

GOES-16 MAG Level 1b (L1b) Release  
Full Data Quality  
February 25, 2021  
Read-Me for Data Users

The GOES-16 Peer Stakeholder Product Validation Review (PS-PVR) for MAG L1b Full Validation Maturity was held on February 25, 2021. The result of this review was the PS-PVR panel chair recommending that the MAG L1b data be declared Full Validation maturity.

The L1b data products derived from MAG are vector measurements of the geomagnetic field sampled at 10 Hz from the inboard and outboard magnetometers.

The GOES-16 MAG Level 1b (L1b) Provisional data products continue to be suitable for operational use but have documented known issues. Product performance has been demonstrated through analysis of a significant number of independent measurements obtained from select locations, periods, and comparisons to nearby spacecraft and magnetic field models. The product was calibrated, validated and optimized to the extent allowed within resources available. Users bear all responsibility for inspecting the data prior to use and for the manner in which the data are utilized.

In late 2019 the L1b GOES-16 data set released on the NCEI website (listed below) included correction for arcjet contamination. However, changes to the arcjet firing configuration on GOES-16 in late 2020 makes the correction invalid. Hence, it is highly recommended that users use the arcjet flag described below to flag the periods contaminated by arcjet firings. For details on the arcjet contamination and correction algorithm see *Califf et al., (2019, 2020)*. It is recommended the users only use the outboard (OB) MAG sensor data. Contamination observed in the inboard (IB) sensor is still being analyzed as of March 2021 and for details of the issues observed in the IB sensor data see *Loto'aniu et al., (2019)*.

Additionally, L2 products based on this scientific data set are also available at the NCEI website (listed below).

Full Validation means:

- Validation, Q&A, and anomaly resolution activities are ongoing;
- Incremental product improvements may still be occurring;
- Users are engaged and user feedback is assessed;
- Product performance for all products is defined and documented over a wide range of representative conditions via ongoing ground-truth and validation efforts;
- Products are operational optimized, as necessary, considering mission parameters of cost, schedule, and technical competence as compared to user expectations (Performance Baseline);
- All known product anomalies are documented and shared with the user community;
- The product is operational.

We recommend that persons using the GOES-16 MAG Full Validation maturity L1b products for scientific and technical investigations, particularly model validation, model development, and plasma waves

analysis, contact the responsible NOAA scientists before making definitive scientific or technical conclusions derived directly from the MAG data.

Cautions, known issues, and issues under work for resolution at MAG L1b Full maturity status:

1. As mentioned above, the inboard sensor (IB\_\* variables in the L1b files) suffers significant magnetic contamination issues and should not be used in science and technical investigations. We are working to understand the inboard sensor issues.
2. The outboard sensor (OB\_\* variables in the L1b files) can be used for science and technical investigations.
3. The L1b files generated after application of the arcjet correction in the GOES-R ground system contain magnetic field variables that have “uncorrected” or “corrected” added to the variables name. In addition, an arcjet flag was added to the data quality flag (DQF) variable that covers the period where arcjets are fired and contaminate the magnetic field observations. However, changes to the arcjet firing configuration on GOES-16 in late 2020 makes the correction invalid. Hence, it is highly recommended that users use the arcjet flag data quality bit named `potentially_degraded_due_to_arcjet_firing_qf` to flag the periods contaminated by arcjet firings.
4. The `amb_mag_*` variables in the L1b files refer to the best observation of the geomagnetic field, which is currently set to the outboard sensor values due to issues with the inboard sensor. This variable should be the default magnetic field observation used by users for science and technical investigations.
5. The outboard sensor observations show slow diurnal and seasonal variations in magnitude when compared to other GOES satellites and models. We are currently investigating this issue and some of these variations are likely due to outboard sensor thermal issues, while others may be due to issues with other GOES sensors and inaccuracies in magnetic field models. The maximum magnitude variation due to the thermal issues on the GOES-16 outboard sensor is likely to be no more than about 5 nT.

Contact for further information: OSPO User Services at [SPSD.UserServices@noaa.gov](mailto:SPSD.UserServices@noaa.gov)

NCEI contact for specific information on the MAG L1b data:

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NCEI website for GOES-R Space Weather data: <https://www.ngdc.noaa.gov/stp/satellite/goes-r.html>

#### References:

Loto'aniu, T. M., Redmon, R., Califf, S., Singer, H. J., Rowland, W., Macintyre, S., Chastain, C., Dence, R., Bailey, R., Shoemaker, E., Rich, F. J., Chu, D., Early, D., Kronenwetter, J., and Todirita, M. (2019) The GOES-16 Spacecraft Science Magnetometer, *Advances in Space Research*, 215: 32.  
<https://doi.org/10.1007/s11214-019-0600-3>.

Califf, S., Early, D., Grotenhuis, M., Loto'aniu, T. M., & Kronenwetter, J. (2020) Correcting the arcjet thruster disturbance in GOES-16 magnetometer data. *Space Weather*, 18, doi:10.1029/2019SW002347.

Califf, S., Loto'aniu, T. M., Early D., and Grotenhuis, M. (2019) Arcjet Thruster Influence on Local Magnetic Field Measurements from a Geostationary Satellite, *Journal of Spacecraft and Rockets*, Vol. 57, No. 1, doi:10.2514/1.A34546