



The DAWN Lidar During CPEX 2017: Performance Assessment, Data Processing and Data Products

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NASA LaRC Doppler Aerosol WiNd (DAWN) Lidar

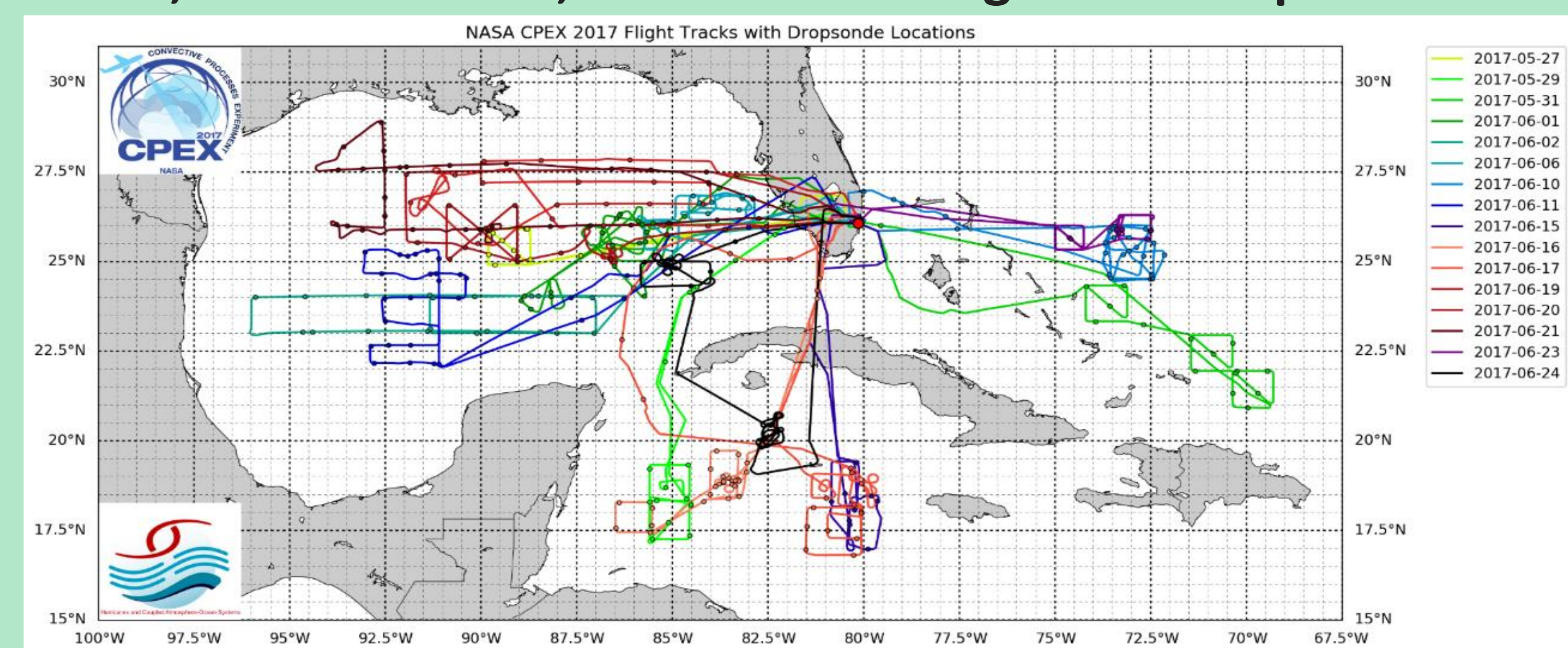


2 micron Coherent
100mJ
10Hz
2 sec LOS nominal
integration
(range 1-20 sec)



