JAXA Agency Report
2022

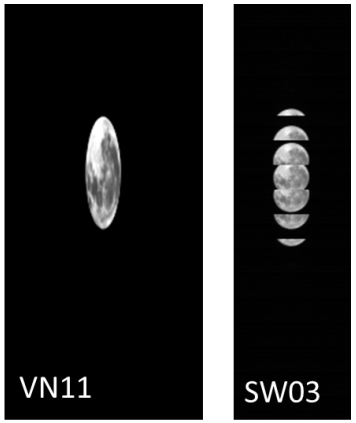
Misako KACHI, Hiroshi MURAKAMI,
Kosuke YAMAMOTO, Takuji KUBOTA,
Kei SHIOMI, and Takeo TADONO

JAXA

Agency's GSICS Activities, Action & Achievements Summary

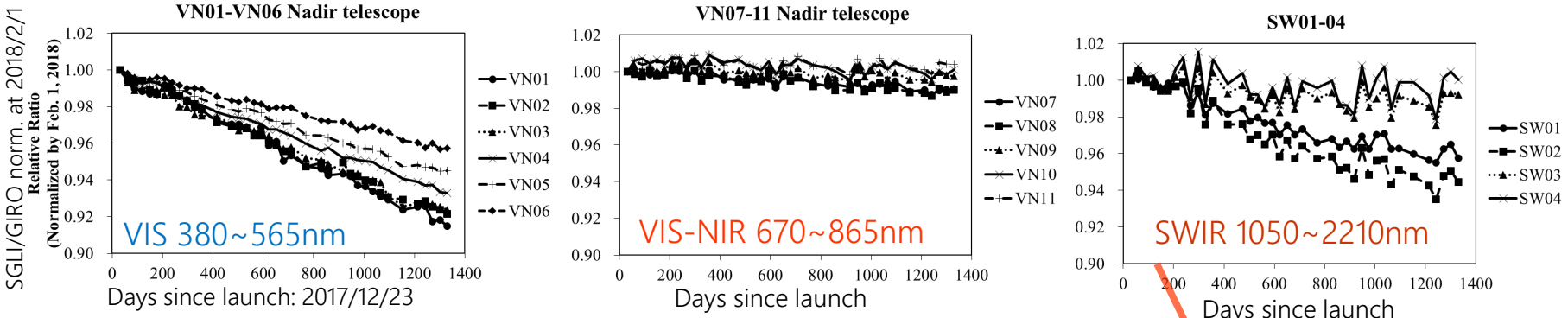
- *Current GSICS Activities*
  - *GCOM-C/SGLI lunar calibration by GIRO is updated (58 times in 2018-2021) and the Lunar data (GLOD) have been provided to the GIRO community*
  - *The new CEOS recommended spectral solar irradiance (TSIS) is tested in the SGLI vicarious calibration*
  - *GOSAT-2/CAI-2 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*
  - *Development of HW & L1 algorithm for GOSAT-GW/AMSR3 is underway, including examination of RFI mitigation, evaluation performance of new G-band channels*
  - *Other calibration activities of each instrument*
  - *Contribution to subgroup meetings*
- *Status of Agency's GSICS Actions*
  - *No GSICS Actions*

SGLI Lunar CAL by GIRO

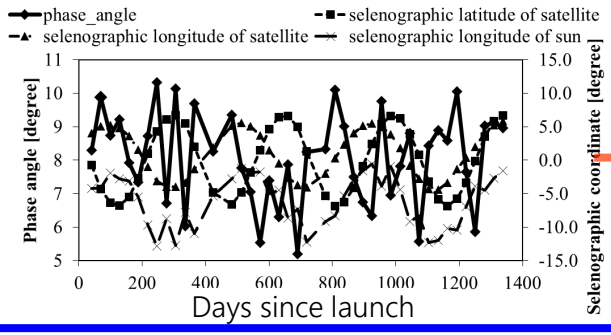


- ✓ GCOM-C SGLI lunar calibration is regularly updated by the monthly lunar observations (by the pitch maneuver; 58 times in 2018-2021) with GIRO
- ✓ The SGLI/GIRO trends are consistent with ones from the other onboard and vicarious calibrations
- ✓ Phase angle (+5~+10 degree) dependency is evaluated by AHI lunar observations at various phase angles
- ✓ The gain degradation has been considered in ver.2 SGLI Level-1B product

