CERES Data Management
Working Group Report
CERES Science Team Meeting

Katie Dejwakh
Walter Miller
CERES DMT
MAY 14, 2024
Agenda

Background
Team Highlights
Improvements:
  • Edition 5
  • Code Re-architecture
  • Systems
Conclusion
Background
Inversion

Victor Sothcott

Surface and Atmospheric Radiation Budget (SARB)

Thomas Caldwell
Temporal Interpolation and Spatial Averaging (TISA)

Beau Branch
Edward Kizer
Joshua Wilkins

FLASHFlux

Jay Garg
PC Sawaengphokhai
Hunter Winecoff
Team

Configuration Management (CM) & Infrastructure

Production Request (PR) Tool

Tammy Ayers
Willinda Evans
Nelson Hillyer
Dennis Keyes

Carla Grune
Elizabeth Heckert
Visualization and Ordering Tool

Chungwei Chu
Pamela Mlynczak
Babak Samani

Atmospheric Science Data Center (ASDC) Support

Karen Brown
Sharon Dukes-Allen
Christopher Harris
Background

CERES/RBSP – not a true Science-Investigator Processing System, or “SIPS”

Science Team (algorithms) → Data Management Team (DMT) (software) → Atmospheric Science Data Center (ASDC)

Funded by Earth Radiation Budget Measurements WBS

Funded by ESDIS
Team Highlights

<table>
<thead>
<tr>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>1965</td>
<td>Initial delivery of FLASH/Flux Inversion subsystem (13-3.0P6, 13-3.1P6)</td>
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<tr>
<td>1965</td>
<td>Create CERES Archiver Profiles for FLASH Inversion PGEs.</td>
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<tr>
<td>1965</td>
<td>Create CATALYST PGE modules for FLASH Inversion PGEs.</td>
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<tr>
<td>1939</td>
<td>Initial delivery of FLASH/Flux TISA Grid Subsystem (13-9)</td>
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</table>

QC specific CERES Archiver profiles for Baseline1-QC processing for PGEs CER1.9P10, CER2.2P1, and CER2.2P2.
Software Deliveries (69)

TISA Gridding:
• Reconfiguration to support MERRA-2 reanalysis MOA input option
• Update to support Edition1C NOAA-20 processing
• Initial delivery of C++ PGE code to produce CRS1deg-Hour from CRS Level 2 data

Clouds:
Update Edition1B cloud retrieval to use either GEOS 5.4.1 or MERRA-2 MOA

Inversion:
Update Edition1B Inversion code to use either GEOS 5.4.1 or MERRA-2 MOA
Software Deliveries (69)

FLASHFlux:
- Clouds normalization files between Terra MODIS C6.1-C5 and NOAA-20 VIIRS V2-Aqua MODIS C5
- Spectral calibration coefficient files

Instrument and ERBE-like:
Several rounds of gains and spectral response function updates for instruments

TISA Averaging: Interpolation adjustment to support surface flux processing
Software Deliveries (69)

CATALYST, PR Tool, and CERESlib:
- MERRA-2 MOA input support
- NOAA-20 Deep Blue aerosol input support

Various SORCE TSI, MATCH aerosol, and gridded GEO ancillary product updates
### Product Availability

<table>
<thead>
<tr>
<th>Product</th>
<th>Platform</th>
<th>Terra</th>
<th>Aqua</th>
<th>S-NPP</th>
<th>NOAA-20</th>
<th>Availability Thru</th>
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New Production

Released: Edition 4A CRS1deg-Hour

Upcoming: Edition1C NOAA-20, featuring NOAA-20 Deep Blue data

Upcoming: Edition 4B SYN1deg (reprocessing):
• Finishing GEO reprocessing: GOES-15 and GOES-17
• Twilight striping correction
• Updated interpolation scheme
• Reprocessing begun – projected finish: Summer 2024

Upcoming: Edition 5 Machine-Learning Flux (MLF)
Switch to MERRA-2 Reanalysis

SSF (Level 2) & SSF1deg (Level 3)

