Canadian Hydrographic Service

Remote Sensing & Satellite-Derived Bathymetry

Arctic Regional Hydrographic Commission (ARHC)
6th Annual Meeting ARHC
Iqaluit, Nunavut, Canada
October 3 & 6, 2016

Canadian Hydrographic Service

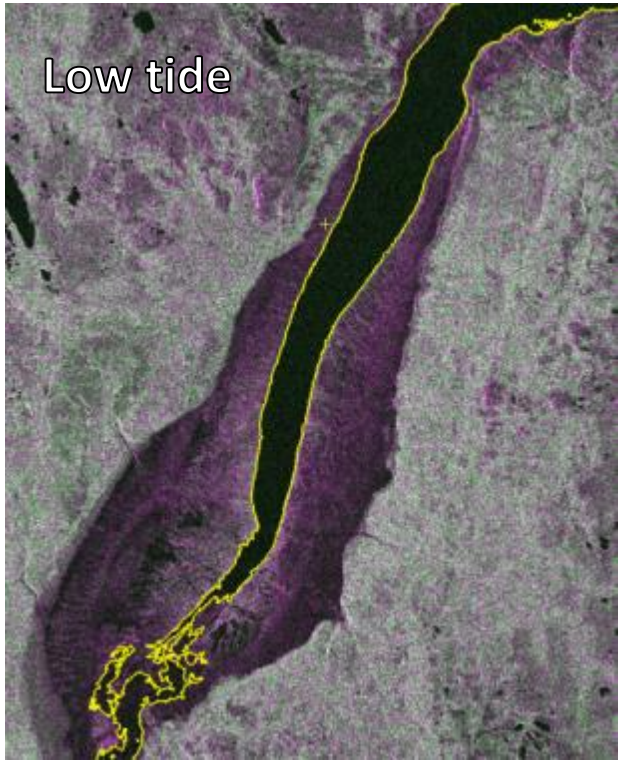
- Collaboration with the Canadian Space Agency (CSA)
- Remote sensing is complementary to the suite of hydrographic acquisition systems
- Work started in September 2015.

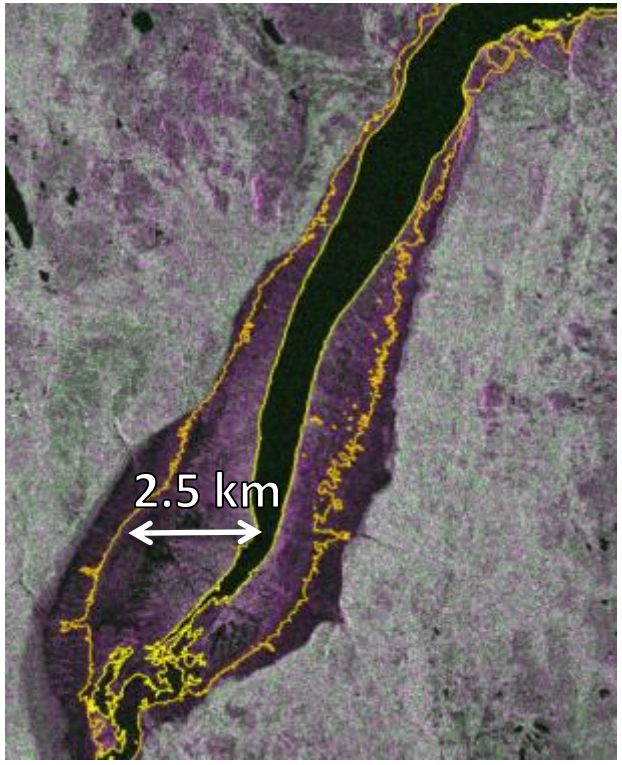
Major activities include:

- Shoreline and intertidal zone charting
  - Uncharted features (e.g. islands) extraction for risk to navigation identification
- Satellite Derived Bathymetry (SDB)
  - Support survey mission planning & reconnaissance
  - Identification of shoals and risks to navigation & Extraction of isobaths
  - Near shore sea bottom characteristics using tidal currents and waves pattern
- Change detection
  - Detecting areas of change/rates of change for shorelines in areas of important activity (sedimentation, sandbar displacement)
- Data integration
  - Incorporate remote sensing extractions into CHS production process