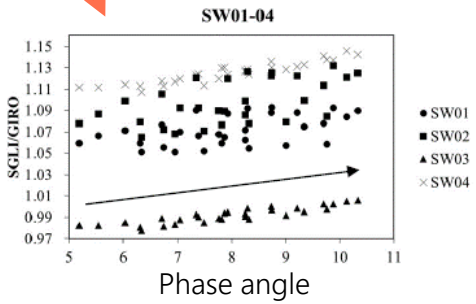
Time series of SGLI/GIRO trend (Normalized by 2018/2/1)



Phase angle of the moon observations

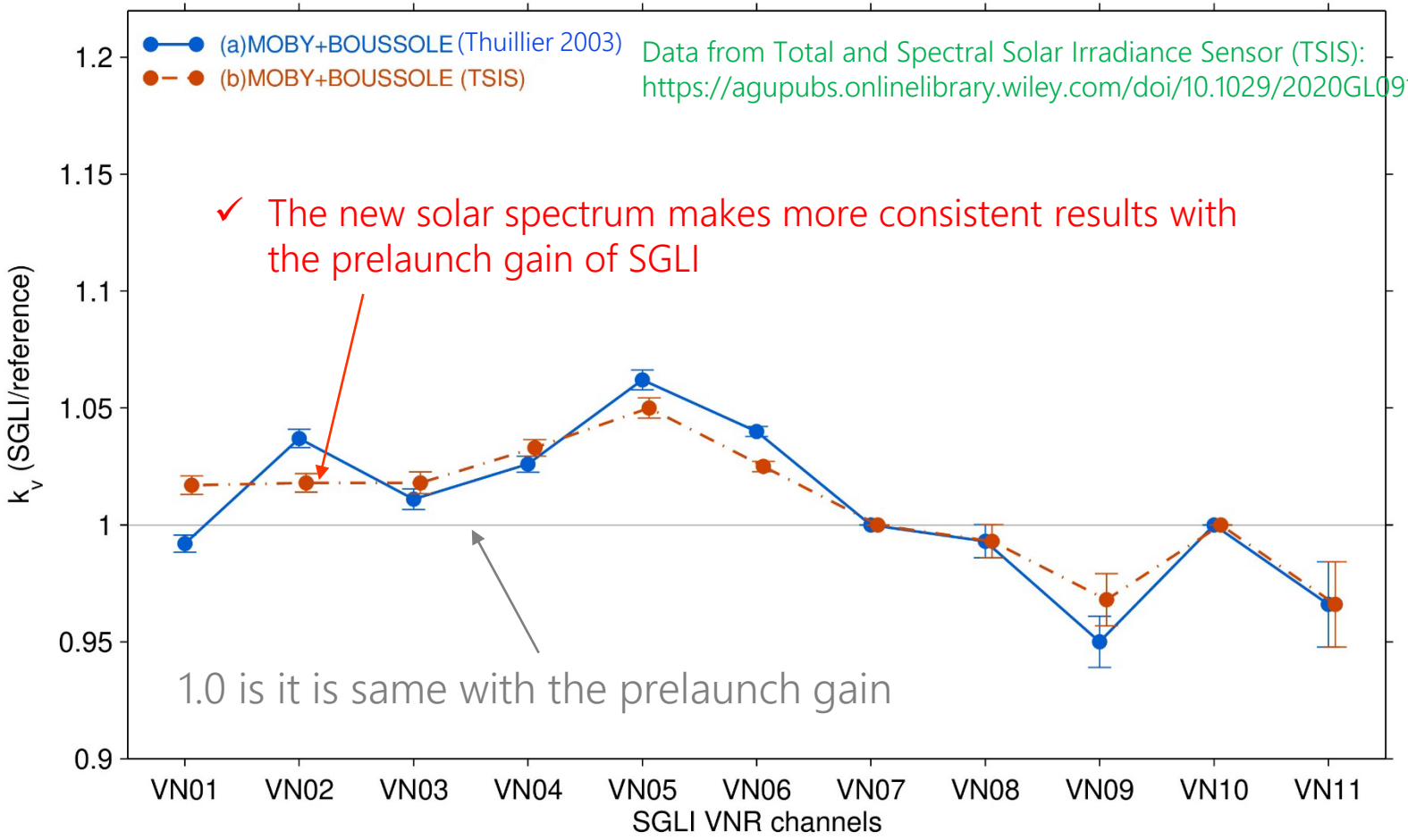


Phase angle dependency (SWIR)



