



EarthCARE 2026 Science and Validation workshop

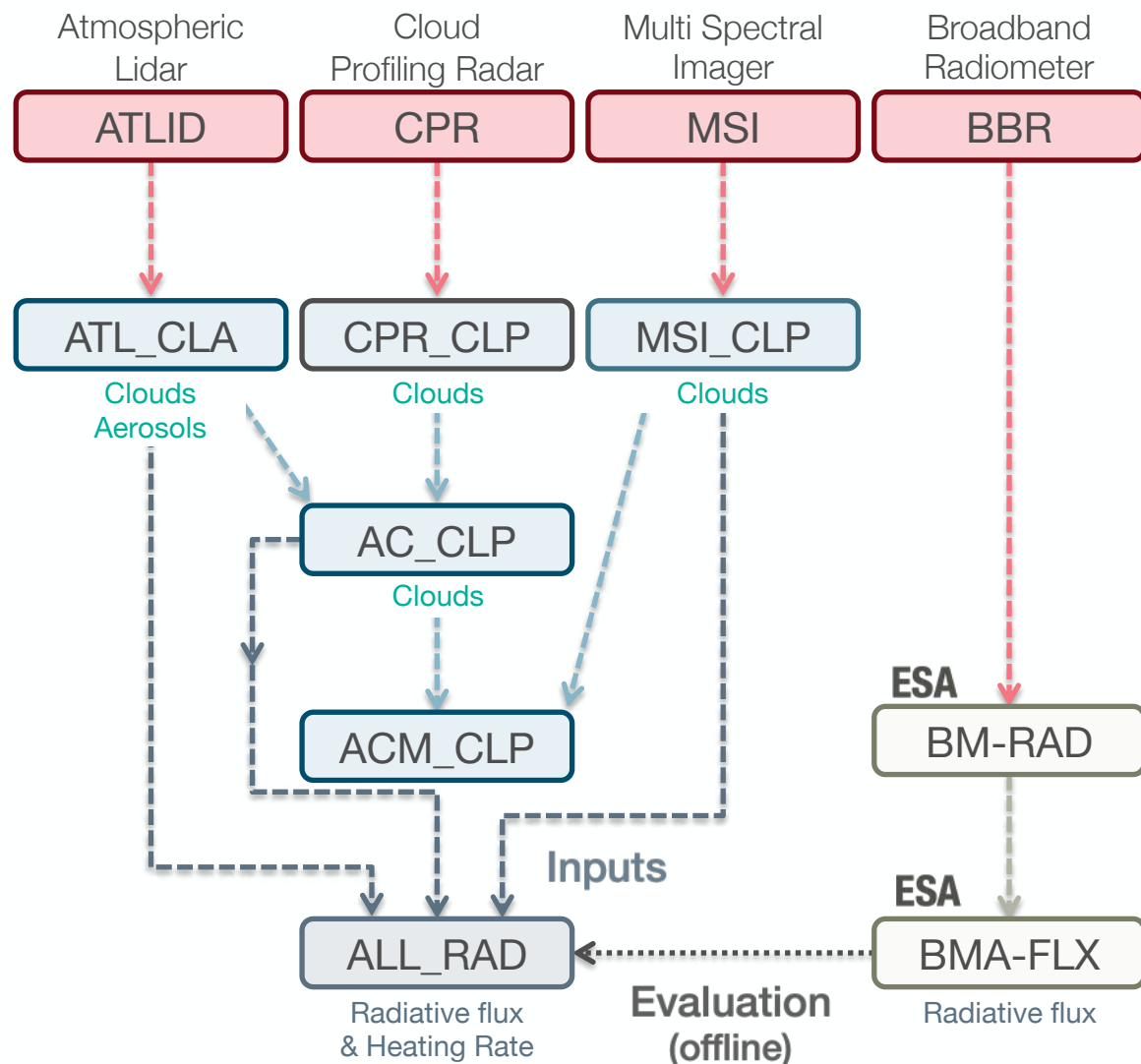
8–12 June 2026 | Rhodes House | Oxford, UK