Edition 4A – Terra

GEOS 5.4.1

April 2022

Edition 4A – Aqua & Edition 2A S-NPP*

GEOS 5.4.1

July 2023

* S-NPP still being decided

Edition 1C NOAA-20

May 2018

MERRA-2

5/14/2024

SPRING 2024 CERES SCIENCE TEAM MEETING

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Switch to MERRA-2 Reanalysis

SYN1deg (Level 3) Terra+Aqua / Terra+NOAA-20

Edition 4A

Edition 4B

GEOS 5.4.1

July 2024

GEOS-IT

April 2022

MERRA-2
CERES Ordering Tool

- Clouds visualization back-end codebase merge
- Preparation for pre-production tool migration to virtual machines
- Support for new data service
  - Public product: CRS1deg-Hour
  - Internal testing: “Alpha1” Edition 5
Improvements
Edition 5 Progress

• Tests with new ancillary input products
  • GEOS-IT
  • Collection 7 MODIS radiances
  • IGBP maps (from MODIS)
  • Emissivity maps (from IASI – Zhou and Huang)
  • NOAA CDR snow/ice

• Tests with new software/algorithms
  • Unfiltering algorithm for Inversion
  • High-resolution (0.5 x 0.5 degree lat/long) MOA code
  • New C++ gridding codebase

• Ran Alpha1 test in November 2023

• Alpha2 estimated June/July 2024
## Edition 5 Anticipated Data Product Availability

<table>
<thead>
<tr>
<th>Product</th>
<th>Terra and Aqua</th>
<th>S-NPP and/or NOAA-20</th>
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TISA Code Re-Architecture

- Running Hybrid Edition4A/Edition 5 codebase to enable intercomparisons
  - Creating binary zonal files (old style) from new, netCDF4 files
  - Refining creation of XGLB coefficients for production runs
  - NB2BB handoff to gridding still under development

- Maturing C++ gridding codebase
  - Testing on new product, Edition 4A CRS1deg-Hour
  - Gridding LW fluxes (SW fluxes in development)
  - Developing associated C++ library for general use

- Increasing use of JSON files to configure code and reduce complexity
Clouds Code Re-Architecture

- Running validation test cases against new, C++ codebase
- AWS PGE run prototyping
- Writing documentation for current, best setup
- Setup:
  - ECS container orchestration
  - Tested Fargate vs. EC2 for scaling
    - EC2 more flexible
    - Enables FSX (filesystem) usage
    - Largely as performant as on premises runtime
    - Most significant gains potentially algorithm, software design
Clouds Code Re-Architecture – AWS

1. ECS Service starts instance from AMI
2. Instance Pulls Docker Image from ECR
3. Instance Launches Docker Container
4. Clouds PGE Runs in Containers

Amazon Machine Image

Elastic Container Service (ECS) / Elastic Cloud Compute (EC2)

Elastic Container Registry (ECR) / Docker

1P6 Hour 0 1P6 Hour 1 1P6 Hour 2 1P6 Hour 3 1P6 Hour N
Open Science

• Team members attending NASA Software for the SMD Workshop, May 7-9, 2024 at NASA Headquarters
  • Presenting TISA:
    • Level 3 framework improvements
    • Developer-scientist collaborative technique

• Metadata and variable improvements aligning with OSSI/TOPS data best practices
Libera Data Management Working Group

- LASP-RBSP meeting every other week
  - Level 1B data requirements
  - Data transfer interfaces and testing strategy
    - LASP → ASDC
    - ASDC → LASP

- LASP-ASDC: finished interface control document (ICD)
Systems

- Data migration to new archive underway
- Renewed Red Hat Linux subscriptions
- Dell/EMC Isilon → Dell PowerScale storage refresh
ASDC & SCF Support

- Refining collection-level metadata for ancillary geostationary imager data

- Receiving continued support for processing and storage infrastructure
  - Quickly resolving IT security vulnerabilities
  - Migrating systems to RHEL8 from RHEL7
Conclusion

• Continuing to develop Edition 5 algorithms and code
• Summer 2024 transition to Edition 4B for SYN1deg products
• Code re-architecture ongoing
• Working with ASDC to upkeep infrastructure & metadata
Questions?