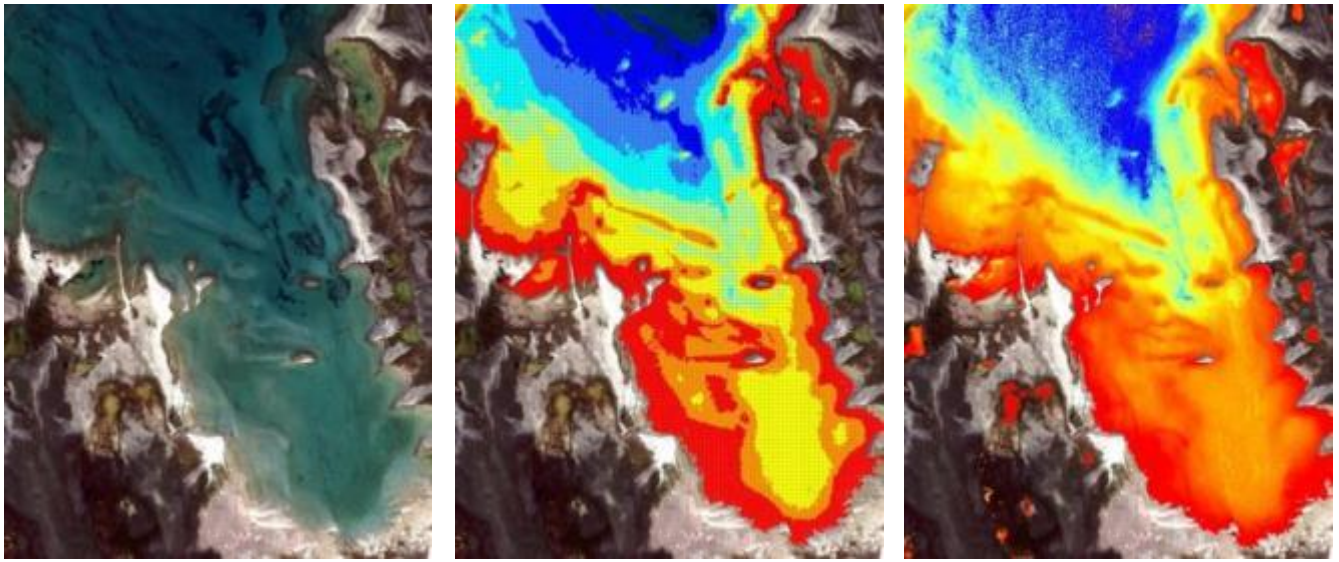
Shoreline and Intertidal Zone Charting

- Image segmentation approach to Chart high and low tide shoreline locations to chart intertidal zones.
- Example below: RADARSAT-2 Fine images - August 29, 2015 (low tide); September 22, 2015 (high tide).
- Desired charting accuracy of ~10 meters.





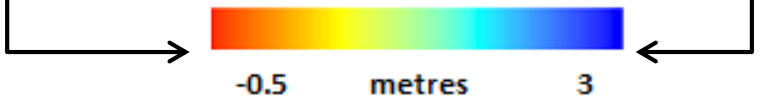
Satellite Derived Bathymetry (SDB)



