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Understanding the dynamics of turbidity and water environments from satellite data as a tool for lidar and satellite bathymetry campaigns

Albada Edward[1], Schenk Karin[2], Hartmann Knut[2], Kleih Christoph[2], Heege Thomas[2]

[1] EOMAP USA INC. edward.albada@eomap.com
[2] EOMAP GmbH & Co. KG, Germany, schenk@eomap.de, hartmann@eomap.de, kleih@eomap.de, heege@eomap.de

Interest in mapping the seafloor in areas of higher latitudes has increased over the last decade. Survey campaigns to map uncharted territory are planned in response to several initiatives (e.g., Seascape Alaska, Seabed 2030, etc.). For these survey campaigns, limited alternatives exist for hydrographers: multibeam (MBES) and airborne lidar bathymetry (ALB) are resource-intensive, and ALB and satellite derived bathymetry (SDB) are limited to shallow waters with favorable water conditions. Surveying deeper waters is only possible with echo sounders, but all methods can potentially contribute to shallow waters data collection. Surveys typically require a combination of technology to optimize the data collection.

Careful planning is required to enable a cost-, resource- and time-efficient surveying solution. Costs and efforts significantly reduce from acoustic to ALB to SDB. But how can the efficiency for shallow water survey with ALB and SDB be optimized? Both are based on optical wavelengths - ALB as an active sensor, SDB within a passive method-based process - and both are therefore dependent on turbidity, which in turn defines the depth, extent and accuracy of the survey. Turbidity in higher latitudes is highly dynamic and variable, especially with the onset of snowmelt. Knowledge of temporal and spatial dynamics is essential to gage ALB and SDB capability in a given area of interest.

Multispectral satellite sensors can measure water constituents, using visible sunlight, which penetrates the atmosphere and waterbody. This light is absorbed and scattered as a function of particles in the water column and dissolved materials. The reflected light detected by satellite sensors can be used to quantify backscatter, which in turn is directly related to turbidity. EOMAP's technology allows analysis of the archives of multiple satellite sensors, including publicly and commercial satellite data, to quantify water turbidity. We achieve a level of detail of up to 3m which allows mapping of coastal waters and inland ponds and lakes. The solutions are embedded into a webapp eoApp© to show time series plots and maps of turbidity, kd and Secchi Disc depth. The presentation will demonstrate the process, and case studies of this solution for different sites in Canada and its application to optimize survey strategy.