Overview of JAXA radiation standard product

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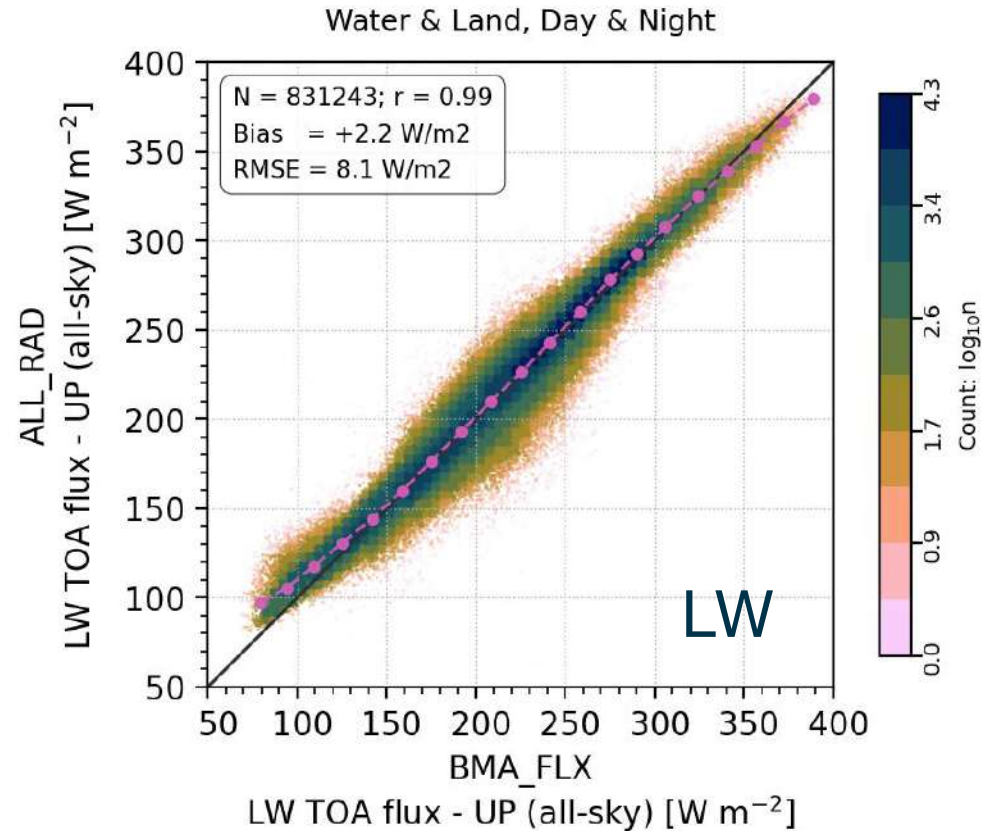
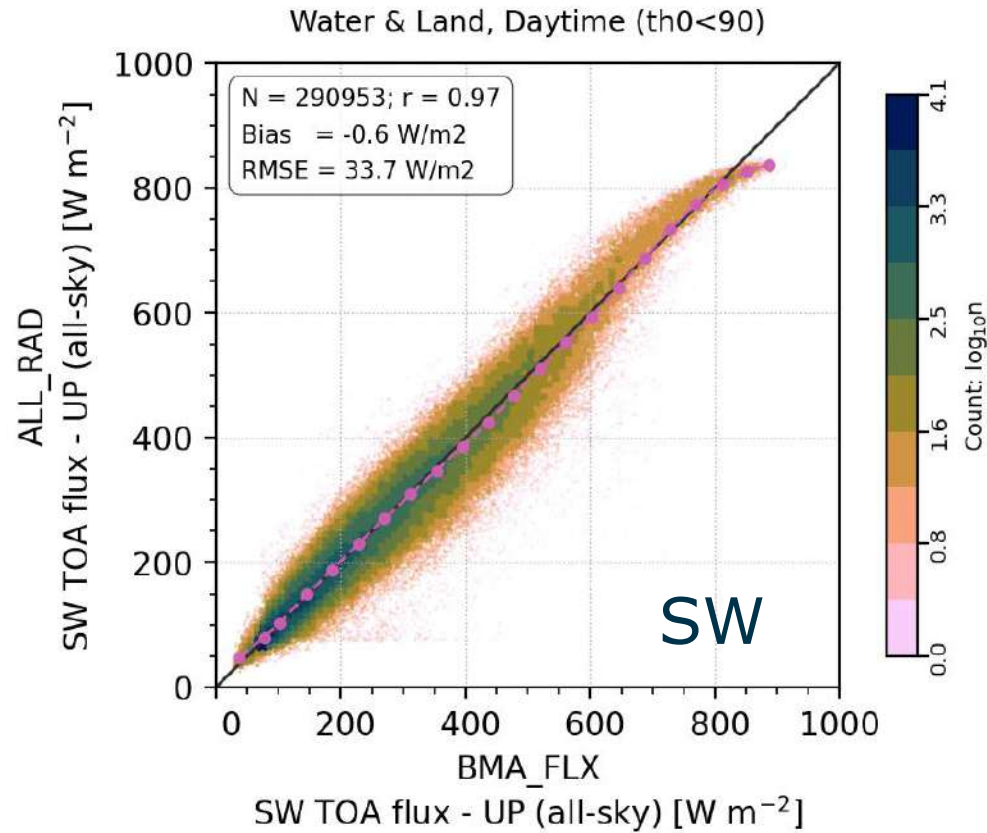
(1: University of Tokyo, 2: JMA/MRI, 3: JAXA, 4: Tokyo Marine Univ.)

