**ABSTRACT**

Approximately 1000 Canadian Hydrographic Service (CHS) charts cover Canada’s oceans and navigable waters. Many charts use information collected with techniques that predate the more advanced and more accurate technologies available to CHS today. Gaps in survey data are also problematic, particularly in the Canadian Arctic where only 1% of waters are surveyed to modern standards. Through a Canadian Space Agency (CSA) Government Related Initiatives Program (GRIP) project, CHS has been exploring remote sensing techniques to assist with the improvement of Canadian navigational charts at a national scale. Projects exploring optical/Synthetic Aperture Radar (SAR) shoreline extraction and change detection, as well as optical Satellite Derived Bathymetry (SDB) are currently underway. This paper focuses on SDB, highlighting current results as well as the challenges and opportunities CHS will face when implementing SDB within its operational chart production process.

SDB is of particular interest to CHS due to its ability to supplement depths derived from traditional hydrographic surveys. This is of great importance in shallow and/or remote Canadian waters where achieving wide area depth coverage through traditional surveys is costly, time consuming and a health/safety risk to survey operators. In order to implement SDB in an operational way, CHS has undertaken research to understand: 1) the SDB techniques and optical sensors which present the greatest potential for success in Canadian waters; 2) the lowest level of error which can be achieved through SDB depth estimates and 3) the degree to which SDB can benefit CHS charts relative to traditional hydrographic techniques.

CHS has explored empirical SDB approaches due to the organization’s substantial archive of bathymetric data, the simplicity of implementation and the robust nature of empirical approaches as described in SDB literature. Analysis has examined band ratio techniques, multiple band statistical models and a Random Forest classification strategy. Each technique was applied to several locations within Canadian waters. Comparisons between SDB techniques as well as accuracy assessments using available bathymetric data were completed in order to identify approaches and sensors which would perform better given the environmental conditions of the study areas.

Results from the three study sites have shown that all of the examined SDB approaches are capable of estimating depth within an error range of ~0.5 to 1 m relative to traditional hydrographic survey data. Comparisons of depth estimates between techniques have also shown good similarities between the approaches, with average differences of <1 m typical. While further work is required, the current results have reinforced the potential of empirical SDB for supplementing traditional chart data sources within operational CHS chart production activities. CHS also plans on evaluating other SDB approaches including photogrammetry, physics-based radiative transfer model and wave tracing SAR model techniques.