LIDAR Observations of Optical and Physical Properties (LOOPP) Workshop

LIght Detection And Ranging (LIDAR) systems have been used in the past to measure distance, speed, rotation and chemical composition and concentration. Most extensively, they have been used to generate Digital Elevation Maps (DEM) of land, ice and coastal bathymetry. There have been

(1) space based LIDARs for studying/measuring ice thickness (ICESat; Ice Clouds and land Elevation Satellite) and clouds and atmospheric aerosols (CALIPSO; Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation),

(2) airborne systems for bottom bathymetry (SHOALS, Scanning Hydrographic Operational Airborne Lidar Survey and EAARL; Experimental Advanced Airborne Research Lidar) and mine detection (Magic Lantern and Oboe Projects; ALMDS, Airborne Laser Mine Detection System) and

(3) land-based systems (EFLUM; water vapor, temperature, cloud cover and height) for atmospheric research.

There have also been efforts in using LIDAR for underwater submarine communication (SLC Program; space based platform in 1986/87, TALC; airborne based platform in 1990s, and most recently TRITON; airborne platform in 2011).

What has not been investigated thoroughly are the capabilities of LIDARs to measure temperature (Brillouin-Scattering) and optical properties vertically in the water column, individually or simultaneously. It can be demonstrated that airborne LIDAR systems can retrieve data as deep as 3-4 optical depths, which means that optical properties can be measured through the thermocline for ~70% of the world's oceans. Selection of other wavelengths may improve the vertical extent of LIDAR systems. In addition, there are advantages in using a hyperspectral LIDAR system and polarization into these measurements, but this has received little attention.

What we are proposing is a conference of experts in the fields of LIDAR, optical properties and radiative transfer modeling (1) to review past research efforts in using LIDARs to retrieve water column optical properties, (2) to review current status of LIDAR systems and propose possible improvements and finally (3) to generate a road-map of where to go in future LIDAR research. We would discuss and select platforms for providing this proof of concept and a schedule for transferring a system from one platform to the next (eg. ship based to airborne to UAVs). Results for this meeting will provide a consensus for future LIDAR research to include LIDAR system description (spectral and polarization, scanning, pixel size, gating time for vertical profiling, etc.), radiative transfer modeling approaches to invert the LIDAR signals to in-water optical properties, and testing/validating of ship or airborne systems.

This Workshop (LOOPP, LIDAR Observations of Optical and Physical Properties) would be a joint effort between NATO Undersea Research Centre (NURC) and NRL-Stennis (Bob Arnone) with NURC providing travel funds for the invited participants. LOOPP will have an international flavor and will be limited to around 20 scientists. This number is large enough to cover all topics, yet small enough for the Co-Chairs to get a consensus. The LOOPP Workshop would be held at NURC, La Spezia, Italy, from 15-17 November 2011. A follow on meeting is being planned by Bob Arnone in spring 2012 in Washington, DC. This second meeting, which will include a larger audience of scientists, engineers, and application specialists, will review the consensus white paper generated by the LOOPP Workshop and discuss funding possibilities.

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