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

Data Management System

Process and Product Quality Assurance Plan

Version 2

Primary Author(s)

Walter F. Miller

Science Applications International Corporation (SAIC)
One Enterprise Parkway, Suite 300
Hampton, VA 23666

NASA Langley Research Center
Climate Science Branch
Science Directorate
21 Langley Boulevard
Hampton, VA 23681-2199

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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
V0.1	10/12/2005	• Initial version of CERES Process and Product Quality Assurance Plan. • Updated format to comply with standards.	All All
V0.2	1/19/2006	• Suggestion from Class C Assessment. • The assignment of resources was clarified. • Update processes and products included. • The frequency of audits was reduced. • Sample report included. • Sample checklist included. • Updated format to comply with standards.	All 2 2 3 App. A App. B All
V0.3	4/4/2006	• incorporated changes from Peer Review. • Created position of QA Manager. • Eliminated QA Audit Report.	All All 5 and App. A
V1	4/14/2006	• Modified document. • Updated format to comply with standards.	All All
V2	7/31/2006	• Changed purpose to agree with Section 1. • Changed the title of QA Manager to CERES QA Lead. • Storage was changed from PAL site to CERES QA Lead workstation. • Added section on PPQA Audit. • Updated format to comply with standards.	Preface All 1 and 5 2, 3, and 4 All

Preface

The CERES DMS supports the data processing needs of the CERES Science Team research to increase understanding of the Earth's climate and radiant environment. The CERES Data Management Team 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 subsystem contains one or more PGEs.

This plan's purpose is used to ensure that the CERES DMT follows processes defined in the various CERES DMS Plans during the development and maintenance of CERES software and the highest quality products are delivered to ASDC. The CERES DMP provides overall guidance to the CERES DMT.

TABLE OF CONTENTS

1.0 Introduction

CERES is a key component of EOS. The CERES instrument provides radiometric measurements of the Earth's atmosphere from 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 CERES instruments are improved models of the ERBE scanner instruments, which operated from 1984 through 1990 on NASA ERBS and on NOAA operational weather satellites NOAA-9 and NOAA-10. The strategy of flying instruments on Sun-synchronous, polar orbiting satellites, such as NOAA-9 and NOAA-10, simultaneously with instruments on satellites that have precessing orbits in lower inclinations, such as ERBS, was successfully developed in ERBE to reduce time sampling errors. CERES continues that strategy by flying instruments on the polar orbiting EOS platforms simultaneously with an instrument on the TRMM spacecraft, which has an orbital inclination of 35 degrees. In addition, to reduce the uncertainty in data interpretation and to improve the consistency between the cloud parameters and the radiation fields, CERES includes cloud imager data and other atmospheric parameters. The CERES instruments fly on the TRMM spacecraft and on the EOS Terra and Aqua platforms. The TRMM satellite carries one CERES instrument while the EOS satellites carry two CERES instruments, one operating in a fixed azimuth scanning mode and the other operating in a rotating azimuth scanning mode.

The CERES DMT is responsible for the development and maintenance of the software used to process the data received from the on-orbit CERES instruments. For the purposes of this document, product refers to the CERES software delivered to the ASDC and is not to be confused with CERES data products, which are created by the CERES software.

The CERES project management and implementation responsibility is at NASA LaRC. 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 used in the production environment. The LaRC ASDC is responsible for the production environment, archival and distribution of the CERES data products generated at NASA LaRC.

The purpose of the CERES DMS Process and Product Quality Assurance Plan will be used to ensure that the CERES DMT follows processes defined in the various CERES DMS Plans during the development and maintenance of CERES software and the highest quality products are delivered to ASDC. CERES Project Management will also be audited.

This document is organized as follows:

This document, CERES DMS Process and Product Quality Assurance Plan, implements the requirement in the CERES DMP for quality assurance of CERES deliverables. The CERES QA Lead will be responsible for implementing this plan under the direction of the CERES DMT Lead Supervisor. It provides a description of how processes will be audited using standard checklists with emphasis on compliance with process descriptions provided in the

- CERES DMS Data Management Plan (see Reference 1),
- CERES DMS Requirements Management Plan (see Reference 2),
- CERES DMS Software Development Plan (see Reference 3),
- CERES DMS Configuration Management Plan (see Reference 4),
- CERES DMS Risk Management Plan (see Reference 5),
- CERES DMS Measurement and Analysis Plan (see Reference 6),
- CERES DMS Training Management Plan (see Reference 7), and
- procedures posted on the CERES web site (see Reference 8).

