RMI

Koninklijk Meteorologisch Instituut België

Institut Royal Météorologique Belgique

Königliches Meteorologisches Institut Belgien

Royal Meteorological Institute of Belgium

BRAVO

Progress Meeting WP1

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23 September 2024

Overview WP1

Work Package number:	**WP1**
Work Package Title:	**Preparation**
Responsible entity:	RMIB
WP responsible person	Aebi
Project phases (0,A,B,C,D,E):	E1
Beginning and end dates of WP	01.06.2024 – 31.08.2024
Total FTE allocated to the WP	3 PM (0.25 FTE)
Objectives of the WP: Preparation of the tools required to carry out the analysis described in WP2,3,4.	

Inputs: Project proposals (ESA & Prodex), Simulated L1 data from ESA and CARDINAL

Description of work and schedule:

1.1 • Analysis of the occurrence of collocated/coangular observations with CERES and GERB instruments.

1.2 • Prepare CERES RAPS/PAPS data matching campaigns in collaboration with the CERES team - possibly attend CERES Science Team Meeting in May 2024.

1.3 • Develop algorithms to enable BBR-like filtered and unfiltered broadband estimates from MSI (i.e. narrowband-to-broadband).

1.4 • Definition, selection and characterization of relevant Earth targets for calibration tracking and transfer (e.g. deep convective clouds, desert, ocean).

1.5 • Prepare tool for statistical comparison of the 3 views (e.g. histograms)

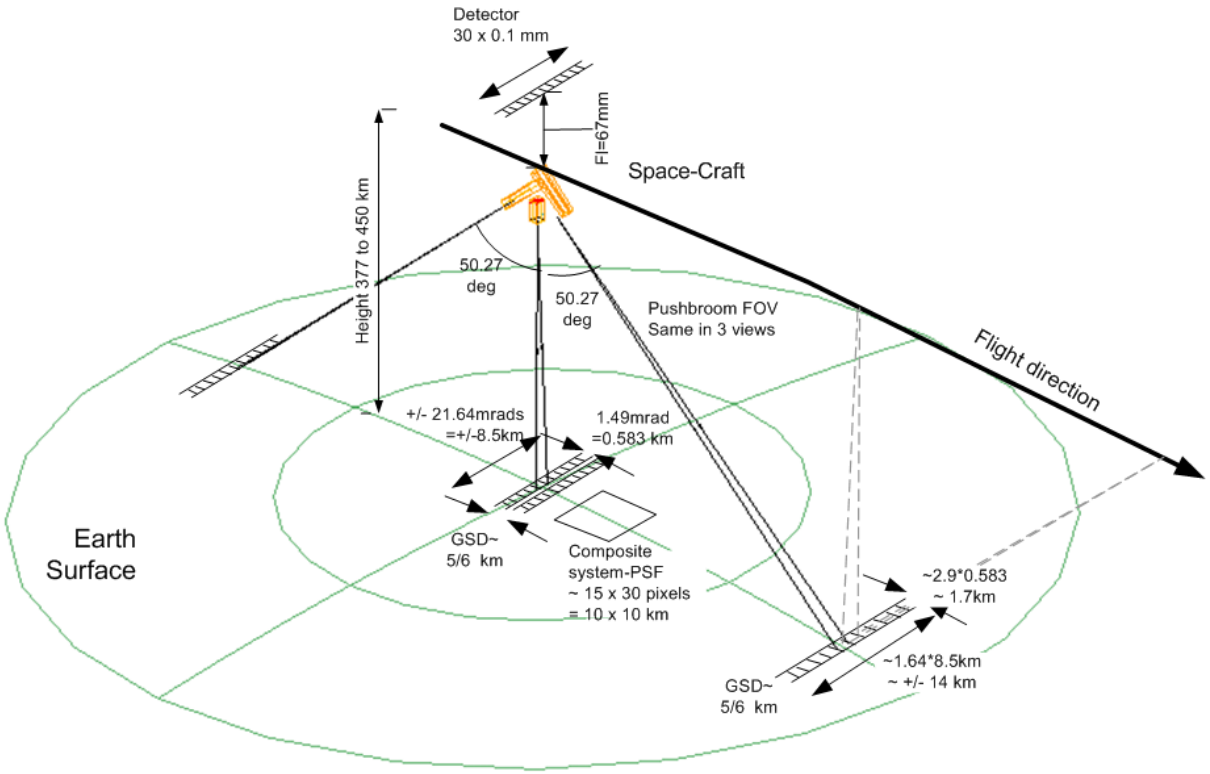
Excluded tasks: Tasks performed entirely by partners are not mentioned in this WP sheets.

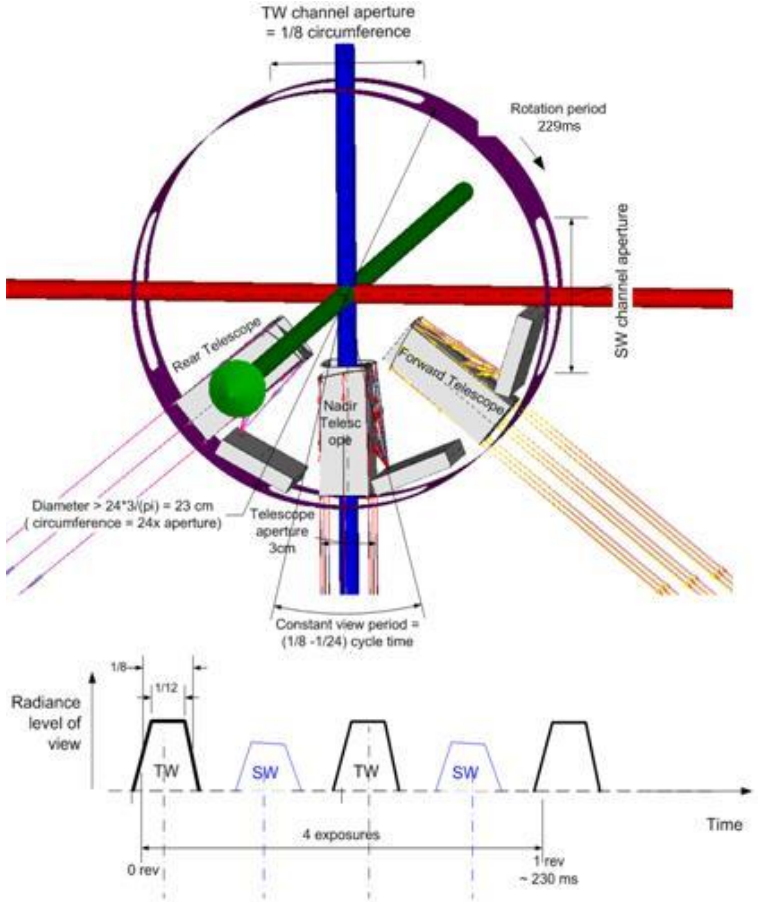
Deliverables and dates:

- Technical reports as wiki pages (31.08.2024)
- Tools implemented (C-language, python, bash scripts) and archive in git (31.08.2024)

Risks: No particular risk identified (the simulated L1 data are already available).

EarthCARE BBR





- Detectors: 30 x 1 Vanadium Oxide microbolometer array
- Single mirror optics (Aluminum coating)
- Two spectral channels: **SW** (0.2 - 4µm) and **TW** (0.2 - >50µm)
- Radiometric accuracy: SW : 2.5 W m^{-2} sr^{-1} & LW: 1.5 W m^{-2} sr^{-1}

EarthCARE BBR

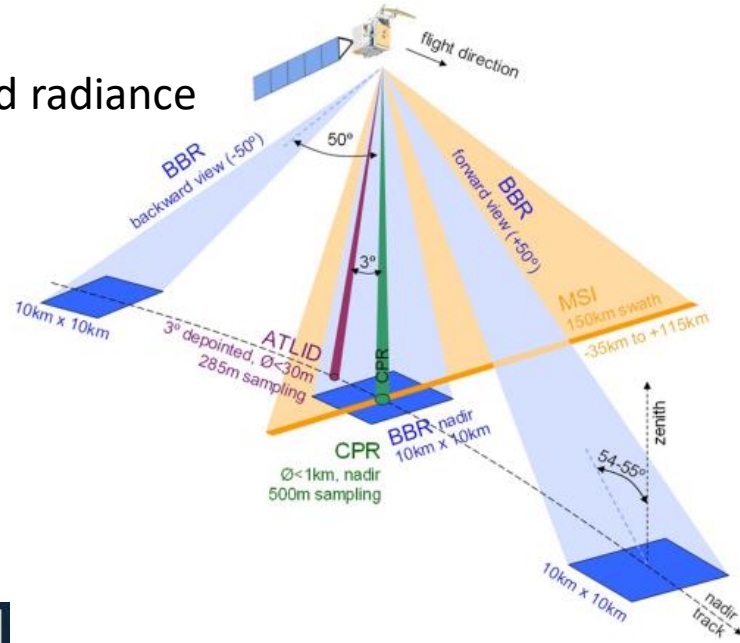
- B-NOM

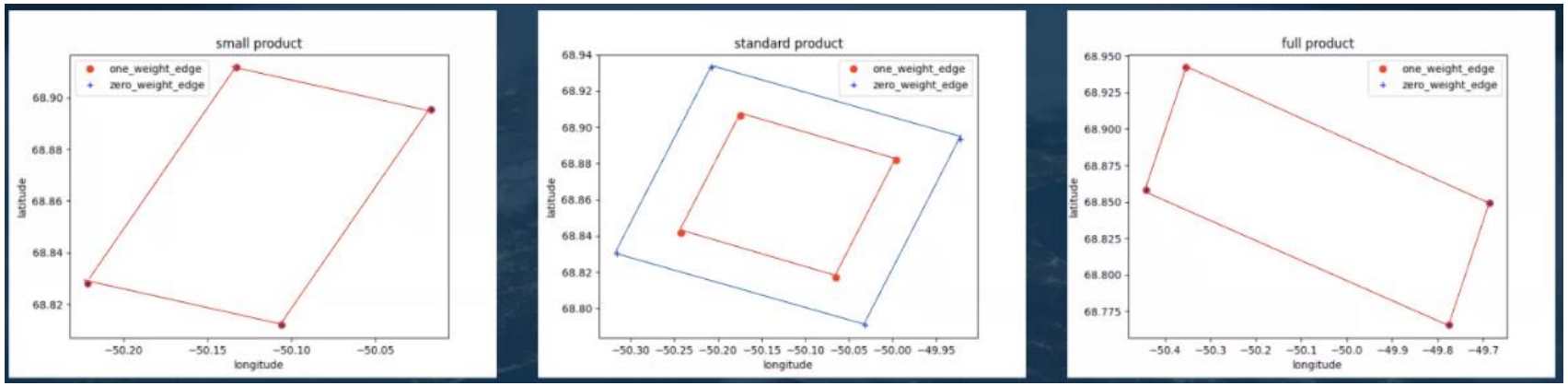
SW and **LW** filtered radiance integrated over 3 resolutions:

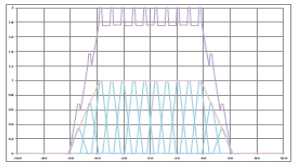
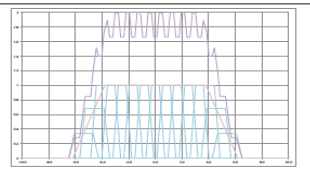
Resolution	along-track (km) x across-track (km)
Small	10 x 5 (configurable)
Standard	10 x 10
Full	Nadir: 10 x ~17 Off-nadir: 10 x ~ 28

- B-SNG

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





	Full speed
Nadir	
Oblique	

Performance requirements specified for Standard resolution

WP1.1: Analysis of the Occurrence of Collocated Observations

GERB (Geostationary Earth Radiation Budget):

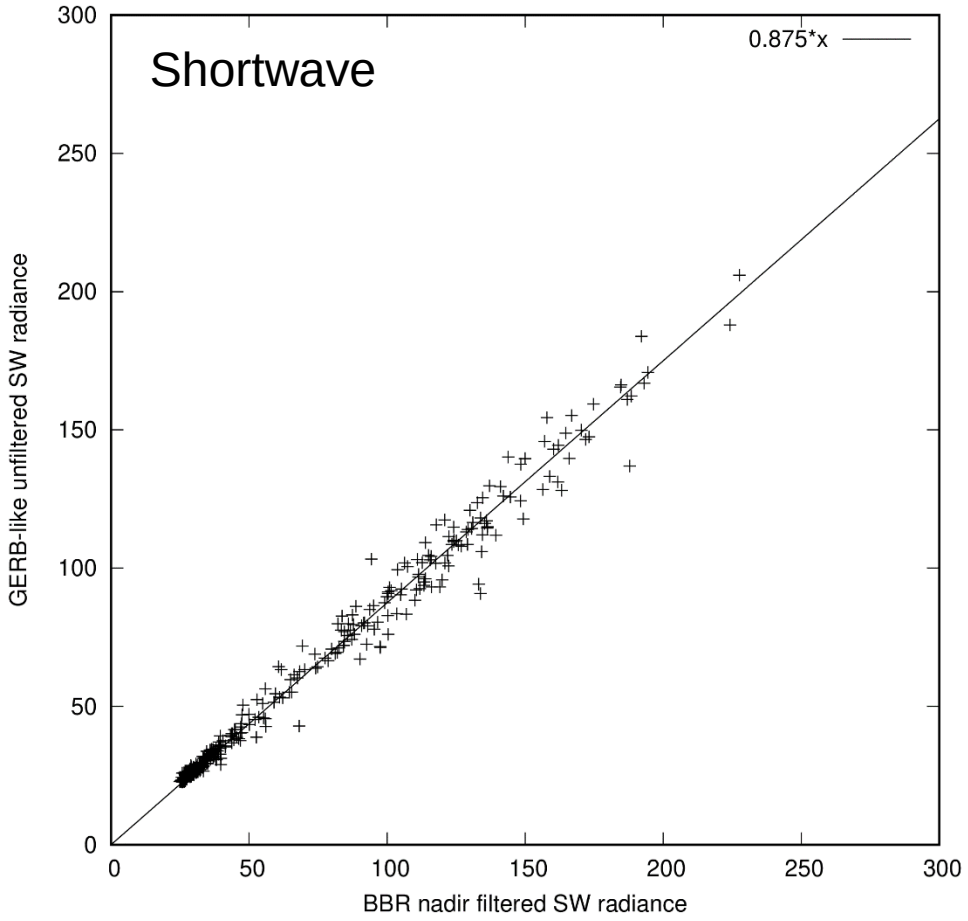
- GERB-3/MSG3 at 0° latitude
- GERB-1/MSG2 at 45.5° E latitude
- GERB-like (based on a narrowband-to-broadband conversion) from SEVIRI/MSG3
- GERB-like from SEVIRI/MSG2

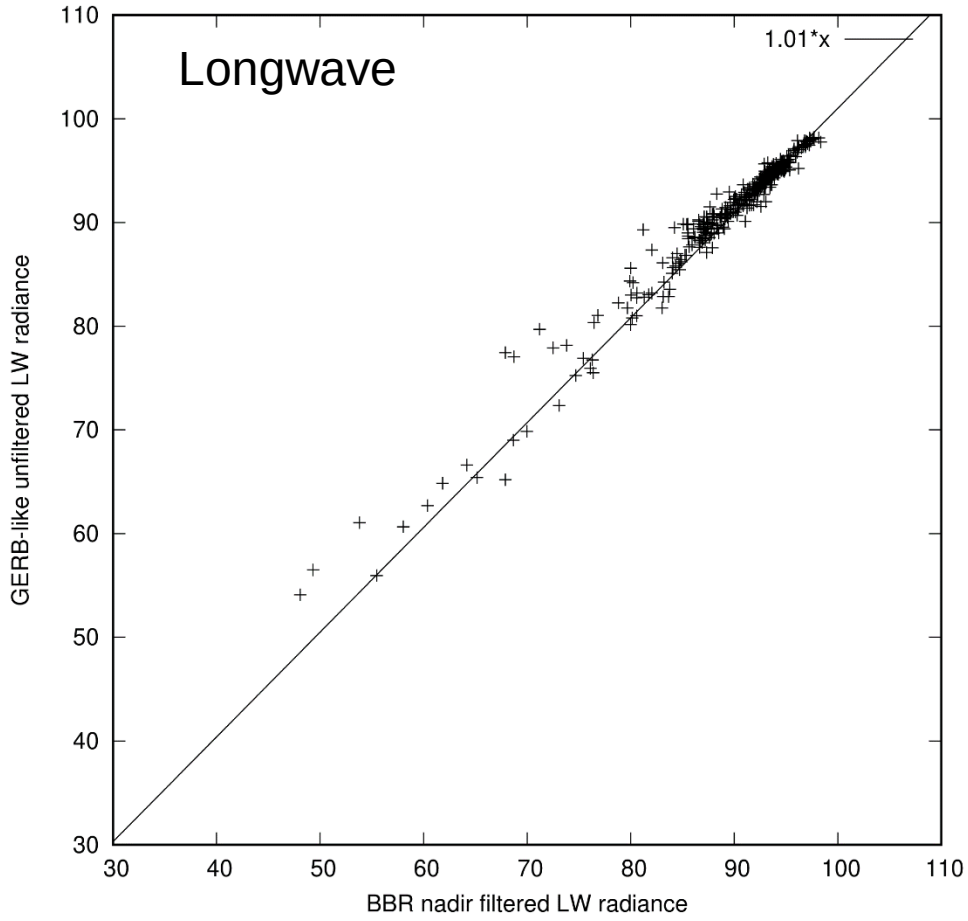
Current status:

- GERB-3 is in sun avoidance since 07/08/2024 until mid/end of October 2024
  - There would be data from 09/06/2024 – 07/08/2024
- GERB-1 is in sun avoidance since 01/08/2024; but no data available since 15/07/2024 already
- GERB-like/SEV3 is available since 09/06/2024 and this throughout the sun avoidance season

WP1.1: GERB-like/SEV3 - B-SNG Collocation (0° E)

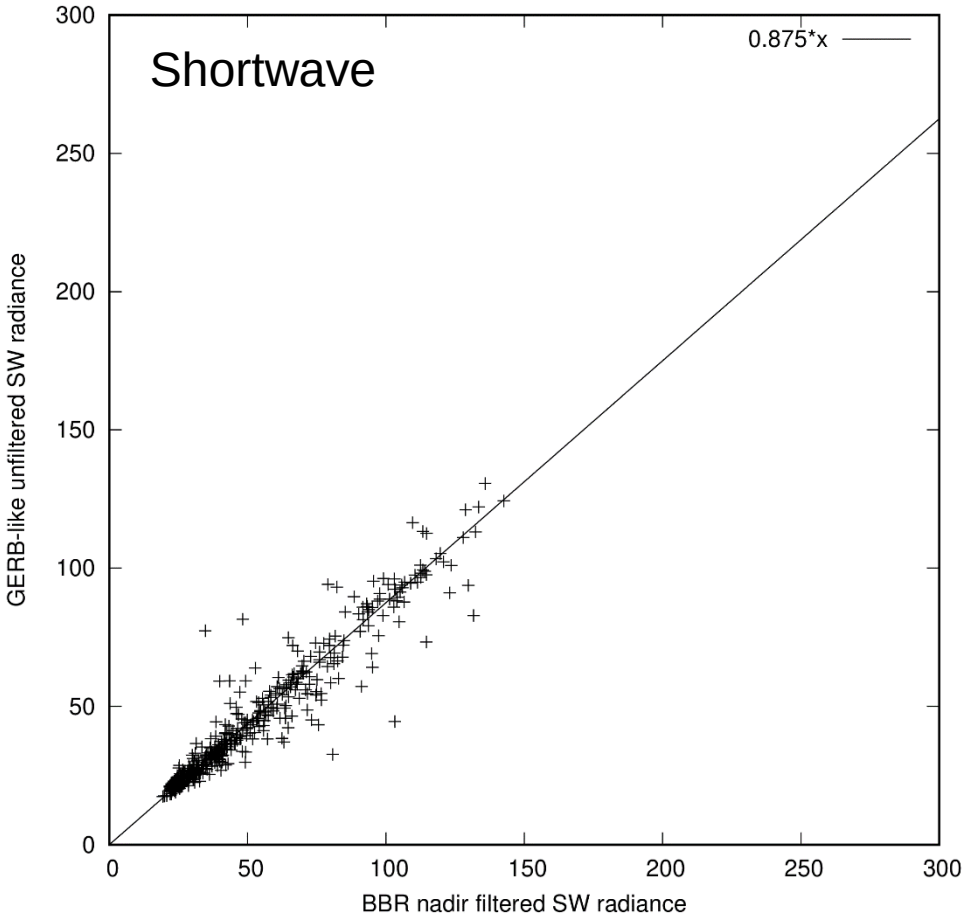
10/08/2024 – 09/09/2024 Frame E, daytime

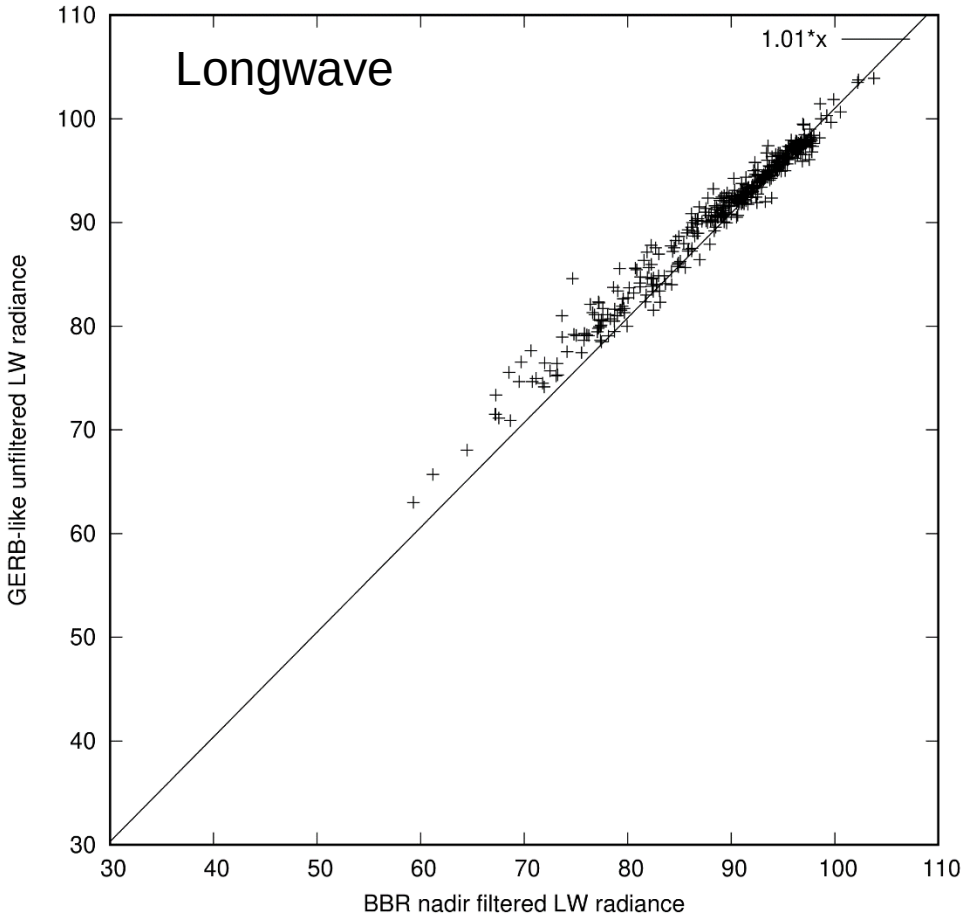




WP1.1: GERB-like/SEV3 - B-SNG Collocation (45.5° E)

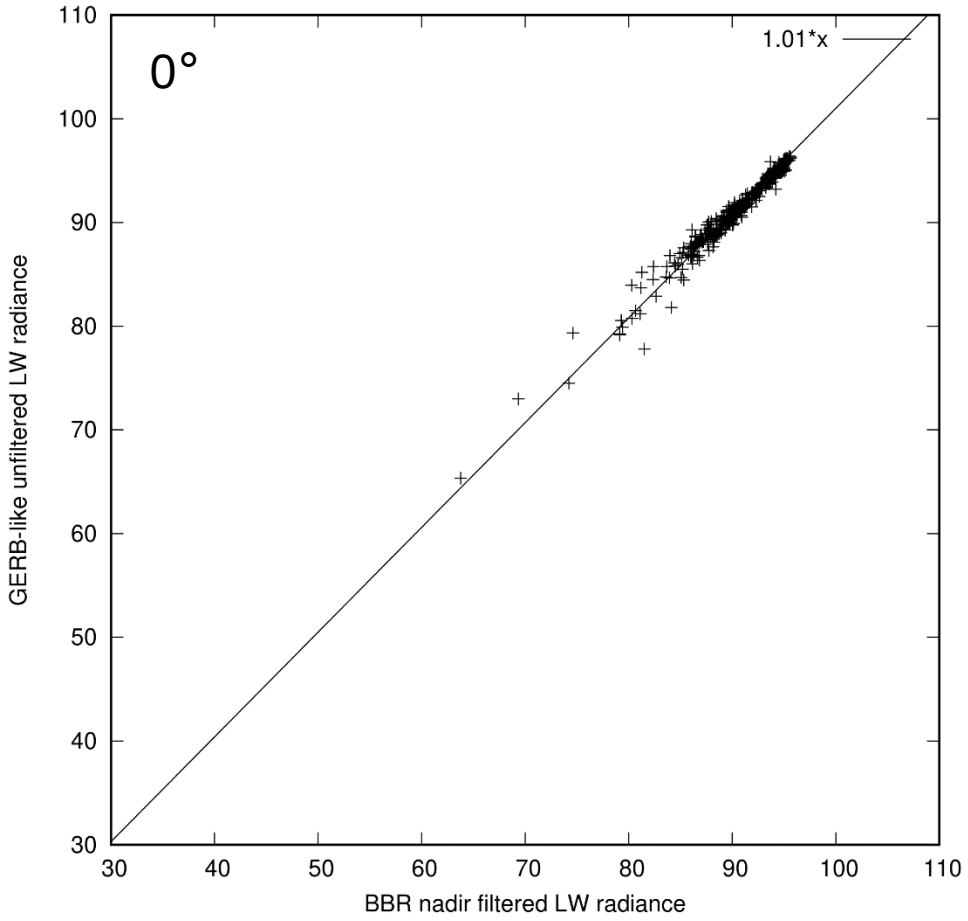
10/08/2024 – 09/09/2024 Frame E, daytime

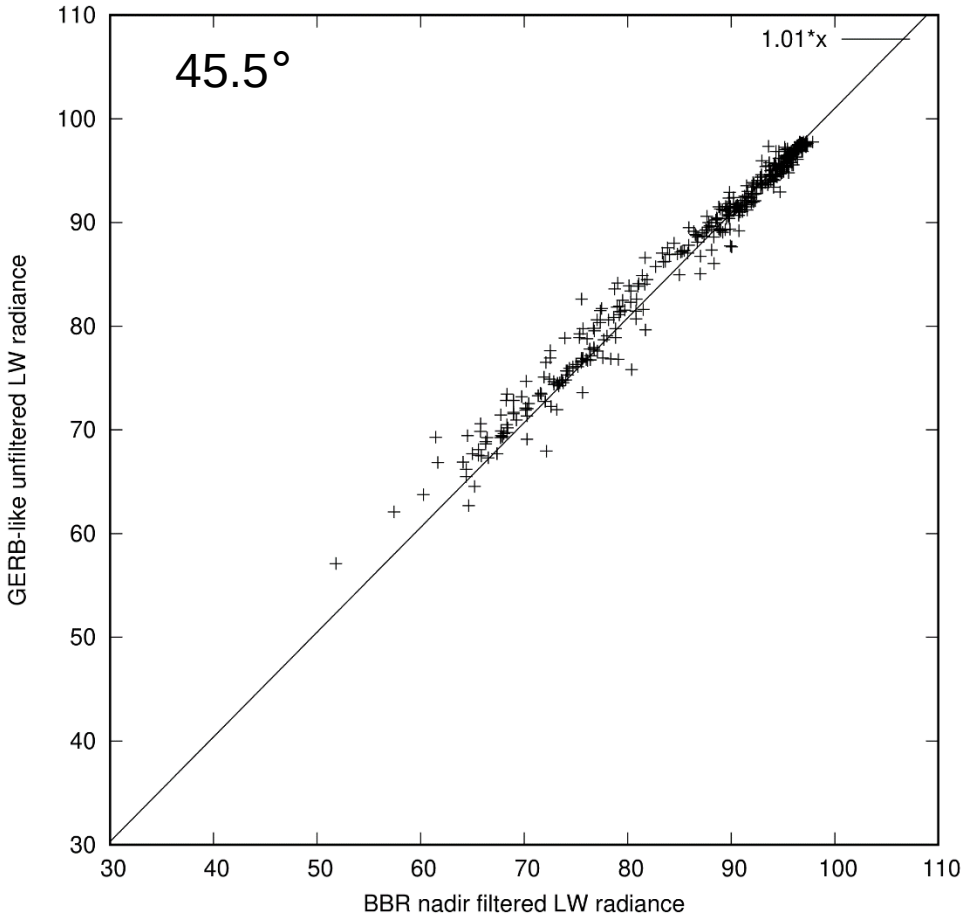




WP1.1: GERB-like/SEV3 - B-SNG Collocation (0° and 45.5° E)

10/08/2024 – 09/09/2024 Frame A, nighttime





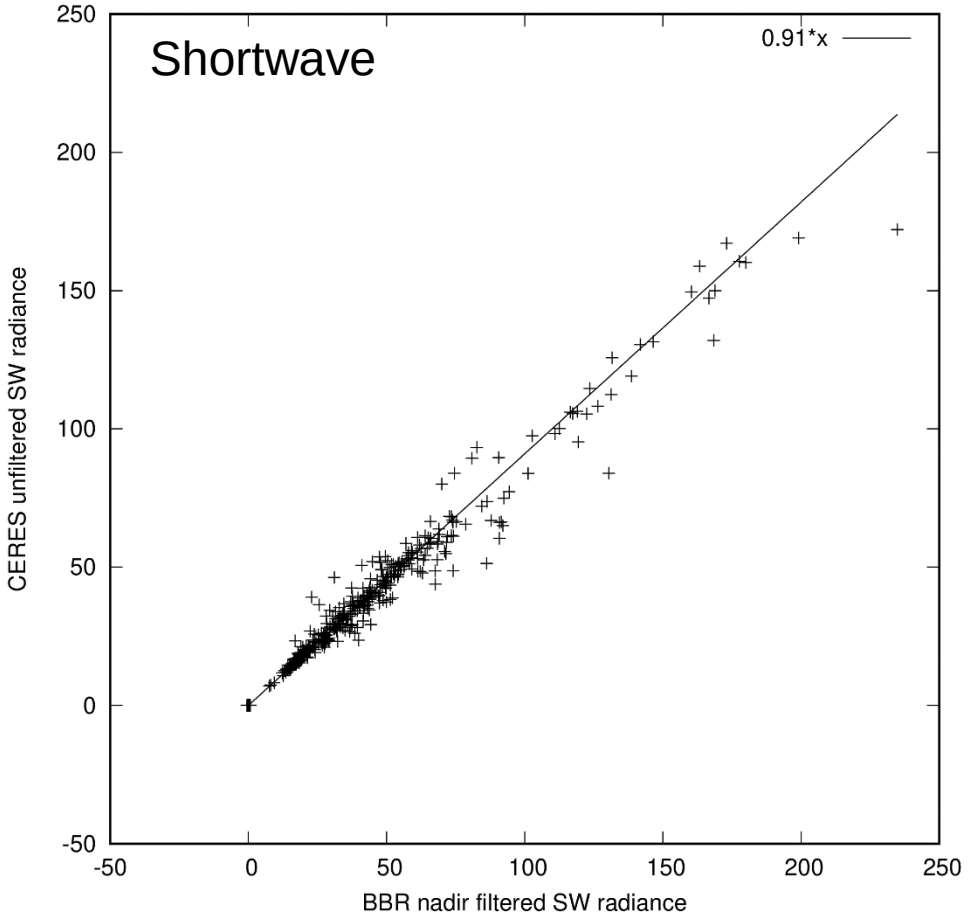
WP1.1: Analysis of the Occurrence of Collocated Observations

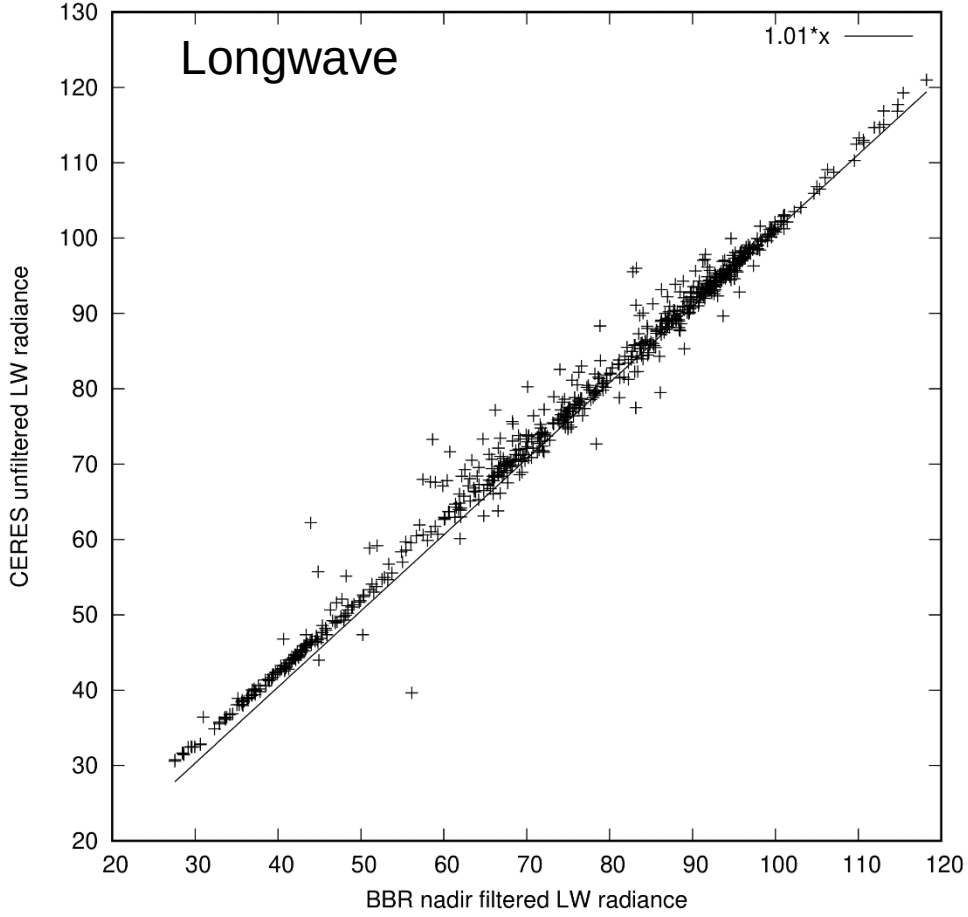
CERES:

- CERES SSF (Single Scanner Footprint) data from FM1-FM6
- FlashFLUX SSF data (because they are available in near-real-time)
- First comparisons with one month of data (10/08/2024 – 09/09/2024)

WP1.1: CERES - B-SNG Collocation

10/08/2024 – 09/09/2024





WP1.2: Preparation of CERES RAPS/PAPS Matching Campaigns

- First discussions with people from CERES:
  - There is an interest from their side to organise such campaigns.
  - However, there is no concrete date defined yet.
  - They would like to look first at the data themselves before organising/planning such campaigns.

