Readme File for CPEX DAWN Data

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Included in this archive 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. Also provided are kmz files showing (for Google Earth and other viewers) the DC-8 flight tracks on each mission with embedded wind and snr profile images for each DAWN profile location. Images and profile data 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 SNR measurements and profiles are still valid and LOS measurements for each look or angle still provide valuable information, especially for modelers.

The times of the DAWN data files are GMT.

The DAWN profiles being provided at this time have been processed using the following:

1) DAWN pointing angles have been calibrated using surface returns from the ground (mostly the Florida peninsula and Cuba) for each mission.
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 3 looks). Number of look angles used to compute wind speed and direction is noted in the ASCII file (see "Notes" on next page)
3) A multi-pass strategy was used. First a "baseline" product is generated with the following rules:
   a) 66 m LOS range gates along each LOS are used to process the "high resolution" profiles. While the shortest possible range gate for DAWN is ~ 30 m, we have found that 66 m is optimum for processing.
   b) A sliding range gate of 33 m is used to report the wind estimates along a LOS. Thus, there is some overlap between adjacent levels.
   c) Profile measurements determined from the LOS velocities are also provided every ~ 33 m in the vertical
   d) 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.
4) An adaptive integration algorithm has also been applied to the DAWN data to improve the vertical coverage in layers of low SNR.
5) Due to contamination by aircraft motion, all DAWN PROFILE data during turns with banks greater than 1.5° or climb/descents greater than 7 m/s have been withheld from distribution. However, the LOS products are still provided.

After the baseline profile product is generated, which provides base profile measurements every 33m in the vertical, the Adaptive Signal Integration Algorithm (ASIA) is applied to the LOS data. The rules for the ASIA were:

a) Select a minimum signal integration length along each line of sight equal to 8 * the display range gate. This minimum ASIA length would be 8*~33 = ~ 266 m (vertical).
b) For the first pass through in the ASIA process, an integrated length of 5 * the minimum ASIA length is used(5*8*~33 = ~ 1330 m (vertical). Successive passes are for integrated lengths of 1063, 797, 531 and 266 m.

Other Notes:

1) Ignore values below z=0. They are just there to confirm surface heights.
2) The user is advised to view the accompanying profile figures to see if the adaptive integration product provides improved data coverage over the base product for the profile in question.
3) When using the product with both the base data and the adaptive integration data, it is best to use the base data measurement when there is more than one observation for a given height.

For the LOS data 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 one may 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

Two separate files are provided, one that contains only the base processed data (_base) and one that includes the adaptive integration data with the base data in one file (_ALL).

Name Examples: dawn_20170621_194844_195324_6_prof_final_base.csv
dawn_20170621_194844_195324_6_prof_final_ALL.csv

20170621 (yyyymmdd)
194844 (hhmmss in GMT) – Beginning time of processing folder
195324 (hhmmss in GMT) – Beginning time 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	
5	V comp	m/s	
6	W comp	m/s	Not computed
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 Line-Of-Sight (LOS) DATA

Name Example: dawn_20170621_194844_195324_6_los_final.dat

20170621 (yyyymmdd)

194844 (hhmmss in GMT) – Beginning time of processing folder

195324 (hhmmss in GMT) – Time of Scan (at the start of the scan)

6 – 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)

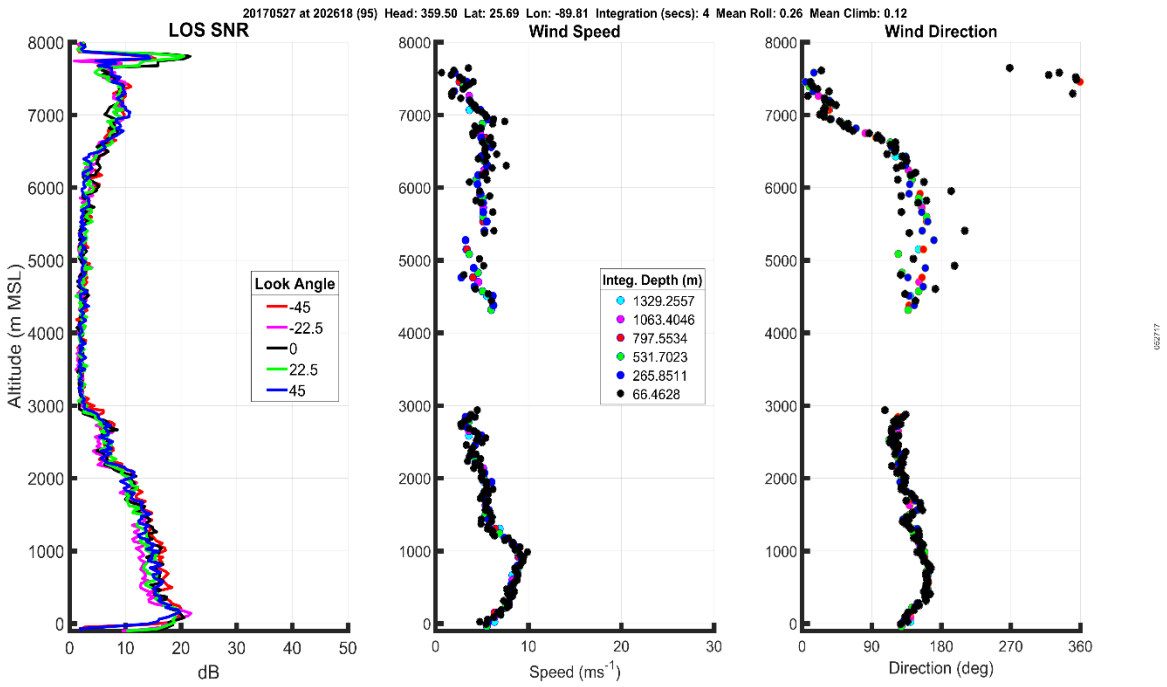
Repeated for Number of Look Angles (i.e., for Look Angles 2, 3, 4 and 5 for a 5-look angle scan)

Other Notes:

1) Ignore values below range gate height=0.

Profile Figures (.png)

A .png image of each corresponding .csv profile is provided, even in cases when profiles were not computed due to exceeding the roll or climb/descent threshold. The SNR profiles for these profiles are still valid.



Name Example: dawn_20170621_194844_195324_6_prof_final.png
20170621 (yyyymmdd)
194844 (hhmmss in GMT) – Beginning time of processing folder
195324 (hhmmss in GMT) – Start time of scan
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Flight Track and Profile Figures (kmz)

For each separate processing folder of each mission, kmz files showing (for Google Earth) the DC-8 flight tracks with embedded wind and snr profile images for each DAWN profile location are provided.

While the profile images displayed when clicking on each flight/profile location are displayed in GMT, the mouse-over labeling indicates PST for the May 29 and May 31 flights and EST for the remainder of the mission.

Contact

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