Pass	*Regional*	Hoge	*Curvature Algorithm Derivation/Validation* Overflight of Cruise
	Airborne Water-Leaving Spectral Radiance	W/m^2/Sr/nm	±5%	±4%	0.001 km	Each Pass	Regional	Hoge	Curvature Algorithm Derivation/Validation
C. Chlorophyll Flour.(Line Height)	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
C1.Clorophyll Fluor. (Curvature)									
D. Pigment Concentration (CZCS)	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
E. Primary Productivity (visible)	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
F. Regional Sea Surface Temp.	Total Water Vapor	cm	5%	5%	10 km	Each Pass		Susskind	AIRS/AMSU
	SFC Wind Speed	m/sec	±2m/s	±2	1.5°	Each Pass		Spencer	HIMSS, ALT, SCATT
	SFC Winds	m/sec	±2m/s	±2	2.5°	Daily	Global	?	NMC, FNOC, EMC
	Total Water Vapor	cm	10%	5%	1 km	Each Pass		Susskind	MODIS
G. Global Sea Surface Temp	Total Water Vapor	cm	5%	5%	10 km	Each Pass		Susskind	AIRS/AMSU
	SFC Wind Speed	m/sec	±2m/s	±2	1.5°	Each Pass		Spencer	HIMSS, ALT, SCATT
	SFC Winds	m/sec	±2m/s	±2	2.5°	Daily	Global	?	NMC, FNOC, EMC
	Total Water Vapor	cm	10%	5%	1 km	Each Pass		Susskind	MODIS
H. Water-Leav Radiance (Visible)	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
I. Attenuation (Kd) @490, Case 1	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU

Italics indicate changes made prior to the Jan-Feb MST meeting. Shaded blocks indicate changes made 6 Mar '90

Updated 6 March, 1990

I. REQUIRED ANCILLARY DATA (continued):

OCEANS -- AT LAUNCH (cont.)

MODIS DATA PRODUCT	ANCILLARY PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
J. Detach Coccolith Concent. E.huxleyi	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
K. Dissolved Organic Matter, Case 1, Glbl	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
	Airborne Laser-Induced Dissolved Organic Matter, Chlorophyll Phyco. Fluorescence	μg, Mol - or - mg/m^3	±15%	± 8%	0.001 km	Each Pass	Regional	Hoge	Algorithm Derivation/Validation Overflight of cruise
L. Diss Organic Matter, Southern	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
M. Sea Ice (Max. Total Extent)									
N. Phycoerythrin Concentration	Airborne Laser-Induced Phycoerythrin Fluo	mg/m^3	±15%	±8%	0.001 km	Overflight	Regional	Hoge	NASA P-3 Airborne Oceanographic LIDAR.
	Shipboard Laser-Induced Phycoerythrin Fluo	mg/m^3	±15%	±5%	0.001 km	Ship Cruises	Regional	Hoge	NASA Shipboard Laser on other ships.
	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
O. Single Scattering Aerosol Radiance	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
P. Aerosol Angstr. Exp.,Opt Depth	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
Q. Total Suspended Solids	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU
R. Calibration Data Sets	Surface Winds	m/sec	±2-4	±2	50 km	Daily*	Global		HIMSS, SCATT, ALT, NMC
	Total Ozone	Dobson	±5-10	±5	20-50 km	Daily*	Global		MODIS, AIRS/AMSU, TOMS
	Surface Pressure	mb	±2-4	±2-4	20-50 km	Daily*	Global		NMC, AIRS/AMSU

ATMOSPHERE -- POST LAUNCH:

MODIS DATA PRODUCT	ANCILLARY PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
									MODIS
A. Aerosol Single Scat. Albedo	At-Launch Aerosol Prod.								MODIS
C. Cloud Jnt.Prob.Dens.Funct	All level 2 Cloud Products Radiances								MODIS Level 1.

