MODIS DATA SYSTEM STUDY

TEAM PRESENTATION

March 10, 1989

AGENDA

1. Status of the MODIS Data System Study Task

   --Proposed Deliverables
   --Proposed Milestone Chart

2. Proposed Agenda for Presentation to the MODIS Science Team

3. Proposed MODIS Data Product Identification Code

4. MODIS Data Product Table

   --Land Studies
   --Ocean Studies
   --Atmospheric Studies
   --Calibration Studies

5. Issues Affecting MIDACS Structure and Function

Status of the MODIS Data System Study
Proposed Deliverables

1. Preliminary MODIS Data Requirements Document

Purpose: To document the description, path, requirements, attributes, and impacts of all data types required by the MODIS data system to fulfill the requirements of the MODIS science team.

Anticipated Delivery Date: March 1989

2. MODIS Data System Scenario For Science Team Members

Purpose: To introduce to the MODIS science team members the present concept of how the MODIS data system will support their proposed activities.

Anticipated Delivery Date: March 1989

3. Preliminary Team Member Science Data Product Summary

Purpose: To summarize, consolidate, and categorize the joint set of MODIS data products proposed by the science team members.

Anticipated Delivery Date: April 1989

4. EosDIS/MIDACS Interface Commonality Report

Purpose: To compare the points of similarity and difference between the MIDACS and EosDIS interface concepts, particularly regarding the MODIS ICC, IST, TMCF, CDHF, and DADS.

Anticipated Delivery Date: April 1989

5. Non-Advocacy Review Materials

Purpose: To support the Eos nonadvocacy review in the area of the MODIS data system, science team requirements, and proposed data products.

Anticipated Delivery Date: May 1989

6. Input Data Attributes Report

Purpose: To identify, quantify, and develop the set of attributes for all ancillary and auxiliary input data required to generate the proposed MODIS data products.

Anticipated Delivery Date: June 1989

7. MODIS Data Product Algorithm Report

Purpose: To identify, quantify, and evaluate the set of algorithms required to generate the proposed MODIS data products.

Anticipated Delivery Date: July 1989

8. Team Member Data Product Analysis Report

Purpose: The document the functional and performance requirements on the MODIS data system that result from the generation of the set of proposed MODIS data products.

Anticipated Delivery Date: August 1989

9. MODIS SDST and ICT Requirements Document

Purpose: The document the functional and performance requirements on the MODIS data system that result from the need to provide general support to the Science Data Support Team (SDST) and the Instrument Characterization Team (ICT) within the MODIS TLCF.

Anticipated Delivery Date: September 1989

10. MODIS Data Requirements Document

Purpose: To document the description, path, requirements, attributes, and impacts of all data types, including all MODIS data products, required by the MODIS data system to fulfill the requirements of the MODIS science team.

Anticipated Delivery Date: October 1989

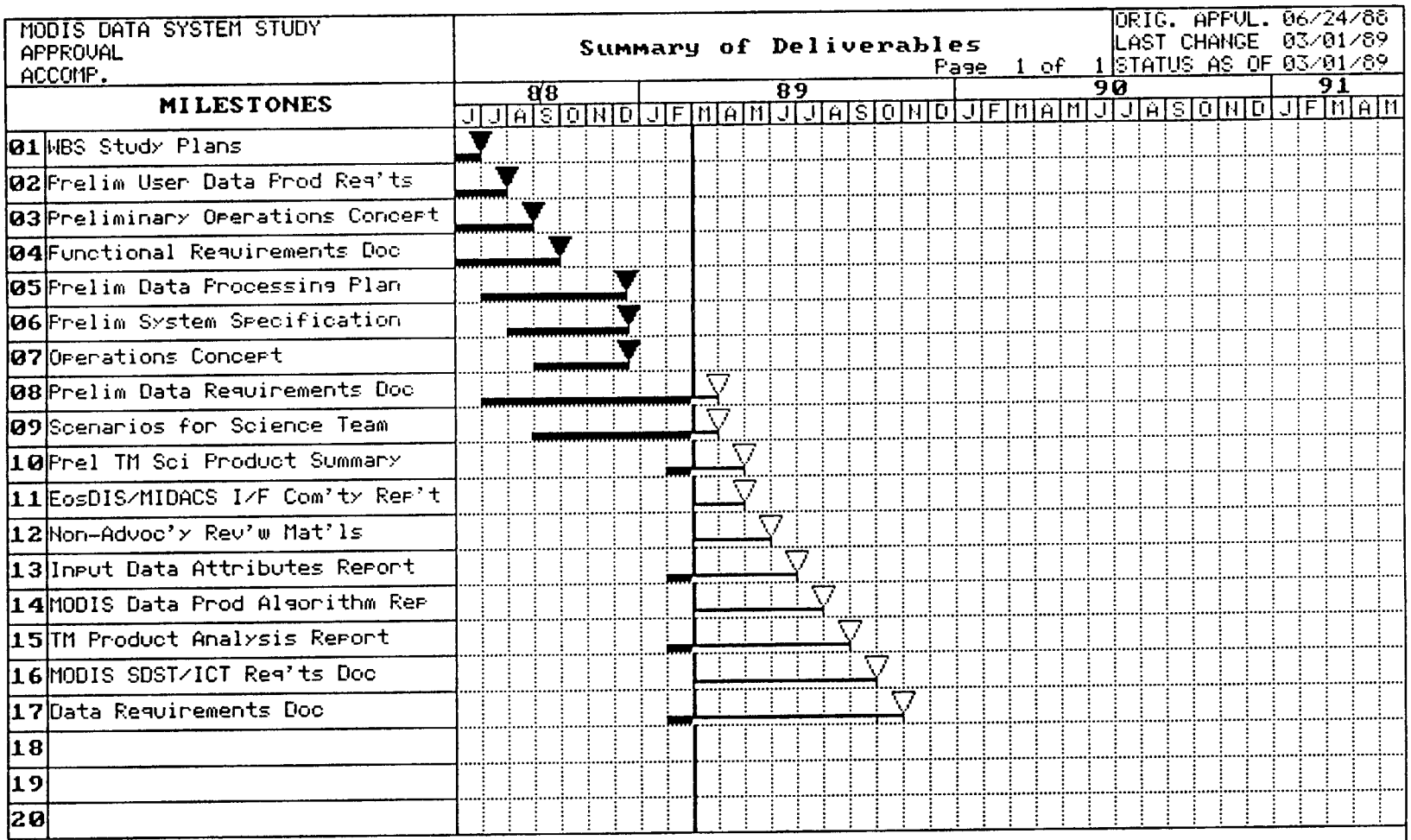
11. Other Deliverables

As required (for example, in response to EosDIS documentation or changes impacting MIDACS, or evolutions in the objectives and understanding of the MODIS science team members), documents will be prepared and issued that identify and advocate the requirements of the MODIS science team and analyze the developments in light of the requirements.