WP1.3: Develop Algorithms to Estimate BBR-like Unfiltered and Filtered BB Radiance from MSI

- Narrowband-to-broadband conversion.
- Algorithms have been developed and also the regressions are available.
- The reprojection is missing, i.e. currently, BBR-like radiance would be available on the MSI-grid but not yet on the BBR grid.

RGB image from MSI:

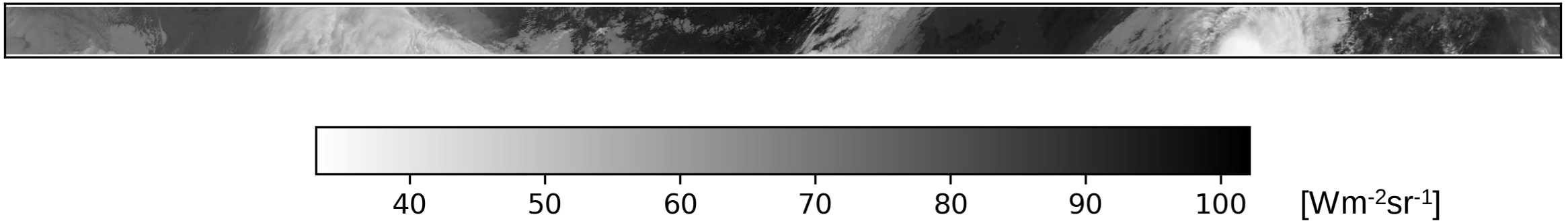
16/09/2024 Frame: 01716D

WP1.3: Develop Algorithms to Estimate BBR-like Unfiltered and Filtered BB Radiance from MSI

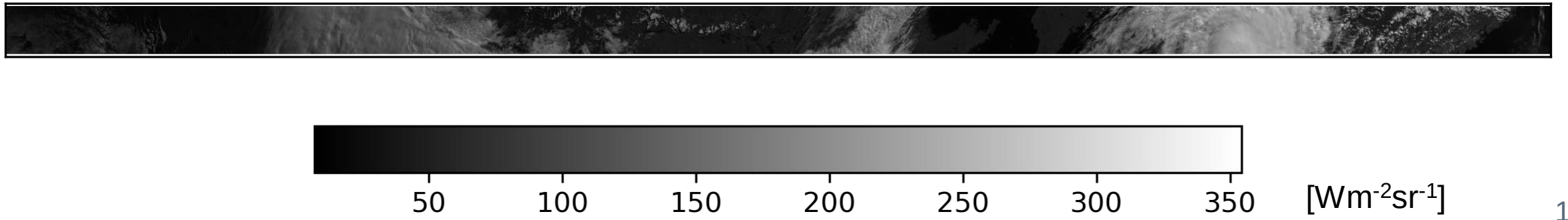
- Regressions for the unfiltered radiances are available.

16/09/2024 Frame: 01716D

Unfiltered Thermal Radiance



Unfiltered Solar Radiance

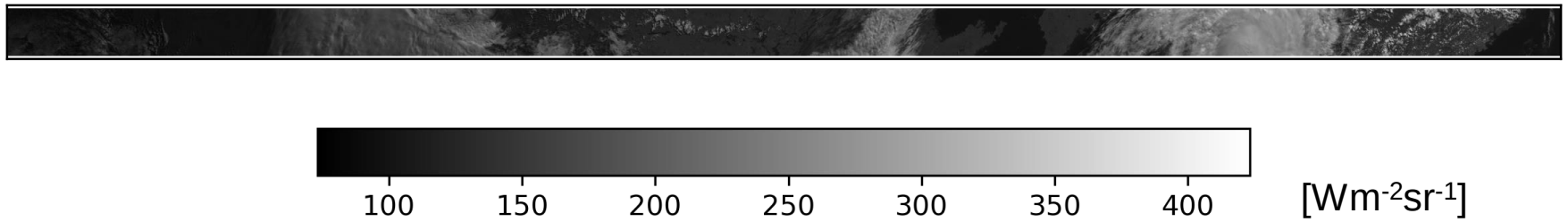


WP1.3: Develop Algorithms to Estimate BBR-like Unfiltered and Filtered BB Radiance from MSI

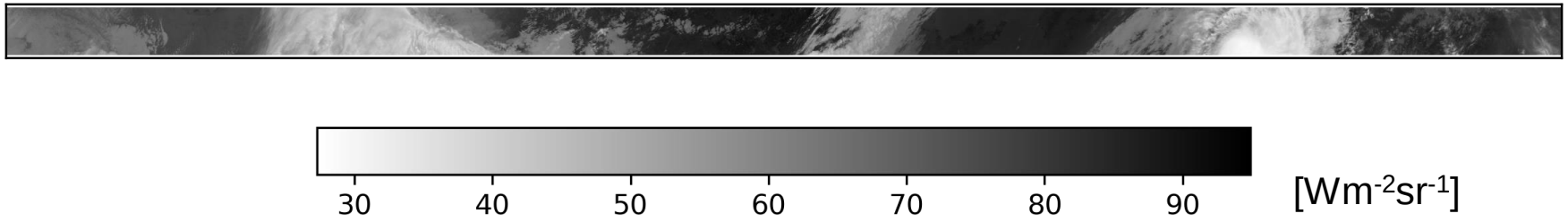
- Second set of regressions available that estimate the filtered radiances as expected from the instruments.

16/09/2024 Frame: 01716D

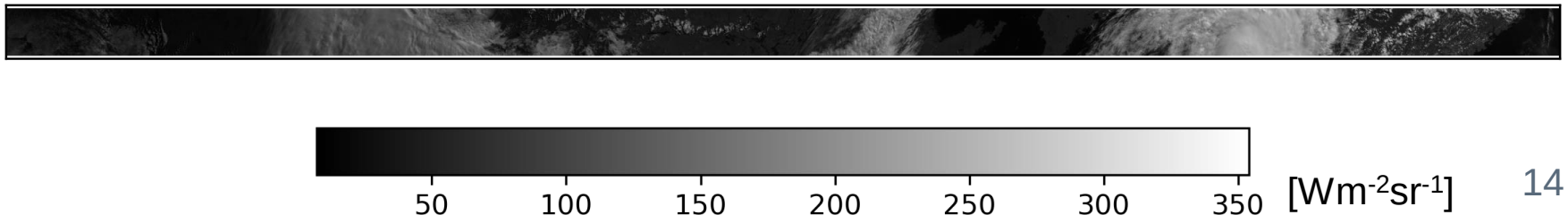
Filtered TW Radiance



Filtered LW Radiance



Filtered SW Radiance



WP1.4: Definition, Selection and Characterisation of Earth Target for Calibration Tracking and Transfer

Typical regions:

- Deep Convective Clouds (DCC)
- Desert
- Clear Ocean

Selection:

- Very high/low radiances
- Coordinates
- Ocean/land mask
- Cloud cover and phase

WP1.5: Preparation of Tools for the Statistical Analysis of the Three Views

- First tools have been developped in python for:
  - B-SNG (L1)
  - B-NOM (L1)
  - BM-RAD (L2)
  - BMA-FLX (L2)

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Risks: No particular risk identified (the simulated L1 data are already available).

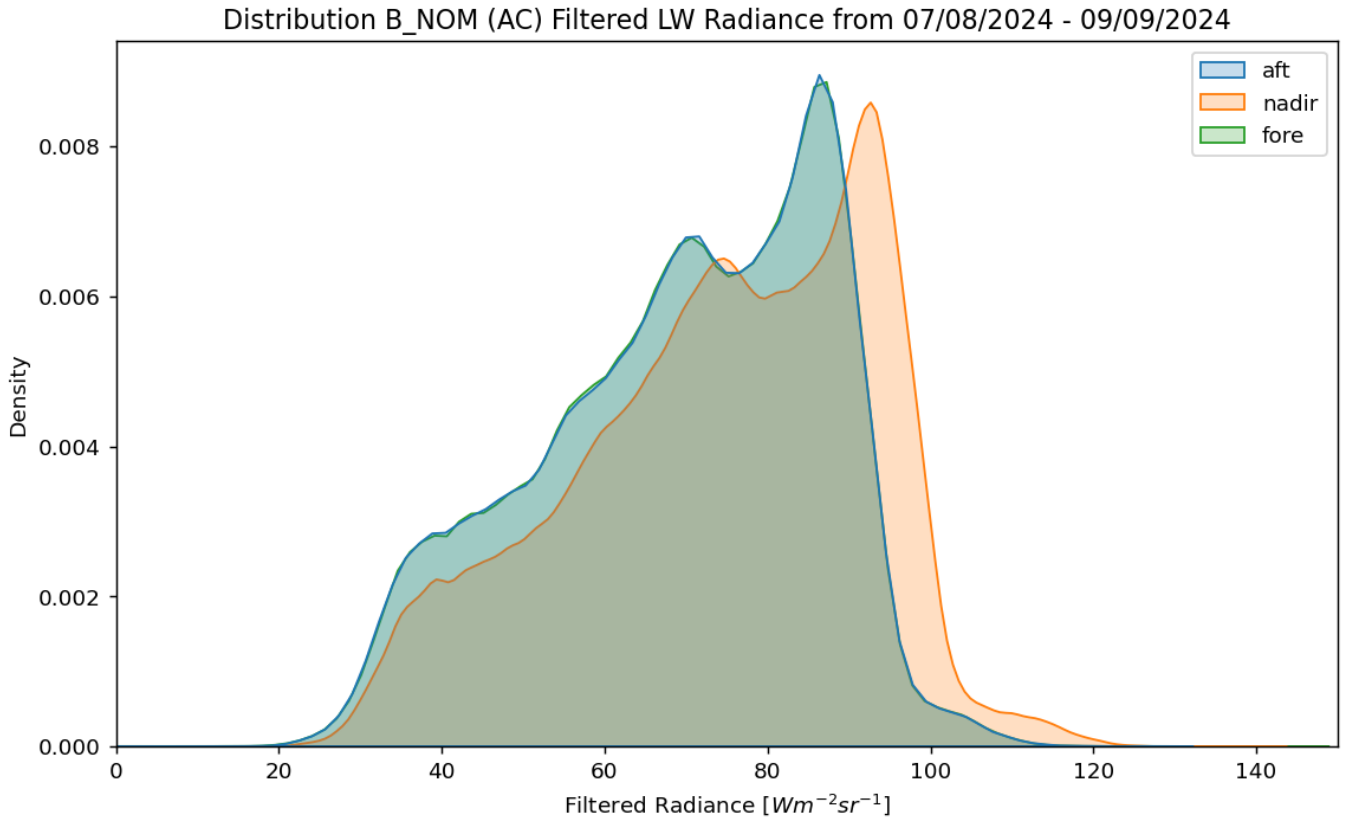
First Results

- Based on real data
- Time range: 07/08/2024 – 09/09/2024
- For B-SNG and B-NOM: baseline AA and AC and standard resolution
- For BM-RAD and BMA-FLX: baseline AA and standard resolution
- Very conservative selection of daytime and nighttime

  Daytime: solar elevation angle > 40°

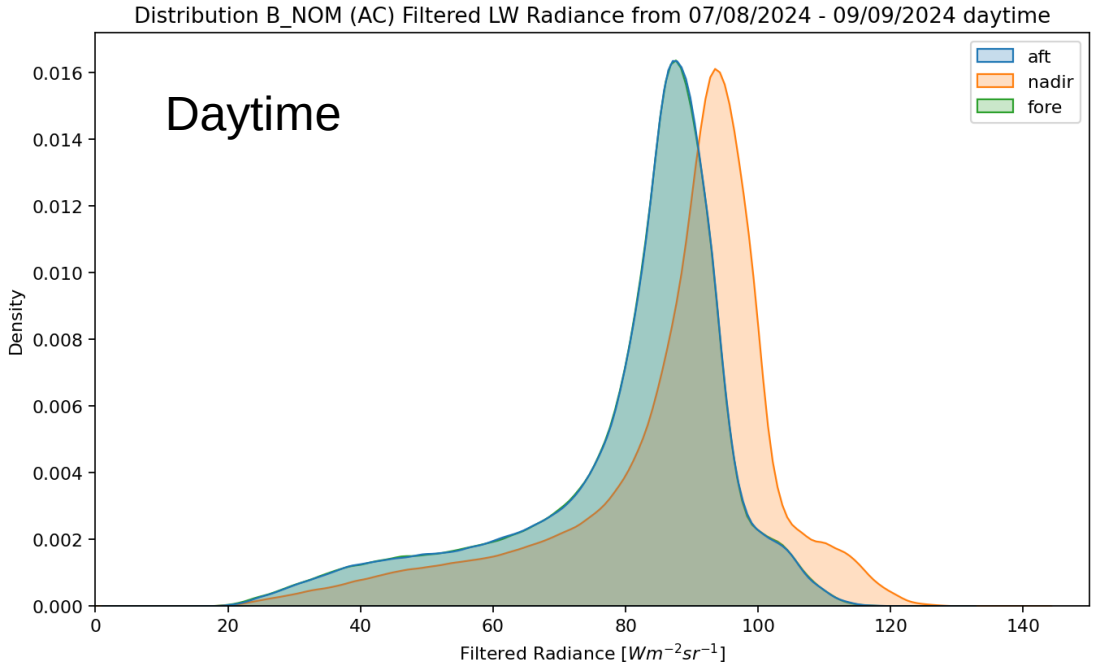
  Nighttime: solar elevation angle < -40°

