JAXA Agency Report
2021

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JAXA

Agency's GSICS Activities, Action & Achievements Summary

Current GSICS Activities

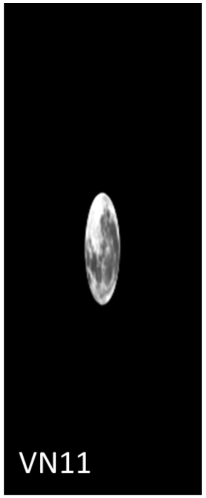
- *GCOM-C/SGLI lunar calibration by GIRO is updated and the lunar phase angle dependency is evaluated by AHI lunar calibration*
- *GCOM-C/SGLI gain degradation estimated from the lunar calibration has been considered in Ver.2 Level-1B (released from 29 June 2020)*
- *GCOM-C/SGLI vicarious calibration by MOBY&BOUSSOLE, CEOS RadCalNet, and TIR vical by satellite sounders are updated*
- *GOSAT-2/CAI-2 lunar calibration by GIRO is updated and the response degradation is estimated*
- *GOSAT/FTS and GOSAT-2/FTS-2 TIR bands are compared with AIRS and IASI at nadir and off-nadir simultaneous observations*
- *Other calibration activities of each instrument*
- *Contribution to subgroup meetings*

Status of Agency's GSICS Actions

- *No GSICS Actions*

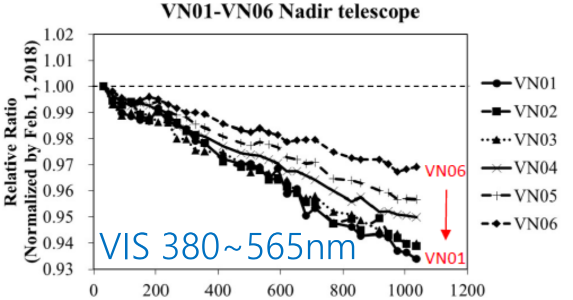
SGLI Lunar CAL by GIRO (1)

- ✓ GCOM-C SGLI lunar calibration is regularly updated by the monthly lunar observations of SGLI with GIRO
- ✓ The SGLI/GIRO trends are consistent with ones from the other onboard and vicarious calibrations
- ✓ Phase angle (+5~+10 degree) dependency is evaluated by AHI lunar observations at various phase angles

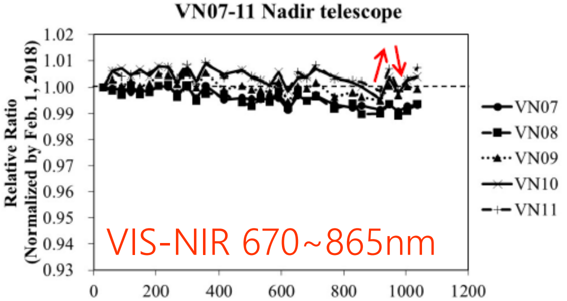


Time series of SGLI/GIRO trend (Normalized by 2018/2/1)

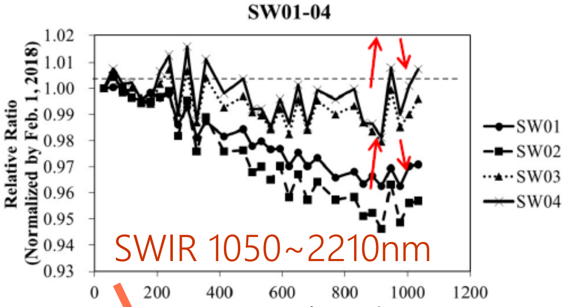
SGLI/GIRO norm. at 2018/2/1



Days since launch: 2017/12/23

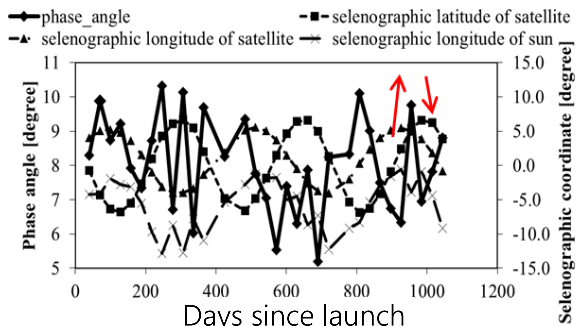


Days since launch



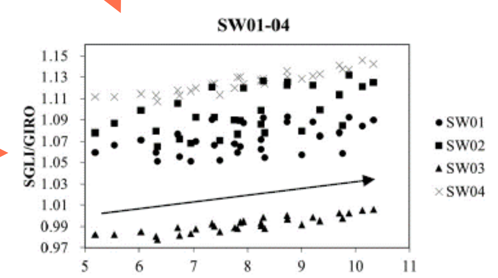
Days since launch

Phase angle of the moon observations



Days since launch

Phase angle dependency (SWIR)