MODIS DATA SYSTEM STUDY
APPROVAL
ACCOMP.

Summary of Deliverables

ORIG. APPVL. 06/24/88
LAST CHANGE 03/01/89
STATUS AS OF 03/01/89



	MILESTONES
01	WBS Study Plans
02	Prelim User Data Prod Req'ts
03	Preliminary Operations Concept
04	Functional Requirements Doc
05	Prelim Data Processing Plan
06	Prelim System Specification
07	Operations Concept
08	Prelim Data Requirements Doc
09	Scenarios for Science Team
10	Prel TM Sci Product Summary
11	EosDIS/MIDACS I/F Com'ty Rep't
12	Non-Advoc'y Rev'w Mat'ls
13	Input Data Attributes Report
14	MODIS Data Prod Algorithm Rep
15	TM Product Analysis Report
16	MODIS SDST/ICT Req'ts Doc
17	Data Requirements Doc
18	
19	
20	

Note:

PROPOSED AGENDA FOR PRESENTATION TO THE MODIS SCIENCE TEAM

CONFIGURATION OF THE MODIS DATA SYSTEM

1. The MODIS Data System in the EosDIS Environment
2. Context and Data Flows for the MODIS Data System
3. Functional Allocations within the MODIS Data System
   - 3.1 ICC
   - 3.2 IST
   - 3.3 TMCF
   - 3.4 CDHF
   - 3.5 DADS
4. The Team Member Computing Facility
   - 4.1 ICT
   - 4.2 SDPT

OPERATION OF THE MODIS DATA SYSTEM

1. Routine Interactions
2. Field Experiment Support
3. Algorithm Development and Implementation
4. MODIS Calibration and Characterization Support
5. Observations of Targets of Opportunity

MODIS DATA PRODUCTS

1. Calibration Data Products
2. Ocean Data Products
3. Land Data Products
4. Atmosphere Data Products

ISSUES OF INTEREST TO THE SCIENCE TEAM

1. Accuracy Requirements for the MODIS Navigation
2. Bit Error Rate Requirements for the Raw MODIS Data
3. Completeness Requirements for the MODIS Level-0 Data
4. Granularity Requirements for the MODIS Level-1 to -4 Data
5. Interdependence of MODIS Data Products

MODIS DATA PRODUCT IDENTIFICATION CODE

Sequential Identification Number:

001-999

Product Level:

L1 Level-1A/B
L2 Level-2
L3 Level-3
L4 Level-4

Product Category:

C Calibration
O Ocean
L Land
A Atmosphere

Originating Team Member:

MA Mark R. Abbott
IB Ian Barton
OB Otis B. Brown
KC Kendall L. Carder
DC Dennis K. Clark
WE Wayne Esaias
RE Robert H. Evans
HG Howard R. Gordon
FH Frank E. Hoge
AH Alfredo R. Huete
CJ Christopher O. Justice
YK Yoram J. Kaufman
MK Michael D. King
WM W. Paul Menzel
JM Jan-Peter Muller
JP John Parslow
SR Steven W. Running
PS Philip N. Slater
AS Alan H. Strahler
JS Joel Susskind
VS Vincent V. Salomonson
DT Didier Tanre
VV Vern Vanderbilt
ZW Zhengming Wan

Examples:

001L2AMK is a Level-2 MODIS data product for the atmosphere originated by Mike King.

002L3LVS is a Level-3 MODIS data product for land originated by Vince Salomonson.

MODIS DATA PRODUCT TABLES

The attached tables relate the data products proposed by the 24 members of the MODIS science team to the input data requirements for each product. The proposed MODIS data products are subdivided into calibration data products, oceanographic data products, land (terrestrial) data products, and atmospheric data products. The proposed input data required for the generation of each product is categorized into MODIS-N spectral channels, MODIS-T spectral channels (both of which are Level-1 data), other MODIS data products (Level-2 through Level-4), other Eos instrument data, non-Eos remotely sensed instrument data, and conventional or in-situ data. The data products are identified following the proposed MODIS data product identification code.

Future improvements to this table include:

1. The merging and elimination of duplicate data products, when appropriate. However, it is recognized that two or more equally valid versions of data product may be produced from quite different algorithms founded from entirely independent theoretical origins. The science team may wish to retain more than one of the parameter estimates.

2. The conceptualization of intermediate-level data products to support the generation of the data product at the level proposed by the investigator. For example, a proposed time and space averaged (Level-3) data product may first require the generation of Level-2 estimates. Conversely, a data product proposed for Level-2 may be sufficiently important to warrant the generation of time and space averages.

3. The refinement of the various data sets required to generate each product. This topic has a fundamental bearing on the data system's requirements, as it impacts the products' interdependence, timeliness, and processing, storage, and communications requirements.

4. The inclusion of additional MODIS data products where deficiencies exist in the set of topics proposed by the selected science team members.

