Koninklijk Meteorologisch Instituut België

Institut Royal Météorologique Belgique

Königliches Meteorologisches Institut Belgien

Royal Meteorological Institute of Belgium

BRAVO

Progress Meeting WP3

Christine Aebi, Almudena Velazquez Blazquez, Edward Baudrez and Nicolas Clerbaux

21 February 2025

Overview WP3

Work Package number:	**WP3**
Work Package Title:	**Accuracy assessment of unfiltered radiances L2 BM-RAD product.**
Responsible entity:	RMIB
WP responsible person	Aebi
Project phases (0,A,B,C,D,E):	E
Beginning and end dates of WP	01.12.2024 – 31.12.2025
Total FTE allocated to the WP	13 PM (1.08 FTE)

Objectives of the WP: Quantitative evaluation of the L2 BM-RAD radiance product, so establishing input data quality for the BBR flux estimation.

Inputs:

- Tools from WP1.
- L2 BM-RAD data (commissioning and beyond)
- CERES (SSF) and GERB (HR) data

Description of work and schedule:

3.1
- Basic, qualitative, evaluation of the BM-RAD product, including visualization (context from MSI images).

3.2
- Comparison unfiltered radiances with the Earth targets defined in WP1.

3.3
- Comparison with coangular co-incident observations from GERB and CERES to assess absolute level (calibration), and scene type consistency (spectral response/unfiltering).

3.4
- Long term stability monitoring of the instrument response will be established using stable Earth targets.

Excluded tasks:

Deliverables and dates:

- Matched databases of coangular radiances for reference and further analysis (30.06.2025).
- BBR L2a quantitative assessment report (31.12.2025).
- Recommendation for BM-RAD processor evolution.

Risks: Availability of co-angular collocated observations from CERES RAPS campaigns

Outlook from progress meeting on November 29, 2024

- Continuation of the monitoring of various parameters.
- Analysis of the level-2 products BM-RAD and BMA-FLX data.
- Analysis of changes per month, per day?
- Continuation of the analysis with GERB and CERES data:
  - GERB is out of the sun avoidance season since middle of October 2024.
  - CERES SSF data are available until 01/08/2024.
- Presentation at the 1st ESA-JAXA EarthCARE In-Orbit Validation Workshop in January 2025.
- Participation at the EarthCARE Validation Workshop in March 2025.

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→ Title: EarthCARE BBR Level 1 Products Assessment within BRAVO Project

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→ Abstract sent: EarthCARE BBR Validation Results within the BRAVO Project

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Outlook from progress meeting on November 29, 2024

- ✓ Continuation of the monitoring of various parameters.
  - → B-NOM (see next slides)
- ✓ Analysis of the level-2 products BM-RAD and BMA-FLX data. → See next slides
- ✓ Analysis of changes per month, per day? → See next slides
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Evaluation of the B-NOM product (L1)

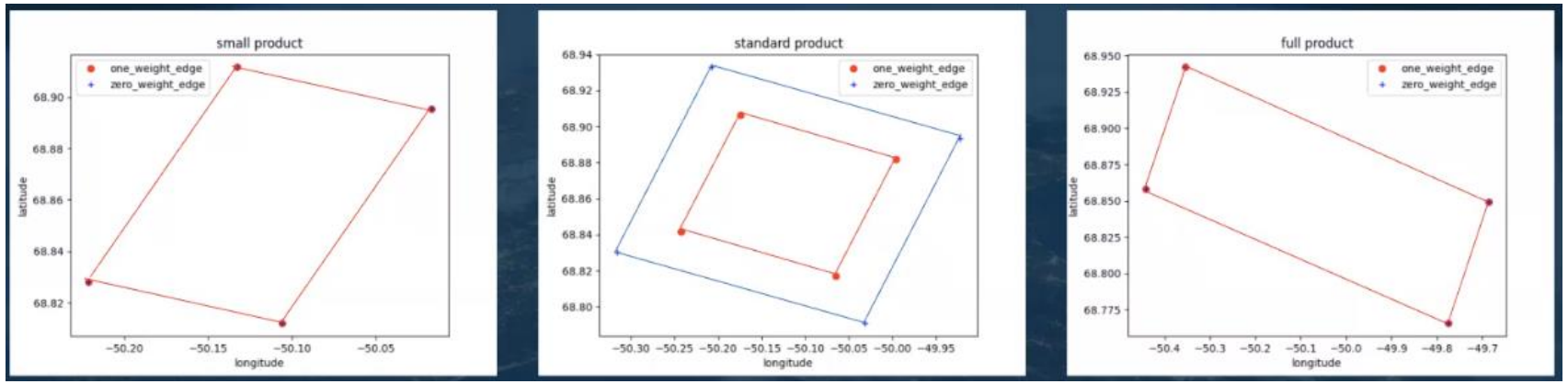
- Containing filtered shortwave and longwave radiances
- No additional information about clouds, snow albedo, etc.
- Available in three different resolutions (small, standard, full)
- Data availability:
  - Baseline AC: 27/07/2024 – 13/01/2025
  - Baseline AD: 13/01/2025 – today

Resolutions B-NOM (L1)

- B-NOM

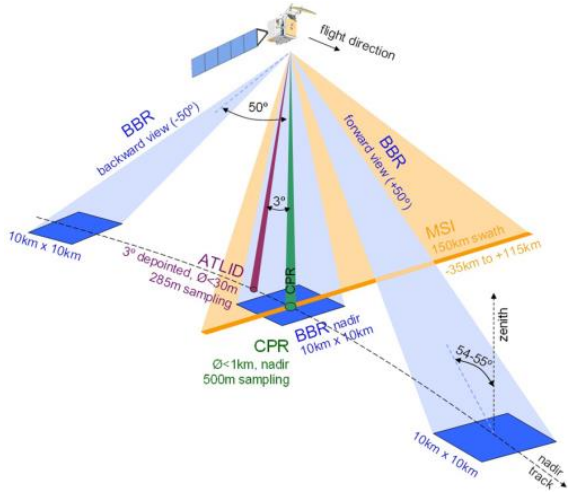
SW and **LW** filtered radiance integrated over three resolutions:

Resolution	along-track (km) x across-track (km)
Small	10 x 5 (configurable)
Standard	10 x 10
Full	Nadir: 10 x ~17 Off-nadir: 10 x ~ 28



- B-SNG

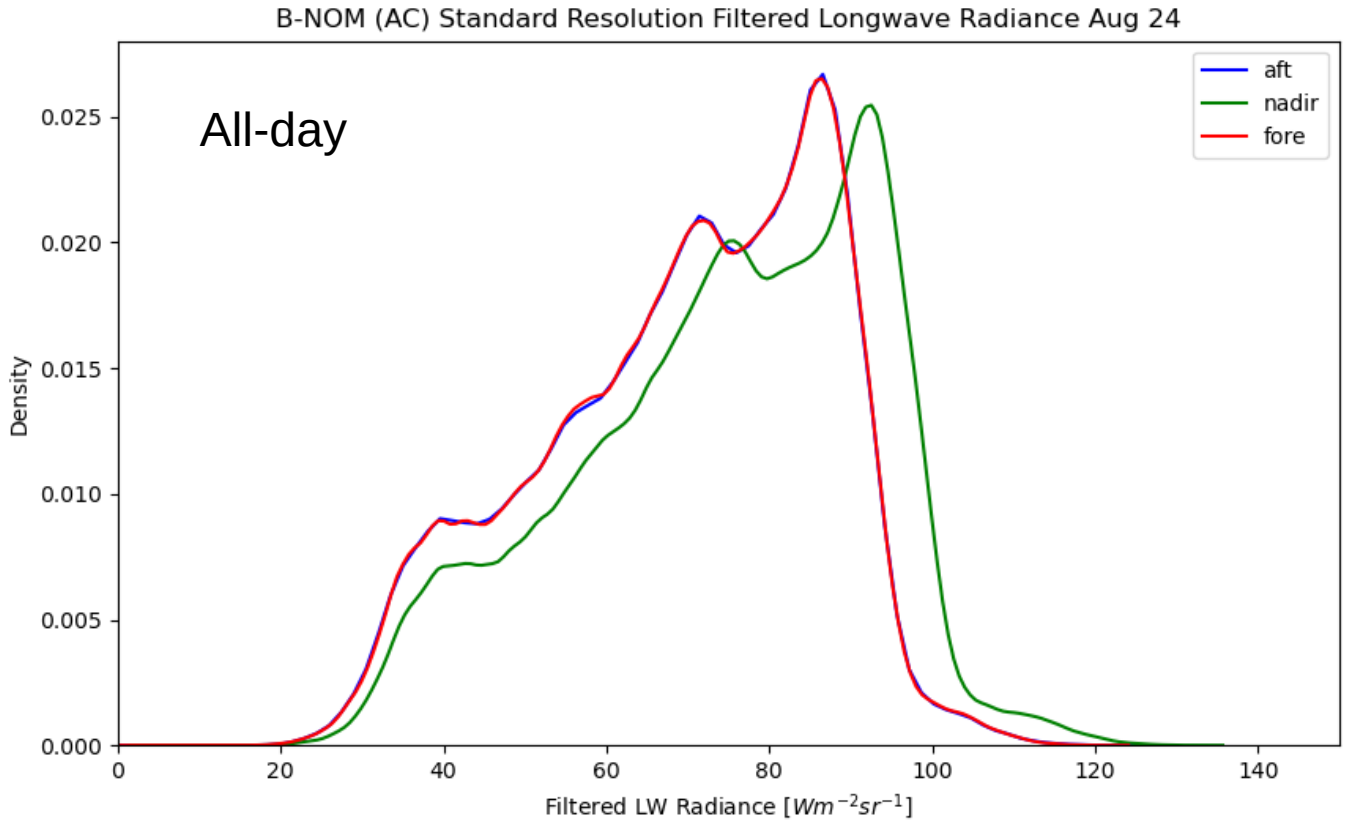
SW and **TW** filtered radiance at pixel level



Filtered Radiances

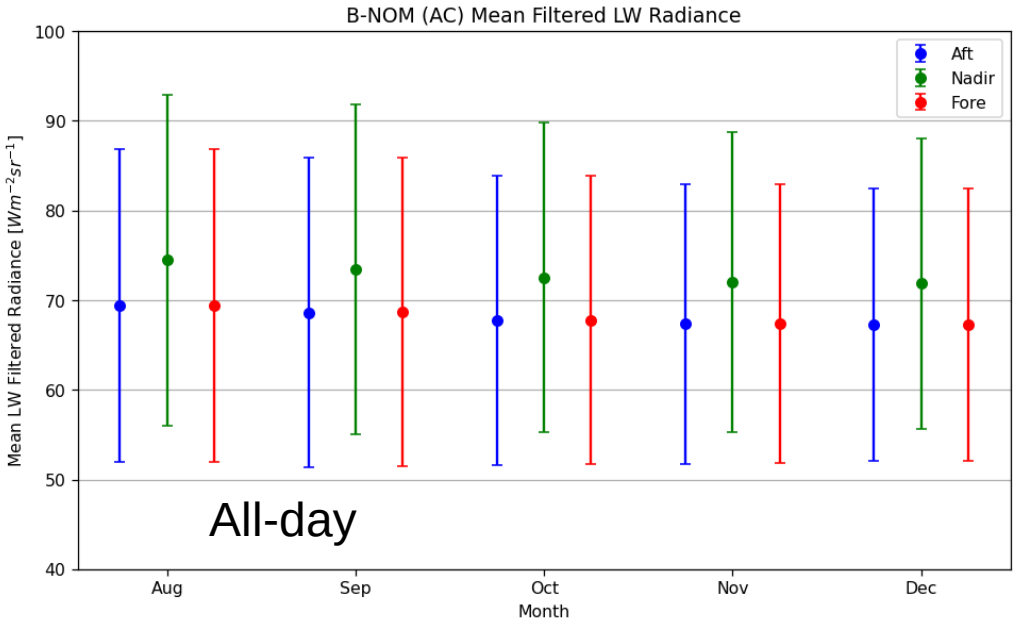
Distribution B-NOM LW Radiance, August 2024

Standard Resolution, Baseline AC

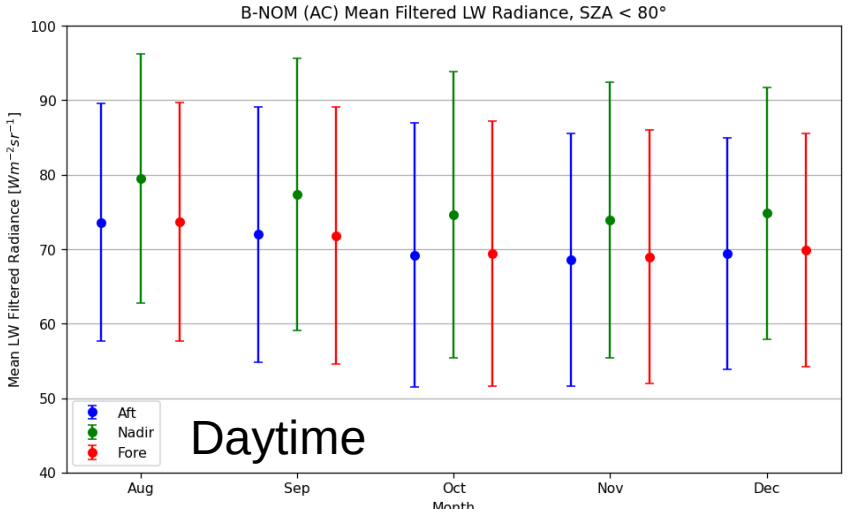


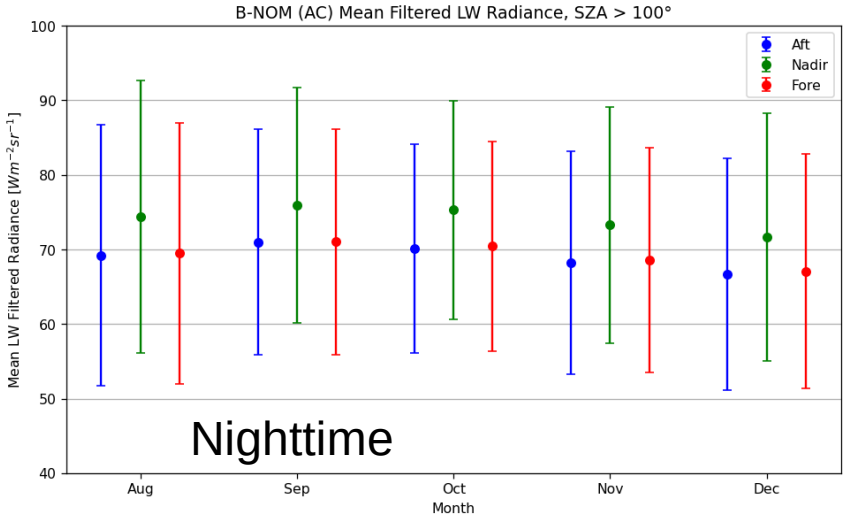
View	Mean [$Wm^{-2}sr^{-1}$]	Std [$Wm^{-2}sr^{-1}$]	Median [$Wm^{-2}sr^{-1}$]
Aft	69.41	17.42	71.85
Nadir	74.45	18.43	76.75
Fore	69.40	17.40	71.82