Documentation, either paper or electronic media, will be audited as a primary means of demonstrating adherence to standard processes. CERES documentation that are required as part of the software delivery will also be audited using standard checklists before being delivered to the ASDC. These audits will be formally documented and maintained on the CERES QA Lead workstation that is backup. The CERES QA Lead will provide a summary of noncompliance issues and quality trends including recommended corrective actions to SAIC management. Lessons Learned from process and product audits will be provided to the project and incorporated into processes as identified. A sample checklist is in Appendix B.

2.0 Scope

The responsibility of QA resides with the designated CERES DMT Supervisor. Several key processes in the preparation and delivery of production software and related documentation are identified for auditing.

2.1 Responsibility

The designated CERES DMT Supervisor will provide resources and assign personnel to perform the quality assurance program as defined in this plan. The supervisor will appoint a CERES QA Lead who will schedule audits, collect checklists, and prepare the required reports. The CERES DMT Supervisor will also assign auditors.

2.2 Process Specification

Key processes have been chosen within the CERES Subsystem and System level that require auditing.

2.2.1 Subsystem-Level Processes

The following CERES DMT Subsystem-level processes will be audited:

- Requirements Management
- Software Development
- Subsystem-level Integration Testing

2.2.2 System-Level Processes

The following CERES DMT System-level processes will be audited:

- Configuration Management
- Project Management

2.2.3 Quality Process

The Process and Product Quality Assurance process will be audited.

2.3 Product Specification

The following CERES DMT products will be audited:

- Test Plan
- Operator’s Manual

3.0 QA Audit Schedule

QA audits for processes will be scheduled for six-month periods that begin in January and July. All subsystem-level processes and each subsystems will be audited during each period. Not all processes for each subsystem, will be audited each period. The audit dates will be coordinated with subsystem leads and supervisors. The QA audit schedule will be reviewed by the CERES QA Lead monthly and updated as needed. The subsystem lead will be contacted to determine if the products identified in Section 2.3 will be included in the delivery for incorporation into the QA audit schedule.

3.1 Subsystem-Level Process Schedule

An audit of subsystem-level processes given in Section 2.2.1 will be scheduled such that each subsystem will be audited on one subsystem-level process every six months. The process selected will be determined based on where the subsystem is in the development cycle. Efforts should be made to perform an audit on each of the subsystem-level processes during each six month period.

3.2 System Process Schedule

An audit of system-level processes given in Section 2.2.2 will be performed every six months. If there has been no activity in a system process since the last audit, the audit will be cancelled for the six-month period.

3.3 Quality Process Schedule

An audit of quality process given in Section 2.2.3 will be performed every two years by someone outside the program.

3.4 Product Schedule

Any CERES DMT product identified in Section 2.3 provided for delivery will be audited when received by the CERES Documentation Team. The audit will be completed before the document is provided to ASDC.

4.0 QA Procedures

QA audits will be conducted using the QA checklist for that process or product. The auditor will check for objective evidence that the process was followed. Best practices and lessons learned may also be included on the checklist. Best practices are methods that makes a process more efficient or improves the product. Lessons learned are experiences both positive and negative that would benefit other CERES DMT members.

4.1 Subsystem-Level, System, and Quality Process QA Procedures

The QA auditor will conduct a face-to-face interview with personnel performing the process and with the team lead. The checklist for each process will be completed by the QA auditor using objective evidence provided during the interview.

The QA auditor will annotate on the QA checklist any deviation from the standard process that cannot be corrected during the interview. The QA checklist used will serve as documenting the audit. The QA checklist is described in Section 4.3 and an example is provided in Appendix B.

4.2 Product QA Procedures

The CERES Documentation Team will receive the document electronically. The documents will be reviewed for spelling, grammar, and formatting errors using the documentation checklist. The CERES Documentation Team will correct obvious spelling, grammar, or formatting errors. The document originator will be contacted if more information is needed or the document may be returned to them for corrections.

The CERES Documentation Team member who audited the document will forward the Documentation Checklist to the CERES QA Lead.

