



Recent Airborne Doppler Wind Lidar Investigations of Lower Troposphere Circulations from the Tropics to the Poles



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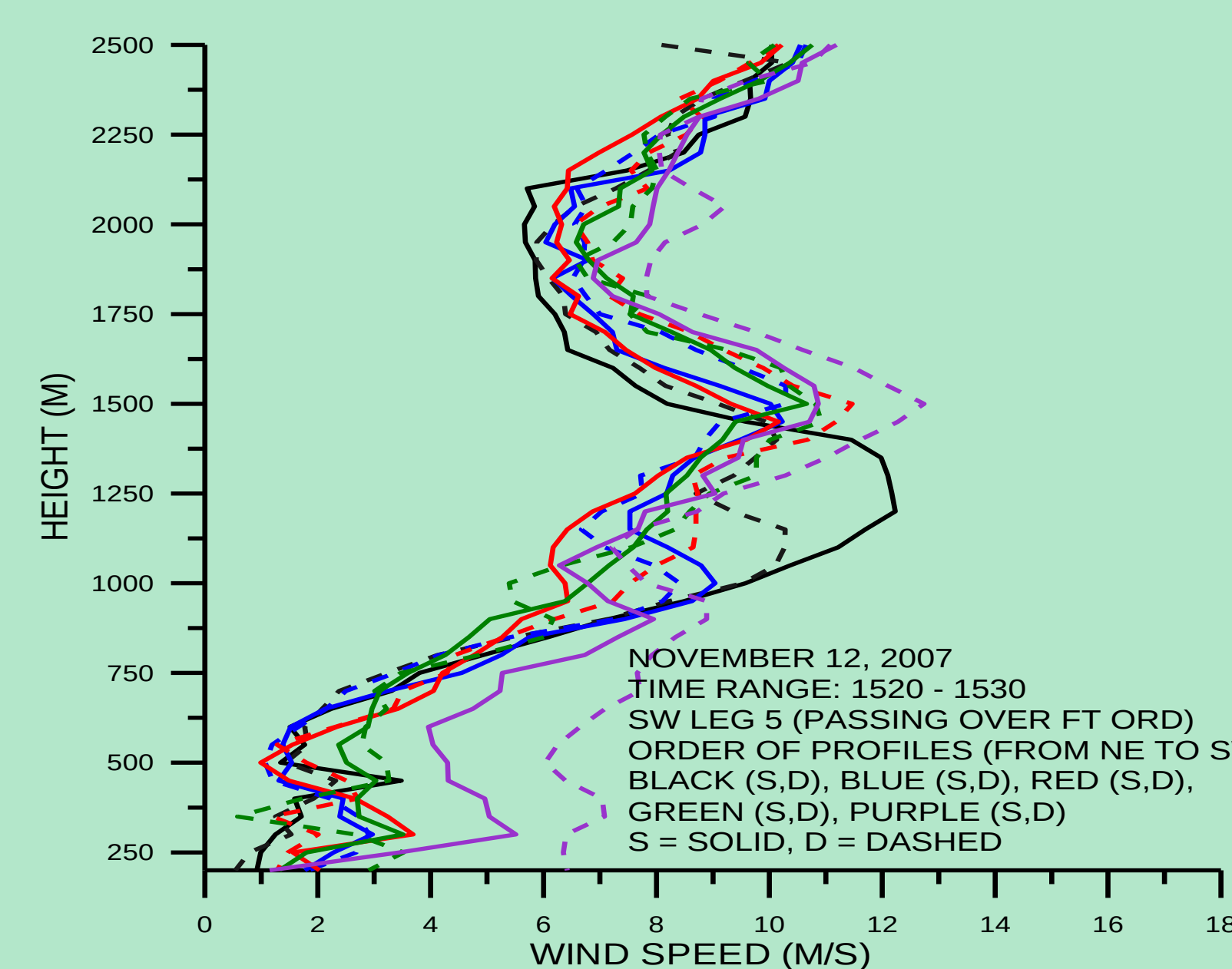
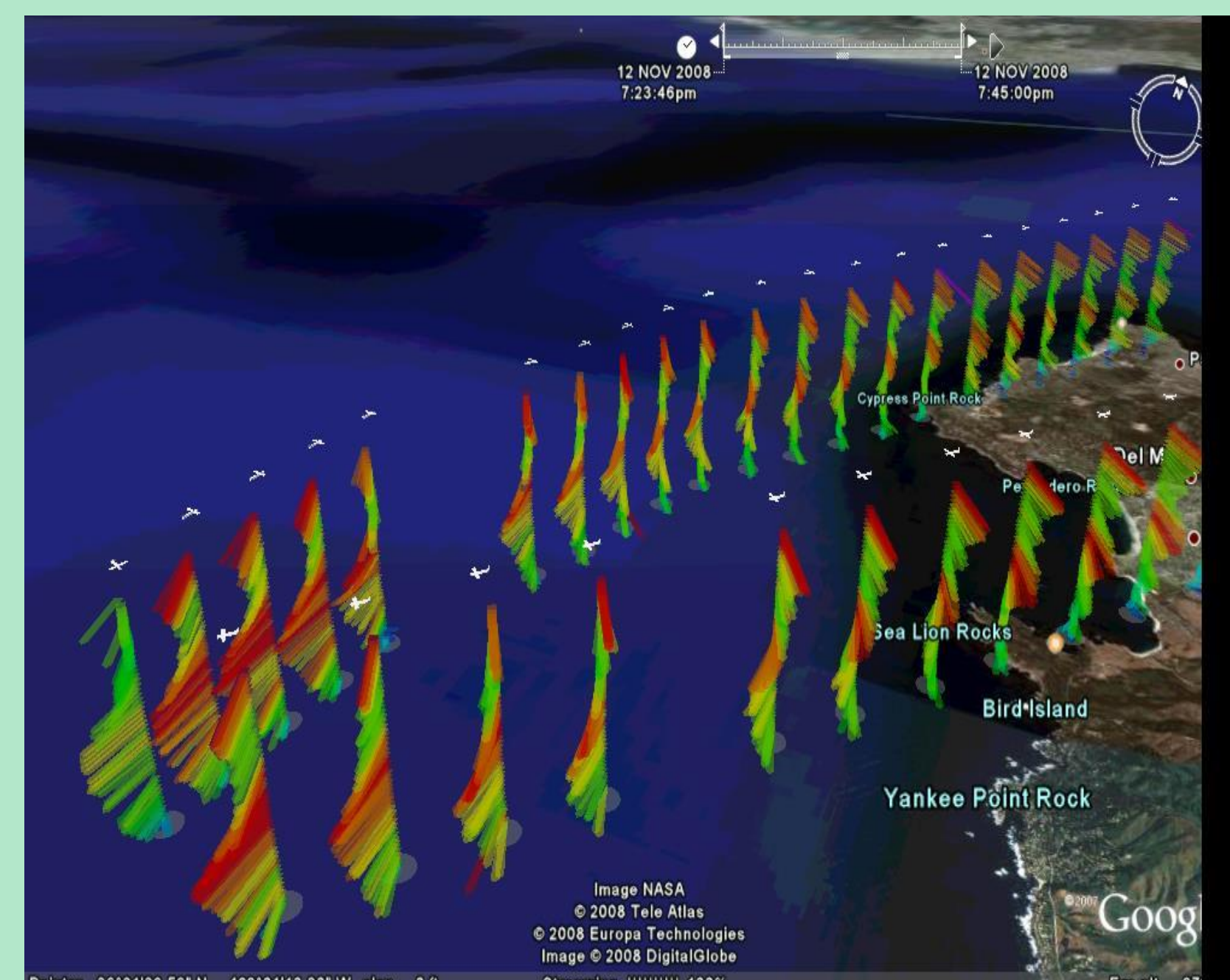
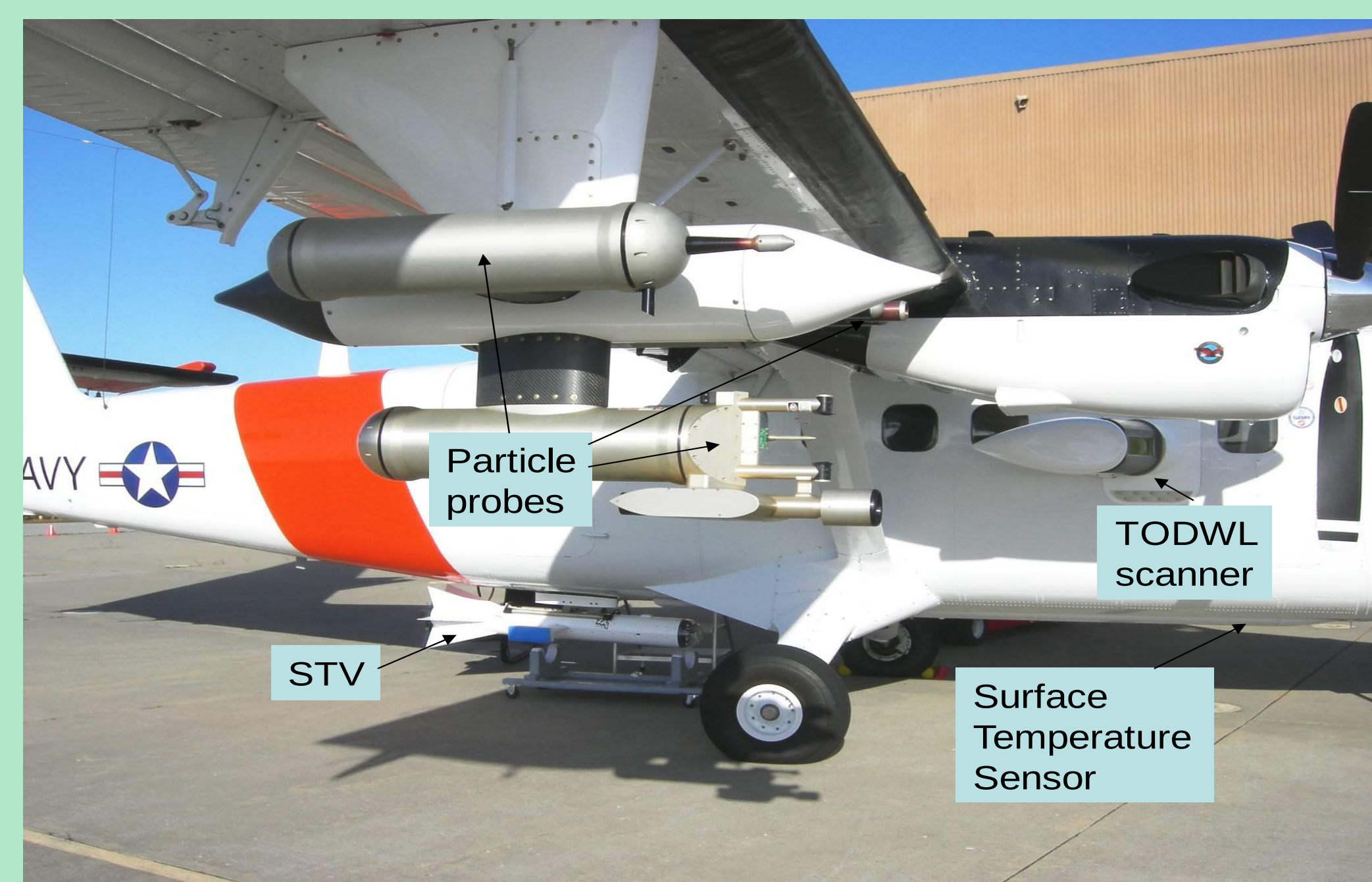
Introduction

