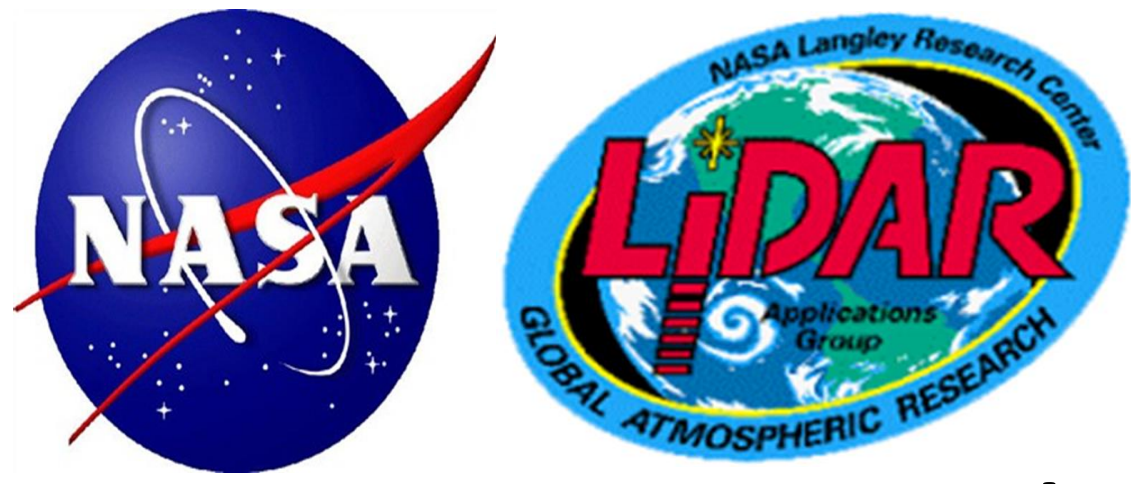
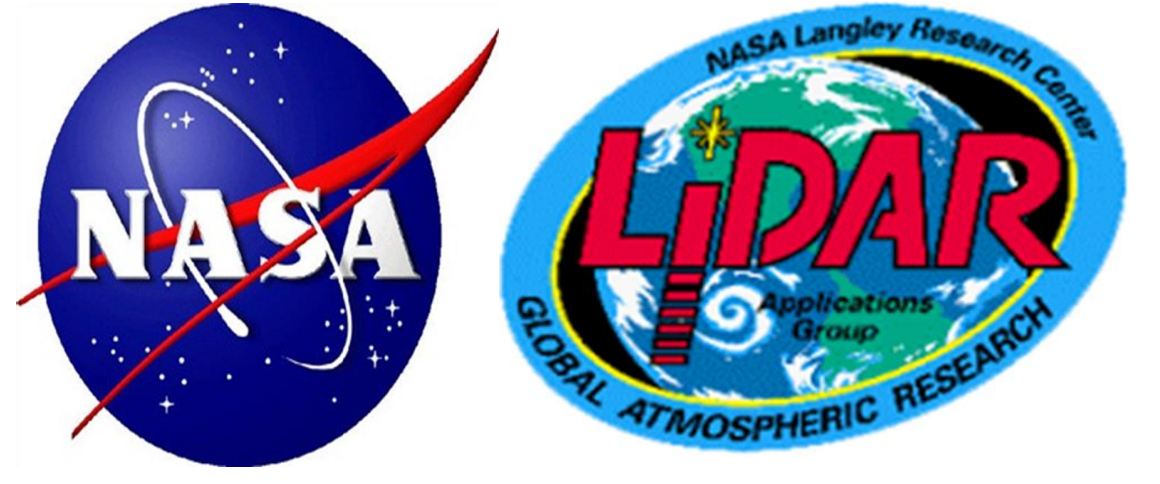




Using an Airborne Doppler Wind Lidar to Evaluate Sampling and Data Processing Strategies Relevant to the PBL and a Future Space-based System