Japanese “4-sensor” algorithm flow



- **JAXA L2b Standard Product**
- **Generates composite aerosol and cloud profiles** by integrating L2 products from CPR, ATLID, and MSI
- **Applies 1D radiative transfer calculations** to derive radiative fluxes & heating-rates
- **Radiative closure** assessment through comparison with BBR observations
- **Public Release of 1st Version: Dec. 2025**
- **Research Product is also being developed with 3D-RT (Iwabuchi Group in Tohoku U)**

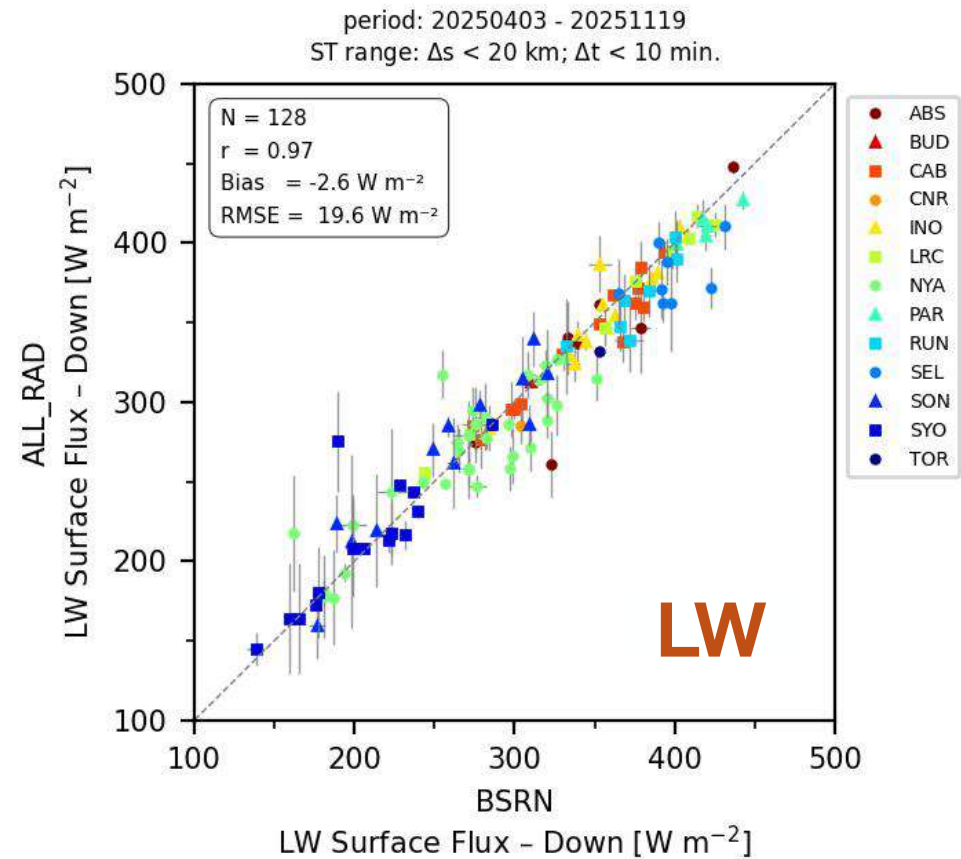
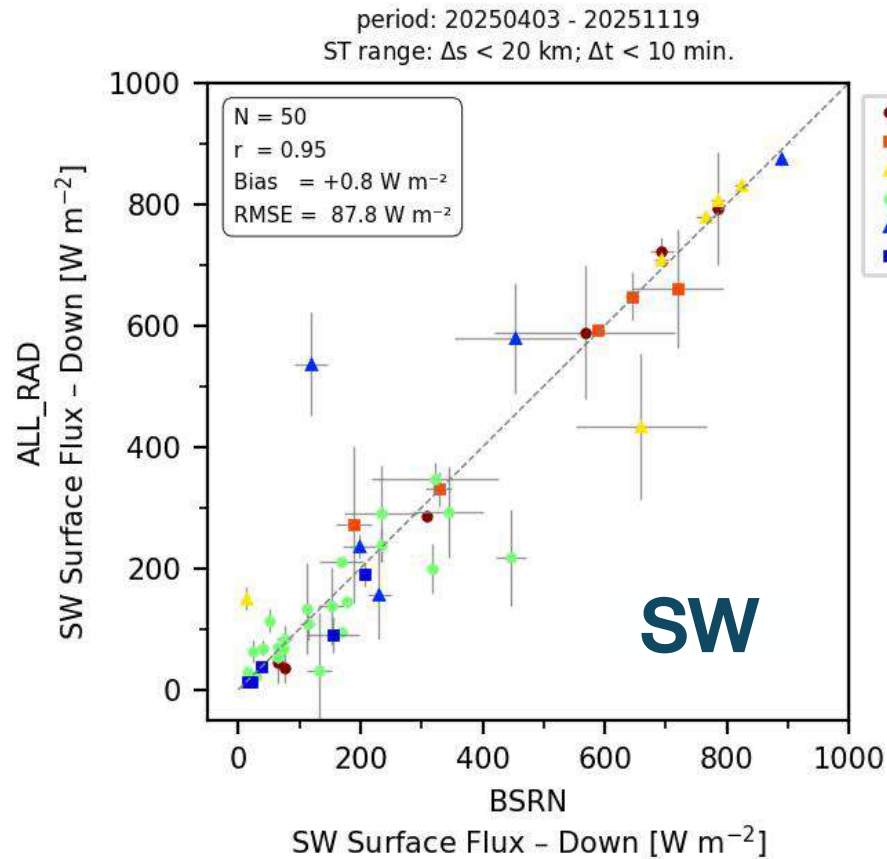
Global validation @TOA (all-sky)