Phase angle

Cited from Hashiguchi et al., GCOM-C/SGLI Lunar Calibration Evaluation @ Lunar Calibration Workshop 2020 (Online) : Nov. 17, 2020

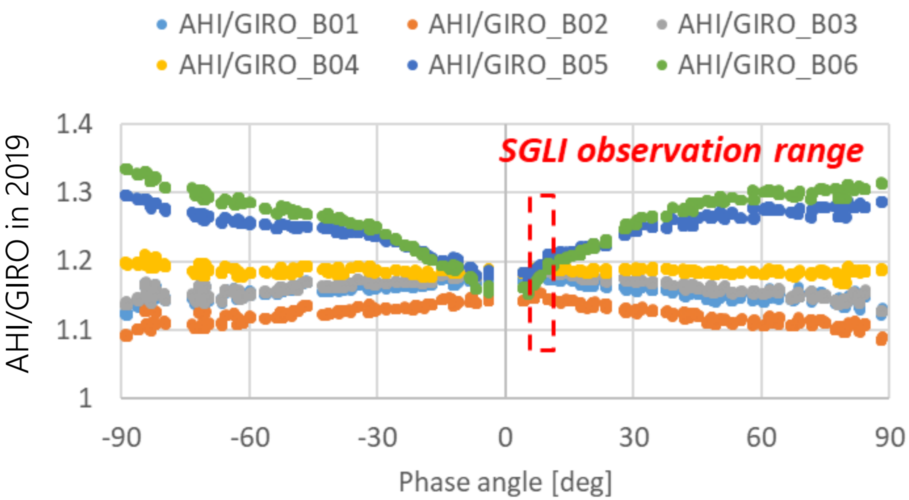
SGLI Lunar CAL by GIRO (2)

✓ The gain degradation could be retrieved by separating the phase angle dependency by the simple multi regression model:

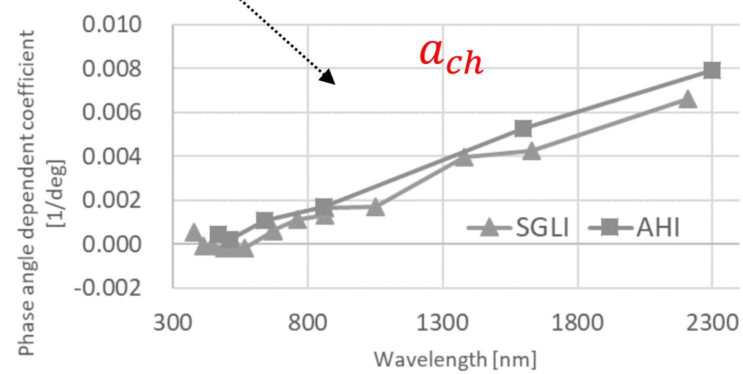
$$f_{ch,n} = a_{ch} \times g_n + b_{ch} \times d_n + c_{ch}$$

f : SGLI/GIRO trend
g : phase angle (deg)
d : days since launch
n : index of each lunar observation
a_{ch}: phase angle dependent coefficient
b_{ch}: sensor degradation coefficient
c_{ch}: constant

✓ The phase angle dependency of SGLI were confirmed by comparing with one of Himawari-8 AHI/GIRO



✓ Consistent between SGLI and AHI



AHI Lunar data are provided by JMA/MSC

✓ The gain degradation, $b_{ch} \times d_n$, has been considered in Ver.2 SGLI Level-1B

Cited from Hashiguchi et al., GCOM-C/SGLI Lunar Calibration Evaluation @ Lunar Calibration Workshop 2020 (Online) : Nov. 17, 2020

GOSAT-2 Lunar CAL by GIRO

- CAI-2 has been operated the lunar calibration for radiometric calibration by along-track (AT) scans (satellite pitch rotations) once a month since December 2018. The lunar phase angle is targeted around 7 deg.
- CAI-2 observes at 340, 380, 440, 550, 670, 870, and 1630 nm and compered with GIRO. 340nm is compared with the extrapolated model.
- CAI-2 B1 340 nm band degraded around 8 %, B6 380 nm band around 2 % in the first 2 years.