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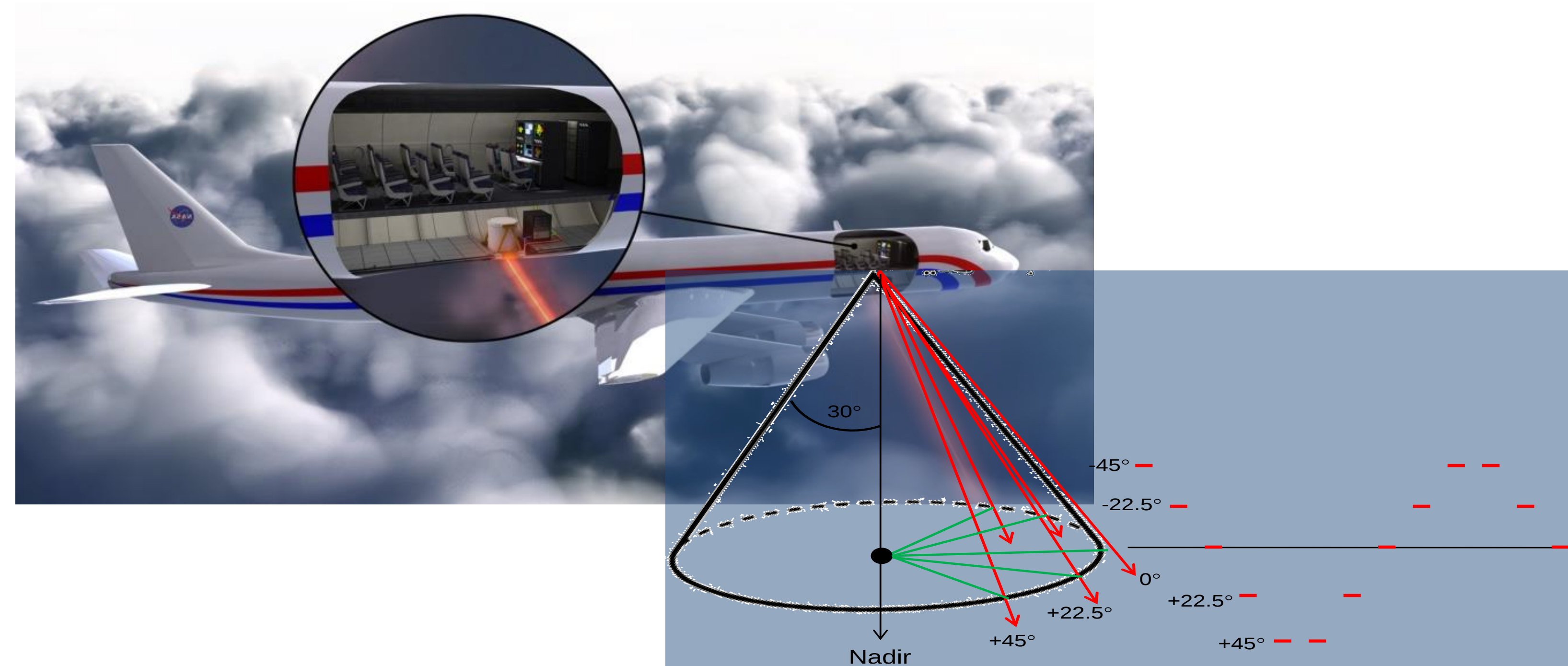
PBL Investigations

The lowest 200m of the PBL is just one focus area of a more comprehensive series of multi-agency (NASA, ONR and NOAA) funded investigations of the PBL (mostly over water) using Airborne Doppler Wind Lidars (ADWL), dropsondes and other remote sensing capabilities. One recent investigation funded by NASA, the Convective Processes Experiment (CPEX) 2017, flew over the Gulf of Mexico, the Caribbean Sea and the western Atlantic Ocean. During CPEX2017 **NASA's Doppler Aerosol WiNd (DAWN)** lidar system was flown on a DC-8 aircraft for over 100 flight hours .

