Validation of Himawari-9 image navigation/registration (INR) and related calibration

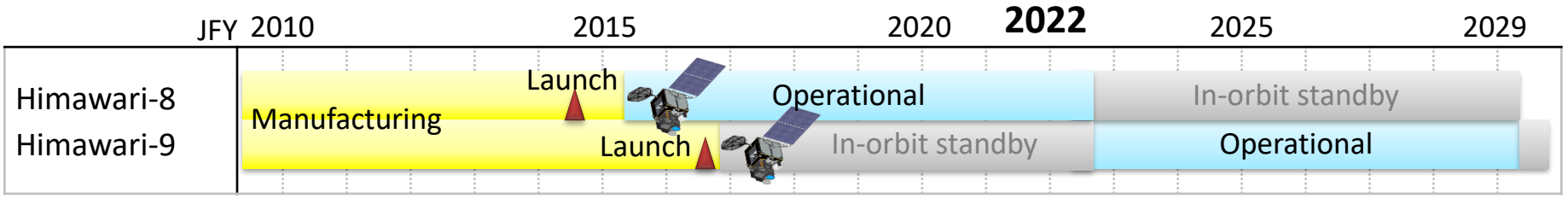
based on health check observations

in Oct. 2018

27 July 2022, Meteorological satellite center of JMA

Introduction

- Himawari-8 (operational since Jul. 2015)
  - Advanced Himawari Imager (AHI) with 16 spectral bands
  - Full-disk observation every 10 min + regional observation every 2.5 min
- Himawari-9 (in-orbit standby since Mar. 2017)
  - Switchover of the operational satellite from Himawari-8 to Himawari-9 is planned around December 2022 (exact date TBA).
  - Specifications identical to those of Himawari-8/AHI
- This presentation outlines Himawari 9/AHI data quality based on health-check observations conducted from 9 to 17 October 2018. Stable performance was observed in other health-check observations.



