

Biophysical Parameter Retrieval for Global Modelling from Satellite Laser Altimetry

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This research aims to evaluate the potential of satellite light detection and ranging (Lidar) for the retrieval of land surface biophysical parameters, in particular over forest biomes. The data source is the Geoscience Laser Altimeter System (GLAS) aboard the Ice Cloud and land Elevation Satellite (ICESat). This new instrumentation has the potential to directly estimate key land surface parameters such as canopy height, currently difficult to obtain by other means. In addition, data from airborne Lidar experiments have been shown to offer information on the vertical distribution of leaf area index (LAI), and, by correlation, biomass. This research aims to combine field measurements and a modelling approach to explore which parameters may be retrieved from satellite Lidar data and evaluate use in support of land surface and climate modelling.

ICESat was launched in 2003 and aims to have a 5 year lifespan with subsequent missions extending data acquisition to around 15 years. Repeat ground tracks or cross-over points of tracks potentially allow changes over time to be detected. The nature of data acquisition and broad footprint size offer challenges for the interpretation of GLAS waveforms. Data are being explored to evaluate the utility of satellite retrieval in support of land surface modelling.

The project includes a case study of the Forest of Dean, Gloucestershire, UK, a highly heterogeneous, ancient forest spanning approximately 11,000 hectares. The influence of topography on waveform interpretation is considered and field measurements at footprint locations allow direct comparison with parameter estimates inferred from ICESat waveforms and predictions from yield models kindly provided by the Forestry Commission Great Britain. In addition, the effect of LAI, canopy height and fractional cover on Lidar waveforms are demonstrated through radiative transfer simulations.