Questions

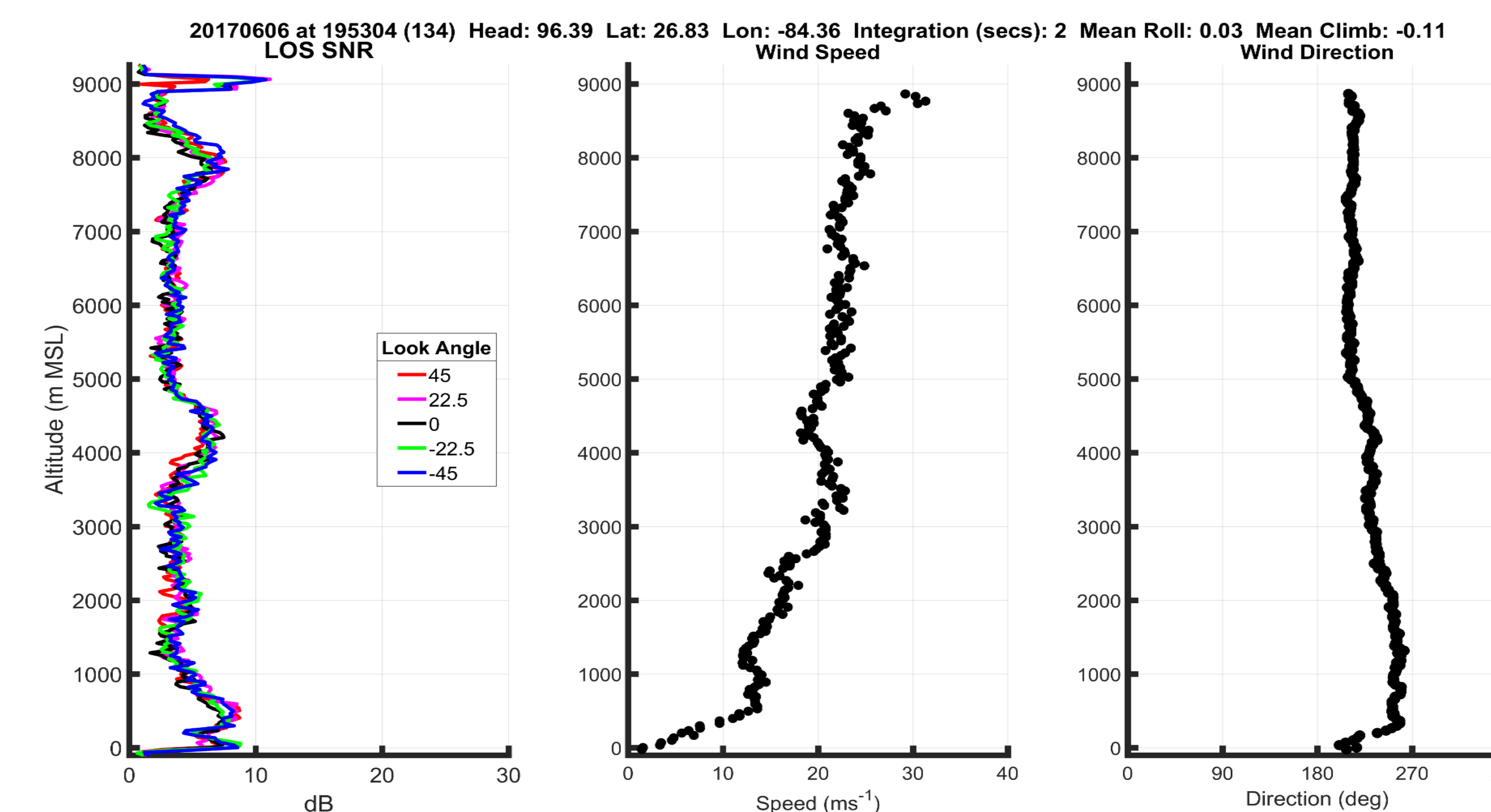
- 1) What does an ADWL have to offer to investigations of the Marine Atmospheric Boundary layer (MABL)?
 - Depth of the MABL defined by aerosols (backscatter), wind profiles and turbulence (spectral width)
 - MABL features – LLJs, OLEs, sea salt spray distribution
 - Ocean surface properties - breaking waves (whitecaps), foam coverage, ocean wave spectra
- 2) What is the “true” wind at the traditional 10 m reference height over water? Log and power wind profiles not suitable for high winds (>15m/s) with highly non-linear interactions between the ocean surface and the lower PBL
- 3) How close to the ocean surface can we observe the winds with a 180nm pulse ADWL and can the wind retrievals below 50m be used in studies of the MABL with >15m/s winds?
- 4) Can single shot processing be used to resolve highly variable wind/aerosol structures in the MABL?