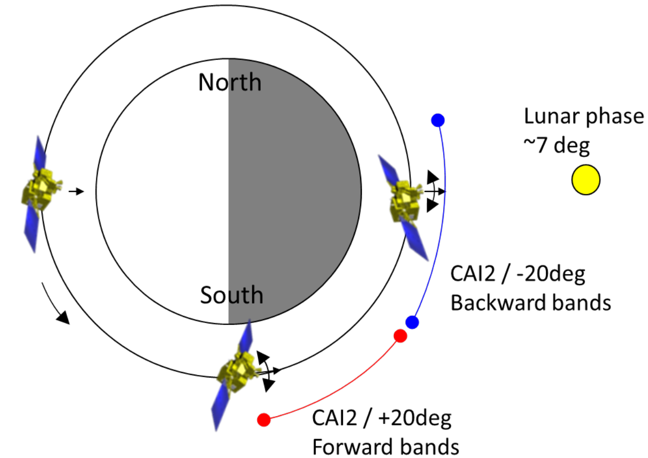
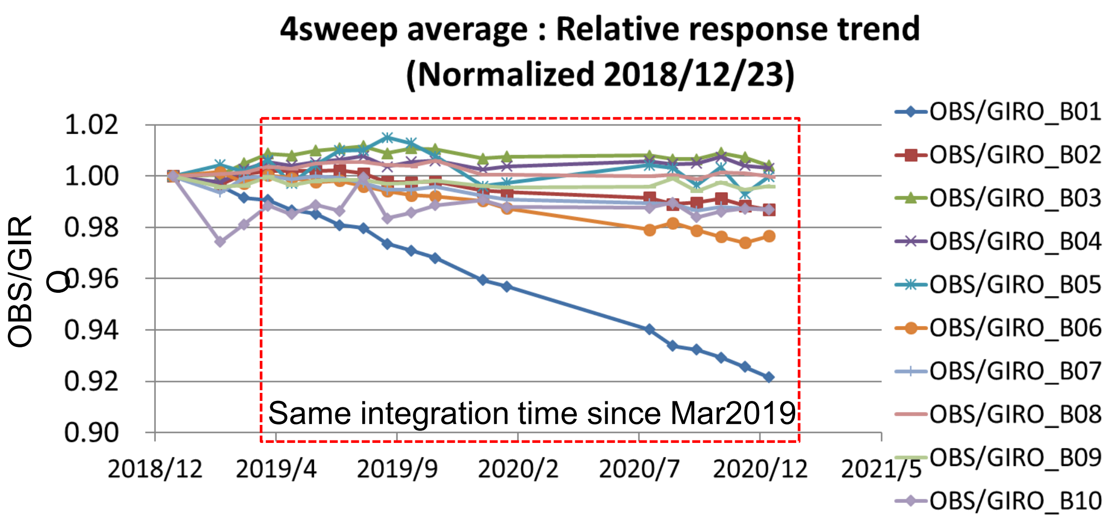
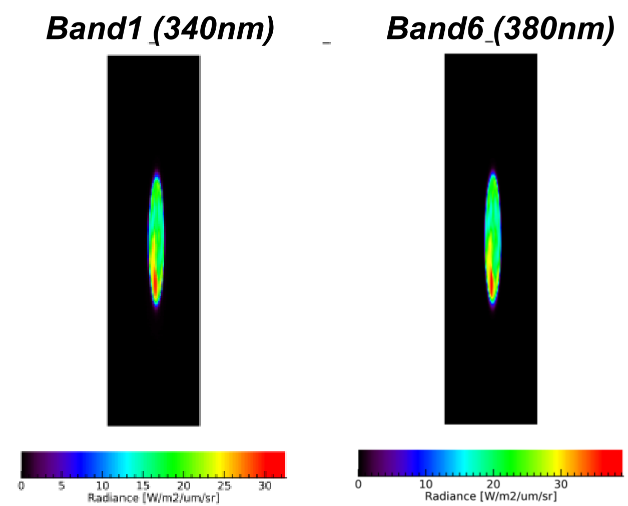


Illustration of GOSAT-2 lunar calibration



CAI-2 radiance compared with GIRO



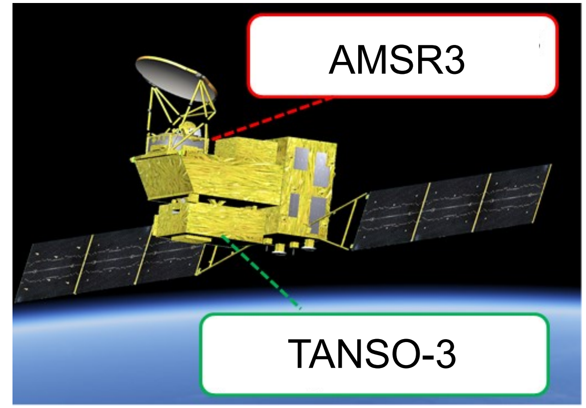
CAI-2 first lunar calibration by AT scan on December 23, 2018

Agency's Instruments Updates & Planned launches

- *Summary of current and future instruments*
  - *GOSAT, GCOM-W, GPMCore/DPR, ALOS-2, GCOM-C, GOSAT-2: Operating*
  - *ALOS-3 (advanced Optical): Planned to be launched in JFY2021*
  - *ALOS-4 (advanced SAR, successor of ALOS-2): Planned to be launched in JFY2022*
  - *EarthCARE/CPR (joint mission with ESA): Planned to be launched in JFY2022*
  - *GOSAT-GW (successor of GOSAT-2 & GCOM-W): Planned to be launched in JFY2023*
- *Status of Level 1 reprocessing*
  - *Aqua/AMSR-E Level 1 (Ver.4), reprocessing to be consistent with AMSR2 algorithm & format, in 2019 and reprocessing was completed*
  - *GOSAT/TANSO-FTS Level 1 (Ver.230.231) will be released in May-June 2021*
  - *GOSAT-2/TANSO-CAI-2 Level 1 (Ver.102.102) was released in May 2020*
  - *GOSAT-2/TANSO-FTS-2 Level 1 (Ver.200.200) was released in Nov. 2020*
  - *GCOM-C/SGLI Level 1 (Ver.2) was released in June 2020 and reprocessing is underway*