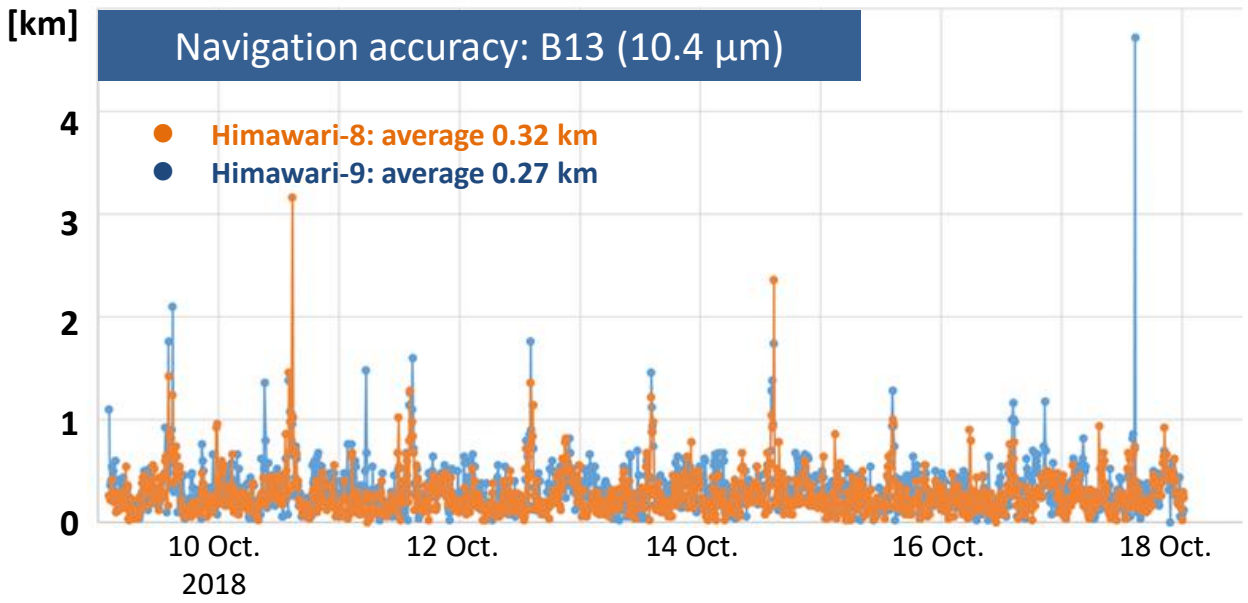
Summary

- Health checks for Himawari-9/AHI functionality show stable data quality.
- INR performance is approximately 0.3 km (for reference mapping) and 40 m (between bands) at the sub-satellite point for both Himawari-8 and Himawari-9.
- Radiometric calibration biases of less than around 5% in reflectivity for VNIR bands and less than 0.3 K in brightness temperature for infrared bands are also observed.

H9/AHI data quality - Image navigation and registration (INR)

Navigation accuracy

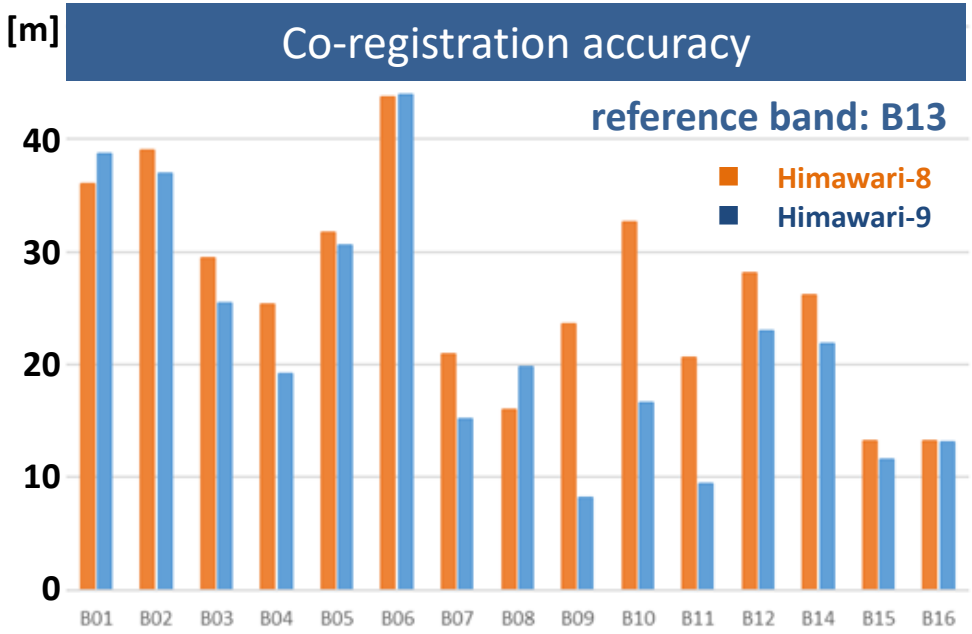
- Absolute navigation accuracy is analyzed by landmark matching approach using observation imagery and referential maps.
- The results of landmark analysis indicate a Himawari-8/9 navigation accuracy of around 0.3 km.
- Information on daily Himawari-8 accuracy is available on the monitoring web page.



H9/AHI data quality - Image navigation and registration (INR)

