

Update of Calibration Information Used to Correct Himawari-9 AHI Sensitivity Trends

Overview of the update

The Japan Meteorological Agency (JMA) plans to update the calibration information used to correct the Himawari-9 sensor sensitivity trend at 07:00 UTC on 16 December 2025.¹

The corrected calibration parameters are included in the calibration information block in Himawari Standard Data (HSD). These are described as Nos. 12 and 13 in the #5 calibration information block for the visible and near-infrared (VNIR) Bands 1 to 6 in HSD format². The values of the parameters are shown in Tables 1 and 2.

Trend of the sensor sensitivity

JMA revised the HSD format on 25 July 2017, which includes the latest calibration coefficients with sensor sensitivity trends taken into account. Figure 1 shows these trends for Himawari-9 Advanced Himawari Imager (AHI-9) VNIR bands derived from on-board solar diffuser observation (solar calibration). Degradation of up to approximately 1% per year is observed.

The sensor sensitivity correction coefficient D for each band is defined as

$$D = \frac{\widehat{m_{yyyy}}}{\widehat{m_{2022}}}$$

where $\widehat{m_{yyyy}}$ is the average calibration slope for all detectors derived from solar calibration conducted from 7 October yyyy to 22 September of the following year, while $\widehat{m_{2022}}$ is the average from 7 October 2022 to 22 September 2023 derived in the same way.

Multiplying the slope (No. 8 in the #5 calibration information block for HSD format) and intercept (No. 9 in the #5 calibration information block for HSD format) for 2022 by the sensor sensitivity correction coefficient D gives the corrected slope and intercept. The results are shown in Tables 1 and 2. Figure 2 also shows the corrected sensor sensitivity trends. The degradations seen in the trends in Figure 1 are appropriately corrected.

¹ The implementation was postponed from 21 October to 16 December due to a Himawari-9 malfunction.

²

https://www.data.jma.go.jp/mscweb/en/himawari89/space_segment/hsd_sample/HS_D_users_guide_en_v13.pdf

Differences between Himawari-8 and -9

Calibration information for the Himawari-8 AHI (AHI-8) VNIR bands was also updated previously³. The results of solar calibration for AHI-9 show seasonal variation approximately four times as large as for AHI-8, while comparison of observations with low-Earth orbit satellites (VIIRSs on S-NPP and NOAA-20) indicates that AHI-8 and -9 show linear degradation trends in Bands 1 to 4 and little degradation in Bands 5 and 6, without such variation (figure omitted). AHI-8 and -9 were manufactured using the same design, which also implies that the seasonal variations shown in Figures 1 and 2 for AHI-9 are caused merely by solar calibration processing factors (such as different solar diffuser characteristics).

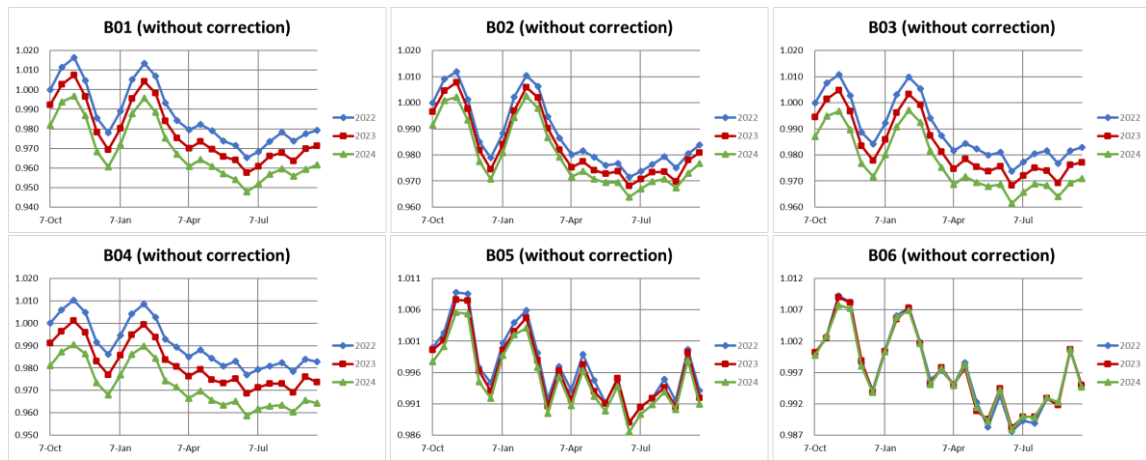


Fig. 1 Time-series representation of sensor sensitivity trends derived from solar calibration (inverse of calibration slope) for AHI-9 VNIR bands. Values are averaged over detectors and normalized with the first solar calibration result of 7 October 2022. The start and end dates for the horizontal axis are 7 October and 22 September.

