

Use of airborne Doppler Wind Lidar to optimize the utility of UAV and space-based systems

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Abstract

Due to their technological complexity and costs, Doppler Wind Lidars (DWL) have primarily been available through well funded laboratories and projects. However, recent commercialization of ground based DWLs for use at airports and atmospheric research has been responsible for increased awareness of what the DWL can provide and the development of smaller and less expensive units for a variety of applications. These applications include the use of DWLs on both piloted and unpiloted aircraft (UAV), balloons and ships. At the other end of the spectrum are the plans for deploying a DWL in space to provide global winds.

Presently, there are only a few airborne DWLs available for research. One such system is flown on the Naval Postgraduate School's Twin Otter at the Center for Interdisciplinary Remotely Piloted Aircraft Studies (CIRPAS). This DWL has been co-funded by the Navy and NOAA and has been flying since 2002. While most of the early flights have served to develop advanced scanning patterns, signal processing and data utility software, science investigations of organized large eddies and flow over complex terrain have also been enabled.

Recently the Twin Otter DWL (TODWL) has been funded to participate in several projects that will serve in the design of future DWLs, including very modest units for UAVs as well as highly capable units for space-based applications.

This paper will report on the following applications of the TODWL system:

1. Developing scan patterns to resolve coherent /persistent vertical wind structures ahead of aircraft
2. Developing strategies for autonomous operations of scanning DWLs (condition recognition)
3. Developing onboard model/lidar interactive operations in support of "now casting"
4. Evaluation of synergisms between a space-based DWL and cloud motion vectors ocean vector winds.

Examples of a complex terrain scanning pattern for airborne lidar will be presented along with vertical velocity products associated with organized convection. Preliminary efforts to detect and estimate vertical velocities from horizontal DWL scans will also be presented.