GOES-18 ABI L2+ Derived Motion Winds (DMW)
Full Data Quality
March 3, 2025
Read-Me for Data Users

GOES-R Advanced Baseline Imager (ABI) L2+ products will achieve Full Validation maturity by default after two years of Provisional and Operational use with no major anomalies reported (minor product improvements may still be occurring). As a result, GOES-18 Derived Motion Winds (DMW) is considered Full Validation maturity as of January 4, 2025.

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.

The NESDIS enterprise version of the winds algorithm was implemented into the operational GOES-R ground system on February 6, 2024 and replaces the baseline version of the winds algorithm. The enterprise winds algorithm is fundamentally the same as the baseline winds algorithm, but some important updates have been introduced to the enterprise winds algorithm. The first update is the introduction of a check on the satellite zenith angle of each target scene. Any target scene whose satellite zenith angle exceeds 70 degrees is discarded. The other updates include changes to the quality control applied to the retrieved winds. The first of these involves checking the realism of the cloud phase associated with each target scene and the second includes slightly reducing the thresholds associated with the vector difference test that compares retrieved longwave infrared (LWIR; ABI band 14) or Cloud-top water vapor (ABI band 8) winds against the NCEP GFS forecast wind.

A full description and format of the baseline 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 enterprise algorithm description will be added to a future PUG revision.

Both the baseline and the enterprise versions of the algorithm used to derive the DMW product from GOES-18 ABI observations are described in their respective algorithm theoretical basis documents (ATBDs) located on STAR's GOES-R ATBD webpage: https://www.star.nesdis.noaa.gov/goesr/documentation_ATBDs.php. The baseline version is described in the document "GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document For Derived Motion Winds". The enterprise version is described in detail in the "Enterprise Algorithm Theoretical Basis Document for Derived Motion Winds".

Full maturity, by definition, means that:
- Validation, quality assurance, 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 operationally optimized, as necessary, considering mission parameters of cost, schedule, and technical competence as compared to user expectations.
- All known product anomalies are documented and shared with the user community.
- Product is operational.

Persons desiring to use the GOES-18 ABI Full maturity DMW products for any reason, including but not limited to scientific and technical investigations, are encouraged to consult the NOAA/NESDIS/STAR Algorithm Working Group (AWG) scientists for feasibility of the planned applications. The DMW product is sensitive to upstream processing that includes the quality of the calibration, navigation, cloud mask, cloud type/phase, and cloud top pressure. The quality of the derived winds is highly dependent on the quality of the cloud-top pressure product which is used to assign heights to the derived winds. The enterprise winds products, particularly those above 400 mb, benefit from the operational implementation of the NESDIS enterprise cloud height algorithm which has been tuned to retrieve improved cloud heights.

Status of the DMW product:
1. The DMW product performance has improved with the implementation of the enterprise cloud height and winds algorithms.
2. Summary of the measured performance of the DMW product as measured against spatially and temporally collocated reference data (e.g., radiosonde, aircraft, and GFS analysis winds):
   - Accuracy specification (7.5 m/s) are met for all winds generated from each of the ABI bands (i.e., Bands 2, 7, 8 (Cloud Top Water Vapor), 8 (Clear-sky Water Vapor), 9-10 (Clear-Sky Water Vapor), and 14)
   - Accuracy specification (4.2 m/s) are met for all winds generated from each of the ABI bands (i.e., Bands 2, 7, 8 (Cloud Top Water Vapor), 8 (Clear-sky Water Vapor), 9-10 (Clear-Sky Water Vapor), and 14)
3. Further work is planned to improve the use of cloud height quality flag information which is expected to result in some further improvement of the performance of the wind products.

Known DMW product issues being resolved include:
1. An anomalous number of GOES-18 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-18 DMW products.

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