GOES-19 ABI L2+ Derived Motion Winds (DMW) Release
Provisional Data Quality
January 29, 2025
Read-Me for Data Users

The GOES-R Peer Stakeholder - Product Validation Review (PS-PVR) for GOES-19 Advanced Baseline Imager (ABI) L2+ Derived Motion Winds (DMW) Provisional Maturity was held on January 29, 2025. As a result of this review, the PS-PVR panel chair declared that the ABI DMW product has reached Provisional Maturity.

The GOES-R ABI DMW product is generated from a sequence of images and provides an estimate of atmospheric motion (Speed, Direction, Height) for a set of targeted tracers (cloud edges or moisture gradients in clear air conditions) viewed in selected spectral bands. Winds are retrieved separately from ABI bands 2 (0.64um), 7 (3.9um), 8 (6.2um), 9 (6.9um), 10 (7.3um), and 14 (11.2um). Collectively, the winds retrieved from all of these bands make up the DMW product. The DMW product is generated once an hour for every ABI Full Disk (FD) of the Earth, every 15 minutes over the Continental United States (CONUS) region, and every 5 minutes over the Mesoscale (MESO) regions.

- *Measurement range*: Speed: 3-155 m/s; Direction: 0 - 360 degrees.
- *Temporal coverage*: ABI band 2 DMW product is generated during daytime with solar zenith angles less than 90 degrees. ABI band 7 DMW product is generated during night time with solar zenith angles greater than 90 degrees. ABI bands 8-10 and 14 DMW products are produced during daytime and night time.
- *Refresh*: Full Disk (FD) DMW products (all bands) are produced every 60 minutes when ABI is in Mode 6 and every 15 minutes when the ABI is in Mode 4. Continental United States (CONUS) DMW products (all bands) are produced every 15 minutes when ABI is in Mode 6 or Mode 4. Mesoscale DMW products (all bands) are produced every 5 minutes when the ABI is in Mode 6.
- *Spatial coverage*: The DMW products (all bands) are produced over the ABI Full Disk (FD), CONUS, and Mesoscale domains. The spatial coverage of good DMW retrievals is limited to satellite zenith angles less than or equal to 62 degrees.
- *Spatial resolution*: The spatial resolution of the DMW band 2, bands 7-10, and band 14 products at nadir are 7.5km, 30km, and 38 km, respectively.
- *Quality*: Evaluation of GOES-19 DMW products (FD, CONUS, Mesoscale) with collocated rawinsonde and aircraft wind measurements for the period November 1, 2024 – January 10, 2025 indicate mean biases (i.e., accuracy) in the range ~ 3.0 m/s (at 950 mb) to ~ 5 m/s (at 200 mb) which fall well within the 7.5 m/s requirement. The standard deviation (i.e., precision) of these mean biases fall within the range of ~ 2.5 m/s (at 950 mb) - ~ 3.7 m/s (at 200 mb) which fall well within the 4.2 m/s requirement.

The DMW product quality is sensitive to upstream processing, such as the quality of calibration, image navigation and registration (INR), cloud mask, cloud phase, and cloud height.

A full description and format of the DMW product can be found in the Product Definition and User's Guide (PUG) Volume 5: Level 2+ Products, located on OSPO's GOES-R documents webpage: https://www.ospo.noaa.gov/Organization/Documents/goes-r.html. The algorithm used for deriving the DMW product from ABI observations is described in "Enterprise Algorithm Theoretical Basis Document for Derived Motion Winds", located on STAR's GOES-R ATBD webpage: https://www.star.nesdis.noaa.gov/goesr/documentation_ATBDs.php.

Provisional maturity, by definition, means that:

- 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 obtained from select locations, periods, and associated ground truth or field campaign efforts;
- 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, tested, and shared with the user community;
- Testing has been fully documented; and
- Product is ready for operational use and for use in comprehensive calibration/validation activities and product optimization.

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-19 ABI DMW product for any reason, including but not limited to scientific and technical investigations, are encouraged to consult the NOAA algorithm working group (AWG) scientists for feasibility of the planned applications.

Known DMW product issues being resolved include:

- An anomalous number of GOES-16/18/19 DMW products with heights at 986 hPa. The DMW algorithm uses the upstream pixel-level cloud-top pressure product in the determination of the DMW height assignment, so this issue will be resolved with a future update of the cloud height algorithm. Fortunately, this issue only mildly impacts the overall quality of the GOES-16/18/19 DMW products.

- There is a known and documented cold bias associated with the GOES-19 ABI band 13.3um observations relative to GOES-16 ABI band 13.3um observations. Based on comparisons of the GOES-19 DMW products to spatially and temporally collocated GOES-16 DMW products

and reference/ground truth wind observations (e.g., GFS analysis winds), the impact of the observed bias of the GOES-19 ABI band 13.3um observations on the DMW product is a slight (~ 30 hPa) shift in the distribution of DMW winds above ~ 450 hPa to higher altitudes. This shift manifests itself in a slight change (~ -0.5 m/s) in the mean speed of GOES-19 DMWs above ~450 hPa relative to the mean speed of reference/ground truth winds at nearly the same time and location.

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