The Doppler Aerosol WiNd (DAWN) Lidar System

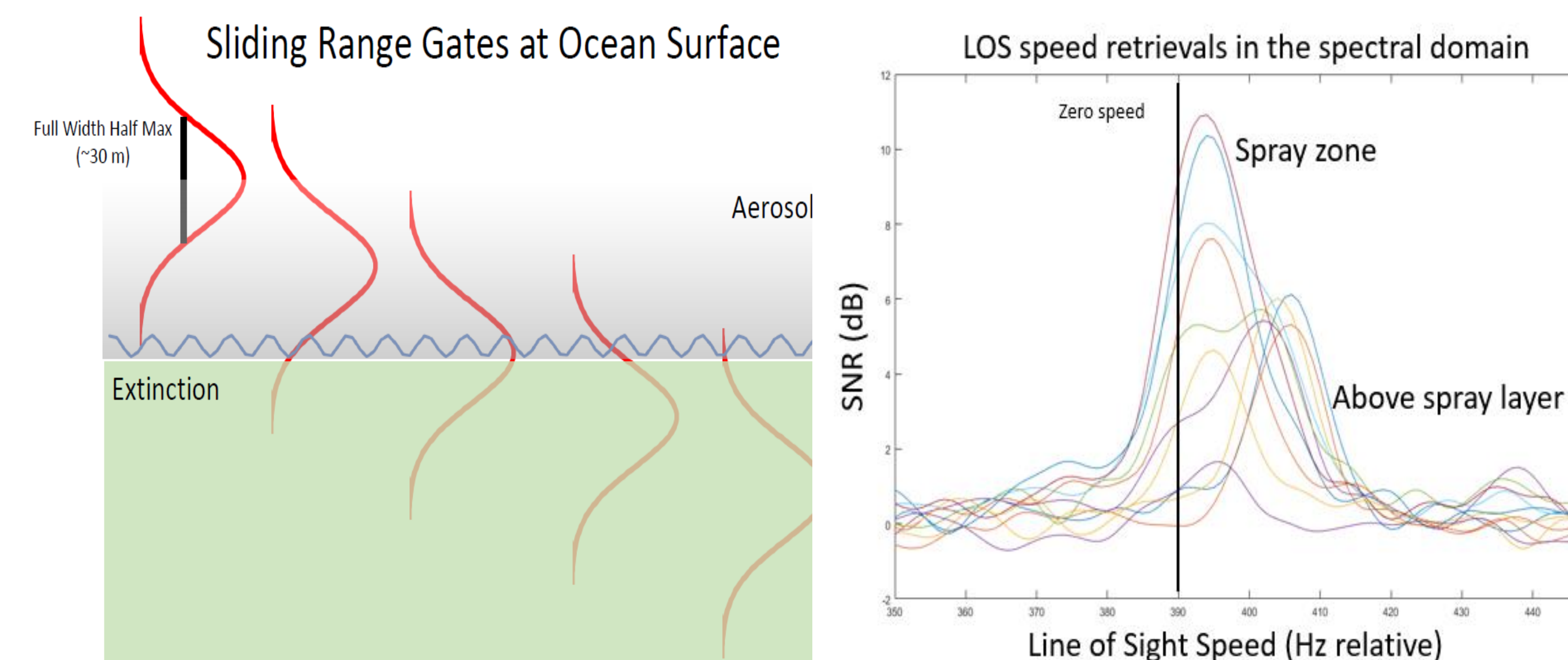


NASA's 100mJ, 10HZ, 180ns coherent lidar with < 1 m/s LOS precision and variable vertical resolution based on range gates. Single shot horizontal resolution in PBL is < 20m and full profiles up to 12 km every 3-12 km. **Using a new “bottom-up” processing algorithm with sliding range gates, winds can be retrieved ~10m from the surface and every 10m in the vertic:**