Italics indicate changes made prior to the Jan-Feb MST meeting. Shaded blocks indicate changes made 6 Mar '90

Updated 6 March, 1990

I. REQUIRED ANCILLARY DATA (continued):

OCEANS -- POST LAUNCH

MODIS DATA PRODUCT	ANCILLARY PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Primary Prod,Case I	chla				20 km	daily	Global		MODIS
	incident PAR	quanta/cm^2 sec	±15%	±5%	20-100 km	daily	Global	Esaias/Guenth	?MODIS, CERES, *Guenther/Tanre*
	KPAR	per m	±15%	±5%	20-100 km	daily	Global	Gordon	
	Winds. Sea Surface Pressure	m^2/sec	±2 m/s	±2 ms	20-100 km	daily		?	HIMSS, SCATT, NMC
	SST	K	1°	±0.5%	20 km	daily		Brown/Barton	
	in-situ (primary productivity/chla)	gC/m^2/day	±25%	±15%		Week/Month	Regional		
B. Chlorophyll Conc. From Fluorescence	Incident Irradoamce, motor					Each Pass			MODIS
	Winds, Sea Surface Pressure	m/sec, mb			1-20 km	Daily/Weekly	Global/Region	Esaias?	Esaias input.
E. Surface Incident PAR (h nu) Keb	Winds, Sea Surface Pressure	m/sec, mb			1-100 km	Daily	Global	Esaias?	Esaias input.
	AVHRR (NOAA)				1-100 km	Daily	Global	Esaias?	Esaias input.
	GOES (NOAA)				1-100 km	Daily	Global	Esaias?	Esaias input.
F. Attenuation of PAR	Winds. Sea Surface Pressure	m/sec, mb			1-20 km	Daily/Weekly	Global	Esaias?	Esaias input.
G. Pigment Concentration (Curvature)	Winds, Sea Surface Pressure	m/sec, mb			1-20 km	Daily/Weekly	Regional	Esaias?	Esaias input.
H. Beam Attenuat. Coeff	Winds, Sea Surface Pressure	*m/sec, mb*			1-20 km	Daily/Weekly	Global	Esaias?	Esaias input.
J. Organic Fraction	Winds, Sea Surface Pressure	m/sec, mb			1-20 km	Daily/Weekly	Global	Esaias?	Esaias input.
L. Currents, Fronts, Eddies									

Italics indicate changes made prior to the Jan-Feb MST meeting. Shaded blocks indicate changes made 6 Mar '90

Updated 6 March, 1990

II. MODIS VALIDATION DATA PRODUCTS:

Ancillary/Validation/Interim/Derivative Data Products (MODIS)

ATMOSPHERE - VALIDATION

MODIS DATA PRODUCT	VALIDATION PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Cloud Optical Thickness	Temperature Profile								MODIS
	Moisture Profile								MODIS
	Total Precipitable Water Vapor								MODIS
C. Cloud Effective Emissivity	Temperature Profiles				1 km				MODIS. 2-3 km Vertical Resolution.

