Clouds and the Earth's Radiant Energy System (CERES)

Data Management System (DMS)

Measurement and Analysis Plan

Version 4

for

Tropical Rainfall Measuring Mission (TRMM), Terra, and Aqua

November 2009

Clouds and the Earth's Radiant Energy System (CERES)

Data Management System

Stakeholder-Commitment Sheet for the CERES Measurement and Analysis Plan

This Stakeholder-Commitment Sheet is to demonstrate that the relevant stakeholders as identified in the CERES Data Management Plan are aware of and support the CERES processes described in the CERES Measurement and Analysis Plan.

Primary Contributors

_____ (Lisa H. Coleman)

Review Team

_____ (Tammy O. Ayers)
_____ (Lisa H. Coleman)
_____ (Denise L. Cooper)
_____ (Walter F. Miller)
_____ (John L. Robbins)

DMT Lead

_____ (Erika B. Geier)

DMT Task Management Team

_____ (Lindsley D. Bodden)
_____ (Lisa H. Coleman)

CM and Documentation Teams

_____ (Tammy O. Ayers, Lead)
_____ (Joanne H. Saunders)

Document Revision Record

The Document Revision Record contains information pertaining to approved document changes. The table lists the Version Number, the date of the last revision, a short description of the revision, and the revised sections. The document authors are listed on the cover.

Document Revision Record

Version Number	Date	Description of Revision	Section(s) Affected
V0	10/xx/2005	• Initial version of CERES Measurement and Analysis Plan. • Updated format to comply with standards.	All All
V0.2	10/06/2005	• Defined acronyms. • Added names of references reports. • Updated format to comply with standards.	1.1.0 and 2.0 2.3.0 All
V0.3	01/06/2006	• Clarified SSI&T phases. • Modified thresholds. • Modified contents of planned reports, storage, analysis, and distribution plans. • Added summary matrix. • Updated format to comply with standards.	2.0 2.1 2.0-2.2, 3.0-3.3, 4.0-4.4 5.0 All
V0.4	01/31/2006	• Modified document version numbering such that draft versions previously designated as version 1.x, are now designated as 0.x. • Included standard CERES Document introduction. • Consolidated Section 3 subsections. • Changed "4 working days" to "6 calendar days." • Refined calendar quarter definition. • Distinguished CM testing from production testing. • Added Appendices A and B. • Updated format to comply with standards.	Cover Page Revision Record Document header 1.0 3.0 2.1, Table 5-1 4.2 2.0, 2.1 App. A and B All
V1	03/17/2006	• Added acknowledgements to Preface. • Removed acronym definitions from the text. • Modified title of Table 5-1. • Updated document version number. • Changed titles for Section 4.0 subsections to reference the QStats Report instead of the Analysis Report. • Modified column headings in Table B-1. • Updated format to comply with standards.	Preface All Section 5.0 Cover page Sections 4.1, 4.2, 4.3, and 4.4 App. B All

Document Revision Record

Version Number	Date	Description of Revision	Section(s) Affected
V2	07/31/2006	• Added text correlating measurement specifics to CERES DMT objectives.	Sections 2.1, 2.2
		• Added rows to summary table Measurement, Deviation, and Acceptability Standard.	Table 5-1
		• Removed indications that TRL counted defects.	All
		• Updated sample QStats Report.	App. B
		• Updated format to comply with standards.	All
		• Converted document from FrameMaker to Word. (04/14/2008)	All
V3	03/02/2009	• Removed references to SAIC or other specific contractor, except in the Document Revision Record where it will be maintained for the historical record.	All
		• Modified cover page to follow new standard.	Cover Page
		• Included updated Stakeholder-Commitment Sheet reflecting new staff.	Stakeholder-Commitment Sheet
		• Modified Preface to follow new standard.	Preface
		• Included new Acknowledgements page.	Acknowledge-ments page
		• Modified Introduction to follow new standard.	Introduction
V4	09/17/2009	• Modified appropriate sections to show that the CERES DM Lead will be managing QStats Report activity.	Sections 4.2, 4.3, & 4.4

Preface

The CERES DMS supports the data processing needs of the CERES Science Team to increase understanding of the Earth's climate and radiant environment. The CERES DMT works with the CERES Science Team to develop the software necessary to support the science algorithms. This software, being developed to operate at the Langley ASDC, produces an extensive set of science data products. The DMS consists of 12 subsystems each of which contains one or more PGEs.

