GOES-18 GLM Level 2 (Events, Groups, Flashes) Release
Beta Data Quality
September 16, 2022
Read-Me for Data Users

The Certification Process for GOES-18 GLM L2 Beta Maturity was held on September 16, 2022. As a result of this review, the panel chair declared the data was of Beta validation maturity.

The GLM L2 product consists of geo-located and time-stamped *events, groups, and flashes*, with associated calibrated optical amplitudes (in units of Joules).

Beta maturity, by definition, means that:

- Initial calibration applied (L1b);
- Rapid changes in product input tables / algorithms can be expected;
- Product quick looks and initial comparisons with ground truth data not adequate to determine product quality;
- Anomalies may be found in the product and the resolution strategy may not exist;
- Product is made available to users to gain familiarity with data formats and parameters;
- Product has been minimally validated and may still contain significant errors; and
- Product is not optimized for operational use.

Beta users bear all responsibility for inspecting the data prior to use and for the manner in which the data are utilized. Persons desiring to use the GOES-18 GLM Beta-maturity L2 products for any reason, including but not limited to scientific and technical investigations, are encouraged to consult the GLM Calibration/Validation science team members for feasibility of the planned applications. A summary of the GOES-18 GLM L2 product assessment at Beta declaration and known issues being resolved include:

1. **Flash Detection:** GOES-18 GLM flash detection efficiency (FDE) ranged from 75% to 79% over the field-of-view during the period September 5-16, 2022 relative to the ENGLN and GLD360 ground networks, respectively. These values are within family to GOES-16/17 GLM FDE performance. The windows employed for matching the GOES-18 GLM flashes with the ground network flashes were $\pm$1 sec and 50 km.

2. **False Events:** False events due to high energy radiation particles, aka "radiation dots" have been reduced by removing Single Group Flashes (SGFs). False events due to blooming, created from glint and/or solar intrusion, have been mitigated by a blooming filter algorithm that was developed and tested by the Instrument Vendor and then delivered to the Ground Segment; it was implemented into the Operational Environment (OE) on 25 July 2019. The blooming filter (BF) has been shown to be effective in removing a substantial fraction of blooming events, but not all of them. Slight modifications to the GOES-18 GLM optics have helped mitigate solar intrusion which has lowered the False Alarm Rate. With a matching window of $\pm$10 min (i.e., larger temporal windows are desired based on detailed simulations) the percent of false flashes was only 1.3% during the period September 5-16, 2022.

3. **Location Errors:** GOES-18 GLM flash location errors, including parallax, are on par with GOES-16/17 GLM location error analyses. The peak of the location error distribution for GOES-18 GLM is 3.5 km for the analysis period September 5-16, 2022.

4. **Timing Errors:** GOES-18 GLM timing errors are on par with GOES-16/17 GLM timing errors. The peak of the timing error distribution for GOES-18 GLM is 0.8 ms for the analysis period September 5-16, 2022.

5. **Un-signed Integer Read:** To save on storage space, some floating-point variables (such as times, latitude, and longitude) are stored in the GLM NetCDF file as a lower resolution internal format with a "scale_factor" and "add_offset" attribute. Some of the GLM data is stored in a non-standard format (as unsigned integers). This affects multiple instruments on GOES-16/17, and a pilot fix was worked via ADR 844 with implementation into the OE on 5 November 2018. For additional details on this subject, see the GOES-16 GLM Level 2 Data Full Validation Data Quality Product Performance Guide For Data Users.

6. **Gridded Data & Data Quality Products:** A suite of gridded products tailored to the GLM characteristics and National Weather Service (NWS) forecaster needs was initially deployed via experimental generation and distribution channels. This gridded product processing has been integrated into the developmental version of the Ground Segment software. Once fully validated, the operational NESDIS implementation will replace the experimental NWS version. Future updates will populate a data quality field to provide forecasters additional real-time information on the GLM data quality. The gridded products succinctly summarize important GLM information not easily extracted from the L2 files. These products move beyond lightning flash frequency to convey the full spatial extent of lightning flashes, as well as their size, duration, intensity, and other important characteristics.

7. **Data Recommended:** The Calibration Working Group (CWG) recommends that GOES-18 GLM data on or after September 2, 2022 is best to use.

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

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