ACLAIM CAMEX-4 Backscatter and Wind Velocity Measurements – Ivan Clark (Co-I) NASA LaRC

Aviation Safety Program

Objectives

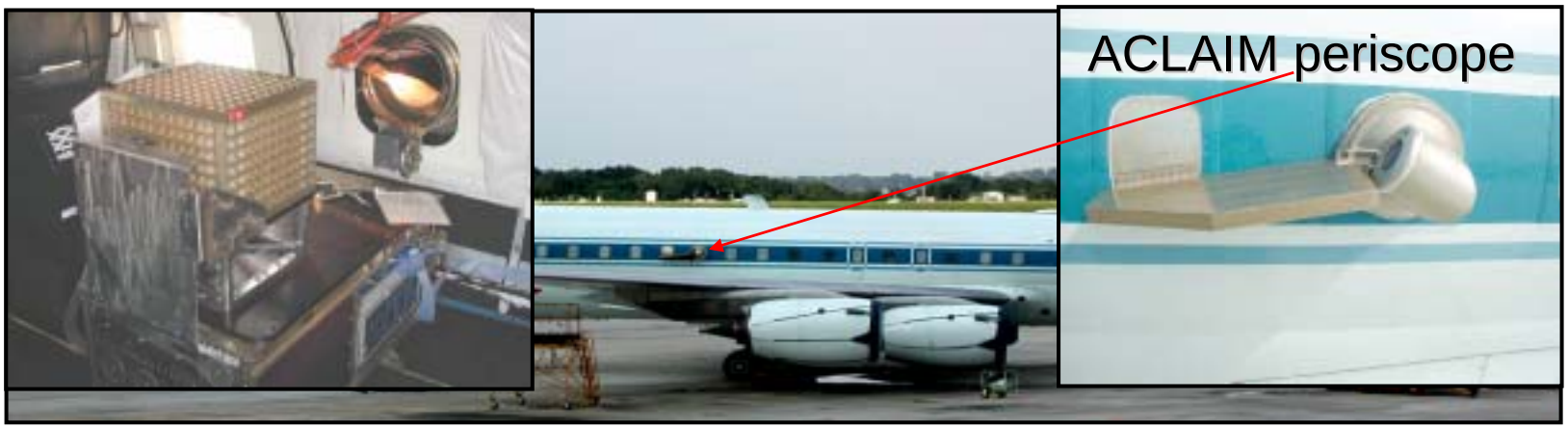
-Operational experience at cruise speed and altitude with:
- -eye-safe Lidar
- -high moisture environment
- -large backscatter variations
- -variety of clouds, clear-air and very clean air
- -cloud entry and exit

-Evaluate range of detection for light to moderate turbulence
-Validate Lidar wind shear measurement capability
-Validate atmosphere backscatter design model
-Demonstrate clear-air turbulence (CAT) detection and prediction

NASA DFRC: Ed Teets (PI),
Jack Ehernberger (Co-I)
Rod Bogue (Co-I);
(AS&M) Chris Ashburn

CTI: Philip Gatt (Co-I),
Sara Tucker & Dale Bruns

NASA LaRC: Gary Grew,
Phil Brockman
Wayne Gerdes;
(Swales) Carroll Rowland



Doppler Radar/Lidar Turbulence Measurement General Principle

Pulse transmitted

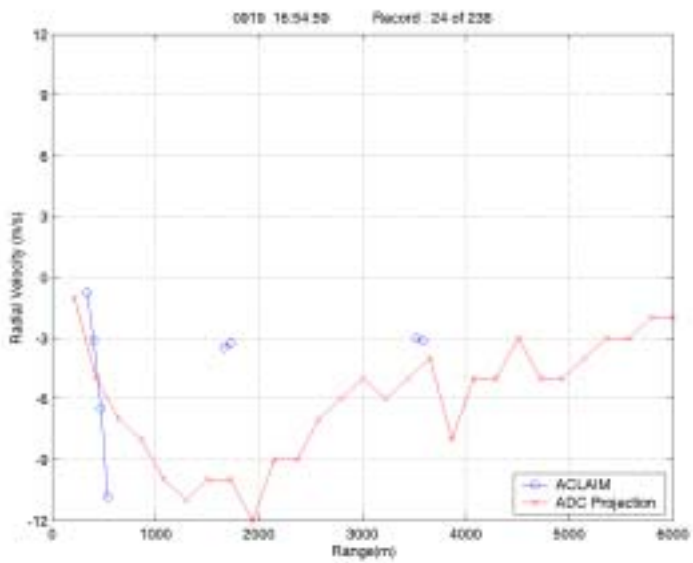
Energy scattered off of naturally-occurring moisture or aerosols