The purpose of the Measurement and Analysis Plan is to provide specific guidance on the definition and collection of metrics useful to the scheduling of deliveries of CERES production software to the Langley ASDC.

The CERES Data Management Plan provides overall guidance to the CERES DMT.

Acknowledgements

This document reflects the collaborative efforts of the CERES DMT (in conjunction, as is appropriate, with the CERES Science Team). The primary contributor to this document is:

SSAI – Lisa H. Coleman

Documentation support was provided by the CERES Documentation Team (Tammy O. Ayers (SSAI) and Joanne H. Saunders (SSAI)).

Erika Geier (NASA) is the CERES DMT Lead. At the time of publication of this document members of the CERES DMT from SSAI are:

J. Ashley Alford
Tammy O. Ayers
Mark Bowser
Ricky R. Brown
Thomas E. Caldwell
Churngwei Chu
Lisa H. Coleman
Denise L. Cooper
Elizabeth D. Filer
Arthur T. Grepiotis
Carla O. Grune
Elizabeth Heckert
Brian E. Magill
Walter F. Miller
Cathy Nguyen
Raja Raju
John L. Robbins
Joanne H. Saunders
Rita Smith
K. Dianne Snyder
Victor E. Sothcott
Sunny Sun-Mack
Mark Timcoe
Dale R. Walikainen
Scott M. Zentz

The DMT wishes to recognize the contributions to this document by Demetria (Dee) S. Wildman of SAIC's Atlantic Programs Division for her many hours of consultation.

TABLE OF CONTENTS

Section Page

Document Revision Record iii

Preface v

Acknowledgements v

1.0 Introduction 1

1.1 CERES Data Management Team Measurement and Analysis Plan Objectives 1

1.2 CERES Data Management Team Measurement and Analysis Plan Organization 2

2.0 Measurement Specifics 3

2.1 Adherence to Delivery Schedule 3

2.2 Defect Data 4

3.0 Measurement Collection and Storage 5

4.0 Analysis Procedures 6

4.1 QStats Report Contents 6

4.2 QStats Report Responsibility 6

4.3 QStats Report Storage 6

4.4 Communication of QStats Report Results 6

5.0 CERES DMT Measurement and Analysis Plan Summary 7

References 8

Appendix A - Abbreviations and Acronyms A-1

Appendix B - QStats Report Sample B-1

LIST OF TABLES

Table Page

Table 5-1. Metric Collection and Analysis Requirements 7

Table B-1. Sample QStats Report B-1

1.0 Introduction

CERES is a key component of EOS and NPP. The first CERES instrument (PFM) flew on TRMM, four instruments are currently operating on the EOS Terra (FM1 and FM2) and Aqua (FM3 and FM4) platforms, and FM5 will fly on the NPP platform currently scheduled for launch in June 2010. CERES measures radiances in three broadband channels: a shortwave channel (0.3 - 5 μm), a total channel (0.3 - 200 μm), and an infrared window channel (8 - 12 μm). The last data processed from the PFM instrument aboard TRMM was March 2000; no additional data are expected. Until June 2005, one instrument on each EOS platform operated in a fixed azimuth scanning mode and the other operated in a rotating azimuth scanning mode; now all are typically operating in the fixed azimuth scanning mode. The NPP platform will carry the FM5 instrument, which will operate in the fixed azimuth scanning mode though it will have the capability to operate in a rotating azimuth scanning mode.

CERES climate data records involve an unprecedented level of data fusion: CERES measurements are combined with imager data (e.g., MODIS on Terra and Aqua, VIIRS on NPP), 4-D weather assimilation data, microwave sea-ice observations, and measurements from five geostationary satellites to produce climate-quality radiative fluxes at the top-of-atmosphere, within the atmosphere and at the surface, together with the associated cloud and aerosol properties.

The CERES project management and implementation responsibility is at NASA Langley. The CERES Science Team is responsible for the instrument design and the derivation and validation of the scientific algorithms used to produce the data products distributed to the atmospheric sciences community. The CERES DMT is responsible for the development and maintenance of the software that implements the science team's algorithms in the production environment to produce CERES data products. The Langley ASDC is responsible for the production environment, data ingest, and the processing, archival, and distribution of the CERES data products.

All acronyms used in this document are defined in Appendix A. They are not defined in the text.