Mean Values of B-NOM Filtered LW Radiances per Month



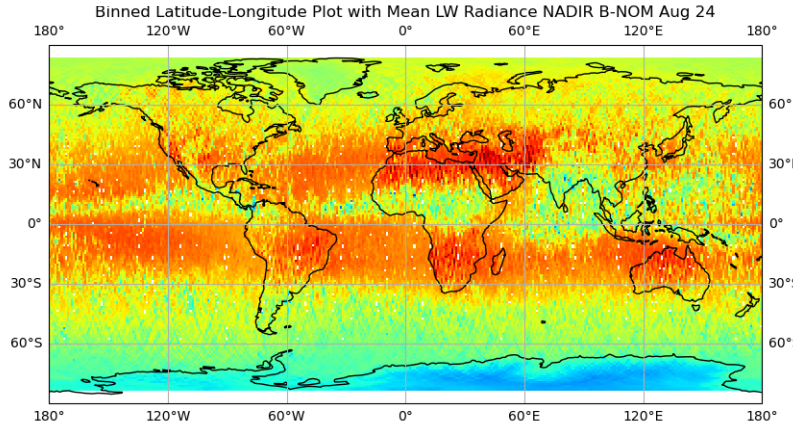
Standard Resolution, Baseline AC



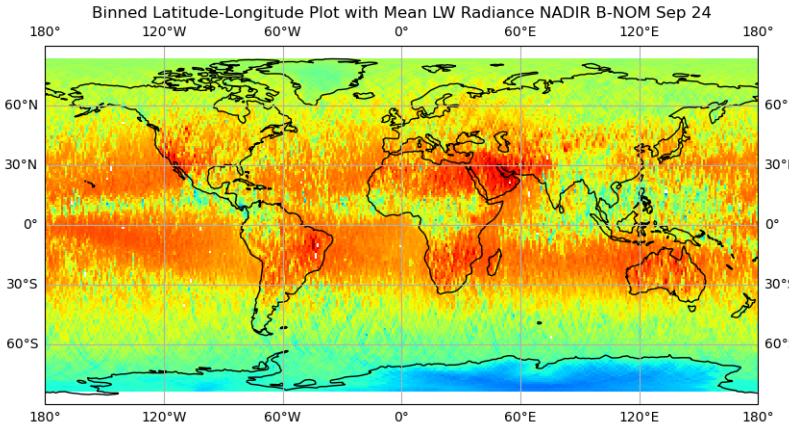


B-NOM Filt. LW Radiance per 1°x1° Lat.-Lon. Bin, Nadir

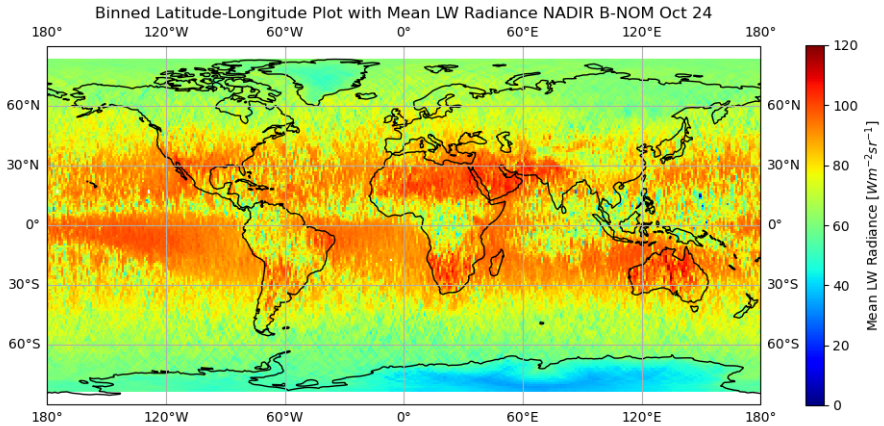
Aug 24



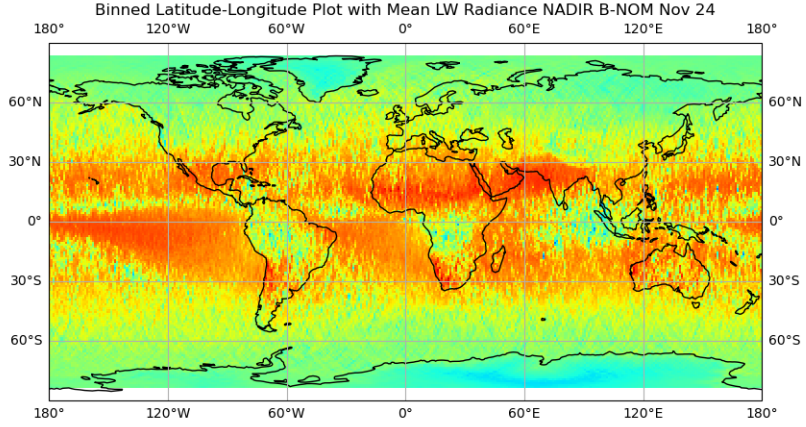
Sep 24



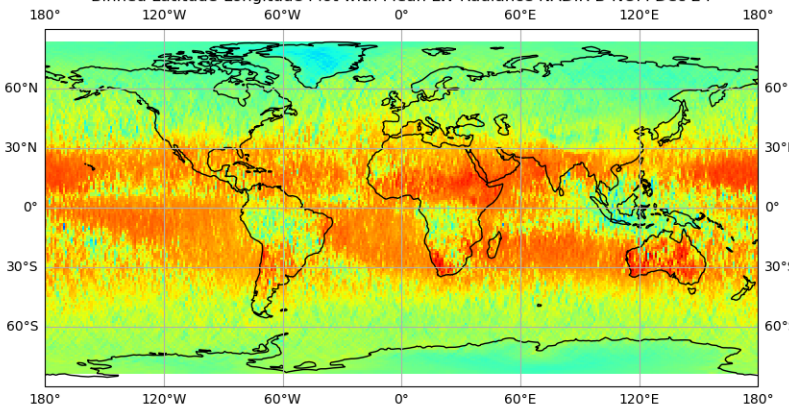
Oct 24



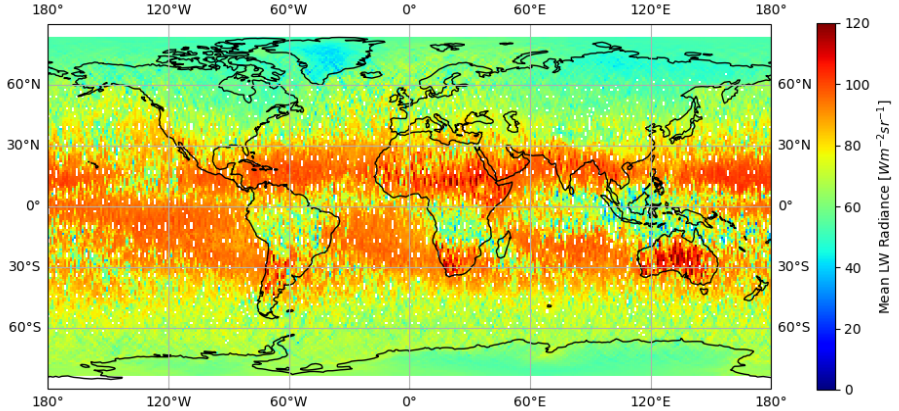
Nov 24



Dec 24

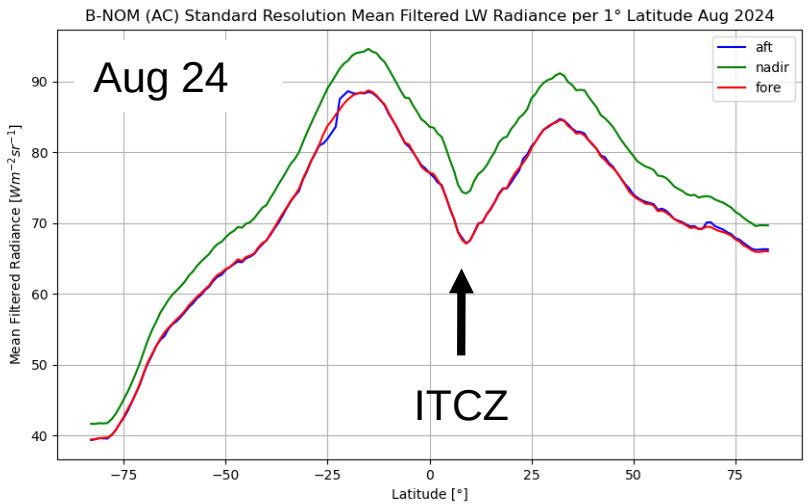


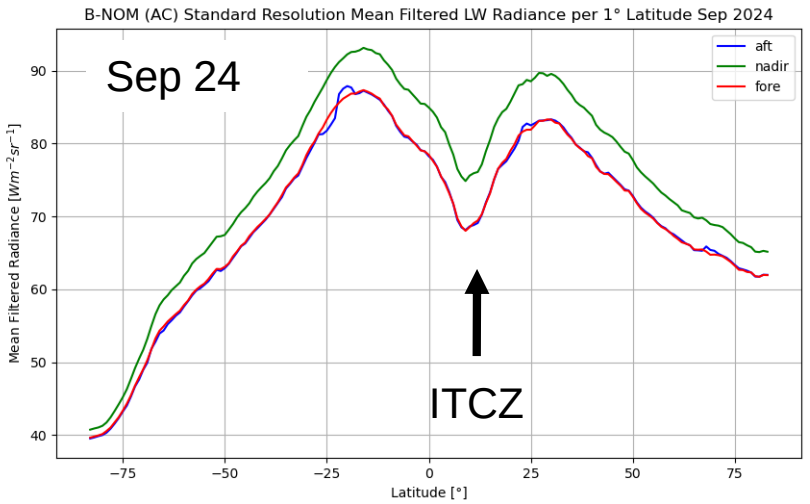
14 – 31 Jan 25, Baseline AD

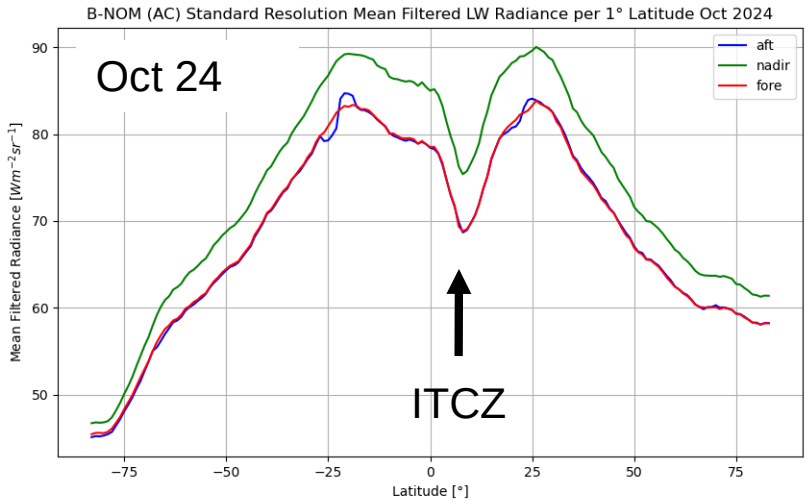


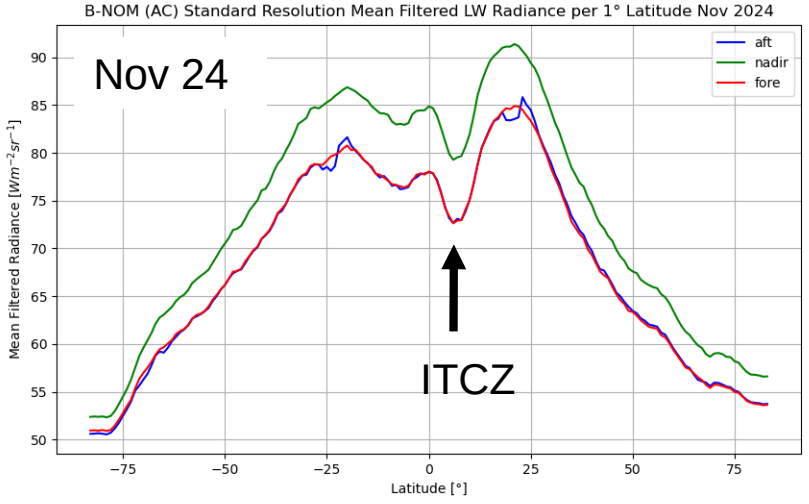
- Decreasing mean LW radiance values from August 2024 to January 2025.

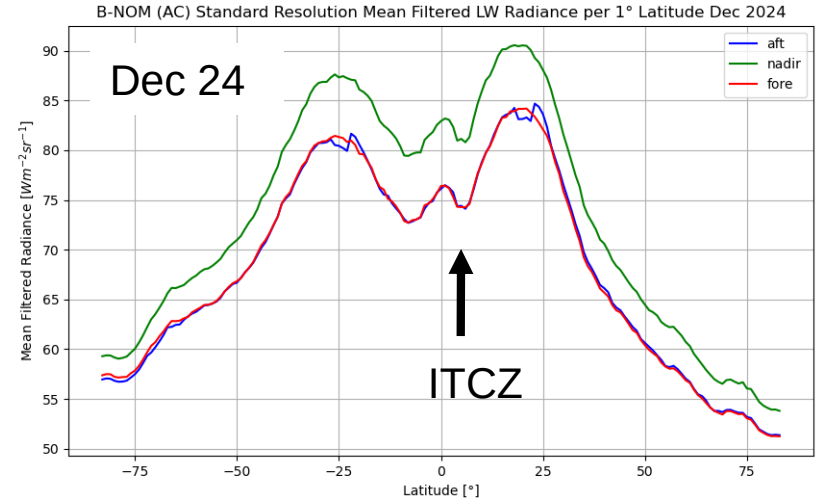
B-NOM Filt. LW Radiance per 1° Lat. Bin, Aug 24 to Feb 25





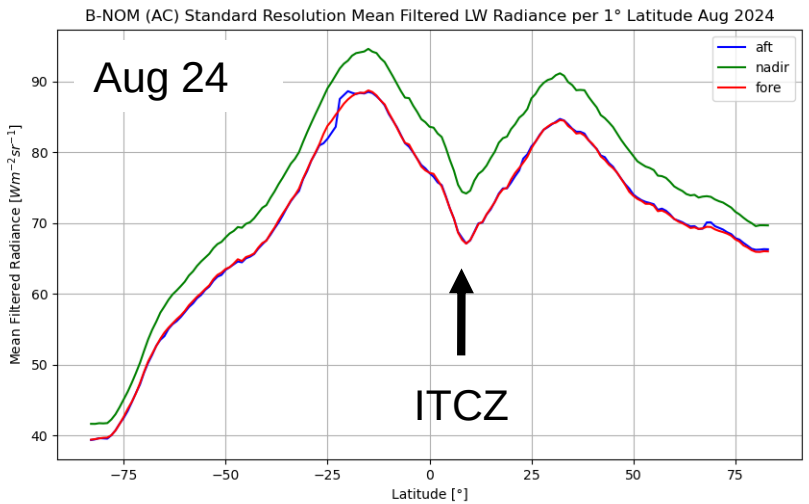


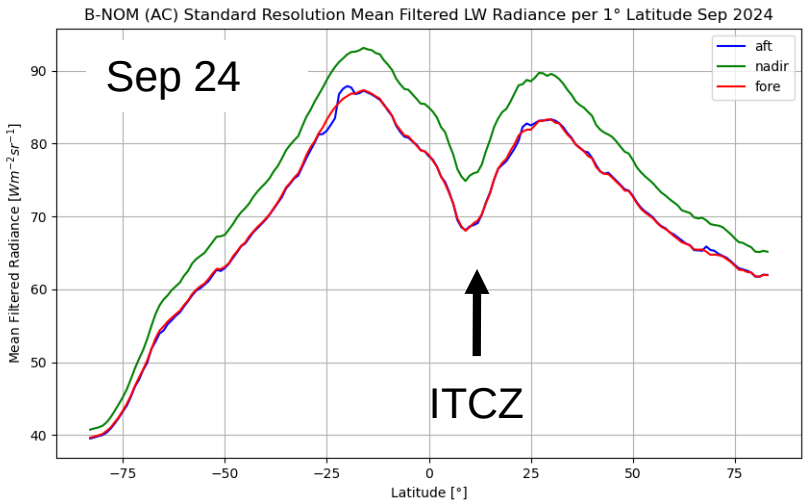


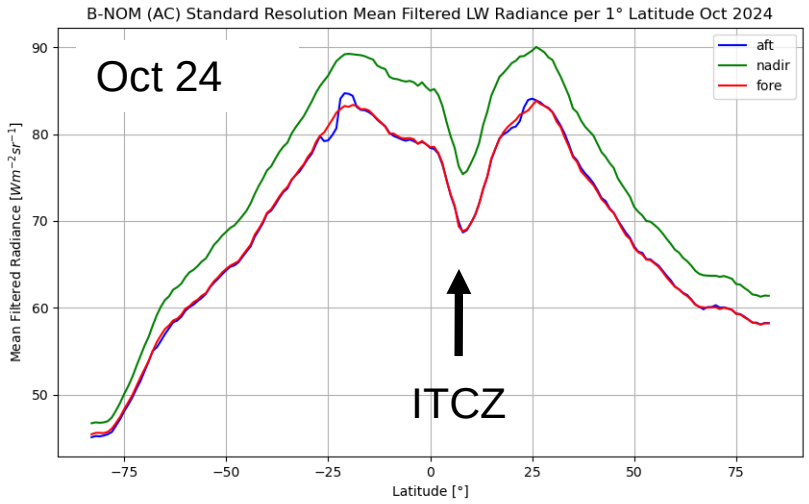


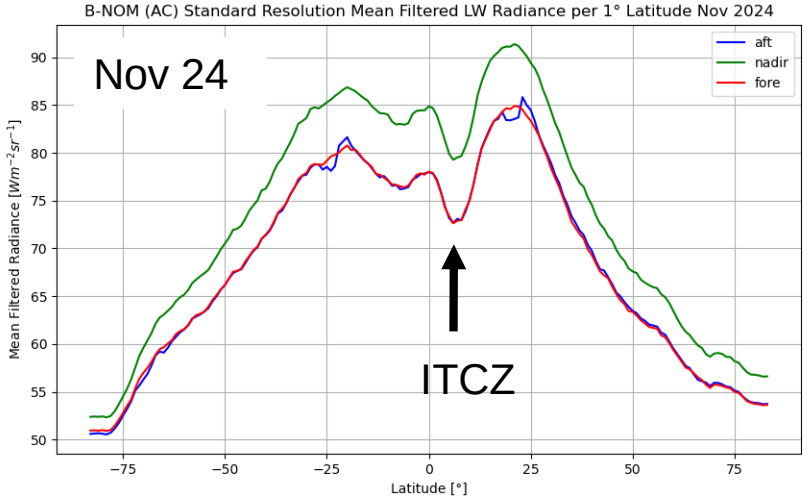
- Gaps in the AFT view at the beginning of each frame – corrected in baseline AD (January-plot).

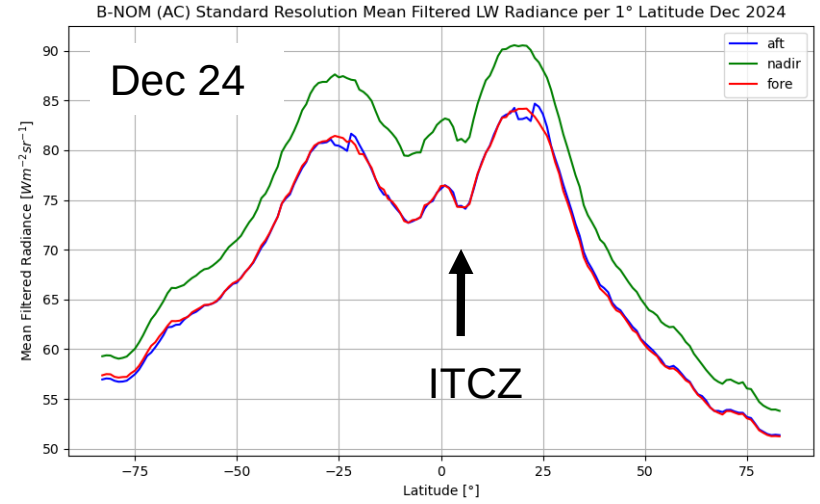
B-NOM Filt. LW Radiance per 1° Lat. Bin, Aug 24 to Feb 25

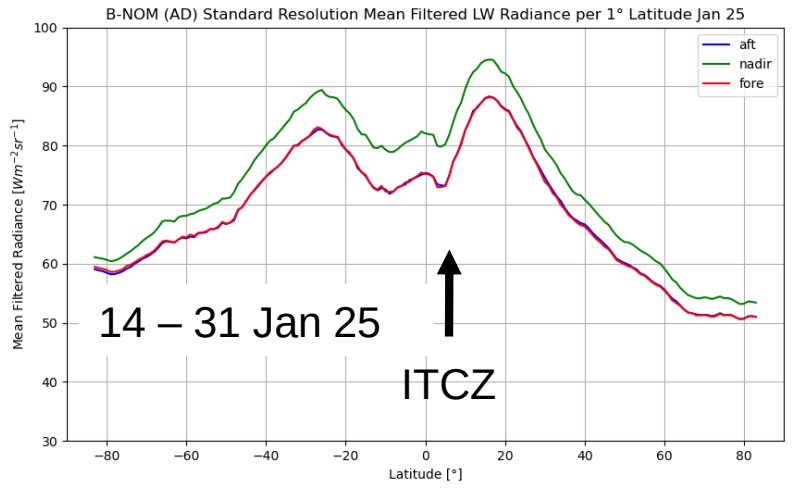








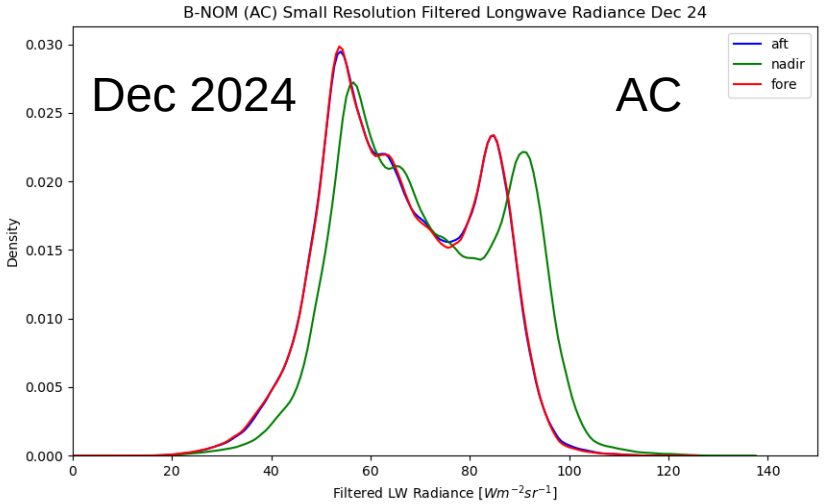




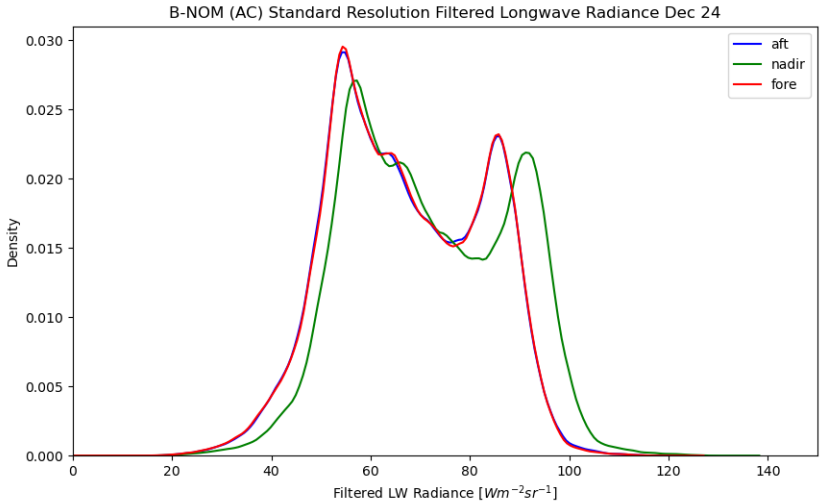
- Gaps in the AFT view at the beginning of each frame – corrected in baseline AD (January-plot).

Comparison of different resolutions B-NOM product: LW Radiance

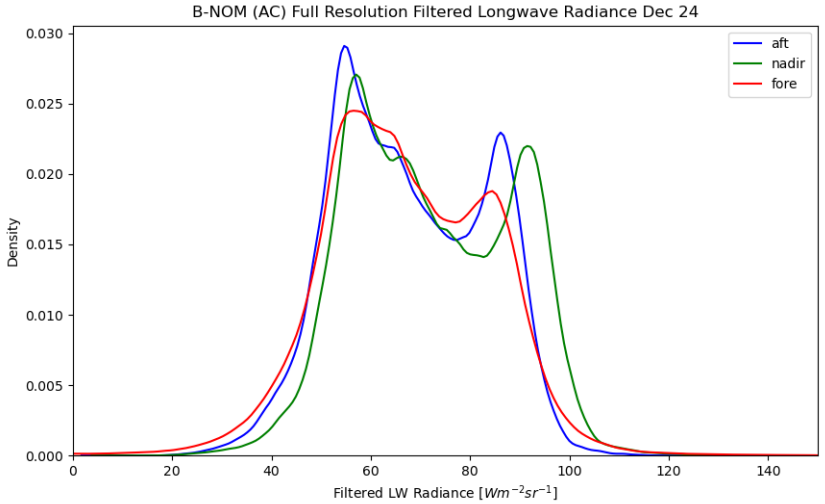
Small Resolution



Standard Resolution



Full Resolution



- Good consistency between the small and the standard resolution.
- FORE view in the full resolution shows some issues (due to a dead pixel) – in baseline AC.