- LW: Meeting the target accuracy (10Wm^{-2})
- SW: Approaching the standard accuracy (25Wm^{-2})

ALL_RAD ver1.0 (vBa) first release version
10km pixel-by-pixel average

Validation against BSRN @SFC

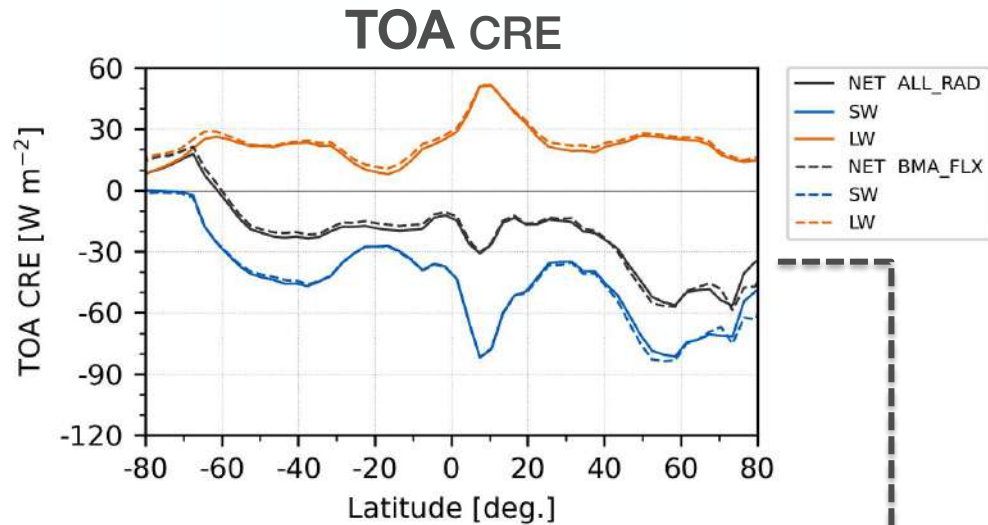


- Good agreement with SFC measurements at locations across the globe
- Better agreement in LW than in SW
- Basis for radiative closure assessment at SFC (in addition to TOA w/ BBR)

