Pêches et Océans Canada | Fisheries and Oceans Canada

Calibration & Correction of CSB data
Enhance Credibility to Achieve Chartability

CSBWG16 Workshop

Mathieu Rondeau

Community Hydrography Team - *Canadian Hydrographic Service*

Wellington (NZ) - March 24, 2025

Canada

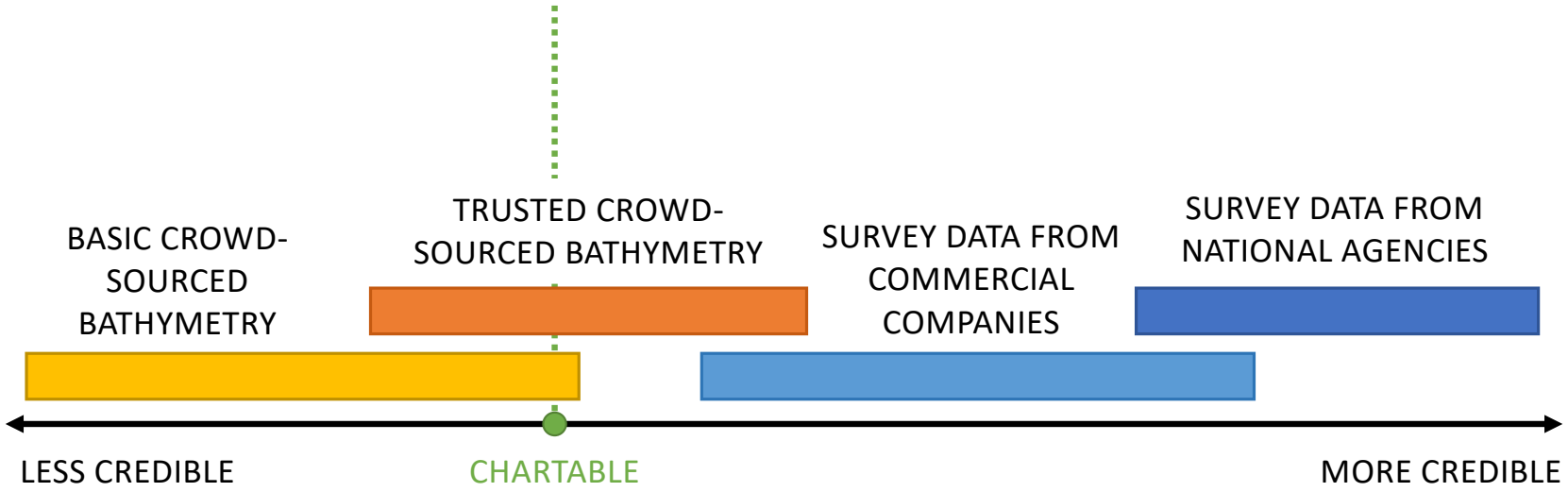
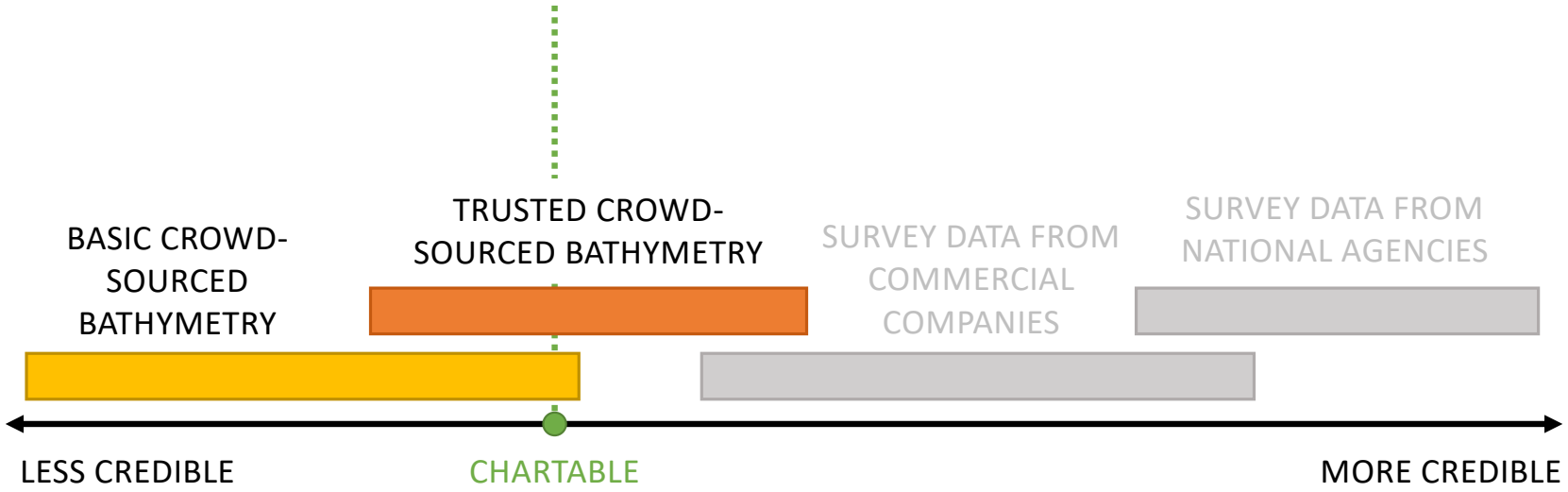
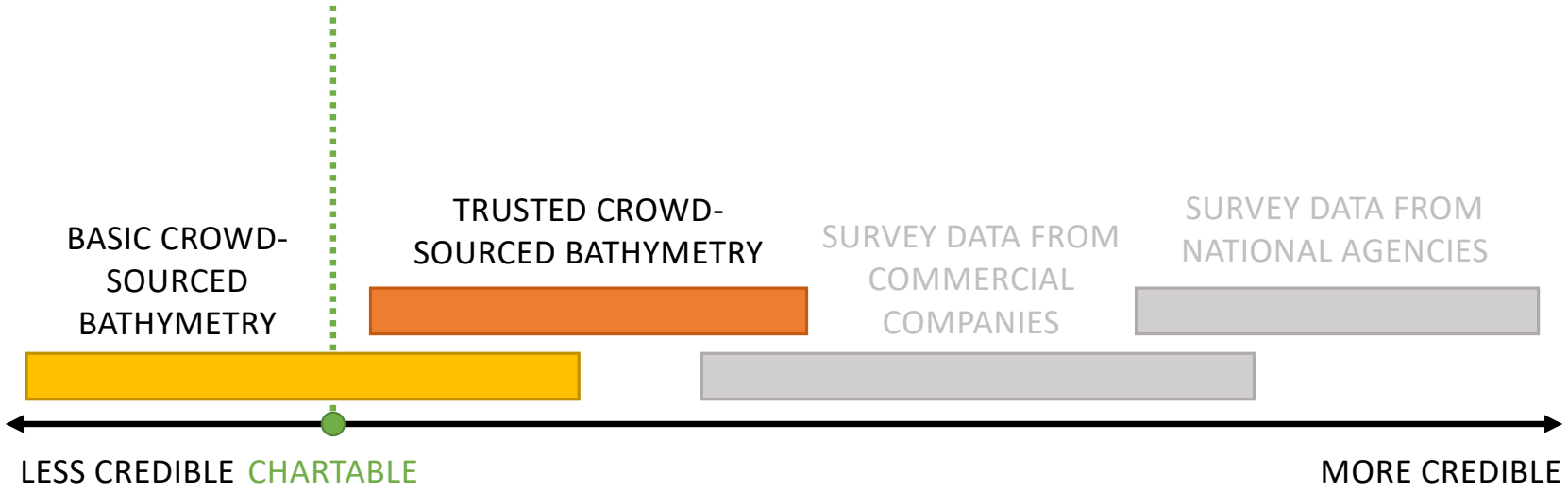


Figure adapted from 'Trusted Crowd-Sourced Bathymetry: From the Trusted Crowd to the Chart' – Masetti et al.