• Urabe et al. (2020). DOI: 10.3390/rs12010069; Urabe et al. (2019) DOI: 10.1109/IGARSS.2019.8897892

Vicarious calibration by the new CEOS recommended Solar Spectral Irradiance Spectrum (TSIS)



- ✓ No influence on the Lunar cal. because we use for relative temporal change
- ✓ L1B reflectance and vicarious calibration is influenced by the Solar Spectral Irradiance

• Vical by Murakami et al. (2022) https://doi.org/10.1007/s10872-022-00632-x

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 12 %, B6 380 nm band around 4 % in the first 3 years.

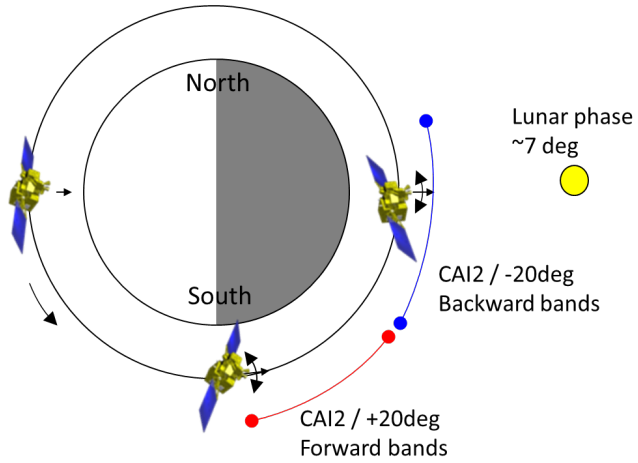
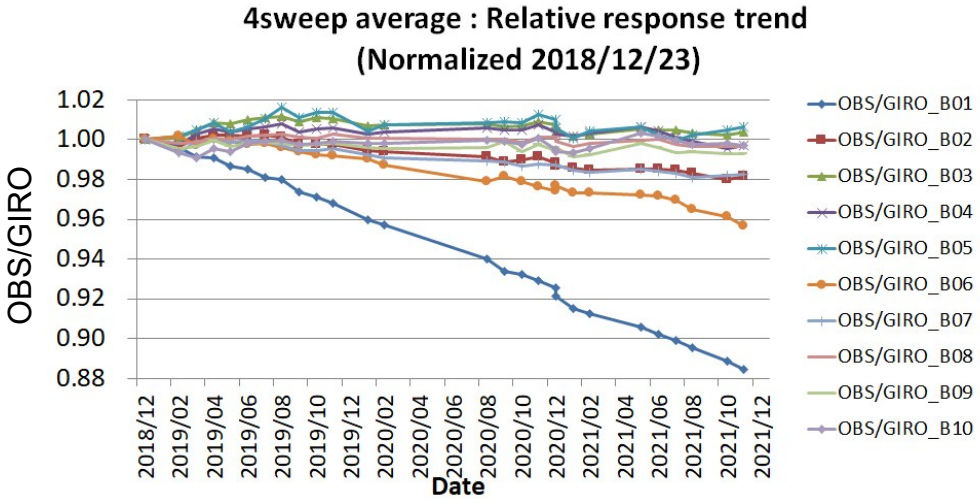
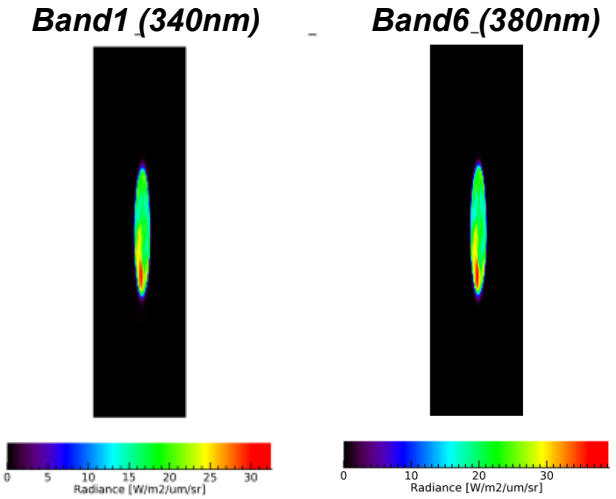


