Geophysical Research Abstracts
Vol. 20, EGU2018-11923, 2018
EGU General Assembly 2018

Airborne Lidar for calibration and validation of spaceborne forest biomass and height products: Examples from NASA's Carbon Monitoring System, AfriSAR and GEDI Missions

Laura Duncanson (1), Lola Fatoyinbo (1), John Armston (2), Marc Simard (3), Nathan Thomas (1), Amy Neuenschwander (4), Steve Hancock (2), Michelle Hofton (2), Suzanne Marselis (2), Jim Kellner (5), Sassan Saatchi (3), and Ralph Dubayah (2)

(1) NASA Goddard Space Flight Center, Biospheric Sciences Lab, United States (laura.i.duncanson@nasa.gov), (2) University of Maryland, College Park, (3) NASA Jet Propulsion Laboratory, California Institute of Technology, (4) University of Texas at Austin, (5) Brown University

Several upcoming NASA and ESA missions will collect data sensitive to forest structure (e.g. GEDI, ICESAT-2, BIOMASS, NISAR). The lidar and SAR data collected by these missions will be used to map forest above ground biomass and height at a range of spatial resolutions (0.0625 ha – 1 km). Both the training of empirical models associated with mission observations, and validation of mission data products, will require globally distributed and accurate forest structure reference data that are both spatially and temporally coincident with satellite observations. Developing a global calibration and validation database for vegetation presents considerable challenges due to the requirement for post hoc collation of forest field plot measurements with often different spatial and temporal resolutions. Contemporaneous field observations and spaceborne observations are therefore limited, particularly in remote areas where data collection is expensive and laborious. Airborne lidar enables spatial scaling from field plots to spaceborne data, both expanding the coverage of reference data and allowing a single field site to calibrate and/or validate multiple mission datasets. A common approach for biomass model development, for example, is to use field data to calibrate airborne lidar biomass maps at whatever spatial resolution and scale is appropriate for the spaceborne mission in question. These calibrations are often transferable to other lidar acquisitions representative of the same conditions, increasing the data available for model development. Here, we demonstrate the utility of airborne lidar as both a calibration and validation tool for upcoming mission biomass and height products, focusing on Sonoma County, California, and Gabon, Africa. We use airborne proxies or simulations of GEDI, NISAR and ICESAT-2 data derived from either discrete return airborne lidar or UAVSAR data, and test the expected performance for height and biomass through comparison with locally calibrated airborne lidar maps. This allows a direct comparison of expected performance between these mission datasets at the appropriate resolution for each mission, where field data alone would limit the scale to 1 ha comparisons (inappropriate for GEDI and ICESAT-2). This approach can be expanded in space and time for GEDI and ICESAT-2 to anywhere with existing airborne lidar, for NISAR to anywhere with coincident lidar and L-band SAR data, and for BIOMASS with coincident lidar and P-band SAR. We demonstrate this expansion using an example from the GEDI mission, where empirical biomass models are developed using hundreds of calibration sites across the globe with existing linked field and lidar data. With the establishment of a formal statistical framework, airborne lidar represents an ideal tool for calibrating and validating spaceborne forest structure products, and multiple missions from ESA and NASA could benefit through the development of a globally representative airborne lidar forest monitoring system.