GOSAT-GW in JFY2023

- GOSAT-GW: Global Observation SATellite for Greenhouse gases and Water cycle
- GOSAT-GW will carry two instruments, AMSR3 and TANSO-3.
  - AMSR3, led by JAXA, will succeed AMSR series observations adding new high-frequency channels for solid precipitation retrievals and water vapor analysis in NWP.
  - TANSO-3, led by Japanese Ministry of Environment (MOE) and National Institute of Environment Studies (NIES) , will improve observation capability of greenhouse gases from GOSAT-2/TANSO-2.
  - Target launch is JFY2023 (Apr. 2023 - Mar. 2024)
- Mission targets of AMSR3
  - To produce long-term continuous data record
  - To enhance operational utilization of near - real time data
    - weather forecast including hurricane analysis
    - fishery in coastal area
    - navigational assistance on arctic shipping route
    - new geophysical parameter products



GOSAT-GW Satellite Specifications

Orbit	Type	Sun-synchronous, Sub-recurrent orbit
	Altitude	666km, recurrent cycle 3days (same as GOSAT)
	MLTAN	13:30±15min (same as GCOM-W)
Mass		2.6 ton (Including propellant)
Power		> 5.3 kW
Design life		> 7 years
Launch vehicle		H-IIA rocket
Mission data downlink rate		Direct transmission with X-band: 400 Mbps Direct transmission with S-band: 1 Mbps (Only for AMSR3)
Instrument		TANSO-3 (for GHG) AMSR3 (for Water Cycle)

Specification of AMSR3

AMSR3 Sensor Characteristics

Sensor type	Conical scanning total power microwave radiometer
Antenna	Off-set parabolic antenna (ϕ2.0m aperture)
Swath width	> 1530m
Quantization	12 bit
Incidence angle	55 deg. except 89GB, 166G,183G
X-polarization	< -20dB
Beam efficiency	> 90%
Range	2.7-340K
Sampling interval	5-10km
Data rate	87.4 kbps (average)
Life time	7 years

Red: Changes from AMSR2 including additional channels

* Bandwidth of 36GHz channels was modified from 1000MHz to 840MHz to reduce risk by the 5th Generation Mobile Communication System (5G). Details will be shown at the MW breakout session.

AMSR3 Channel Sets

Center frequency [GHz]	Polarization	Band width [MHz]	NEDT (1σ)	Beam width (spatial resolution)
6.925 7.3	H/V	350	< 0.34 K	1.8° (34km x 58km)
10.25	H/V	500	< 0.34 K	1.2° (22km x 39km)
10.65	H/V	100	< 0.70 K	1.2° (22km x 39km)
18.7	H/V	200	< 0.70 K	0.65° (12km x 21km)
23.8	H/V	400	< 0.60 K	0.75° (14km x 24km)
36.42	H/V	840	< 0.70 K (TBD)	0.35° (7km x 11km)
89.0 A/B	H/V	3000	< 1.20 K	0.15° (3km x 5km)
165.5	V	4000	< 1.50 K	0.3° (4km × 9km)
183.31±7	V	2000 × 2	< 1.50 K	0.27° (4km × 8km)
183.31±3	V	2000 × 2	< 1.50 K	0.27° (4km × 8km)