OCEANS - VALIDATION

MODIS DATA PRODUCT	VALIDATION PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Chlorophyll-A Concentration (Case I)	Incident Spectral Irradiance-Ed,Z(0,+)	µW/cm^2/nm	5%	1-2%	sealevel		local	Clark	Buoy and ship measurements
	Downwelled Spectral Irradiance-Ed,Z	µW/cm^2/nm	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Upward Spectral Radiance-Lu	µW/cm^2/nm/sr	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Water-Leaving Spectral Radiances-Lw	µW/cm^2/nm/sr	8%	3%	±0		local	Clark	Buoy and ship meas., act. + normalized
	Spectral Beam Attenuation Coeff.-c	per meter	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Diffus.Atten.Coef.Downwel.Irrad.-KEd	per meter	5%	2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Diffus. Atten. Coef. Upwel. Rad.-KLu	per meter	5%	2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Humic and Fulvic acids	mg/m^3	±10%	±3%	dZ=5m		local	Carder	Ship measurements
	Particle absorption *coefficient*	per m	±10%	±4%	dZ=5m		local	Carder	Ship measurements
	Detrius absorption coefficient	per m	±15%	±6%	dZ=5m		local	Carder	Ship measurements
	Backscattering coefficient bb	per m	±7%	±4%	dZ=5m		local	Carder	Ship measurements
	Total Dissolved Organic Carbon	mg/m^3	TBD	TBD	dZ=5m		local	Carder	Ship measurements
	Spectral Solar Atmos. transmission (Ta)	percent	NA	1%			local	TBD	Ship Shore stations
	AOL fluorescen(*DOM,Chl a, Phycoerythrin*)	*mg/m^3*	±15%	±8%	near sfc.		0.01 km av	Hoge	Overflights of cruises, moorings
	Airborne Radiances (Lw 410-750 nm)	µW/cm^2/nm/sr	±10%	±5%	near sfc.		0.01 km av	Hoge	Overflights of cruises, moorings
B. Chlorophyll-A Concentration (Case II)	In-Situ Validation Observations see A.	µg/liter	±10%	±2%	Test Site	TBD	Test Site	Hoge?	Hoge input. Mid-Atlantic Bight
C. Chlorophyll Fluorescence (Line Height)	In-Situ Validation Observations		±10%	±2%	Test Site	TBD	Test Site	Hoge?	Hoge input. Mid-Atlantic Bight.
Chlorophyll Fluorescence (Curvature)	Incident Spectral Irradiance-Ed,Z(0,+)	µW/cm^2/nm	5%	1-2%	sealevel		local	Clark	Buoy and ship measurements
	Downwelled Spectral Irradiance-Ed,Z	µW/cm^2/nm	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Upward Spectral Radiance-Lu	µW/cm^2/nm/sr	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Water-Leaving Spectral Radiances-Lw	µW/cm^2/nm/sr	8%	3%	±0		*local*	*Clark*	*Buoy and ship meas., act. + normalized*
	Spectral Beam Attenuation Coeff.-c	per meter	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Diffus.Atten.Coef.Downwel.Irrad.-KEd	*per meter*	5%	2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Diffus. Atten. Coef. Upwel. Rad.-KLu	per meter	5%	2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Fluoresc. Line Magnit. @685 nm- FLM(z)	1 m	10%	4%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Spectral Reflec.(or Radiance)Factor-RL	percent	5%	2%	dZ=1m,0<Z<150m		local	Clark	*Ship measurements, at depth and in air*
	Phyt.Pig(Fluor.Tech)Chlor.a+Phaeopig.a	mg/m^3	15%	10%	dZ=5m		loc.,along trak	Clark	Ship measurements
	Phytoplankton Pigm.(HPLC Technique)	nanomoles/liter	5%	1-2%	dZ=5m		loc.,along trak	Clark	Ship measurements
	Phycobilipigments (mg/m^3)	mg/m^3	TBD	TBD	dZ=5m		loc.,along trak	TBD	Ship measurements
	Spectral Solar Atmos. transmission (Ta)	percent	NA	1%			local	TBD	Ship Shore stations
	AOL fluorescen(DOM,Chl a, Phycoerythrin)	mg/m^3	±15%	±8%	near sfc.		0.01 km av	Hoge	Overflights of cruises, moorings
5	Airborne Radiances (Lw 410-750 nm)	µW/cm^2/nm/sr	±10%	±5%	near sfc.		0.01 km av	Hoge	Overflights of cruises, moorings

Italics indicate changes made prior to the Jan-Feb MST *meeting. Shaded blocks indicate changes made 6 Mar '90*

Updated 6 March, 1990

OCEANS - VALIDATION (cont.)

