State of CERES

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CERES Science Team Meeting, April 26-28, 2022
Virtual Meeting
CERES Science Team Meeting

• Review status of CERES Instruments and Data Products

• Invited Presentations Session. Each presentation is 45 min including time for questions.

• Contributed Science Reports. Each report is 20 min including time for questions.

*Please send an electronic copy of your presentation to Ed Kizer (edward.a.kizer@nasa.gov) at least one day prior to your presentation*
CERES Technical Meeting

Review Status of CERES Instruments and Data Products:
- State of CERES
- CERES Terra, Aqua, S-NPP, NOAA-20 Instrument Calibration Update
- MODIS & VIIRS Cloud Algorithm & Validation Status
- ADM, SARB and TISA Working Group Reports
- EBAF Update
- FLASHFlux Update
- Data Management Team Update
Niño 3.4 Index (ONI) Anomaly & PDO Index (01/2000 – 03/2022)

-2.0°C to +3.0°C

Niño 3.4 Index (°C)

1998-2001

2002-2003

2006-2007

2009-2010

2015-2016

2018-2019

2020-2022

<PDO> = -0.87
(Jan 00 – Feb 14)

<PDO> = 0.7
(Mar 14 – Jun 17)

<PDO> = -0.89
(Jul 17 – Mar 22)
Global Mean All-Sky TOA Flux Anomalies & Multivariate ENSO Index
(CERES EBAF Ed4.1; 03/2000 – 01/2022)

EBAF Trends (03/2000-01/2022)

ASR: $0.69 \pm 0.20$ Wm$^{-2}$ per decade

LW: $-0.27 \pm 0.21$ Wm$^{-2}$ per decade

NET: $0.42 \pm 0.20$ Wm$^{-2}$ per decade

EEI Changes: First and Last 5 years

• EEI (03/2000—02/2005): 0.44 Wm$^{-2}$
• EEI (02/2017—01/2022): 1.14 Wm$^{-2}$
• ΔEEI: 0.7 Wm$^{-2}$

=> Approximate doubling of EEI
Global Mean All-Sky TOA Flux Monthly Anomalies (03/2000-01/2022; Climatology: 05/2018—06/2019)

- Based upon CERES SSF1deg products (no GEO)
- NET monthly anomalies consistent to 0.3 Wm\(^{-2}\) (1σ)
- No evidence of CERES instrument drift
• SST trend shows strong warming over Northern Hemisphere Eastern Pacific Ocean
• SW TOA flux trend pattern is closely linked to SST trend pattern (especially in regions with abundant low cloud)
CERES Journal Publications and Citation Counts
(For Papers Between 1993-2022; Updated March 8, 2022)

- Total number of peer-reviewed journal articles: 2,359
- Total number of citations to CERES papers: 96,853

(Compiled by Dennis Keyes)
## Number of Unique Users by CERES Data Product (through March 31, 2022)

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FLASHFlux via POWER since last year: **105,702**

*The numbers are lower because most orders through ASDC now come from Direct Data Download, which are not currently captured in the ESDIS Metrics System (EMS), although they are working on it.*
Aqua Status

• March 31, 2022: Fault in primary Power Controller (PC-A) was detected. Swap to redundant PC-B was automatically made.

• Spacecraft was put into Earth Point Safe Mode

• Root cause: Likely a solar weather event while the Aqua was passing through the South Atlantic Anomaly, leading to one or more bit flips.

• Current Status: Aqua fully recovered and brought out of safe mode on April 14. FM3 and FM4 were brought out of safe mode April 15 and are nominal.
President’s in-guide budget for Terra, Aqua and Aura ends science data collection in 2023, even though the missions can last at least through 2026 (Terra & Aqua), albeit with a drifting MLT.

Aqua, Terra and Aura Projects are investigating alternate scenarios that might enable the missions to continue operating beyond 2023 (e.g., cost savings) should there be an opportunity.