Additional Slides not Presented

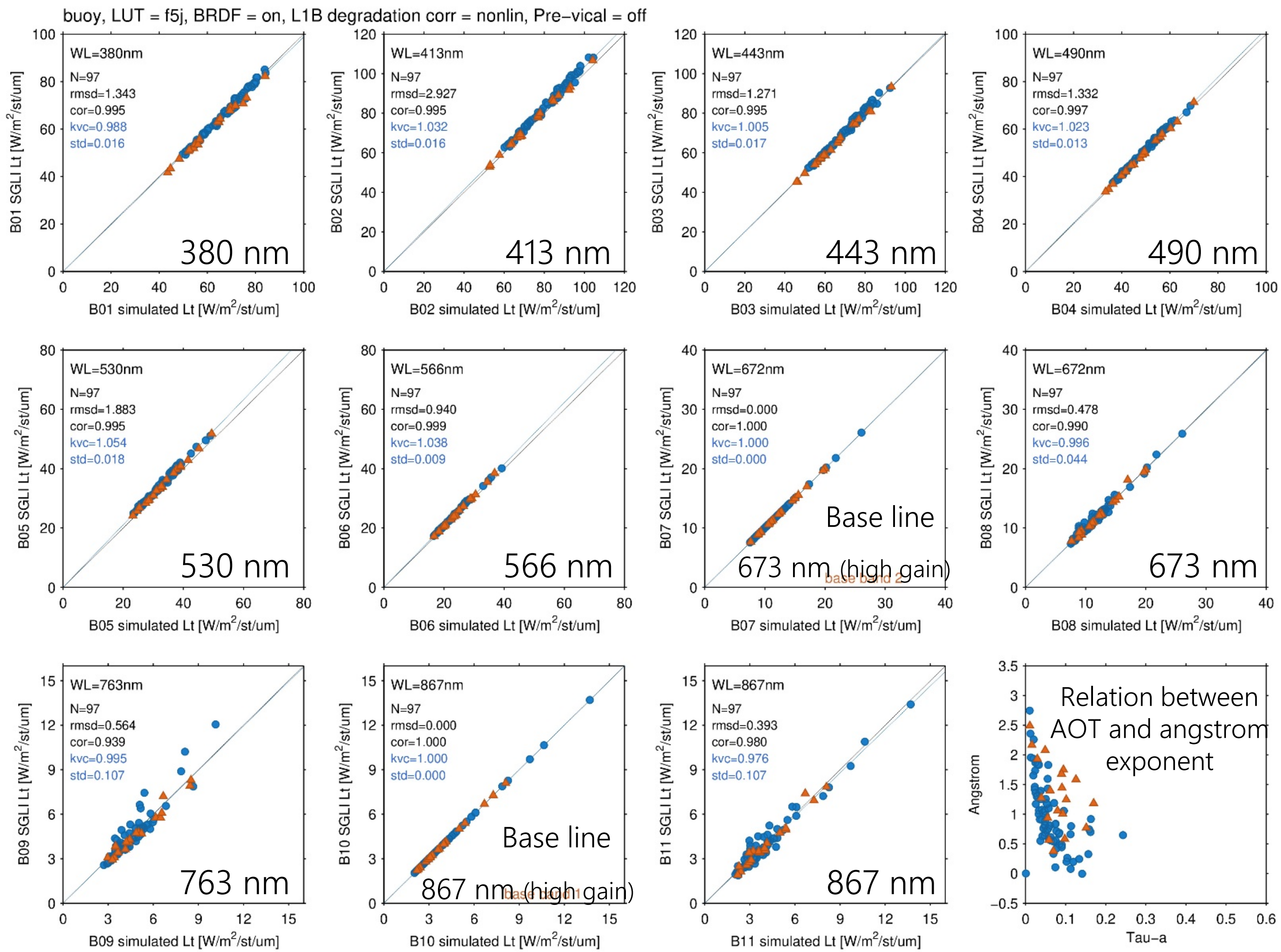
SGLI ocean colour vicarious calibration by MOBY and BOUSSOLE

- ✓ Vicarious calibration of dark target is updated by in-situ MOBY and BOUSSOLE measurements