Inter-band navigation (co-registration) accuracy

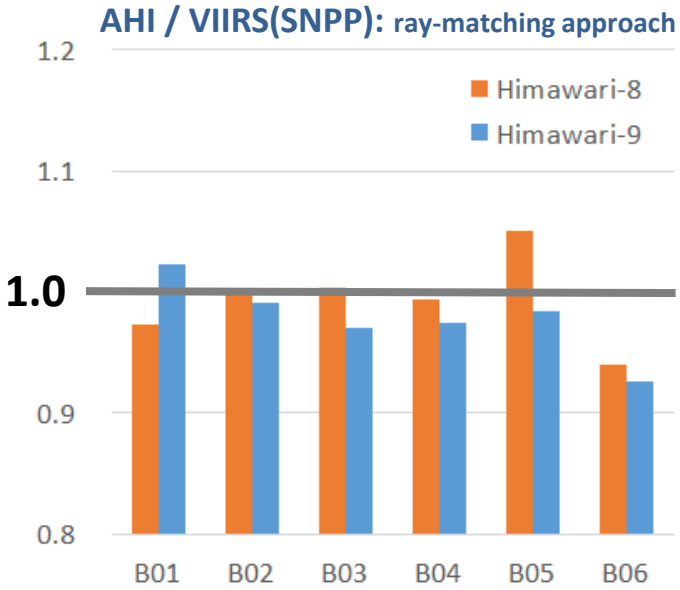
- Relative navigation accuracy is analyzed via pattern matching between imagery of monitored and reference bands.
- Although accuracy varies by band, verification for both Himawari-8 and -9 showed values of around 40 m, which corresponds to 0.02 pixels for thermal infrared bands at the sub-satellite point.



* 24h average of the data from Himawari-8/9 on 10 Oct. 2018

H9/AHI data quality - Radiometric calibration (VNIR bands)

- Calibration validation is developed under the GSICS framework (e.g., direct comparison via ray-matching with VIIRS).
- SNPP/VIIRS data indicate that observation values for both Himawari-8 and -9 are within around 5% of the reference.



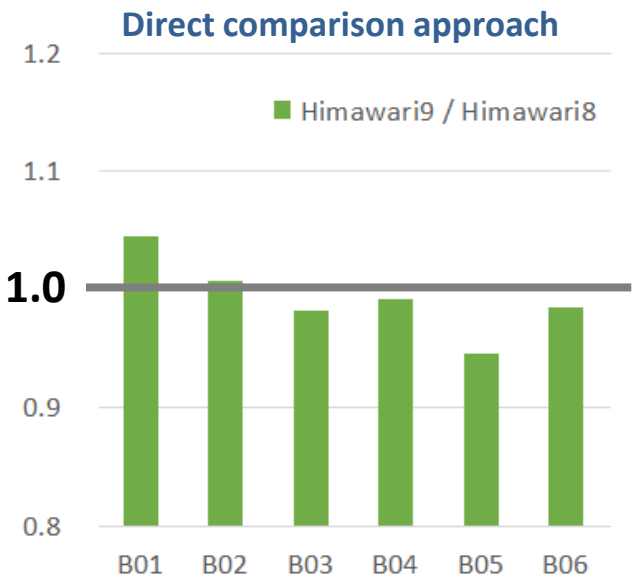
Data period:
1 to 29 October 2018 for H8/AHI
9 to 17 October 2018 for H9/AHI

	AHI(H8) / VIIRS(SNPP)	AHI(H9) / VIIRS(SNPP)
B01	0.972	1.021
B02	1.001	0.990
B03	1.003	0.970
B04	0.993	0.974
B05	1.050	0.983
B06	0.938	0.925

The SRF difference between AHI and VIIRS is evaluated using a tool for calculation of Spectral Band Difference Adjustment Factors (https://satcorps.larc.nasa.gov/cgi-bin/site/showdoc?mnemonic=SBAF)

H9/AHI data quality - Radiometric calibration (VNIR bands)

- Direct comparison between Himawari-8 and Himawari-9 data is also made.
- The difference between data from the two satellites is also within around 5%.