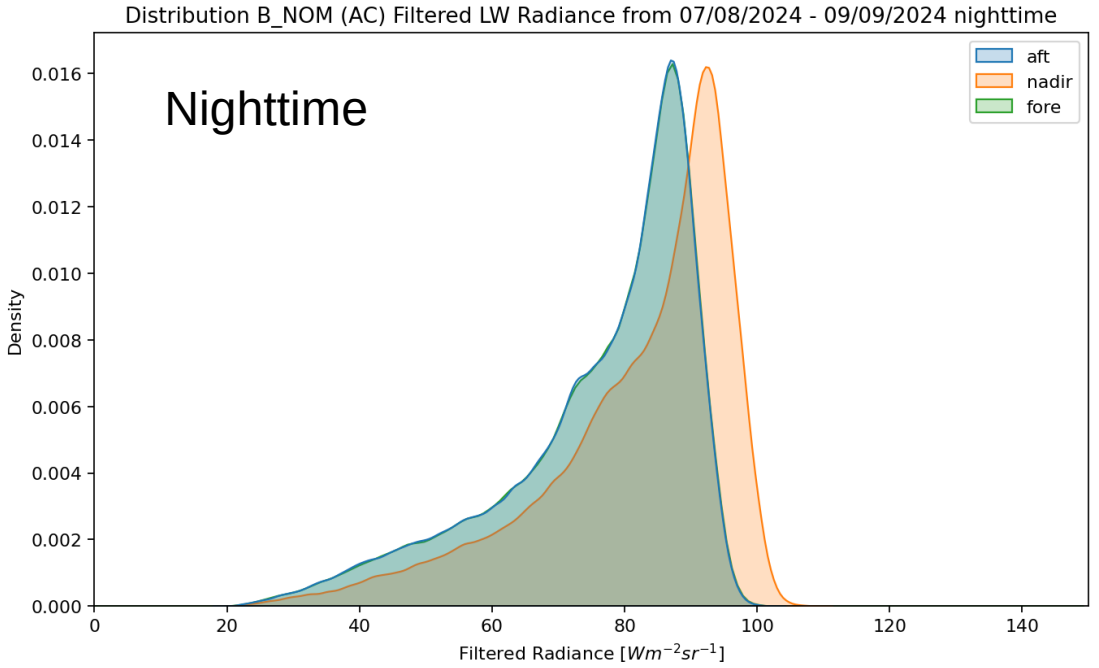
Distribution B-NOM LW Radiance All-day



View	Mean [$Wm^{-2}sr^{-1}$]	Std [$Wm^{-2}sr^{-1}$]	Median [$Wm^{-2}sr^{-1}$]
Aft	69.24	17.52	71.45
Nadir	74.24	18.56	76.37
Fore	69.23	17.50	71.40

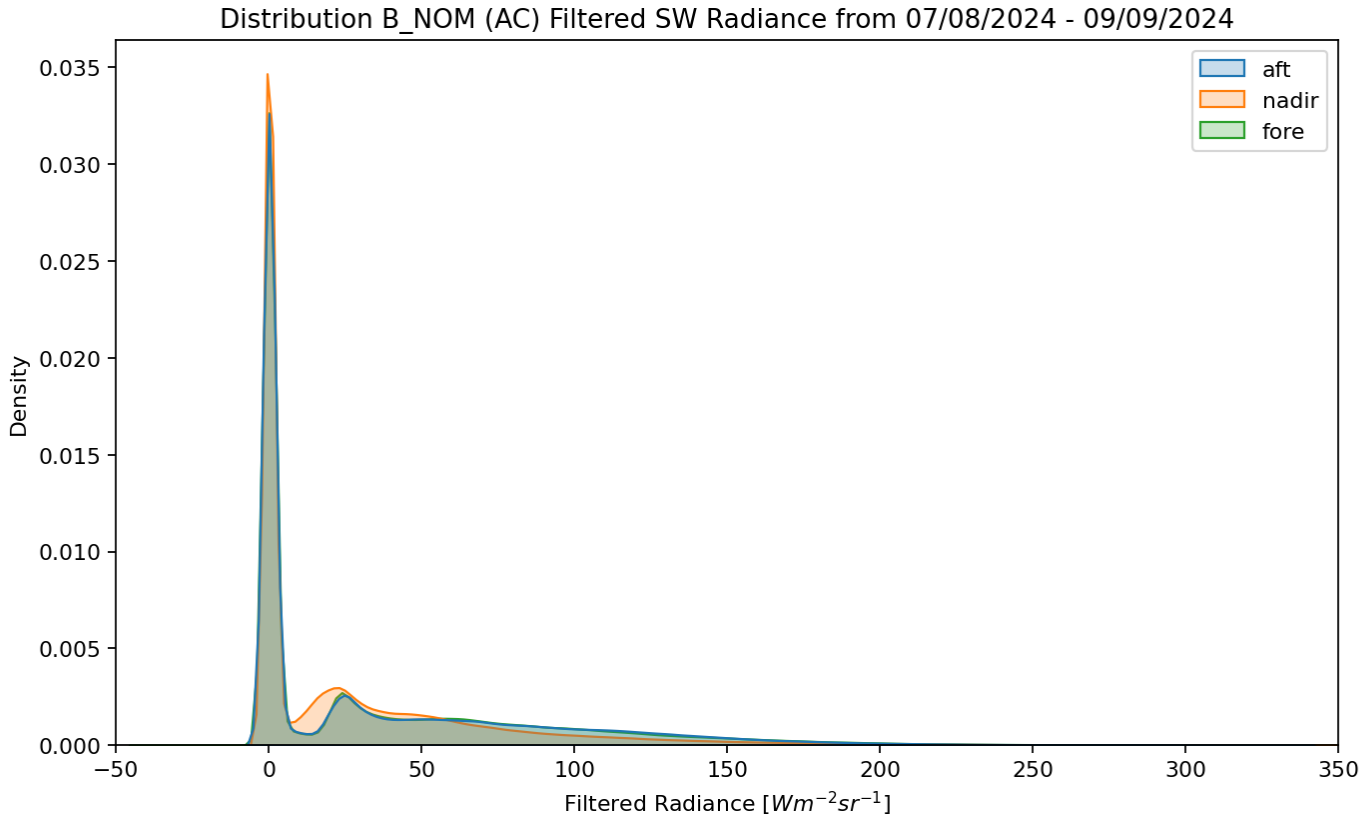
Distribution B-NOM LW Radiance Daytime and Nighttime





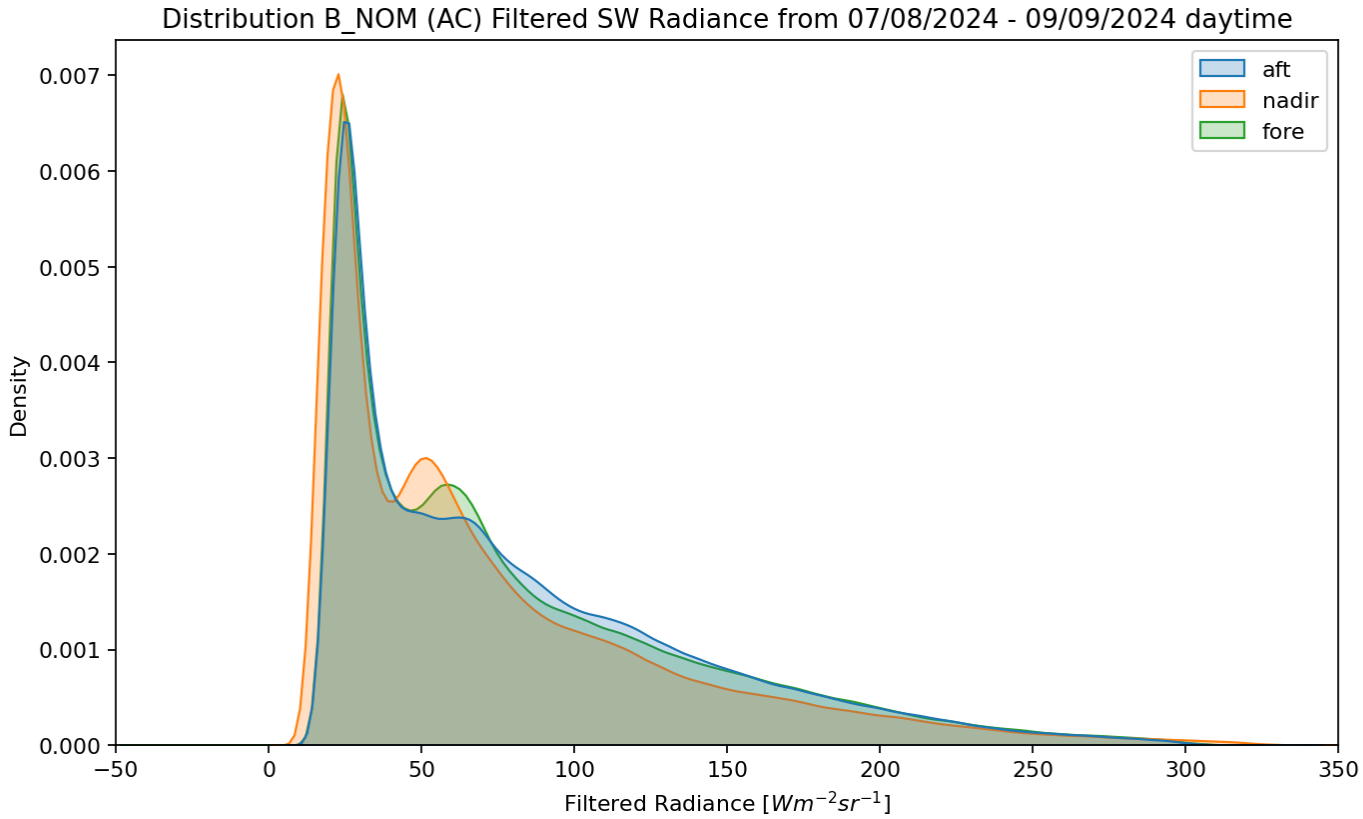
View	Mean [$Wm^{-2}sr^{-1}$]	Std [$Wm^{-2}sr^{-1}$]	Median [$Wm^{-2}sr^{-1}$]		Mean [$Wm^{-2}sr^{-1}$]	Std [$Wm^{-2}sr^{-1}$]	Median [$Wm^{-2}sr^{-1}$]
Aft	80.17	16.54	85.19		75.88	14.71	80.44
Nadir	86.79	16.99	91.35		81.68	14.76	86.19
Fore	80.09	16.62	85.14		75.94	14.71	80.49

Distribution B-NOM SW Radiance All-day



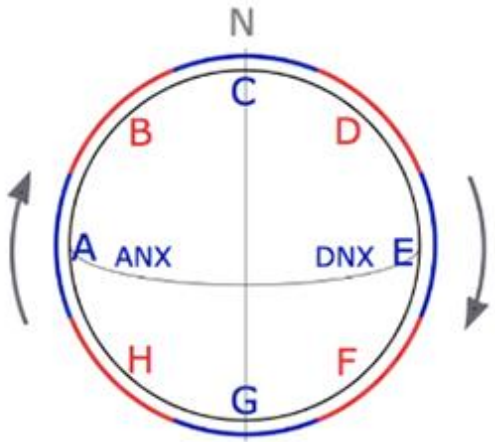
View	Mean [$Wm^{-2}sr^{-1}$]	Std [$Wm^{-2}sr^{-1}$]	Median [$Wm^{-2}sr^{-1}$]
Aft	38.27	52.41	6.40
Nadir	29.59	45.66	3.54
Fore	38.05	52.37	6.44

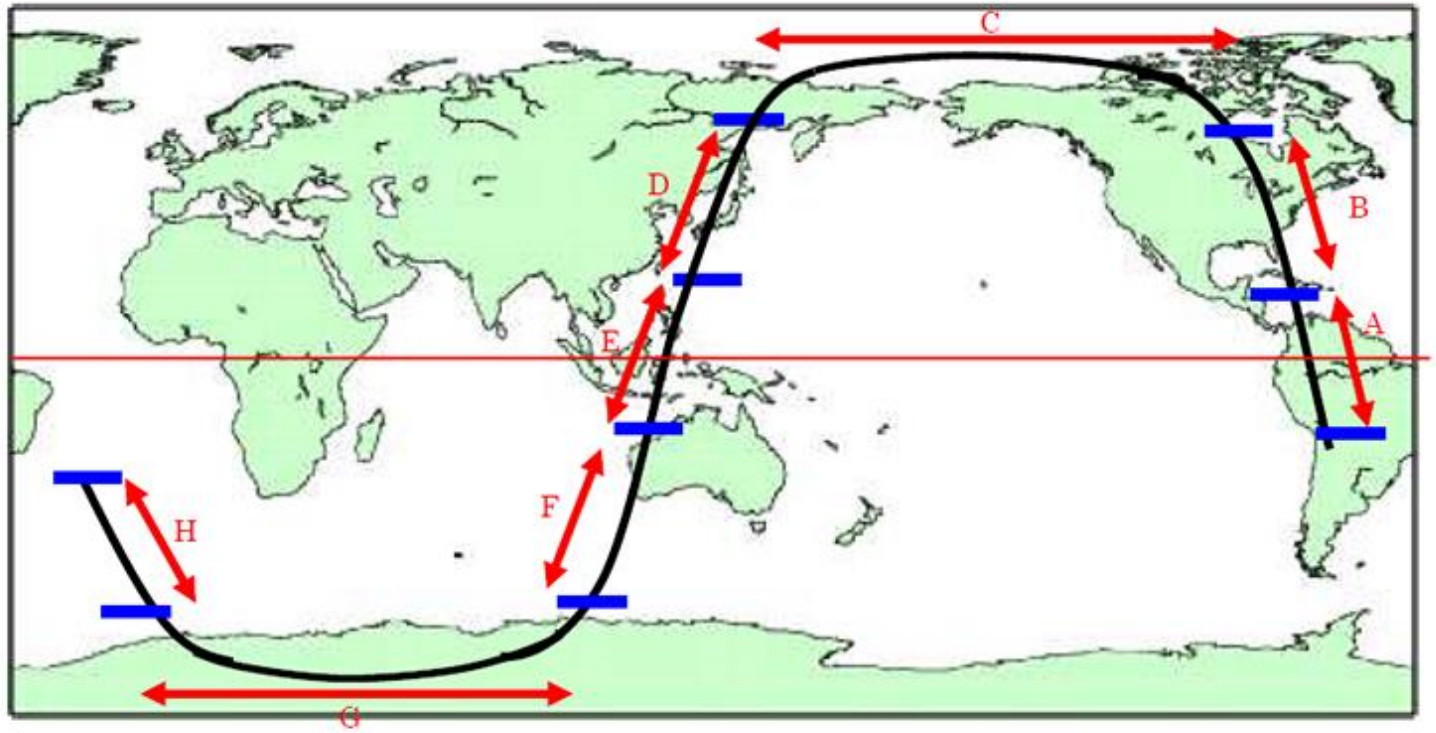
Distribution B-NOM SW Radiance Daytime



View	Mean [$Wm^{-2}sr^{-1}$]	Std [$Wm^{-2}sr^{-1}$]	Median [$Wm^{-2}sr^{-1}$]
Aft	81.42	58.16	65.07
Nadir	73.09	58.62	54.36
Fore	80.65	58.73	62.93

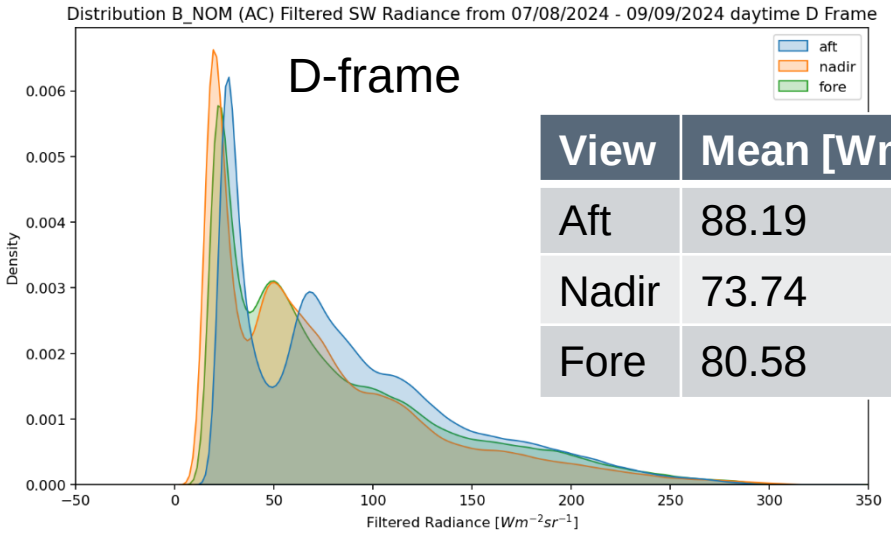
Latitude of the Different Frames



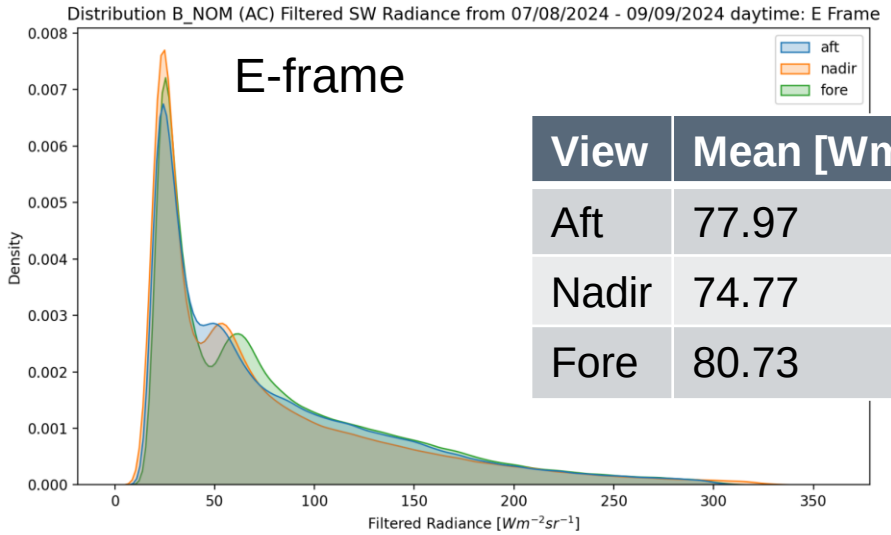


A, B, H: night
D, E, F: day
C, G: day or night depending on the season

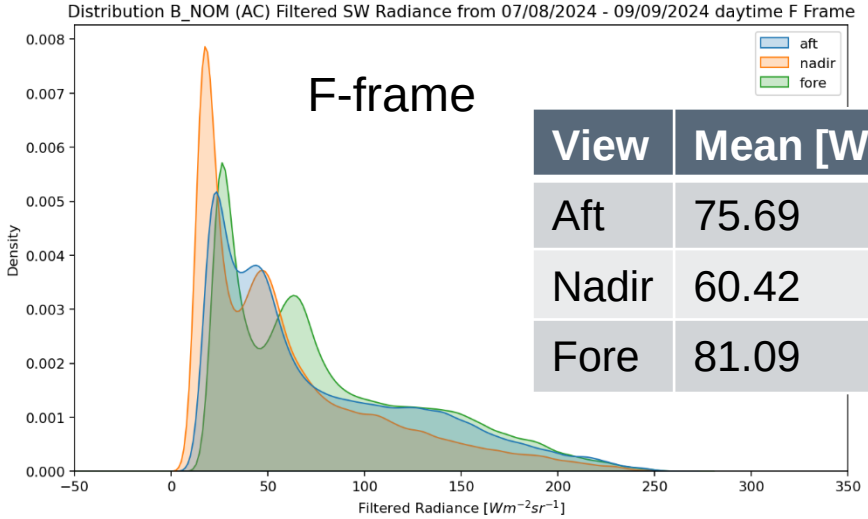
Distribution B-NOM SW Radiance Daytime: Different Frames