MOBY data is provided by NOAA

BUSSOLE data is provided by PI D. Antoine

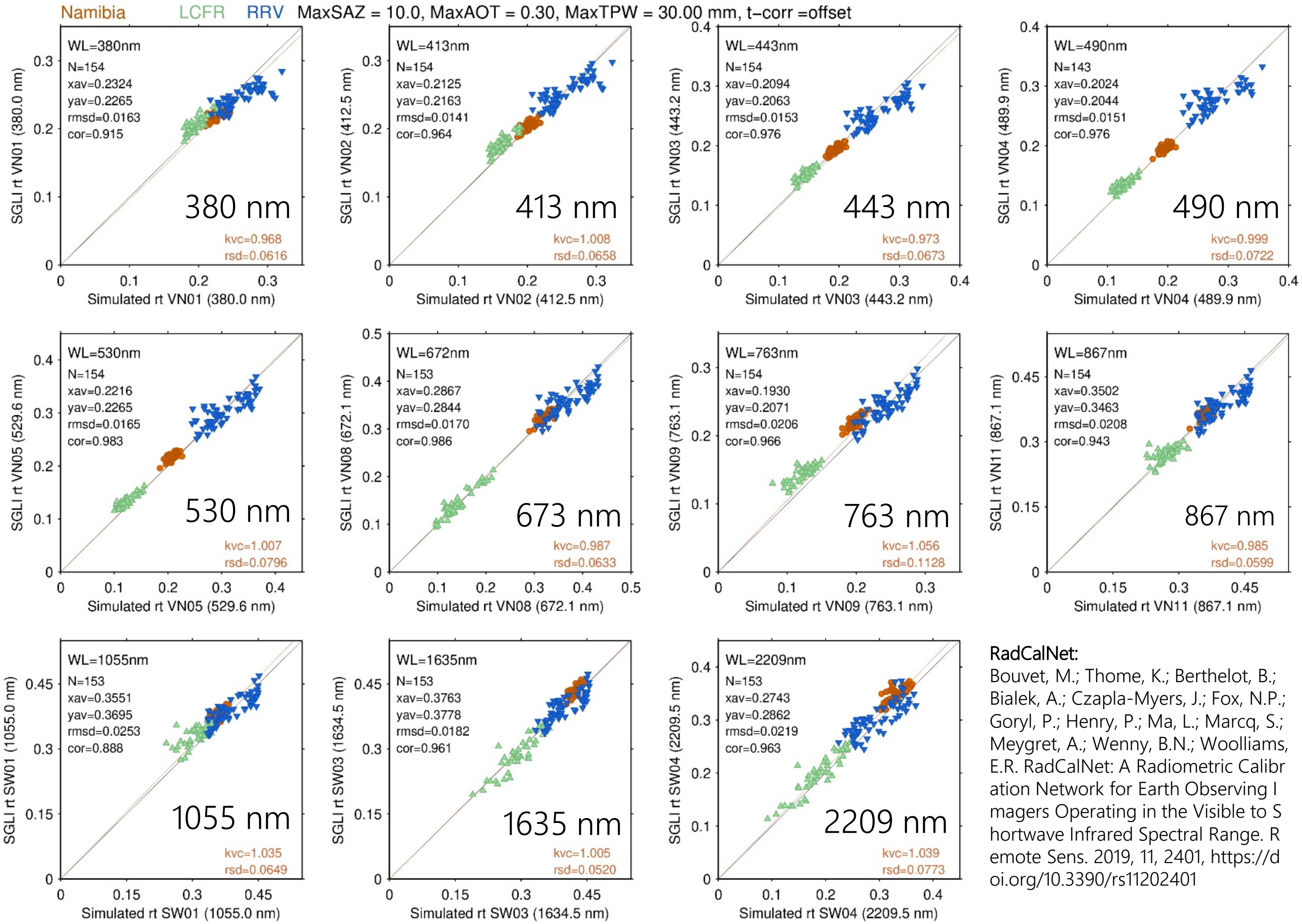
Aerosol is estimated by B07 and B10



SGLI vicarious calibration by RadCalNet

https://www.radcalnet.org/

- ✓ Vicarious calibration of bright target is updated by CEOS RadCalNet measurements