Beam

updraft

downdraft

Doppler Turbulence Sensor



Lidar Pulse Envelope (50-100 meters)
Radar Pulse Envelope (~300 meters)

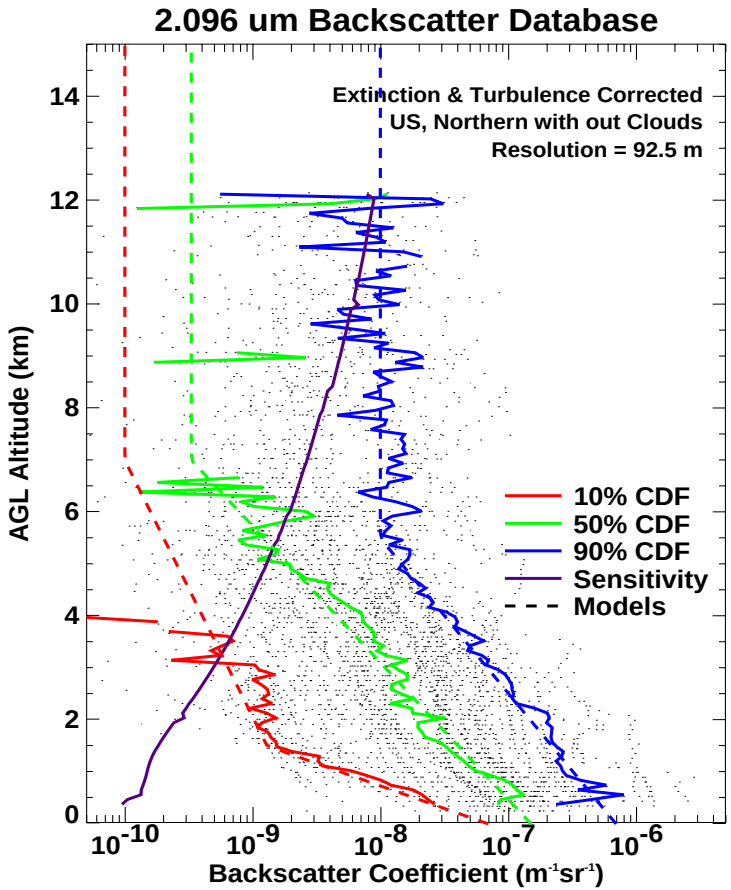
Radar Beam Spread 3.5°

Lidar"Pencil" Beam Width 10-20 cm

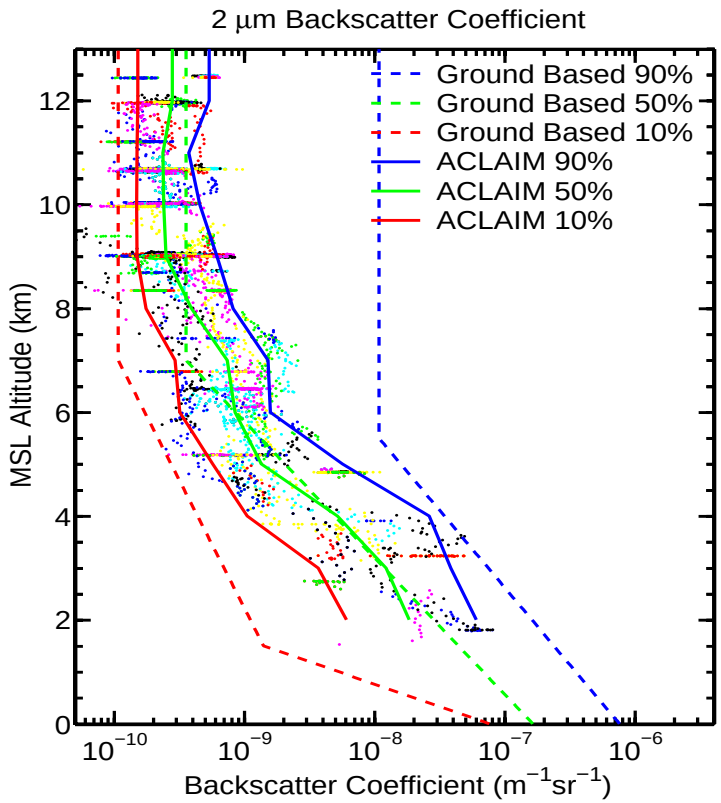
Relative wind induces a Doppler frequency shift in the backscattered light; this frequency shift is detected by the sensor