Illustration of GOSAT-2 lunar calibration



CAI-2 radiance compared with GIRO



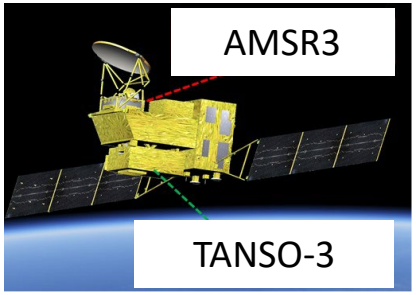
CAI-2 first lunar calibration by AT scan on December 23, 2018

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) & ALOS-4 (advanced SAR, successor of ALOS-2): Planned to be launched in TBD (hopefully JFY2022)*
  - *EarthCARE/CPR (joint mission with ESA): Planned to be launched in JFY2023*
  - *GOSAT-GW (successor of GOSAT-2 & GCOM-W): Planned to be launched in JFY2023*
- *Status of Level 1 reprocessing*
  - *GOSAT/TANSO-FTS Level 1 (Ver.230.231) was released in June 2021*
  - *GOSAT-2/TANSO-CAI-2 Level 1 (Ver.103.103) was released in January 2022*
  - *GOSAT-2/TANSO-FTS-2 Level 1 (Ver.210.210) was released in January 2022*
  - *GCOM-C/SGLI Level 1 (Ver.2) was released in June 2020 and the reprocessing is completed*

AMSR3 on GOSAT-GW: Global Observation SATellite for Greenhouse gases and Water cycle

- GOSAT-GW will carry two instruments, AMSR3 & 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 the 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)



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)

AMSR3 Channel Sets

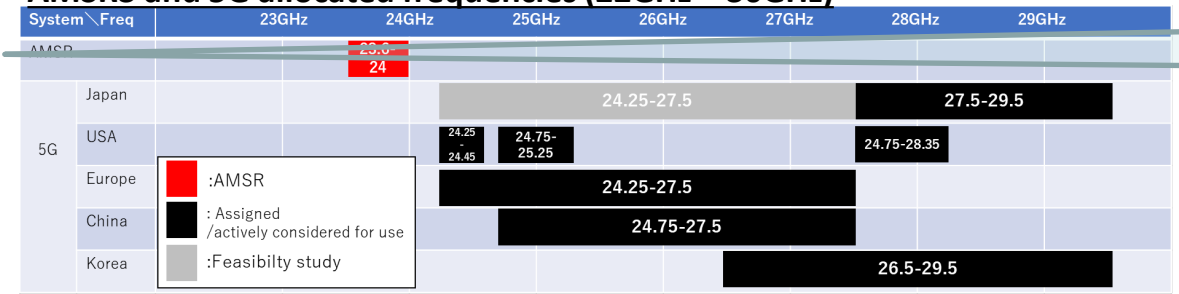
Center frequency [GHz]	Polarization	Band width [MHz]	NEDT (1σ)	Beam width (spatial resolution)
6.925 7.3	H/V	350	< 0.34 K	1.8° (34km x 58km)
10.25	**H/V**	**500**	**< 0.34 K**	**1.2° (22km x 39km)**
10.65	H/V	100	< 0.70 K	1.2° (22km x 39km)
18.7	H/V	200	< 0.70 K	0.65° (12km x 21km)
23.8	H/V	400	< 0.60 K	0.75° (14km x 24km)
36.42	H/V	**840***	< 0.70 K	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**	**AZ=0.23° / EL=0.30° (4km x 9km)**
183.31±7	**V**	**2000×2**	**< 1.50 K**	**AZ=0.23° / EL=0.27° (4km x 8km)**
183.31±3	**V**	**2000×2**	**< 1.50 K**	**AZ=0.23° / EL=0.27° (4km x 8km)**