Sites of spatial scale>250m is used

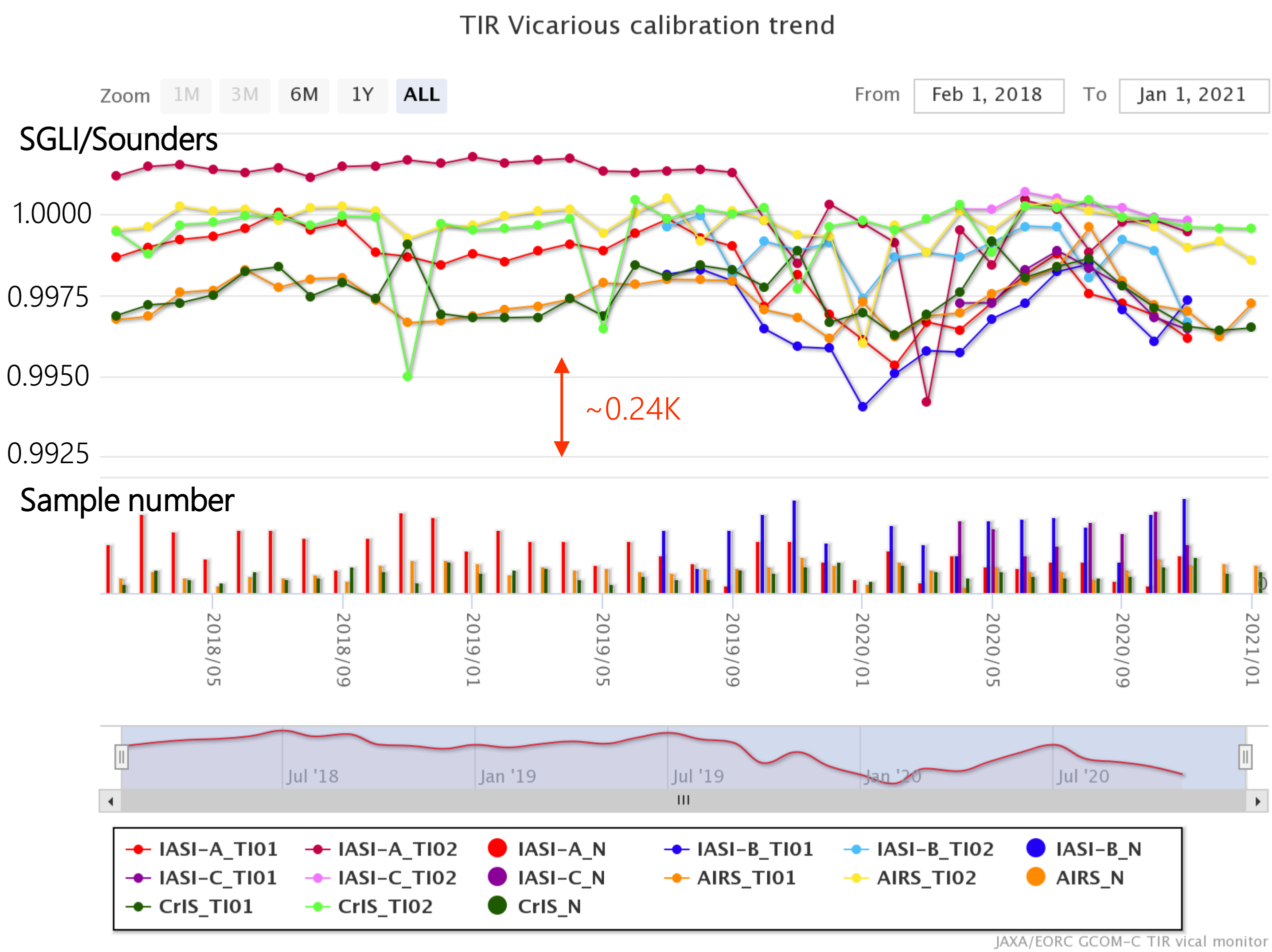
Gobabeb

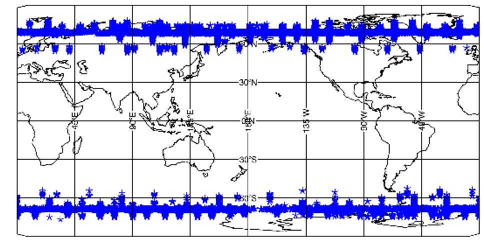
La Crau

Railroad Valley Playa

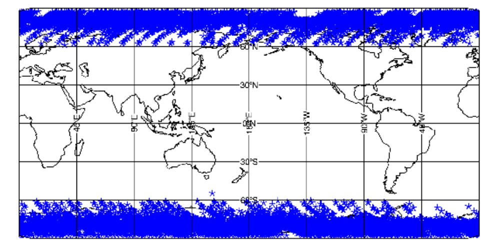
RadCalNet:
Bouvet, M.; Thome, K.; Berthelot, B.; Bialek, A.; Czapla-Myers, J.; Fox, N.P.; Goryl, P.; Henry, P.; Ma, L.; Marcq, S.; Meygret, A.; Wenny, B.N.; Woolliams, E.R. RadCalNet: A Radiometric Calibr ation Network for Earth Observing I magers Operating in the Visible to S hortwave Infrared Spectral Range. R emote Sens. 2019, 11, 2401, https://d oi.org/10.3390/rs11202401

SGLI thermal infrared (TIR) cross calibration by satellite sounders





match-up locations of CrIS



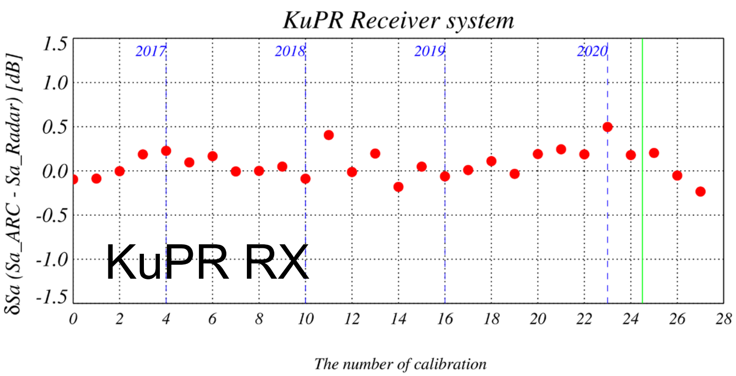
match-up locations of IASI-A

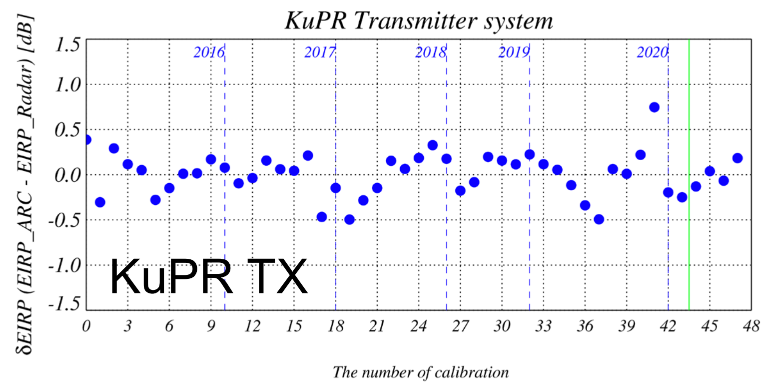
- ✓ SGLI/AIRS and SGLI/CrIS indicate that SGLI TIR is stable
- ✓ SGLI/IASI shows some fluctuation but that seems due to the inconsistency of the samples