Comparison of different resolutions B-NOM product: LW Radiance

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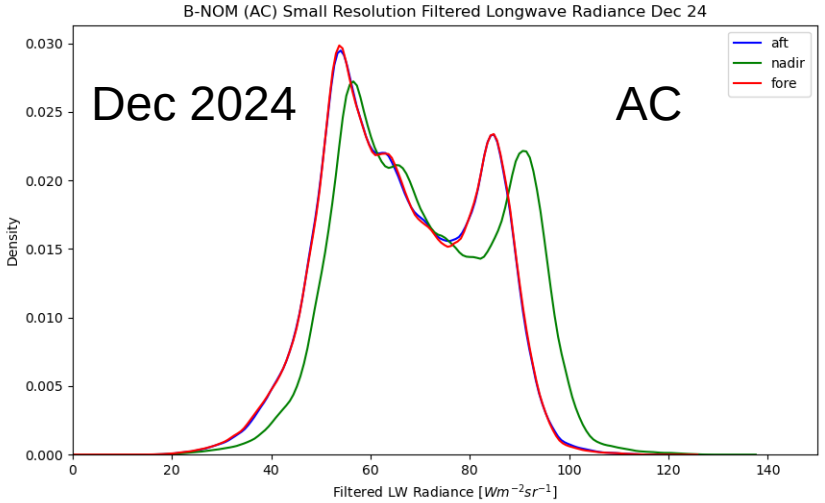
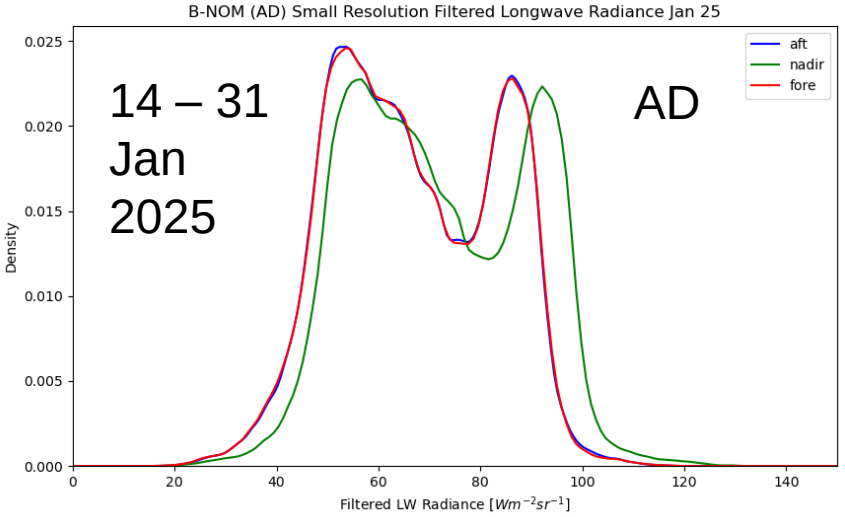
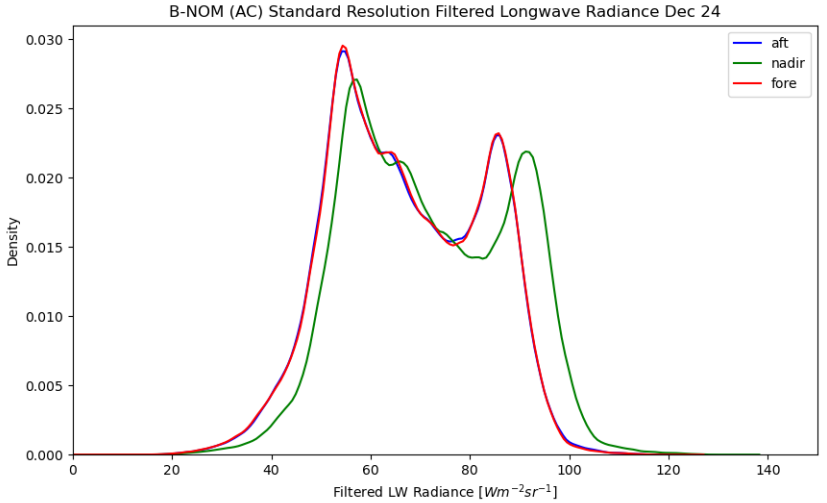
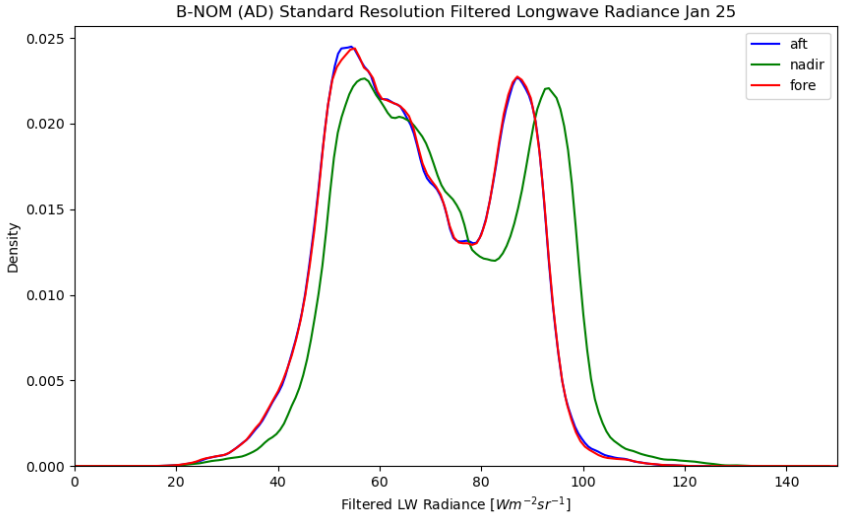


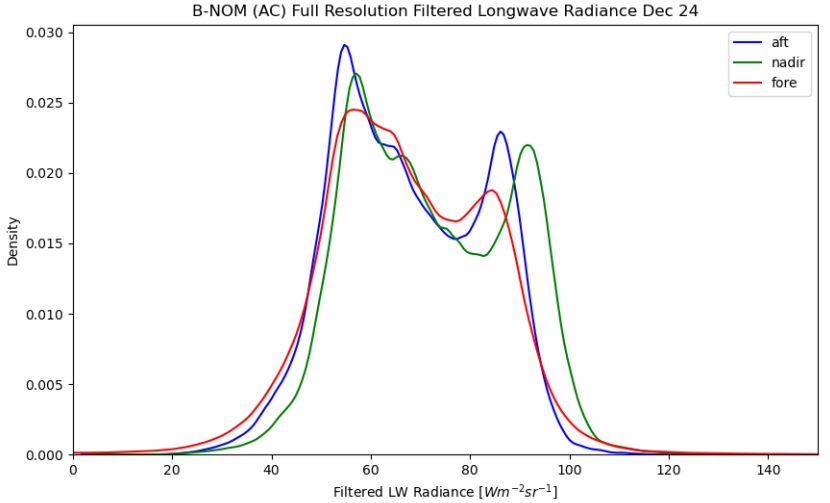


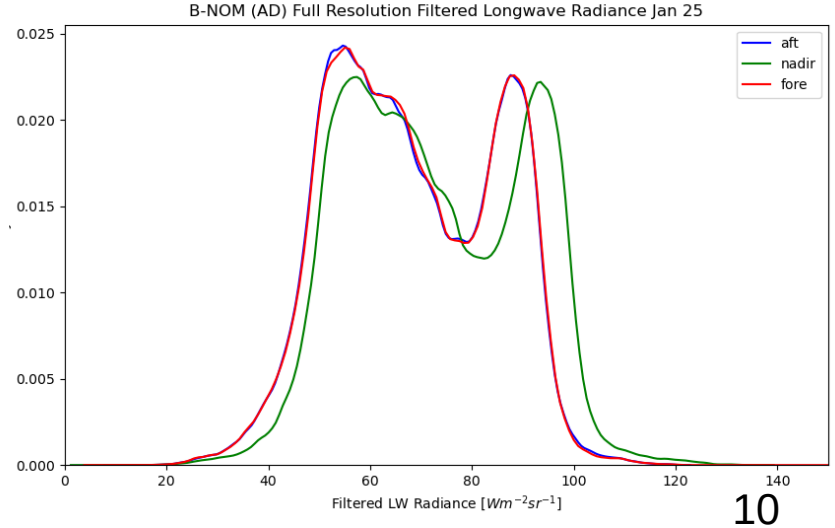
Standard Resolution





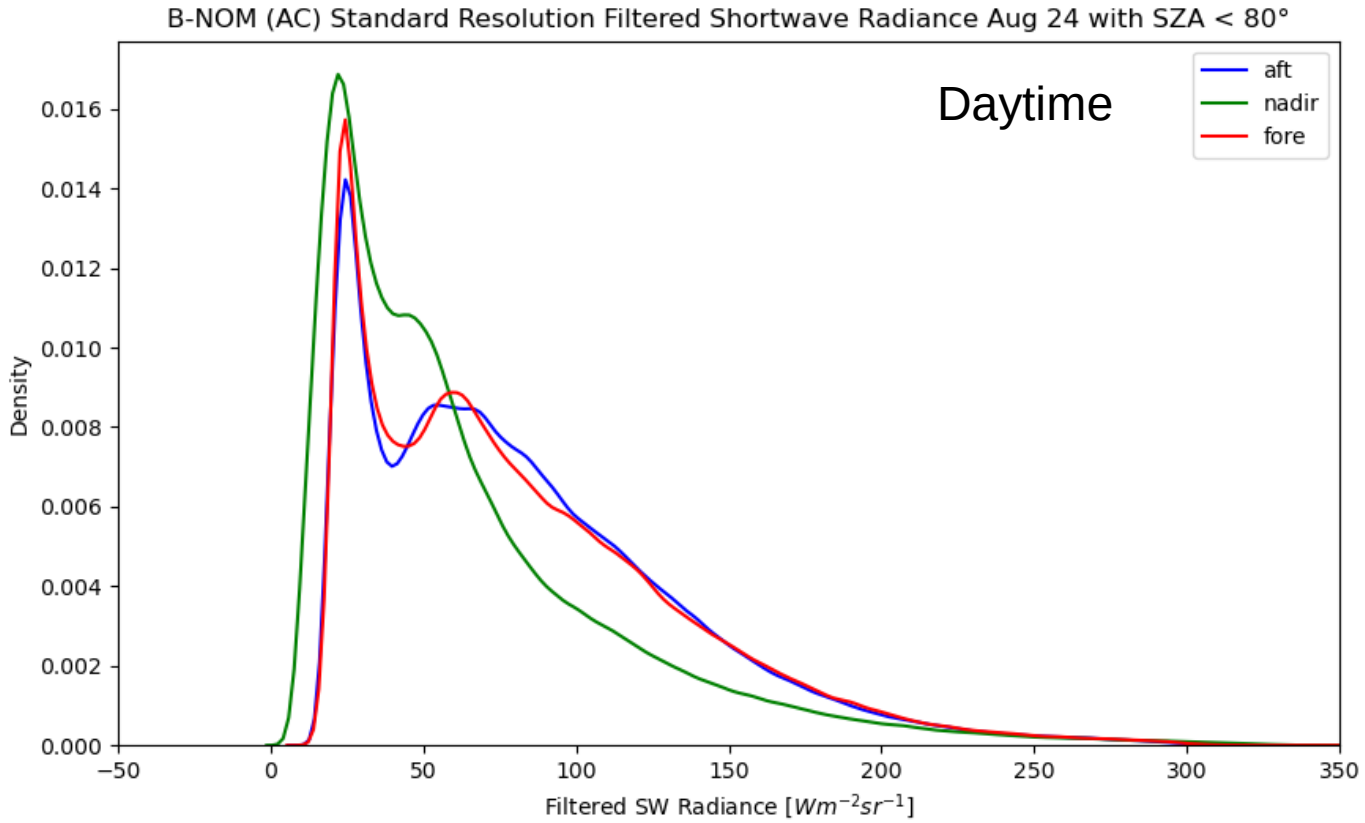
Full Resolution





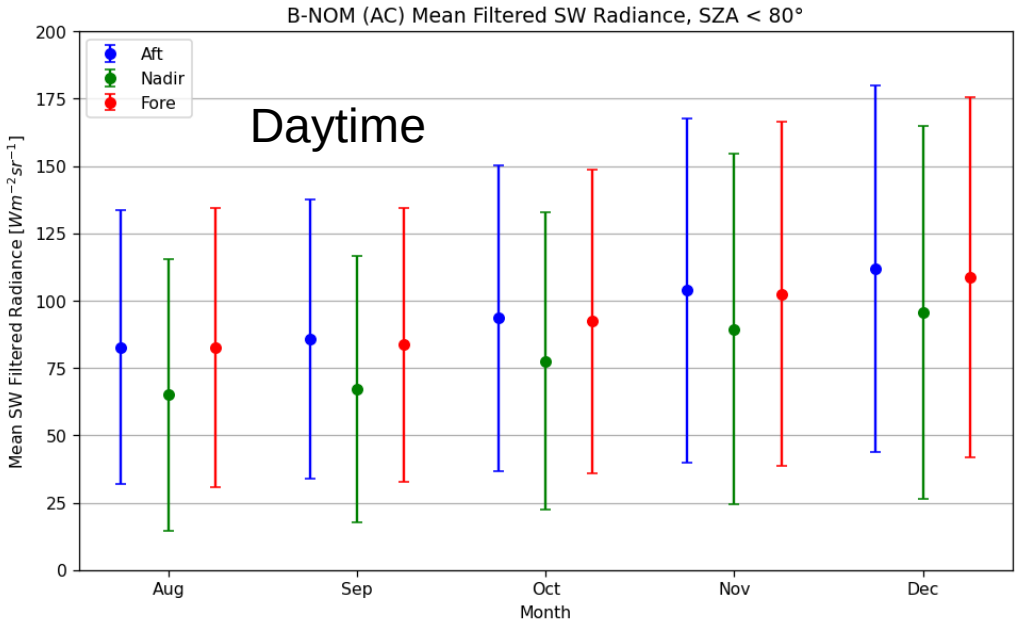
Distribution B-NOM SW Radiance, August 2024

Standard Resolution, Baseline AC



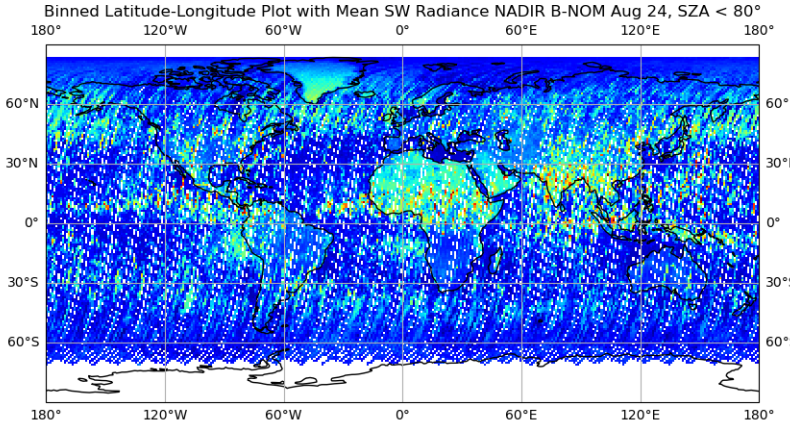
View	Mean [$Wm^{-2}sr^{-1}$]	Std [$Wm^{-2}sr^{-1}$]	Median [$Wm^{-2}sr^{-1}$]
Aft	82.74	50.54	72.83
Nadir	64.69	50.34	49.73
Fore	82.27	51.37	71.09

Mean Values of Filtered SW Radiances per Month - Daytime

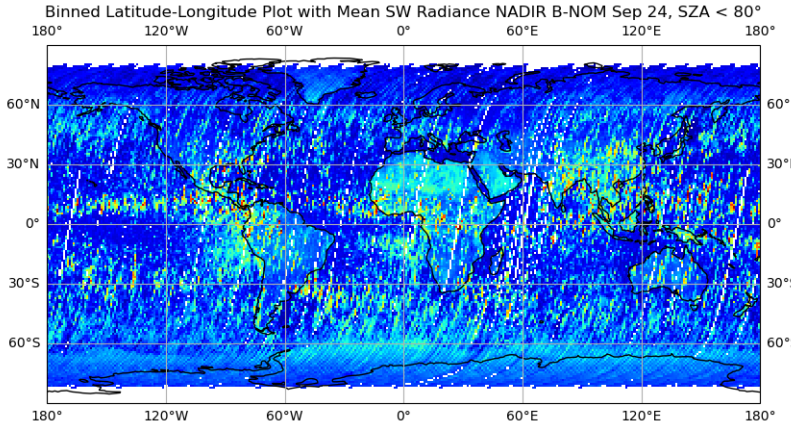


B-NOM Filt. SW Radiance per 1°x1° Lat.-Lon. Bin, Nadir, Day

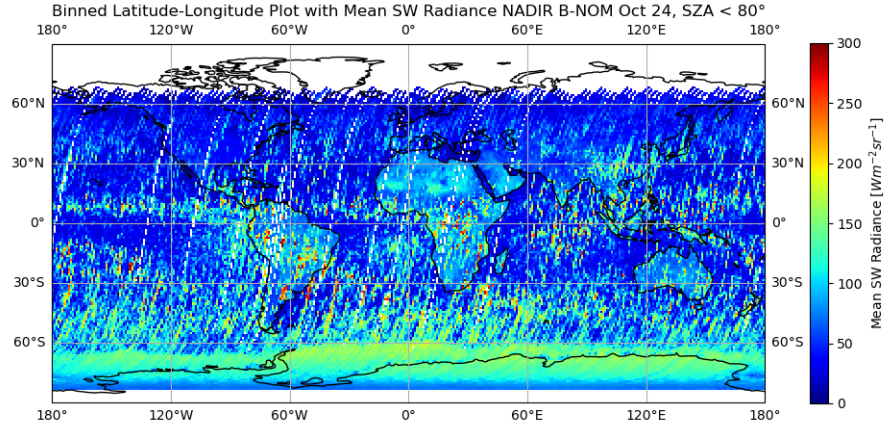
Aug 24



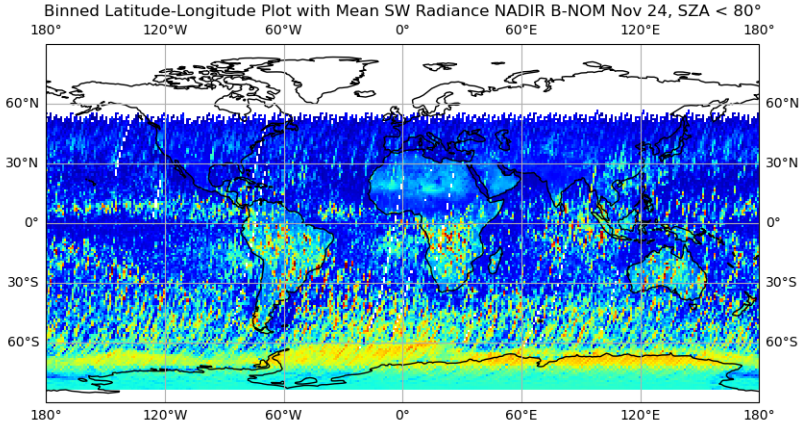
Sep 24



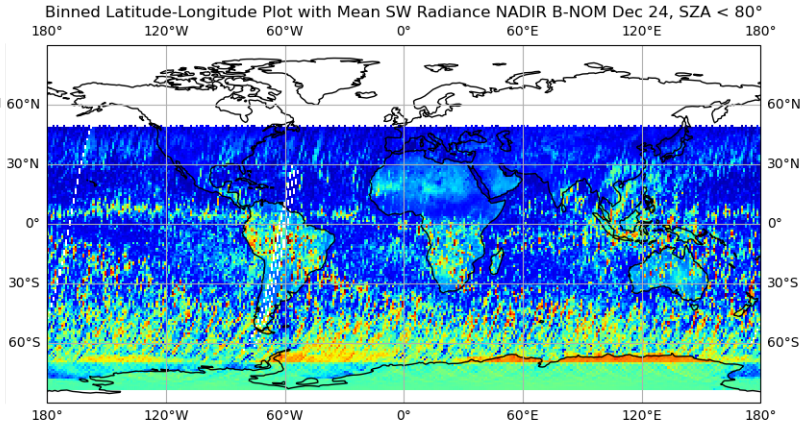
Oct 24



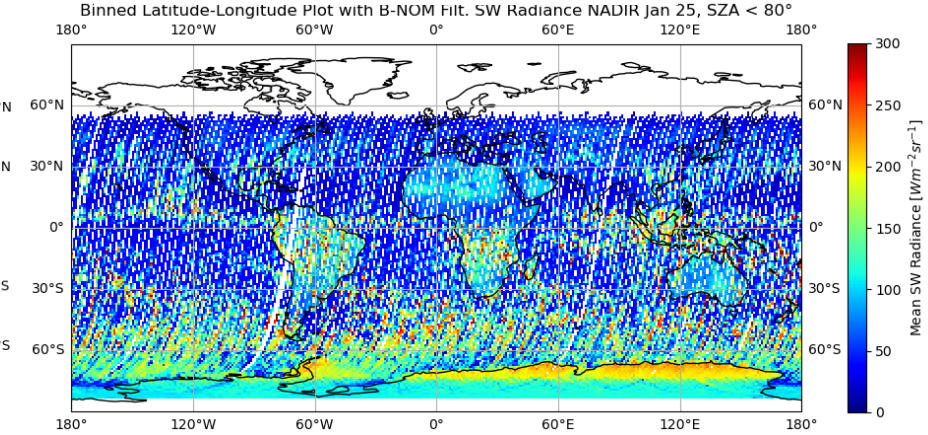
Nov 24



Dec 24



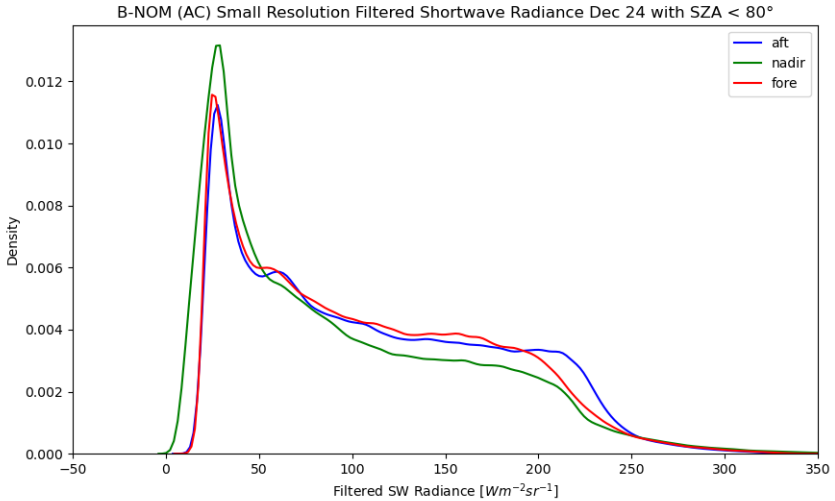
14 – 31 Jan 25, Baseline AD



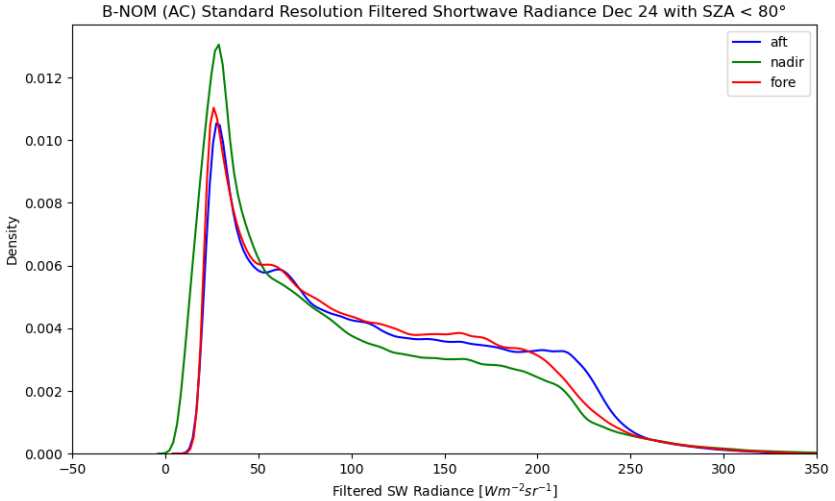
- Largest changes are detected over the Southern polar regions.