BASIC CROWD-SOURCED BATHYMETRY
TRUSTED CROWD-SOURCED BATHYMETRY
SURVEY DATA FROM COMMERCIAL COMPANIES
SURVEY DATA FROM NATIONAL AGENCIES
LESS CREDIBLE
CHARTABLE
MORE CREDIBLE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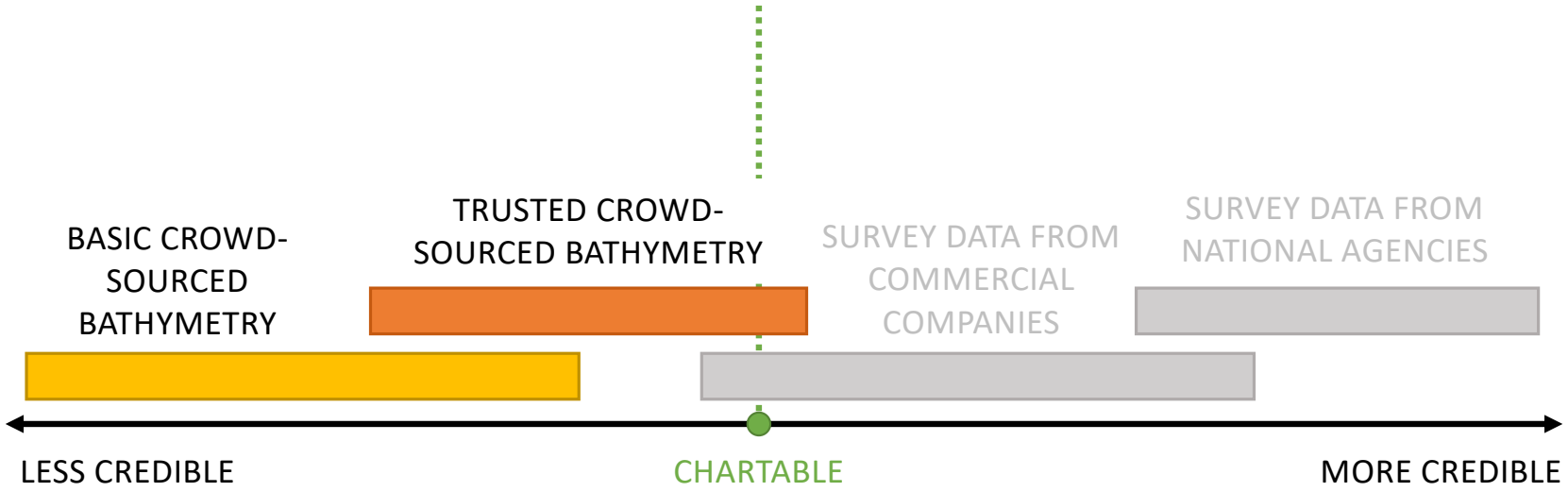
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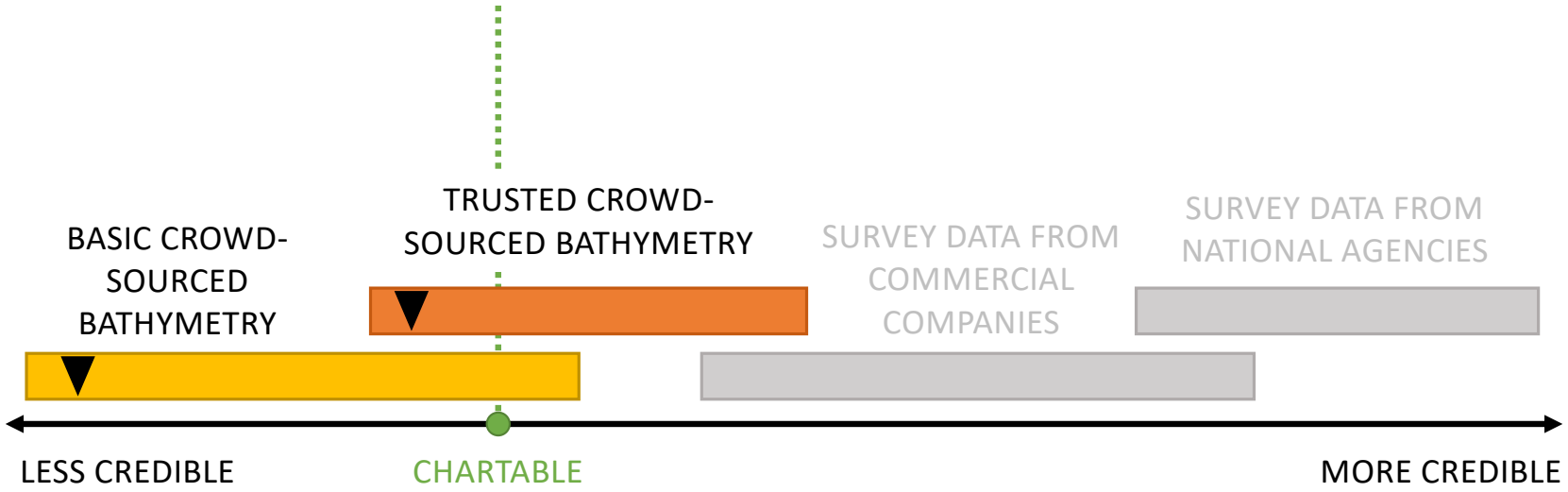
BASIC CROWD-SOURCED BATHYMETRY
TRUSTED CROWD-SOURCED BATHYMETRY
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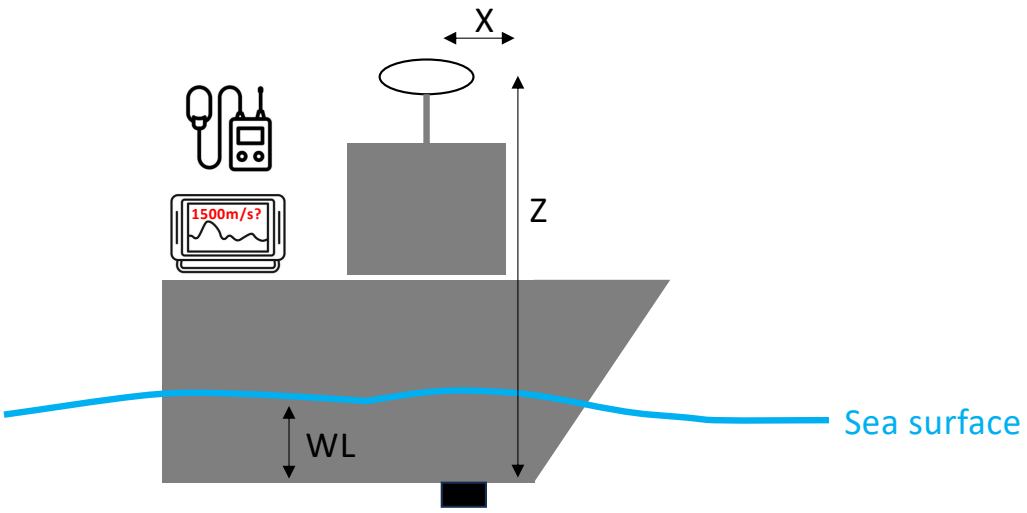
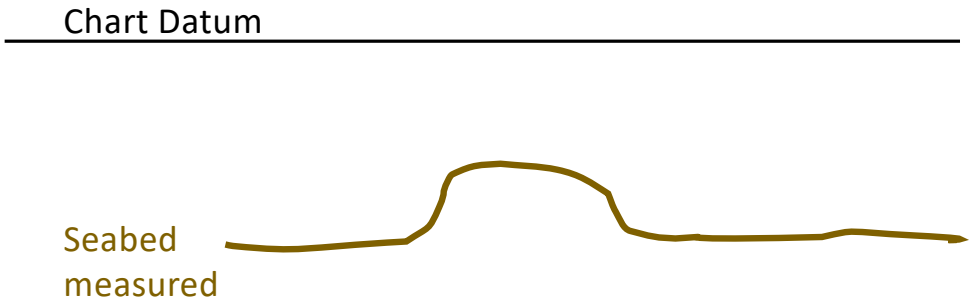
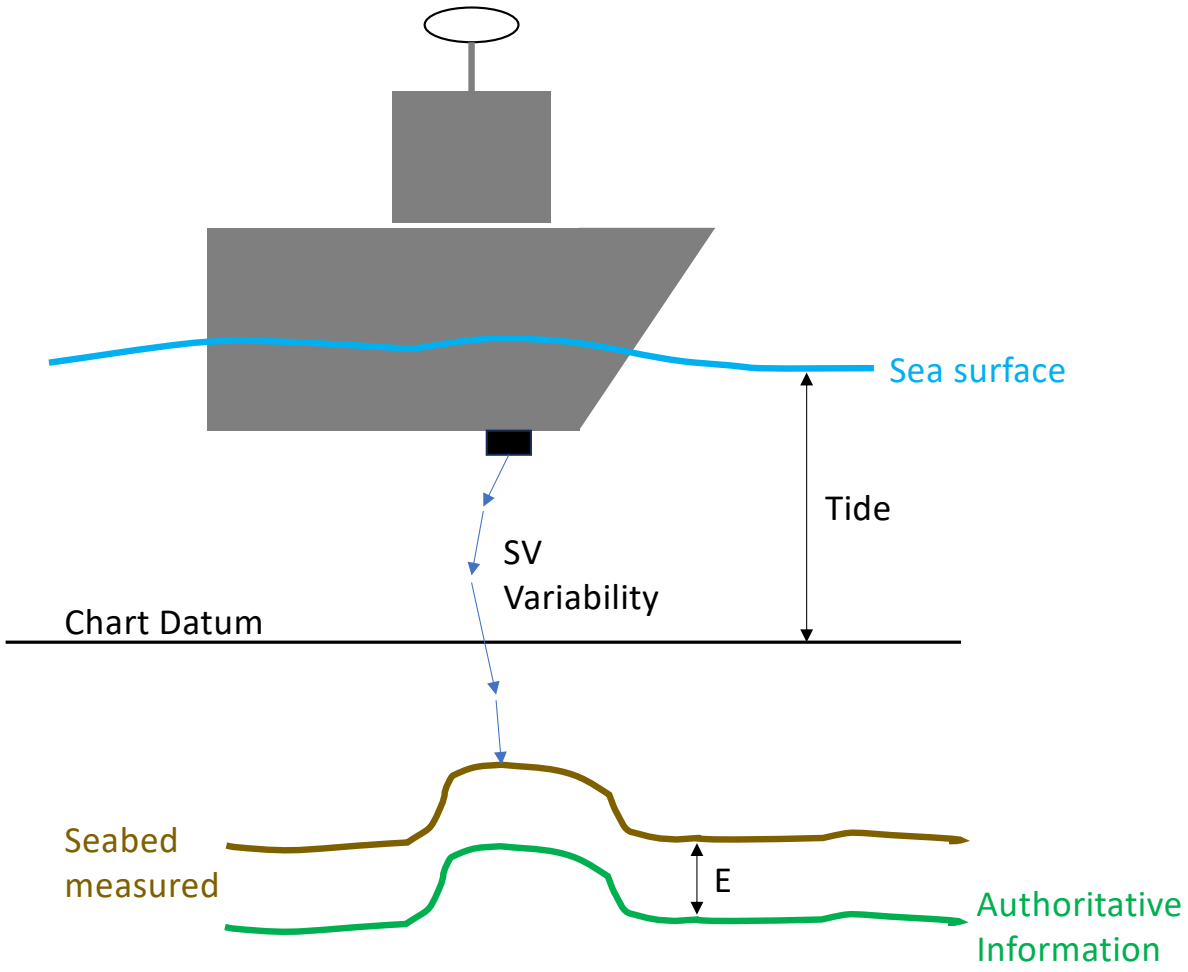




CSB Contributor's

Field of Action

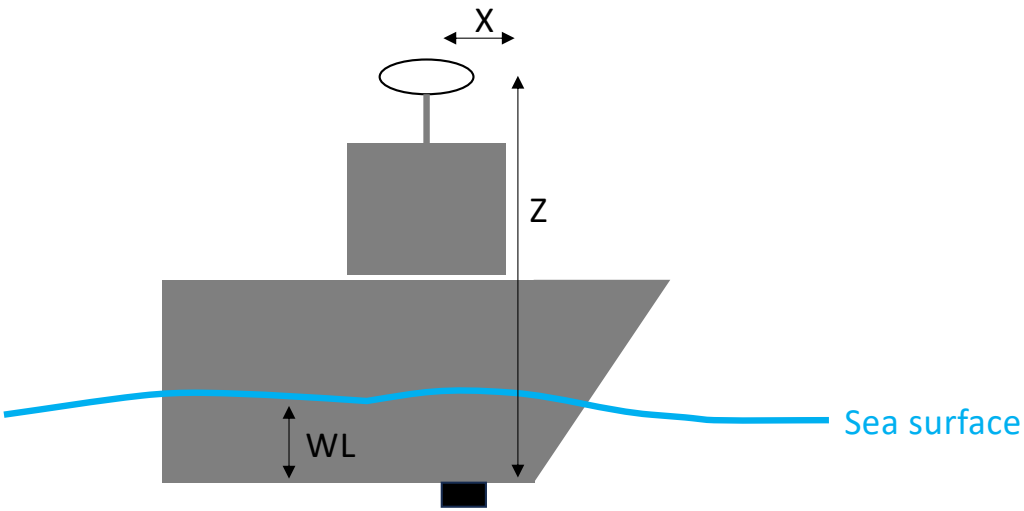
- Choosing the Datalogger (see slides 10-11)
- Mastering the vessel geometry (lever arms) (see slides 12-14)
- Mastering the EchoSounder settings (Sound Velocity preset value)

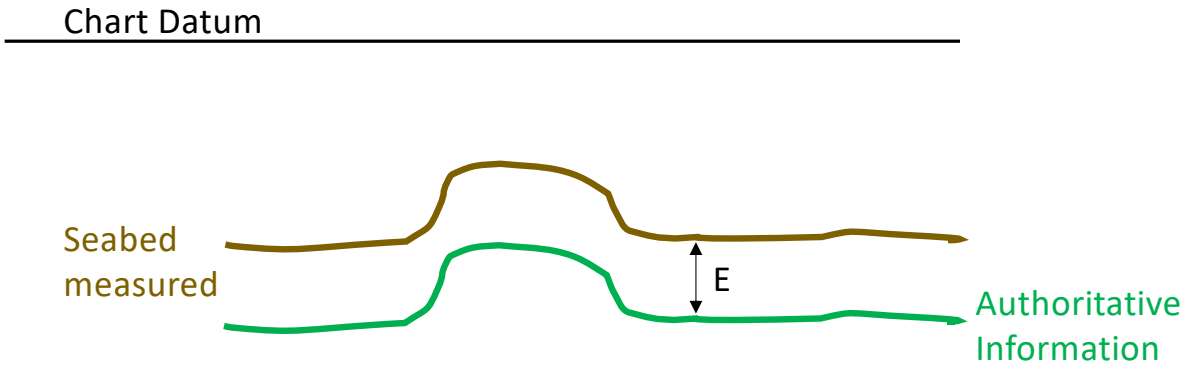


HO's

Field of Action

- Correcting for Water Levels (Tides) (see slides 21-28)
- Correcting for Sound Velocity Variability (see slides 29-32)
- Comparing against Authoritative Information (Peer-Consistency Assessment)





