

GOES-18 SEISS SGPS Level 1b (L1b) Data Release
Provisional Data Quality
September 13, 2022
Read-Me for Data Users

The GOES-R Peer Stakeholder - Product Validation Review (PS-PVR) for GOES-18 Space Environment In-Situ Suite (SEISS) Solar and Galactic Proton Sensor (SGPS) L1b Provisional Maturity was held on September 13, 2022. As a result of this review, the PS-PVR panel chair declared that the SGPS L1b data are at Provisional Validation Maturity as of September 13, 2022.

There are two SGPS sensor units mounted on each GOES-R series spacecraft, facing in the spacecraft -X and +X directions. When the spacecraft is not in the yaw-flipped configuration SGPS-X faces west and SGPS+X faces east. Each SGPS unit has three solid-state (silicon detector) telescopes T1, T2, and T3 for measuring 1-25, 25-80, and 80-500 MeV protons, respectively. All three telescopes have the same look direction (i.e., +X or -X). T1 and T2 have 60° (full cone angle) fields of view, and T3 has a 90° field of view. Each unit measures 1-500 MeV proton fluxes in 13 logarithmically spaced differential channels (P1-P10) and >500 proton flux in a single integral channel (P11). The L1b data product is one-second cadence fluxes. The channels generally register counts above backgrounds only during solar energetic particle events, except for P11 which measures galactic cosmic rays in the absence of a solar particle event.

Provisional validation maturity, by definition, means:

- Validation 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;
- Product performance has been demonstrated through analysis of a small number of independent measurements;
- Product analysis is sufficient to establish product performance relative to expectations (Performance Baseline);
- 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, and tested;
- 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 SGPS 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 SGPS L1b data processed prior to declaration of Provisional Maturity (e.g., those available from CLASS) should be used. NCEI will reprocess and release the early mission data using Provisional Maturity algorithms and look-up tables.

2. As of the date of this note, no solar proton events (SPEs) have been observed by GOES-18 with sufficiently high energies to elevate Telescope 3 (T3) channels above background levels; therefore, it has not been possible to identify all GOES-18 SGPS T3 instrument and/or calibration anomalies.
3. GOES-18 SGPS P5 is contaminated with electrons when radiation belt fluxes are elevated. The magnitude of the contamination with respect to solar proton fluxes during a SPE is small.
4. There are gaps in L1b data.
5. SGPS P1-P9 differential channels were designed and calibrated to measure SPE spectra. Outside of Solar Energetic Particle (SEP) events, when SGPS observes galactic cosmic ray protons, background fluxes reported from these channels are much higher than actual GCR fluxes.
6. GOES-18 SGPS+X T3 channels exhibit temperature dependence. The temperature dependence causes significant diurnal variations in the reported fluxes.

Pre-launch SEISS overview:

Dichter, B. K., Galica, G. E., McGarity, J. O., Tsui, S., Golightly, M. J., Lopate, C., Connell, J. J. (2015). Specification, design and calibration of the space weather suite of instruments on the NOAA GOES-R program spacecraft. *IEEE Transactions on Nuclear Science*, 62(6), 2776–2783.

Comprehensive review of SGPS measurements:

Kress, B. T., Rodriguez, J. V., Boudouridis, A., Onsager, T. G., Dichter, B. K., Galica, G. E., & Tsui, S. (2021). Observations from NOAA's newest solar proton sensor. *Space Weather*, 19, e2021SW002750.
<https://doi.org/10.1029/2021SW002750>

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

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