Global climatology of cloud radiative effect

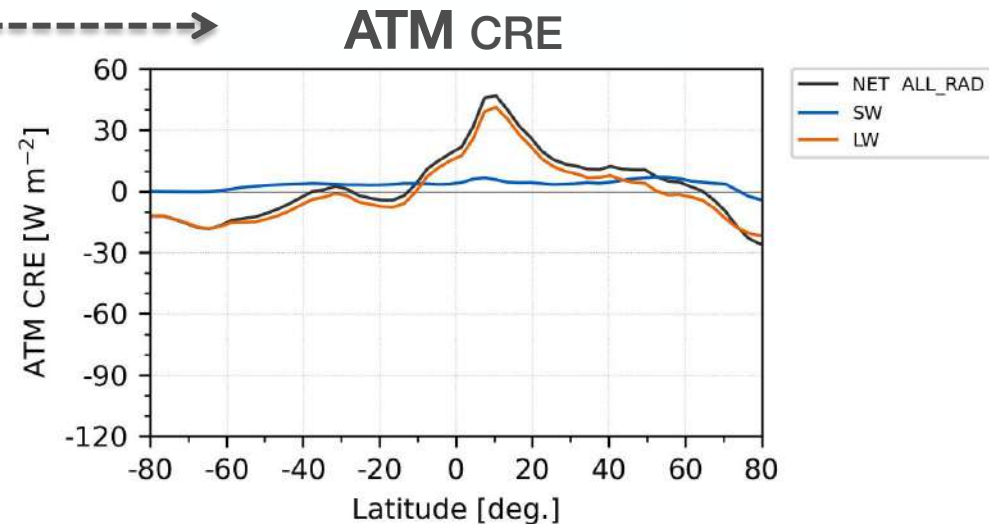
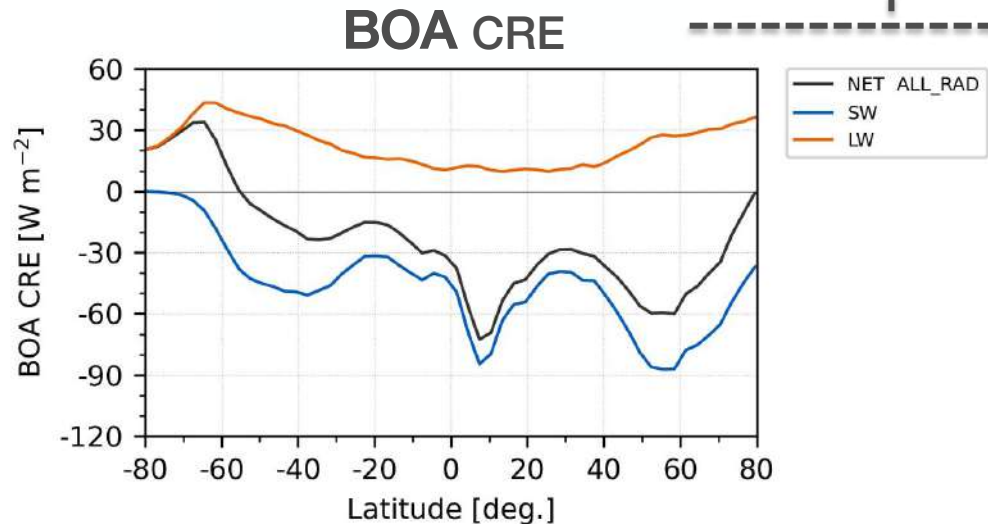