Atmospheric Aerosol Backscatter for Clear Air: Previous Database and CAMEX-4 ACLAIM Database

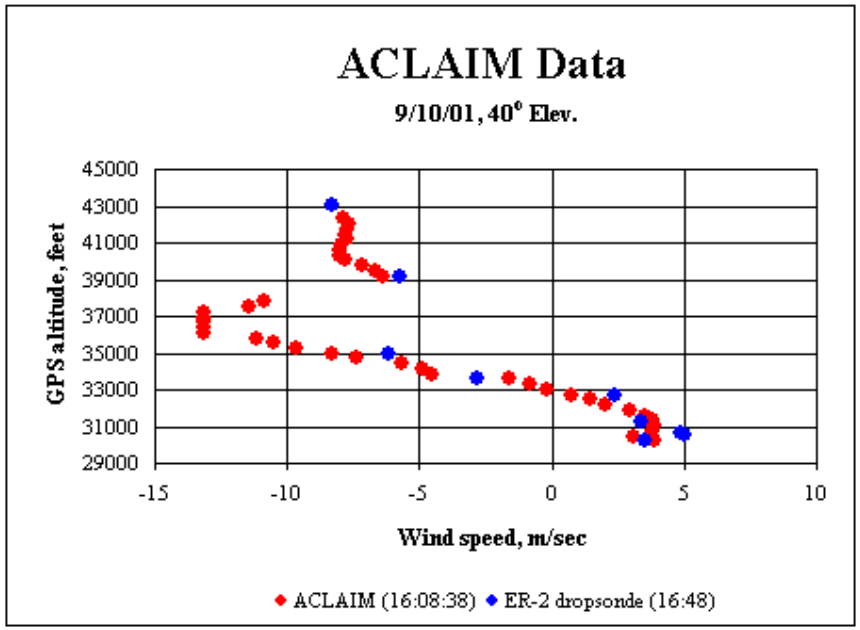
- Ground database collected 1995-96 in continental US
- High altitude 50% profile derived from 1.06m GLOBE measurements

