Current Challenges and Opportunities for Space-Based Doppler Wind Lidar Systems

Sara C. Tucker[(1)], R. Michael Hardesty[(2)]

[(1)] *Ball Aerospace, Boulder, Colorado, U.S.A., sara.tucker@ballaerospace.com*

[(2)] *Cooperative Institute for Research in Environmental Sciences, Univ. of Colorado, Boulder, CO, U.S.A.,*

The need for global wind measurements to feed forecast models and measure dynamic processes from turbulence scale to global scales has naturally driven communities to focus on space-based observations. Many organizations have worked development of Doppler wind lidar (DWL) systems for space-based application, with ESA providing the first DWL in space – the ALADIN lidar on the Aeolus mission. ESA faced, and successfully addressed, numerous challenges in the Aeolus demonstration mission, leading the way for future missions while providing valuable lessons learned and significant technology development and assimilation tools, maximizing the value of the measurements. The Aeolus lidar uses Fizeau interferometer fringe-imaging (FFI) and Double Edge Fabry Perot (DEFP) techniques to measure wind-induced Doppler shifts from aerosol and molecular backscatter, respectively. Other DWL approaches to measuring wind include Quadrature Mach Zehnder Interferometry (QMZI), and heterodyne detection (HD). Looking ahead, we discuss potential science objectives and measurement needs for future space-based wind lidar missions, and compare the advantages and challenges of the various wind lidar technologies to address these objectives. We focus on the challenges faced by the different systems and their components to provide space-based measurements with the needed resolution and precision to maximize scientific impact.