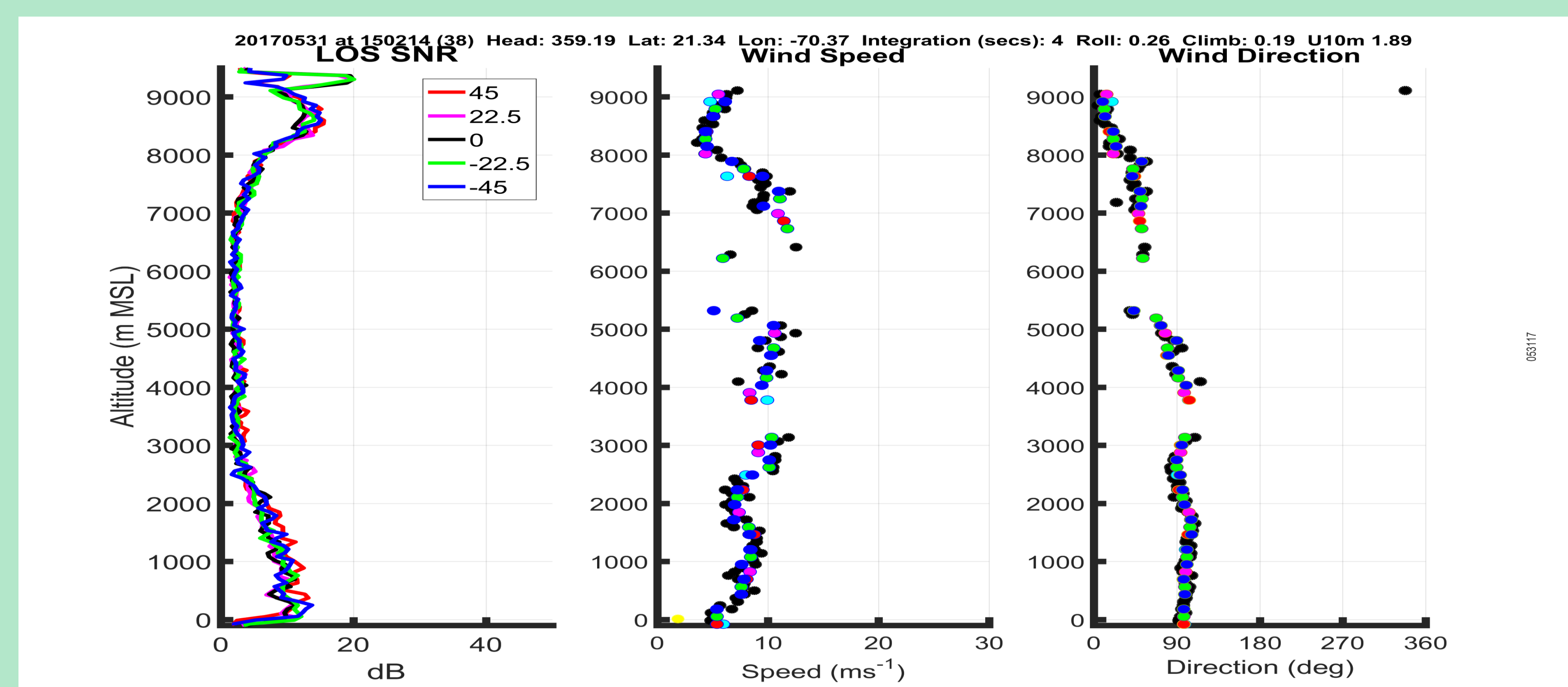
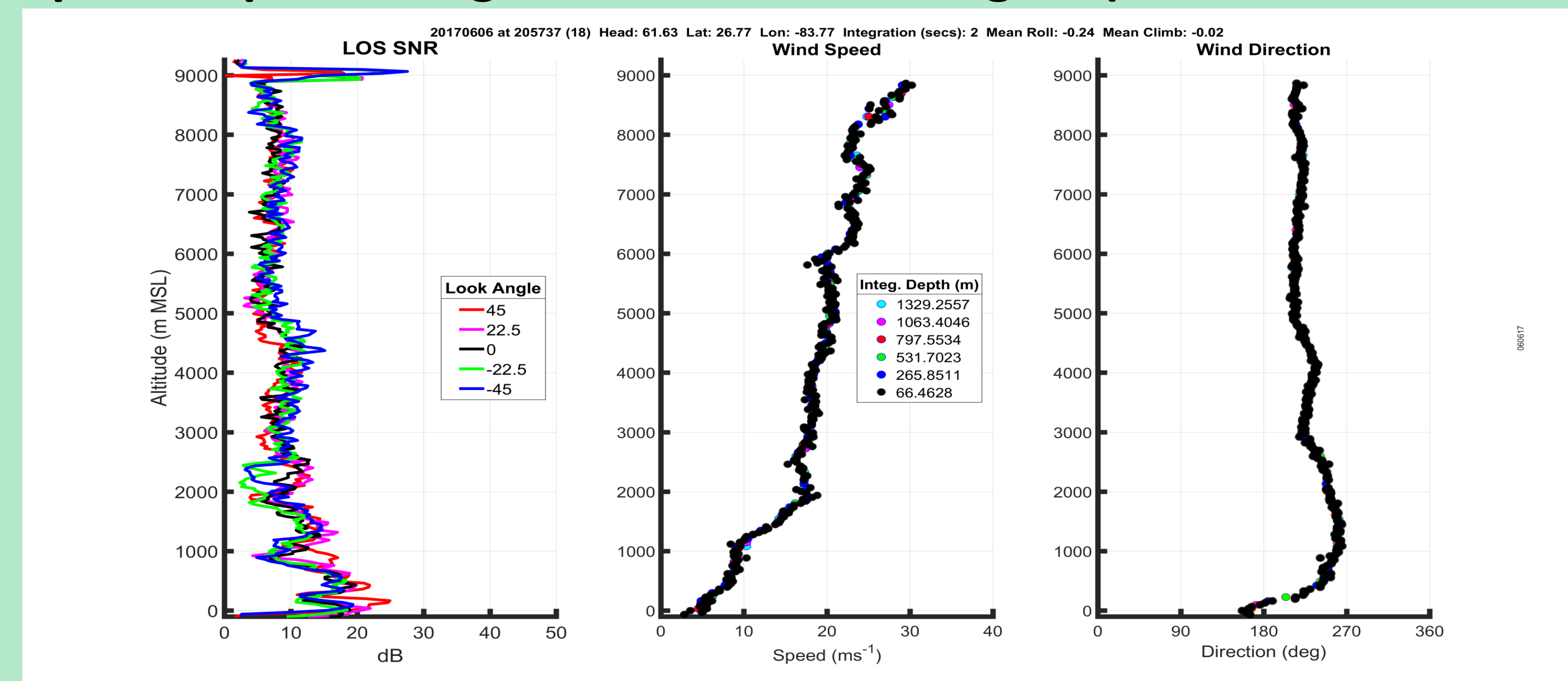
Flown on NASA DC-8 in GRIP(2011), Polar Winds II (2015) and CPEX
CPEX 2017 - 25 May – 24 June 2017

