

GOES-18 SEISS MPS-HI Level 1b (L1b) Data Release
Provisional Data Quality
October 11, 2022
Updated: December 8, 2023
Read-Me for Data Users

The Peer Stakeholder - Product Validation Review (PS-PVR) for the GOES-18 Space Environment In-Situ Suite (SEISS) Magnetospheric Particle Sensor – High Energy (MPS-HI) L1b Provisional Maturity was held on October 11, 2022. As a result of this review, the PS-PVR panel chair has declared that the MPS-HI L1b data are at Provisional Validation Maturity as of October 11, 2022.

The MPS-HI L1b data product consists of 50 keV – 4 MeV electron fluxes and 80 keV – 12 MeV proton fluxes. MPS-HI consists of 5 electron solid-state (silicon detector) telescopes and 5 proton solid-state (silicon detector) telescopes with 30-degree full-width conical fields-of-view, arranged in a north-to-south fan with field-of-view centers separated by 35 degrees.

Each electron telescope reports 10 differential channels plus a >2 MeV integral channel. Each proton telescope reports 7 channels in the 80 keV – 1 MeV range and 4 channels in the 1-12 MeV range. The highest three energy channels generally register counts above backgrounds only during solar energetic particle (SEP) events.

In addition, there are two dosimeters that distinguish dose from particles depositing < 1 MeV and > 1 MeV under domes of 250 and 100 mil aluminum shielding.

Provisional validation maturity, by definition, means:

- Validation and quality assurance activities are ongoing, and the general research community is now encouraged to participate.
- Severe algorithm anomalies are identified and under analysis. Solutions to anomalies are in development and testing.
- Incremental product improvements may still be occurring.
- Users are engaged in the Customer Forums, and user feedback is assessed.
- Product performance has been demonstrated through analysis of a small number of independent measurements obtained from selected locations, periods, and associated ground-truth/field program efforts.
- Product analysis is sufficient to communicate product performance to users relative to expectations.
- Documentation of product performance exists that includes recommended remediation strategies for all anomalies and weaknesses. Any algorithm changes associated with severe anomalies have been documented, implemented, tested, and shared with the user community.
- Testing has been fully documented;
- Product is ready for operational use and for use in comprehensive calibration/validation activities and product optimization.

Users of the GOES-18 MPS-HI L1b data bear responsibility for inspecting the data and understanding the known caveats prior to use. Below is the list of caveats that have been identified and are under analysis. Solutions are in development and testing.

1. No MPS-HI L1b data prior to declaration of Provisional Maturity should be used. NCEI will reprocess and release the early mission data using up-to-date algorithms and look-up tables.
2. Cross-comparisons among the MPS-HI electron telescopes using three months of data (June 7 to September 6, 2022) give scale factors (SF) ranging from 0.556 to 1.151 depending on the energy and telescope. These SFs have not been applied to the data, and might be revised following the application of this cross-comparison method to a longer period of data.
3. Cross-comparisons among the MPS-HI proton telescopes using three months of data (June 7 to September 6, 2022) give SFs ranging from 0.752 to 1.383 depending on the energy and telescope. Some of these differences may be due to the finite gyroradii effects of the protons, particularly at higher energies, which has not been accounted for in the present analysis. These SFs have not been applied to the data, and might be revised following the application of this cross-comparison method to a longer period of data.
4. Comparisons between >2 MeV electron fluxes observed by GOES-17 and GOES-18 MPS-HI during the month of August 2022 when the two spacecraft were only 0.4 degrees of longitude apart, show good agreement above the SWPC alert level of 1000 particle flux units. The agreement is better for telescopes 2, 3, and 4, while telescopes 1 and 5 show lower GOES-17 fluxes.
5. Comparisons between GOES-17 and GOES-18 MPS-HI electron differential channels during the period of June 6 to September 5, 2022 (three months), show excellent agreement. A small exception is telescope 5, for which the GOES-18 fluxes in certain channels are slightly lower than GOES-17.
6. Comparisons between GOES-17 and GOES-18 MPS-HI protons show that GOES-17 proton fluxes are lower by a factor of 2-4. The possibility of degradation of the GOES-17 proton channels is currently being investigated.
7. Comparisons of solar proton observations by GOES-17 and GOES-18 MPS-HI show good agreement for most cases (with a few exceptions). Similar comparisons with GOES-16 show that channel P11 (6.5-12 MeV) of GOES-18 MPS-HI is much higher than GOES-16 P11.
8. Comparison of a Solar Energetic Particle (SEP) event (August 27-30, 2022) observed by GOES-18 MPS-HI P8-P11 (1-12 MeV) and GOES-18 SGPS P1-P4 (1-12 MeV) channels, show lower MPS-HI fluxes for P8-P10 (1-6.5 MeV) and similar fluxes for MPS-HI P11 and SGPS P4 (6.5-12 MeV). The MPS-HI and SGPS sensors have different look directions, and thus caution is required in the comparison for an SEP event during low solar wind dynamic pressure (as in the August 2022 event), as isotropy of fluxes has not been achieved.
9. Evaluation of the GOES-18 MPS-HI electron channel E9-E11 backgrounds during a three-week period (April 25 to May 17, 2022), shows that the method used to estimate the backgrounds is