1.1 CERES Data Management Team Measurement and Analysis Plan Objectives

The two main objectives of the CERES DMT are to deliver scientific source code to execute in the production processing environment maintained by the ASDC (1) on time according to a delivery schedule and (2) defect free. Relevant data are routinely collected, analyzed, and maintained to identify obstacles that may prevent the team from meeting these objectives. Data regarding the amount of actual time a delivery spends in SSI&T are also maintained to aid in setting schedules as accurately as possible. The purpose of the CERES DMS Measurement and Analysis Plan is to identify the data that are collected, and to describe the collection, maintenance, and analysis procedures of these data.

This Measurement and Analysis Plan is based on the current processes followed by the CERES project's DMT. Additional documents associated with the project provide the specific details regarding the data interfaces, processing algorithms, output products, instrument design and calibration, and science investigations as they are developed through the project life cycle. These documents are accessible from the CERES Project Web site (see Reference 1).

1.2 CERES Data Management Team Measurement and Analysis Plan Organization

The CERES Data Management System Measurement and Analysis Plan is organized as follows:

Section 1.0 - Introduction
Section 2.0 - Measurement Specifics
Section 3.0 - Measurement Collection and Storage
Section 4.0 - Analysis Procedures
Section 5.0 - CERES DMT Measurement and Analysis Plan Summary

Appendix A - Acronyms and Symbols
Appendix B - QStats Report Sample

Section 2.0 describes the data that are routinely collected in order to identify weaknesses that may prevent meeting the major objectives of the CERES DMT. Section 3.0 describes the process for collecting and maintaining these data. Section 4.0 describes the report contents for the quarterly analysis of the data identified in Section 2.0, along with the responsibility, storage, and communication of the report.

Section 5.0 contains a table summarizing the metric collection and analysis requirements described in this plan.

A list of abbreviations and acronyms is contained in Appendix A, and a sample of the quarterly report described in Section 4.0 is included in Appendix B.

2.0 Measurement Specifics

SSI&T is comprised of multiple phases. The first phase, the CM testing phase, includes the delivery of production software to the CM Team through the cm_move utility, the placing of the files under configuration management, the generation of the executables, and CM testing of the software in the production environment. The first phase is complete when the CM Team releases the delivery by notifying the ASDC SSI&T Team that CM testing of the delivered software was successful and therefore the ASDC SSI&T testing phase may begin. The testing phase conducted by the ASDC involves testing the delivery with operational tools that are not accessible to the CERES DMT during software development or CM testing. SSI&T is complete at this point and production processing to produce the CERES science products may begin. Additional testing beyond SSI&T occurs in the ASDC operational environment prior to full-scale production processing of software intended to generate science products available for public use. This additional testing typically processes data for selected dates from the full dataset intended for the production environment, providing results from a broad set of data-imposed scenarios and is complete when both the CERES Science Team and the DMT indicate approval of the results.

The CERES DMT Measurement and Analysis Plan is applicable only to the CM testing phase of SSI&T, which includes the activities described in Reference 2 that involve the CERES DMT.

2.1 Adherence to Delivery Schedule

As stated in Section 1.1, a main objective of the CERES DMT is to deliver scientific source code to execute in the production processing environment maintained by the ASDC on time according to the CERES Subsystem Delivery Schedule. This delivery schedule lists the scheduled dates of software deliveries as agreed upon by the DMT and the CERES Science Team. The CERES CM Team tracks the scheduled delivery dates, the actual dates of deliveries to CM, and the dates the CM Team releases the deliveries to the ASDC SSI&T Team in the DelFT Document. Tracking these dates provides data useful in monitoring how well the DMT is meeting the objective of delivering software to the production environment in accordance with the delivery schedule. The length of a delay is measured in calendar days.

Typically, the date scheduled for CM to release a delivery to the ASDC is seven calendar days after the date scheduled for that delivery to CM. This seven-day period allows time for CM activities and testing of the newly delivered software in its intended environment. Since a delivery made later than six days after the scheduled date eliminates the possibility that the CM Team can test, perform CM activities, and release the new delivery to the ASDC according to the Delivery schedule, a software delivery is considered delayed when six calendar days have passed since the scheduled delivery date to CM without the delivery occurring.