MODIS DATA PRODUCT	VALIDATION PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
D. Pigment Concentration (CZCS)	see C. Except for Fluoresc. Line Magnit.								
E. Ocean Prim. Productivity (Empirically)	See L. Except for Humic and Fulvic Acids								
	Also, Photosynth.Active Radiat.(400-700nr	#quanta/s/m^2	5%	2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Also, Primary Productivity (14-C)	mg C/m^3/hr	±20-100%	±5-10%	TBD		loc.,along trak	Clark	Ship measurements
	Also, Backscatter profile	per meter	TBD	TBD	2m in z			Hoge	Overflights, upper 5 optical depths
F. Regional Sea Surface Temperatures	In-Situ Validation Observations	°K	0.5°K	0.15°K	2 km	Pass±15 min		Brown	Brown input. ±1 km position on Earth grid.
	In-Situ Validation Observations	°K		±0.1°K		Daily	Local	Barton?	Barton input. Ship & buoy measurements.
	Temperature	°C	0.04°C	0.001°C	dZ=1m,0<Z<150m		loc.,along trak	Clark	Ship measurements, Buoys ±0.2 Acc.
	IR Surface Brightness Temperature	°K	0.5K	10%			loc.,along trak	TBD	Ship measurements
G. Global Sea Surface Temperatures	See F.								
H. Water-Leaving Radiance (Visible)	See A.								
I. Attenuation (Kd) at 490nm, (Case I)	See L.								
	Also, Photosynth. Active Rad. (400-700nm)								
J. Detached Coccolith Conc. (E. huxleyi)	See A. Except for Humic and Fulvic Acids								
	also, Coccolith Co..centration	mg CaCO3,#/m^3	±10%	±5%	dZ=5m		local	Clark	Ship measurements
K. Dissolved Organic Matter Case 1 Global	See A.								
L. Dissolved Organic Matter, Southern	In-Situ Validation Observations	µg/liter	±10%	±2%	Test Site	TBD	Test Site	Hoge?	Hoge input. Mid-Atlantic Bight.
	See A. Except for AOL Fluorescence and Airborne Radiances								
M. Sea Ice (Maximum Total Extent)	Spectral Solar Atmos. transmission (Ta)	percent	NA	1%			local	TBD	Ship Shore stations
N. Phycoerythrin Concentration	In-Situ Validation Observations	µg/liter	±10%	±2%	Test Site	TBD	Test Site	Hoge?	Hoge input. Mid-Atlantic Bight.
	See A, except for Humic & Fulvic Acids								
	also, Phycoerythrin fluores. (ship laser)	mg/m^3	±15%	±5%	near sfc.		0.01 km av	Hoge	Ship measurements
O. Single Scattering Aerosol Rad., ta < 0.6	See D.								
P. Aerosol Angstrom Exp., Optical Depth	Incident Spectral Irradiance-Ed,Z(0,+)	µW/cm^2/nm	5%	1-2%	sealevel		local	Clark	Buoy and ship measurements
	Downwelled Spectral Irradiance-Ed,Z	µW/cm^2/nm	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Upward Spectral Radiance-Lu	µW/cm^2/nm/sr	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Water-Leaving Spectral Radiances-Lw	µW/cm^2/nm/sr	8%	3%	±0		local	Clark	Buoy and ship meas., act. + normalized
	Spectral Beam Attenuation Coeff.-c	per meter	5%	1-2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Diffus.Atten.Coef.Downwel.Irrad.-KEd	per meter	5%	2%	dZ=1m,0<Z<150m		local	Clark	Buoy and ship measurements
	Spectral Reflec.(or Radiance)Factor-RL	percent	5%	2%	dZ=1m,0<Z<150m		local	Clark	Ship measurements, at depth and in air
	Phyt.Pig(Fluor.Tech)Chlor.a+Phaeopig.a	mg/m^3	15%	10%	dZ=5m		loc.,along trak	Clark	Ship measurements
	Phytoplankton Pigm.(HPLC Technique)	nanomoles/liter	5%	1-2%	dZ=5m		loc.,along trak	Clark	Ship measurements
	Phycobilipigments (mg/m^3)	mg/m^3	TBD	TBD	dZ=5m		loc.,along trak	TBD	Ship measurements
	Spectral Solar Atmospheric Transmission(	per cent	N/A	1%			Local	TBD	Ship, shore stations, sun photometer.
Q. Total Suspended Solids	See A, except for Humic & Fulvic Acids								
	Total Suspended Matter (TSM) concen.	g/m^3	10%	5%	dZ=5m		loc.,along trak	Clark	Ship measurements
	Organic Suspended Matter Concen.	g/m^3	10%	5%	dZ=5m		loc.,along trak	Clark	Ship measurements
	Inorganic Suspended Matter Concen.	g/m^3	10%	5%	dZ=5m		loc.,along trak	Clark	Ship measurements
R. Calibration Data Sets	See L.								