4.3 QA Checklist

A QA checklist will be developed for each process and product that were identified in Section 2.2 and Section 2.3 for auditing. The checklists will be maintained on the CERES QA Lead workstation.

A checklist template is available from the CERES QA Lead. An example checklist is included in Appendix B.

5.0 Reports

The QA Audit Schedule, QA Checklist, QA Action Item Log, and QA Status Report will be created to implement this plan.

5.1 QA Audit Schedule

The QA Audit Schedule will identify the process, subsystem being audited when applicable, date of audit, and who will perform the audit. This document will be reviewed by the CERES QA Lead monthly and updated when necessary.

5.2 QA Checklist

During each audit, QA checklist(s) will be completed. The QA checklist will identify

- the auditors and personnel interviewed during the audit,
- the date and time of the audit,
- the process or product audited, and
- any discrepancies found.

A sample checklist is included in Appendix A. All checklists used during the audit will be reviewed by the CERES QA Lead who will suggest corrective actions. A DMT supervisor will determine the corrective action needed and provide a copy of the checklist to the subsystem lead.

The CERES QA Lead will assign a checklist number to the checklist being used in the audit. It will consists of the calendar year and a sequential number starting with 1 at the beginning of the year.

5.3 QA Action Item Log

The QA Action Item Log will be maintained by the CERES QA Lead. It will

- identify corrective action requested during QA Audits,
- responsible person,
- action required, and
- the current status.

All items will be tracked to closure by the CERES QA Lead. The team lead or supervisor of the area audited will complete the requested action and provide evidence to the CERES QA Lead to determine if it has been accomplished. CERES QA Lead will review the Action Item list monthly and request status on open action items.

5.4 QA Status Report

By the 15th of the month following the end of each calendar quarter, the CERES QA Lead will generate the QA Status Report and forward it to the designated CERES DMT Supervisor. The QA Status Report will provide:

- a list of audits completed,
- summary of key findings during these audits, and
- number of action items opened, closed, and pending since the last report.

5.5 Record Maintenance

The reports and schedule produced as a result of this plan are maintained electronically on the CERES QA Lead workstation. QA Checklists are scanned to allow them to be maintained electronically. Hardcopies of QA Audits including Verifiable Objective Evidence will be stored in the CERES QA Lead office.

References

1. CERES DMS Data Management Plan (http://asd-www.larc.nasa.gov/ceres/docs.html)
2. CERES DMS Requirements Management Plan
3. CERES DMS Software Development Plan
4. CERES DMS Configuration Management Plan (http://earth-www.larc.nasa.gov/~cerescm)
5. CERES DMS Risk Management Plan
6. CERES DMS Measurement and Analysis Plan
7. CERES DMS Training Management Plan
8. CERES Home Page - (http://asd-www.larc.nasa.gov/ceres/ASDceres.html)

Appendix A
Abbreviations and Acronyms

ASDC	Atmospheric Sciences Data Center
CERES	Clouds and the Earth's Radiant Energy System
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
LaRC	Langley Research Center
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
QA	Quality Assurance
SAIC	Science Applications International Corporation
TRMM	Tropical Rain Measuring Mission

Appendix B
Sample Checklist

Requirements Management Audit Checklist

Checklist Number:	**Date:**
CERES Subsystem:	**Task Lead:**
Team Members:	**Auditor:**

Audit Elements	Yes	No	Comments	Action Item #
Were the requirements conveyed by CERES PI, WG Chair, or TM?				
Were the requirements conveyed by Face-to-Face, Phone Call or Email?				
Are there Emails containing the requirement or confirming a discussion about the requirement?				
Are the requirements within the scope of the SOW for NOW 1.23?				
Are the requirements implementable within the current schedule and current resources?				
If additional time or resources needed, is the impact provided to conveyor?				
Are the requirements consistent with the existing software?				
Is an understanding of the requirements demonstrated?				
Is the requirement understanding confirmed with the conveyor in an Email?				
Have the requirements been entered into the requirement log?				
Has an SCCR been generated for this requirement?				
Is the SCCR number included in the requirement log?				
Is the requirement number in the SCCR?				
Is your subsystem’s requirements log current?				
Do you follow the Requirements Management Plan?				

Audit Elements	Yes	No	Comments	Action Item #
Comments: **Total Action Items:**				

_____ _____

CERES QA Auditor[s] Signature, Date CERES QA Lead, Date