Since a delay in the release of the software to the ASDC production environment results in a delay of completing SSI&T, and therefore a delay in the onset of production processing, the release of the delivery from the CM Team to the ASDC SSI&T Team is considered delayed when six calendar days have passed since the scheduled release date without the release occurring.

The reasons for delays may also be maintained for a period of time if deemed necessary by the management of the DMT. The reasons for delays to CM, categorized for simplicity, may include:

- Change in requirement definition by customer
- Subsystem / data dependencies not in place, e.g., missing external input data or previous subsystem not delivered
- Incorrect estimation of time needed to implement requirements
- Lack of resources, either computer or personnel, for implementing requirements
- Imposition of other higher priority activity

The reasons for delays for the CM Team's release of the delivery to the ASDC SSI&T Team, categorized for simplicity, may include:

- Defects detected during CM testing
- Lack of resources, either computer or personnel, for testing, storage, etc.
- Imposition of other higher priority activity
- Late delivery of software to CM

2.2 Defect Data

As stated in Section 1.1, another main objective of the CERES DMT is to deliver scientific source code that is free of defects to execute in the production processing environment maintained by the ASDC. The occurrence of a defect in the software prevents the successful completion of testing by the CM Team and may also result in a delay of the release of the software to the ASDC production environment (see Section 2.1).

The CM Team tracks the defects discovered during CM testing along with the causes of these defects and records the occurrence of defects in the TRL. A defect is counted whenever an error occurs that results in corrections made by the DMT to data, software, or documentation files during CM testing. Tracking the defects provides data useful in monitoring problems encountered during CM testing that result in delays of software releases to the ASDC. The review of these data as discussed in Section 4.0 may identify problems that need to be resolved to prevent recurrence.

The type of defects encountered during initial CM testing may also be maintained in the TRL if deemed necessary by the DMT management. The types of defects, categorized for simplicity, may include:

- Defects in delivery package assembly
- Defects in Test Plan
- Missing input data
- Incorrect expected output

3.0 Measurement Collection and Storage

The CERES CM Team is responsible for collecting, compiling, and storing the data regarding adherence to the delivery schedule and the number of defects.

Adherence to the most recent delivery schedule is documented in the DelFT Document. Data regarding defects identified during CM testing are maintained in the TRL. Designated members of the CM Team enter the data into these reports with each delivery. These documents are stored by the CERES CM Team on individual, regularly backed-up workstations.

4.0 Analysis Procedures

Quarterly reports are generated from the data contained in the TRL and DelFT. These reports show the scheduled and actual dates of software deliveries to CM and releases of software to the ASDC, along with the number of defects identified during CM testing. This information is stored in the QStats Report.

4.1 QStats Report Contents

The QStats Report consists of two sections. The first section contains information obtained from the TRL and DelFT reports for the current quarter. At a minimum, the information contained in this section includes the following items for each delivery made during the quarter:

- Scheduled delivery date
- Delta between scheduled and actual delivery dates to CM
- Scheduled release date
- Delta between scheduled and actual release dates from CM to ASDC
- Number of defects identified during CM testing

The second section of the QStats Report contains a summary indicating whether or not the delivery delays and number of defects for the quarter are acceptable and if the cause for each is understood. If not, the comment section indicates the appropriate action to be taken to improve results in future quarters.

An example of the QStats Report is included in Appendix B.

4.2 QStats Report Responsibility

The initiation of the generation of the QStats Report and the completion of the first section are the responsibility of the CM Team. The CERES DM Lead or his/her designee is responsible for reviewing the quarterly reports as received from the CM Team and completing the second section.

A QStats Report is completed within 15 calendar days after the end of each calendar quarter, with the beginning of the first calendar quarter for each year being defined as January 1.

4.3 QStats Report Storage

The completed QStats Report is provided back to the CM Team by the DM Lead and is stored by the DM Lead and CM Team on individual, regularly backed-up workstations.

4.4 Communication of QStats Report Results

The results contained in the QStats Report are communicated by the CERES DM Lead to the contractor technical lead or his/her designee. If the summary indicates corrective action by a particular subsystem team is necessary, the technical lead or designee provides the pertinent summary information to that team. The Stakeholder Matrix contained in the CERES DMP (Reference 3) identifies all of the DMT members whose tasks may be impacted by the contents of the QStats Report.

5.0 CERES DMT Measurement and Analysis Plan Summary

A summary of the data routinely collected, analyzed, and maintained during CM testing is contained in Table 5-1.