III. MODIS INTERIM DATA PRODUCTS:

The products given below will be available in the process of producing the at- or post-launch data products.

ATMOSPHERE -- AT LAUNCH

MODIS DATA PRODUCT	INTERIM PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
H. Spec.Aerosol Opt.Thk.ocean	Aerosol Optical Thickness				214/428 m	Daily			
Spec.Aerosol Opt.Thk.land	Aerosol Optical Thickness				214/428 m	Daily			
K. Atmosph. Stabil.(lift. ind.)	Temperature Profile								3 levels. archivable
	Dew-point Temperature								2 levels. archivable
L. Total Precipitable Water	Total Precipitable Water				Pixel				

OCEANS -- AT LAUNCH:

MODIS DATA PRODUCT	INTERIM PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
H. Water Leaving Radiance	Raleigh Radiance	µw/am^2 sr.m	±5%						Esaias input. Several bands.
	Sea Surface Winds from Glitter	m/s	TBD	TBD	1, 20 km	Daily	Regional/Globa	Gordon	Uses MODIS-N vis. land bands lookng into glit
J. Detached Coccolith Conc. (E. huxleyi)	Total Backscattering Coefficient (bb)	per meter	±25%	±10%	1, 20 km	Day/Wk/Mon	Regional/Globa	Gordon	Computed in E. huxleyi blooms w/model.
	Coccolith Backscattering Coefficient (bb)*	per meter	±25%	±10%	1, 20 km	Day/Wk/Mon	Regional/Globa	Gordon	Intermediate to Coccolith concentration.
	Total Backscattering - Phytoplankton	soft, med., hard	TBD	TBD	1, 20 km	Day/Wk/Mon	Regional/Globa	Gordon	Classif. of scattrers in Coc.-free wtrs. Specul
L. Sea Ice (Maximum Total Extent)	Cloud Identification	Km^2	TBD		1-10 km	Daily/Weekly	Global/Regionl		Differentiation&subtraction importnt. Ardanu
N. Phycoerythrin Concentration	Along-Track Laser-Induced Phycoerythrin and Chlorophyll Fluorescence; SST and DOM	counts	±15%	±6%	0.001 km	Each Pass	A/c overflight of Cruise Site	Hoge	Produced from airborne ancillary products. Esaias input. Several bands.
	Total Scattering Coefficient b	per meter	TBD	±15%	1, 20 km	Daily/Weekly	Global	Gordon	(Carder)
	Phytoplankton Scattering Coefficient b*	per meter	TBD	±20%	1, 20 km	*Daily/Weekly*	Global	Gordon	(Carder)
	b - b*	per meter	TBD	±20%	1, 20 km	Daily/Weekly	Global	Carder	
	Total Absorptance	per meter	TBD	±115%	1, 20 km	Daily/Weekly	Global	Carder	
	Phytoplankton Absorptance (a/p)	per meter	TBD	±20%	1, 20 km	Daily/Weekly	Global	Carder	
	Non-phytoplankton Absorp.(a/other)	per meter		±20%	1-20 km	Daily/Weekly	Global	Carder	
	Glint Field	Dimensionless	N/A	N/A	1, 20 km	Daily	Global	Evans/Gordon	

ATMOSPHERE -- POST LAUNCH:

MODIS DATA PRODUCT	INTERIM PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
B. Cloud Area & Perimeter Geometry	Cloud Area & Perimeter- Geometry	km^2 & km	N/A	N/A	Pixel	Monthly	Global	Kaufman	

Italics indicate changes made prior to the Jan-Feb MST meeting. Shaded blocks indicate changes made 6 Mar '90

Updated 6 March, 1990

III. MODIS INTERIM DATA PRODUCTS (continued):

LAND -- POST LAUNCH:

MODIS DATA PRODUCT	INTERIM PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Hemispheric Reflectance	BRDF/Albedo	dimensionless			1-10 km	Daily/Weekly	Global/Region	Huete?	Huete input.
B. Nadir Reflectance	BRDF/Albedo	dimensionless			1-10 km	Daily/Weekly	Global/Region	Huete?	Huete input.
C. Atmospheric Correct. (Transmittance)	BRDF/Albedo	dimensionless			1-10 km	Daily/Weekly	Global/Region	Gordn/Susknd	Huete input.
D. Atmospheric Correct. (Transmittance)	Level-2 Leaving Rads.	dimensionless			Pixel size	Daily	Global/Region	Gordn/Susknd	Ardanuy input.