Although there are still issues such as cost, size and availability, after over thirty-five years of development, the Airborne Doppler Wind Lidar (ADWL) is now mature enough to be called operational. Over the past ten years, Simpson Weather Associates (SWA) has participated in numerous ADWL missions and field campaigns that have allowed us to measure and investigate the 3-dimensional wind circulations of the lower troposphere and planetary boundary layer (PBL) and to compare with other observations (Profilers, dropsondes,) and models (MM5/WRF).

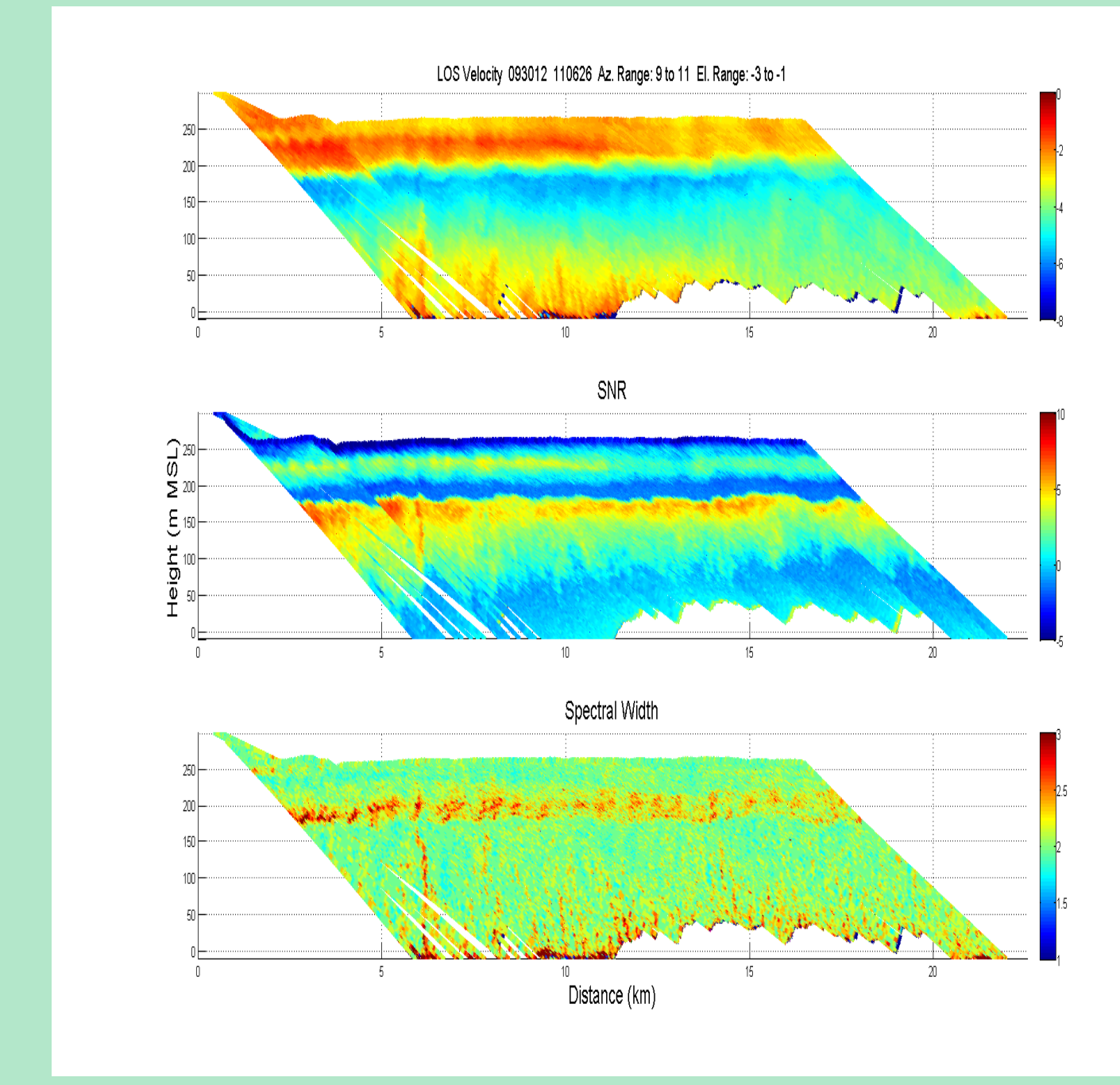
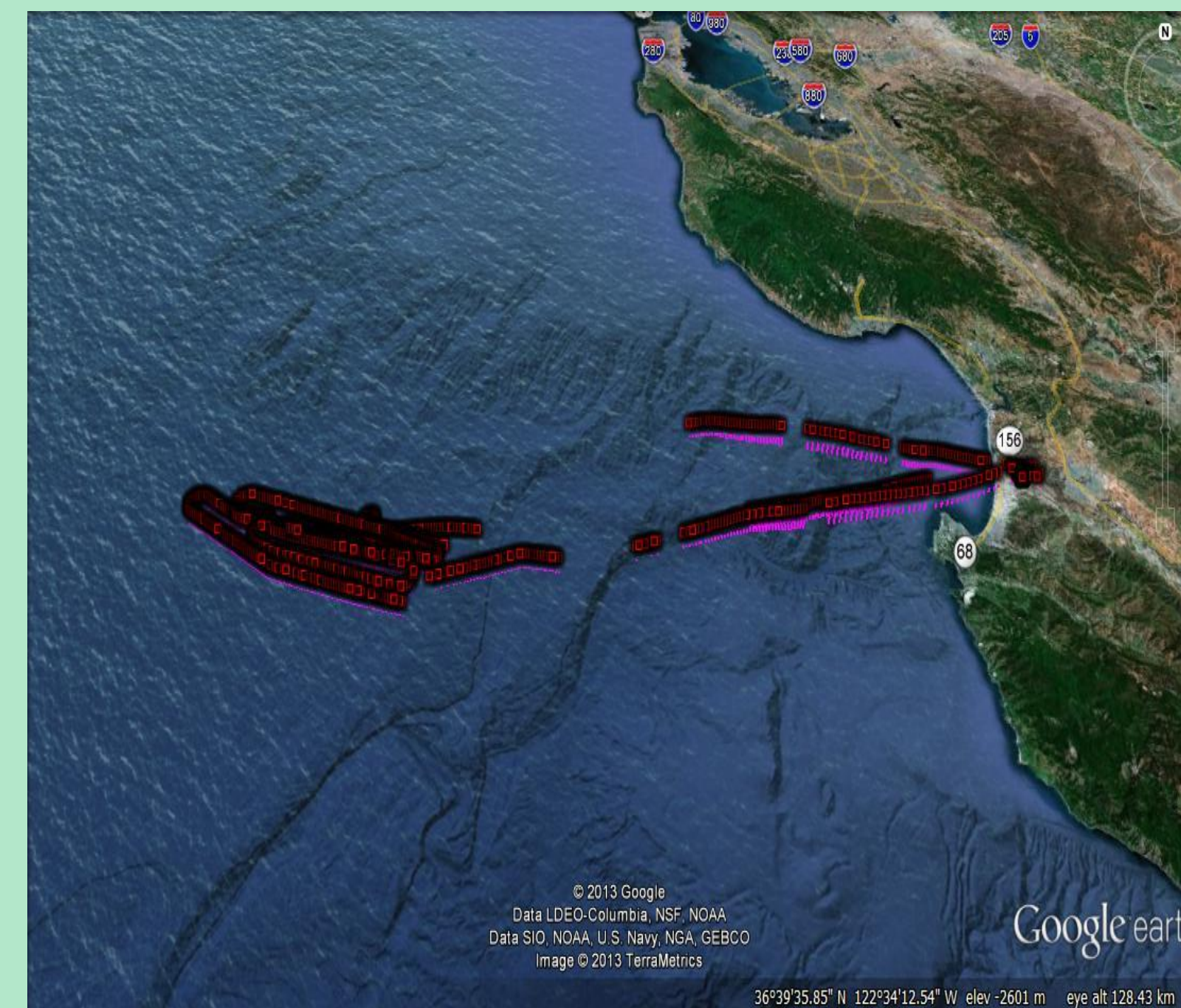
SWA has flown over 500 hours of ADWL Dt collection all over the globe including the following:

- Using ONR's Twin Otter Doppler Wind Lidar (TODWL) to investigate PBL coastal circulations and open ocean OLEs near Monterey, CA (2003-2012);
- Using the NOAA P3-DWL to investigate low-level flow in and around western Pacific Typhoons (2008) and Atlantic Hurricanes (2015/2016); (Earl and Joaquin during 2016)
- Polar Winds - Utilizing NASA LaRC's DAWN lidar to investigate the low-level flows(Tip Jet, Barrier Winds, katabatic winds) off the coasts of Greenland (2104-2015) – Over 20 missions flown.