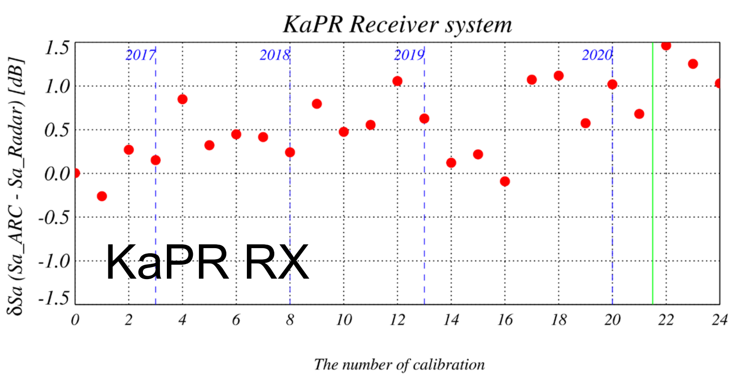
*10W/m^2/sr/um(@300K) *0.003 *8K/(W/m^2/sr/um)=0.24K

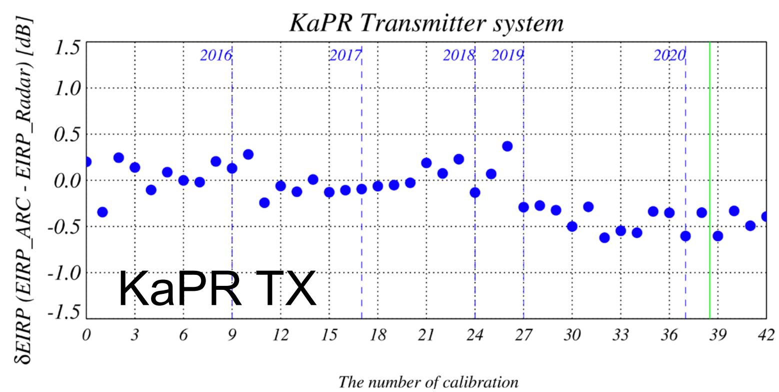
Current status of GPM/DPR calibration

- JAXA usually conducts 10 times external calibrations in a year at Tsukuba Space Center in Japan.
- Current calibration activities show the GPM/KuPR and GPM/KaPR are working well.
- A paper of the DPR calibration was published in Dec. 2020 (Masaki et al. 2020, *IEEE TGRS*, https://doi.org/10.1109/TGRS.2020.3039978) .









T. Masaki et al.(2020), "Calibration of the Dual-Frequency Precipitation Radar Onboard the Global Precipitation Measurement Core Observatory," in IEEE Transactions on Geoscience and Remote Sensing, doi: 10.1109/TGRS.2020.3039978.

ALOS-2/PALSAR-2 Calibration Summary Updates

- ALOS-2 was launched in 2014 and will pass 7 yrs. of the post operation in May 2021.
- On-board internal calibration is performed every 3 months.
- Product quality of major observation modes is evaluating regularly using SAR data over calibration sites.
- The standard product processing software was updated in June (radiometric calibration) and Nov. 2018 (correction of range offset).

> PALSAR-2 keeps in good conditions and performances.

Summary of evaluation results of ALOS-2 PALSAR-2 Standard products as of Sep. 2020.

Items	Results	
Geometry (RMSE)	[Stripmap and Spotlight] [ScanSAR]	5.53 m (L1.1) / 6.73 m (L2.1) 60.77 m (L1.1) / 29.33 m (L2.1)
Radiometry	RCS accuracy (1σ)	0.535 dB (Corner Reflectors) 0.41 dB (Amazonian forests)
Polarimetry [SM 6m]	VV-HH amplitude ratio	1.003 (σ=0.012)
	VV-HH phase difference	-0.248 deg (σ=1.441)
	Cross talk	[HV/HH] -43.245 dB (σ=6.615) [VH/VV] -42.762 dB (σ=5.498)

Introduce/Confirm the Agency's Personnel supporting GSICS

- *GRWG:*
  - *Hiroshi Murakami (optical & IR imager) (murakami.hiroshi.eo@jaxa.jp)*
  - *Misako Kachi (MW) (kachi.misako@jaxa.jp)*
- *GDWG:*
  - *None*
- *Other key agency personnel supporting GSICS activities:*
  - *Kosuke Yamamoto & Takuji Kubota (precipitation radar),*
  - *Kei Shiomi (GOSAT, GOSAT-2)*
  - *Takeo Tadono (high resolution optical imager & SAR)*

Thank you for your attention

WMO GSICS Portal

http://gsics.wmo.int

GSICS Coordination Centre

http://www.star.nesdis.noaa.gov/smcd/GCC/index.php

GSICS Product Catalog

https://www.star.nesdis.noaa.gov/smcd/GCC/ProductCatalog.php

GSICS Wiki

http://gsics.atmos.umd.edu/wiki/Home