Comparison of different resolutions B-NOM product: SW Radiance

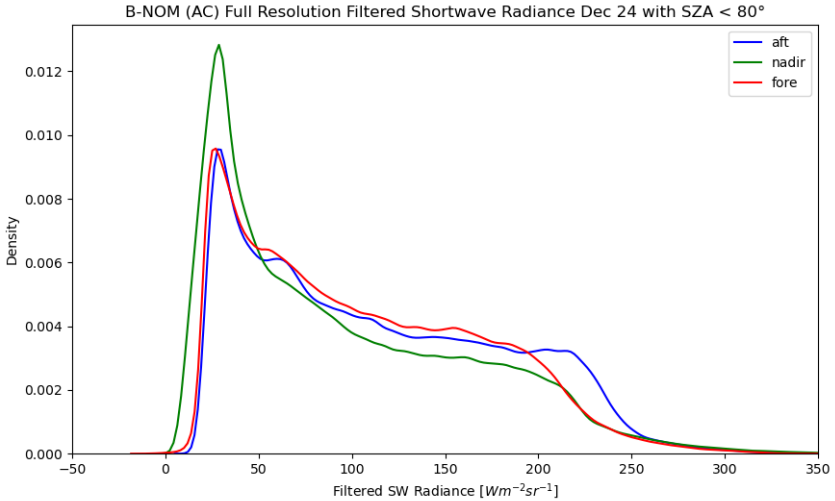
Small Resolution



Standard Resolution



Full Resolution



Daytime, Dec 2024

- Good consistency between all three resolutions – baseline AC.

Evaluation of the BM-RAD product (L2)

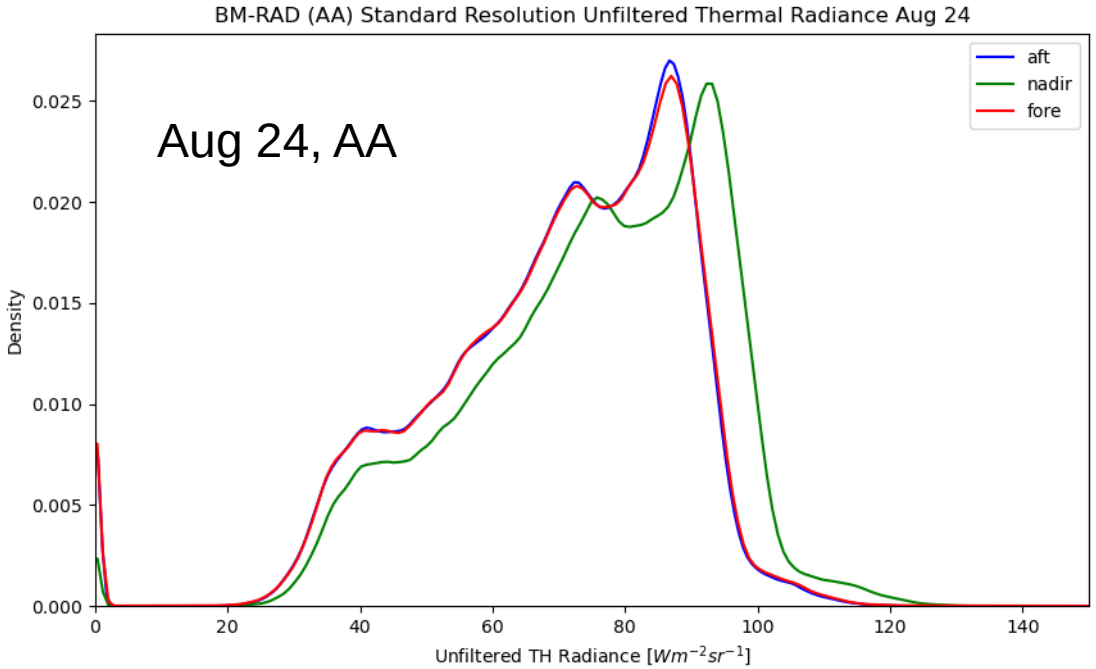
- Containing unfiltered solar and thermal radiances (in contrast to the L1 products)
- Containing information about clouds (cover and phase), snow albedo, surface type, etc.
- Available in four different resolutions (small, standard, full, assessment)
- Data availability:
  - Baseline AA: 27/07/2024 – 18/12/2024
  - Baseline AB: 18/12/2024 – today

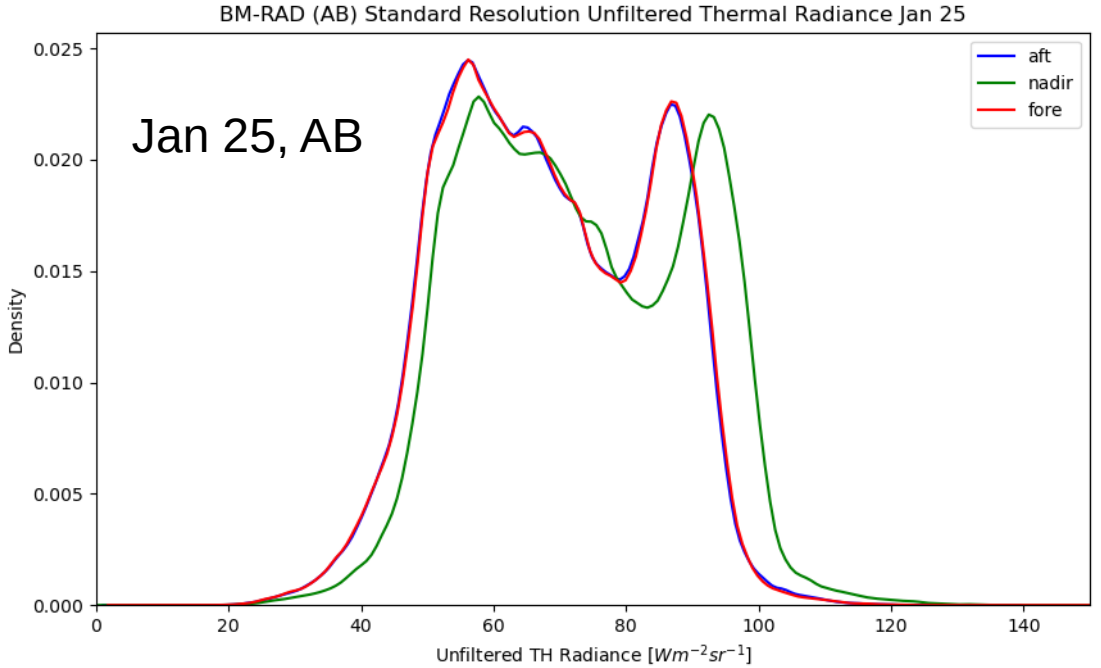
BM-RAD Product Resolutions

L1 PSF	Size (across x along track)	Reference grid	L1 filtered radiances	BM-RAD unfiltered radiances	BMA-FLX fluxes	BMA-FLX combined flux
Standard	10x10 km2	BBR	B-NOM	✓	✓	✓
Small	5x10 km2	BBR	B-NOM	✓	✓	✓
Full	17x10 km2 (nadir) 28x10 km2	BBR	B-NOM	✓	✓	
Assessment domain	5x21 JSG (configurable)	JSG	B-SNG	✓	✓	✓
JSG*	1x1 JSG (or 3x3 JSG)	JSG	B-SNG	✓		

Distribution BM-RAD Unfiltered TH Radiance, Aug 24 and Jan 25

All-day, Standard Resolution





View	Mean	Std	Median
Aft	69.14	19.18	72.34
Nadir	74.89	18.92	77.39
Fore	69.21	19.40	72.36

N = 13’094’213

All values in $Wm^{-2}sr^{-1}$

View	Mean	Std	Median
Aft	68.40	15.42	67.21
Nadir	73.00	16.56	71.53
Fore	68.50	15.46	67.35

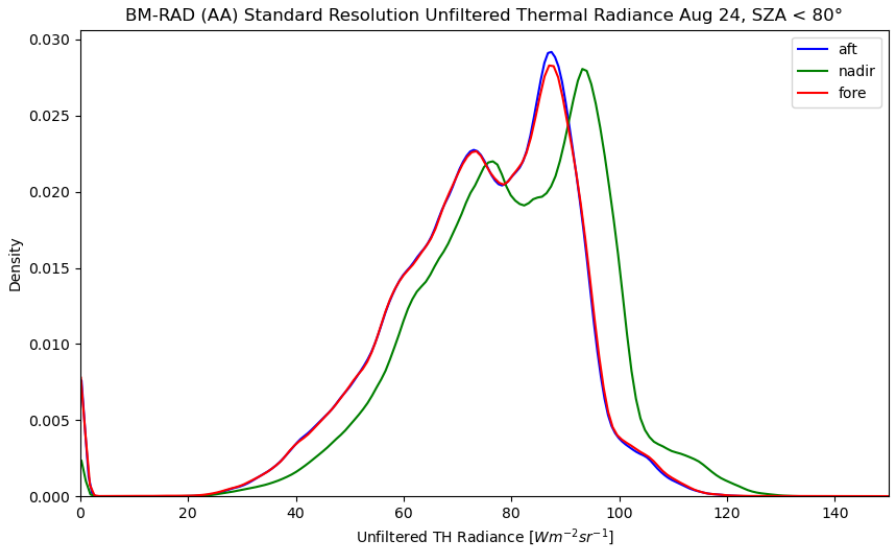
N = 12’845’718

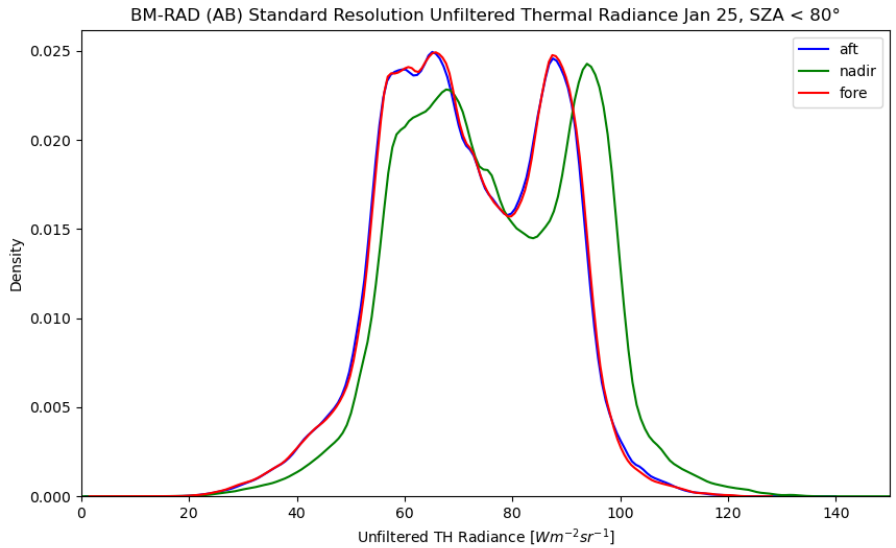
Distribution BM-RAD Unfiltered TH Radiance, Aug 24 and Jan 25

August 2024, AA

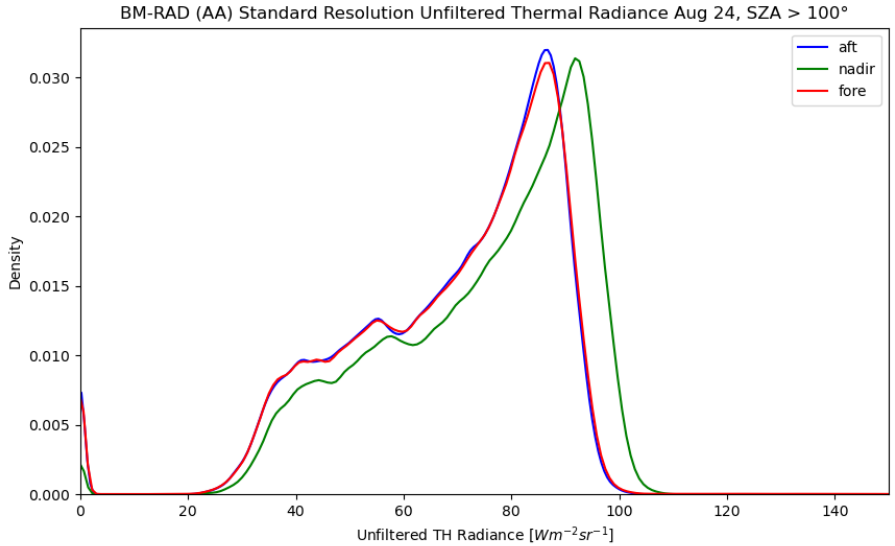
January 2025, AB

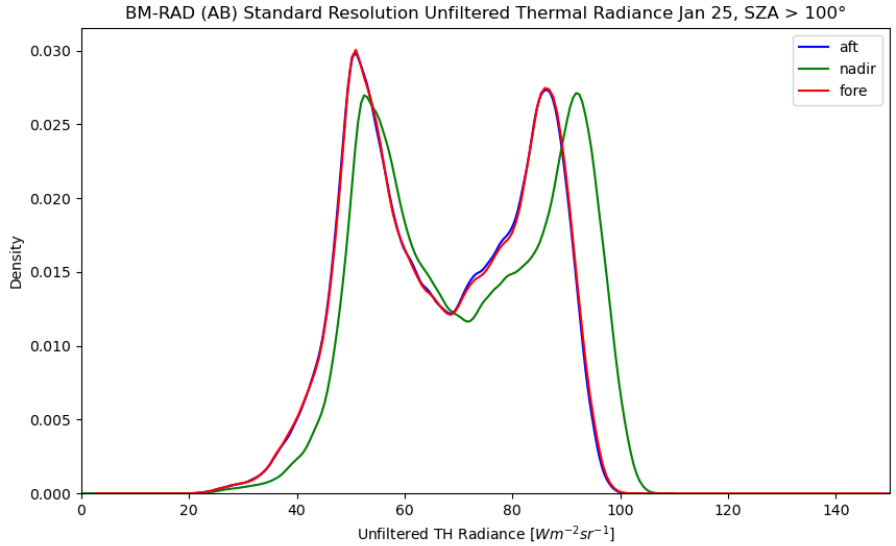
Daytime





Nighttime

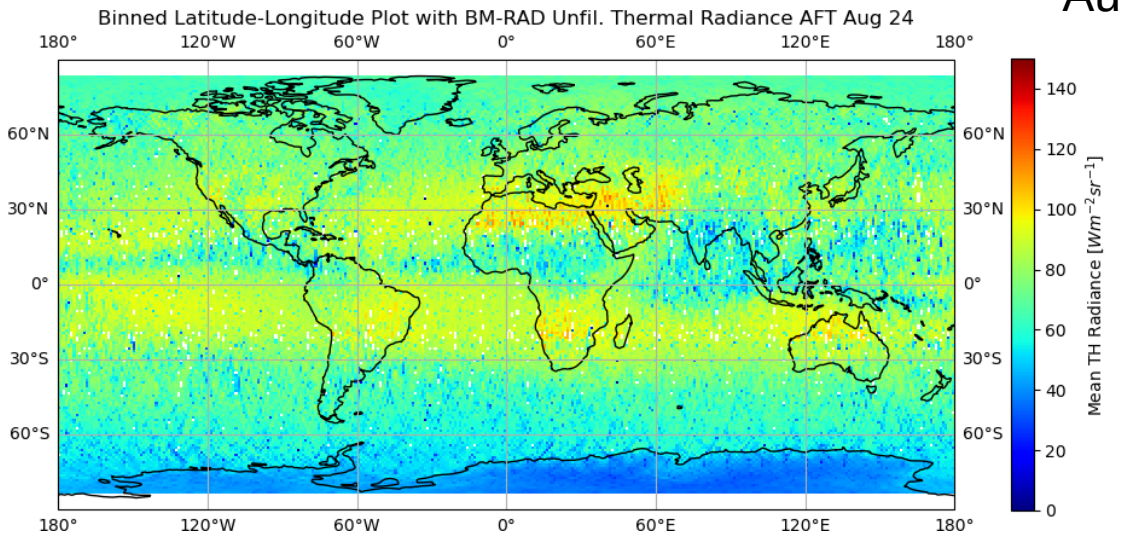




BM-RAD Unfilt. TH Radiance per 1°x1° Lat.-Lon. Bin, Aug 2024

Aug 24

AFT



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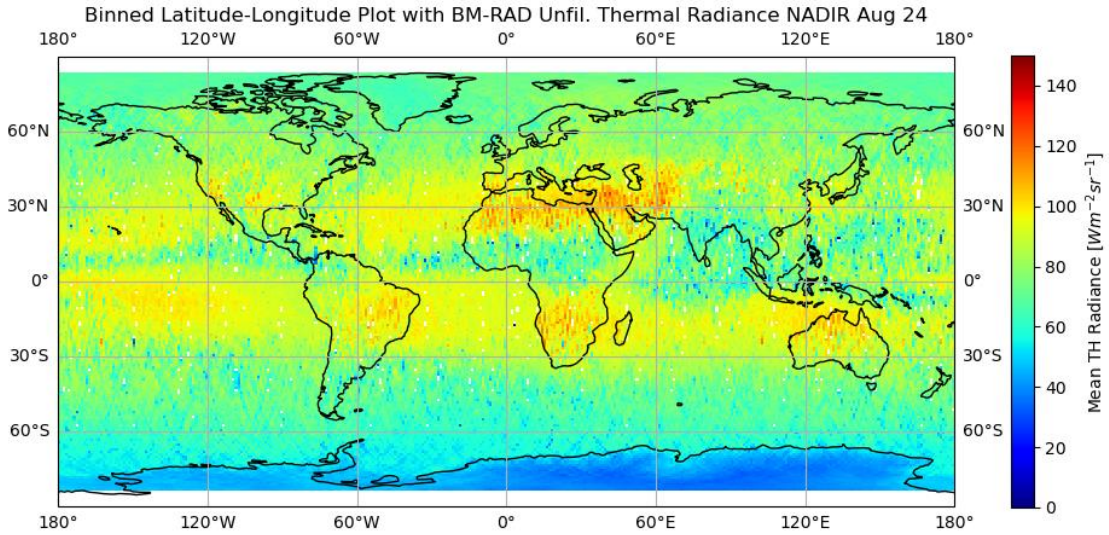