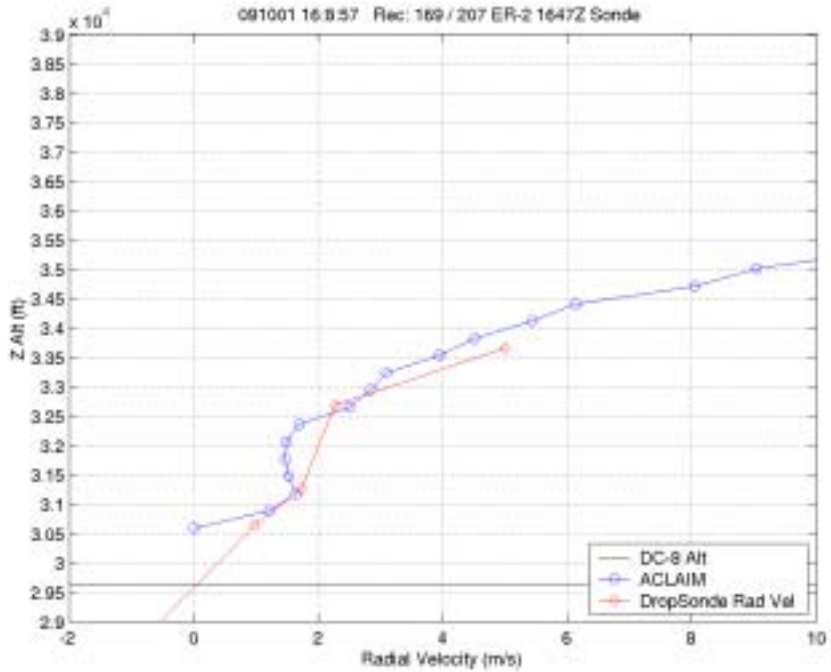


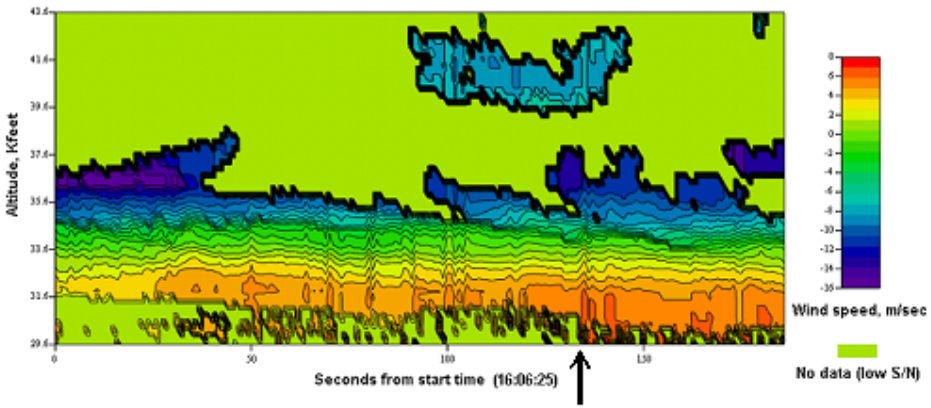
- CAMEX-4 ACLAIM database
- Forward-looking, clear-air only
- 3600 discrete samples of 5 seconds each
- Consistent with ground-based measurements