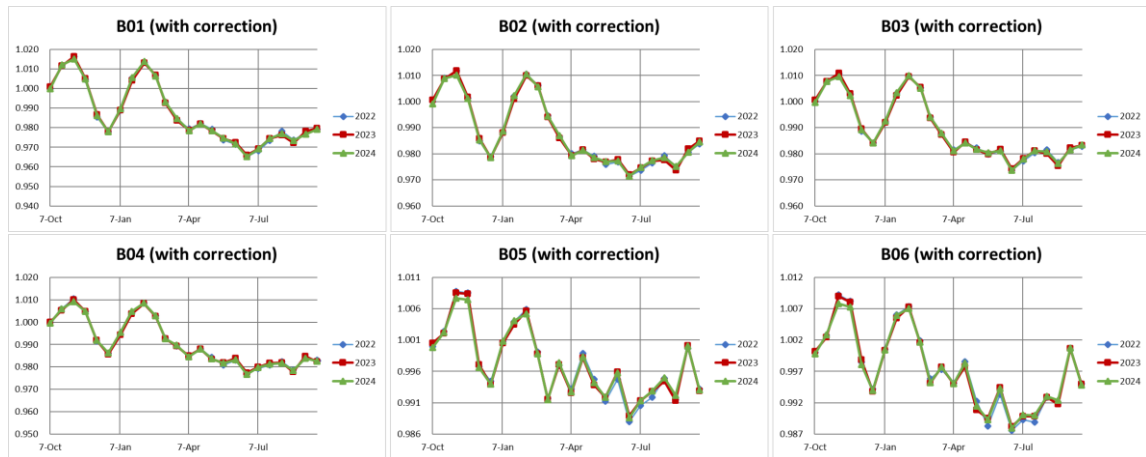


Fig. 2 As per Fig. 1, but with correction of sensor sensitivity trends using the coefficient D for AHI-9 VNIR bands.

³ https://www.data.jma.go.jp/mscweb/en/oper/eventlog/Update_of_Calibration_Information_2022.pdf

Table 1 Slope of digital count – radiance conversion equation (AHI-9). The latest data will be included in No. 12 of VNIR bands in the #5 calibration information block for HSD format. The values for 2022 are the uncorrected slope included in No. 8 of VNIR bands in the #5 calibration information block for HSD format. The values for 2023 and 2024 were derived from solar calibration conducted from 7 October of the relevant year to 22 September of the following year.

Year/Band	B01	B02	B03	B04	B05	B06
2022	0.37735153	0.35414147	0.30510371	0.18195941	0.04561718	0.01406418
2023	0.38066932	0.35558364	0.30701094	0.18358262	0.04565772	0.01406362
2024	0.38426197	0.35695365	0.30901666	0.18538935	0.04571172	0.01406556

Table 2 Intercept of digital count – radiance conversion equation (AHI-9). The latest data will be included in No. 13 of VNIR bands in the #5 calibration information block for HSD format. The values for 2022 are the uncorrected intercept included in No. 9 of VNIR bands in the #5 calibration information block for HSD format. The values for 2023 and 2024 were derived from solar calibration conducted from 7 October of the relevant year to 22 September of the following year.

Year/Band	B01	B02	B03	B04	B05	B06
2022	-7.54703059	-7.08282941	-6.10207412	-3.63918824	-0.91234353	-0.28128353
2023	-7.61338646	-7.11167285	-6.14021873	-3.67165238	-0.91315441	-0.28127237
2024	-7.68523932	-7.13907292	-6.18033310	-3.70778691	-0.91423441	-0.28131112