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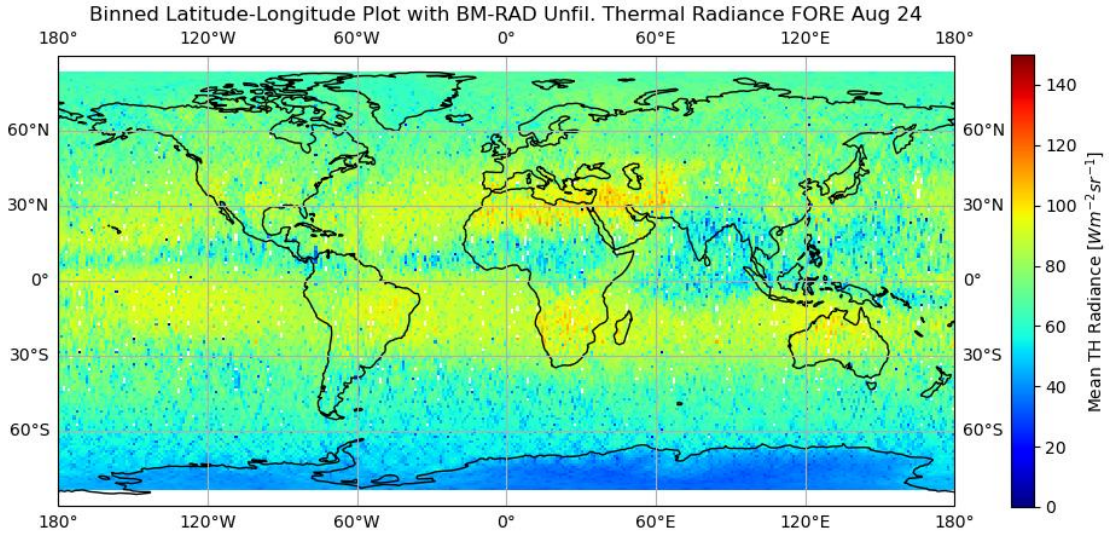
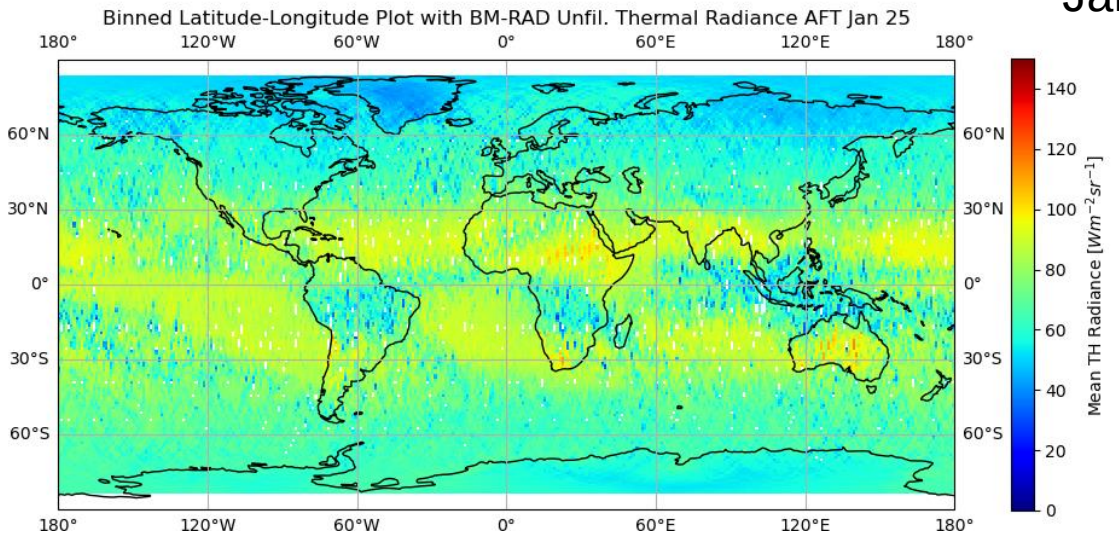


August 2024, All-day, Standard Resolution, Baseline AA

BM-RAD Unfilt. TH Radiance per 1°x1° Lat.-Lon. Bin, Jan 2025

Jan 25

AFT



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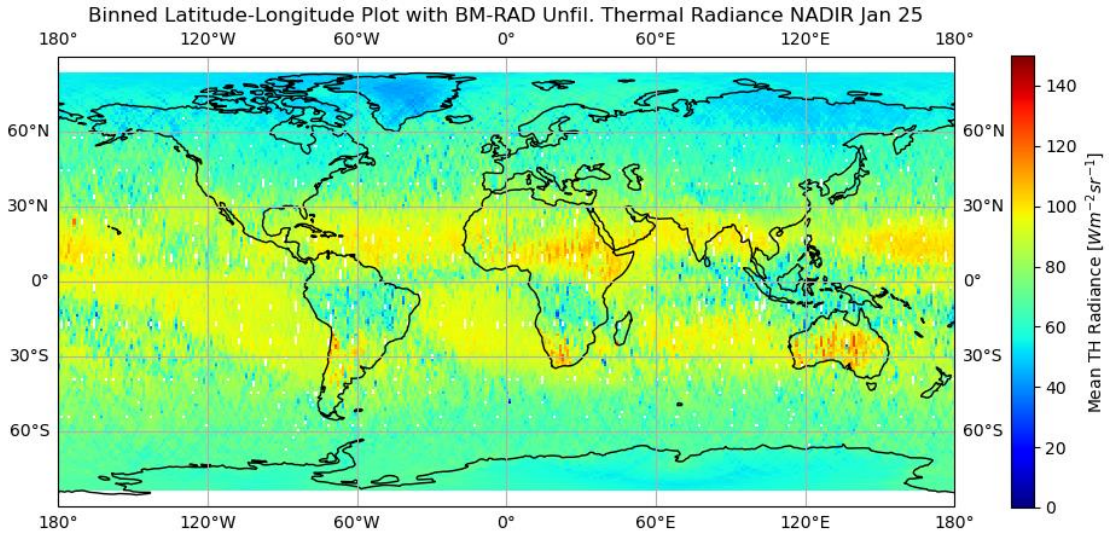

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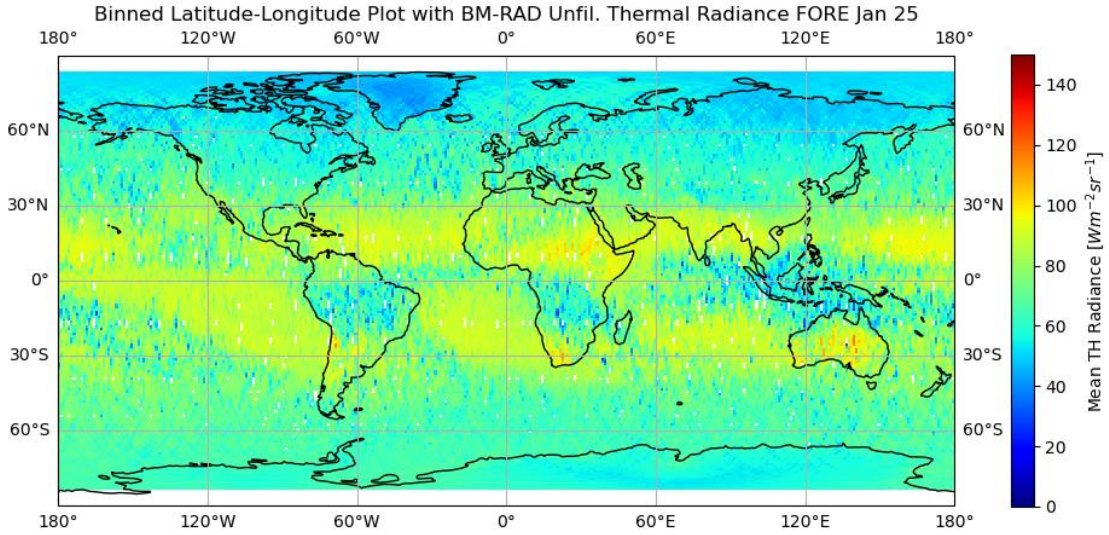
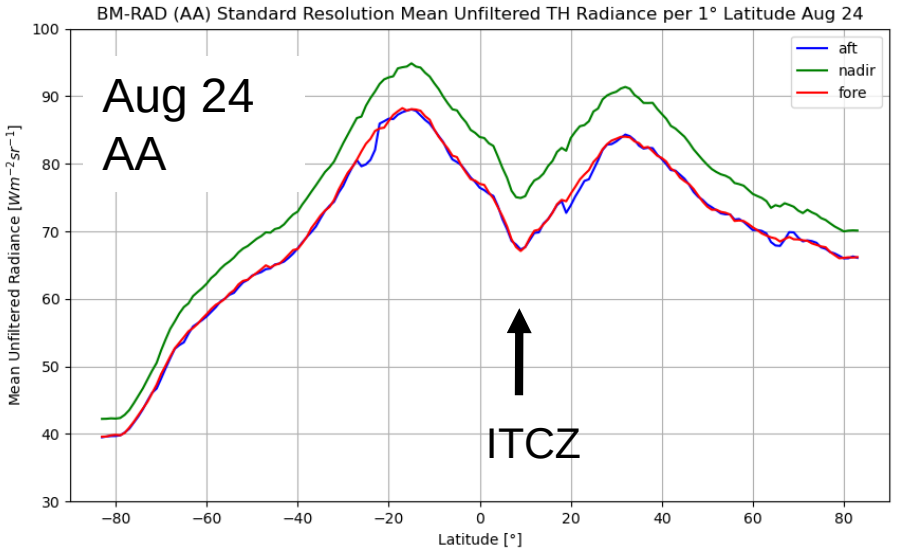
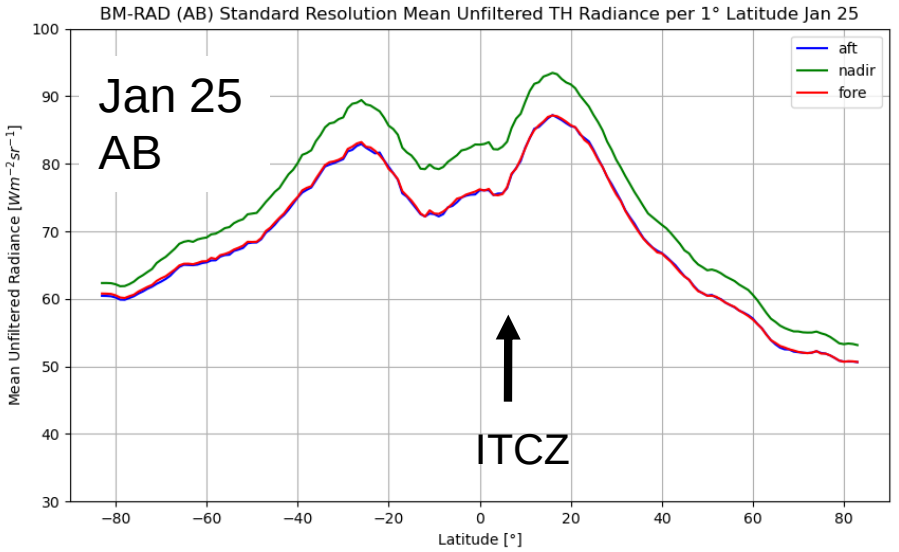


January 2025, All-day, Standard Resolution, Baseline AB

BM-RAD Unfilt. TH Radiance per 1° Lat. Bin, Aug 24 and Jan 25

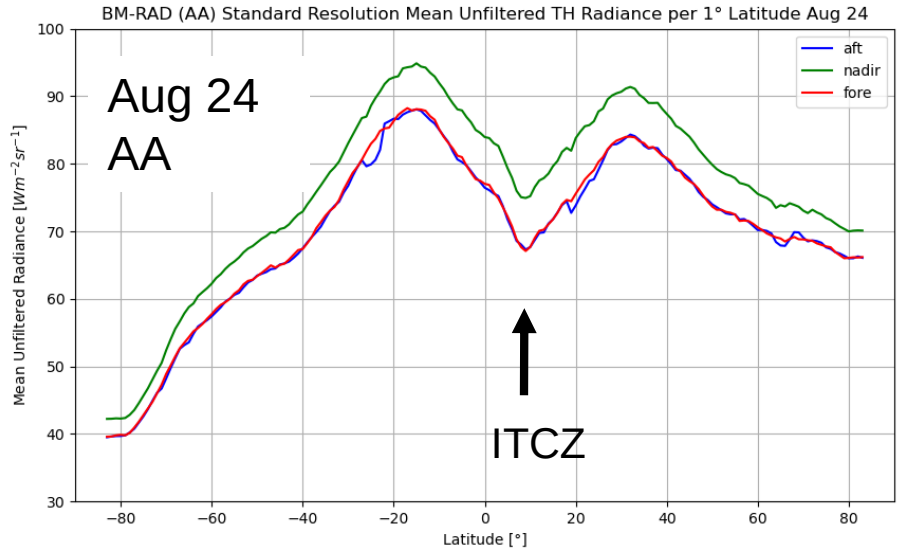
Standard Resolution

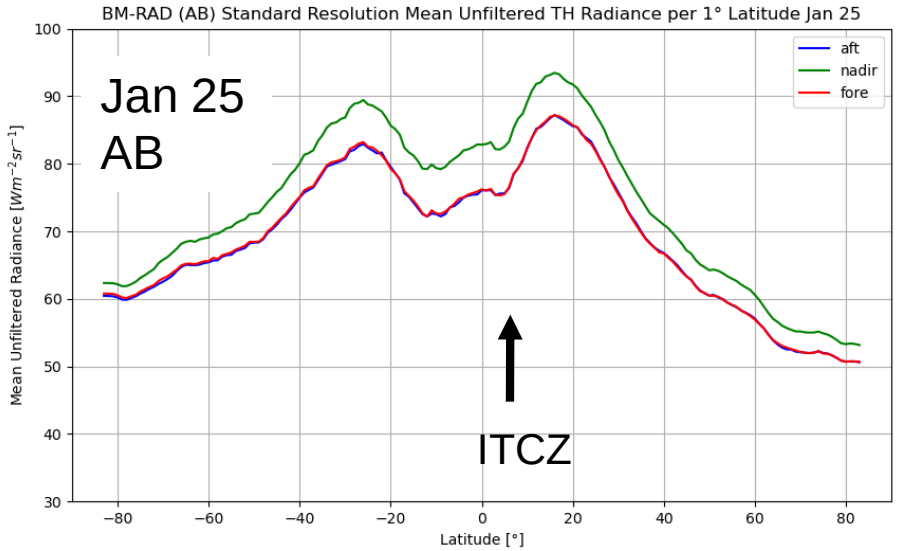




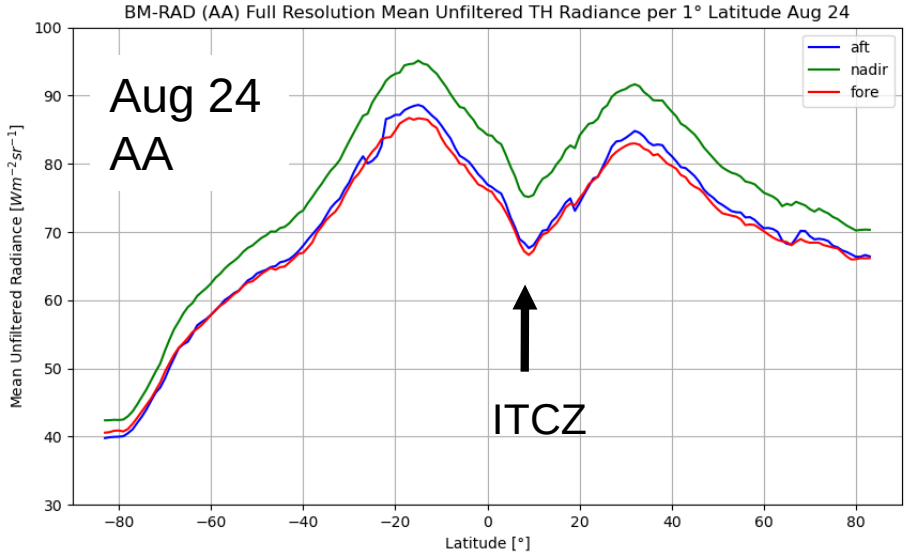
BM-RAD Unfilt. TH Radiance per 1° Lat. Bin, Aug 24 and Jan 25

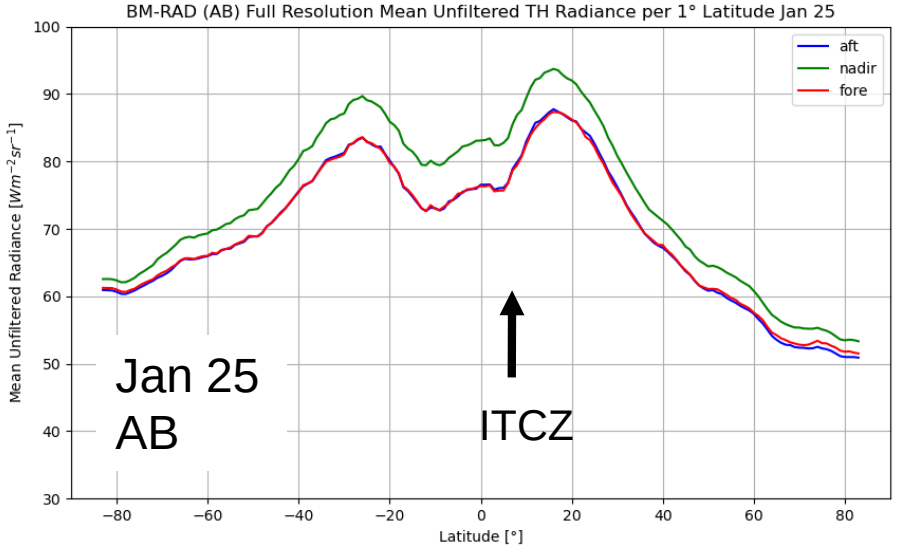
Standard Resolution





Full Resolution





Statistics BM-RAD Unfiltered TH Radiance, Aug 24 and Jan 25

All-day, Standard Resolution

Standard Resolution

Aug 24, AA

View	Mean	Std	Median
Aft	69.14	19.18	72.34
Nadir	74.89	18.92	77.39
Fore	69.21	19.40	72.36

N = 13’094’213

All values in $Wm^{-2}sr^{-1}$

Jan 25, AB

View	Mean	Std	Median
Aft	68.40	15.42	67.21
Nadir	73.00	16.56	71.53
Fore	68.50	15.46	67.35

N = 12’845’718

Full Resolution

Aug 24, AA

View	Mean	Std	Median
Aft	69.57	19.06	72.66
Nadir	75.14	18.75	77.57
Fore	68.81	19.01	71.58

N = 13’212’123

All values in $Wm^{-2}sr^{-1}$

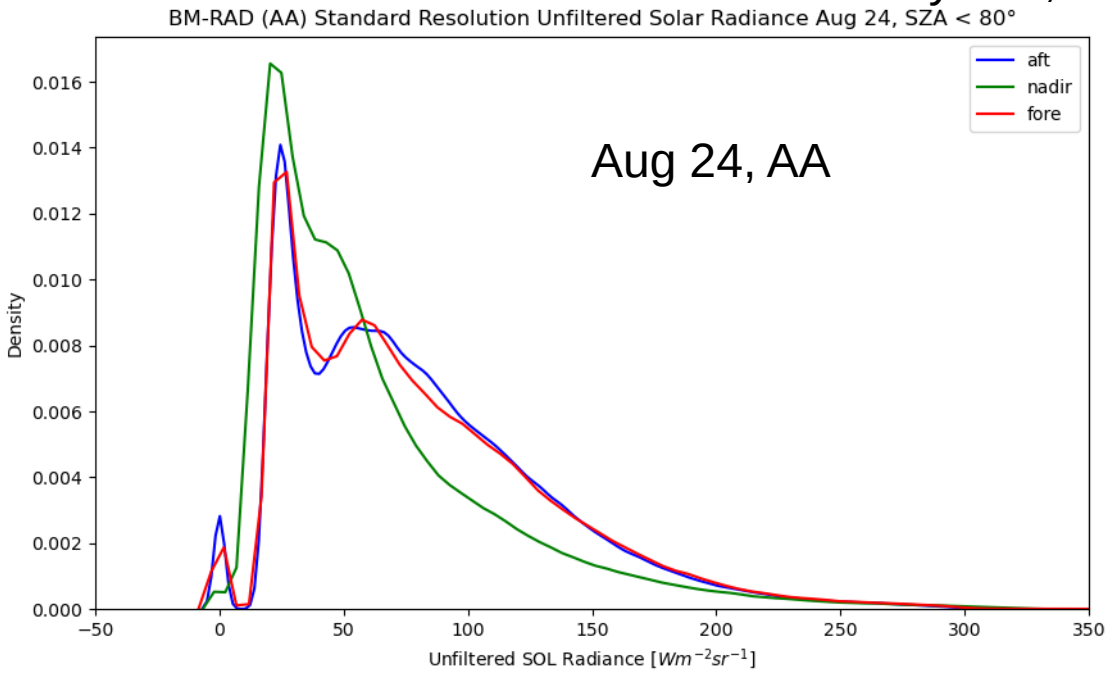
Jan 25, AB

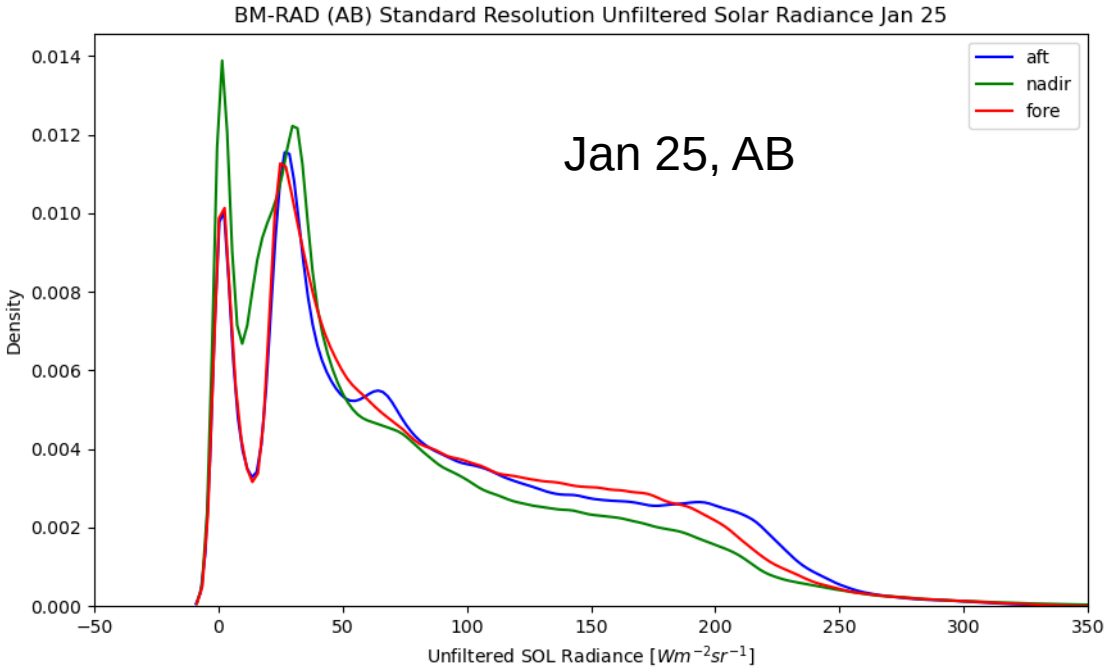
View	Mean	Std	Median
Aft	68.85	15.42	67.66
Nadir	73.22	16.53	71.76
Fore	68.97	15.82	67.73