MODIS DATA ʼDUCT TABLE
CALIBRAT STUDIES

MODIS PRODUCT (CATEGORIZED BY STUDY)	MODIS-N	MODIS-T	OTHER MODIS DATA PRODUCTS	OTHER EOS INSTRUMENTS	NON-EOS REMOTELY SENSED DATA	CONVENTIONAL OR IN-SITU DATA
001LXCRE MODIS-N Calibration Coefficients (visible channels)	Visible channels TBD (Level-0 count data)	NONE	NONE	NONE	NONE	NONE
002LXCCB MODIS-N Calibration Coefficients (7 channels)	26,27,28,30,33,34, 35 (Level-0 data)	NONE	NONE	NONE	NONE	NONE
003LXCWM MODIS-N Calibration Coefficients (Thermal Channels)	Thermal Channels TBD (Level-0 data)	NONE	NONE	NONE	NONE	NONE
004LXCPS MODIS-N Calibration Coefficients (using ATCU)	ALL	NONE	NONE	NONE	NONE	Calibration data from Phase C/D contractors for ATCU
005LXCPS MODIS-N Calibration Coefficients (via intercomparisons over selected calibration targets)	All (Level-0 data)	NONE	MODIS-T data over calibration sites	HIRIS, AMRIR, and other multispectral sensors over White Sands, Edwards AFB, and other calibration sites TBD	TM, ETM, AVHRR, and AVIRIS over calibration sites	Calibration data from Phase C/D contractors
006LXCVS MODIS-N Calibration Coefficients (all channels)	All (Level-0 data)	NONE	MODIS-T Level-1B radiances for comparison	AMSR, AMRIR, and HIRIS for validation studies	SPOT and Landsat occasionally	PARABOLA measurements by investigator and others
007LXCJP MODIS-T Calibration Coefficients (selected channels)	NONE	TBD	NONE	NONE	NONE	NONE
008LXCJP MODIS-T Calibration Coefficients (using the moon as a calibration target)	NONE	TBD Lunar Observations	NONE	NONE	NONE	NONE
009LXCRE MODIS-T Calibration Coefficients (all channels)	1 to 64 (Level-0 data)	NONE	NONE	NONE	NONE	NONE
010LXCVS MODIS-T Calibration Coefficients (all channels)	NONE	All (Level-0 data)	MODIS-N Level-1B radiances for comparison	AMSR, AMRIR, and HIRIS for validation studies	SPOT and Landsat occasionally	PARABOLA measurements by investigator and others

011LXCYK MODIS Calibration Coefficients (blue-green channels using sunglint as a calibration target)	Blue-Green channels TBD	Blue-Green channels TBD	TBF	NONE	NONE	NONE
012LXCYK MODIS Calibration Coefficients (visible channels using deserts as calibration targets)	Visible channels TBD	Visible channels TBD	TBD	NONE	NONE	TBD
013LXC Destriping Algorithm	ALL	ALL	Calibration Coefficients	NONE	NONE	NONE
014LXCVS Level-0 to Level-1A Data Conversion Algorithm	All Level-0 counts data	All Level-0 counts data	NONE	NONE	NONE	Ground Control Points

MODIS DATA ATMOSPHE DUCT TABLE STUDIES

MODIS PRODUCT (CATEGORIZED BY STUDY)	MODIS-N	MODIS-T	OTHER MODIS DATA PRODUCTS	OTHER EOS INSTRUMENTS	NON-EOS REMOTELY SENSED DATA	CONVENTIONAL OR IN-SITU DATA
101LXAAS Atmospheric Correction Algorithms	TBD	TBD	TBD	TBD	TBD	TBD
102LXAAS Registration Algorithms for Tilt-Pass Products	TBD	TBD	TBD	TBD	TBD	TBD
103LXAAS Inversion Algorithms for Estimation of Bidirectional Reflectance Distribution Function (BRDF) (sr^{-1})	TBD	TBD	TBD	TBD	TBD	TBD
104L2AAS BRDF (sr^{-1})	NONE	24 channels (Level-1B radiances)	NONE	NONE	NONE	Plant canopy structure at 6 to 10 sites
105LXAAS Rectification Algorithms for BRDF Products (Level-3)	TBD	TBD	TBD	TBD	TBD	TBD
106L2AAS Production Mode Spectral Directional Radiance ($W/m^2/sr$)	NONE	24 Channels (Level-1B radiances)	NONE	NONE	NONE	Plant canopy structure at 6 to 10 sites
107L2AAS Production Mode Spectral Surface Radiance ($W/m^2/sr$)	NONE	24 channels (Level-1B radiances)	NONE	NONE	NONE	Plant canopy structure at 6 to 10 sites
108LXAAS Inversion Algorithms for Canopy Structure	TBD	TBD	TBD	TBD	TBD	TBD
109LXAAS Algorithms for Estimation of Green Biomass, Woody Biomass, IPAR, etc.	TBD	TBD	TBD	TBD	TBD	TBD
110L3AMK Degree of Polarization over the Oceans (dimensionless)	Polarization channels (17' to 19')	NONE	NONE	NONE	NONE	Ground-truth data by Dr. M. King
111L3AYK Global Aerosol Loading Map (dimensionless)	TBD	TBD	NONE	NONE	NONE	Sun-photometer-radiometer measurements for validation studies

112L3AYK Global Aerosol Size Distribution Map (dimensionless)	TBD	TBD	NONE	NONE	NONE	Sun-photometer-radiometer measurements for validation studies
113L3AMK Daytime Cloud Effective Particle Radius (um)	0.754, 1.640, and 2.130 micron channels	NONE	NONE	NONE	NONE	Ground-truth data by Dr. M. King
114L3AMK Aerosol Size Distribution over the Oceans (dimensionless)	0.435 to 0.865 micron channels (5 to 13)	NONE	NONE	NONE	NONE	Ground-truth data by Dr. M. King
115L3ADT Aerosol Size Distribution over Oceans (dimensionless)	All channels below 4 microns	NONE	MODIS-T Level-1B radiances over test sites	HIRIS LASA	NONE	Ground-truth observations over test sites
116L3ADT Aerosol Size Distribution over Deserts (dimensionless)	All channels below 4 microns	NONE	MODIS-T Level-1B radiances over test sites	HIRIS LASA	NONE	Ground-truth observations over test sites
117L4AYK Atmospherically Corrected Imagery	TBD	TBD	Global Aerosol Loading; Global Aerosol Size Distribution	NONE	NONE	NONE
118L4AYK Aerosol Effect on Cloud Albedo Studies	TBD	TBD	Global Aerosol Loading; Global Aerosol Size Distribution	HIRIS	AVHRR GOES	Sun-photometer-radiometer measurements
119L4AYK Biomass Burning Studies (%/unit area/unit time)	TBD	TBD	Global Aerosol Loading; Global Aerosol Size Distribution	HIRIS	AVHRR GOES	Sun-photometer-radiometer measurements
120L3AMK Daytime Cloud Thermodynamic Phase	0.754, 1.640, and 2.130 micron channels	NONE	NONE	NONE	NONE	Ground-truth data by Dr. M. King
121L3AMK Daytime Cloud Optical Thickness (dimensionless)	0.754, 1.640, and 2.130 micron	NONE	NONE	NONE	NONE	Ground-truth data by Dr. M. King
122L3AMK Aerosol Optical Depth over the Oceans (dimensionless)	0.435 to 0.865 micron channels (5 to 13)	NONE	NONE	NONE	NONE	Ground-truth data by Dr. M. King

