

A NEW DOPPLER WIND LIDAR CONCEPT FOR OBTAINING SPACE-BASED VECTOR WINDS THROUGHOUT THE TROPOSPHERE: DATA PRODUCT SIMULATIONS.

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Abstract

Late in the 1970's, the Air Force and NOAA developed a Doppler Wind Lidar (DWL) concept for space deployment. It proposed coherent detection at 10.6 μm of sufficient energy to make wind measurements off aerosols throughout the troposphere. Subsequently, proposals using coherent detection at 10.6 μm and 2 μm have been made with various claims to full tropospheric coverage. ESA has chosen to use two direct detection concepts (Atmospheric Dynamics Mission: ADM) to achieve full tropospheric coverage arguing that the mid and upper troposphere winds are best sampled using molecular detection rather than relying on aerosols. ADM will also use direct detection of aerosol motion to get lower tropospheric winds. NASA proposals have been generated that use molecular direct detection for the mid and upper troposphere and/or coherent detection for the lower troposphere. When paired together these concepts have been referred to as hybrid systems.

Recently Ball Aerospace with support from NASA has developed the Optical Autocovariance Wind Lidar (OAWL) that can use aerosol returns throughout the troposphere to provide useful returns better than 50 % of the time. This greatly enhanced sensitivity in low aerosol concentrations provides expectations that very precise wind measurements can be achieved without coherent detection and thus simplify (i.e. lower the costs of) the instrument needed to make hybrid (molecular and aerosol) wind observations.

While the "full up" Ball DWL concept may include molecular return detection to supplement the aerosol products, we report here only on detailed simulations conducted by SWA of the aerosol based products. These simulations have been done to generate inputs to Observing System Simulation Experiments (OSSE)s that will allow quantification of the relative impacts of the OAWL based DWLs compared to other DWL configurations including ADM and coherent/direct detection ideas. We also provide metrics that express the spatial, temporal and data precision expected from the OAWL compared to current global wind observations used in global forecast model data assimilation systems.

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