OCEANS -- POST LAUNCH:

MODIS DATA PRODUCT	INTERIM PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Primary Productivity, Case I Waters	Depth of Euphatic Zone Zen Euphatic Biomass	m mgChl/m^2	±10% ±20%	±5%	20-100 km	Week/Month Monthly	Global/Region Regional	Esaias	

IV. MODIS DERIVATIVE DATA PRODUCTS:

The products given below will be easily developed from the At-Launch product, and would be expected in the Post-Launch period.

ATMOSPHERE -- AT LAUNCH:

MODIS DATA PRODUCT	DERIVATIVE PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Cloud Optical Thickness	Cloud Joint Probably Density Cloud Characterization Statistic				1°	Daily/Month	Global	King King	Requires clustering of several cloud prod.
B. Cloud Fractional Area	Cloud Type				1°			Kaufman ?	At-Launch? Multidim. Histogram.Level 3
C. Cloud Effective Emissivity	Emissivity							Menzel	Requires B for input

OCEAN -- AT LAUNCH:

MODIS DATA PRODUCT	DERIVATIVE PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
N. Phycoerythrin Concentration	Phytoplankton Speciation Variabil. Images	Dimensionless	200%	±50%	1,20 km	Daily/Weekly	Reg./Global	Hoge	Chlorophyll-normalized phycoerythrin images

OCEAN -- POST LAUNCH:

MODIS DATA PRODUCT	DERIVATIVE PRODUCT/PARAMETER	MEASUREMENT UNITS	ABSOLUTE ACCURACY (std. error)	PRECISION (RELATIVE ACCURACY)	RESOLUTION (SPATIAL or VERTICAL)	PRODUCT TEMPORAL RESOLUTION	SPACE SCALE	RESPONSIBLE SCIENTIST	COMMENTS
A. Primary Productivity, Case I Waters	Ecological Efficiency	gmC/Quanta	±50%	TBD	50 km	Wk/Mon/Yr	Reg./Global	Esaias	

Italics indicate changes made prior to the Jan-Feb MST meeting. Shaded blocks indicate changes made 6 Mar '90

Updated 6 March, 1990

MODIS COST PROPOSAL - COST ELEMENT - PRODUCT PRODUCTION

	COST ELEMENT	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
11.0	SCIENCE TOTAL											
	Program Management											
	Program Support											
	Field Experiments											
	Experiment design											
	Experiment hardware											
	Experiment operations											
	Equipment design											
	Ground equipment											
	Equipment repair											
	Shipping											
	Software development											
	Data analysis											
	Calibration											
	Travel											
	Meetings											
	Travel											
	Pubs/Documentation											
	Laboratory Research											
	Modelling/Simulations											
	Ancillary Data											
	Purchase											
	Analysis											
	Office Expenses											

Cost-Labor budget brought out to year 2001, updated on 6 April 1990

27 February, 1990

Attachment 6

MODIS COST PROPOSAL - COST ELEMENT - PRODUCT PRODUCTION

	COST ELEMENT	1991	1992	1993	1994	1995	1996	1997	1998	1999
12.0	COMPUTER TOTAL									
	Hardware									
	Purchase									
	Mainframes									
	PC's									
	Workstations									
	Monitors									
	Image display									
	Printers									
	Drives									
	Networking									
	Memory									
	Documents									
	Other									
	Installation									
	Upgrades									
	Maintenance/Repair									
	Lease									
	Use time									
	Software (Licenses)									
	Operations (supplies)									
	Programmer(s)									