2007 TODWL - Low Level Jet Near Monterey , CA



TODWL 9/30/2012 – Using LOS to see OLEs over the Pacific

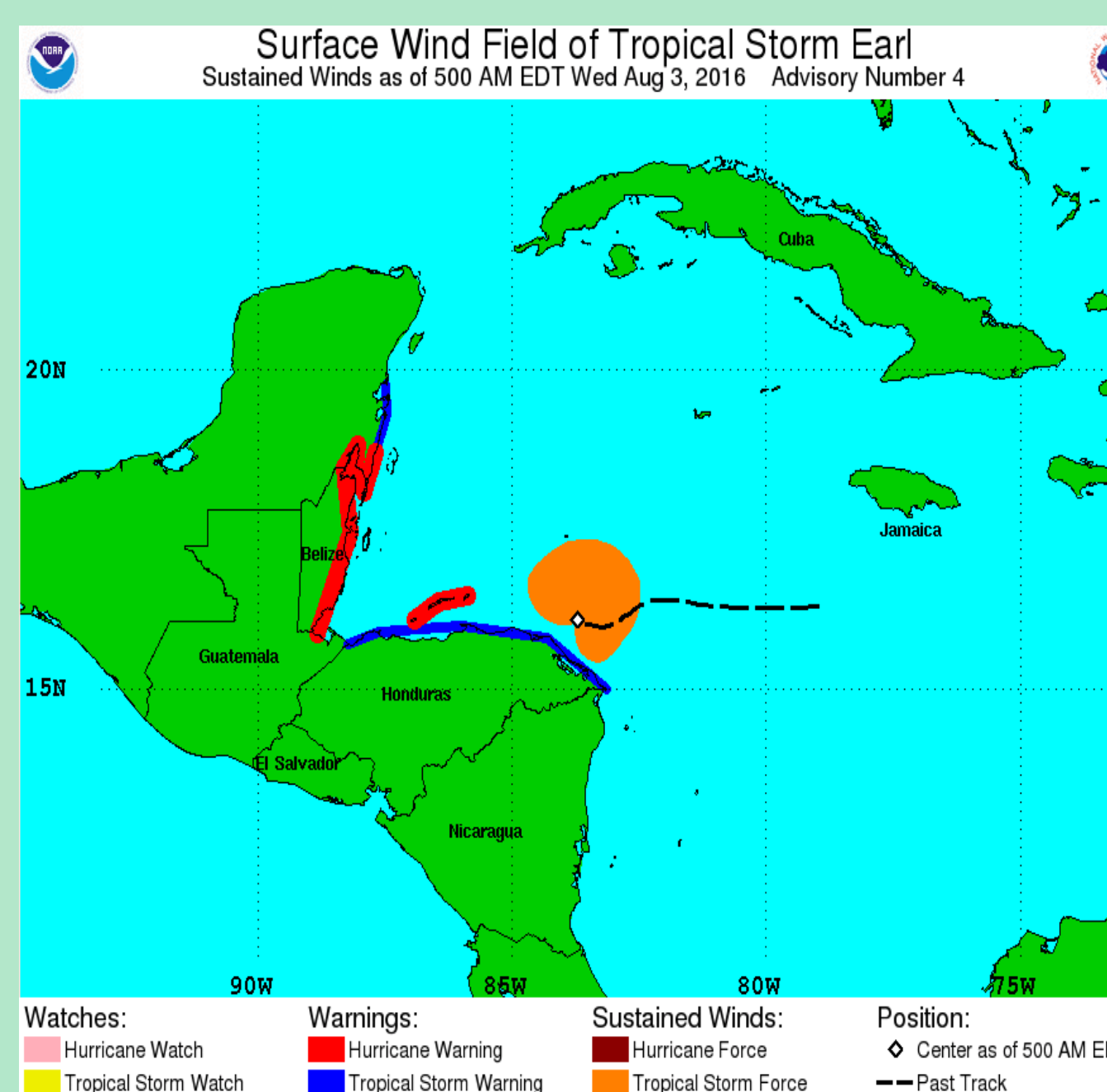


2016 P3-DWL Hurricane Earl Investigation