N = 12’999’835

Distribution BM-RAD Unfilt. SOL Radiance, Aug 24 and Jan 25

Daytime, Standard Resolution





View	Mean	Std	Median
Aft	80.42	50.66	70.75
Nadir	63.55	49.94	48.59
Fore	82.54	62.29	69.64

N = 5’781’750

All values in $Wm^{-2}sr^{-1}$

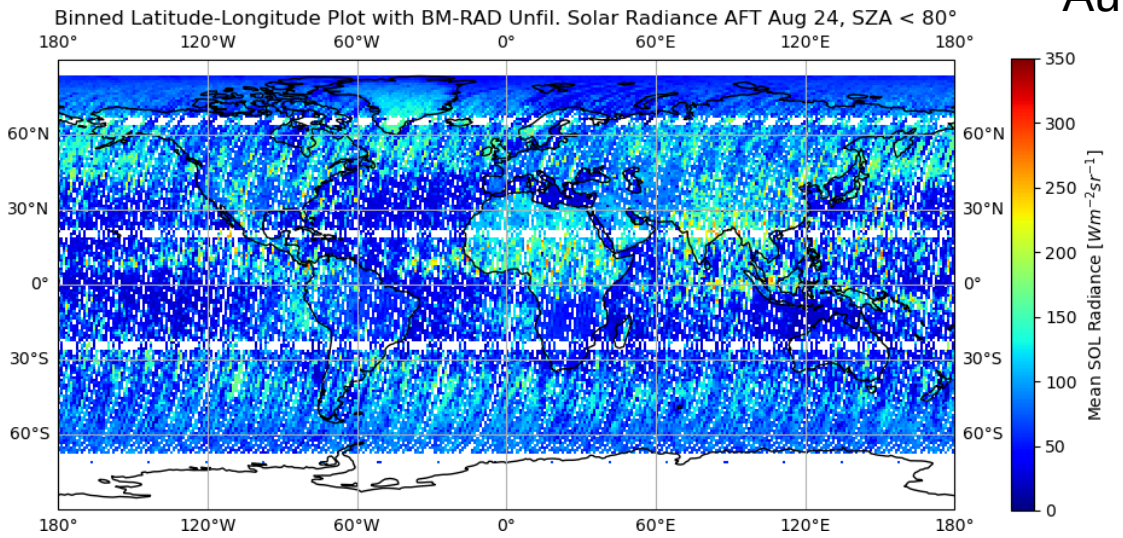
View	Mean	Std	Median
Aft	107.95	66.76	95.27
Nadir	90.45	65.49	71.85
Fore	104.43	64.43	92.76

N = 5’615’344

BM-RAD Unfilt. SOL Radiance per 1°x1° Lat.-Lon. Bin, Aug 2024

Aug 24

AFT



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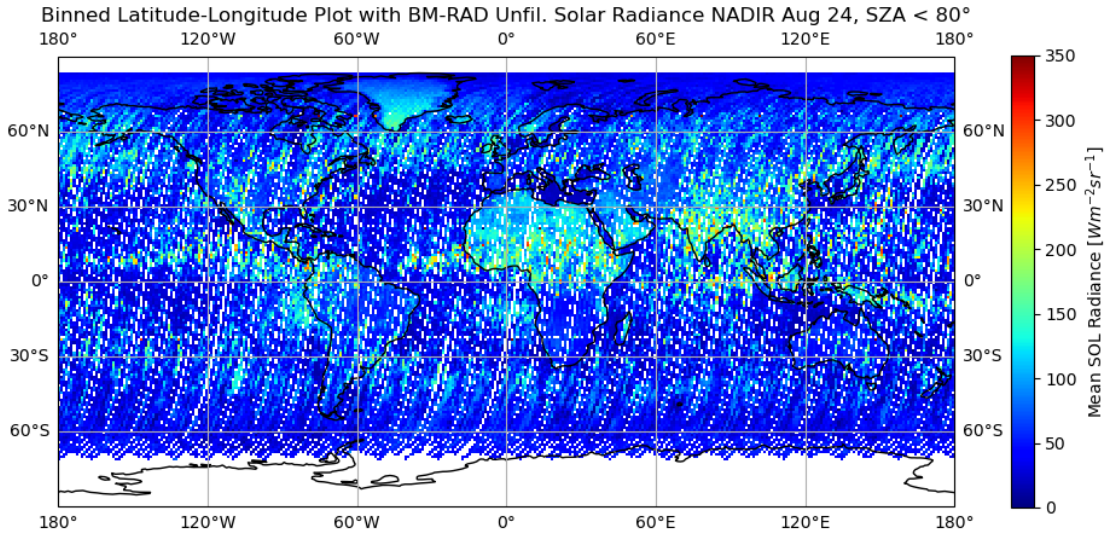
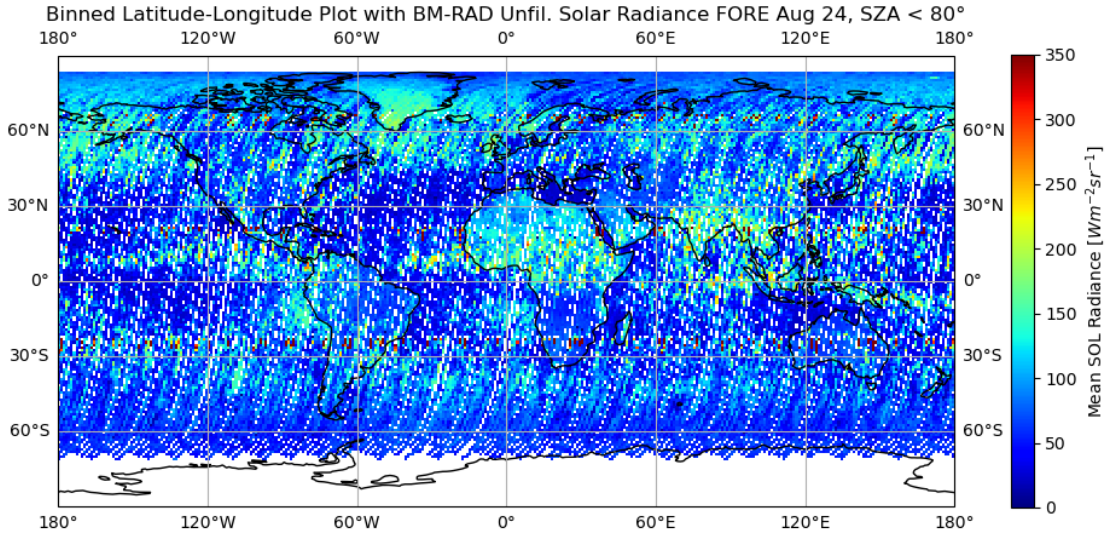


FORE

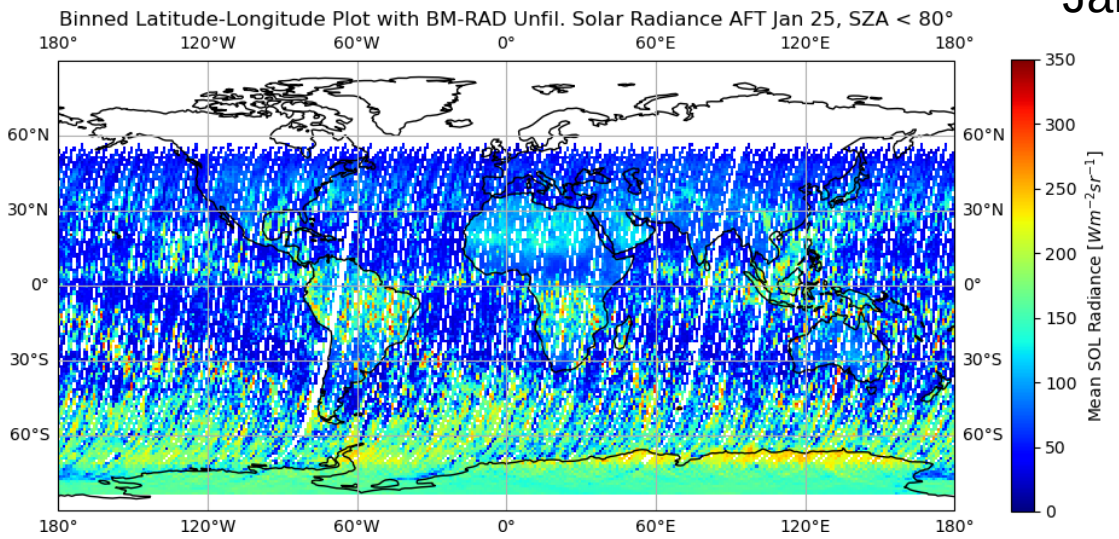


August 2025, Daytime, Standard Resolution, Baseline AA

BM-RAD Unfilt. SOL Radiance per 1°x1° Lat.-Lon. Bin, Jan 2025

Jan 25

AFT



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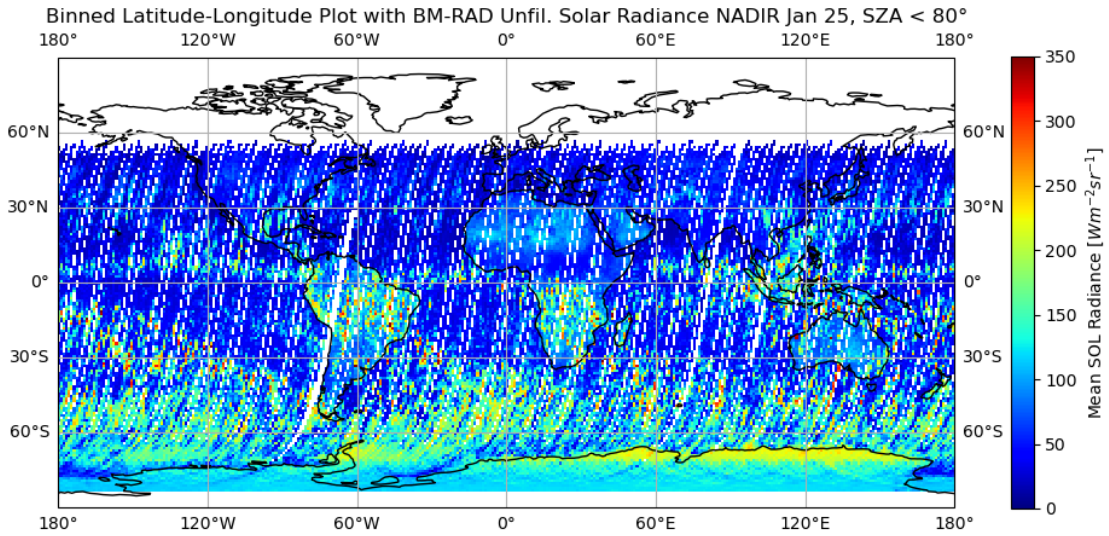
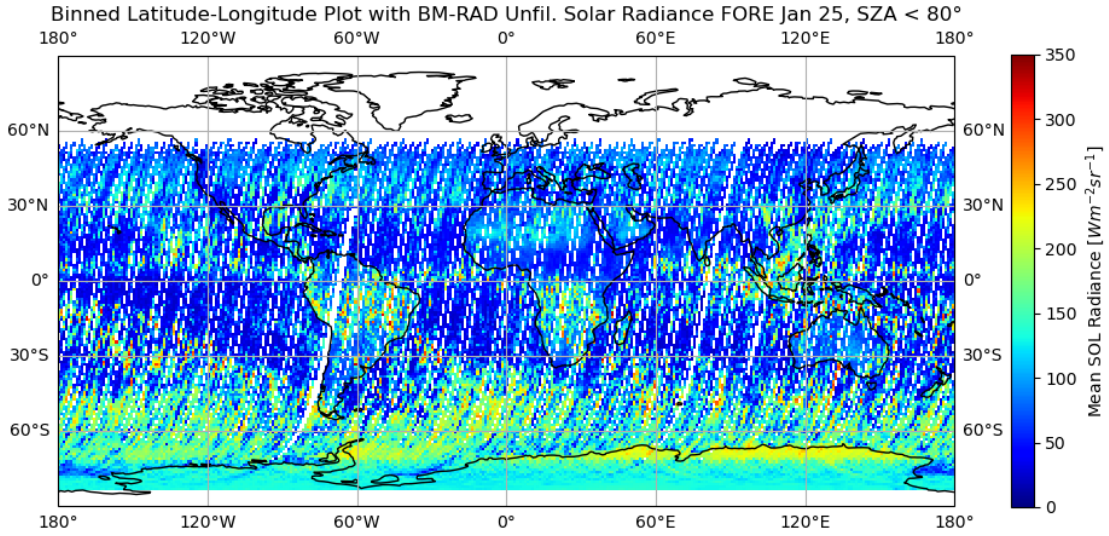


FORE

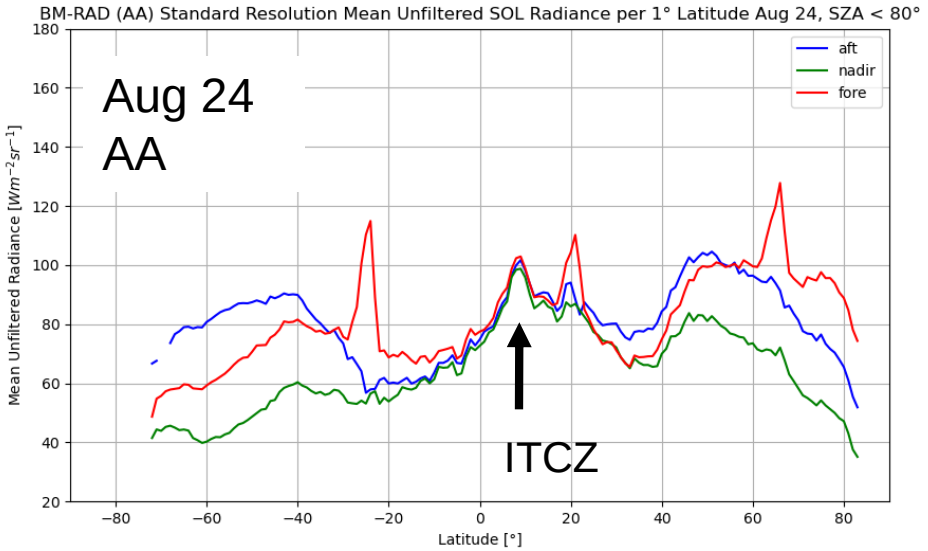


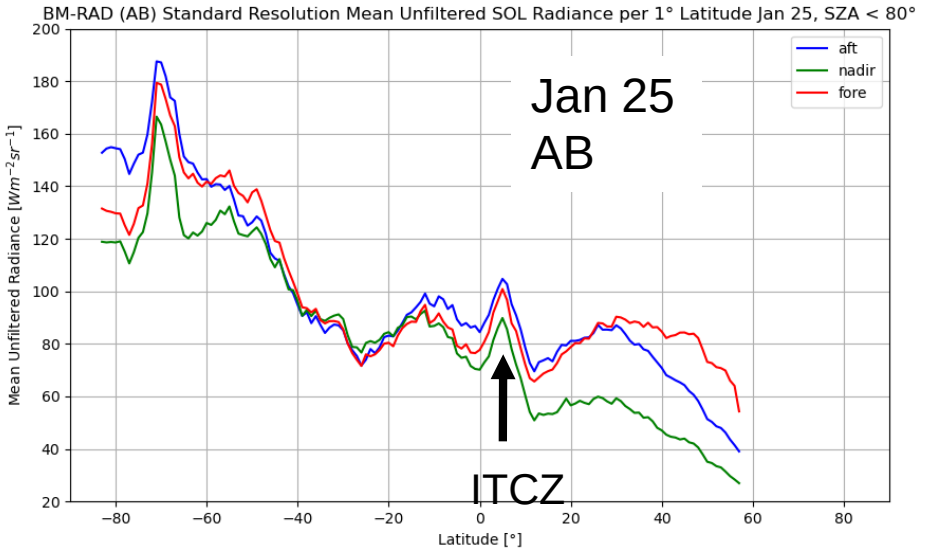
January 2025, Daytime, Standard Resolution, Baseline AB

BM-RAD Unfilt. SOL Radiance per 1° Lat. Bin, Aug 24 and Jan 25

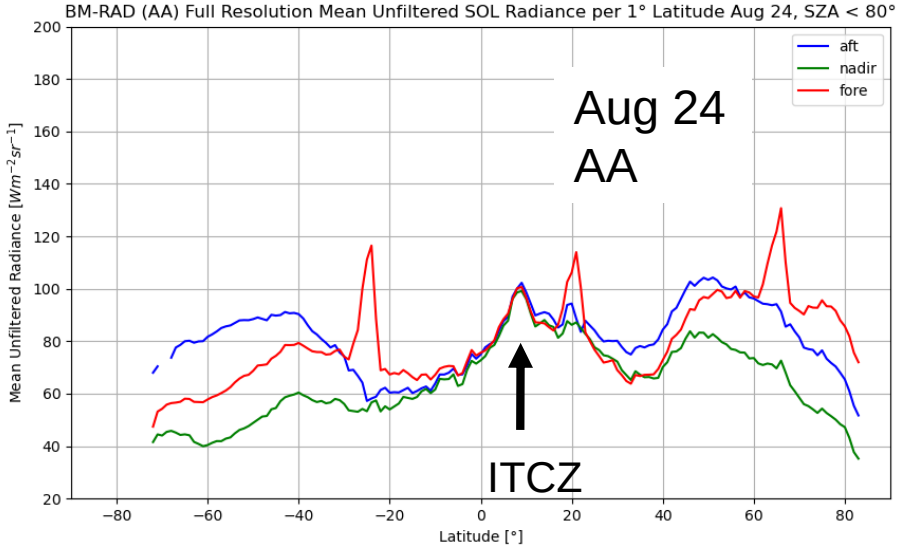
Daytime

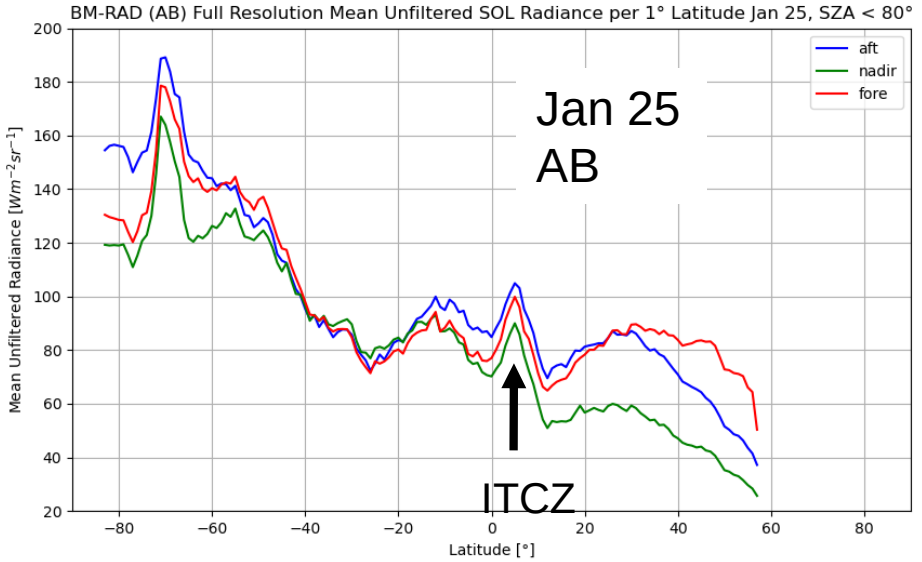
Standard Resolution





Full Resolution



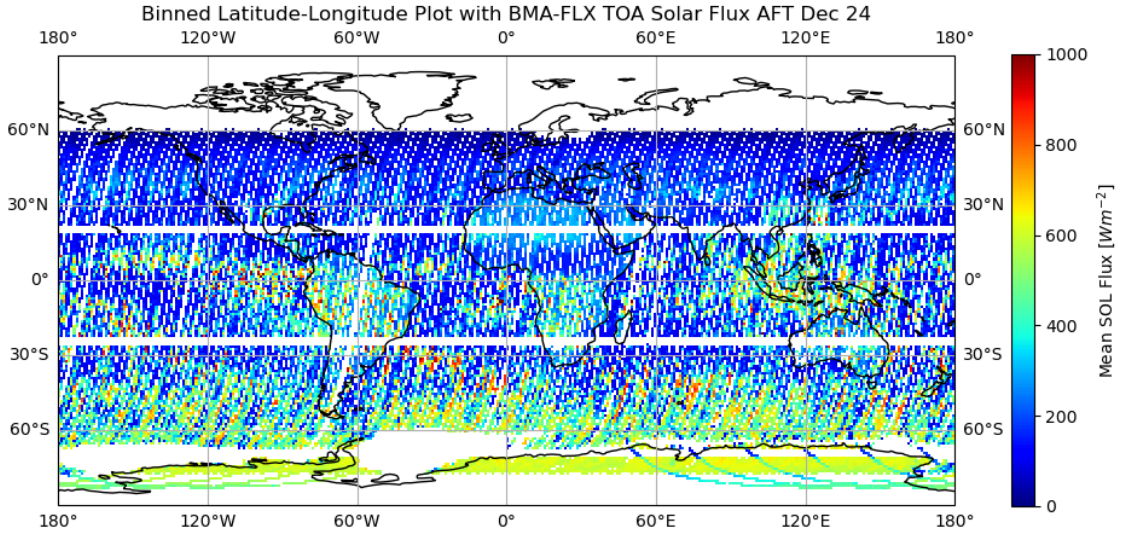


Evaluation of the BMA-FLX product (L2)