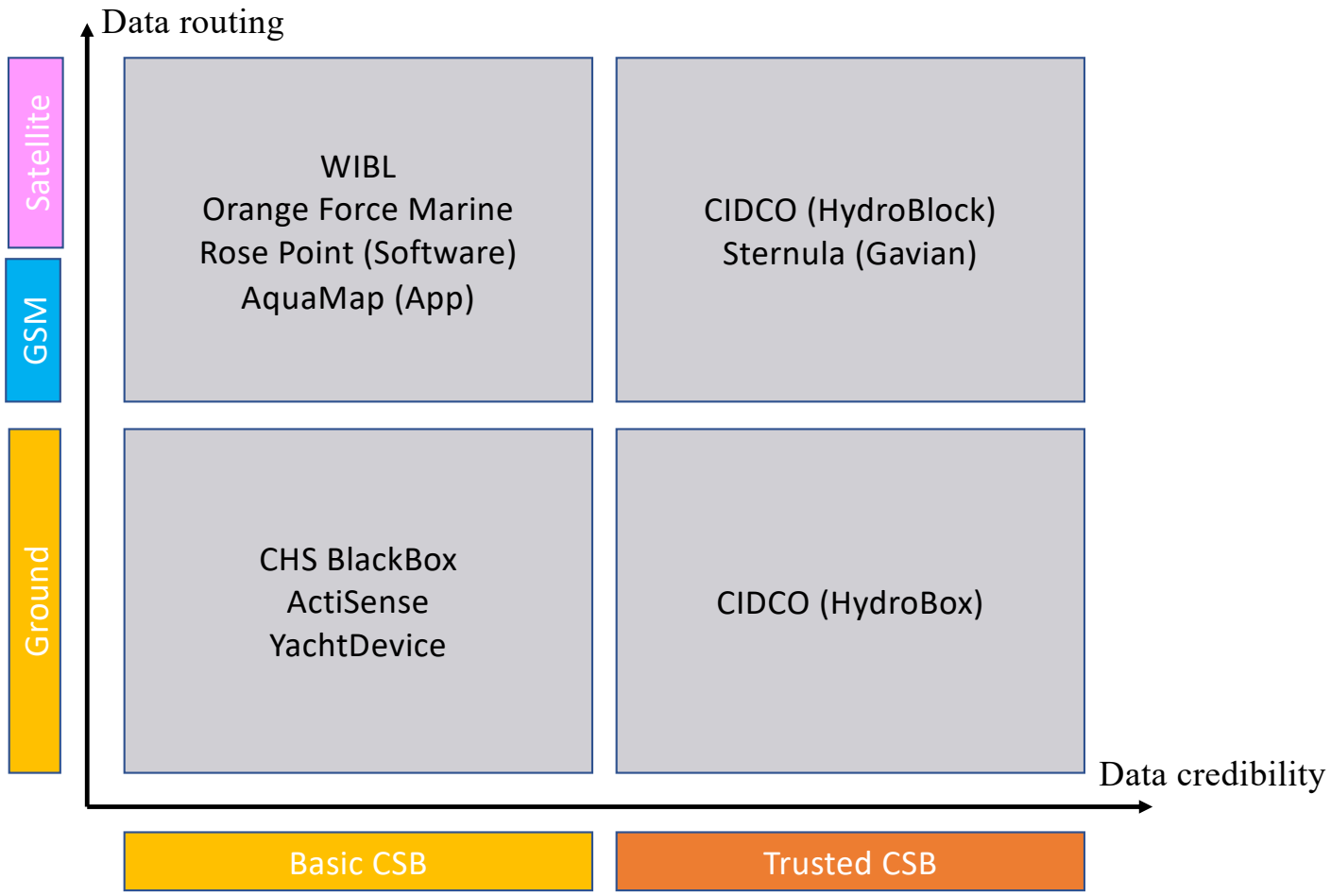
HO's

Field of Action

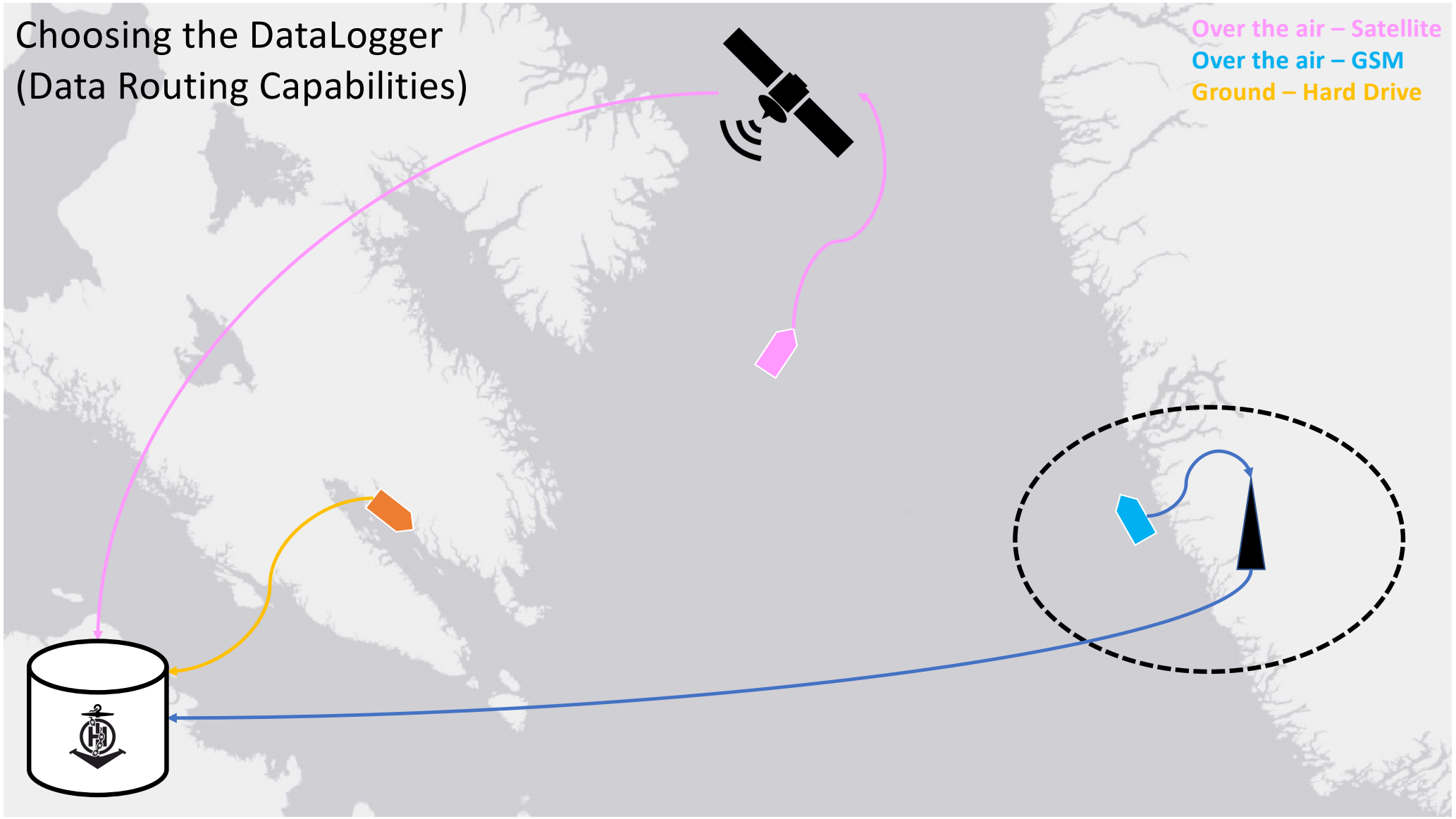
- Comparing against Authoritative Information (Peer-Consistency Assessment)

-> A Posteriori Calibration of Lever Arms (see slides 15-20)

