The use of large footprint waveform lidar for landscape characterization: past experience and future prospects

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Abstract

The exploding use of small-footprint lidar over the last 10 years has to some degree obscured the development and application of large footprint waveform recording lidar. Such systems have included the airborne Laser Vegetation Imaging Sensor (LVIS) of NASA, the developed but unlaunched Vegetation Canopy Lidar (VCL) space mission, as well as the currently orbiting ICESAT satellite. A new space mission, the DESDynI (Deformation, Ecosystems, and Dynamics of ICE) mission, is currently under development by NASA as well which will provide global observations of land surface vertical structure using radar/lidar fusion. There is thus considerable interest in understanding both the potential and limits of large footprint waveform lidar for large area assessments. In this talk I present our experience using waveform lidar for a variety of environmental and forest-related applications. I begin by providing a brief overview of waveform lidar and show its equivalance to small-footprint discrete return systems. I next present a series of examples using the LVIS system for a variety of environmental applications. These include estimation of tropical forest biomass, carbon flux and dynamics, habitat mapping for endangered species (the ivory-billed woodpecker and California spotted owl), and derivation and mapping of forest fire fuel structure for montane coniferous forests. In addition, I outline our efforts to marry an ecosystem model with lidar-derived forest structure for improved carbon stocks and flux estimation. I then explore the use of space-based waveform observations from the ICESAT satellite. Lastly, I provide a preview of the next generation space-based lidar systems, including the planned DESDynI mission, which hopes to provide spatially continuous estimates of forest structure for the Earth.