Red: Changes from AMSR2 including additional CHs

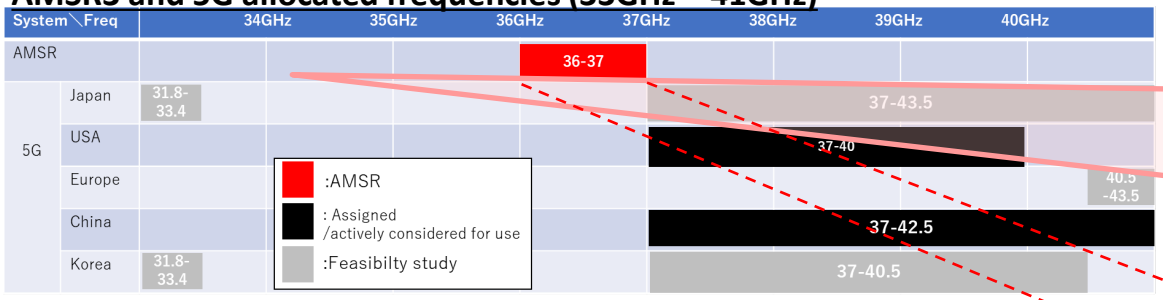
* Changed the specification of Ka-band passband to reduce the future risk of RF interference from 5-G mobile communication system

Toward RFI mitigation in GOSAT-GW/AMSR3

AMSR3 and 5G allocated frequencies (22GHz ~ 30GHz)

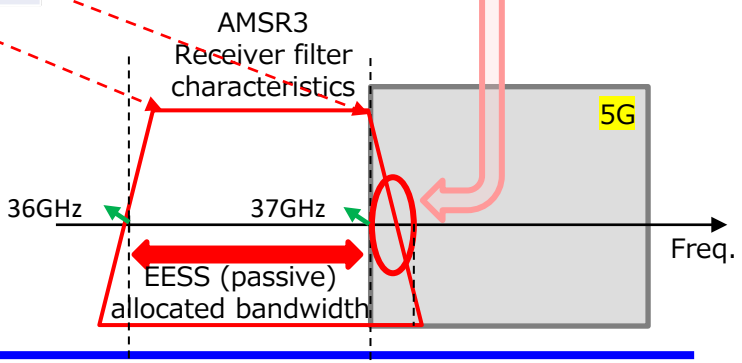


AMSR3 and 5G allocated frequencies (33GHz ~ 41GHz)



AMSR3 and 5G frequencies have a buffer band of 250 MHz (24.0 to 24.25 GHz)

