Comparison of Measured and Modeled Aerosol Backscatter during Twin Otter Doppler Wind Lidar (TODWL)/2003

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Abstract

Office of Naval Research (ONR) and Integrated Program Office (IPO) funded DWL activities, including TODWL and development of a trailer version called GWOLF. ONR and IPO co-funded upgrades and NASA/LaRC provided a hemispherical scanner allowing for independent airborne and trailer DWLs. IPO is interested in calibration and validation of scatterometers, cloud and water vapor motion winds, ground based sounders, GPS derived winds, and future space-based DWLs and validation of DWL simulation models. The Twin Otter aircraft is operated by CIRPAS out of Marina CA. It is unpressurized, normally operating up to 10,000 t and cruising at 100 to 140 kts, and instrumented with GPS/INS, dropsondes, aerosol probes, temperature, water vapor, and turbulence sensors. The DWL is a 2-micron coherent lidar, with 4 to 6 mJ, 330 nanosecond pulse, 80 pulses per second. The 10-cm two-axis scanner is mounted on a side door, GUI with real time control and display. It scans up, down, and straight ahead and performs VAD scanning and processing. TODWL 2003 flights took place near Monterey CA in February 2003. The experiments examined issues unique to space, including downward look and measurement over water. They included underflight of the NPOESS Airborne Sounder Testbed (NAST) aircraft. Other activities were investigation of aerosol/wind correlated structures, validation of the NPS MM5 model winds over complex terrain and coastline, and development of sampling strategies for deployment in THORPEX adaptive targeting experiments and C-BLAST investigations. Dave described observations of organized marine boundary layer structures. Advanced signal processing techniques are needed for shear measurements because of non-gaussian smearing of spectra. TODWL provided coincident aerosol and wind observations for evaluating β/U correlations for their potential impacts on spacebased DWL data products. Within MBL, biases of 0.25 to 0.50 m/s can be expected for aerosol direct detection systems. Larger biases may be realized in the presence of wave-like structures in the mid and upper troposphere. A Lidar Altitude and Height Determination and Signal Search Algorithm (LAHDSSA) that uses surface return to correct for aircraft ground speeds was discussed. Data showed atmospheric structure. Removal of aircraft attitude and motion effects was

discussed. The soundings were processed to obtain accuracies of <0.1 m/s in each component (u,v,w). Comparison with other sounders must be interpreted with caution since integration times and sample volumes vary. A significant effort is needed to understand the differences between TODWL vs. MM5 predictions.