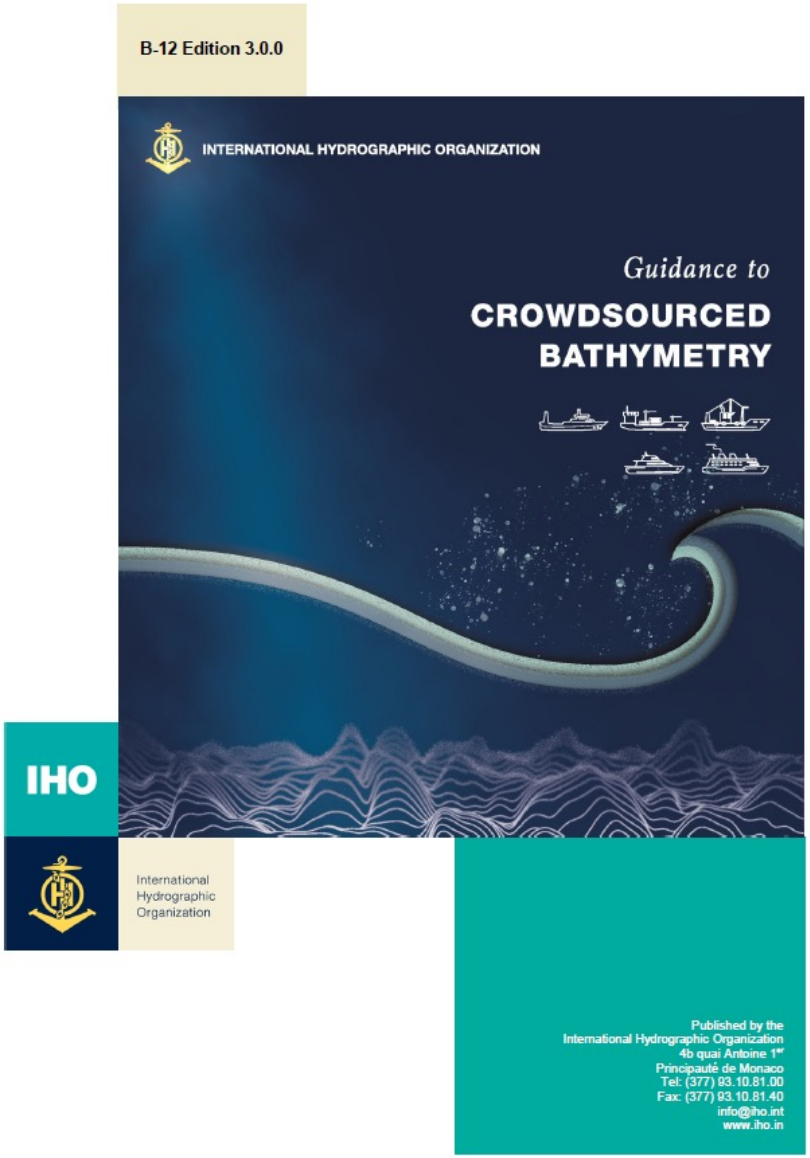
Choosing the DataLogger



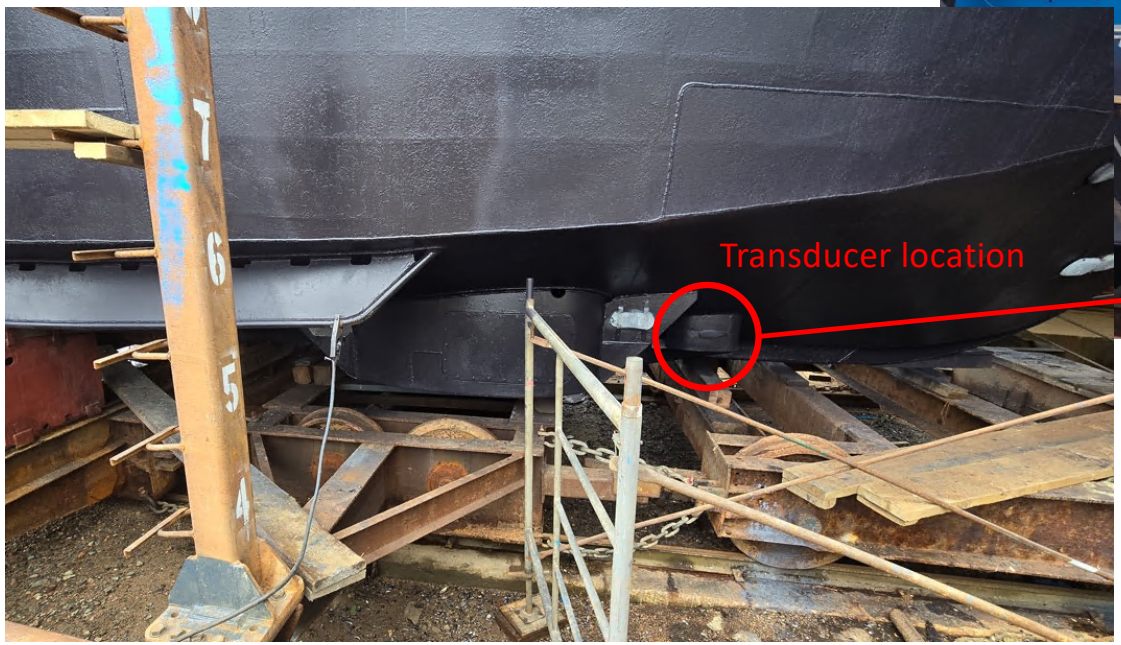
Choosing the DataLogger (Data Routing Capabilities)



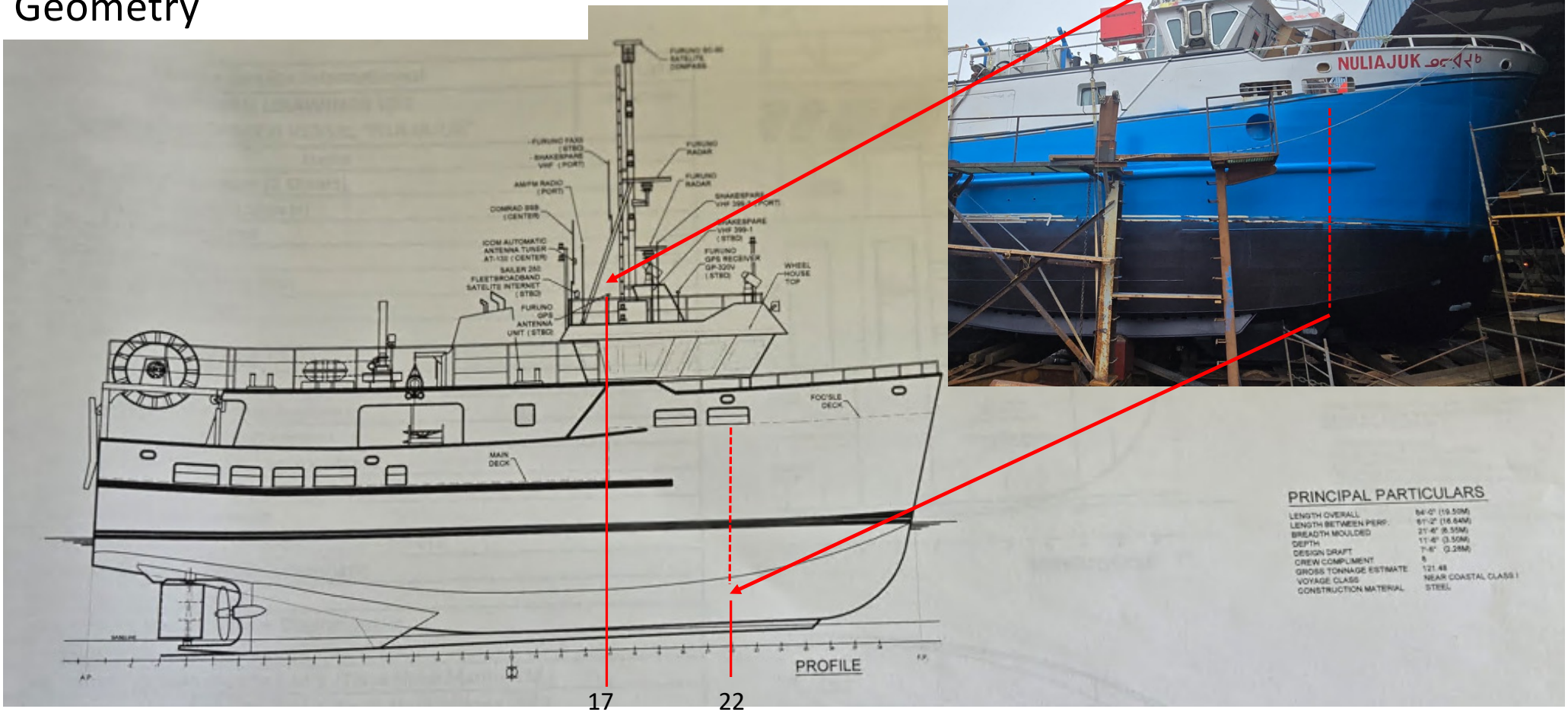
Mastering the Vessel Geometry



Mastering the Vessel Geometry



Mastering the Vessel Geometry

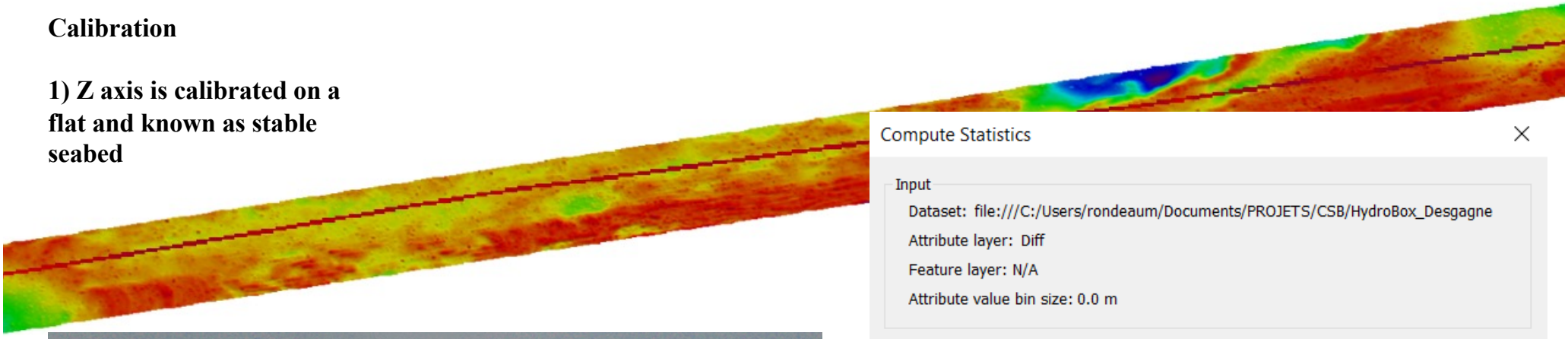


Mastering the Vessel Geometry – A Posteriori Calibration

Laurentia Desgagnés
PANAMAX Tanker
LOA : 228m
Breadth : 32m
Draught : 14.2m
2 Quebec/Montreal round trips per week

Calibration

1) Z axis is calibrated on a flat and known as stable seabed



Compute Statistics

Input

Dataset: file:///C:/Users/rondeaum/Documents/PROJETS/CSB/HydroBox_Desgagne

Attribute layer: Diff

Feature layer: N/A

Attribute value bin size: 0.0 m

Statistics

Minimum 35.0 m

Maximum: 41.7 m

Mean: 39.0 m

Area: N/A

Std_dev: 1.0 m

Total count: 405,306

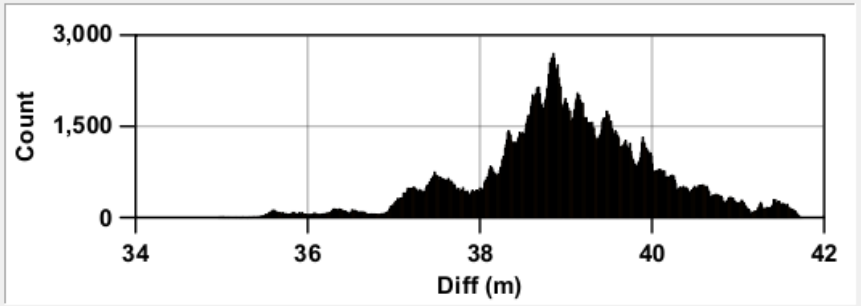
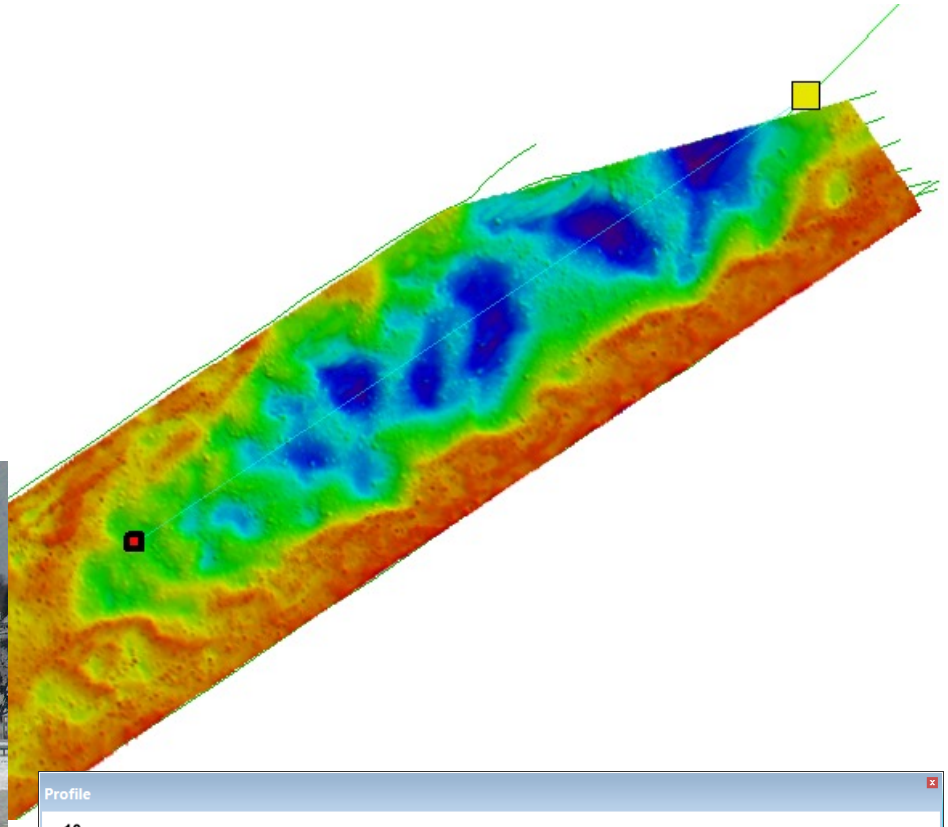
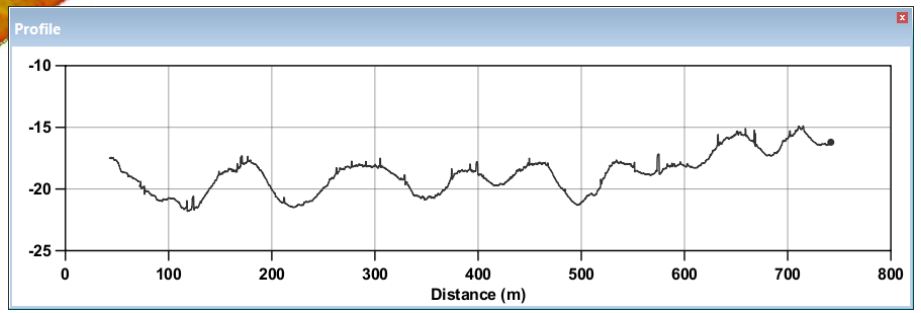