- Containing unfiltered and coregistered solar and thermal radiances (in contrast to the L1 products)
- Containing flux-data (all three views separately and combined)
- Containing information about clouds (cover and phase), snow albedo, surface type, etc.
- Available in four different resolutions (small, standard, full, assessment)
- Data availability:
  - Baseline AA: 27/07/2024 – today

BMA-FLX SOL Flux per 1°x1° Lat.-Lon. Bin, 1 – 18 Dec 2024

AFT



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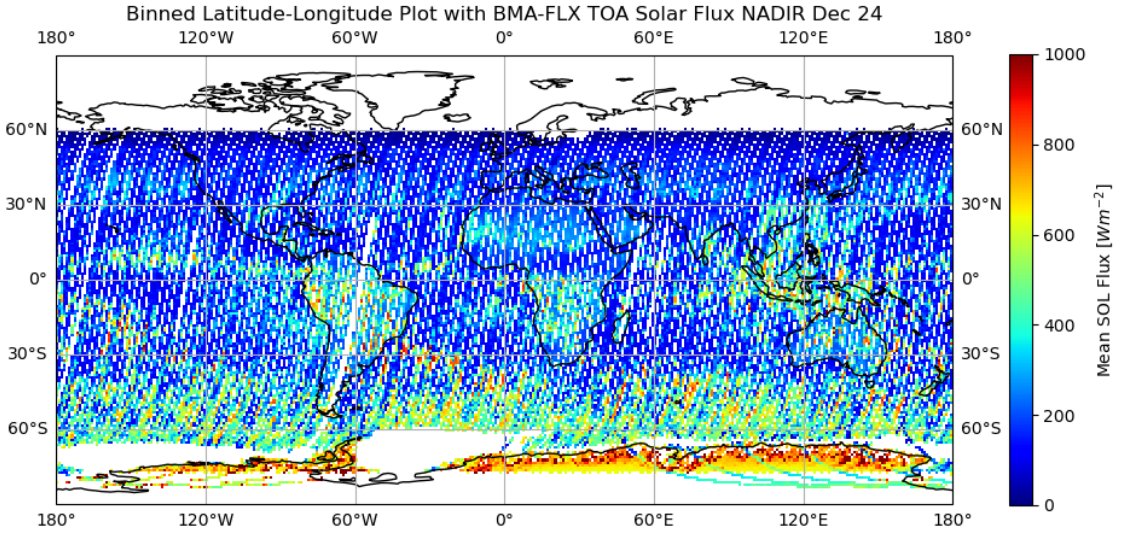

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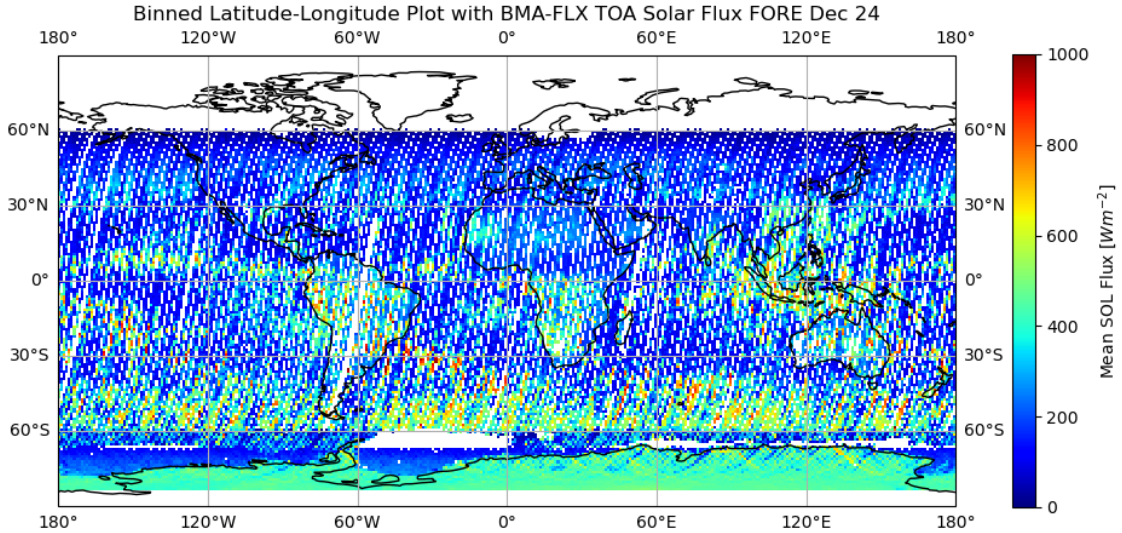
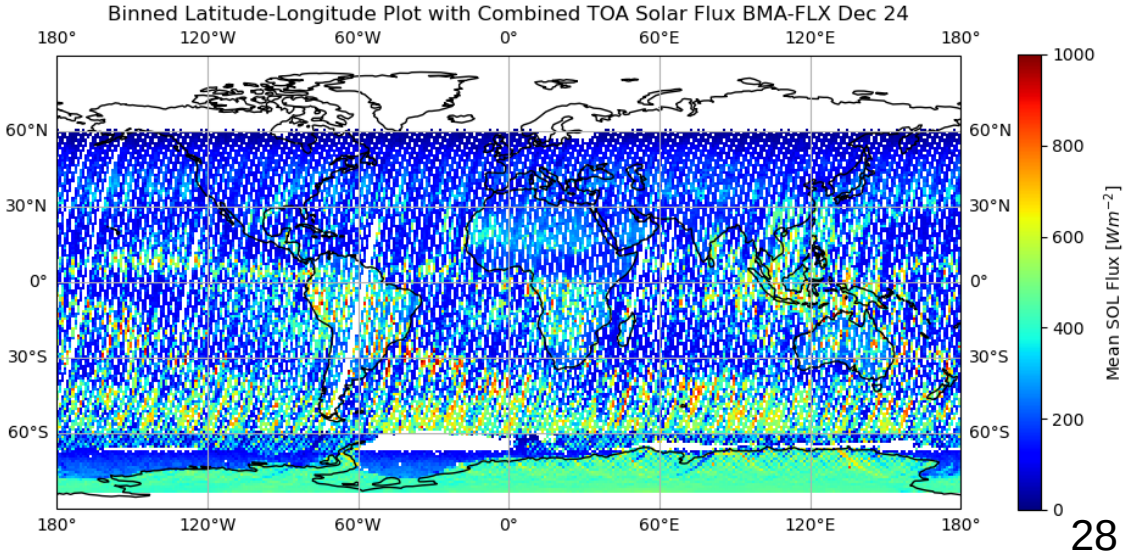
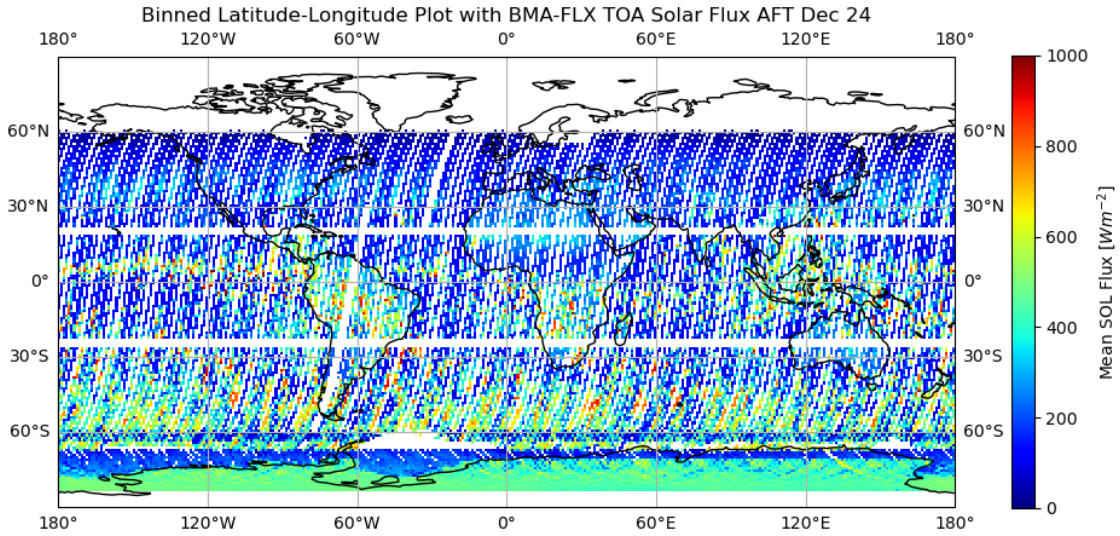


COMBINED



BMA-FLX SOL Flux per 1°x1° Lat.-Lon. Bin, 19 – 31 Dec 2024

AFT



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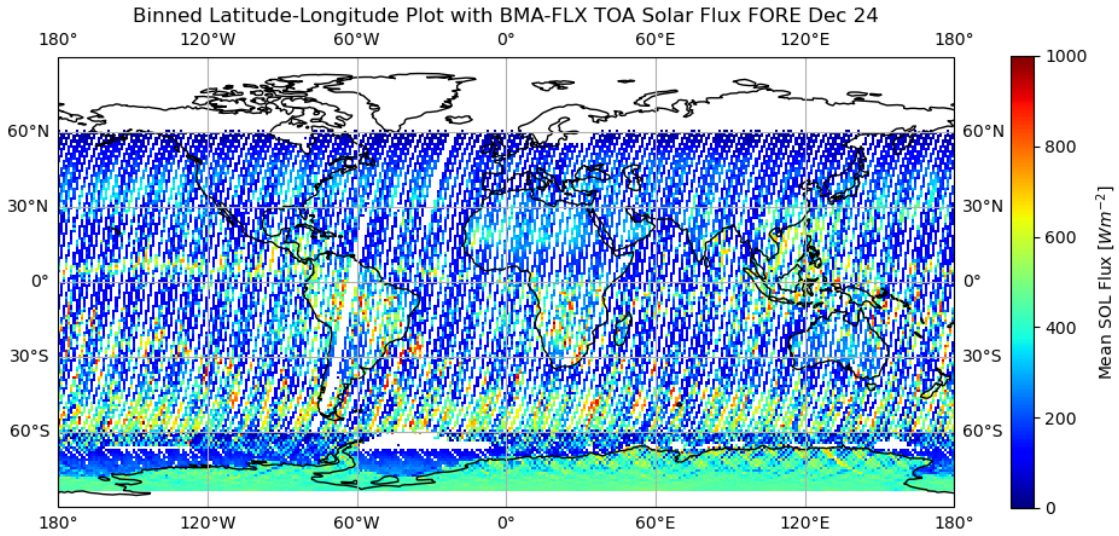

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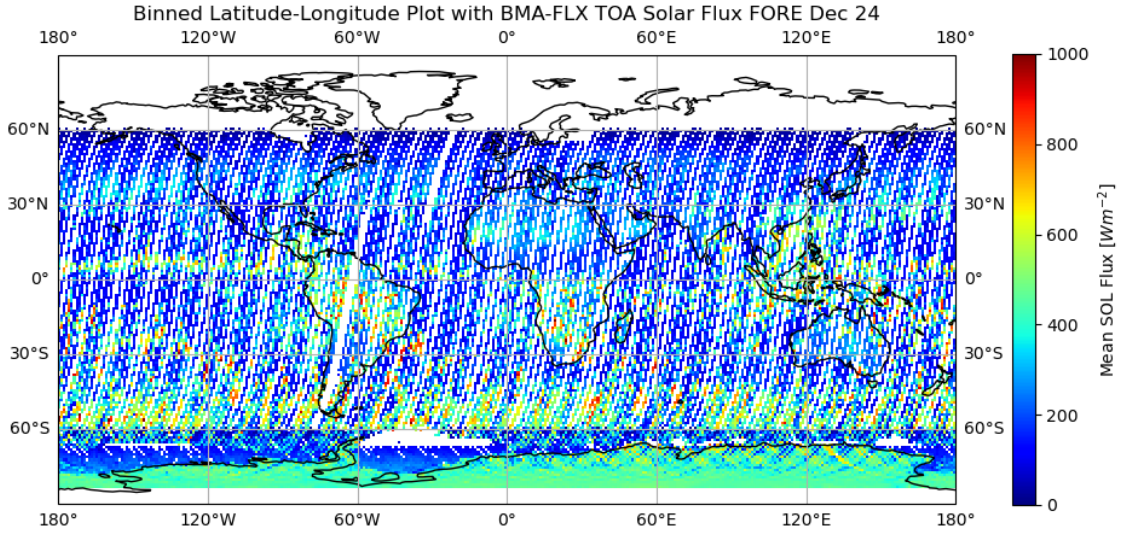
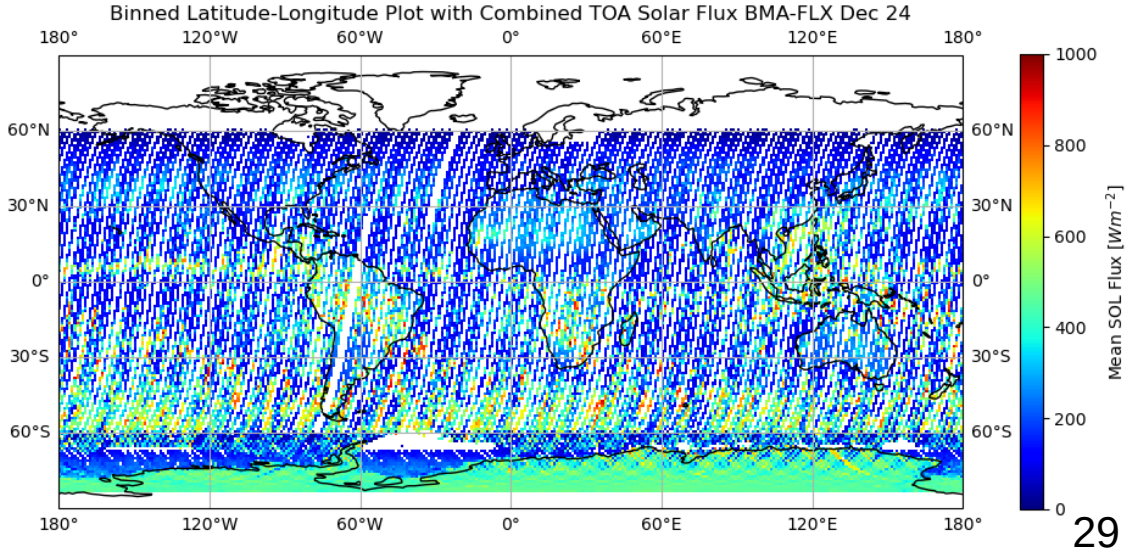
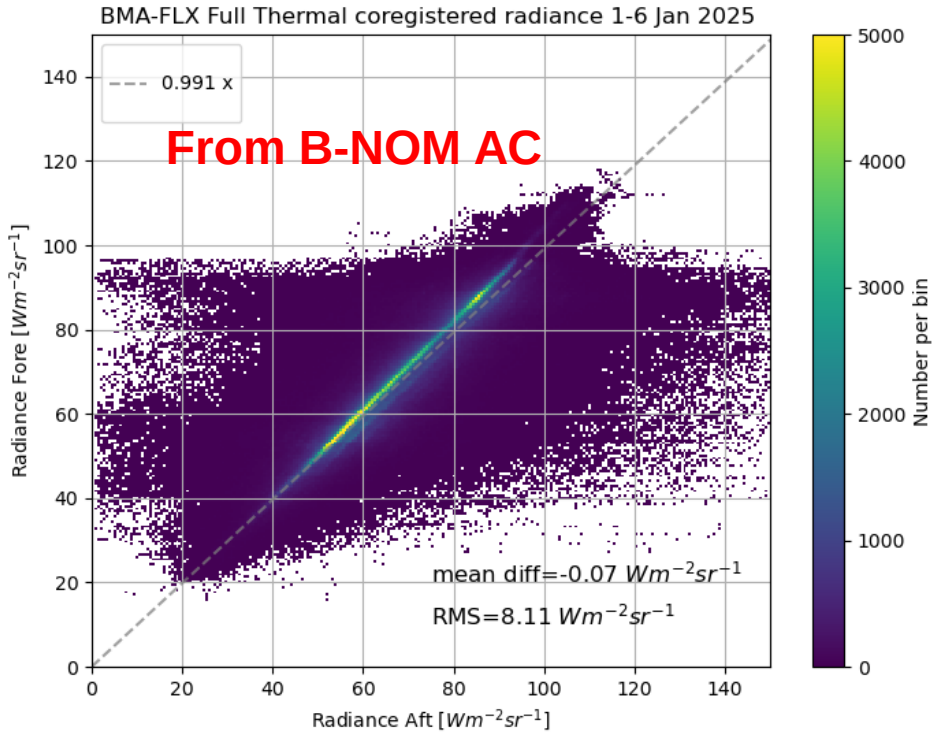
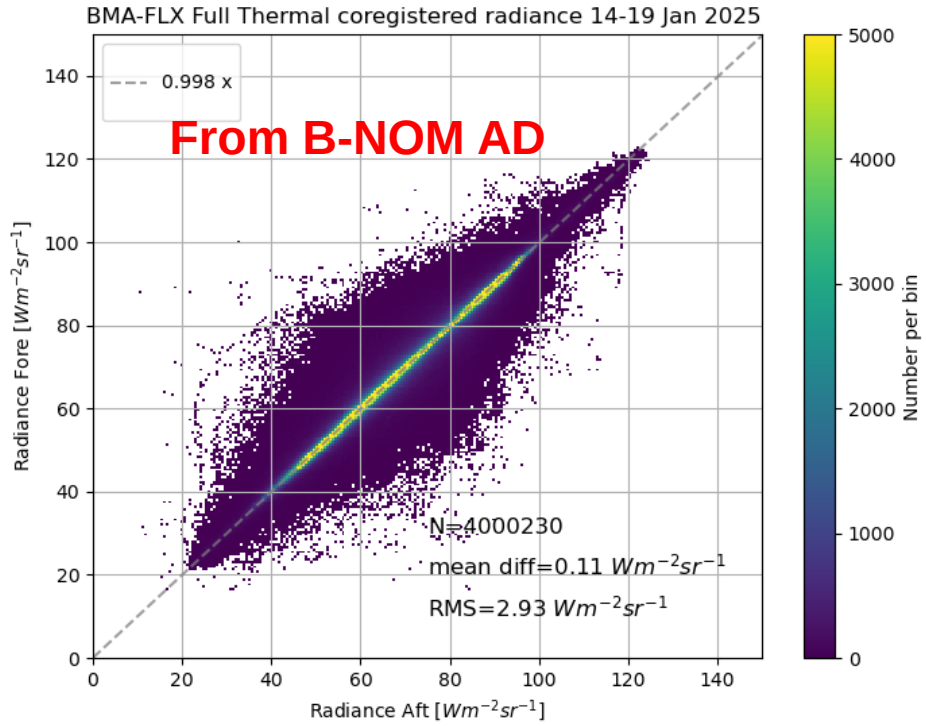


COMBINED



BMA-FLX Thermal Coregistered Radiance, Full Resolution

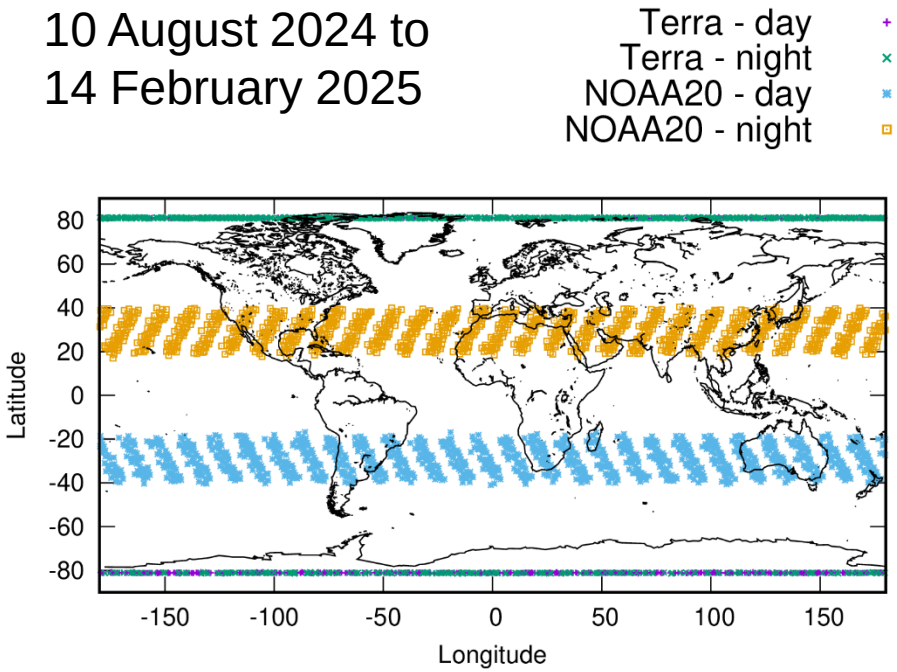




- Dead pixel (6th) in the FORE view is integrated in B-NOM AC full resolution -> BM-RAD -> BMA-FLX.
- The issue is solved with the new baseline AD.