- 1) DC-8 airborne campaign based out of Ft. Lauderdale, FL
- 2) Instruments : DAWN, HDSS Dropsondes, APR-2, HAMSR, MTHP
- 3) Obtained a comprehensive set of observations, especially from DAWN, in undisturbed, scattered and organized deep convection.



DAWN Data Processing

- 1) DAWN signal return from every shot of each look used to derive LOS winds/SNR. Includes removal of LOS velocity contributions from platform motion/attitude, and frequency “jitter”.
- 2) Base vertical profiles (black dots below) derived from either a 2-look or 5-look step stare. Levenberg-Marquardt solving algorithm used.
- 3) Adaptive integration over various integration depths used to optimize processing in mid-level weak signal (colored dots below).

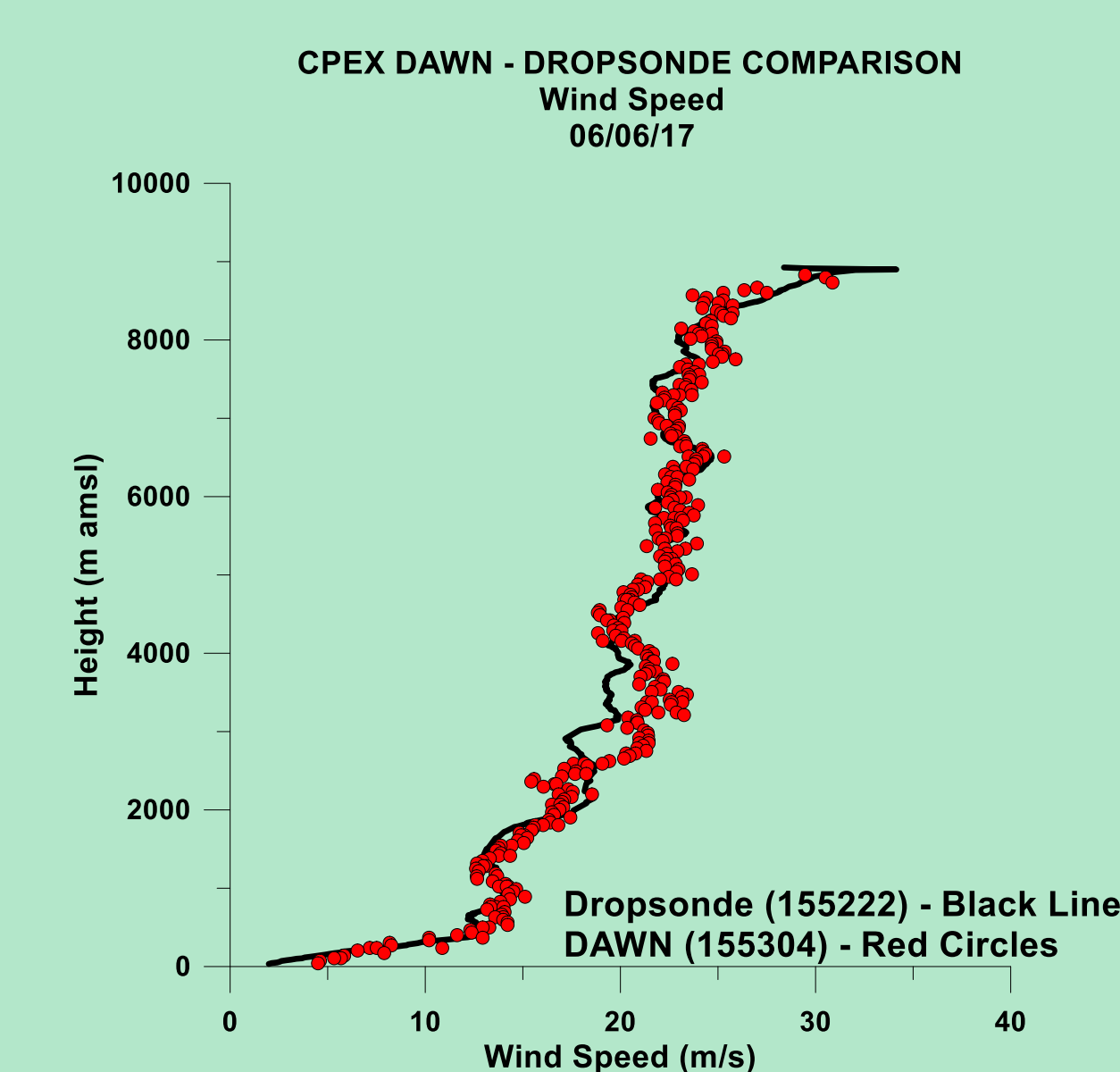
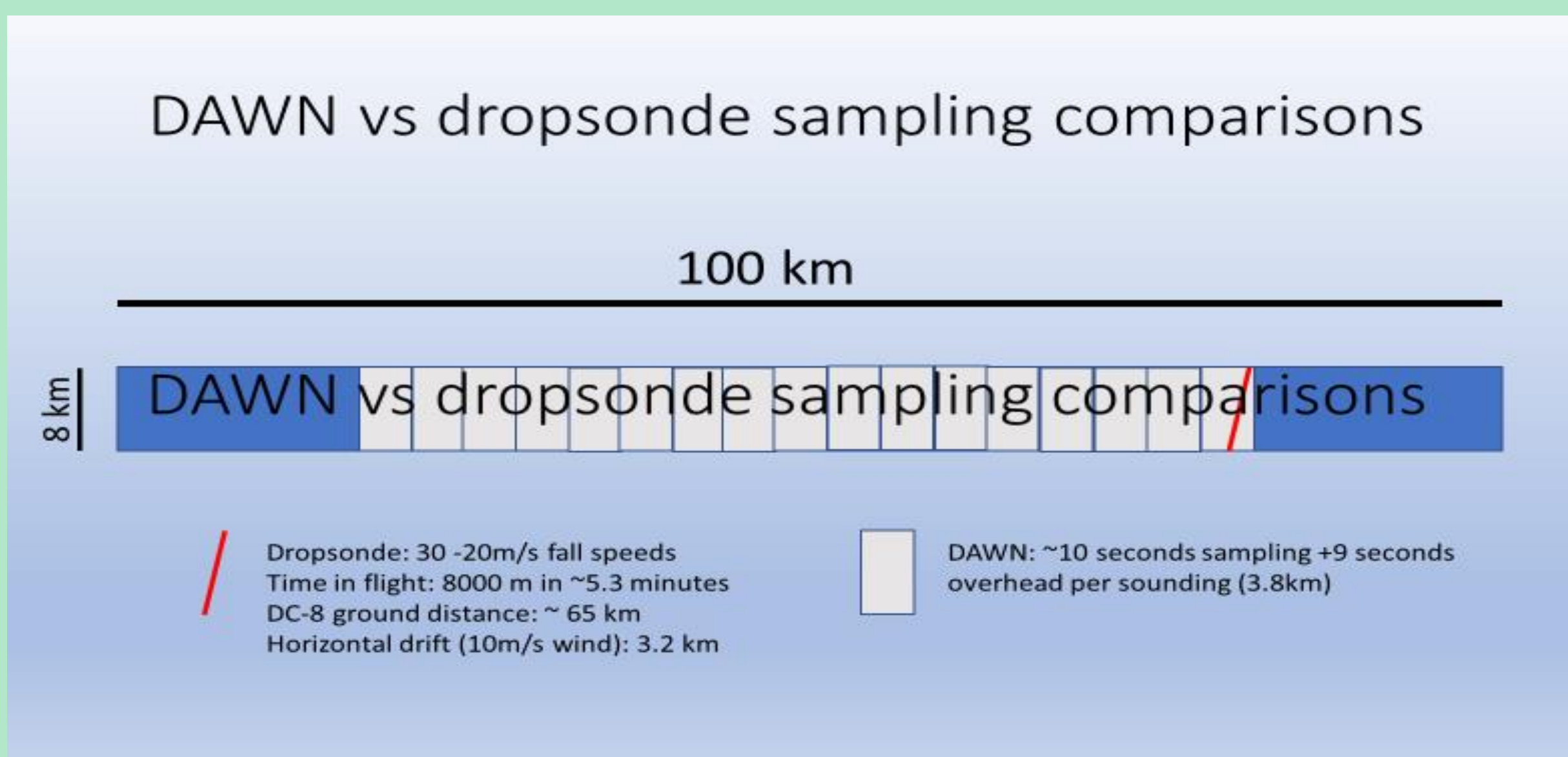


