

This study introduces space-based ocean and atmospheric profiling lidar for improving modeling and understanding of ocean carbon cycle. Unique measurements from space-based profiling lidars include (1) the global ocean surface mean square slope measurements for improving air-sea turbulence exchange estimates; (2) the backscatter and beam attenuation measurements for improving the global estimate of partial pressure of CO<sub>2</sub> of the ocean with the reduction of uncertainties in primary productivity estimates. Global statistics of CALIOP integrated ocean subsurface backscatter measurements of coastal waters will be presented. The study will also assess the impact of CALIOP on the uncertainty reduction of primary productivity and the improvement of CO<sub>2</sub> partial pressure estimates. Ocean surface roughness statistics, its applications in air-sea interaction and its comparisons with other measurements will also be presented.