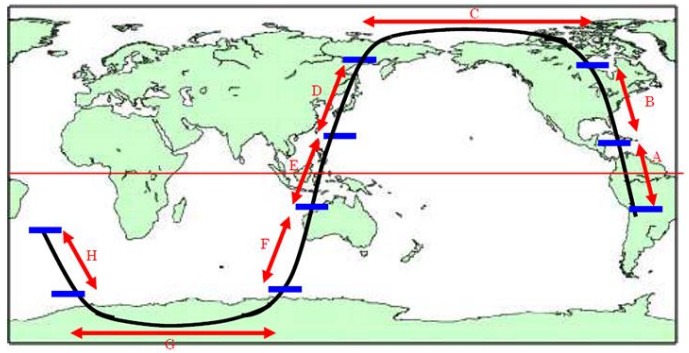
View	Mean [$Wm^{-2}sr^{-1}$]
Aft	88.19
Nadir	73.74
Fore	80.58



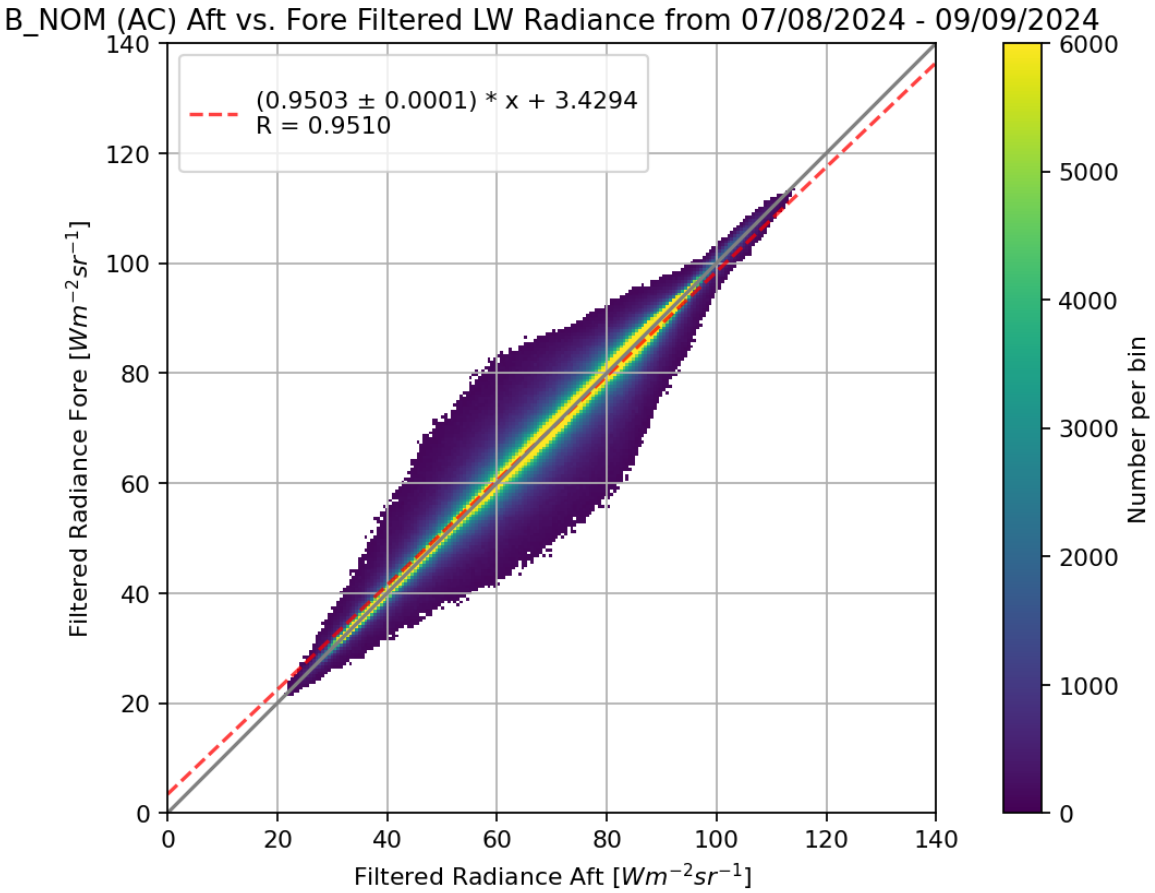
View	Mean [$Wm^{-2}sr^{-1}$]
Aft	77.97
Nadir	74.77
Fore	80.73