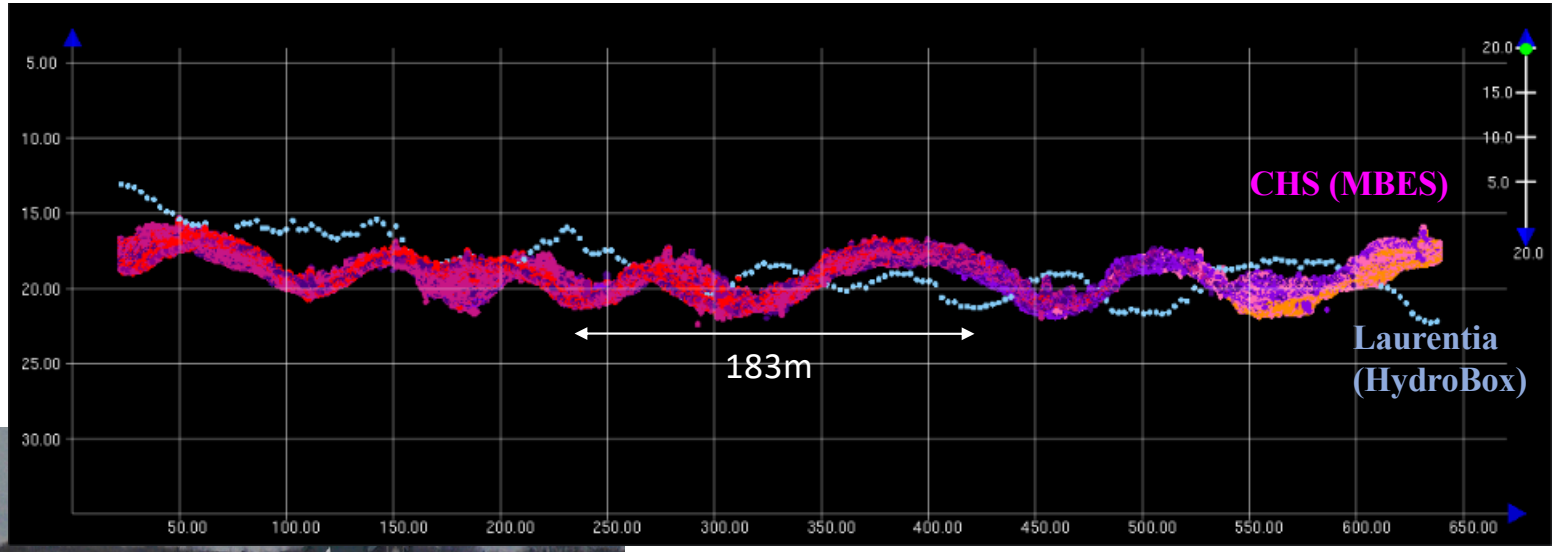
Image Export | ASCII Export | OK | Help

Calibration

2) X axis is calibrated on a series of bumps and hollows known as stable (no dunes)



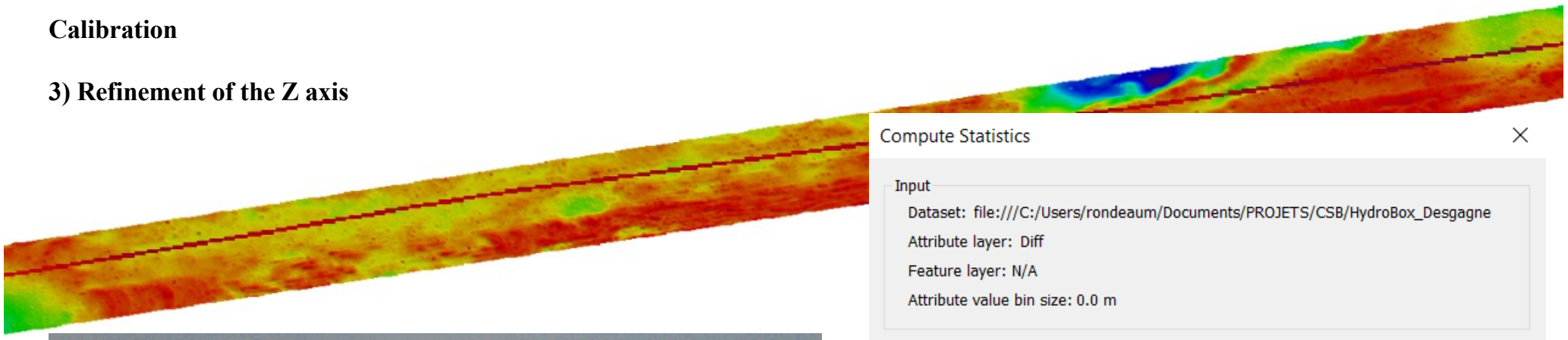


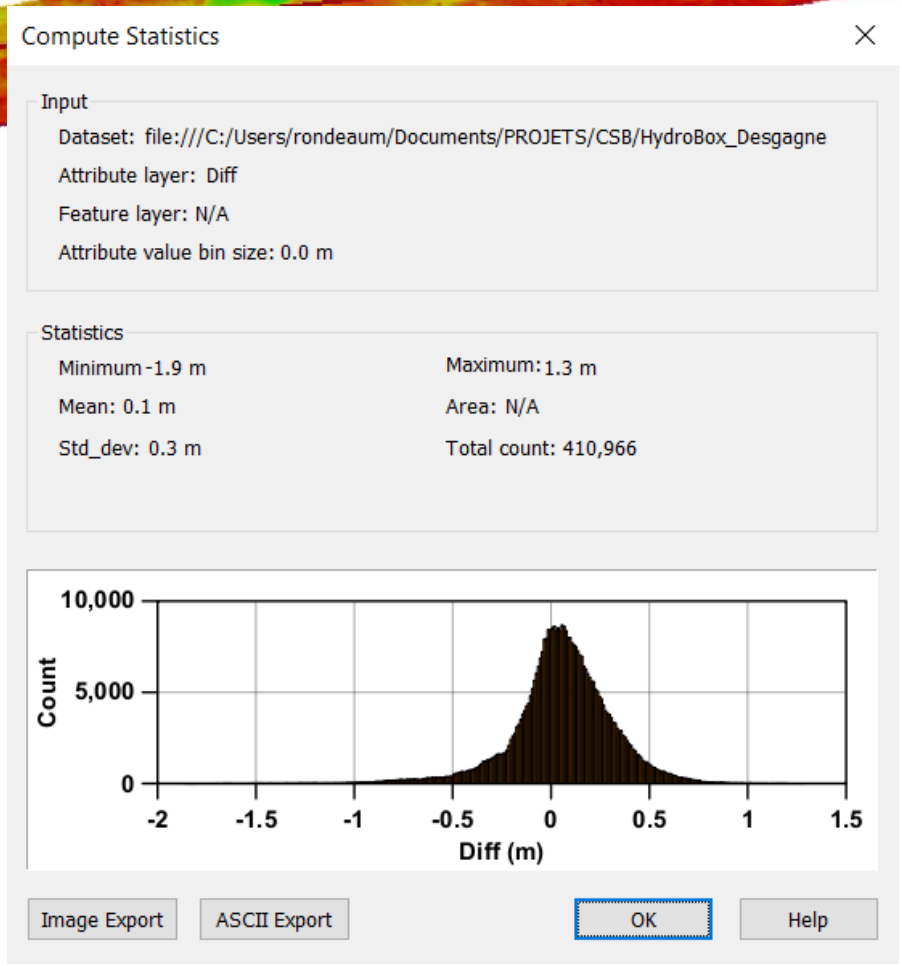

5.00
10.00
15.00
20.00
25.00
30.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
650.00
20.0
15.0
10.0
5.0
20.0
CHS (MBES)
183m
Laurentia
(HydroBox)