August 2025

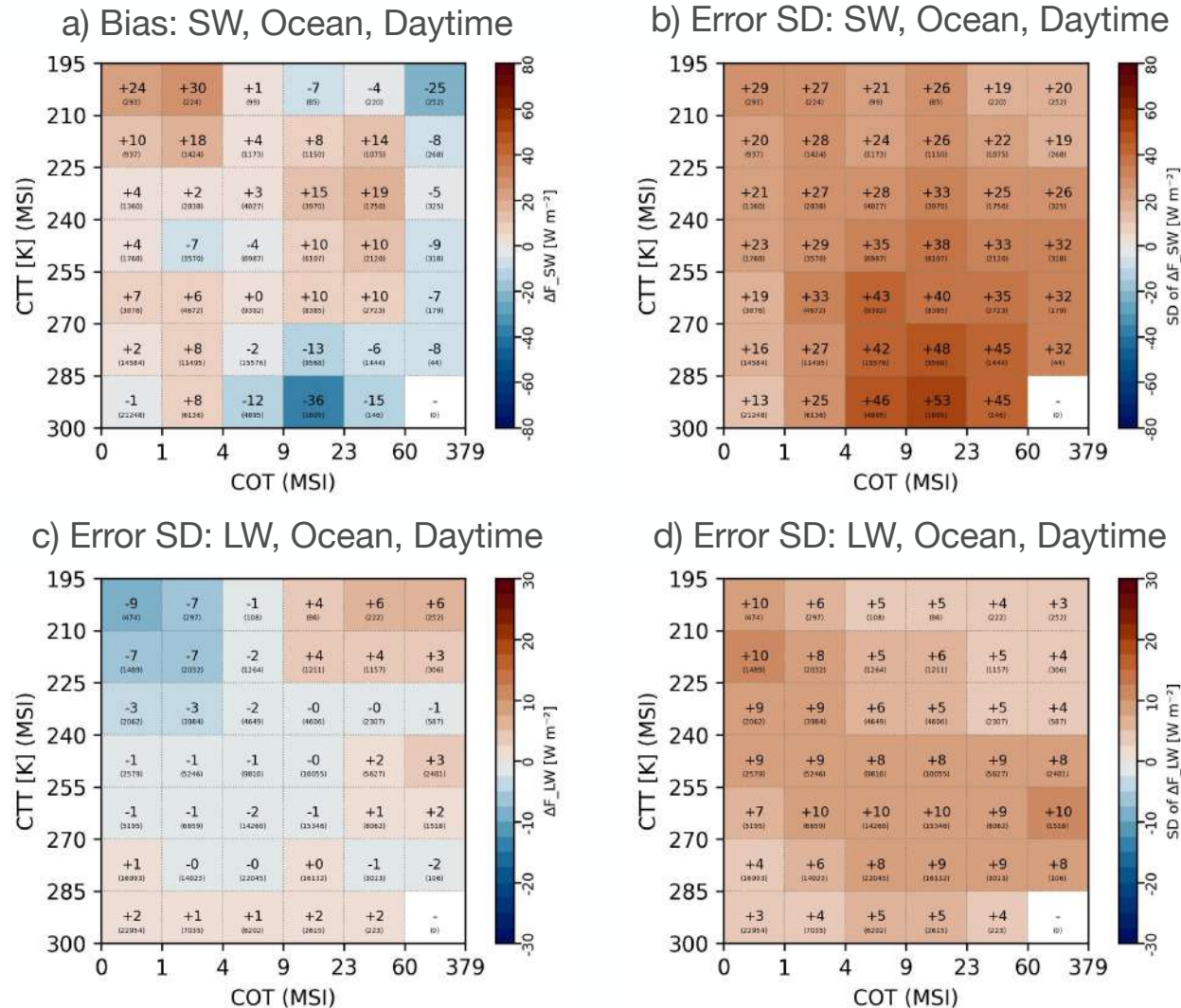


$$CRE = (F^{\downarrow} - F^{\uparrow})_{all} - (F^{\downarrow} - F^{\uparrow})_{clear}$$
$$CRE_{ATM} = CRE_{TOA} - CRE_{BOA}$$

- ALL_RAD flux estimates lead to reasonable CRE
- CRE climatology broadly consistent with A-Train