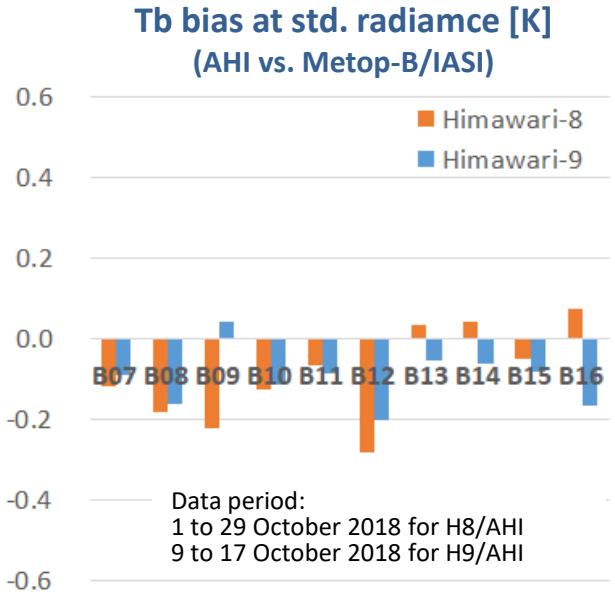


Data period:
9 to 17 October 2018 for H8/AHI, H9/AHI

	AHI(H9) / AHI(H8)
B01	1.044
B02	1.007
B03	0.981
B04	0.991
B05	0.944
B06	0.985

H9/AHI data quality - Radiometric calibration (IR bands)

- Calibration validation for IR bands is also developed under the GSICS framework.
- The observed brightness temperatures (Tb) of Himawari-8/9 are within 0.3 K of the reference at a standard radiance.



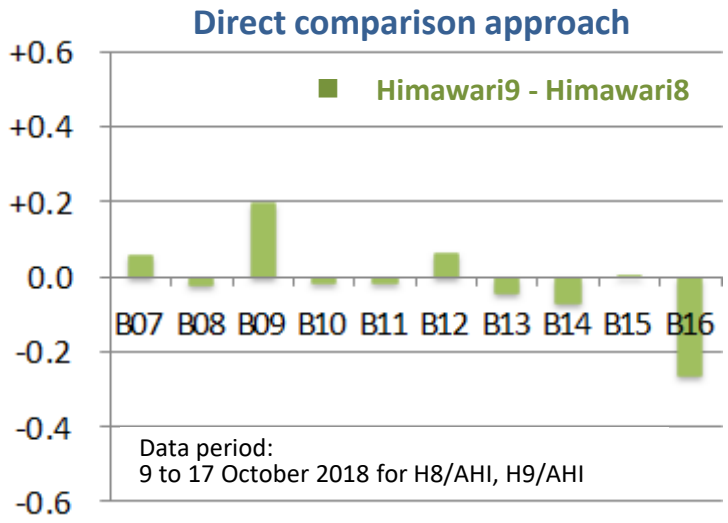
AHI8	Tb bias at std. radiance [K]
B07	-0.12
B08	-0.18
B09	-0.23
B10	-0.13
B11	-0.07
B12	-0.28
B13	+0.03
B14	+0.04
B15	-0.05
B16	+0.07

AHI9	Tb bias at std. radiance [K]
B07	-0.09
B08	-0.16
B09	+0.04
B10	-0.12
B11	-0.09
B12	-0.21
B13	-0.06
B14	-0.07
B15	-0.09
B16	-0.17

* The standard radiance is a Tb equivalent to clear-sky sea surface computed using a radiative transfer code (RTTOV). Details are provided online. (https://www.data.jma.go.jp/mscweb/data/monitoring/gsics/ir/techinfo_geoleoir.html).

H9/AHI data quality - Radiometric calibration (IR bands)

- Direct comparison between Himawari-8 and Himawari-9 is also examined.
- The difference between the two satellites is also within 0.3K.



	Himawari9 - Himawari8 [K]
B07	+0.05
B08	-0.03
B09	+0.20
B10	-0.02
B11	-0.02
B12	+0.06
B13	-0.05
B14	-0.07
B15	+0.00
B16	-0.27

SRF difference between Himawari-8 and Himawari-9 AHI is considered.

References

JMA/MSC INR monitoring
https://www.data.jma.go.jp/mscweb/data/monitoring/navigation.html

JMA/MSC Calibration portal
https://www.data.jma.go.jp/mscweb/en/oper/calibration/calibration_portal.html

Event log
https://www.data.jma.go.jp/mscweb/en/oper/event_H8.html

GSICS
https://gsics.wmo.int/