DAWN Performance during CPEX 2017

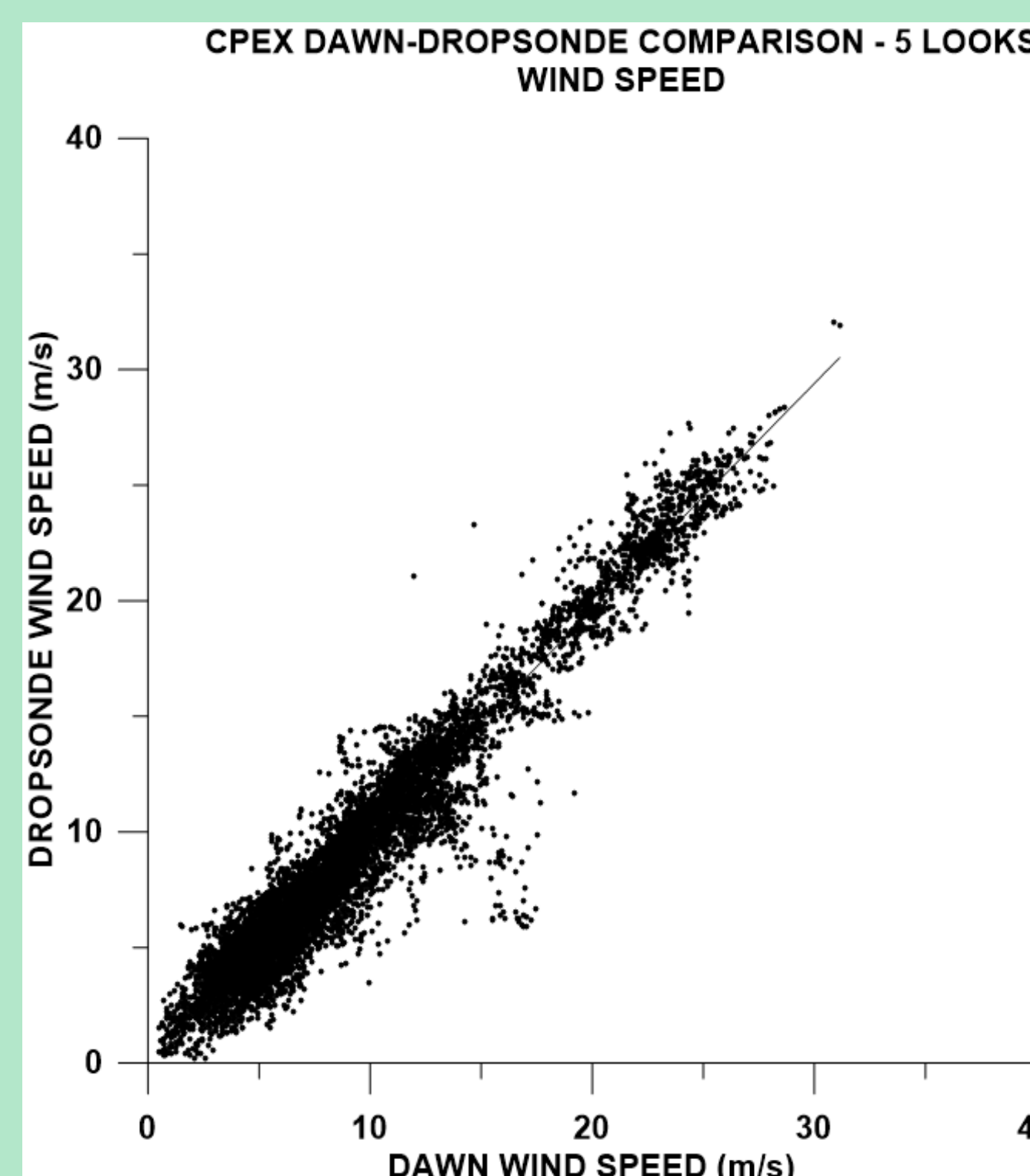
Over 5000 DAWN wind profiles taken over 16 missions:

- Vertical profiles of wind and aerosol (SNR) every 5-15 km
- Vertical resolution of 50-100 m; Vertical extent of 4-12 km.
- Over 80% of all DAWN profiles on all provided needed measurements in the upper portions of the vertical column
- Almost 50% of the DAWN profiles provided PBL measurements
- Full profiles were obtained almost 20% of the time

DAWN-Dropsonde Comparisons

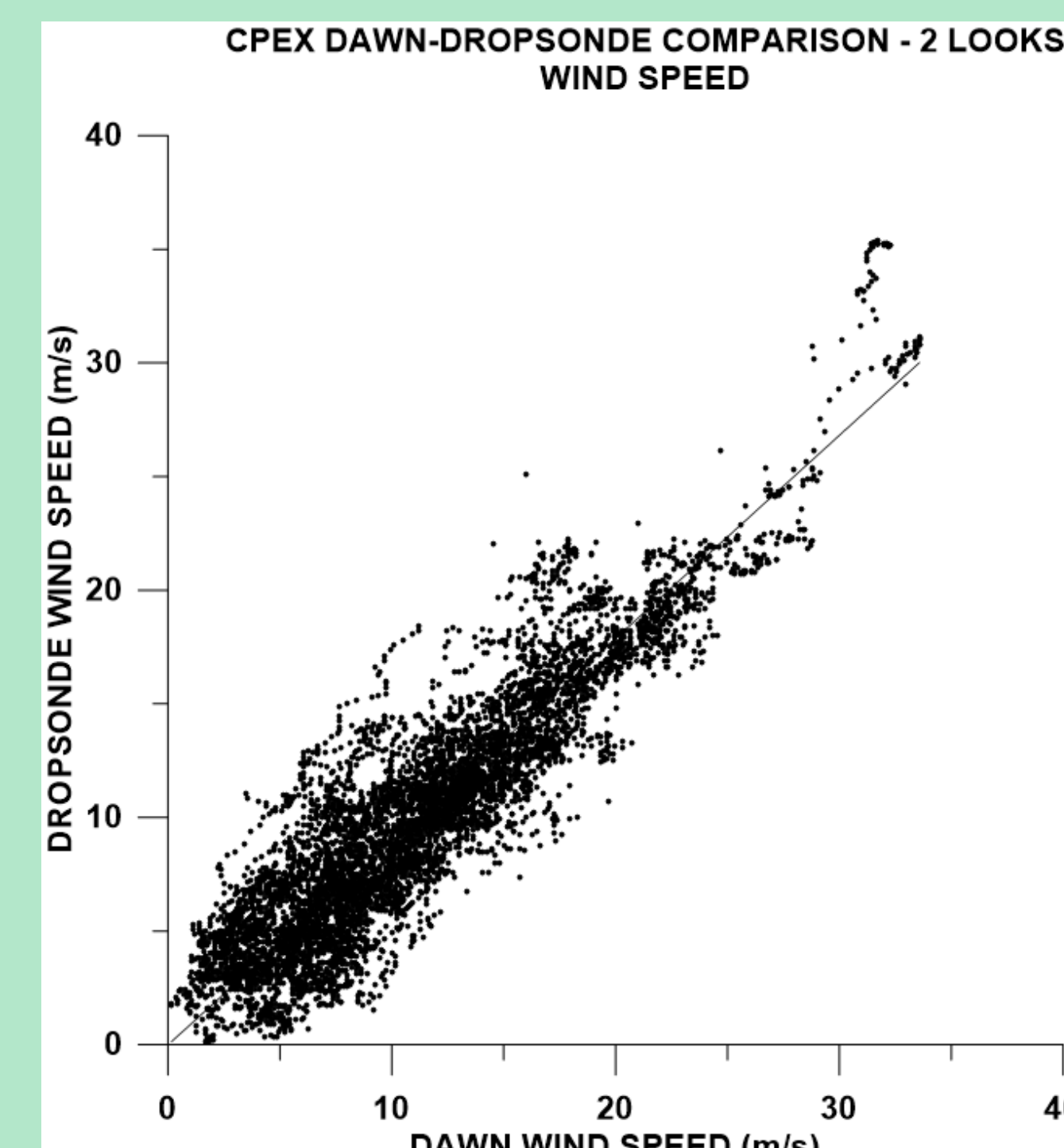