123L3ADT Aerosol Optical Depth over Oceans (dimensionless)	All channels below 4 microns	NONE	MODIS-T Level-1B radiances over	HIRIS LASA	NONE	Ground-truth observations over test sites
124L3ADT Aerosol Optical Depth over Deserts (dimensionless)	All channels below 4 microns	NONE	MODIS-T Level-1B radiances over	HIRIS LASA	NONE	Ground-truth observations over test sites
125L3ADT Aerosol Absorption over Deserts (dimensionless if imaginary index of refraction is calculated)	All channels below 4 microns	NONE	MODIS-T Level-1B radiances over	HIRIS LASA	NONE	Ground-truth observations over test sites
126L3ADT Aerosol Optical Depth over Polar Regions (dimensionless)	All channels below 4 microns	NONE	MODIS-T Level-1B radiances over	HIRIS LASA	NONE	Ground-truth observations over test sites
127L4ADT Global Aerosol Climatology (dimensionless)	NONE	NONE	Aerosol Optical Depths, Size Distributions, and Absorption derived weekly or monthly	NONE	NONE	Comparisons to ground-based climatologies
128L4ADT Global Aerosol Transport Processes (including sources and sinks of desert aerosols)	NONE	NONE	Aerosol Optical Depths, Size Distributions, and Absorption derived weekly or monthly	NONE	NONE	Comparisons to ground-based climatologies
129L3AJS Cloud Top Pressure (mb)	14 channels (Level-1B radiances)	NONE	NONE	AMSU (Level-1 radiances); GOMR (Level-2 ozone profiles);	NONE	Radiosondes, ship and aircraft observations of surface pressure, temperature, wind, and moisture in Level-2 data product formats
130L3AWM 3-Day Mean Cloud Top Pressure (mb)	15 Thermal channels; 4 CO_2 channels	NONE	NONE	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
131L3AWM Global Monthly Cloud Top Pressure (mb)	NONE	NONE	3-day mean cloud top pressure	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
132L4AWM Global 4-Year Cloud Top Pressure Clima-	NONE	NONE	Global Monthly Mean Cloud Top Pressure	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation

133L3AJS Effective Cloud Fraction (%/unit area)	14 channels (Level-1B radiances)	NONE	NONE	AMSU (Level-1 radiances; GOMR (Level-2 ozone profiles)	NONE	Radiosondes, ship and aircraft observations of surface pressure, temperature, wind, and moisture in Level-2 data products formats
134L3AWM 3-Day Mean Cloud Extent (%/unit area)	15 Thermal Channels 4 CO_2 channels	NONE	NONE	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
135L3AWM Global Monthly Cloud Extent (%/unit area)	NONE	NONE	3-day mean cloud extent	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
136L4AWM Global 4-Year Cloud Climatology (%/unit area)	NONE	NONE	Global monthly mean cloud extent	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
137L3AWM 3-Day Mean Cloud Extent by Type (%/unit area)	15 thermal channels 4 CO_2 channels	NONE	NONE	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
138L3AWM Global Monthly Cloud Extent by Type (%/unit area)	NONE	NONE	3-day mean cloud Extent by type	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
139L4AWM Global 4-Year Cloud Type Climatology (%/unit area)	NONE	NONE	Global monthly mean cloud extent by type	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
140L3AJS Outgoing Longwave Radiation (W/m^2)	14 Channels (Level-1B radiances)	NONE	NONE	AMSU (Level-1 radiances); AIRS (subset of Level-1 radiances; GOMR (Level-2 ozone profiles	NONE	Radiosondes, ship and aircraft observations of surface pressure, temperature, wind, and moisture in Level-2 data product formats
141L3AJS Longwave Cloud Forcing (units TBD)	14 channels (Level-1B radiances)	NONE	NONE	AMSU (Level-1 radiances); AIRS (subset of Level-1 radiances; GOMR (Level-2 ozone profiles	NONE	Radiosondes, ship and aircraft observations of surface pressure, temperature, wind, and moisture in Level-2 data product formats
142L3AWM 3-Day Mean Cloud Emissivity (dimensionless)	15 thermal channels 4 CO_2 channels	NONE	NONE	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation

143L3AWM Global Monthly Cloud Emissivity (dimensionless)	NONE	NONE	3-day mean cloud Emissivity	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
144L4AWM Global 4-Year Cloud Emissivity Climatology (per unit area)	NONE	NONE	Global monthly mean cloud emissivity	NONE	AVHRR and HIRS via DOMSAT	MAMS and HIS underflights for validation
145LXADT Simulated MODIS-N Imagery Data	NONE	NONE	NONE	NONE	Landsat-TM or AVHRR for simulations	NONE
146L4ADT Vegetation Development Study (units TBD)	NONE	NONE	Aerosol Optical Depths, size distributions, and absorption derived weekly or monthly	NONE	NONE	Comparisons to ground-based derived studies
147L3ADT Global Ocean Color Map (units TBD)	All channels below 4 microns	NONE	MODIS-T Level-1B radiances over test sites	HIRIS LASA	NONE	Ground-truth observations over test sites