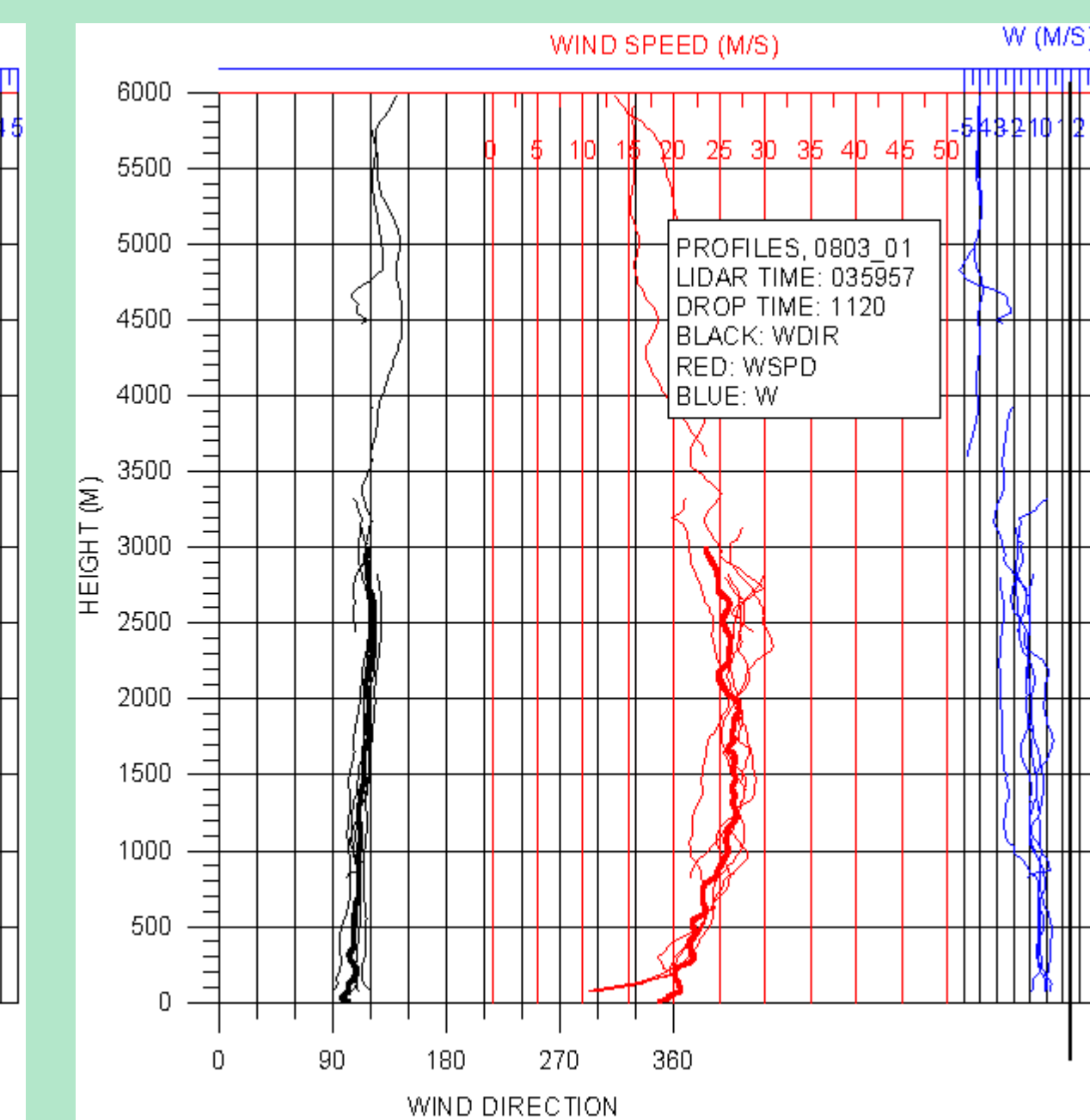
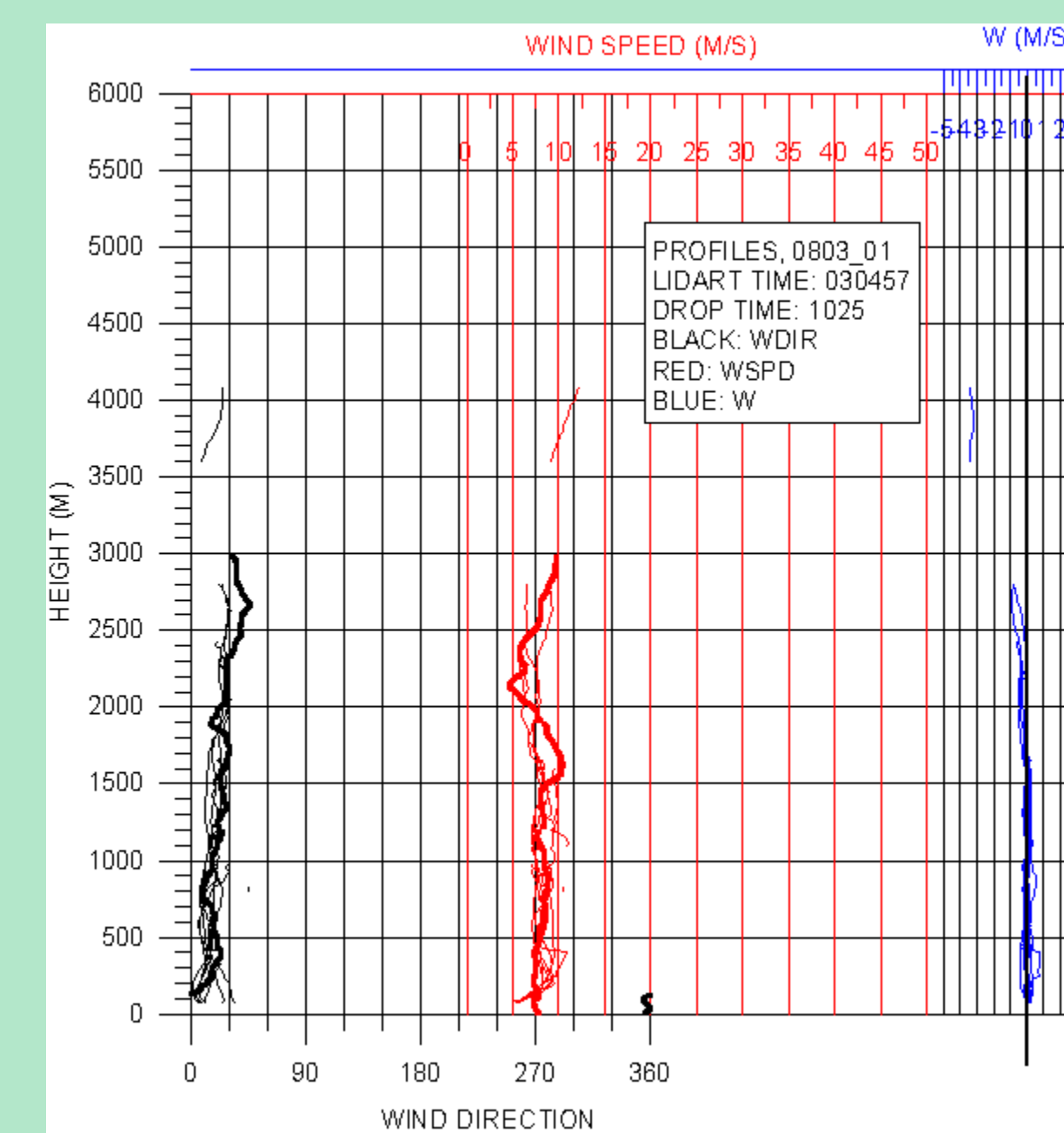
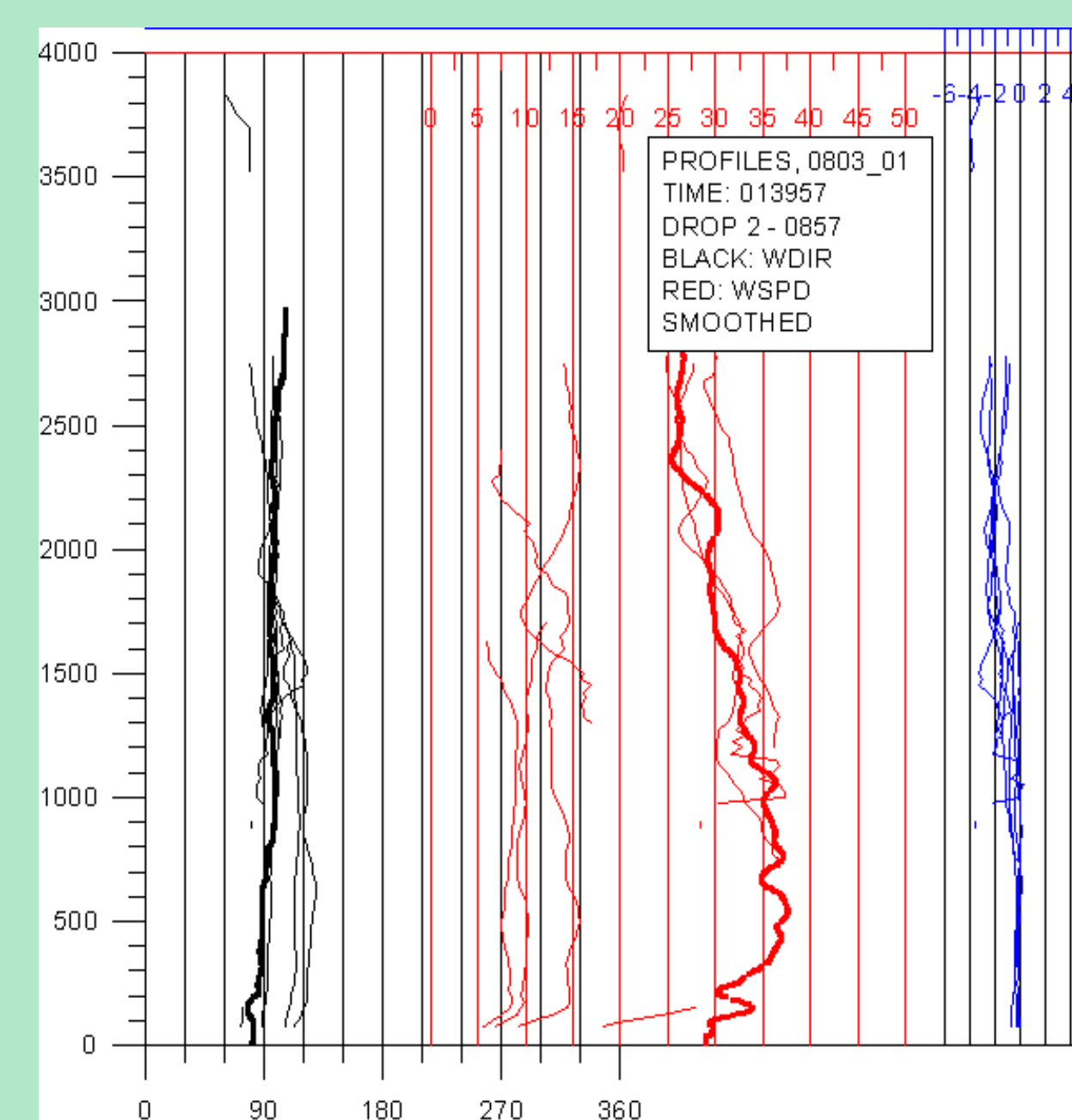
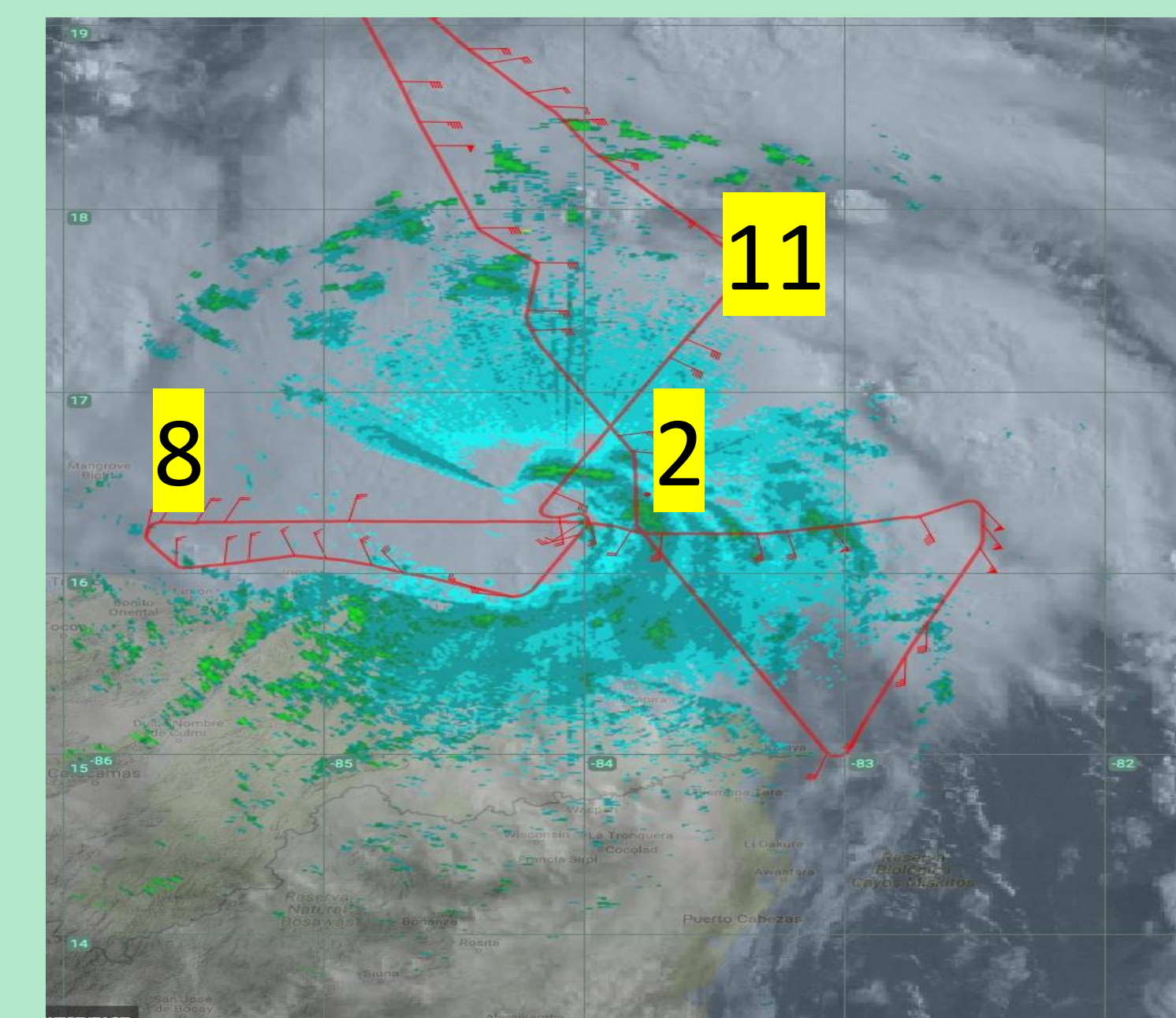
2015-2016 Hurricane season was the first time an ADWL was successfully operated on a NOAA-P3 aircraft to measure winds in the environment and near the center of a hurricane