View	Mean [$Wm^{-2}sr^{-1}$]
Aft	75.69
Nadir	60.42
Fore	81.09

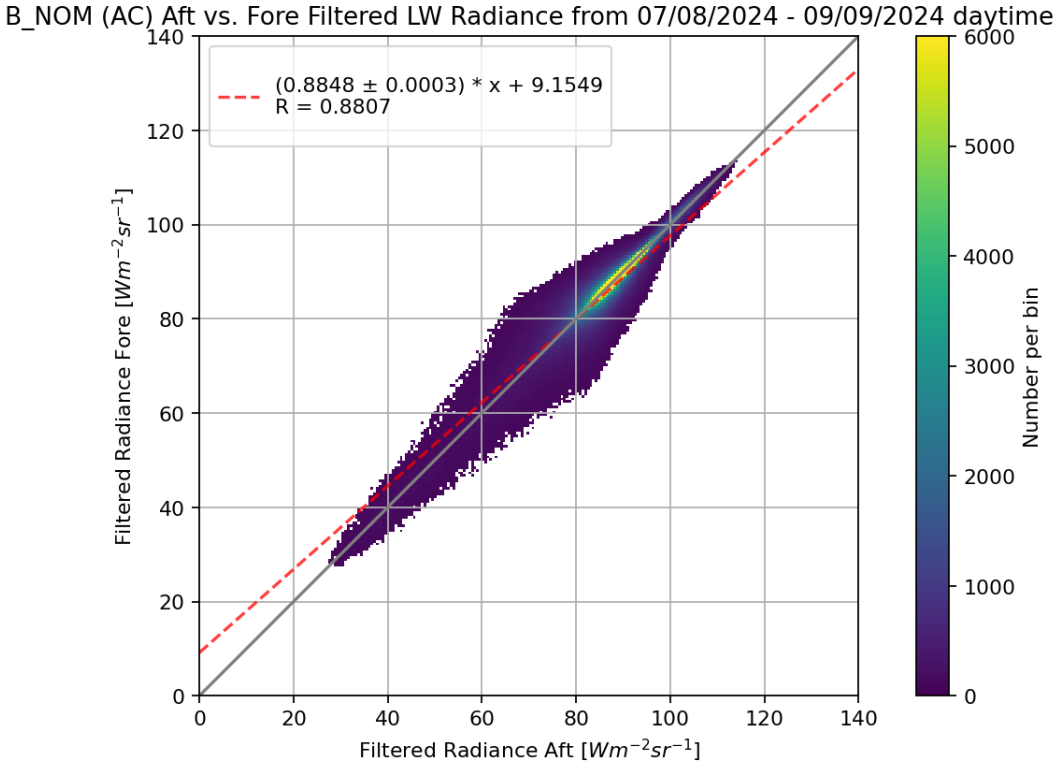


B-NOM LW Radiance Aft vs. Fore All-day

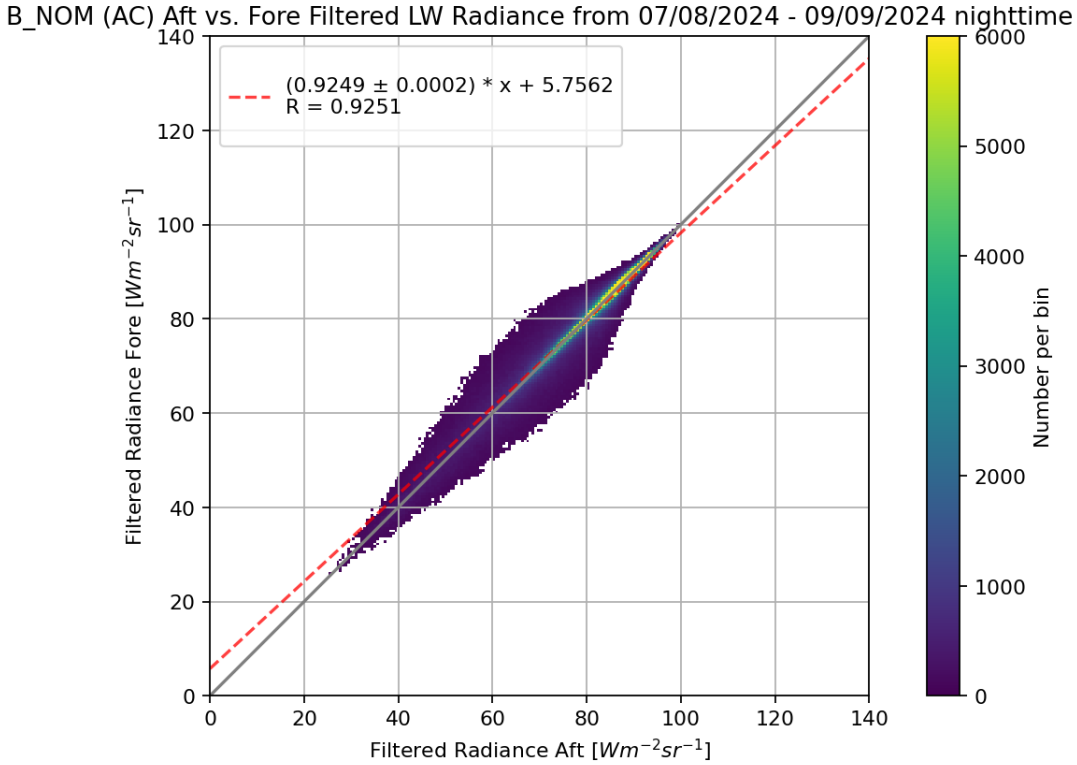


B-NOM LW Radiance Aft vs. Fore Daytime and Nighttime

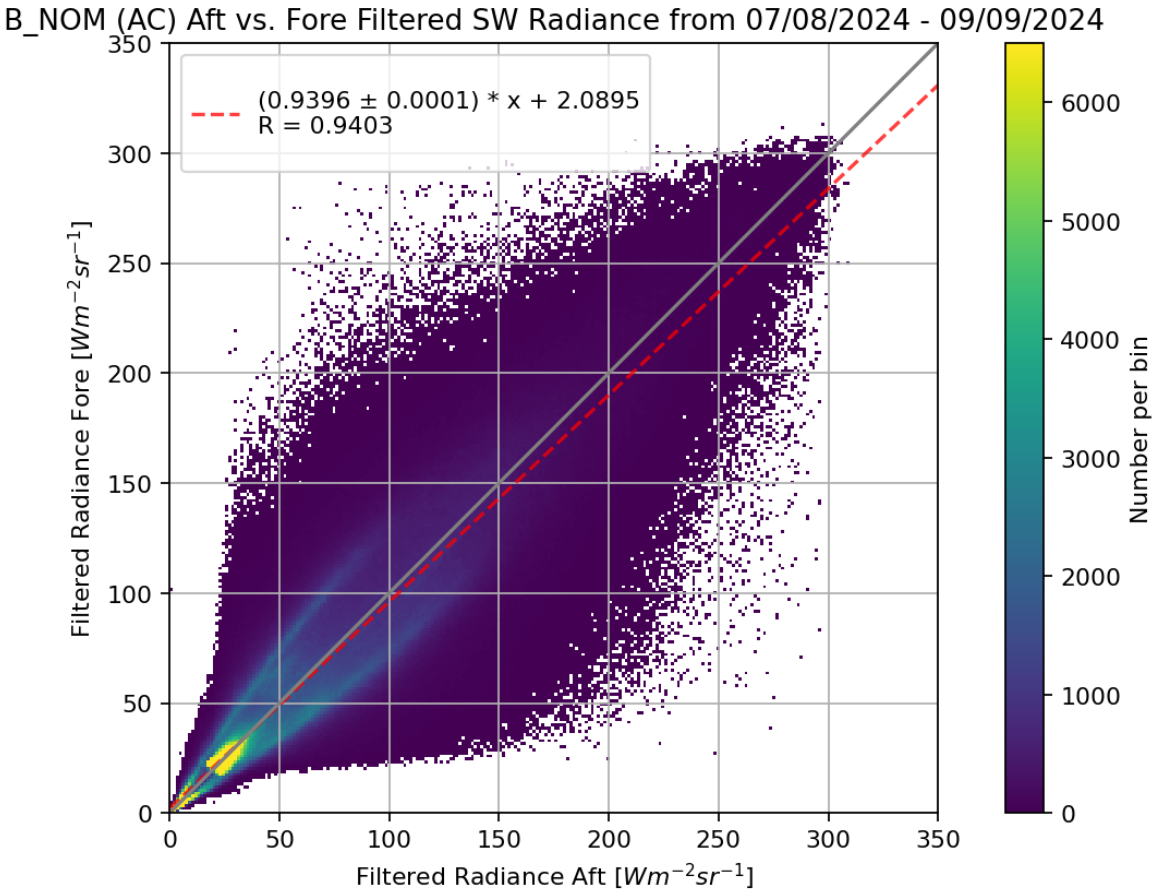
Daytime



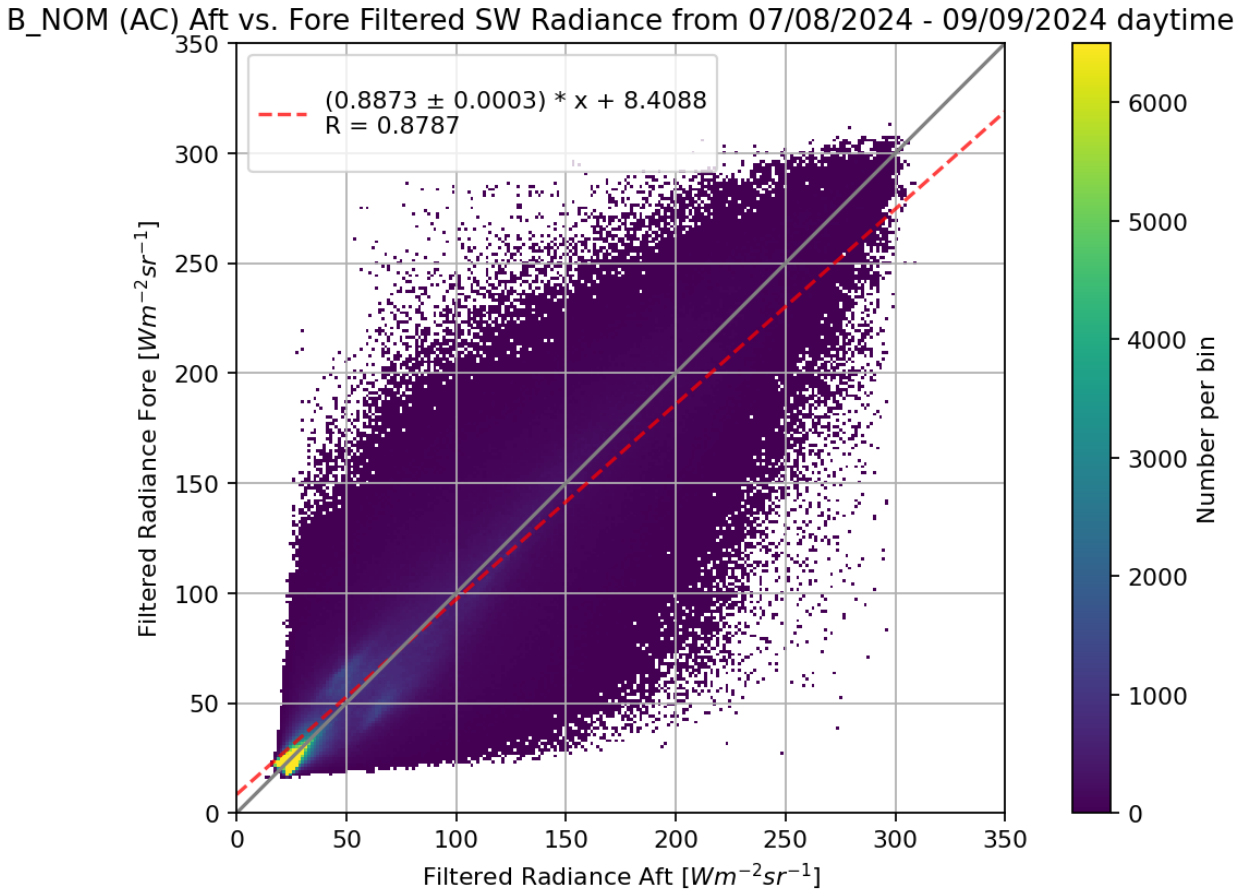
Nighttime



B-NOM SW Radiance Aft vs. Fore All-day

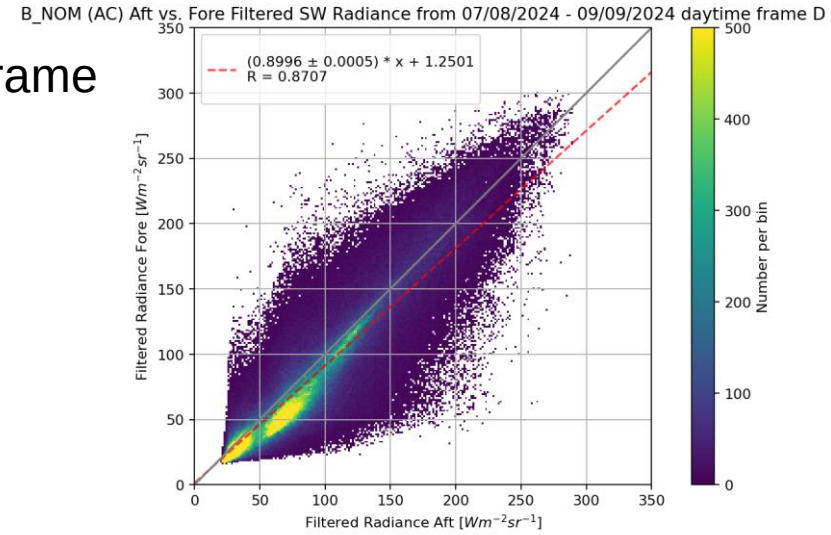


B-NOM SW Radiance Aft vs. Fore Daytime

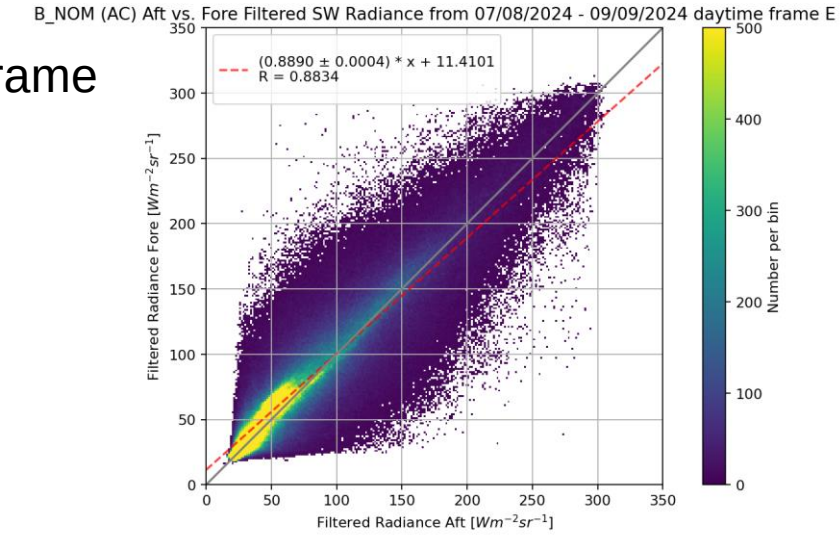


B-NOM SW Radiance Aft vs. Fore Different Frames

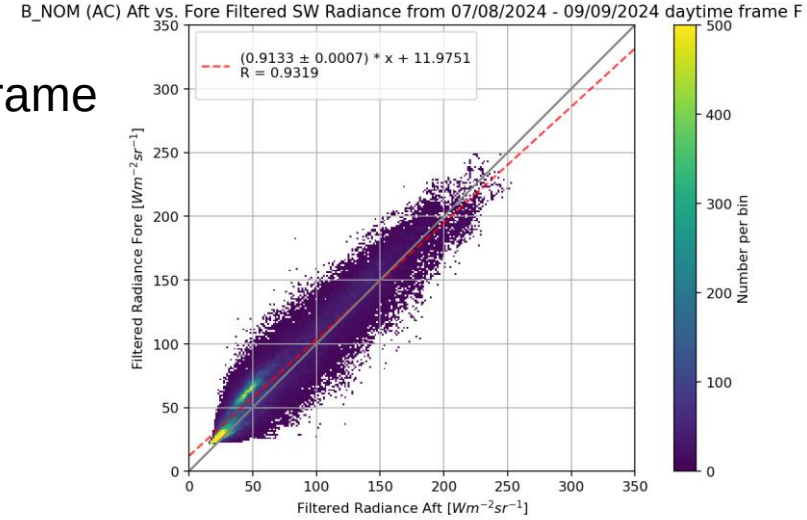
D-frame

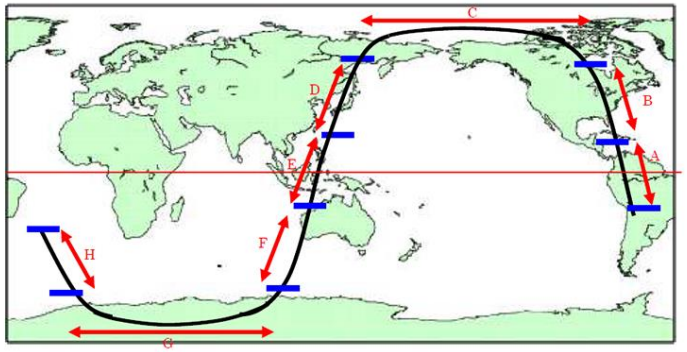


E-frame

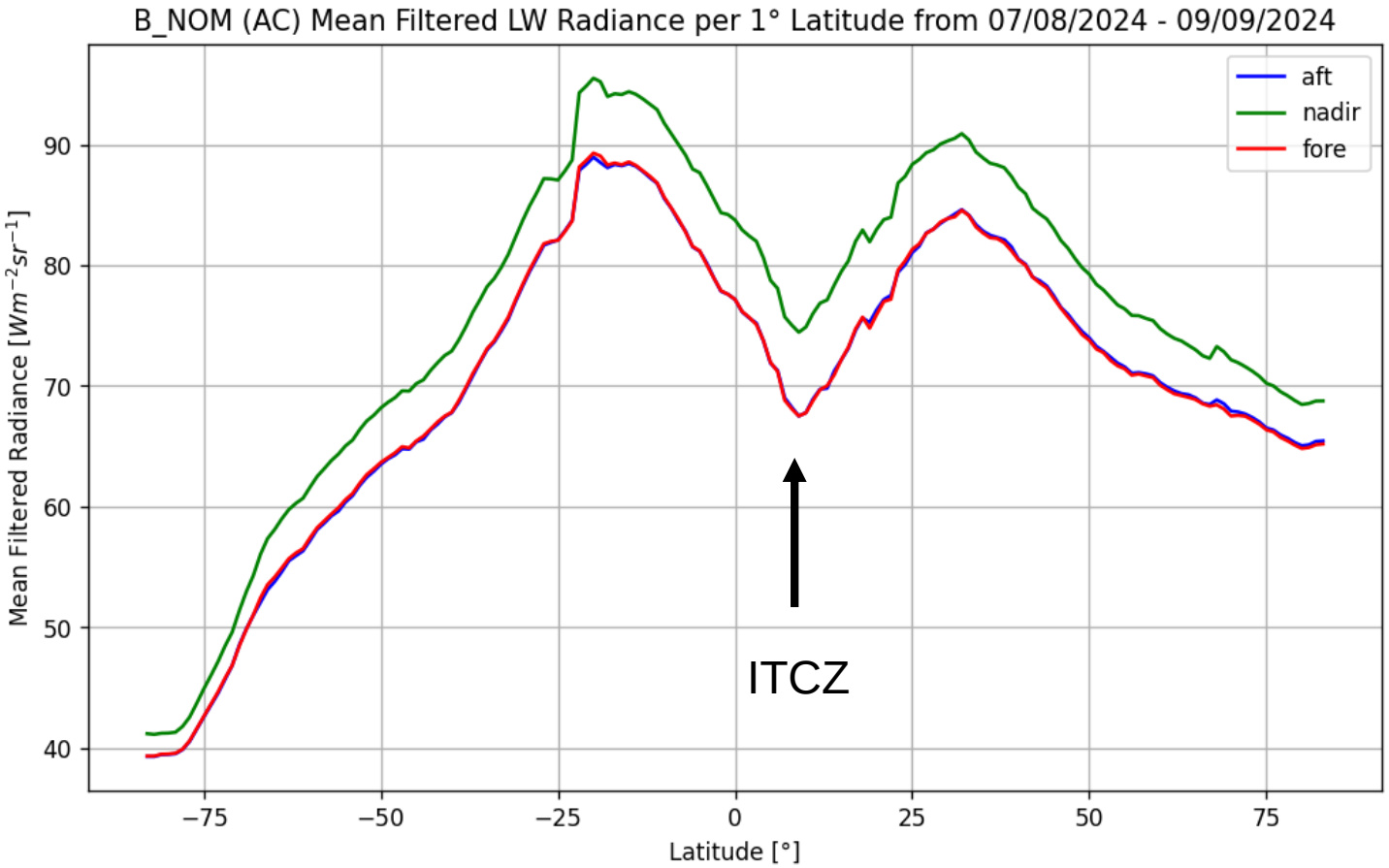


F-frame



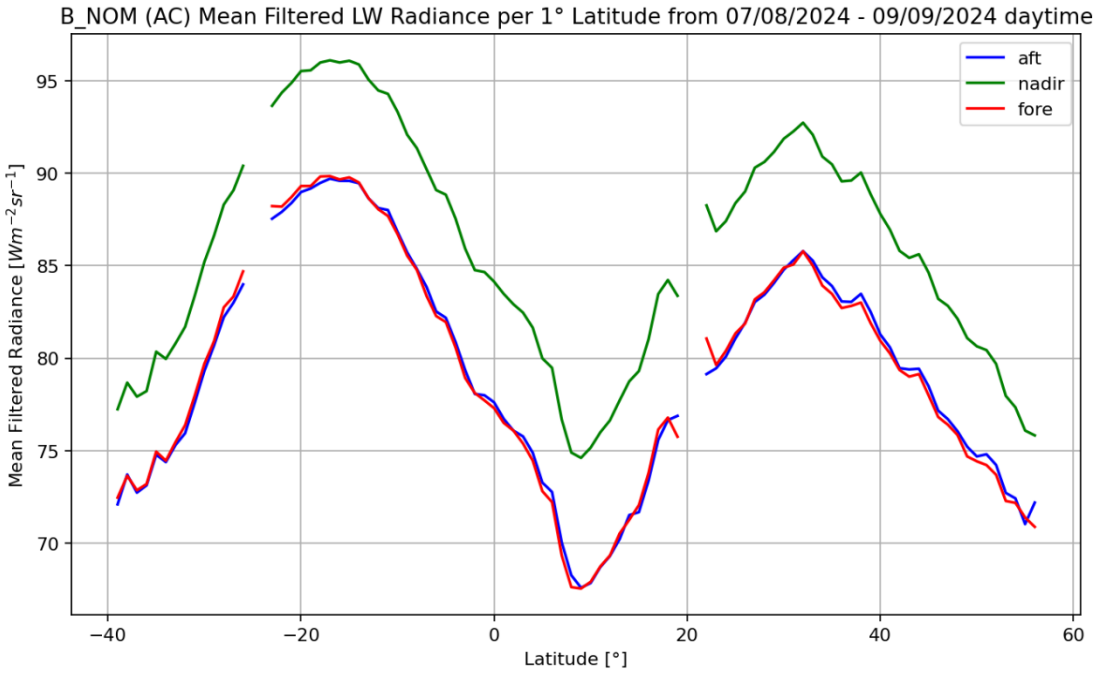


B-NOM Mean LW Radiance per 1° Latitude Bin All-day

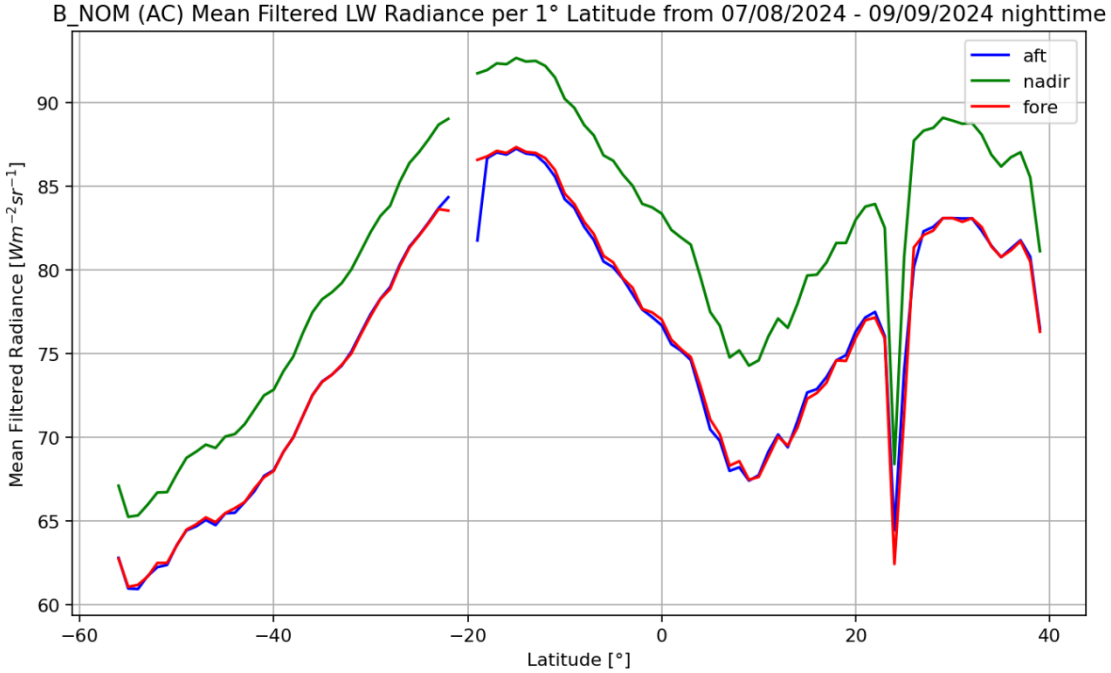


B-NOM Mean LW Radiance per 1° Latitude Bin

Daytime

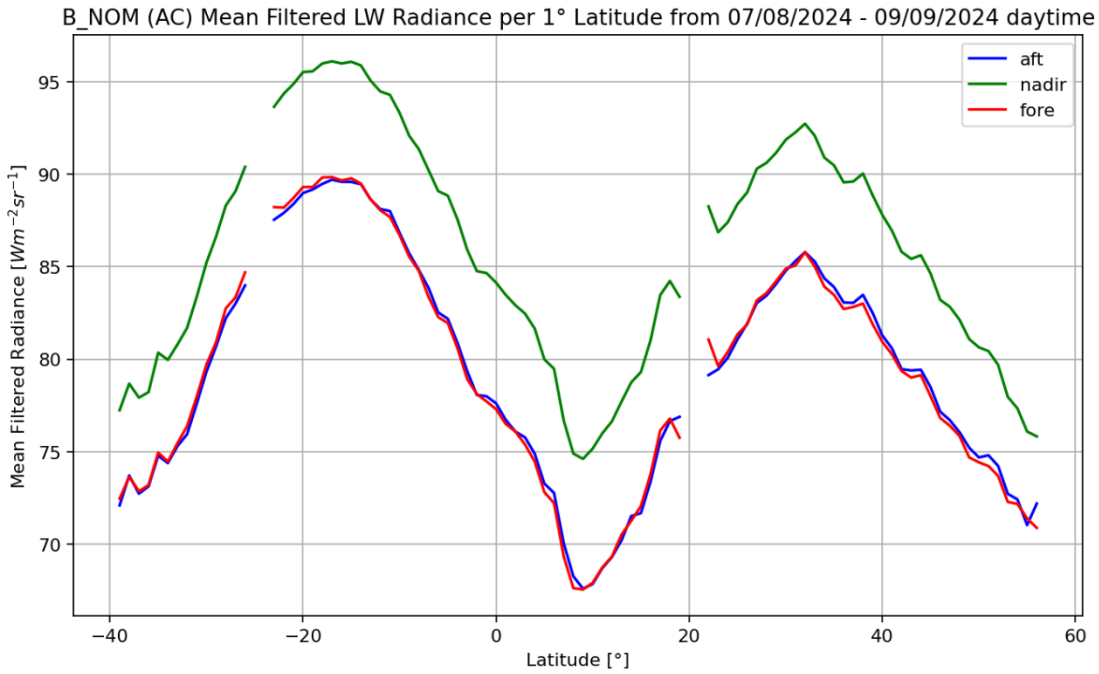


Nighttime

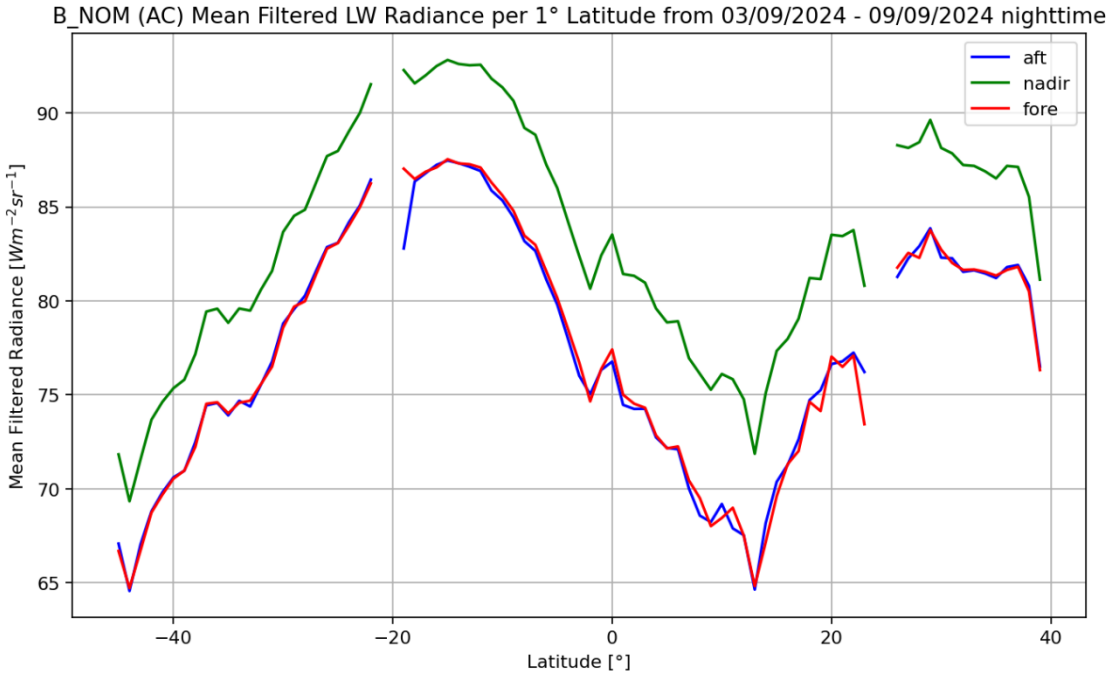


B-NOM Mean LW Radiance per 1° Latitude Bin

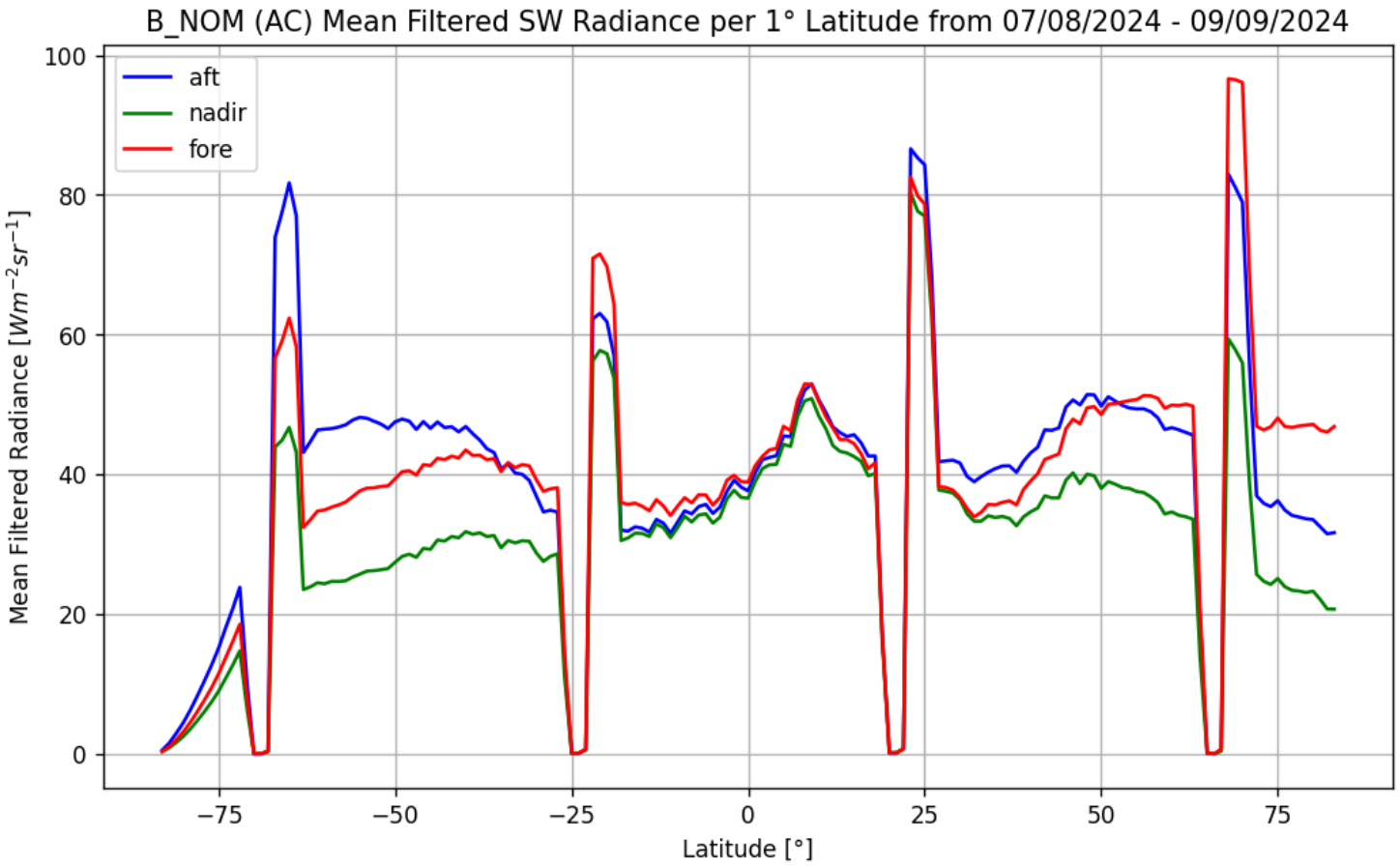
Daytime



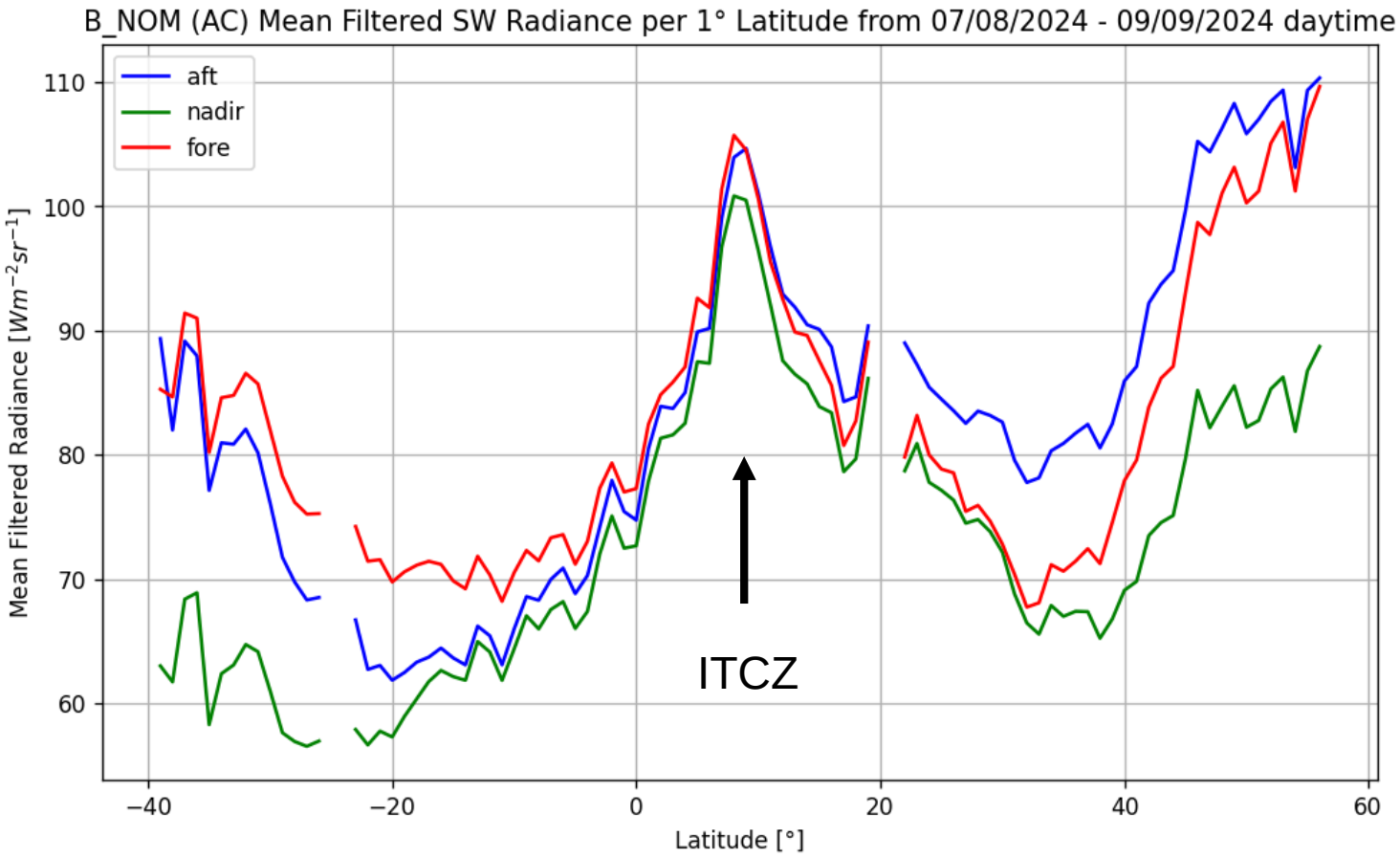