MODIS DATA]UCT TABLE
LAND JIES

MODIS PRODUCT (CATEGORIZED BY STUDY)	MODIS-N	MODIS-T	OTHER MODIS DATA PRODUCTS	OTHER EOS INSTRUMENTS	NON-EOS REMOTELY SENSED DATA	CONVENTIONAL OR IN-SITU DATA
201L3LVS Daily Outgoing Solar Exitance at Top of the Atmosphere (units TBD)	TBD	TBD	TBD	NONE	NONE	PARABOLA measurements by investigator
202L3LVS Daily Outgoing Thermal Exitance at Top of the Atmosphere (units TBD)	TBD	TBD	TBD	NONE	NONE	PARABOLA measurements by investigator
203L3LVS Daily Surface Downwelling Thermal Radiation (W/m^2)	TBD	TBD	NONE	NONE	NONE	PARABOLA measurements by investigator
204L3LVS Daily Surface Upwelling Thermal Radiation (W/m^2)	TBD	TBD	Land Surface Temperatures (not an identified data product for polar regions)	NONE	NONE	PARABOLA measurements by investigator
205L3LVS Daily Surface Downward Solar Radiation (W/m^2)	TBD	TBD	NONE	NONE	NONE	PARABOLA measurements by investigator
206L3LVS Daily Surface Reflected Solar Radiation (W/m^2)	TBD	TBD	Daily surface Downward solar radiation	NONE	NONE	PARABOLA measurements by investigator
207L3LVS Daily Surface Albedo (%)	NONE	NONE	Daily surface downward solar radiation and Daily Surface Reflected Solar Radiation	NONE	NONE	PARABOLA measurements by investigator
208L3LSR MODIS Normalized Difference Vegetation Index (NDVI)	2 Channels TBD (Level-1B radiance values)	2 Channels TBD (Level-1B radiance Values	NONE	NONE	NONE	NONE
209L3LCJ MODIS-N NDVI	2 Channels (Level-1B radiances)	NONE	TBD	NONE	NONE	NONE
210L3LSR Daily Net Photosynthesis Values (t C/ha/day)	NONE	NONE	MODIS NDVI	NONE	NONE	Canopy carbon conversion efficiency (g/MJ). Canopy or surface resistance factor

211L3LSR Daily Absorbed Photosynthetically Active Radiation (APAR) (W/m^2)	TBD	TBD	TBD	NONE	NONE	Incident solar radiation at test sites for validation studies
212L3LSR Weekly Net Photosynthesis Map (t C/ha/wk)	NONE	NONE	Daily Net Photosynthesis Values	NONE	NONE	NONE
213L4LSR Annual Net Primary Production (NPP) Map (t C/ha/yr)	NONE	NONE	Weekly Net Photosynthesis Values	NONE	NONE	Correlation and ecosystem models using weekly net photosynthesis values to derive aboveground NPP
214L4LCJ Global Phenology (10-day composite)	NONE	NONE	Daily MODIS-N NDVI	NONE	NONE	NONE
215L4LCJ Multi-Resolution Global Phenology	NONE	NONE	Daily MODIS-N NDVI High spatial and temporal resolution global phenology product	NONE	NONE	NONE
216L4LCJ Global Growing Season Length and Its Interannual Variability	NONE	NONE	MODIS-N Global Phenology	NONE	NONE	NONE
217L4LSR Canopy Leaf Area Index (LAI; dimensionless)	NONE	NONE	Weekly NDVI and perhaps others	NONE	NONE	Field experiment correlation studies
218L4LSR Biome Types (names)	NONE	NONE	Weekly NDVI and perhaps others	NONE	NONE	Field experiment correlation studies
219L4LCJ Grassland Biome Annual Production Estimates (units TBD)	NONE	NONE	MODIS-N NDVI	NONE	NONE	NONE
220L4LCJ Land Degradation in sub-Saharan Africa (units TBD)	NONE	NONE	MODIS-N NDVI	NONE	NONE	NONE
221L3LSR Daily Evapotranspiration Values (mm H_2O/ha/day)	NONE	NONE	MODIS NDVI	NONE	NONE	Canopy water conversion efficiency (mm/MJ). Canopy or surface resistance factor

222L3LSR Weekly Evapotranspiration Map (mm H_2O/ha/wk)	NONE	NONE	Daily Evapotranspiration	NONE	NONE	NONE
223L4LAH Generalized Vegetation-Soil Distribution Maps	TBD	NONE	MODIS-T Level-1B radiances for exploratory purposes	HIRIS images for case studies (2 to 3/yr)	TM and LAC Data for algorithm development and testing	NONE
224L4LAH Organic Carbon Pools in Living Biota and Soil	TBD	NONE	MODIS-T Level-1B radiances for exploratory purposes	HIRIS images for case studies (2 to 3/yr)	TM and LAC data for algorithm development and testing	NONE
225L3LSR MODIS Land Surface Temperature (°C)	Thermal Channels TBD (Level-1B radiances)	NONE	NONE	NONE	NONE	NONE
226L3LZW MODIS Land Surface Temperature (°C)	Thermal Channels TBD (Level-1B radiances	NONE	NONE	HIRIS and SAR for validation	NONE	On Occasion
227L4LJM Microstructure Data Arrays	ALL	ALL	TBD	SAR	SPOT Landsat-6 JERS-1	Field experiments with stereo CCD camera and spectroradiometers and from EOS prototypes
228L4LJM Macrostructure Data Arrays	ALL	ALL	TBD	SAR	SPOT Landsat-6 JERS-1	Field experiments with stereo CCD camera and spectroradiometers and from EOS prototypes
229L3LVS Global Bidirectional Radiance Maps	TBD	TBD	NONE	AMSR, AMRIR, and HIRIS for validation studies	SPOT and Landsat occasionally	Parabola measurements, etc. by investigator
230L3LVS Daily Global Snow Cover Maps	TBD	TBD	NONE	AMSR, AMRIR, and HIRIS for validation studies	SPOT and Landsat occasionally	Parabola measurements, etc. by investigator
231L3LSR Weekly Global Snow Cover Maps	NONE	NONE	Daily Global Snow Cover Maps	AMSR, AMRIR, and HIRIS for validation studies	SPOT and Landsat occasionally	Parabola measurements, etc. by investigator
232L3LSR Daily North American Snowcover Maps (provisional data product)	TBD	TBD	NONE	NONE	NONE	NONE

233L3LSR Weekly North American Snowcover Maps	NONE	NONE	Daily North American Snowcover Maps	NONE	NONE	NONE
234L4LSR Weekly North American Water Stress Maps (units TBD)	NONE	NONE	Weekly Evapotranspiration Maps, Weekly Net Photosynthesis Maps, and perhaps others	NONE	NONE	NONE
235LXLVV Atmospheric Polarization Correction Algorithms	Polarization Channels 17′ to 19′)	NONE	TBD	TBD	Shuttle polarimeter observations for validation studies	ER-2 measurements, ground measurements
236L3LVV Polarized Part of Ground Radiance	Polarized Channels	NONE	TBD	TBD	Shuttle polarimeter observations for validation studies	ER-2 measurements, ground measurements
237L3LVV Polarized Vegetation Indices (VI) TBD	Polarized Channels	NONE	NDVI for validation studies	Other VI's for validation studies	Other VI's Shuttle polarimeter observations for validation studies	ER-2 measurements, ground measurements