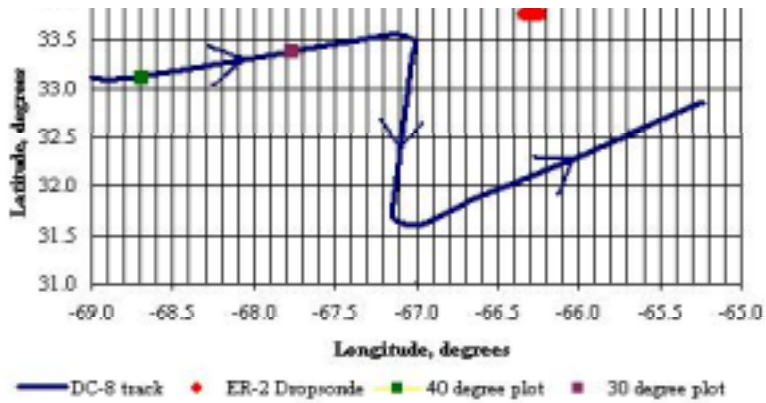


ACLAIM vs Dropsonde Radial Velocity
September 10, 2001 Comparison

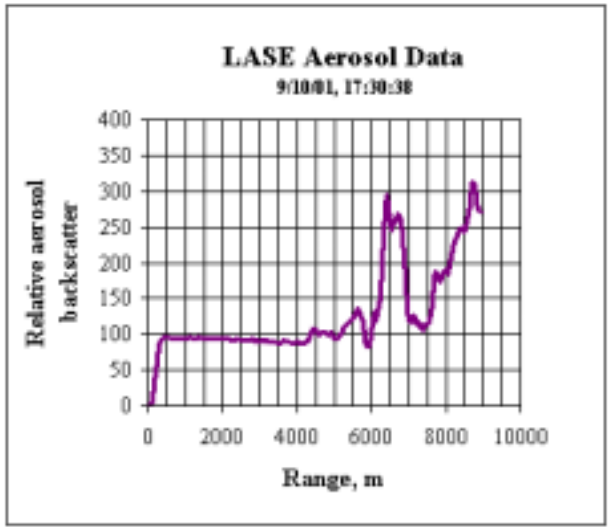


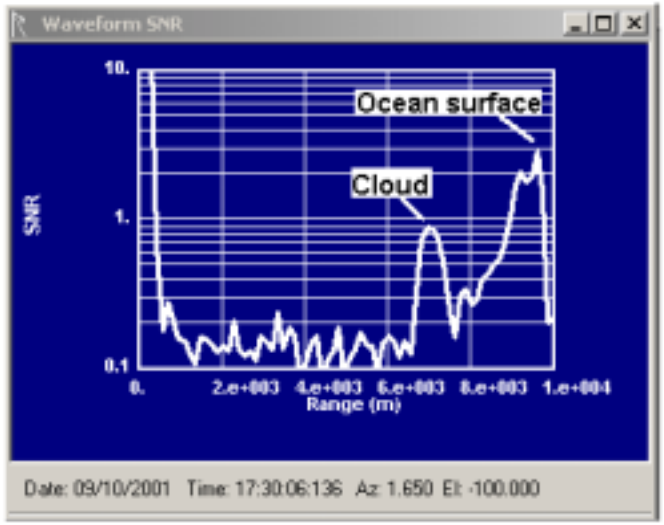


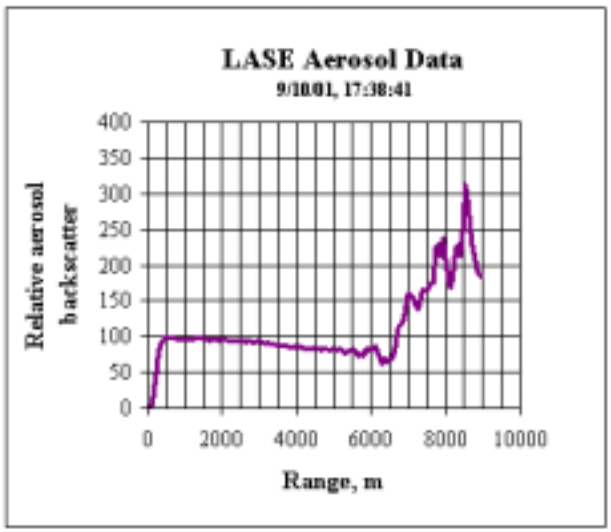


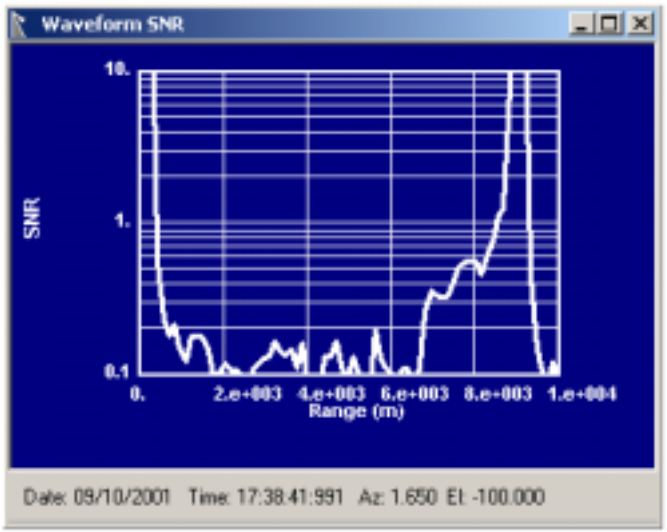


Lidar Atmospheric Sensing Experiment (LASE) vs ACLAIM September 10, 2001 Comparison









CAMEX-4 Analyses Status

- CAMEX-4 flights very helpful to AvSP Turbulence Lidar effort
- ACLAIM forward-looking velocity and backscatter initial analysis done
- Quick look qualitative comparison of LASE and ACLAIM very promising
- ACLAIM up-slope line-of-sight data analysis underway for vertical windshear
- ACLAIM CAMEX-4 data and experience very helpful for evaluation of beam quality, data acquisition and archiving procedures, and 2-micron lidar doppler behavior in convectively-induced turbulence
- ACLAIM up-slope line-of-sight configuration could support a wind shear measurement inter-comparison between rawinsondes, ICATS climb winds, and both DC-8 and ER-2 dropsonde wind profiles on a future mission