**Readme File for DAWN\_V4 Data**

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**Update: 05/23/18**

**As of 05/23/18, Version4 files have only been processed for the CPEX missions of 060617 and 061017.**

**In this Version, not only are is there, like previously, a Profile Ascii file that contains all the base data and the adaptive integration data (\_ALL\_SORT) but also separate files for both (\_base and \_integ). Changes/additions are highlighted in yellow.**

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**Update: 04/24/18**

**On 03/07/18, the start of Version4 changed the format and added content to the LOS file. The new information included the mean latitude, mean longitude, and the azimuth and elevation angle in Earth coordinates for each look or stare and, more importantly, the latitude and longitude at each range gate of each stare. Changes/additions are highlighted in yellow.**

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**Update: 03/07/18**

**On 03/07/18, the Version 3 data for the remaining eight days (May 31, June 1, June 2, June 6, June 10, June 17, June 19, and June 24 were made available to the CPEX Science Team. For these days, by not including the data in turns/rolls and ascents/descents we have tried to include only the “good” vertical profile ascii data and los ascii data. However, the .png images and the .kmz files which show the flight tracks are included for all profiles.**

Included in this Version4 release are ascii files and .png images of the DAWN vertical profiles of SNR, wind speed, and wind direction, as well ascii files containing line-of-sight (LOS) wind measurements, and .kmz files (still reflecting Version3 profiles) showing (for Google Earth) the DC-8 flight tracks on each mission with embedded wind and snr profile images for each DAWN profile location. Currently, images and profiles are provided for all DAWN scans even when roll and climb/ascent prevented the accurate calculation of DAWN profiles (missing images and data). In these instances, the LOS measurements for each look or angle still provide valuable information, especially for modelers.

The times of the files are LST/EST except for May 27 and May 29 which are 3 hours earlier because the time was still being recorder on PST as it was during the test flight.

The DAWN profiles being provided at this time have been processed with DAWN\_V4 software. DAWN\_V0 was used to generate the “Quick Look” profiles available in near real time during the CPEX campaign.

The primary upgrades from V0 to V3 were the following:

1. DAWN pointing angles have been calibrated using surface returns from the ground (mostly the Florida peninsula and Cuba).
2. For the scans using more than 2 looks (usually 5 looks) velocities have been computed using the available data at fewer than 5 looks (minimum 2 looks). Number of look angles used to compute wind speed and direction is noted in the ASCII file (see “Notes” on next page)
3. For DAWN\_V3 processing, a multi-pass strategy is used. First a “baseline” product is generated with the following rules:
4. 75 m LOS range gates are used to obtain the “high resolution” profiles. While the shortest-range gate for DAWN is ~ 30 m, we have found that 75 m is optimal for V3. Should a researcher want the 30 m LOS product, that can be provided but will be only useful in areas with high aerosol/cloud returns.
5. A sliding range gate of 37 m is used to display and report wind estimates. Thus, there is some overlap between adjacent levels.
6. The quality thresholds are very relaxed for this product and thus it will tend to be noisy when the signal is weak. The two quality tests set for “baseline reasonable quality” are the Signal-to-Noise Ratio (SNR) for individual LOS products and the Goodness of Fit (GOF) for the vector products derived from a best fit solver.
7. Adaptive integration (new SWA algorithm) has been applied to the DAWN data to improve (vastly) the vertical coverage in V3 compared to V0. See file entitled “Adaptive Signal Integration Algorithm” for more detail on this process.
8. All DAWN data collection during turns with banks greater than 2° or climb/descents greater than 3 m/s have been withheld from distribution in V3. V4 will include soundings obtained under those conditions.
9. A value for the 10-m wind speed is plotted in yellow. At this time this wind speed is only a suggestion and is not to be used for analysis. The wind speed value is computed using the following equation:

 U10M = Uref \* (10/Zref).143

After the baseline product is generated, the Adaptive Signal Integration Algorithm (ASIA) is applied to the LOS data. The rules for the ASIA V3 process are:

1. Select a minimum signal integration length equal to 8 \* the baseline range gate. In the V3 case, this minimum ASIA length would be 8\*37 = 296 (~ 300 m vertical).
2. For the first pass through the ASIA process, an integrated length of 5 \* the minimum ASIA length is used. For V3 processing this maximum ASIA length is 5\*8\*37 = 1480 (~ 1300 m vertical).
3. The SNR thresholds for passing data on to the solver is tighter for the ASIA product than for the baseline product. The GOF threshold is also tighter for the ASIA product than for the baseline product. The reasoning is that the ASIA products should be the “best” products the integration will produce. This is not saying that the baseline products are all, as a class, less reliable. In V3 we allowmore marginal base line products to be viewed just in case the researcher wishes to mine those noisy baseline values for “good” data at very high vertical resolutions.

Other Notes:

1. Ignore values below z=0. They are just there to confirm surface heights.
2. Recommend using integration type “o” values with care and where 65 m vertical resolution is desired. Otherwise use integration type “1” for the higher resolution product.
3. For most complete profiles, use integration type 1-5 data and note the integration depth.