MODIS DATA ᴰUCT TABLE
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MODIS PRODUCT (CATEGORIZED BY STUDY)	MODIS-N	MODIS-T	OTHER MODIS DATA PRODUCTS	OTHER EOS INSTRUMENTS	NON-EOS REMOTELY SENSED DATA	CONVENTIONAL OR IN-SITU DATA
301L3OKC Backscattering Coefficient at 565 nm ($1/m^{-1}$)	NONE	565 nm Channel (Level-1B)	NONE	NONE	NONE	NONE
302L2OHG Single Scattering Aerosol Radiance over Oceans ($W/m^2/sr$)	Visible Channels below 550 nm (Level-1B)	Visible Channels below 550 nm (Level-1B)	NONE	GOMR (ozone concentration) SCATT-2 (Low resolution wind speed	NONE	Atmospheric surface pressure at low resolution. Reduced accuracy results can be generated without this data
303L3ORE Single Scattering Aerosol Radiance ($W/m^2/sr$)	Visible Channels TBD (Level-0 data)	17 bands TBD (Level-0 data)	NONE	GOMR (Total ozone) SCATT-2 (surface wind observations)	NOAA/NAVY (Global atmospheric pressure)	Water leaving radiances (Clark and Smith)
304L2OHG Water Leaving Radiances ($W/m^2/sr$)	Visible channels below 550 nm (Level-1B)	Visible channels below 55 nm (Level-1B)	NONE	GOMR (ozone concentration; SCATT-2 (low resolution wind speed)	NONE	Atmospheric surface pressure at low resolution. Reduced accuracy results can be generated without this data.
305L3ORE Global Water Leaving ($W/m^2/sr$)	Visible Channels (Level-0)	17 bands TBD (Level-0)	NONE	GOMR (total ozone) SCATT-2 (surface wind observations)	NOAA/NAVY (Global atmospheric pressure)	Water leaving radiances (Clark and Smith)
306LXODC Ground-Truth Ocean Parameters	NONE	NONE	NONE	NONE	NONE	Ship tracks buoy data: downwelled spectral irradiance, upwelled spectral irradiance, water leaving spectral radiances, diffuse attenuation coefficients, photosynthetic active radiation, fluorescence line height, spectral reflectance (or radiance) factor, phytoplankton pigment concentrations, total suspended matter concentration, FLH chlorophyll a concentration, fluorescence quantum efficiency, phaeopigment a concentrations, and primary production.
307L3ODT Global Ocean Color Map (units TBD)	All Channels below 4 microns	NONE	MODIS-T Level-1B radiances over test sites	HIRIS LASA	NONE	Ground-truth observations over test sites

308L3OIB Fast Delivery Sea Surface Temperatures (SST) (°C) (Daily within 96 hrs.)	Thermal Channels TBD	NONE	NONE	AMRIR (AMSU, SCATT, ALT, etc. for validation studies)	TBD	Field campaigns by Dr. Ian Barton
309L3OIB Daily Global SST (°C) (within 96 hrs)	Thermal Channels TBD	NONE		AMRIR (AMSU, SCATT, ALT, etc. for validation studies)	TBD	Field campaigns by Dr. Ian Barton
310L3OOB MODIS SST (°C)/ Quality Flag (dimensionless), daily within 48 hrs of Level-1B	14,26,27,28,30,33, 34,35 (Level-1B)	NONE	NONE	SCATT-2	NONE	For validation study only: ARGOS buoy data and ships of opportunity surface observations
311L3OIB Weekly Global SST (°C)	NONE	NONE	Daily MODIS SST's	NONE	TBD	Field campaigns by Dr. Ian Barton
213L3OMA Daily Fluorescence Yield (units TBD)	TBD	TBD	Calibration Coefficients	SCATT-2 (Level-3) ALT (Level-3) SST from AMRIR and AMSR (Level-3)	CZCS, SeaWIFS, and OCTS prelaunch studies	JGOFS; NSCAT and TOPEX for primary production modeling
313L3OMA Monthly Fluorescence Yield in the Oceans (units TBD)	NONE	NONE	Daily fluorescence yield in the oceans	SCATT-2 (Level-3) ALT (Level-3) SST from AMRIR and AMSR (Level-3)	CZCS, SeaWIFS, and OCTS prelaunch studies	JGOFS; NSCAT and TOPEX for primary production modeling
314L3OJP Chlorophyll Pigment Concentration in Australian Waters (ug/L)	NONE	TBD	NONE	NONE	NONE	CSIRO Div. Fisheries water quality and ocean color data for algorithm development and validation
315L3OJP Other TBD pigment Concentration in Australian Waters (ug/L)	NONE	TBD	NONE	NONE	NONE	CSIRO Div. Fisheries water quality and ocean color data for algorithm development and validation
316L3OFH Chlorophyll Pigment Maps (ug/L)	TBD	TBD	NONE	NONE	NONE	NASA AOL underflights for validation
317L3OKC Case II Chlorophyll (mg/m^3)	NONE	3 to 4 Channels TBD (Level-1B)	NONE	NONE	NONE	NONE
318L3OKC Case II Degradation Products (g/m^3)	NONE	3 to 4 Channels TBD (Level-1B)	NONE	NONE	NONE	NONE

