CLARREO Pathfinder Inter-Calibration Data System: Requirements, Concepts, and Status

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Outline:

- Inter-Calibration Data System Requirements
- Data Management Plan
- Inter-Project Agreement with ESDIS
- Data System Hardware Status
- Multi-instrument Inter-calibration (MIIC) System
- Issues and Challenges
MIIC IC Data Management Requirements

- Level 2 Data Requirements are Specified in the SMRD
  - SMRD SCI.24040 ESDIS Compliance
    - Adhere to NASA Earth Science Data and Information Policy specified at http://science.nasa.gov/earth-science/earth-science-data/data-information-policy/ - open access to data
    - NASA Earth science data systems to adhere to ESDIS standards and practices, http://earthdata.nasa.gov/data/standards-and-references - produce data products in compliant file format (HDF5, netCDF4)
  - Data Latency
    - CPF IC L1B: 1 month after measurement
    - L4: 6 months after measurement
    - VIIRS and CERES input TBD
  - Data Release (available to outside users)
    - CPF IC L1B: L+10 mos. (Beta), L+20 mos. (Ed1)
    - L4: L+12 mos. (Beta), L+24 mos. (Ed1)
CPF Data Management Planning Documents

- **Draft Data Management Plan CPF-04-014 Draft**
  - Implementation plan for CPF Science Segment – addresses life cycle of science data product generation: software development, data systems, science operations, data assessment, …

- **Inter-Project Agreement (IPA) with ESDIS**
  - Define DAAC and Project responsibilities to archive and distribute data products to the science community
  - Need draft IPA by SRR
  - Jeff Walter (ASDC) leading the effort
  - Help explain “ESDIS compliance” requirements
New hardware procured and installed for small cluster and shared storage (GPFS)
Need to interface to MIIC system
Inter-Calibration New Data System Hardware

- **Excellent ASDC support**: Dave Johnson, Chris Jones, Andrei Vakhnin, Chris Harris

- New CPF data system being configured and tested
  - Head node
  - 6 compute nodes, 16 Intel cores/node
  - Local GPFS storage (185 TB, RAID6)
  - MIIC blades (3)

- Benchmark results
  - (48 jobs, 512KB bsz)
  - GPFS_local /Pathfinder RAID6
  - ext4_local /data2 RAID5
  - GPFS_remote /data3_3500 RAID6
  - ibm_seq_write 2.7 GB/s 1.0 GB/s (per RAID) 59 MB/s
  - ibm_seq_read 1.8 GB/s cache biased 1.8 GB/s
  - iozone
  - gpfper

- HP (SGI) meeting 1/10 to verify system configuration and perform system tuning
- Univa Grid Engine installed, runs on top of GPFS
- Run multiple processes (1-16 per node) using UGE or MPI; only 3 compute nodes configured!
Multi-Instrument Inter-Calibration (MIIC) System

- Distributed system that uses OPeNDAP to access remote data sets
- Event Prediction, Data Acquisition, and Data Analysis web services
- CPF Project to determine how best to leverage the MIIC system
- Lead software architect: Aron Bartle, Mechdyne
- Demo capabilities w/ CERES NPP FM5 vs. Aqua FM3 inter-comparison


Multi-Instrument Inter-Calibration (MIIC) software development funded by NASA ROSES ACCESS 2011 and 2013
MIIC Event Prediction

Figure 1. CERES NPP vs. Aqua Event prediction: MIIC (left) vs. SPIE 2014 (right), January 5, 2013; MIIC Event Prediction settings: Δvza=5°, Δraz=180°, Δtime= 24 sec., and 0-75 sza; footprints are averaged within 1°×1° geographic grid cells.
MIIC Data Acquisition

Multi Instrument Inter-Calibration

Current User: Jon

Home > Plans > Copy Of Copy Of Copy Of EP-DAY-TEST [ Events, Analysis ]

Current State: ANALYSIS_COMPLETED

Target Variables
- Clear_Footprint_Area
- Clear_area_percent_coverage_at_subpixel_resolution
- MIIC_standard_latitude
- MIIC_standard_longitude
- Surface_Map_Surface_type_index
- Time_and_Position_Time_of_observation
- Unfiltered_Radiiances_CERES_LW_radiance_upwards
- Unfiltered_Radiiances_CERES_SW_radiance_upwards
- Viewing_Angles_CERES_solar_zenith_at_surface
- Viewing_Angles_CERES_viewing_zenith_at_surface
- Viewing_Angles_CERES_relative_azimuth_at_surface

Target dimensions

Reference Variables
- Clear_Footprint_Area
- Clear_area_percent_coverage_at_subpixel_resolution
- MIIC_standard_latitude
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- Viewing_Angles_CERES_viewing_zenith_at_surface
- Viewing_Angles_CERES_relative_azimuth_at_surface

Reference dimensions

Advanced Options

Save Plan
Filter merged 1° x 1° grid cells on server:

\[ \Delta r_{az} \leq 5^\circ, \]
\[ \Delta v_{za} \leq 5^\circ, \]
\[ \text{count} > 7, \]
\[ \sigma_{SW/\overline{SW}} < .25 \]
## MIIC Data Analysis Visualization

![Graph showing data analysis](image)

**SW_fit2**
2D Histogram: result/SW_fit2

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<th>CER_SSF_NPP-FMS-VIIRS_Unfiltered_Radiances_CERES_LW_radianc_upwards</th>
<th>CER_SSF_NPP-FMS-VIIRS_Unfiltered_Radiances_CERES_SW_radianc_upwards</th>
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Count: 16178, X mean: 110.141294, X std dev: 46.348057, Y mean: 0.011310, Y std dev: 0.038445
Working w/ CERES Cal-Val Team to Validate MIIC
(NPP FM5 vs. Aqua FM3 Inter-comparison)

<table>
<thead>
<tr>
<th>Date</th>
<th>IC Events</th>
<th>SW Relative Difference All-Sky [%]</th>
<th>SW Relative Difference Overcast [%]</th>
<th>LW Relative Difference All-Sky [%]</th>
<th>LW Relative Difference Overcast [%]</th>
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<td>Feb. 1, 2012 – April 30, 2013 (15 mos.)</td>
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<td>1.34</td>
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<td>1.74</td>
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Relative Difference: (FM5-FM3)/FM5

SW Difference Monthly Trend: FM5-FM3

SW diff trend
1D Profile: result/SW_diff

CERSSF_NPP-FM5-VIIRS:Time_and_Position_Time_of_observation (UTC time)
CPF IC Data System Issues and Challenges

- Work with science working groups for requirements
  - ATBDs - define algorithms to implement
  - Data Product Catalog – define data products to produce
- DM software effort – run IC science jobs (PGEs) -> framework
- Select file format (HDF5, netCDF4)
- Define Interfaces
  - Ingest and Archive interface to be defined by DAAC
  - IC Command interface to be defined by LASP
  - Controller interface to science jobs (PGEs) via Univa Grid Engine
- Determine how to best leverage the MIIC system
  - Currently access CERES L2 data from ASDC DPO
  - Deploy MIIC OPeNDAP server at LAADS to access VIIRS data (TBD)
- Plan Build 1
- Plan CPF Data Management Workshop w/ LASP (Feb., ’17 TBC)
- Prepare for SRR