MODIS COST PROPOSAL - COST ELEMENT - PRODUCT PRODUCTION

	COST ELEMENT	1991	1992	1993	1994	1995	1996	1997	1998	1999
13.0	PROD. PRODUCTION TOT.									
	Definition									
	Systems Design									
	Utility Definition/Dev.									
	Algorithms									
	Conceptualization									
	Development (Math)									
	Limitation determin.									
	Coding									
	Design									
	Write/compile/debug									
	Reviewing (travel)									
	Integration									
	Simulation									
	Collect data									
	Modelling									
	Error analysis									
	Systems Test Review									
	Quality Control Defin.									
	Validation									
	Documentation									
	Journal Pubs.									
	Operator's Guide									
	Users' Guide									

27 February, 1990

MODIS COST PROPOSAL - LABOR ELEMENT - PRODUCT PRODUCTION

	LABOR ELEMENT	1991	1992	1993	1994	1995	1996	1997	1998	1999
11.0	SCIENCE TOTAL									
	Program Management									
	Program Support									
	Publications									
	Field Experiments									
	Experiment design									
	Experiment hardware									
	Experiment operations									
	Equipment design									
	Ground equipment									
	Equipment repair									
	Shipping									
	Software development									
	Data analysis									
	Calibration									
	Meetings									
	Laboratory Research									
	Modelling/Simulations									
	Ancillary Data Analysis									
12.0	COMPUTER TOTAL									
	Programmer(s)									
	Operations									
	Hardware									
	Installation									
	Maintenance									
	Repair									

27 February, 1990

MODIS COST PROPOSAL - LABOR ELEMENT - PRODUCT PRODUCTION

	LABOR ELEMENT	1991	1992	1993	1994	1995	1996	1997	1998	1999
13.0	PROD. PRODUCTION TOT.									
	Definition									
	Systems Design									
	Utility Definition/Dev.									
	Algorithms									
	Conceptualization									
	Development (Math)									
	Limitation determin.									
	Coding									
	Design									
	Write/compile/debug									
	Reviewing (travel)									
	Integration									
	Simulation									
	Collect data									
	Modelling									
	Error analysis									
	Systems Test Review									
	Quality Control Defin.									
	Validation									
	Documentation									
	Journal Pubs.									
	Operator's Guide									
	Users' Guide									

MODIS SCIENCE TEAM MEETING
JAN 31 - FEB 2, 1990
NASA/GSFC, GREENBELT, MD 20770

(HAND OUTS ARRANGED IN THE ORDER OF THE AUTHORS' NAMES)

1. MODIS Characterization System (MCS):.....J. Barker
   In-House Engineering Team Activity
   in Team Leader's Computing Facility
   (TLCF)

2. MODIS UPDATE .....W. BARNES

3. Bidirectional Reflectance Distribution ...M. Barnesly
   Function (BRDF) Sampling Capabilities

4. MODIS Communications .....B. Conboy

5. (a) Calibration Management Plan Outline
   (b) Calibration Requirements & Constraints..B.Guenther

6. MODIS Science Data Product Documentation..D. Han
   Status

7. MODIS Data Study Team Minutes

8. At- & Post-Launch MODIS "Land" ...A. Huete
   Data Products

9. "Land" Discipline Group Data ...C. Justice
   Products & Issues

10. Atmospheric Corrections for MODIS . ..Y. Kaufman & D. Tanre

11. Atmosphere Discipline Status Report ....M. King

12. MODIS-T Instrument Status Report ...T. Magner

13. Topographic Corrections for MODIS-T ...J -P. Muller

14. Aircraft Support for BRDF, ...J-P. Muller & M. Barnesly
    surface roughness, canopy geometry,
    topographic corrections

15. MODIS Team Member Proposals ... V. Salomonson and A. Fleig

16. Regional Scale Model .. .S. Running

17. Probable Calibration/Characterization .. P. Slater

18. Modeled BRDF ... A. Strahler

Attachment 7

19. Land Cover Data product ... A. Strahler

20. BRDF Product and Albedo Product ... A. Strahler

21. Improved NDVI Taking Polarization in to Account ... V. Vanderbilt

22. Surface Temperature and Emissivity ... Z. Wan