183m
39m

Calibration

3) Refinement of the Z axis





Calibration

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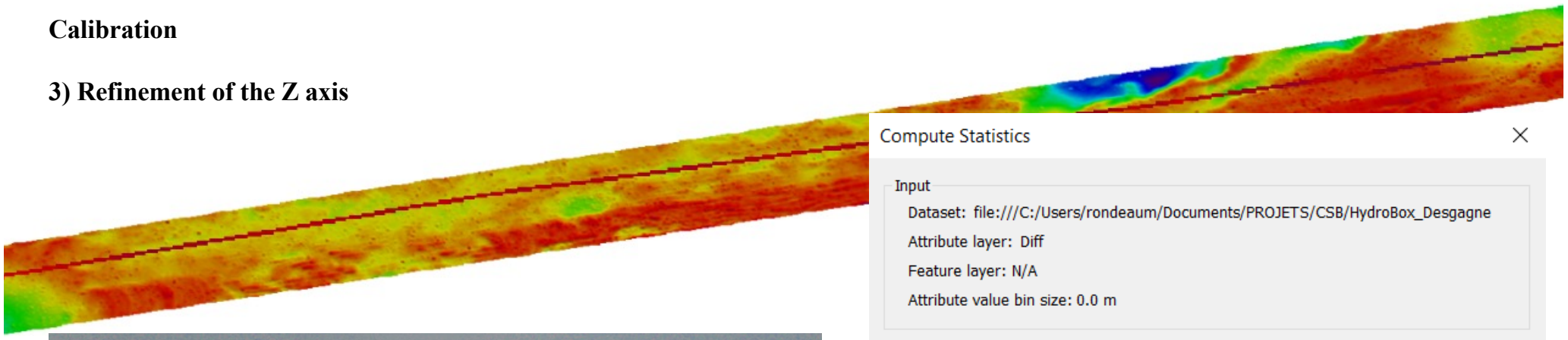
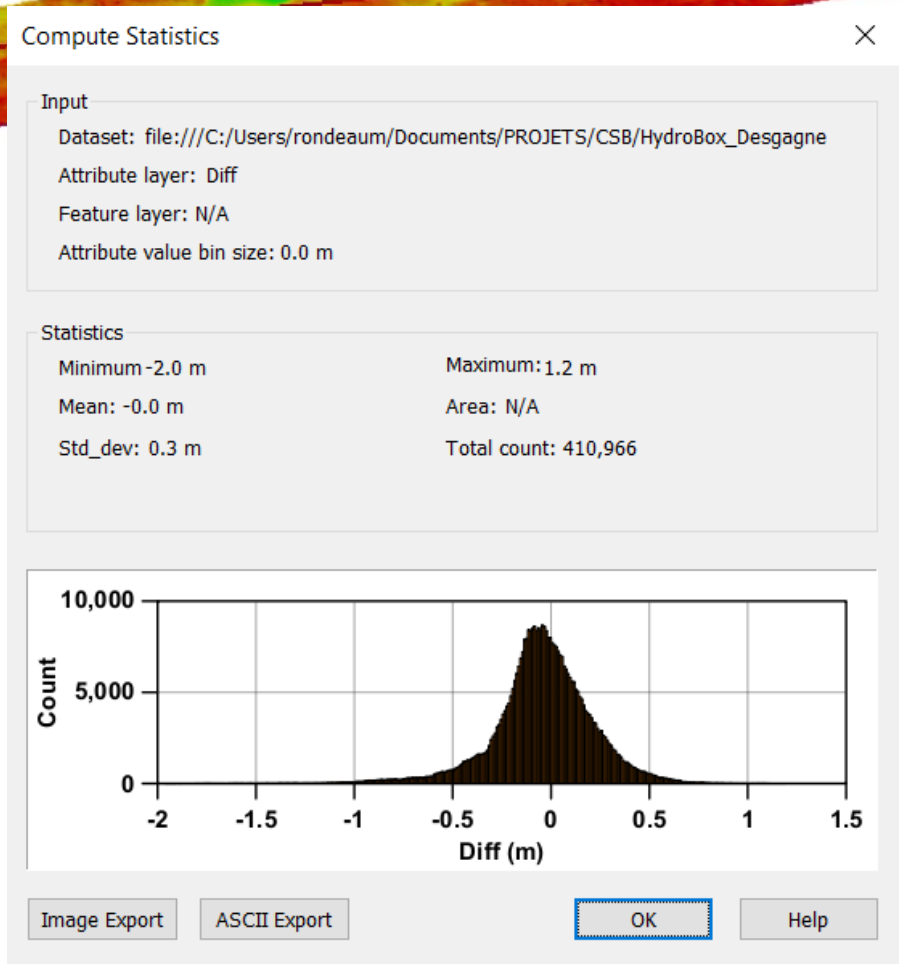
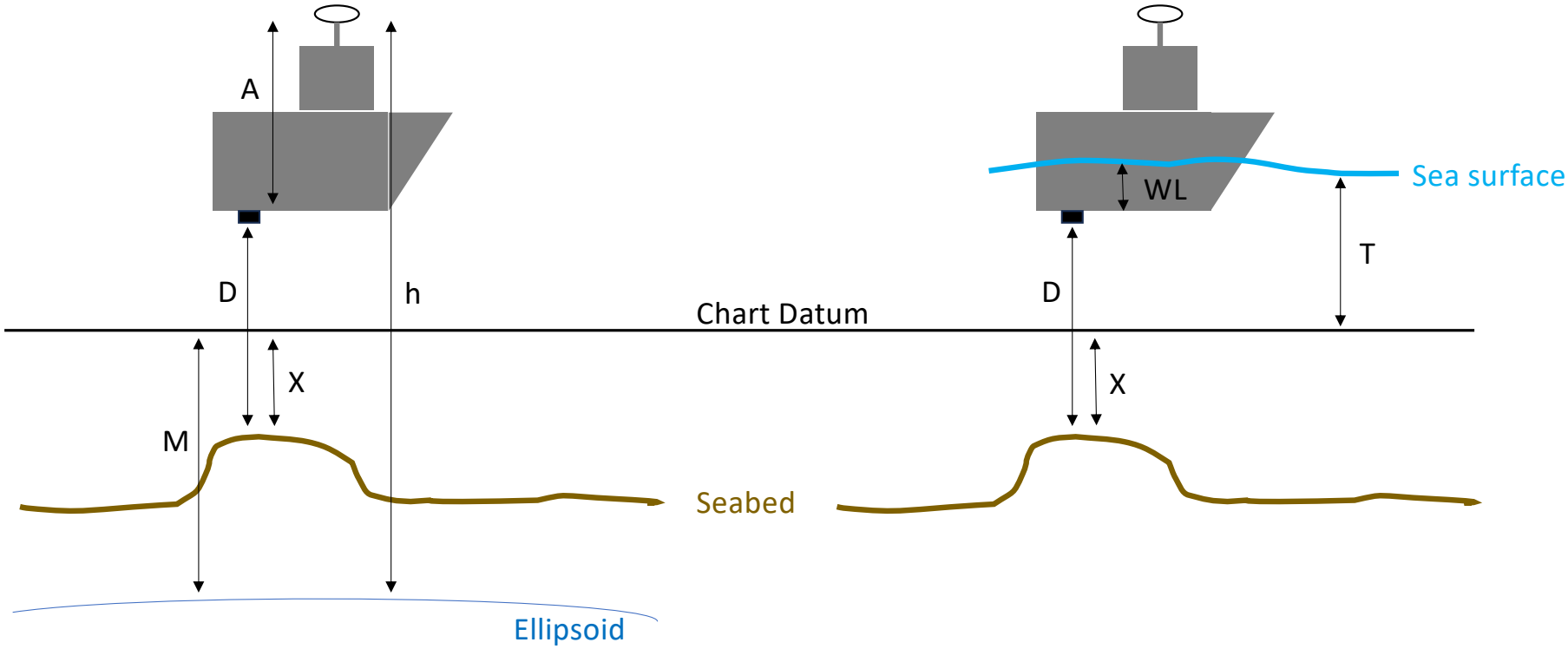




Correcting for Water Levels (Tides)