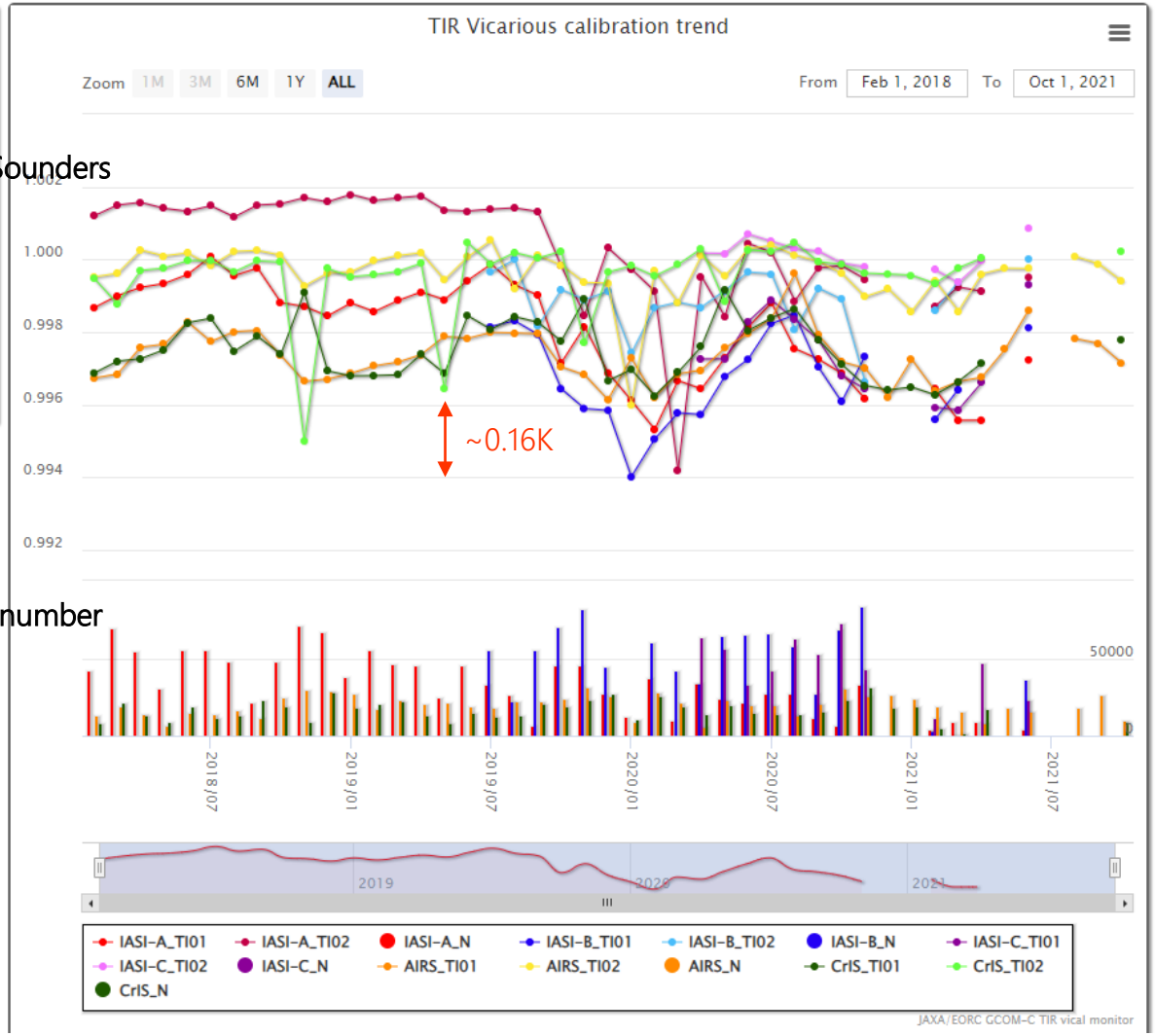
AMSR3 and 5G frequencies are adjacent to each other with no buffer band.
Its impact cannot be avoided by improving the out-of-band frequency characteristics while maintain the bandwidth.



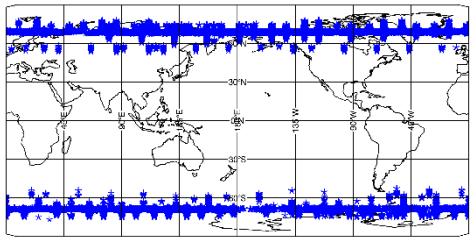
As a result of the study to minimize the reduced bandwidth, the bandwidth of 36 GHz was changed from 1000MHz to 840 MHz while NEDT specification unchanges.

Additional Slides not Presented

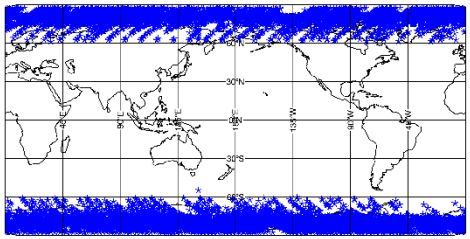
SGLI thermal infrared (TIR) cross calibration by satellite sounders