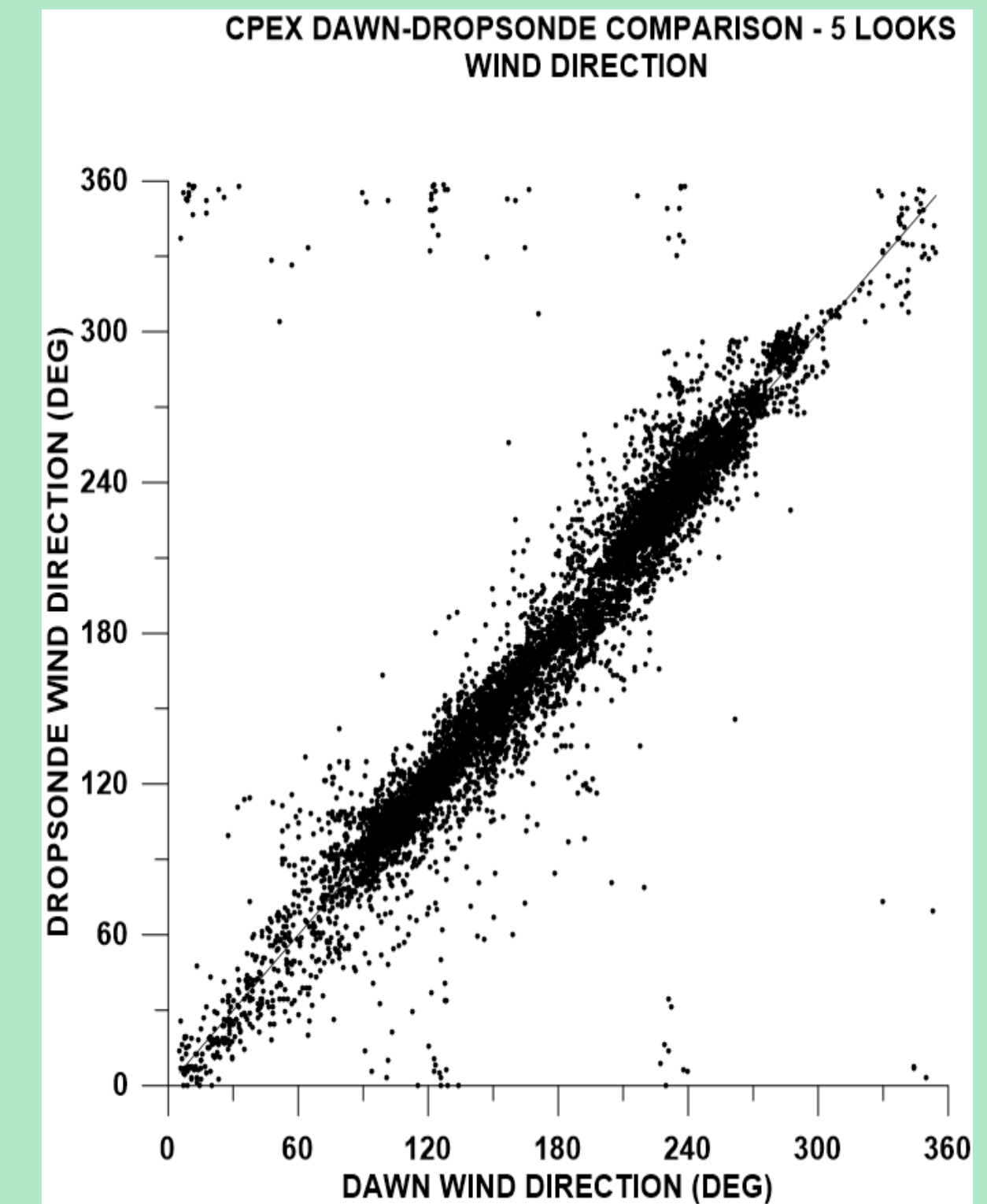


162 DAWN-Dropsonde comparison pairs were identified with 15687 comparison points. Main reason for RMSD (difference) is spatial and temporal separation of dropsonde and DAWN, especially in convective environments. 5 Look scanning was preferred in undisturbed conditions and 2 Looks, with longer integration, often used in active convection.



