

VISITOR RESEARCH REPORT

Visitor Name: Ms. Xiaomei Lu

Area of Research: *Building Climate Record Using CALIPSO Data*

Period of Visit: September 13, 2010 – May 13, 2011

Goal:

Obtain the Global land surface elevation from atmospheric profiling lidar – CALIPSO lidar. Based on the accurate surface elevation, the vegetation heights on the land surface can be estimated from atmospheric profiling lidar.

Strategy:

First, the CALIPSO detector's transient response model is obtained from the near 5-year measurements. Then, the peak surface lidar return indicates the coarse resolution of land surface elevation, and the distance between the exact location of the land surface and the center of the peak backscatter range bin is estimated from the surface backscattered energy distribution at the three range bins by CALIPSO detector's the transient response model. Based on the two advantages, the surface elevation can be retrieved from the atmospheric profiling lidar with a high resolution.

Accomplishments:

- (1) The new CALIPSO detector's transient response models for both 532nm parallel and perpendicular channels have been obtained and are compared with the model obtained by Hu et al.
- (2) The surface elevation retrieved from CALIPSO lidar has been compared with the 1 arc second (~30-meter horizontal resolution) land surface elevation maps from United States Geological Survey (USGS) National Elevation Database (NED). The surface elevation bias between the NED surface elevation and the ones retrieved from the CALIPSO lidar measurements is less than 1-meter and has a standard deviation of about 2 meter.
- (3) The land surface elevation products of United States from CALIPSO near 5-year measurements are obtained. The surface elevation uncertainties are analyzed and the results indicate that both the surface variance within the laser footprint and signal-to-noise ratio of surface backscattered signals can induce the retrieved surface elevation uncertainties.

Future Work:

- (1) Based on the surface elevation, the vegetation heights can be derived, which is useful for the studies of above-ground biomass.
- (2) Building the CALIPSO detector's transient response model for the 1064nm channel. Based on the transient response models at 532nm and 1064nm channels,

the ocean surface and the water depth can be estimated from the two channels measurements.

Pending Publications:

1. A super-resolution laser altimetry concept- Optics Express
2. A super-resolution laser altimetry concept- International Symposium on Lidar and Radar mapping: Technologies and Applications, Hohai University, Nanjing, China, May. 26-29, 2011

Seminar Presented:

CALIPSO altimetry study- Workshop at Stevens Institute of Technology, April 24-26, 2011