*10W/m²/sr/um(@300K) *0.002 *8K/(W/m²/sr/um)=0.16K



match-up locations of CrIS

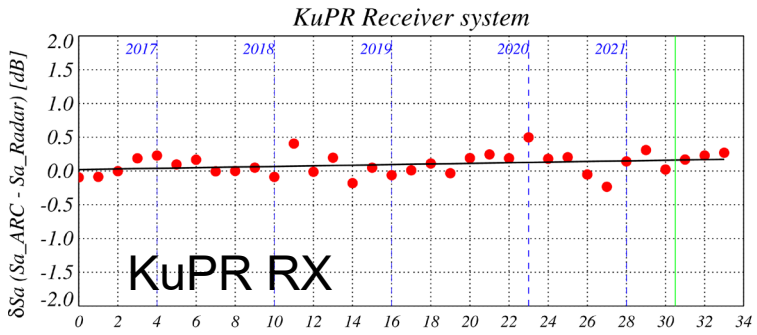


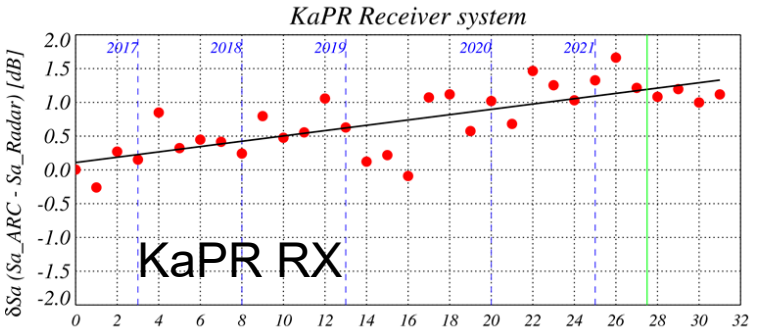
match-up locations of IASI-A

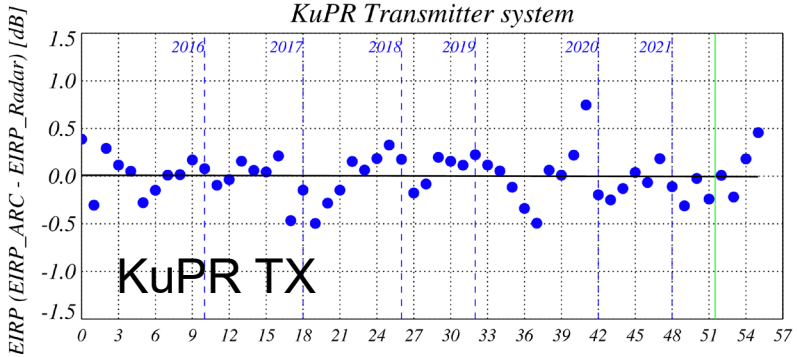
- ✓ SGLI/AIRS and SGLI/CrIS indicate that SGLI TIR is stable
- ✓ SGLI/IASI shows some fluctuation but that seems due to the inconsistency of the samples

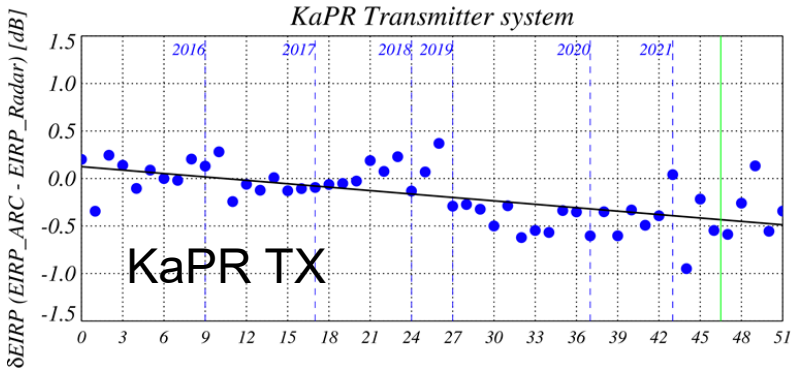
Current status of GPM/DPR calibration

- 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.