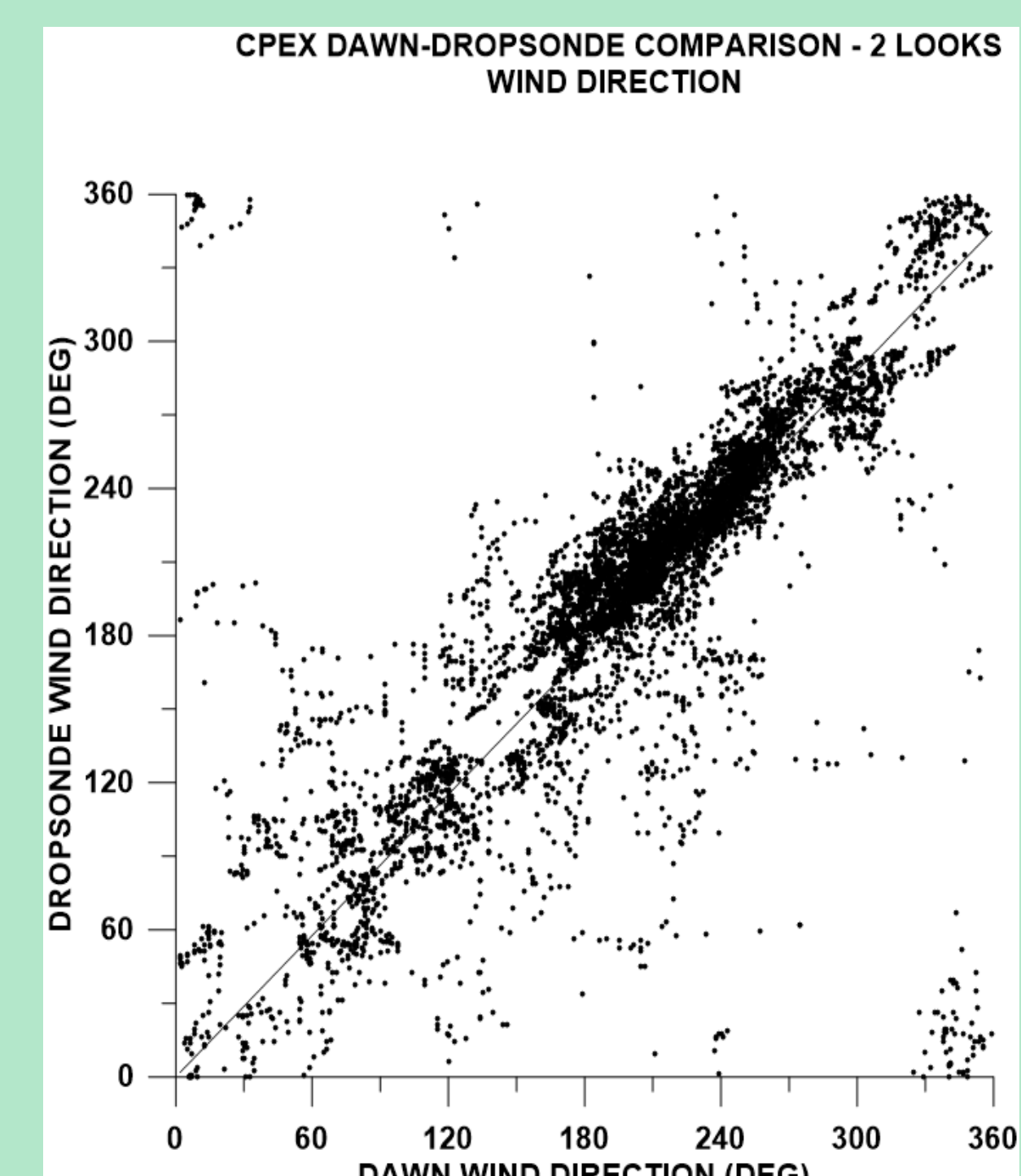
5 LOOK STATISTICS

Number = 8617
Mean $\Delta WS = 0.14$
Mean $ABS(\Delta WS) = 1.01$
 ΔWS RMSD = 1.43
Mean $\Delta WD = 0.14$
Mean $ABS(\Delta WD) = 10.1$
 ΔWS RMSE = 18.4



2 LOOK STATISTICS

Number = 6970
Mean $\Delta WS = 1.02$
Mean $ABS(\Delta WS) = 2.10$
 ΔWS RMSD = 2.5
Mean $\Delta WD = 1.16$
Mean $ABS(\Delta WD) = 19.1$
 ΔWS RMSE = 28.4



DAWN Data Products

- 1) LOS velocities and SNR along each LOS of every scan, includes height, latitude, and longitude at each range gate (for data assimilation).
- 2) Vertical profiles of SNR, wind speed, wind direction, u, v, “goodness of fit” and number of looks used in the determination of each profile.
- 3) Data will be archived at and available from the NASA LaRC Atmospheric Science Data Center (by Feb 2019).