Cloud-type dependence of flux error



$$\text{RMSE}^2 = \text{Bias}^2 + \text{SD}^2$$

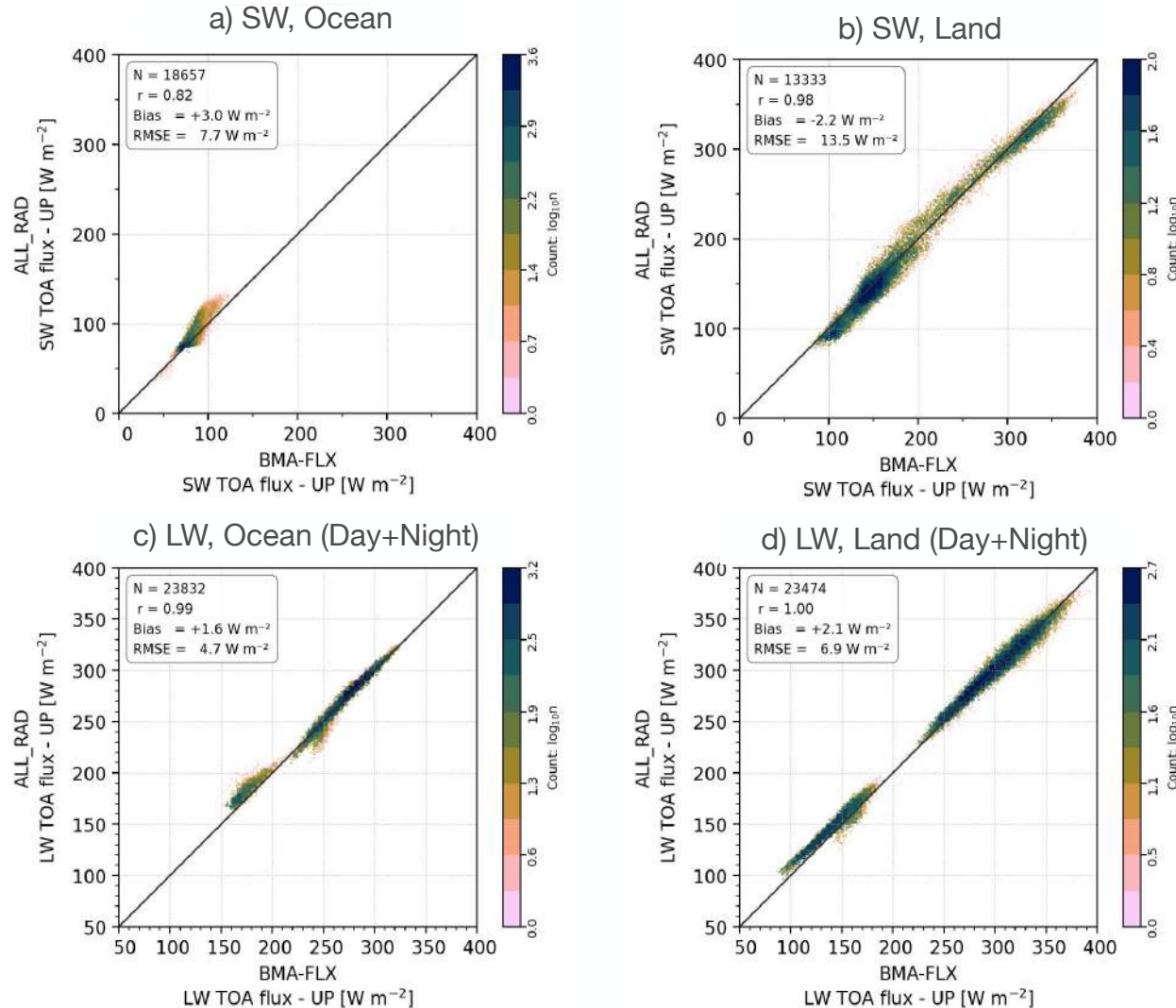
SW:

- SD > Bias
- SD/Bias vary with cloud type
- Error compensation among cloud types

LW:

- Small SD/Bias, SD > Bias
- SD/Bias vary with cloud type weakly
- Small error compensation

TOA global validation for clear-sky



Clear-sky: 0% cloud cover in BMA-FLX & no cloud layers in ATL_CLA

SW has:

- Small positive bias over ocean (aerosols)
- Larger RMSE over land (surface albedo)

LW has:

- Two clusters (Antarctic/SO and others)
- Slight positive bias in Antarctic/SO due to uncertainty of surface temperature