S-NPP (launched in 2011), will continue to operate at least through spring 2024, 1.5 years after JPSS-2 launches in September 2022.

- S-NPP can last at least through 2027 based upon available consumables.

If S-NPP ends science data collection in 2024, that will leave only CERES FM6 (NOAA-20, L2017), to provide overlap with Libera, scheduled for launch in 2028.
- Currently, 6 CERES instruments fly on 4 satellites: Terra (L1999), Aqua (L2002), SNPP (L2011), NOAA-20 (L2017)
- Libera scheduled for launch in 2027 on JPSS-3
• Gap risk in 2025 exceeds 20% if SNPP ends in 2024 and TER & AQU end in 2023. Remains <5% if either SNPP ends in 2027 or TER & AQU end in 2026.

• Gap risk in 2026 reaches 27% if SNPP ends in 2024 but remains <10% if SNPP ends in 2027.

• Gap risk reaches 38% when Libera launches in 2028 for all scenarios.
Bridging a Data Gap in the ERB CDR

Goal: Examine the feasibility of using less-accurate imager retrievals to compute radiative fluxes and tie the time series before and after a data gap together.
Assumes imager remains healthy and perfectly stable across the data gap. The longer the gap, the greater the risk.

The resulting uncertainty is too large to enable decade-to-decade changes in EEI to be resolved.

Time to detect a real trend above uncertainty would increase substantially.

A gap would require considerable extra post-processing effort, thereby delaying release of the ERB data products.

\[ \pm 0.32 \text{ Wm}^{-2} \]
\[ \pm 0.37 \text{ Wm}^{-2} \]
\[ \pm 0.49 \text{ Wm}^{-2} \]
Planning for Terra & Aqua Edition 5

Main Considerations:

1) GMAO improvements to their atmospheric reanalysis system.
   • CERES and GMAO hold WebEx meetings every 3 weeks to gauge progress and
     provide ongoing validation results for the latest GEOS FP or FPIT version.

2) MODIS Collection 7 schedule.

4) CERES production code improvements.

5) CERES algorithm improvements (particularly those enabling a seamless transition
   across satellite platforms).

Note: EBAF Ed4.2 will be released this year in order transition from Terra+Aqua to
NOAA-20 and to mitigate discontinuities in EBAF-SFC associated with input
reanalysis data and GEO artifacts.
GRANITE ISLAND

* Data was humming along until early January 2022, when a severe ice/snow storm caused solar tracker failure.
* Then, in late January, the batteries failed due to lack of charging (No sun for weeks). The island’s power system was also strained, first time in 5 years.
* New batteries are “on order” to bring the site back online. An agreement has been made with the owner of the island to draw power from the island’s generator system. This should prevent any future power failures due to lack of sun.
* The site is expected to become operational again on our next visit (May/June).
* Current data availability is 2018 July – 2022 January.

COVE (Legacy)

* Data availability from 2000 May - 2016 November.
* Paper on the Upwelling Longwave Tower Effect is progressing.

LaRC

* Everything is working well.
* Added PAR instrument.
* New Vaisala weather station installed (Hardware provided by Margaret Pippin).
* New control system for the reference absolute cavity pyrheliometers, used for shortwave calibrations, is currently being tested to replace 15+ year system.
* Current data availability is 2014 December – 2022 March.
Upcoming Conferences & Meetings of Interest

Sun-Climate Symposium
- May 16-20, 2022, Madison, WI

International Radiation Symposium (IRS)
- July 4-8, 2022, Thessaloniki, Greece.

AMS 16th Conference on Cloud Physics & Atmospheric Radiation
- August 8-12, 2022, Madison, WI.

Fall 2022 ERB Workshop (CERES/Libera/GERB/ScaRaB)+Science
- October 12-14, 2022, Hamburg, Germany.

Fall AGU
- December 12-16, 2022, Chicago, IL