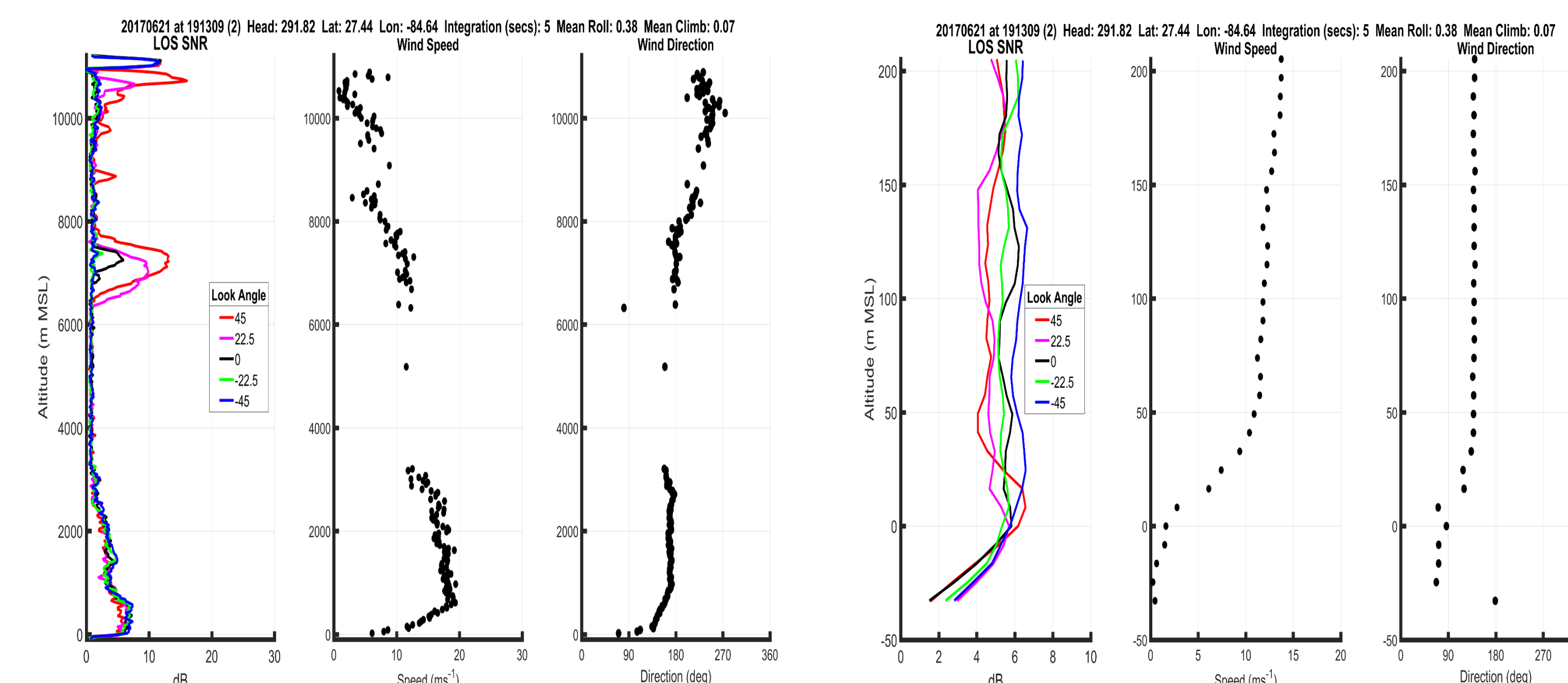
Example of DAWN Profile



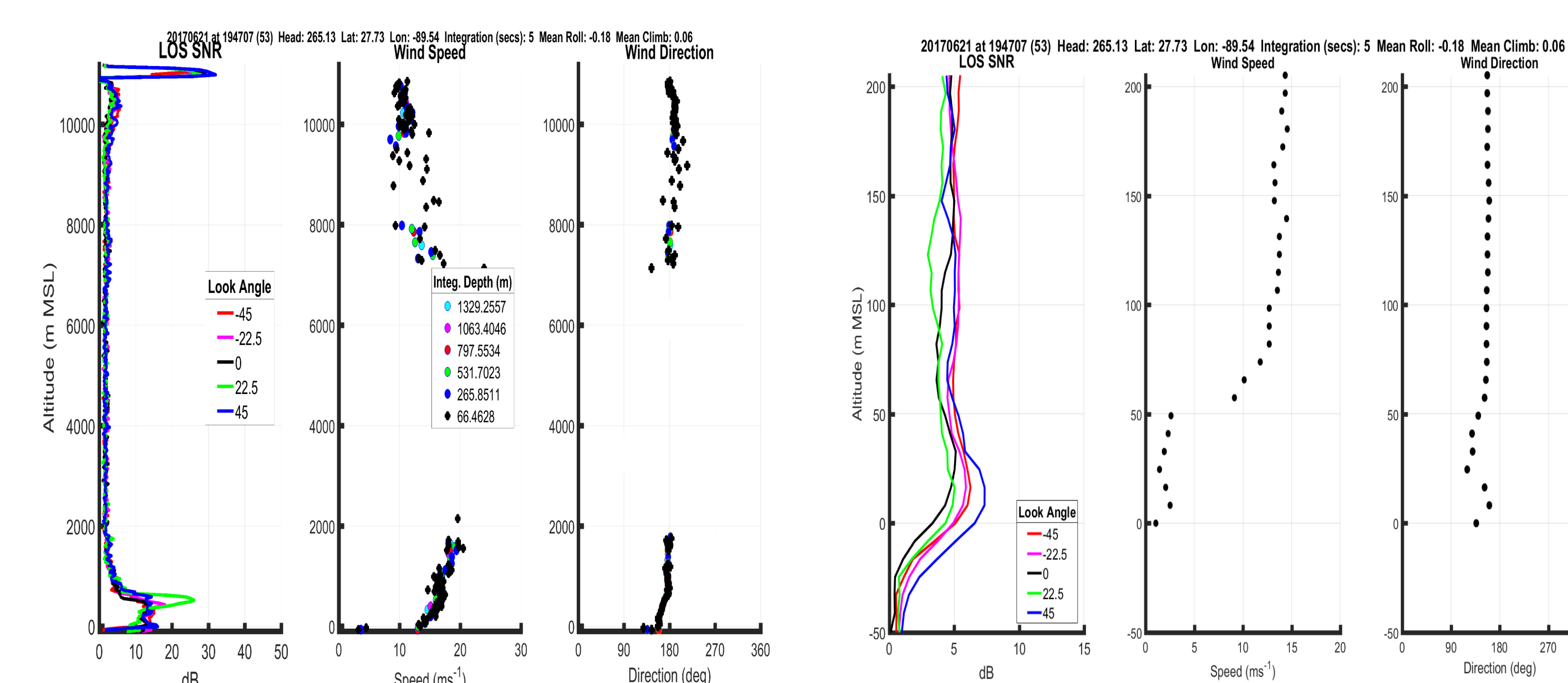
Sliding range gate approach



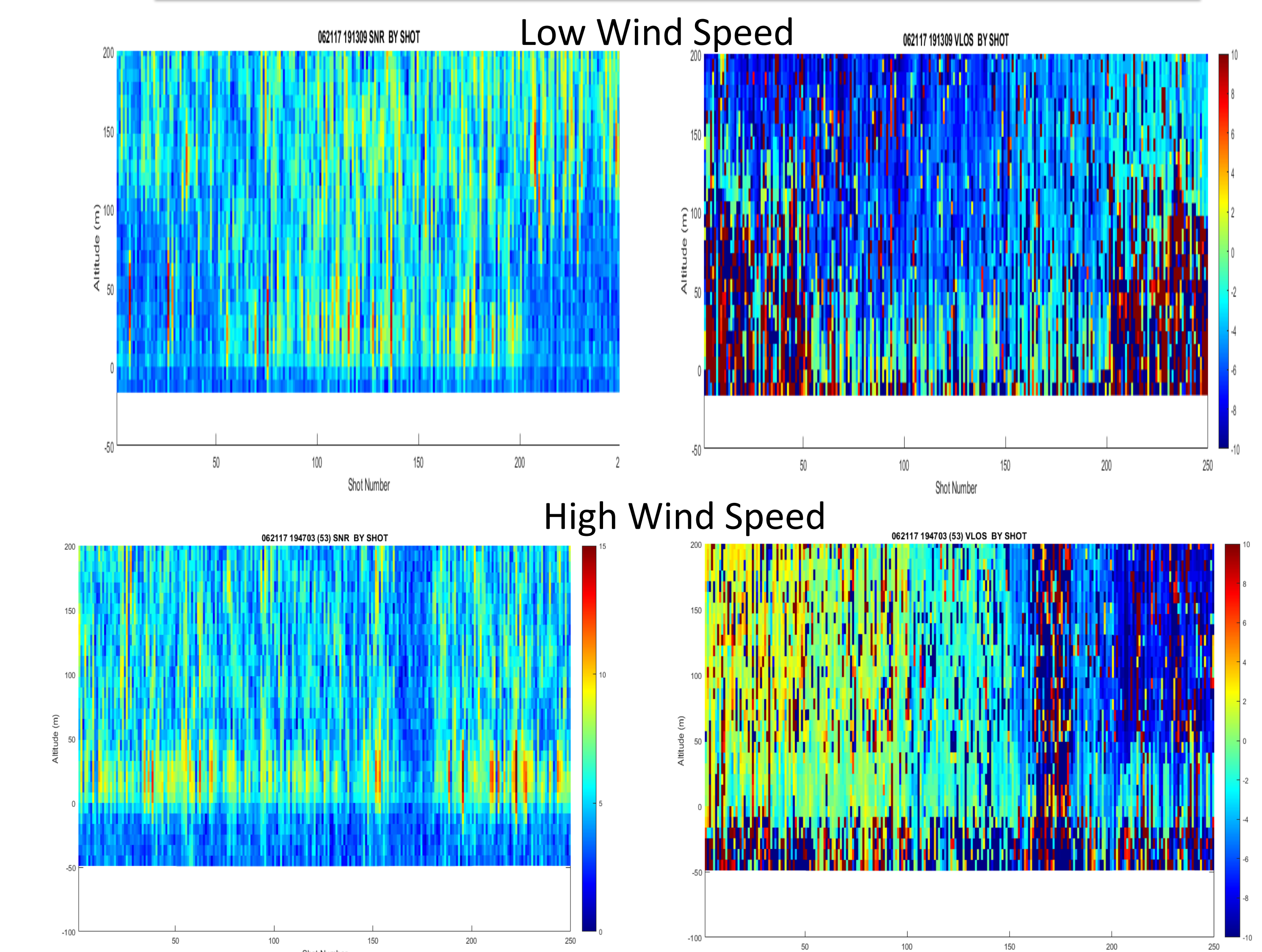
Weak Surface Winds



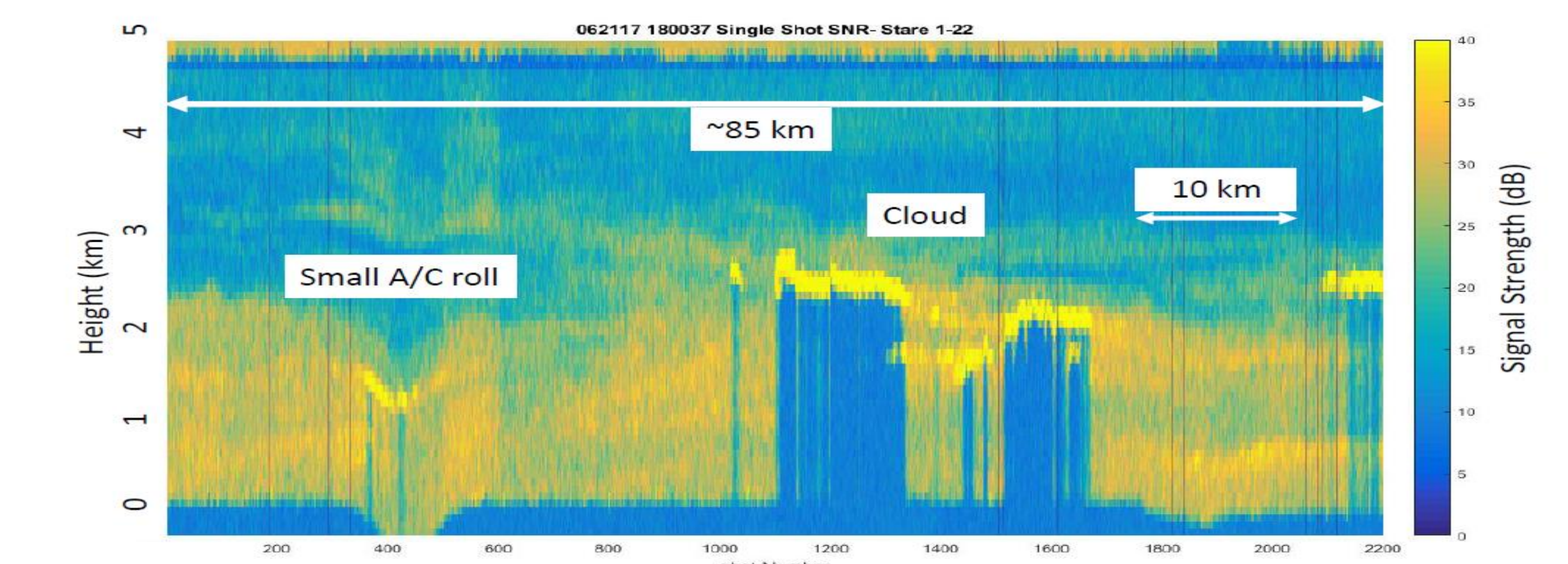