1.6 um coherent CTI wind Tracer (LM)
Side mounter 10 cm bi-axis scanner (NASA LaRC)

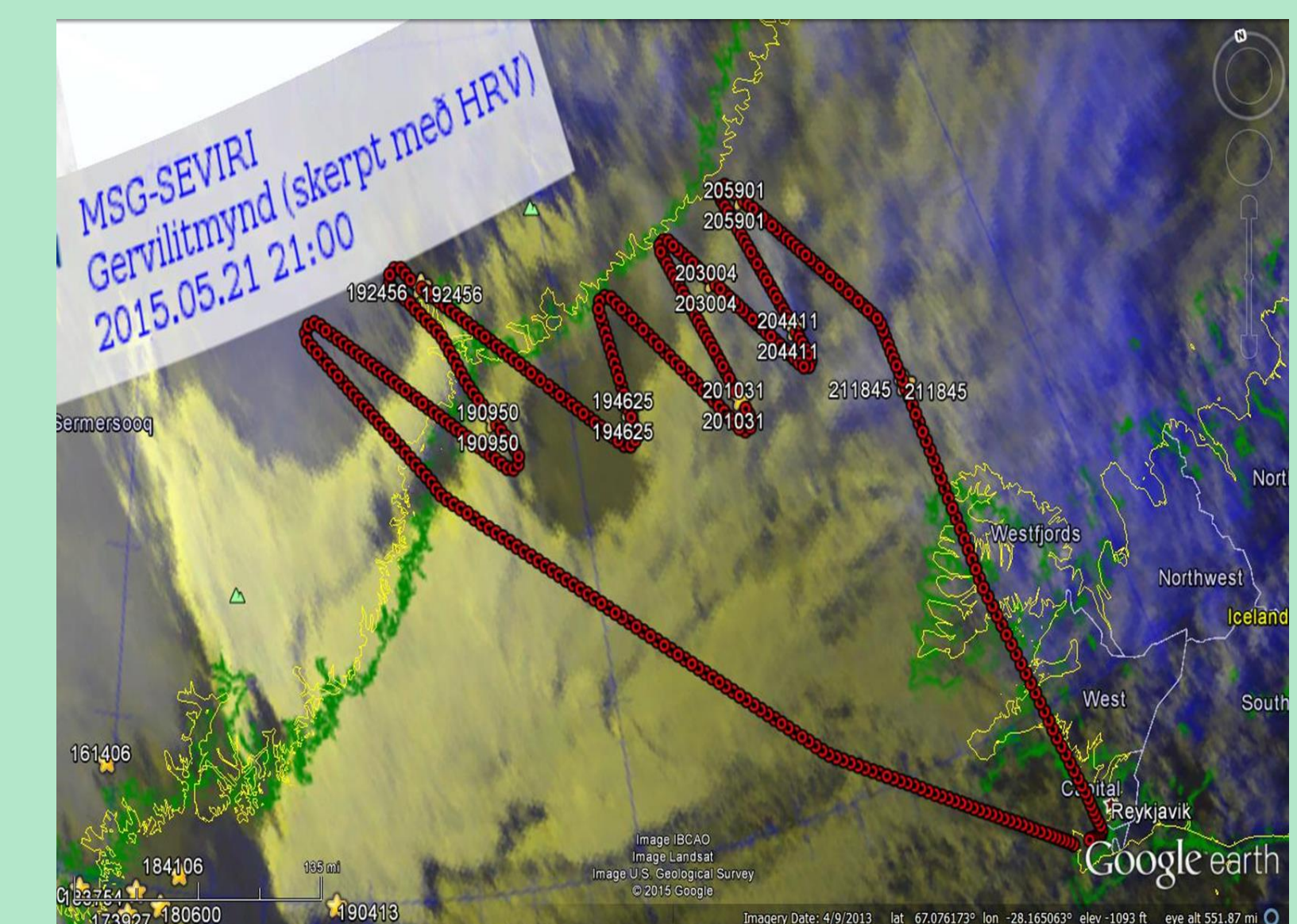


Hurricane Earl- 8/3/2016

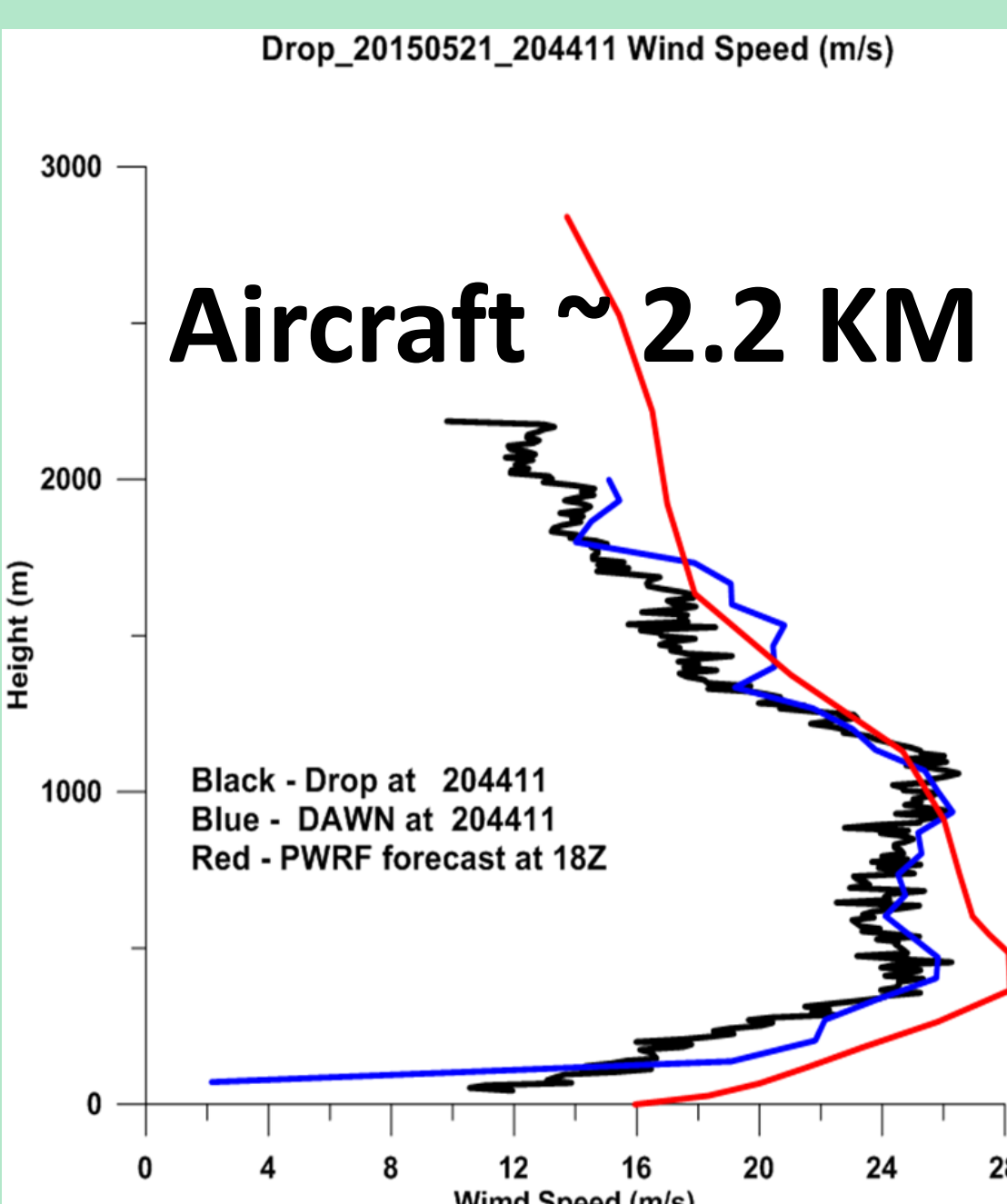
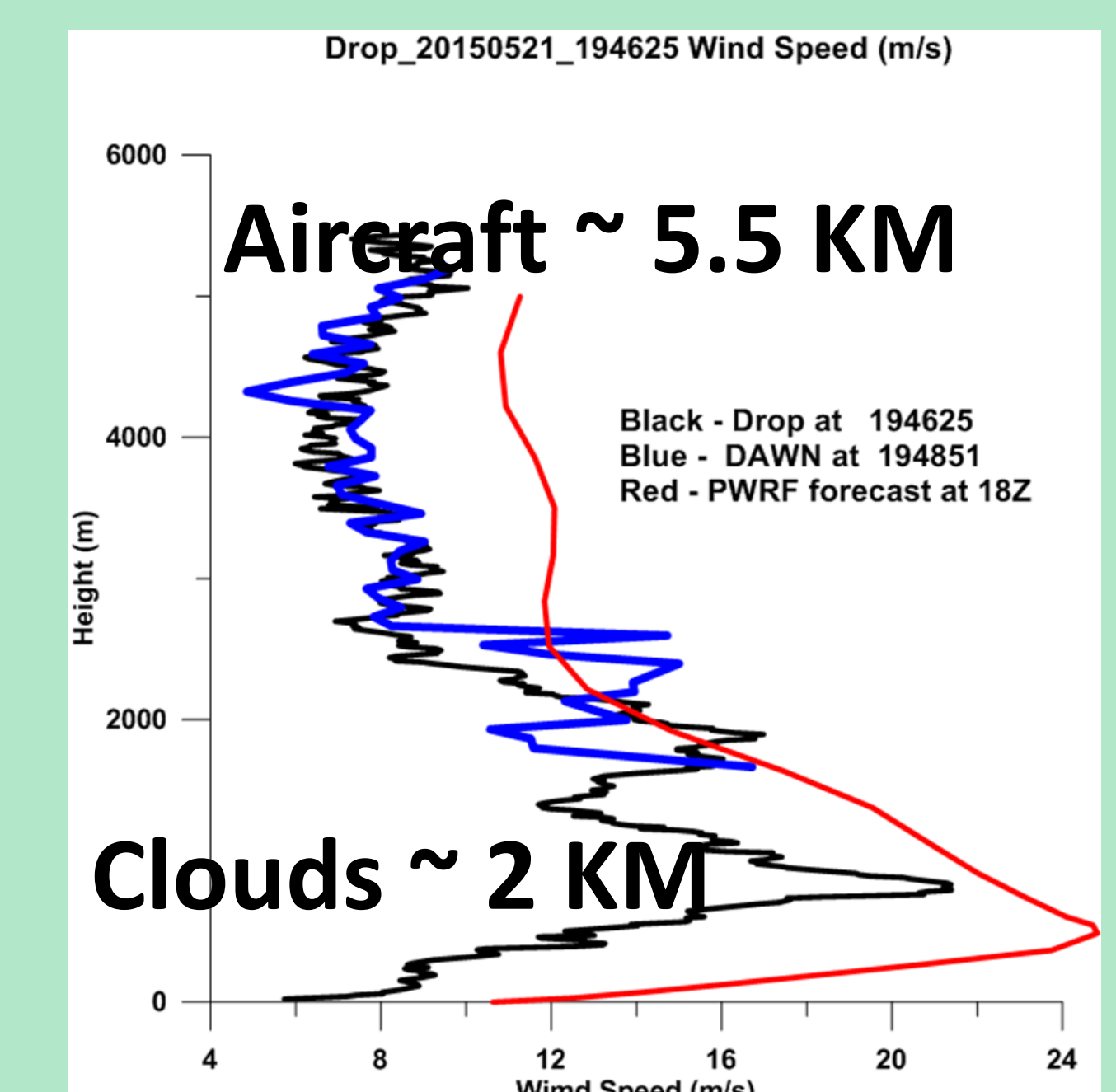


2014-2105 Polar Winds using DAWN

Attribute	Value
Airplanes Flown	DC-8 and UC-129
Solid-State Laser Crystal and Wavelength	HoTm-LiAlF ₄ , 2.053472 Microns
Laser Architecture	Master Oscillator Power Amplifier (MOPA)
Pumping Source, Wavelength, Duration	Laser Diode Arrays (LDA), 792 nm, 1 ms
Laser Pulse Energy E, Rate f, PWDIM Duration t	250 mJ, 10 Hz, 180 ns
Telescope Diameter D, Magnification M	15 cm, 20
Light Detection Material, Technique	InGaAs, Coherent, Dual-Balanced
Scanner Diameter, Type, Deflection	15 cm, Step-Stare Rotating Wedge, 30° About Nadir
Eye Safety	Safe at any Range When DAWN Closed Up for Flight
Pointing Knowledge Technique	Dedicated INS/GPS on Lidar
LOS Wind Measurement Precision	< 1 m/s
Maximum LOS Horizontal Wind	480 m/s, ±160 m/s
Captured Data Length in Range, Altitude	0 – 16.4 km, 0 – 14.2 km
Vertical Resolution	133 m for 512-Sample Range Gate



5/21/15
Barrier Winds
Off Greenland
- DAWN
- Dropsondes
- Polar WRF



5/19/15 – Upper Jet