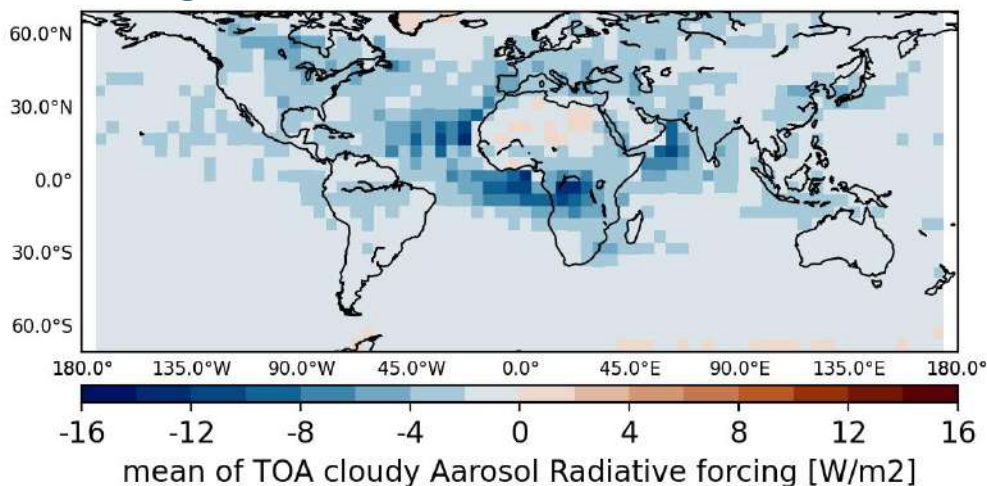
Overall better agreement than all-sky

Aerosol radiative forcing - Early results



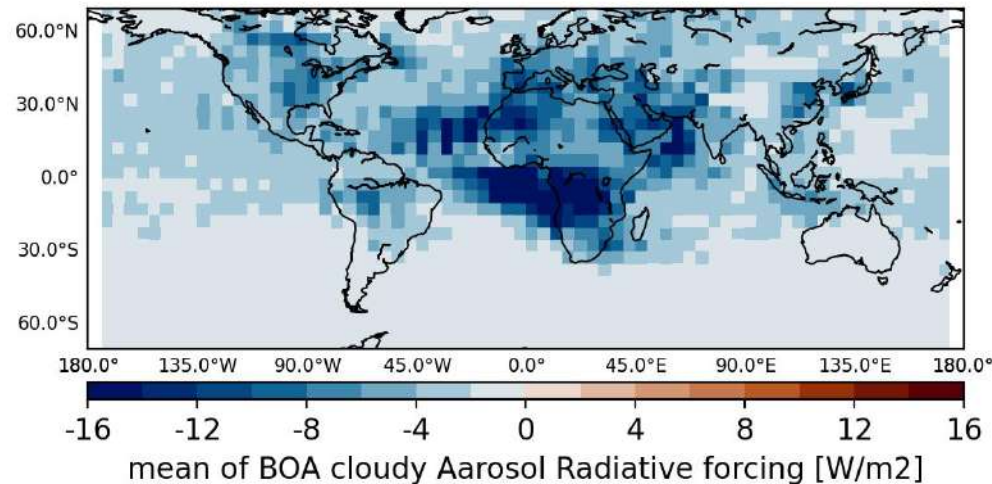
TOA

Day (th0<90), all weather



BOA

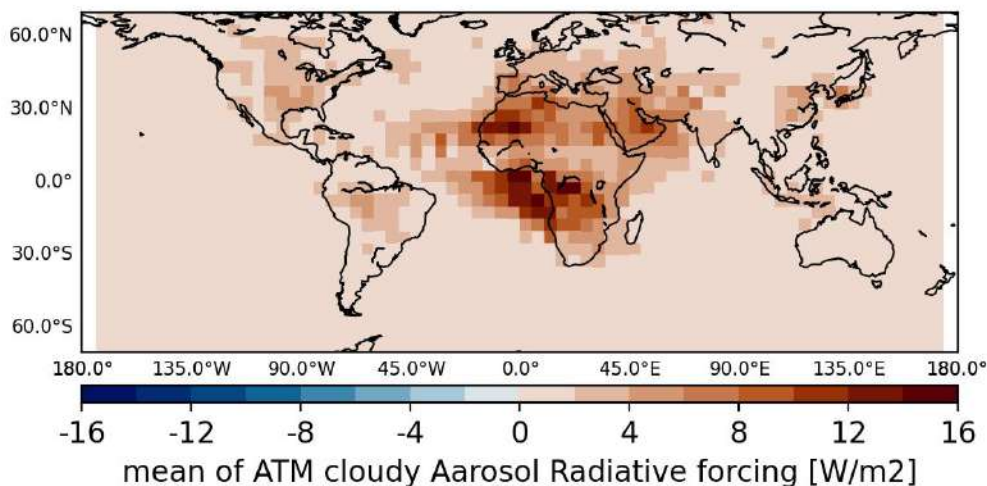
Day (th0<90), all weather



All-sky

ATM

Day (th0<90), all weather



- Reasonable climatology w/ ATM/SFC partitioning
- BOA cooling & ATM heating over source areas
- Positive TOA forcing unclear over some areas

ALL_RAD v1.1 (1Bb) 2025.8.1 ~ 8.31

- **The first version (ALL_RAD ver 1.0) has been released as of December 1, 2025**
- **Estimated fluxes validated both at TOA & SFC against BMA-FLX and BSRN to show reasonable agreement: Encouraging for radiative closure (even with 1D-RT)**
- **Flux errors are characterized with cloud types to expose error compensations particularly for SW**
- **The results are to be submitted to AMT (by T. M. Nagao et al.)**
- **Radiative closure with 3D-RT is ongoing in parallel (Iwabuchi/Ezaki)**