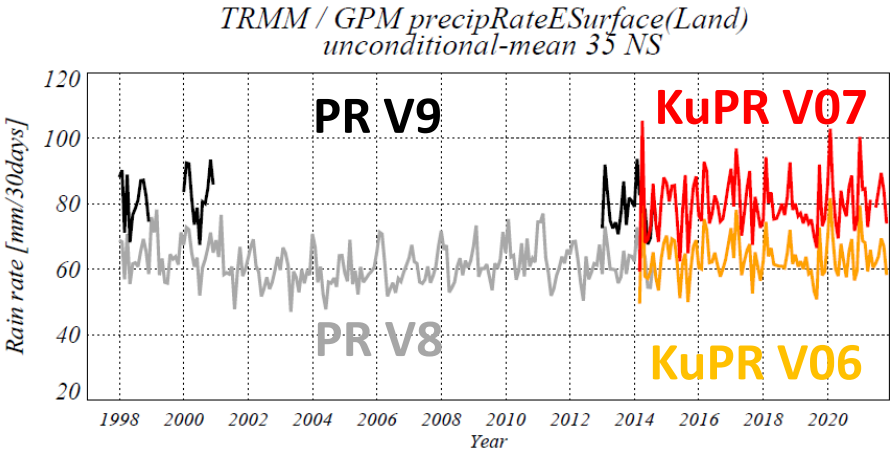




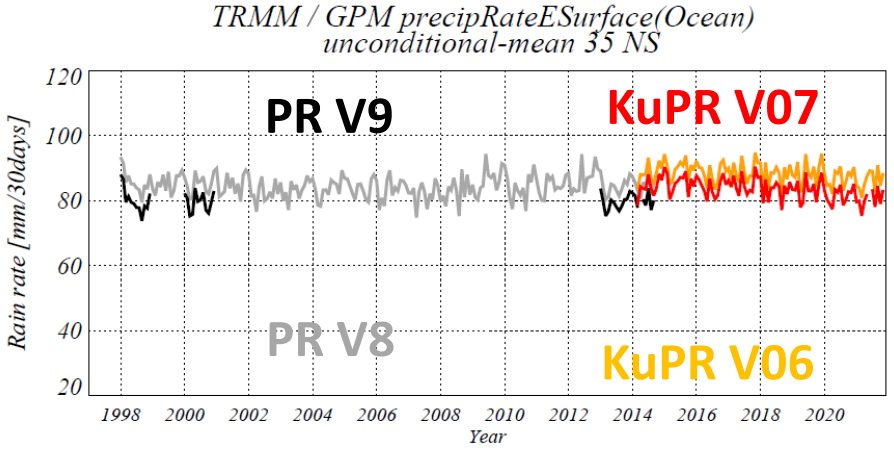
Continuity of the GPM/DPR and the TRMM/PR

- Both GPM/DPR's calibration factors and TRMM/PR's calibration factors were changed in 2017.
- After the algorithm update in Dec. 2021, the GPM/KuPR V07 and the TRMM/PR V9(GPM TRMM V07) show good continuity on surface precipitation rate.
- These dataset was used long-term precipitation analyses, such as heavy rainfall over East Asia (Takahashi and Fujinami 2021, https://doi.org/10.1038/s41598-021-93006-0)

Over-land surface precipitation rates averaged in 35S-35N.



Over-ocean surface precipitation rates averaged in 35S-35N.



ALOS-2/PALSAR-2 Calibration Summary Updates

- ✓ ALOS-2 was launched in 2014, successfully passed 7 yrs. of the post operation in May 2021. It is now operating well in the post operation phase 2.
- ✓ 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 2018 (radiometric calibration), Nov. 2018 (correction of range offset), and May 2021 (updates the software for Spotlight and ScanSAR).

> PALSAR-2 keeps in good conditions and performances.

Summary of evaluation results of ALOS-2 PALSAR-2 Standard products as of Sep. 2021.

Items	Results	
Geometry (RMSE)	[Stripmap and Spotlight] 5.53 m (L1.1) / 6.73 m (L2.1) [ScanSAR] 60.77 m (L1.1) / 29.33 m (L2.1)	
Radiometry	RCS accuracy (1σ)	0.529 dB (Corner Reflectors) 0.41 dB (Amazonian forests)
Polarimetry [SM 6m]	VV-HH amplitude ratio	1.003 (σ=0.012)
	VV-HH phase difference	-0.323 deg (σ=1.436)
	Cross talk	[HV/HH] -42.858 dB (σ=6.638) [VH/VV] -42.667 dB (σ=5.518)

* https://www.eorc.jaxa.jp/ALOS/en/alos-2/a2_calval_e.htm

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:*
  - *Yukio Kurihara (optical & IR imager, MW)*
  - *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