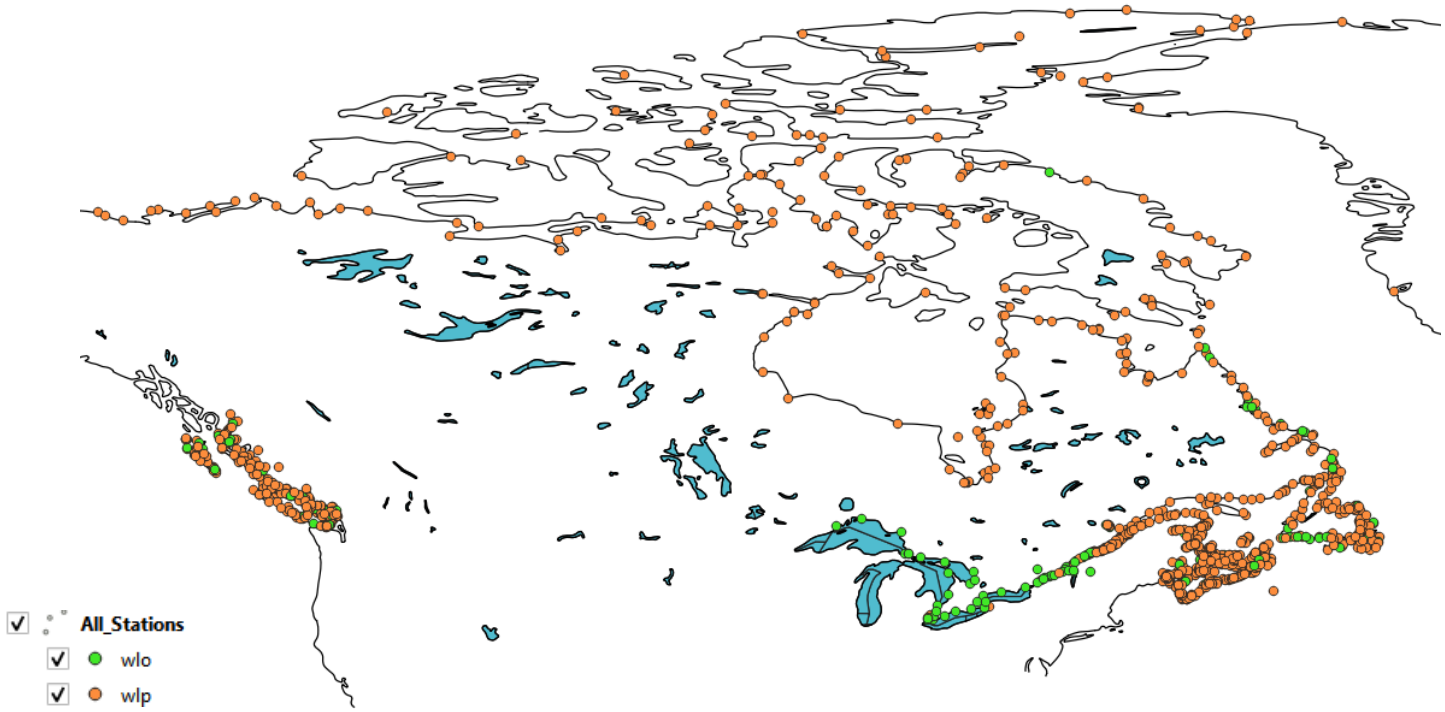


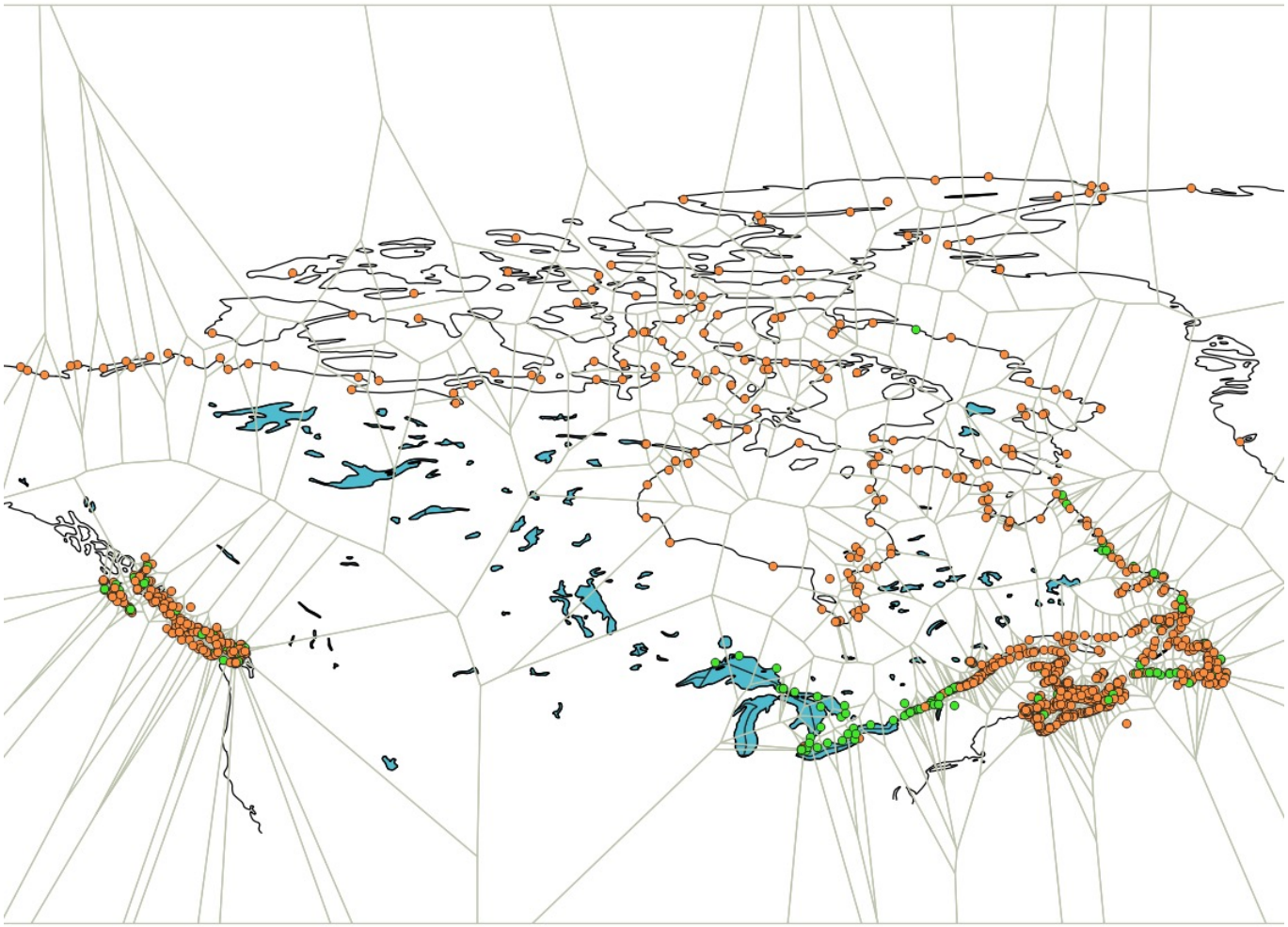
GPS Tide Reduction

Trusted CSB

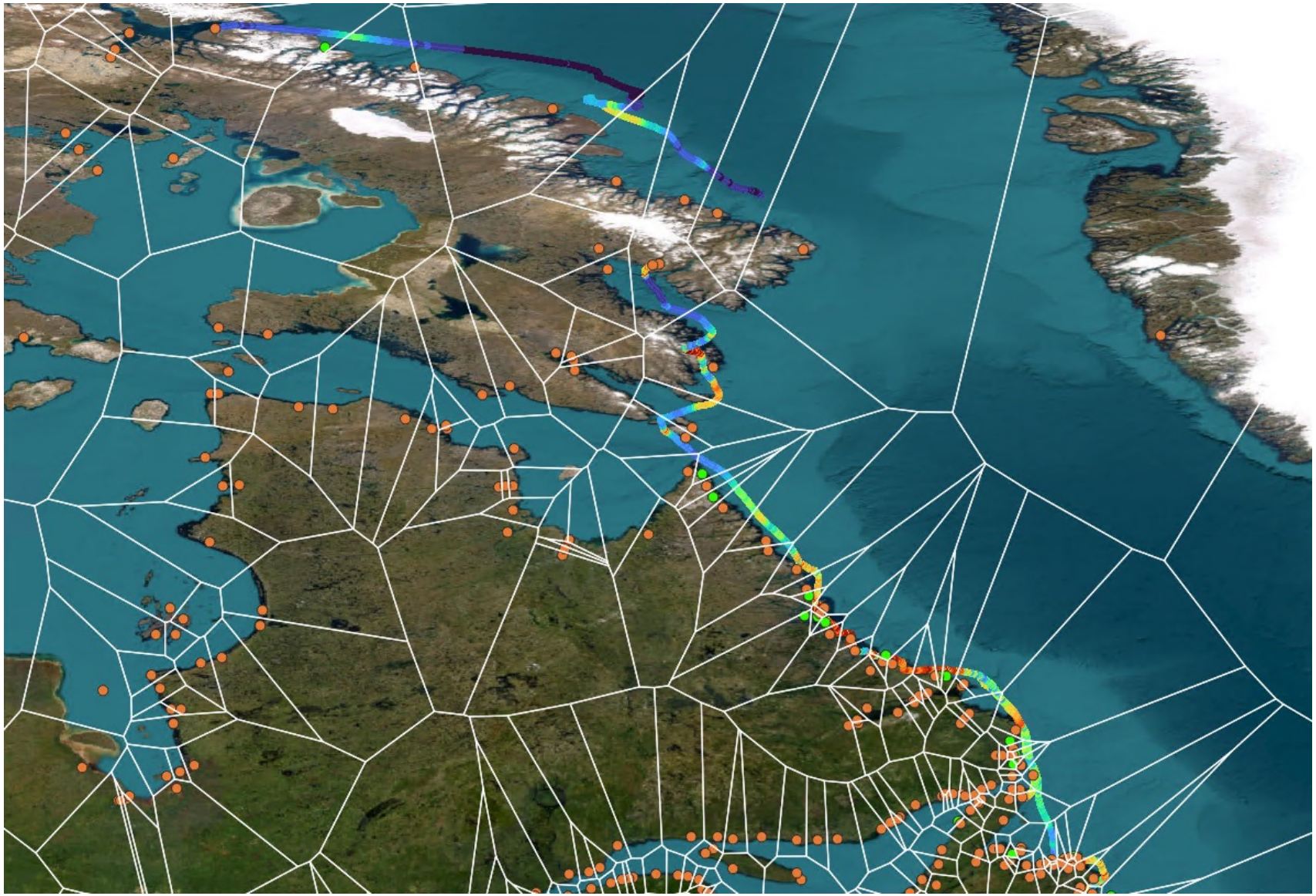
Water Level Reduction

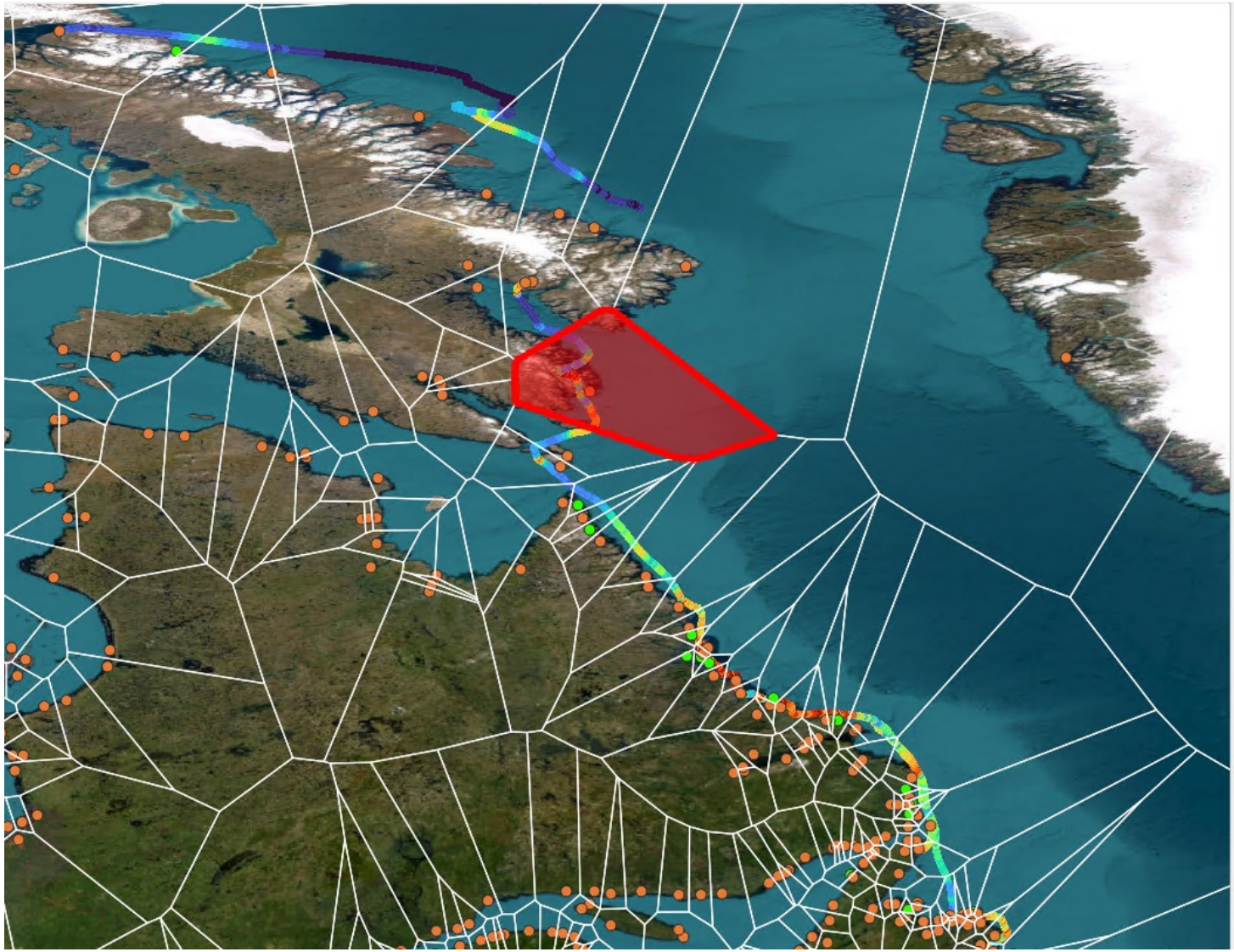
Basic CSB


All_Stations
wlo
wlp




wlo
wlp





Identify Results

Feature	Value
StationVoronoi-2	
name	Brevoort Harbour
(Derived)	
(Actions)	
fid	767
id	5cebf1df3d0f4a073c4bbbfb
code	04070
name	Brevoort Harbour
time_series	['wlp']
is_tidal	True
station_position	POINT (-64.15 63.316667)

Mode: Current Layer

View: Tree

Identify Results | Processing Toolbox

Search QMS

Search string...

Filter by extent | All

Last used:

ESRI Satellite (ArcGIS/World_Imagery)

TMS details, report a problem

Add

Download geodata for your project

Correcting for Water Levels (Tides)

References:

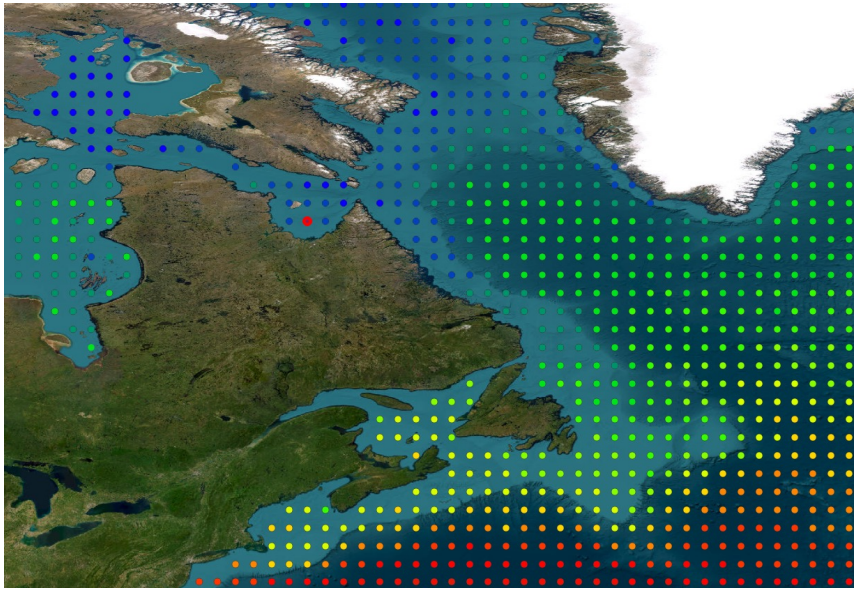
- AusBed Tide UI
https://github.com/ausseabed/tide-tool-ui