319L3OFH Phycoerythrin Pigment Maps (ug/L)	TBD	TBD	NONE	NONE	NONE	NASA/AOL underflights for validation
320L3OFH Phycocyanin Pigment Maps (ug/L)	TBD	TBD	NONE	NONE	NONE	NASA/AOL underflights for validation
321L3OFH Species Diversity Maps (units TBD)	TBD	TBD	NONE	NONE	NONE	NASA/AOL underflights for validation
322L4OFH Regional Oceanic (units TBD)	NONE	NONE	Phycoerythrin, phycocyanin, and chlorophyll pigment concentrations and species diversity	NONE	NONE	NASA/AOL underflights for validation
323L4OFH Regional Primary Productivity (t C/ha/day)	NONE	NONE	Phycoerythrin, phycocyanin, chlorophyll pigment concentrations and species diversity	NONE	NONE	NASA/AOL underflights for validation
324L3OMA Daily Primary Production in the Oceans (ug/L)	TBD	TBD	Calibration Coefficients	SCATT-2 (Level-3) ALT (Level-3) SST (from AMRIR and AMSR (Level-3)	CZCS, SeaWIFS, and OCTS prelaunch studies	JGOFS, NSCAT and TOPEX for primary production modeling
325L3OWE 5-Day Mean Low Resolution Primary Productivity (t C/ha/day)	9 to 15 (Level-1B radiances)	1 to 64 (Level-1B) radiances)	GOMR (Level-3) for ozone optical depth); SCATT-2 (wind speed for glint correction and wave height for glint and foam); Incident spectral radiance (water leaving radiances from Clark, Evans, and Gordon); Mixed layer depth (no identified source); Sea surface irradiance (Evans and Gordon); Diffuse light attenuation coefficient (no identified source); Pigment ratios (Hoge, Carder, and Parslow); Population structure (no identified source); Physical history (no identified source).	NONE	NONE	NONE

326L3OWE Monthly Primary Production in the Oceans (ug/L)	NONE	NONE	Daily primary production in the oceans	SCATT-2 (Level-3) ALT (Level-3) SST (from AMRIR, AMSR (Level-3)	CZCS, SeaWIFS, and OCTS prelaunch studies	JGOFS; NSCAT and TOPEX for primary production modeling
327L3OWE Monthly Mean Low Resolution Primary Productivity (t C/ha/day)	9 to 15 (Level-1B radiances)	1 to 64 (Level-1B radiances)	GOMR (Level-3) for ozone optical depth); SCATT-2 (wind speed for glint correction and wave height for glint and foam); Incident spectral radiance (water leaving radiances from Clark, Evans, and Gordon); Mixed layer depth (no identified source); Sea surface irradiance (Evans and Gordon); Diffuse light attenuation coefficient (no identified source); Pigment ratios (Hoge, Carder, and Parslow); Population structure (no identified source); Physical history (no identified source).	NONE	NONE	NONE
328L3OWE Annual Mean Low Resolution Primary Productivity (t C/ha/day)	NONE	NONE	Monthly mean primary Productivity	NONE	NONE	NONE
329L3OKC Selected Case II Suspended Sediment (g/m^3)	NONE	Up to 25 channels TBD (Level-1B)	NONE	NONE	NONE	NONE
330L3OHG Detached Cocolith Concentration from Coccolithophores (m^{-3})	Visible Channels below 550 nm (Level-1B)	Visible Channels below 550 nm (Level-1B)	NONE	GOMR (ozone concentration); SCATT-2 (low resolution wind speed)	NONE	Atmospheric surface pressure field at low resolution. Reduced accuracy results can be generated without this data
331L3ORE Detached Cocolith Concentration (m^{-3})	Visible channels TBD (Level-0)	17 bands TBD (Level-0)	NONE	GOMR (total ozone); SCATT-2 (wind surface observations)	NOAA/NAVY (global atmospheric pressure)	Water leaving radiances (Clark and Smith)

ISSUES AFFECTING MIDACS FUNCTION AND STRUCTURE

To ensure that the science team members' requirements relating to the MODIS data are properly addressed, certain fundamental issues must be considered. At this time, a number of issues have surfaced which bear directly on the concept and design of the MODIS data system, as well as that of the EosDIS, the MODIS instrument, and perhaps the polar platform itself. Many of these issues fall outside the scope of the MODIS data system study and therefore will not be considered further by us. However, it is important that the issues be dealt with. For this reason, this incomplete and evolving list of issues affecting the MIDACS function and structure are being circulated, not only for information purposes, but also to ensure that the final design of EosDIS fully meets the requirements of the MODIS and other science teams.

SYSTEM CONTROL

1. Interdependence of MODIS and other Eos instrument products.

How can the efforts of the various Eos data systems be coordinated to provide optimum product availability when many products are generated from other Eos products that must be previously available?

Even more complicated, how can data reprocessing be coordinated when many products depend on many others?

What support does the MIDACS need to provide to the Eos control process?

What information or guidance does the MIDACS need to receive from the larger Eos control system?

2. Interdependence of MODIS and other Eos instrument control plans.

Does the acquisition of data to produce some Eos data products require coordinated operation among several Eos instruments?

How is such coordination to be achieved?

Specifically, how does the MIDACS take account of the needs of other Eos and non-Eos instrument data systems in deciding to acquire data or not acquire data for "Targets of Opportunity"?

The reverse question also applies. How do other data systems take account of MODIS product needs when deciding their responses to Targets of Opportunity?

3. Purpose of MIDACS system information at IMC.

Does the IMC perform the overall Eos coordination function?

Or does the IMC serve only as a central distribution facility for information available to users?

4. Team Leader role in resource allocation.

Given the inter-relatedness of Eos products, can the MODIS Team Leader reasonably be expected to manage the operation of the MIDACS?

Is the administrative work load assigned to the Team Leader in our data flow diagrams appropriate? Is the Team Leader overworked?

5. Integration of IST into TLCF.

Given the close relationship between the Team Leader and the IST, is there justification for retaining the IST as a distinct entity? Could IST functions be integrated into the TLCF subsystem, or should they simply be collocated?

PROCESSING

6. Processing and availability of instrument monitoring data.

Can the MIDACS and supporting data systems be designed so that the DHC sorts the data needed for MODIS instrument monitoring and provides the ICC with only the required monitoring data (at a reduced data delivery rate)?

7. Locations at which processing is done.

Should some of the processing needed for algorithm development or implementation be done at the CDHF? Will all TMCFs have sufficient processing capacity to provide required functions without CDHF resources?

If a TMCF has sufficient processing capacity, should some Standard-Data-Products be generated at the TMCF?

8. Extent of routine MIDACS processing.

Is user demand for MIDACS products always sufficient to justify the routine generation of all Standard-Data-Products for which appropriate data is available? Or could some Standard-Data-Products for some regions of the earth be appropriately generated only on user request?

9. Nature of special processing requests.

Is it presumed that algorithms required to meet special processing

requests are previously available and already running on the CDHF or on one of the TMCFs?

10. Data storage at the CDHF.

How much data should be retained at the CDHF?

Will data to produce weekly or monthly averages be retained at the CDHF, or will required data be retrieved from the DADS?

