

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 21 October 2025.

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 format¹. 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.

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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 previously². 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).

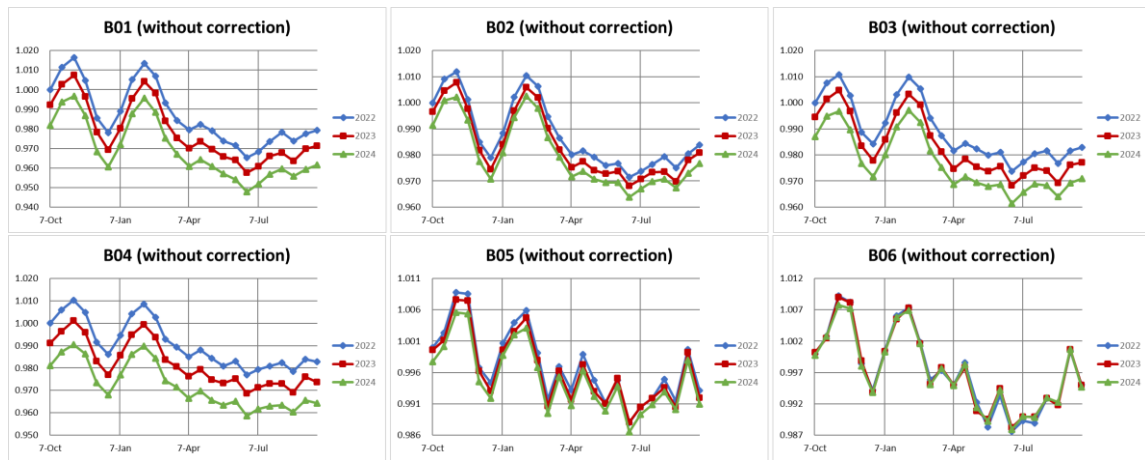


Fig. 1 Time-series representation of sensor sensitivity trends derived from solar calibration (inverse of calibration slope) for AHI-9 VNIR bands. Values are averaged over detectors and normalized with the first solar calibration result of 7 October 2022. The start and end dates for the horizontal axis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

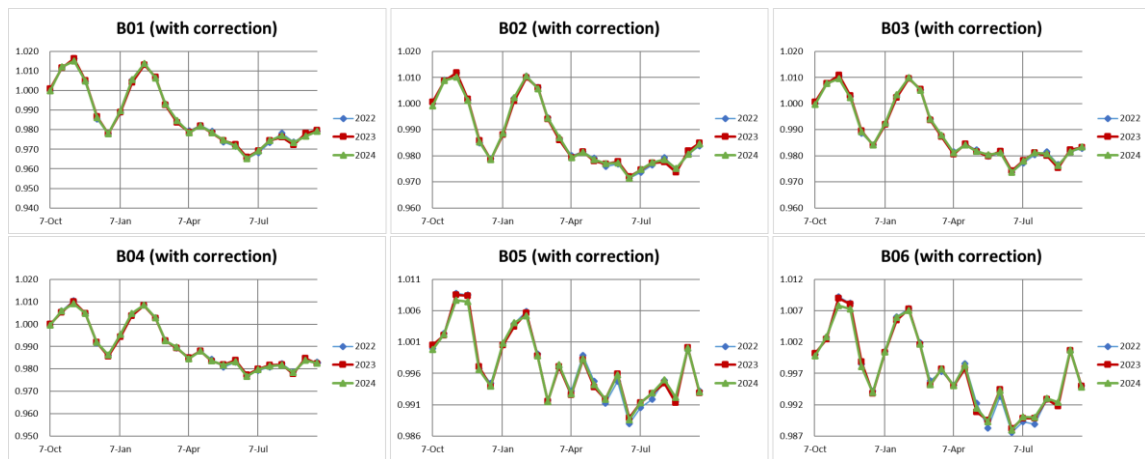


Fig. 2 As per Fig. 1, but with correction of sensor sensitivity trends using the coefficient D for AHI-9 VNIR bands.

² 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