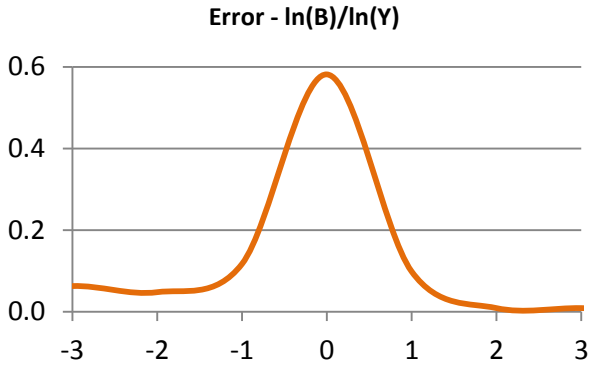
Natural colour

Survey data

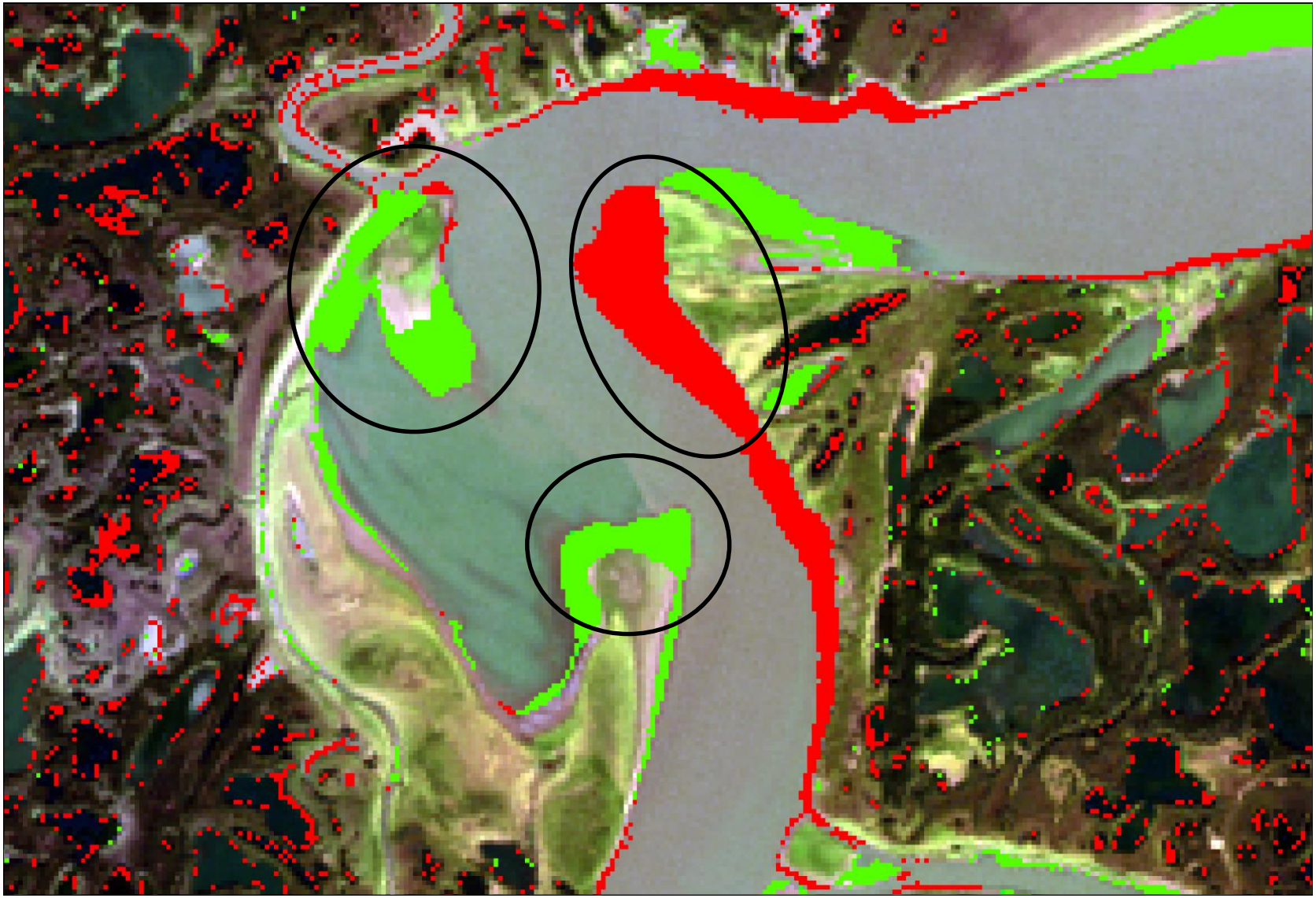
SDB



- O'Reilly Island, Nunavut. Multibeam survey August 2012.
- SDB using Worldview data from August 4, 2012.
- Accuracies of up to 30 cm have been achieved using SDB within a 0-10 m range (water depth)
  - Depths > 10 m have shown a high margin of error and should not be considered accurate.