11. Team Member access to data products stored in CDHF.

Are the data retrieval resources at the CDHF adequate and appropriate to support direct access to CDHF data by MODIS Team Members?

Are significant savings in resources or access time achieved by direct access (instead of through the DADS)?

12. Variations in types and capabilities of TMCFs.

What types of TMCF hardware must the MIDACS accommodate? What variations in function and data flow are required to accommodate hardware variations?

13. Release of experimental products.

At what stage of development are experimental products generated at the TMCF made available for general public use? Should preliminary data, with appropriate caveats, be made available to Team Members or other members of the scientific community before it is released to the general public?

DATA STORAGE AND ACCESS

14. Data attributes used for data selection.

Is the system to support the use of any data parameter as a selection criterion for data retrieval, or can meaningful simplification be achieved by limiting data selection criteria to a small subset of available data parameters?

15. Physical retrieval of distributed archive data.

How will the system deal with data requests that require the retrieval of small segments of data from many physically separate data storage units, i.e. tapes?

Could the entire data archive be routinely brought on line by mounting a few tapes at a time and retrieving data for more than one request at each pass?

Could the data be arranged on the tapes in a way that would minimize the need to access hundreds or thousands of tapes to fill common data requests?

16. Metadata formats.

How will common metadata formats useful to the IMC be established for Eos instruments of radically different function?

17. Data block identification.

Is complete descriptive information (metadata) for all data blocks to be retained in headers appended to the data blocks? Can all data blocks throughout the MIDACS (or EosDIS) be appended with descriptive headers?

18. Storage of metadata.

Where is MODIS metadata to be stored? Only in the DADS? Only at the IMC? At both? Perhaps all the metadata at the DADS and a suitable subset at the IMC?

19. Long-term archives.

How is data transferred to long-term archives? Is original data format retained? Are the original physical storage units (tapes) also retained?

Is the original metadata structure also retained? Can the original physical storage units for metadata be transferred directly?

Is the metadata for information that has been transferred to the long-term archives also permanently retained in the MIDACS? What support does the MIDACS provide to the user who needs data from the long-term archives?

Will data physically move when it is transferred, or will the data be retained in the original MIDACS facility, and will the "transfer" mean a transfer in funding and responsibility only?

20. Timeliness of DADS response.

To optimize computer use, can information be uploaded to the DADS primarily during "off" times when the user service load is not high? What is the acceptable delay in making routine products available from the DADS? How will the DADS accommodate field experiments and other situations where data must be brought on-line quickly?

ISSUES RELATED TO REQUIREMENTS ON DATA

21. Pixel Location Accuracy.

One of the data requirements is the location of a pixel with an error of less than 10% of the pixel size (which ranges 250 to 1000 m) at nadir. This requirement can be met only through the accurate determination of the sub-satellite position and accurate attitude information. The current platform design will result in more than a 100 arc second uncertainty in attitude and 50 m of uncertainty in sub-satellite position determination, which will not meet the requirement. So, MODIS must have its own star tracker which can determine the attitude within 4 arc seconds, and will require the platform to determine the sub-satellite position uncertainty to less than 10 m. Do the present MODIS instrument designs and requested GPS quality meet this location accuracy?

22. MODIS Bit Error Rate.

After corrections are made, the bit error rate (BER) of the MODIS data should be less than 10^-8. At a BER of 10^-12, on average only one bad MODIS bit will be encountered every day. However, at a BER of 10^-8, 10^4 bad bits will be encountered daily. The packets with uncorrectable errors will be flagged as such by the DHC. Each packet will consist of up to 10^4 bits. In general, it will not be possible to identify the bad bit in a flagged packet. As a result, it may be necessary to reject up to 10^8 bits of MODIS data per day; this is the equivalent of ten seconds of data out of 86,400. The current Grade II service of the TDRSS will meet this BER requirement. Will this error rate cause more serious data problems downstream because of the multi-channel nature of many of the MODIS data product algorithms?

23. MODIS Data Completeness.

The MODIS instrument is capable of operating simultaneously in two modes. These have been termed the "survey instrument" mode and the "observatory instrument" mode. The survey instrument takes continuous observations and regularly observes the entire Earth. The observatory instrument acquires data only in response to a user's data acquisition request (DAR). Each of these modes will have a different level of allowable data loss.

When data collection is dictated by a response to a DAR, there is a specific requirement for the data. The need for the data may be critical (e.g., supporting and directing aircraft flights), or alternate data may be acceptable (e.g., from two days later). It must be assumed that a 100% coverage requirement applies to the DAR, and that none of the requested MODIS data may be lost. Should a conflict arise that will result in the loss of the data covered by the DAR, then the MODIS science team leader must be involved in the resolution of the conflict. Can EosDIS guarantee such data completeness?

When data collection is not dictated by a response to a DAR, the extent of lost MODIS data will be driven by the science requirements on the accuracy of the geophysical parameters (including the radiances). These requirements have not yet been formally stated, and will no doubt vary from parameter to parameter. It may be necessary to conduct system simulation studies to assess the impact of data gaps on the product accuracies. However, it is clear that no spatially systematic gaps in data coverage will be tolerable. Only non-systematic (random) data losses will be allowable. Will the TDRSS and EosDIS ensure that systematic data losses in space or time will not occur?

At present, the requirement on the data coverage is not specified. To help to understand this requirement, consider the following computation: completeness to only the 99% level would result in a loss of 15 minutes of coverage per day. At the 6.5 km per second velocity of the satellite, this is about 51° in latitude, or about a 5600 km along the orbit with the full swath. Because MODIS data will be used to produce products with global coverage, missing data will degrade the quality of the final product. The personnel involved in the design of the DHC are unwilling even to commit to a 90% or 95% data completeness figure at this time, and apparently do not take the EosDIS requirements seriously. What is the worst level of data completeness allowable?

24. MODIS Data Granularity.

We define a MODIS data granule as the smallest block of MODIS data that may be easily accessed from the archived data products. The definition of the MODIS data granules, as opposed to the time/space domain of a MODIS data product, is of fundamental interest to a MODIS team member because it determines the time/space resolution to which a MODIS data product will be segmented, addressed, and ordered. The MODIS science team may wish to recommend different granule definitions for the Level-2 and Level-3 data products (e.g., swath or swath cube/non-rectified image or image cube versus a rectified image).