Nighttime: one week



B-NOM Mean SW Radiance per 1° Latitude Bin All-day

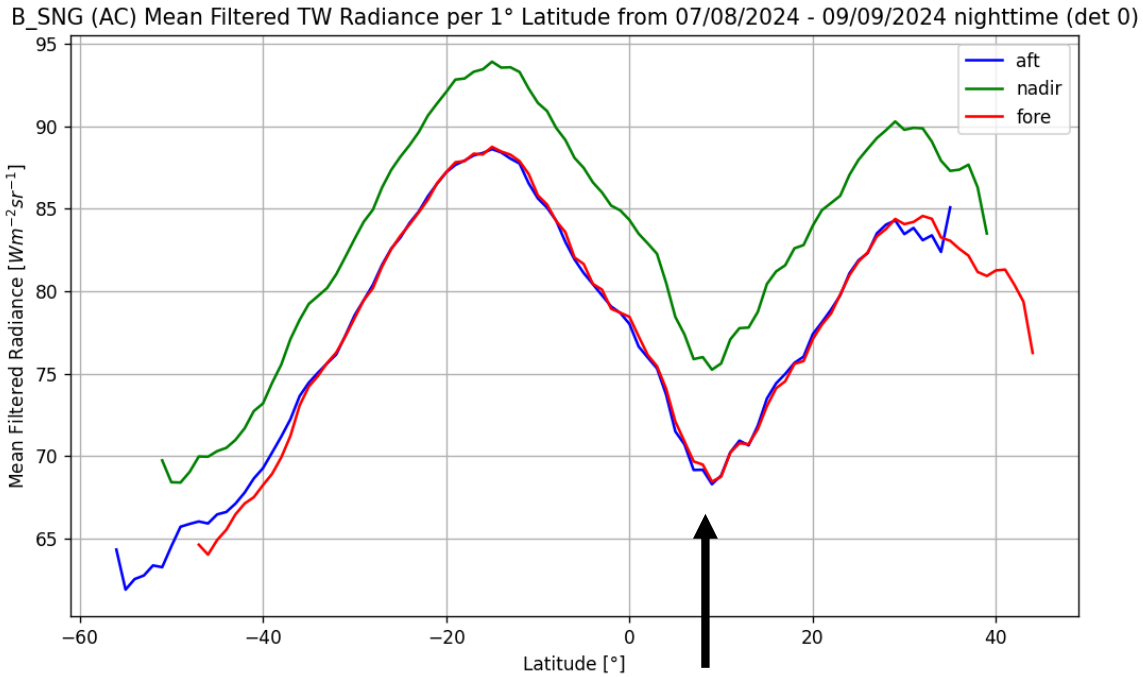


B-NOM Mean SW Radiance per 1° Latitude Bin Daytime



B-SNG (Det 0) Mean TW Radiance per 1° Latitude Bin Nighttime

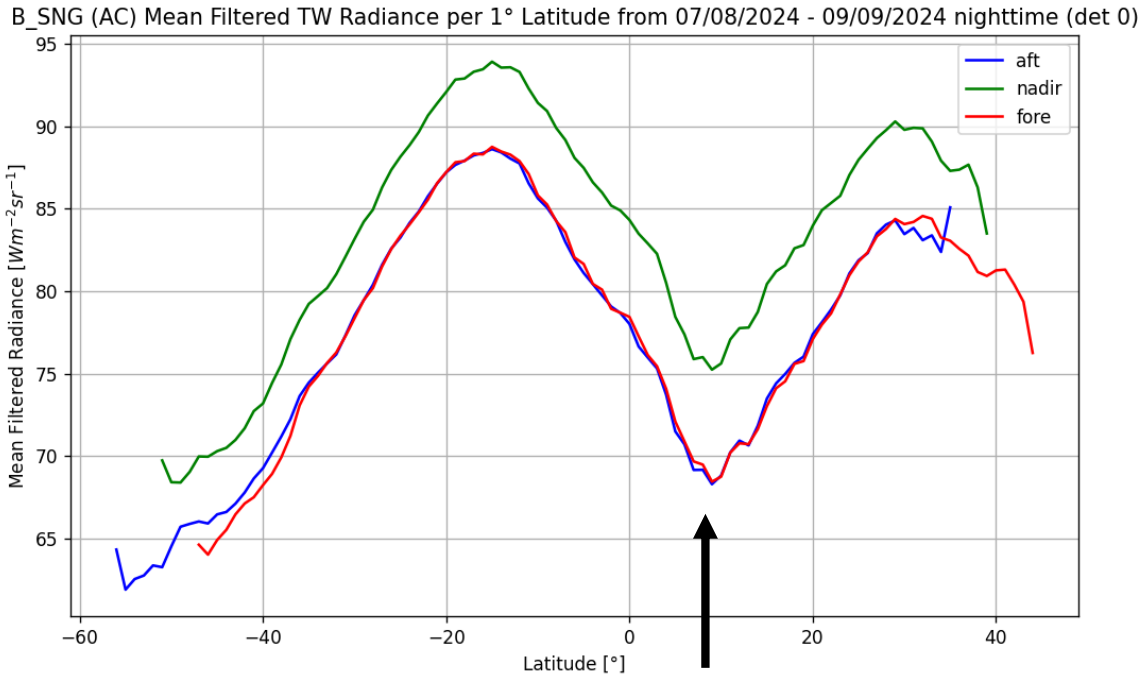
B-SNG TW



ITCZ

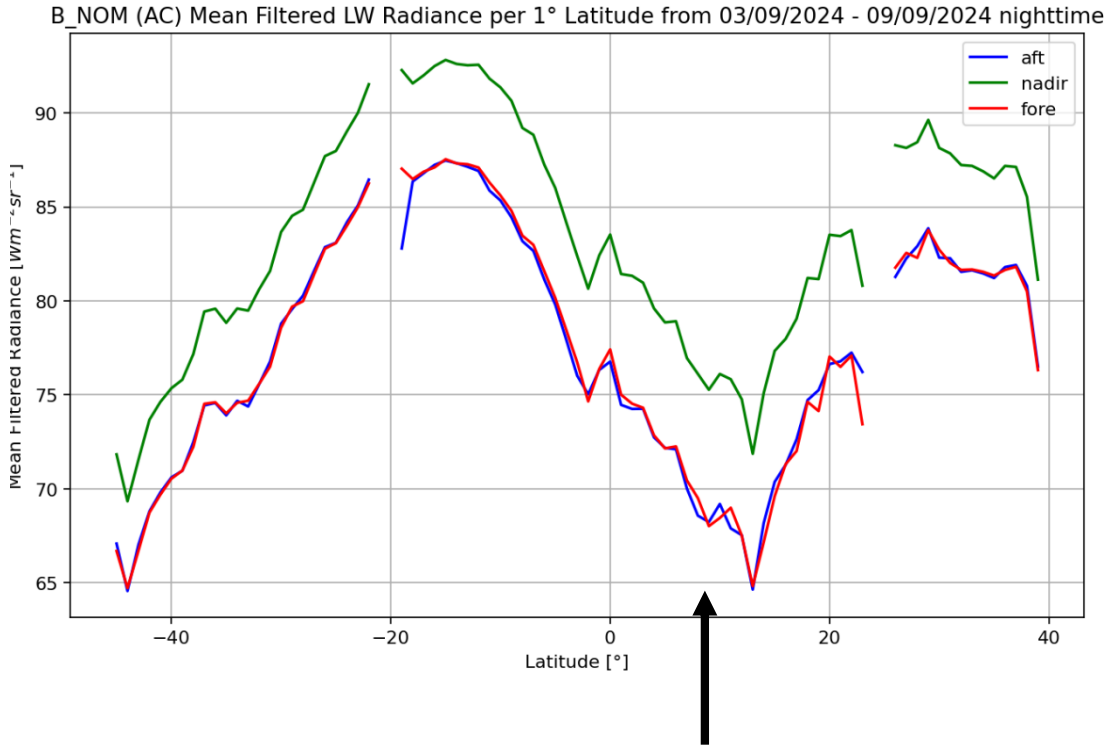
B-SNG (Det 0) Mean TW Radiance per 1° Latitude Bin Nighttime

B-SNG TW



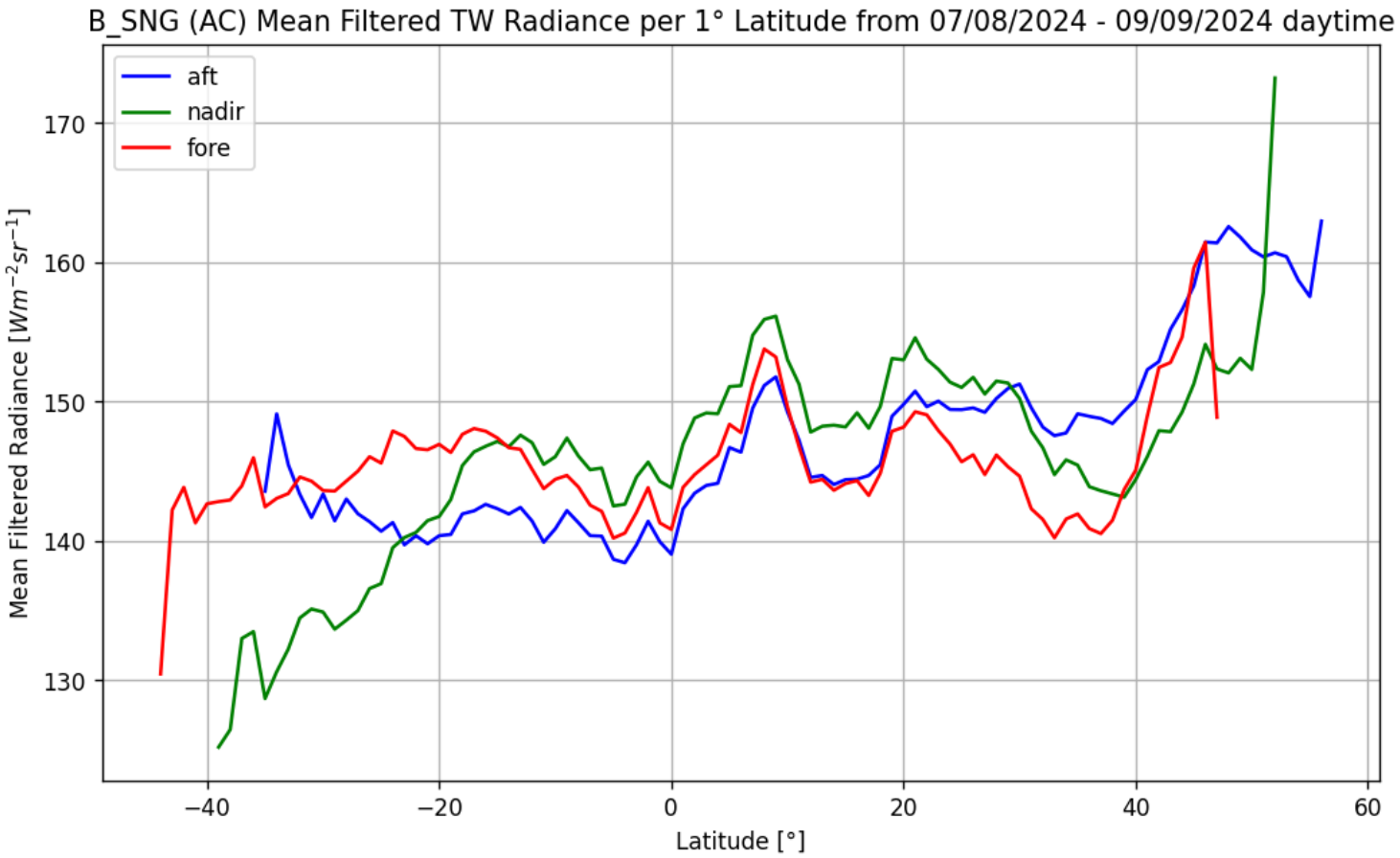
ITCZ

B-NOM LW

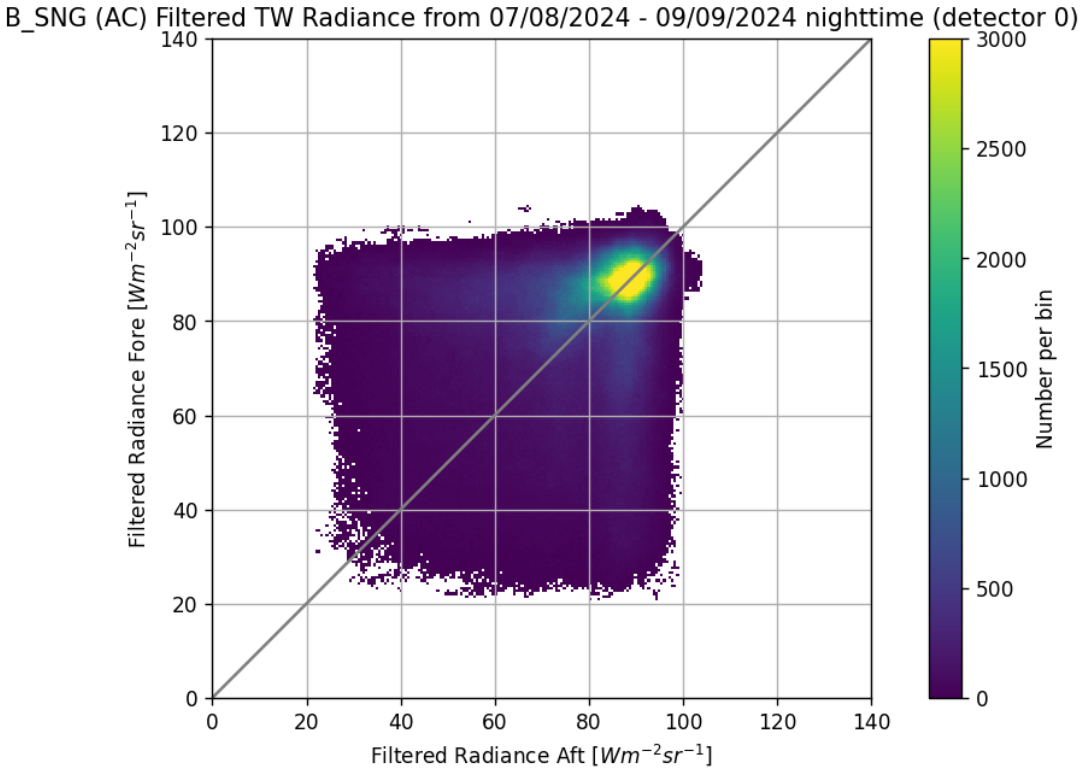


ITCZ

B-SNG Mean TW Radiance per 1° Latitude Bin Daytime



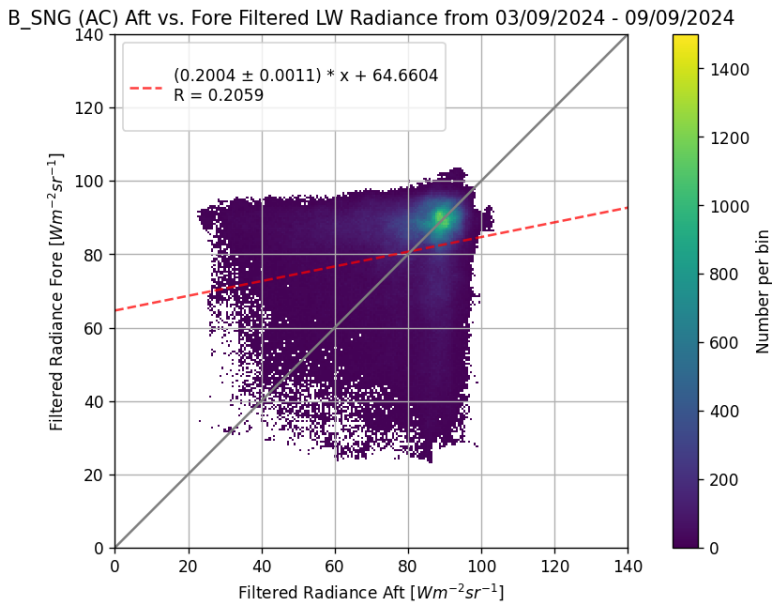
B-SNG TW Radiance Aft vs. Fore Detector 0 Nighttime



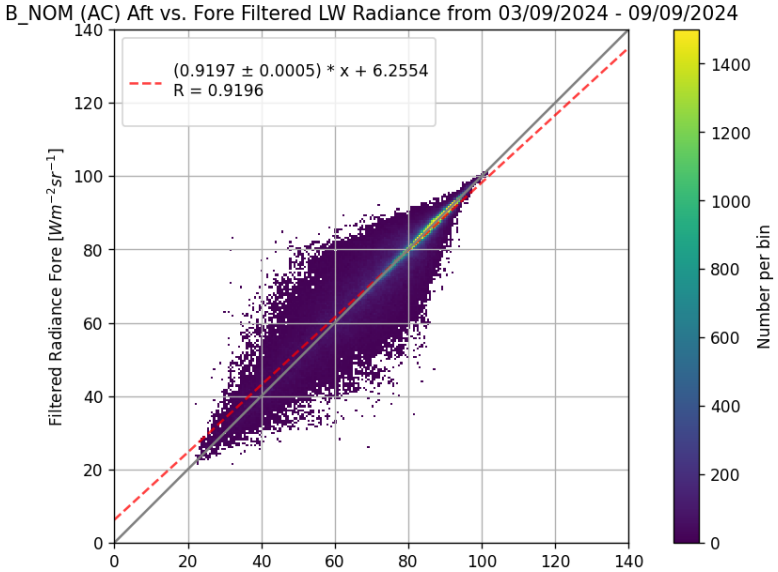
- Aft and fore radiometers do not measure the same scene (roughly 1’000 km between them).
- Nicolas is showing B-SNG analysis on detector level.

Radiance Comparison of the Four Products (Nighttime)

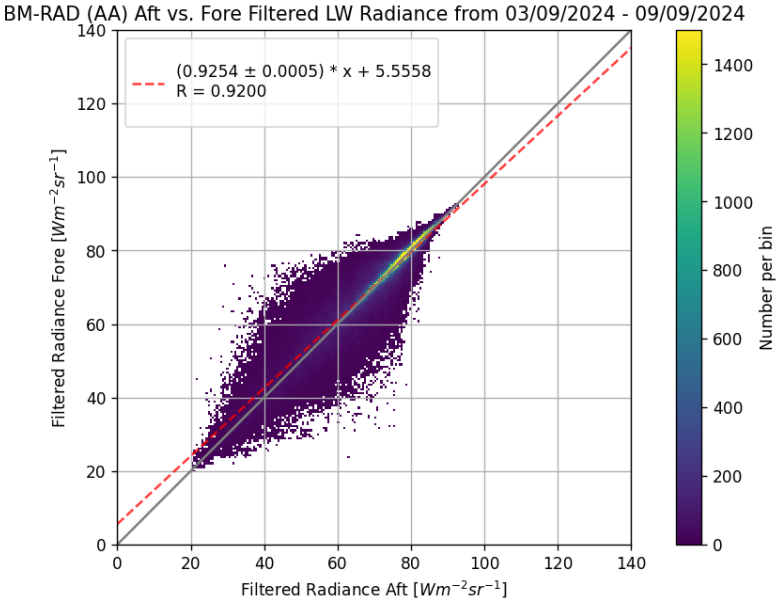
B-SNG



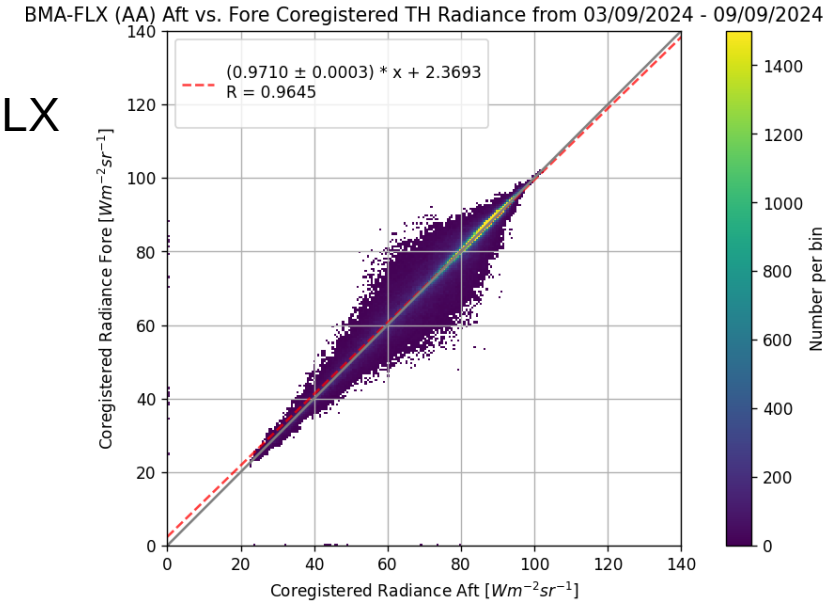
B-NOM



BM-RAD



BMA-FLX



Next Steps – WP2

Work Package number:	**WP2**
Work Package Title:	**Commissioning phase**
Responsible entity:	RMIB
WP responsible person	Aebi
Project phases (0,A,B,C,D,E):	E1
Beginning and end dates of WP	01.09.2024 – 30.11.2024
Total FTE allocated to the WP	3 PM (0.25 FTE)
Objectives of the WP: perform first, mostly qualitative, assessment of the BBR products at level 1	

Inputs:

- Tools from WP1.
- Commissioning L1b data for B-NOM, B-SNG and M-NOM

Description of work and schedule:

- Visualization of actual BBR products over several orbits, with context given by the MSI (color composite)
- Statistical analysis of data from several orbits to highlight outliers, effect of observational conditions and differences between telescopes and pixels.
- Analysis/visualisation of ratio between BBR and MSI-based BBR-like data.
- Additional studies to address extreme and challenging conditions e.g. sun glint, high contrast changes during or close to the acquisition period.

Excluded tasks:

- The geolocation / coregistration assessment is excluded of this proposal as it is part of CARDINAL.
- Tasks performed entirely by partners are not mentioned in this WP sheets.

Deliverables and dates:

- BBR L1 qualitative assessment report (30.11.2024).

Risks: availability of the BBR L1b data.