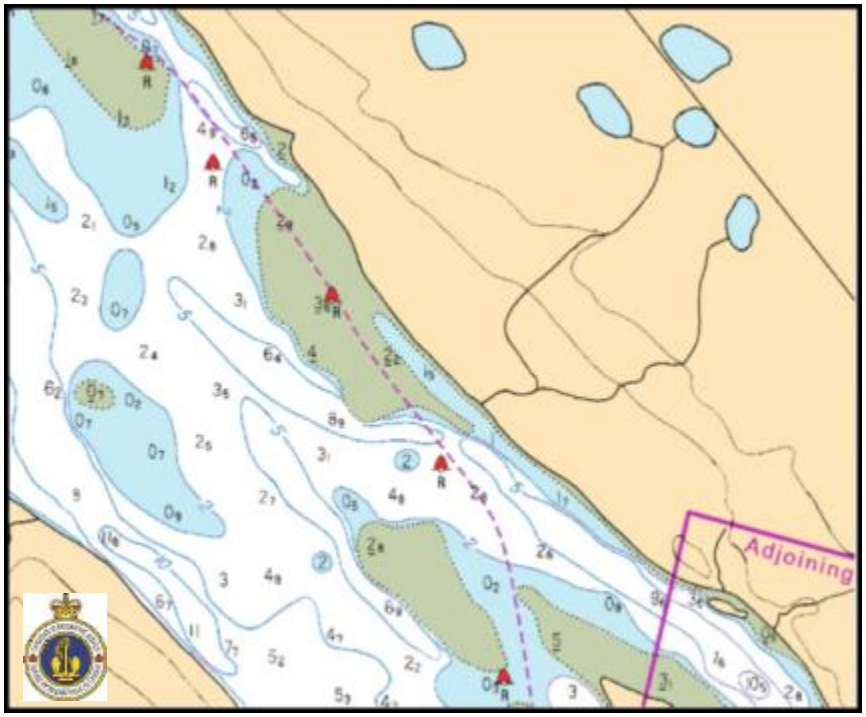
Optical Change Detection

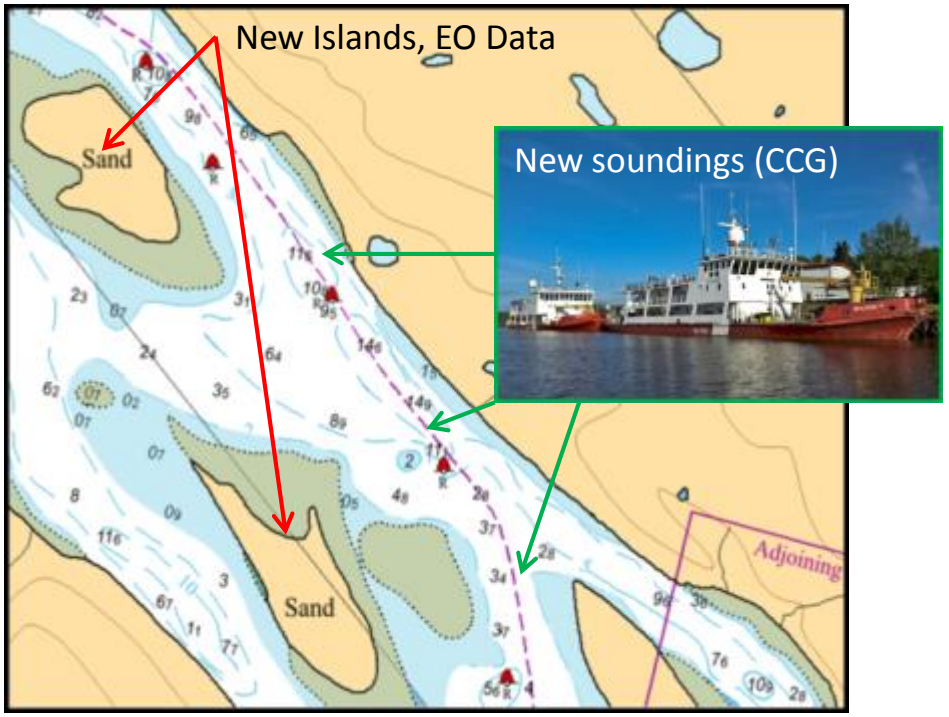


USGS/NASA Landsat **Red = Erosion**
Green = Sedimentation

Data Integration

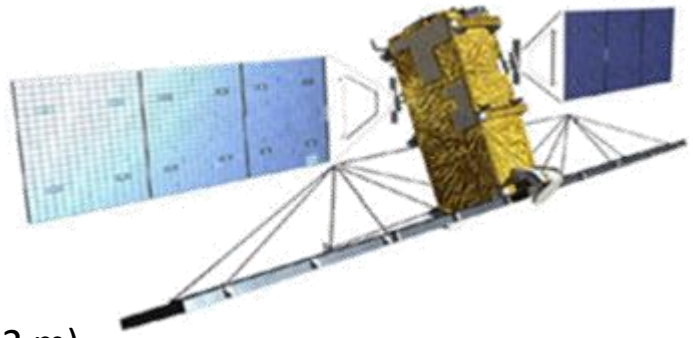
- Incorporation of remote sensing information into CHS charts
  - Vectors are created representing feature of interest (e.g. shorelines, coastal infrastructure, isobaths)
  - Vectors are coded to S-57 standard format
  - S-57 files are added as new source information to the CHS Hydrographic Production Database (HPD)





Sensors

- RADAR Sensors
  - RADARSAT-2 (1 to 10 m)
  - TerraSAR-X (1 to 3 m)



- Optical Sensors
  - DigitalGlobe Satellites (WorldView, Quickbird, GeoEye) (2 m)
  - RapidEye (5 m)
  - Sentinel-2 (10 m)
  - Landsat (30 m)

RADARSAT-2 (2 m) | **WorldView-2 (2 m)** | **Sentinel-2 (10 m)** | **Landsat-8 (30 m)**