successful in reducing the originally high backgrounds assumed to be due to Galactic Cosmic Rays (GCRs). A second estimate of the backgrounds during a two month period (July-August 2022), shows a varying space environment of GCR fluxes. The backgrounds will be re-evaluated again in the future, to ascertain the consistency of the current methodology.

10. Comparisons between particle detectors with different energy channels must include careful estimation of the effective energies of the channels. The broader the channels, the more sensitive such estimates are to assumptions.

Update on 12/08/2023 with regard to pre-Provisional Maturity MPS-HI L1b 1 s data (point 1 above).

The NCEI SEISS team has reprocessed the pre-Provisional Maturity MPS-HI L1b 1 s data. The reprocessed L1b data can be found at https://data.ngdc.noaa.gov/platforms/solar-space-observing-satellites/goes/goes18/l1b/seis-l1b-mpsh_science/

Comments on the first version of this reprocessing:

1. The reprocessing was conducted from the start of mission (04/25/2022) to the implementation of Algorithm Discrepancy Report (ADR) 1253 in PR.09.08.34 (PR: PRO Release, Product Readiness and Operations Release) on 09/01/2022. This ADR included the following:
 - a. Application of the results of the Bowtie analysis to all electron channels and all telescopes for correct flux specification from L0 counts.
 - b. Improved Background subtraction for electron channels E9-E11 for all telescopes.
2. The daily aggregations of the Operational L1b 1 s data files for this period were read and the following changes were made:
 - a. Substituted the Electron Differential Flux variables with the ones calculated from L0 using the Bowtie-derived Geometric Factors. Channels E9 and E10 had corrected background subtraction as well.
 - b. Substituted the Electron Differential Flux Uncertainty variables with the ones calculated from L0 using the Bowtie-derived Geometric Factors. Channels E9 and E10 had corrected background subtraction as well.
 - c. Substituted the Electron Differential Data Quality Flags (DQFs) variable with a similar variable that contains only 0 values (good data).
 - d. Substituted the Electron Integral Flux variable (E11) with the one calculated from L0 using the Bowtie-derived Geometric Factors, and corrected background subtraction.
 - e. Substituted the Electron Integral Flux Uncertainty variable (E11) with the one calculated from L0 using the Bowtie-derived Geometric Factors, and corrected background subtraction.
 - f. Substituted the Electron Integral DQFs variable (E11) with a similar variable that contains only 0 values (good data).
3. Caveats:
 - a. In order for a reprocessed file to be created, both the daily Operational L1b file and the daily L0 file for that day need to be present. If the Operational L1b file is missing, the reprocessing cannot proceed, even if the daily L0 file is present.
 - b. This version of reprocessing did not explicitly calculate the new DQFs from the new flux data, but set them all to 0 (good data). A detailed calculation of the correct DQFs will be performed in a future version of reprocessing.

Contact for further information: OSPO User Services at SPSD.UserServices@noaa.gov

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NCEI website for GOES-R Space Weather data (provides daily aggregations of MPS-HI L1b data):

<https://www.ngdc.noaa.gov/stp/satellite/goes-r.html>