Stronger Surface Winds



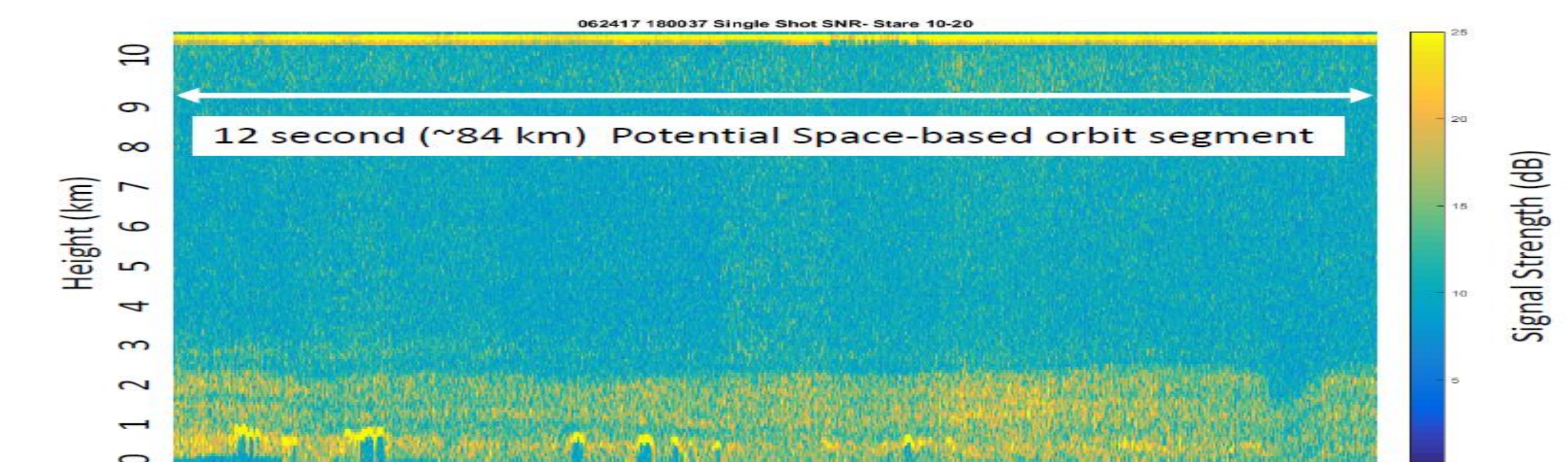
Single Shot



Single Shot Returns from Airborne DAWN (CPEX 2017) (~20m between shots; ~ 60m vertical resolution)



Example of Airborne DAWN mapping the ABL



Future Work

- 1) Perform simulations of coherent space-based lidars to predict accomplishment of science and technology objectives:
- 2) Validate global attenuated backscatter distributions used to design coherent space-based lidars and establish coverage expectations, especially over oceans
- 3) Develop techniques for taking advantage of synergisms between the DWL and scatterometers (ASCAT), AMVs and other wind observing systems