- CHS-CSB_Processing
https://github.com/YanBilodeau/CHS-CSB-Processing

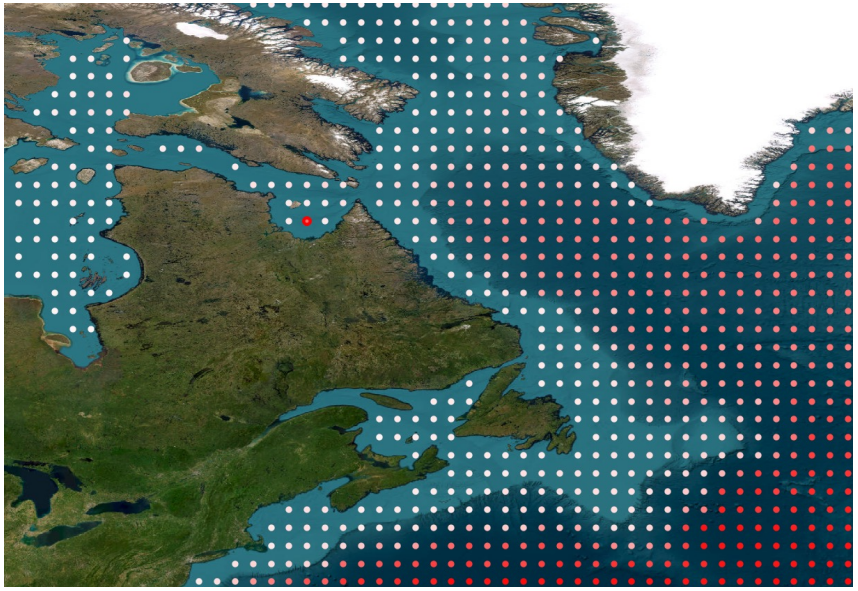
- NOAA
https://github.com/anthonyklemm/Crowdsourced_Bathy_Processing

- CNES aviso-fes -> WorldWide Tide Predictions Model
https://github.com/CNES/aviso-fes

Correcting for Sound Velocity Variability

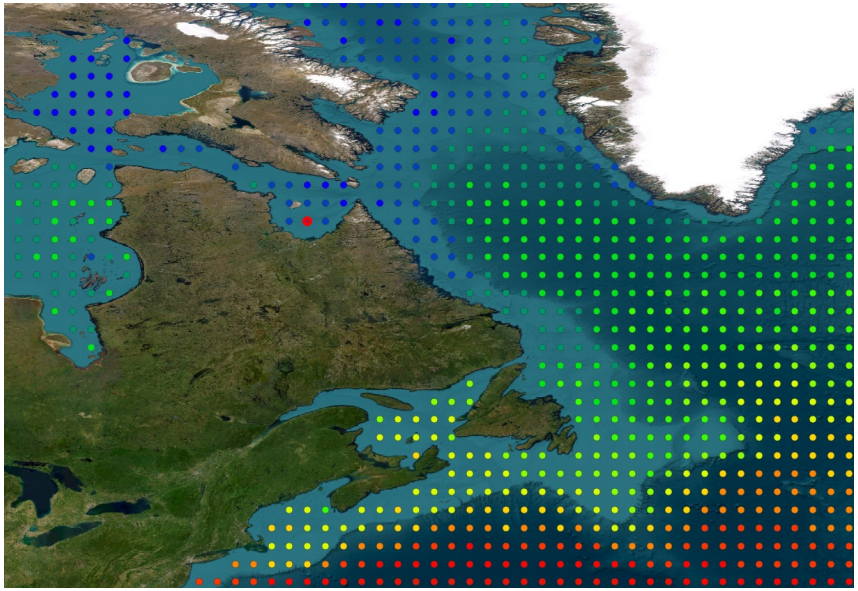


World Ocean Atlas – Mean Temperature in Summer over 2015-2022 period

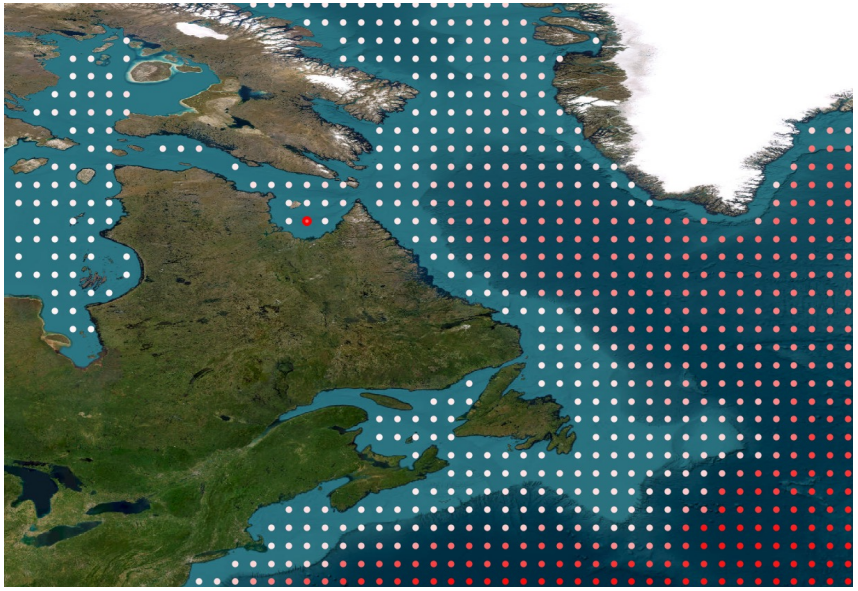


World Ocean Atlas – Mean Salinity in Summer over 2015-2022 period

Correcting for Sound Velocity Variability

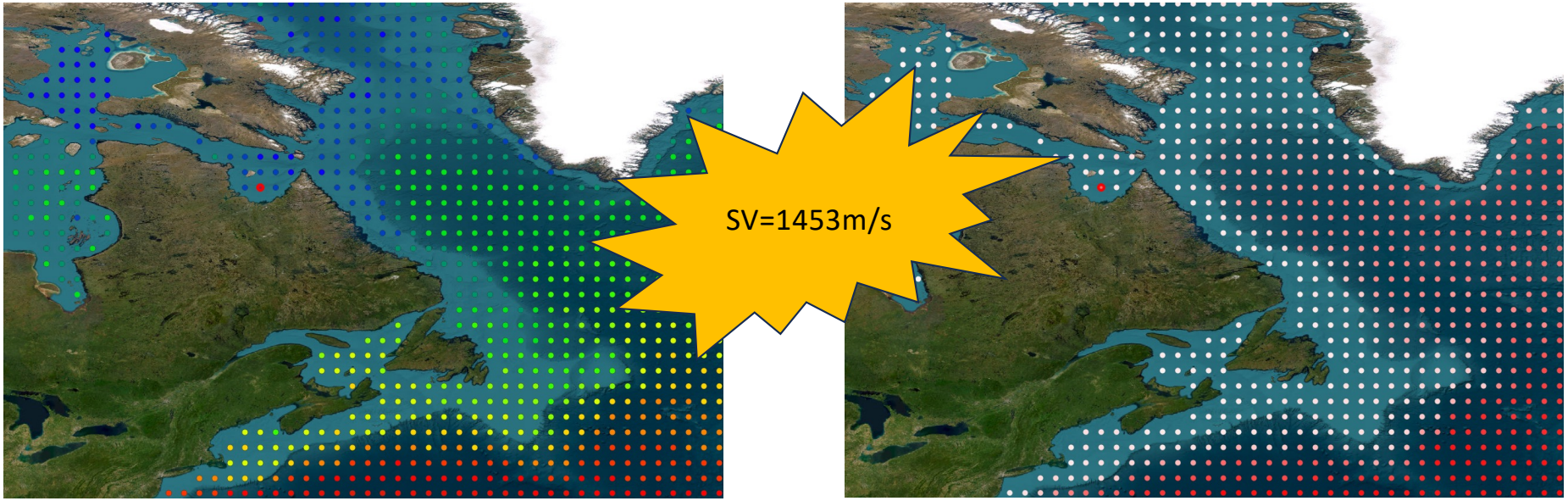


T=1,8° at the red dot (Ungava Bay)



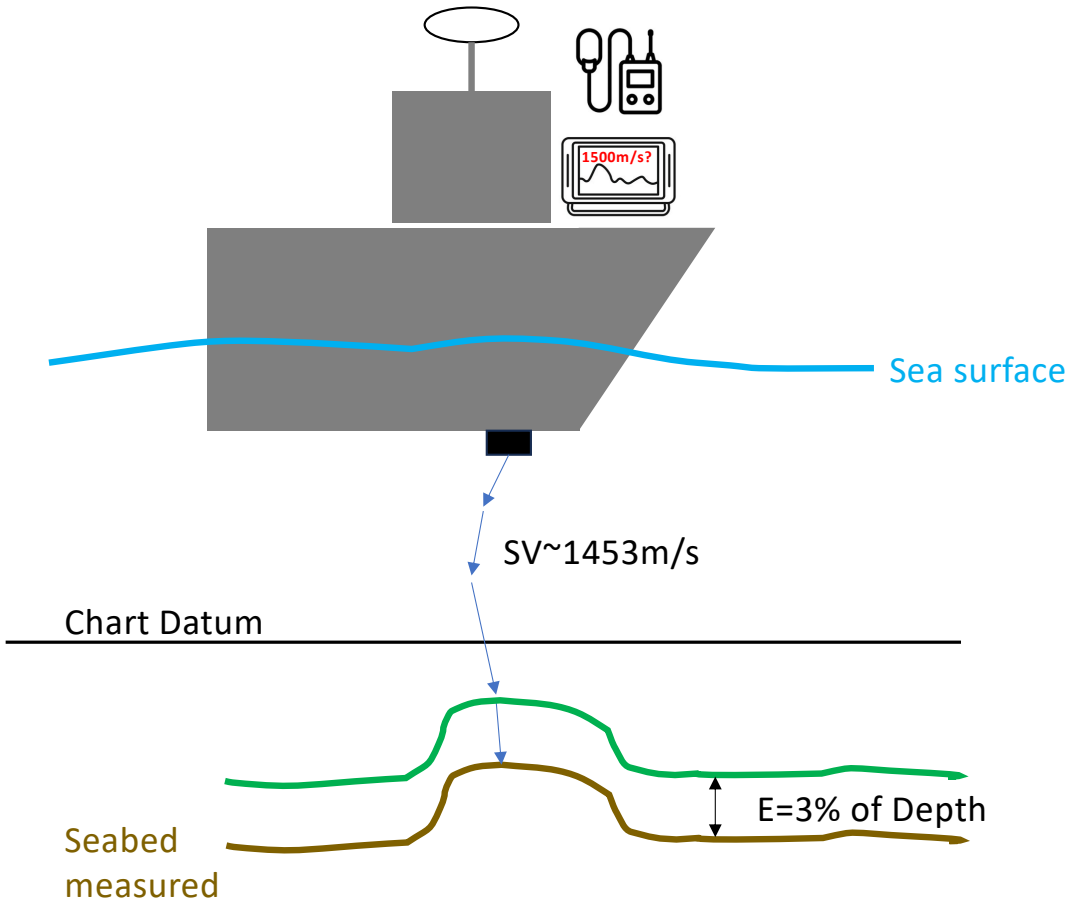
S=31.7 at the red dot (Ungava Bay)

Correcting for Sound Velocity Variability



T=1,8° at the red dot (Ungava Bay)

S=31.7 at the red dot (Ungava Bay)


1500m/s?
Sea surface
SV~1453m/s
Chart Datum
E=3% of Depth
Seabed
measured

CSB contributors can increase the data's credibility by:

- Using a TCSB (GNSS-capable) logger
- Mastering the geometry of the CSB survey system (lever arms)
- Documenting the pre-set speed of sound value of the echosounder

Hydrographic Offices can increase the data's credibility by:

- Correcting for the water levels (tides)
- Correcting for sound speed variability
- Calibrating for the lever arms (Peer-Consistency)