**Version4**

Foe Version4, we have included the mean latitude, mean longitude, and the azimuth and elevation angle in Earth coordinates for each look or stare and, more importantly, the latitude and longitude at each range gate of each stare.

The following is a step-by-step instruction on how to use the LOS data with model data (such as the WRF in this case) for comparisons.

**Step 1:** Read DAWN LOS file and get Aearth(position3) and Eearth(position4) in second line of file (for first look). For subsequent look angles, the Aearth and Eearth are in the line preceding the LOS data in the LOS file.

**Step 2**: Loop through the LOS speeds (column 9) and heights (column 7) and get latitude (column 5), longitude (column 6) and LOS speed for each reported height.

**Step 3**: Interpolate WRF gridded u,v,w data to LOS segment’s (gate’s) lat, lon and height (AMSL)

**Step 4**: Compute projection of the WRF u,v,w at the location determined in Step 3 on to the DAWN LOS using the following logic:

A = Azimuth in earth’s coordinates of the DAWN LOS (CW with 0 at north)

E= Elevation of DAWN’s LOS relative to the vertical (usually around 30 degrees).

AZ= mathematical transform of A for computations = 450-A (now in CCW system with 0 pointed east)

EL= LOS angle above the horizon = 90 -E

WRF projected LOS= -(u\*COS(AZ)+v\*SIN(AZ)+w\*sin(EL))\*cos(EL)

The convention is for the DAWN LOS to be negative for winds blowing away along the LOS projection.

ASCII Profile Data

Files are provided that contains all of the base data and the adaptive integration data in one file (\_ALL\_SORT) and also separate files for both (\_base and \_integ).

Name Examples: 20170615\_132152\_132421\_6\_prof\_ver4\_ALL\_SORT.csv

 20170615\_132152\_132421\_6\_prof\_ver4\_integ.csv

 20170615\_132152\_132421\_6\_prof\_ver4\_baseT.csv

 20170615 (yyyymmdd)

 132152 (hhmmss in LST) – Beginning time of processing folder

132421(hhmmss in LST) – Time of Scan (at the start of Look #1 of scan)

 6 – Number of Scan in processed folder

Header definitions for ASCII Profile file

|  |  |  |  |
| --- | --- | --- | --- |
| Column | Parameter | Units | Comments |
| 1 | Height | m | AMSL |
| 2 | Wind Direction | deg |  |
| 3 | Wind Speed | m/s |  |
| 4 | U comp | m/s | Not computed for ASIA products |
| 5 | V comp | m/s | Not computed for ASIA products |
| 6 | W comp | m/s | Not computed for ASIA products |
| 7 | SNR | dB | Average of the LOS SNRs used in estimate |
| 8 | GOF | m/s | Output of solver (stdev of deviations from best fit) |
| 9 | # angles max | # |  |
| 10 | # angles used | # | Usually 2 or 5 |
| 11 | Latitude | deg | Mean Latitude of all shots in all angles (from (DAWN GPS) |
| 12 | Longitude | deg | Mean Longitude of all shots in all angles (from DAWN GPS) |
| 13 | A/C heading | deg |  |
| 14 | A/C altitude | m | AMSL |
| 15 | Integration length | m |  |
| 16 | Integration index | # | Use for sorting ASIA products from baseline products |
|  |  |  |  |

ASCII LOS DATA

Name Example: 20170615\_132152\_132251\_2\_los\_ver4.dat

 20170615 (yyyymmdd)

 132152 (hhmmss in LST) – Beginning time of processing folder

 132251(hhmmss in LST) – Time of Scan (at the start of Look 1 of the scan)

 2 – Number of Scan in processed folder

The following is the format for the LOS files (i.e., 20170606\_164455\_174146\_80\_los\_quick.dat)

Line 1 Example 174146 5 172

 160710 start time (LST) of scan

 2 Number of Look Angles

 172 Number of Range gates AND lines to follow

Line 2 Example 22.081 -81.816 155.258 30.3370

 22.081 Mean latitude of all shots in Look 1

 -81.816 Mean longitude of all shots in Look 1

 155.25 Azimuth Angle (earth)

 30.337 Elevation Angle (earth)

Line 3-174 – Look angle time,

 Look angle,

 Range gate number,

 aircraft heading (deg),

 latitude (deg N),

 longitude (deg W),

 range gate height (m amsl),

 SNR (dB),

 Los velocity (m/s) (Negative moving away from aircraft)

Repeated for Number of Look Angles (i.e., for Look Angles 2, 3, 4 and 5 for a 5-look angle scan)

Other Notes:

1. Ignore values below range gate height=0.

Profile Figures (.png)

Name Example: 20170615\_135337\_140450\_30\_prof\_ver4.png

 20170615 (yyyymmdd)

 135337 (hhmmss in LST) – Beginning time of processing folder

 140450 (hhmmss in LST) – Time of Scan

 30 – Number of Scan in processed folder

A .png image of the corresponding .csv profile

Contact

If you have any questions on any of the data, please contact Steven Greco at 434-979-3571 or sxg@swa.com.