Table 5-1. Metric Collection and Analysis Requirements

	Schedule Variance: Delivery from Subsystem Team to CM Team	**Schedule Variance: Delivery Release from CM Team to ASDC SSI&T Team**	**Defects**
Measurement	Actual delivery date	Actual release date	Number of defects
Deviation	Delta = Actual delivery date - Scheduled delivery date	Delta = Actual release date - Scheduled release date	NA
Threshold	≤ 6 calendar days past scheduled date	≤ 6 calendar days past scheduled date	0
Acceptability Standard	Delta - Threshold ≤ 0	Delta - Threshold ≤ 0	Number of defects = 0
Frequency	Per Delivery	Per Delivery	Per Delivery
Owner	CM	CM	CM
Data Type: Report	Itemized List: DelFT	Itemized List: DelFT	Itemized List: TRL
Data Source	CM	CM	CM
Data Collector: Procedure	CM: Enter scheduled and actual dates into DelFT	CM: Enter scheduled and actual dates into DelFT	CM: Enter occurrence of defects into TRL
Storage	Individual, backed-up workstations assigned to CM Team	Individual, backed-up workstations assigned to CM Team	Individual, backed-up workstations assigned to CM Team
Analysis and Actions Taken	N/A	N/A	Corrective action taken for all defects found

References

1. CERES On-Line Documentation, URL: http://science.larc.nasa.gov/ceres/docs.html
2. CERES DMS Software Development Plan Version 5 for TRMM, Terra, and Aqua, March 2009, URL: http://science.larc.nasa.gov/ceres/docs.html
3. CERES DMS Data Management Plan Version 5 for TRMM, Terra, and Aqua, March 2009, URL: http://science.larc.nasa.gov/ceres/docs.html

Appendix A
Abbreviations and Acronyms

ASDC	Atmospheric Sciences Data Center
CERES	Clouds and the Earth's Radiant Energy System
CM	Configuration Management
DelFT	Delivered Files Tracking
DMP	Data Management Plan
DMS	Data Management System
DMT	Data Management Team
EOS	Earth Observing System
ERBE	Earth Radiation Budget Experiment
ERBS	Earth Radiation Budget Satellite
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
PGE	Product Generation Executive
QStats	Quarterly Delivery Statistics Report
SSI&T	Science Software Integration and Testing
TRL	Test Results Log
TRMM	Tropical Rainfall Measuring Mission
URL	Universal Resource Locator
μm	micrometers

Appendix B
QStats Report Sample

Table B-1. Sample QStats Report

QStats Report for April 1, 2006 - June 30, 2006

Section I: CM Results

Report Date: July 7, 2006

Acceptable Delivery to CM Date Delta = 6 days | **Acceptable Release to ASDC Date Delta = 6 days**

Delivery Number	SCCR Number	Subsystem	Scheduled Delivery to CM Date	Actual Delivery to CM Date	Delta	Delta Minus Acceptable Delta	Scheduled Release to ASDC Date	Actual Release to ASDC Date	Delta	Delta Minus Acceptable Delta	Number of Defects	Action Required	Action Completed
1	621	Instrument	04/14/2006	04/14/2006	0.00	-6.00	04/21/2006	04/19/2006	-2.00	-8.00	0	None	N/A
2	618	GGEO	04/28/2006	04/20/2006	-8.00	-14.00	05/05/2006	04/24/2006	-11.00	-17.00	0	None	N/A
3	624	TISA Averaging	05/19/2006	05/19/2006	0.00	-6.00	05/26/2006	05/24/2006	-2.00	-8.00	0	None	N/A
4	626	Instantaneous SARB	05/26/2006	05/25/2006	-1.00	-7.00	06/02/2006	06/05/2006	3.00	-3.00	4	None	N/A
5	629	TISA Averaging	06/21/2006	06/20/2006	-1.00	-7.00	06/28/2006	06/21/2006	-7.00	-13.00	0	None	N/A

Section II: Supervisory Comments

Report Date: 13-Jul-06

Schedule Adherence: All deliveries to CM were either on time or early.

All deliveries were released to ASDC within the allowable time

Defects: 4 defects were noted for delivery Number 4. These defects were due to managing the massive quantities of input data that had to be staged on both the SGI and the IBM platforms. These problems were resolved and testing completed successfully with no corrections required to either the software or Test Plan that were delivered to CM.