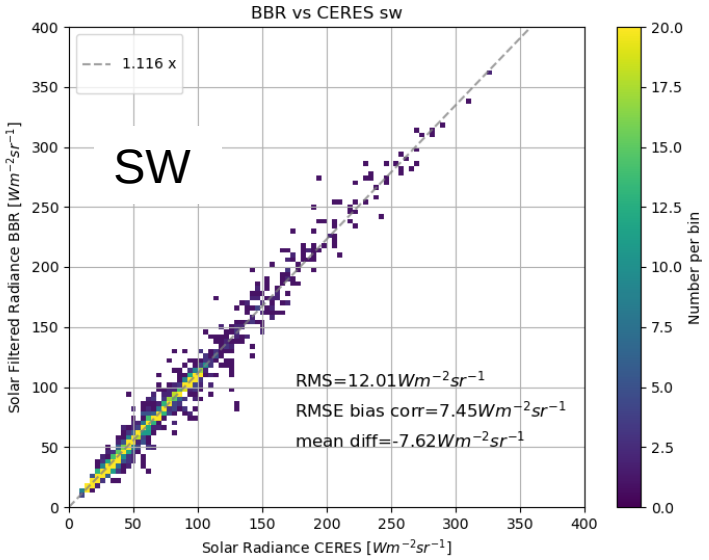
CERES FLASHflux comparison: SW and LW Radiance

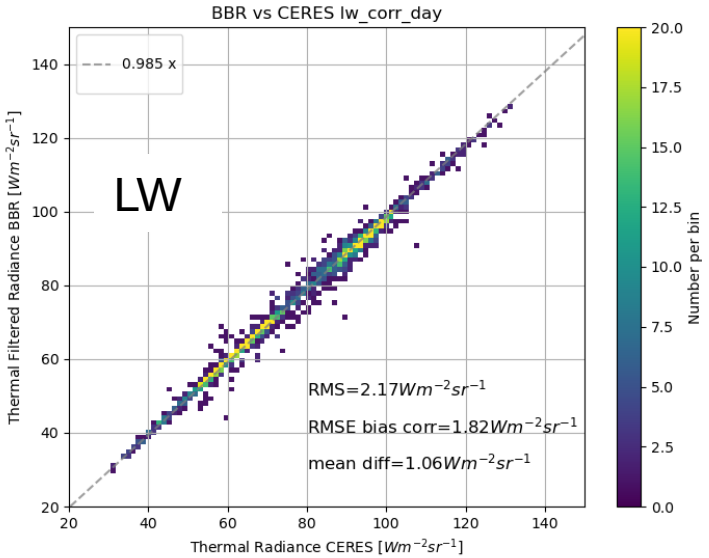
10 August 2024 to
14 February 2025



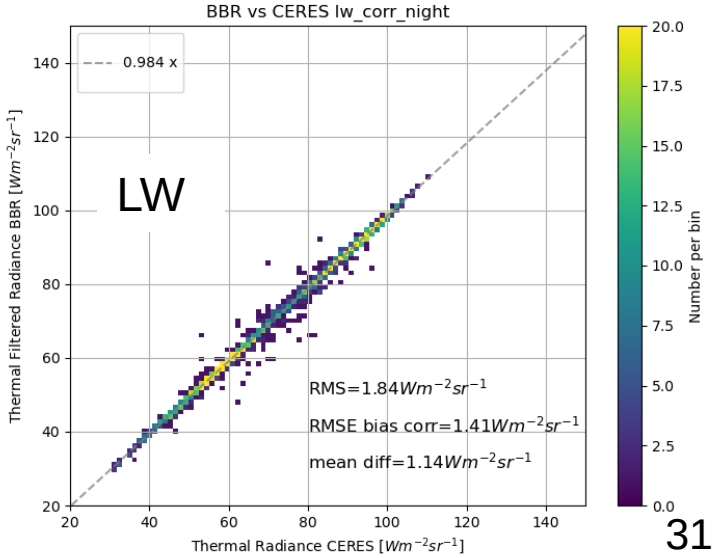
CERES VZA < 50°
Δdist < 3 km
Δtime < 5 min

Daytime



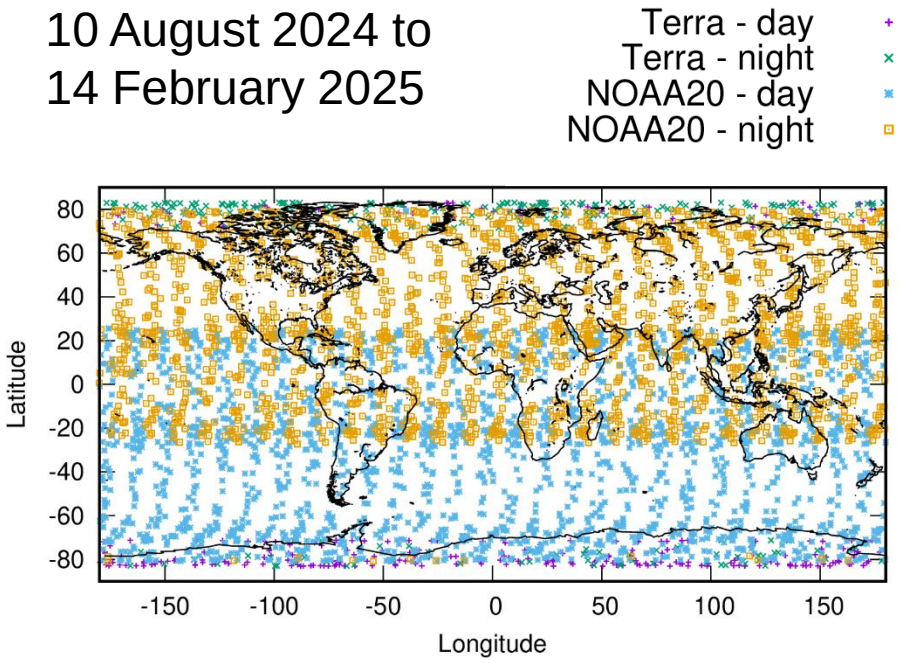


Nighttime

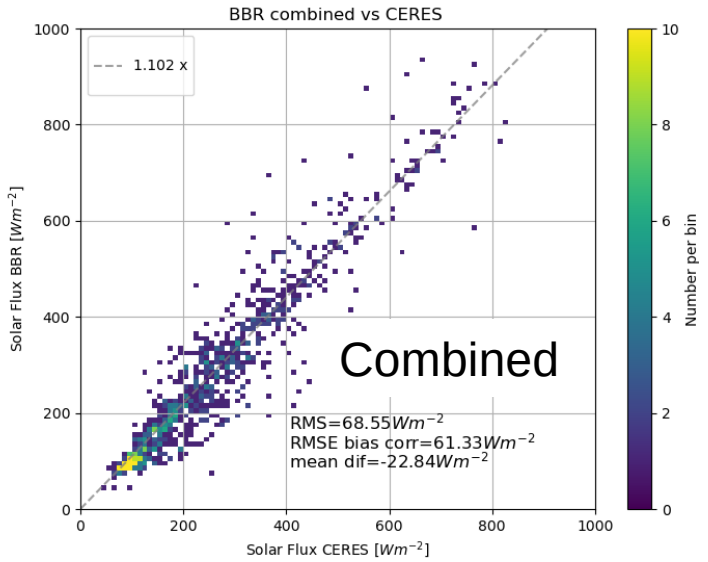


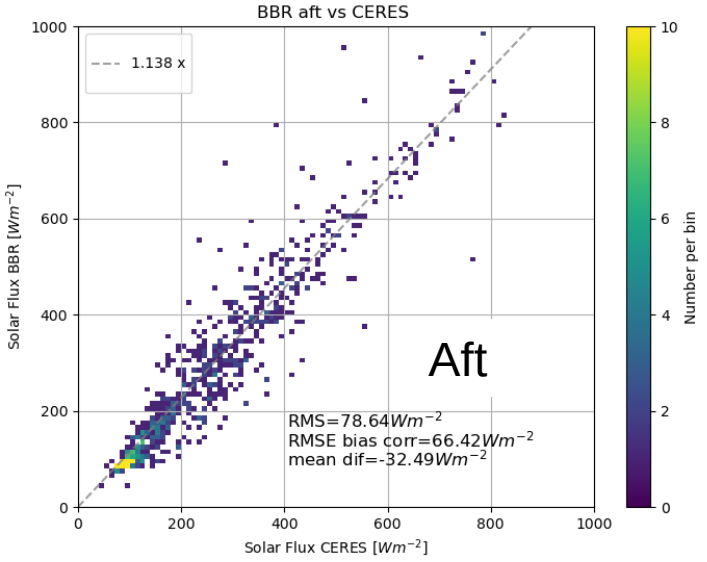
CERES FLASHflux comparison: SW Flux, Daytime

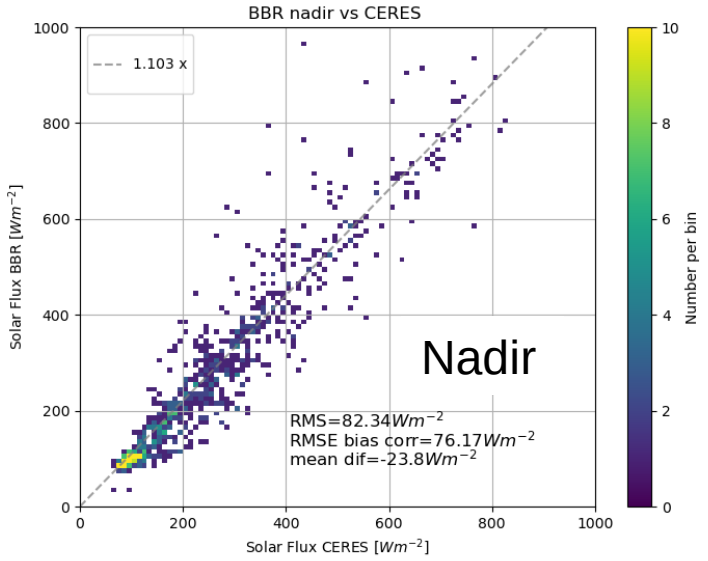
10 August 2024 to
14 February 2025

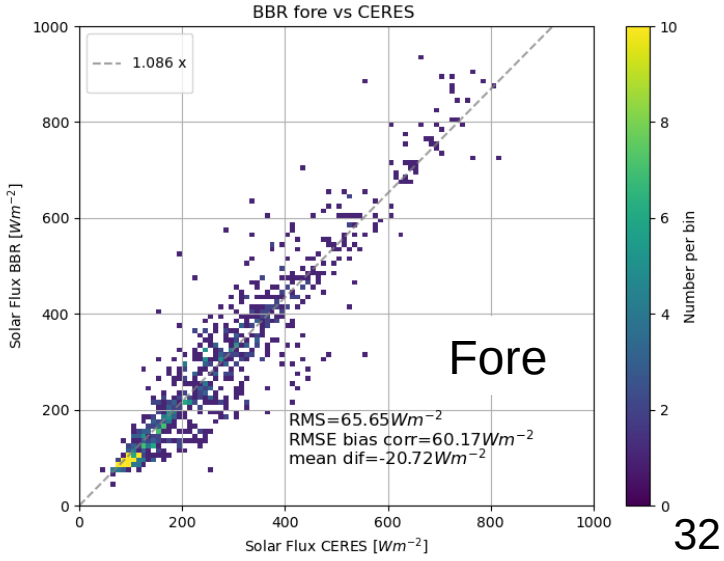


CERES VZA < 50°
Δdist < 3 km
Δtime < 5 min



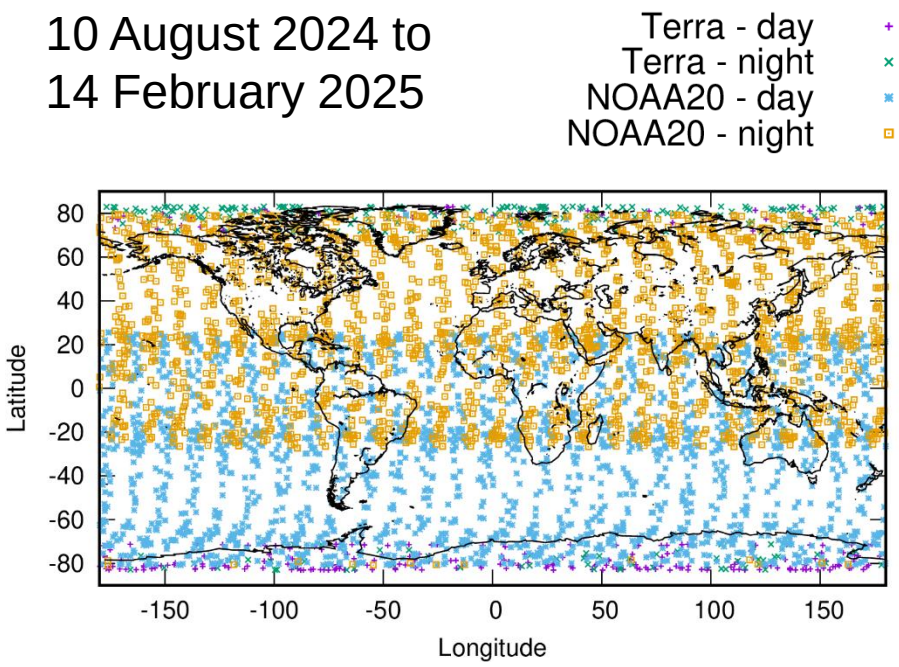




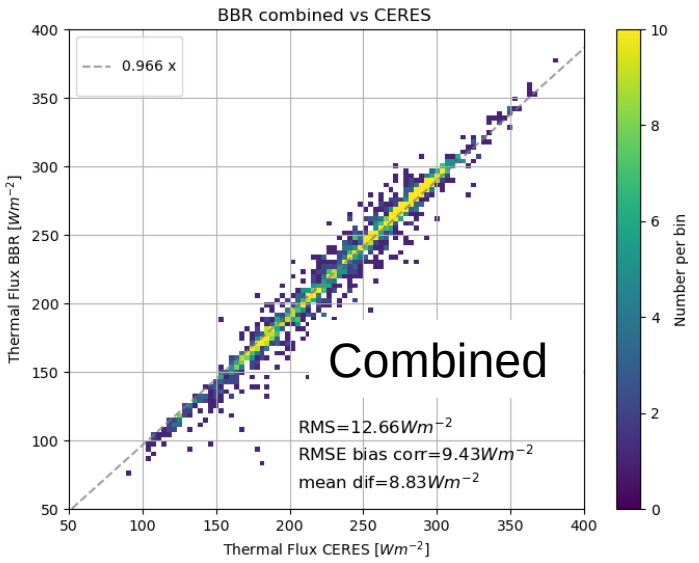


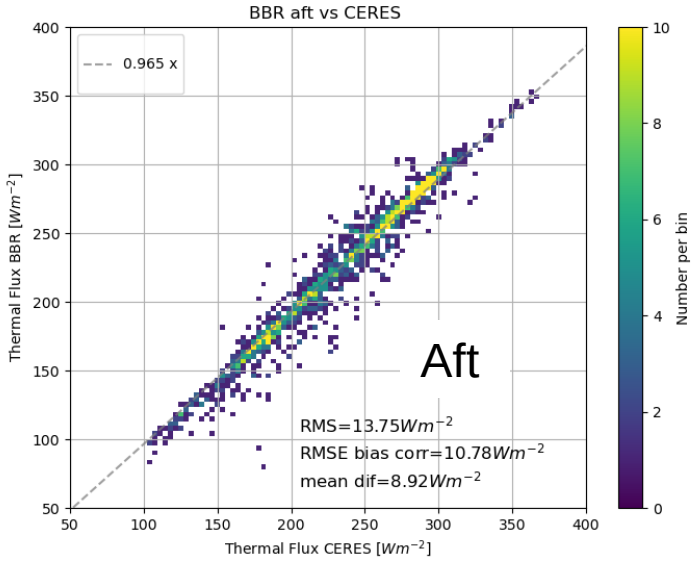
CERES FLASHflux comparison: LW Flux

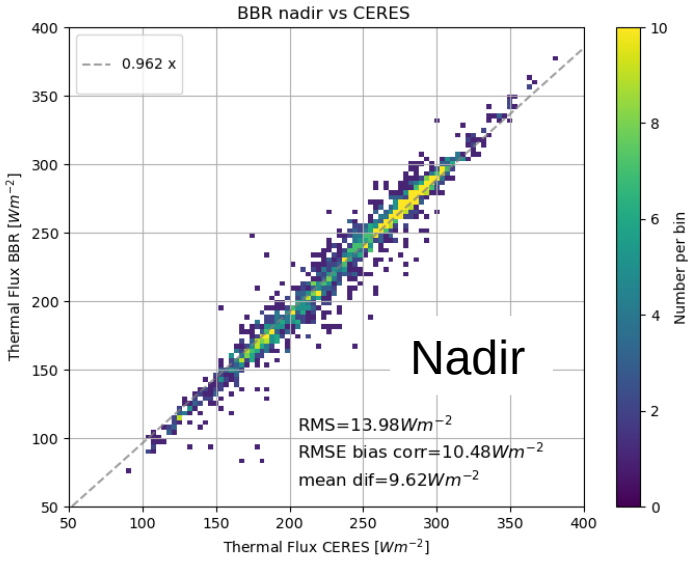
10 August 2024 to
14 February 2025

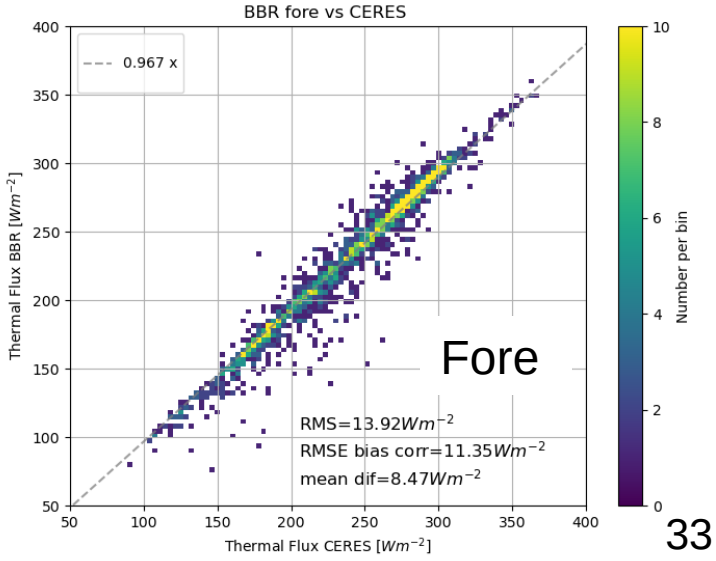


CERES VZA < 50°
Δdist < 3 km
Δtime < 5 min









Overview WP3

Work Package number:	**WP3**
Work Package Title:	**Accuracy assessment of unfiltered radiances L2 BM-RAD product.**
Responsible entity:	RMIB
WP responsible person	Aebi
Project phases (0,A,B,C,D,E):	E
Beginning and end dates of WP	01.12.2024 – 31.12.2025
Total FTE allocated to the WP	13 PM (1.08 FTE)

Objectives of the WP: Quantitative evaluation of the L2 BM-RAD radiance product, so establishing input data quality for the BBR flux estimation.

Inputs:

- Tools from WP1.
- L2 BM-RAD data (commissioning and beyond)
- CERES (SSF) and GERB (HR) data

Description of work and schedule:

3.1
- Basic, qualitative, evaluation of the BM-RAD product, including visualization (context from MSI images).

3.2
- Comparison unfiltered radiances with the Earth targets defined in WP1.

3.3
- Comparison with coangular co-incident observations from GERB and CERES to assess absolute level (calibration), and scene type consistency (spectral response/unfiltering).

3.4
- Long term stability monitoring of the instrument response will be established using stable Earth targets.

Excluded tasks:

Deliverables and dates:

- Matched databases of coangular radiances for reference and further analysis (30.06.2025).
- BBR L2a quantitative assessment report (31.12.2025).
- Recommendation for BM-RAD processor evolution.

Risks: Availability of co-angular collocated observations from CERES RAPS campaigns

Outlook

- Continuation of the monitoring of various parameters in L1 and L2 (including new baseline-releases).
- Continuation of the analysis of changes per month or even per day.
    - Will there be a reprocessing with the new baseline for all data (e.g. for B-NOM AD)?
- Continuation of the analysis with GERB and CERES data:
    - GERB is out of the sun avoidance season since middle of October 2024, but has issues.
    - CERES SSF data are available until 01/08/2024.
- Participation and poster presentation at the EarthCARE Validation Workshop in March 2025.
- Analysis of the ratio between BBR and MSI-based BBR-like data (open point from WP2).