

An Overview of the Oceanographic Component of the World Class Tanker Safety Initiative: Phase 1 – Northern British Columbia

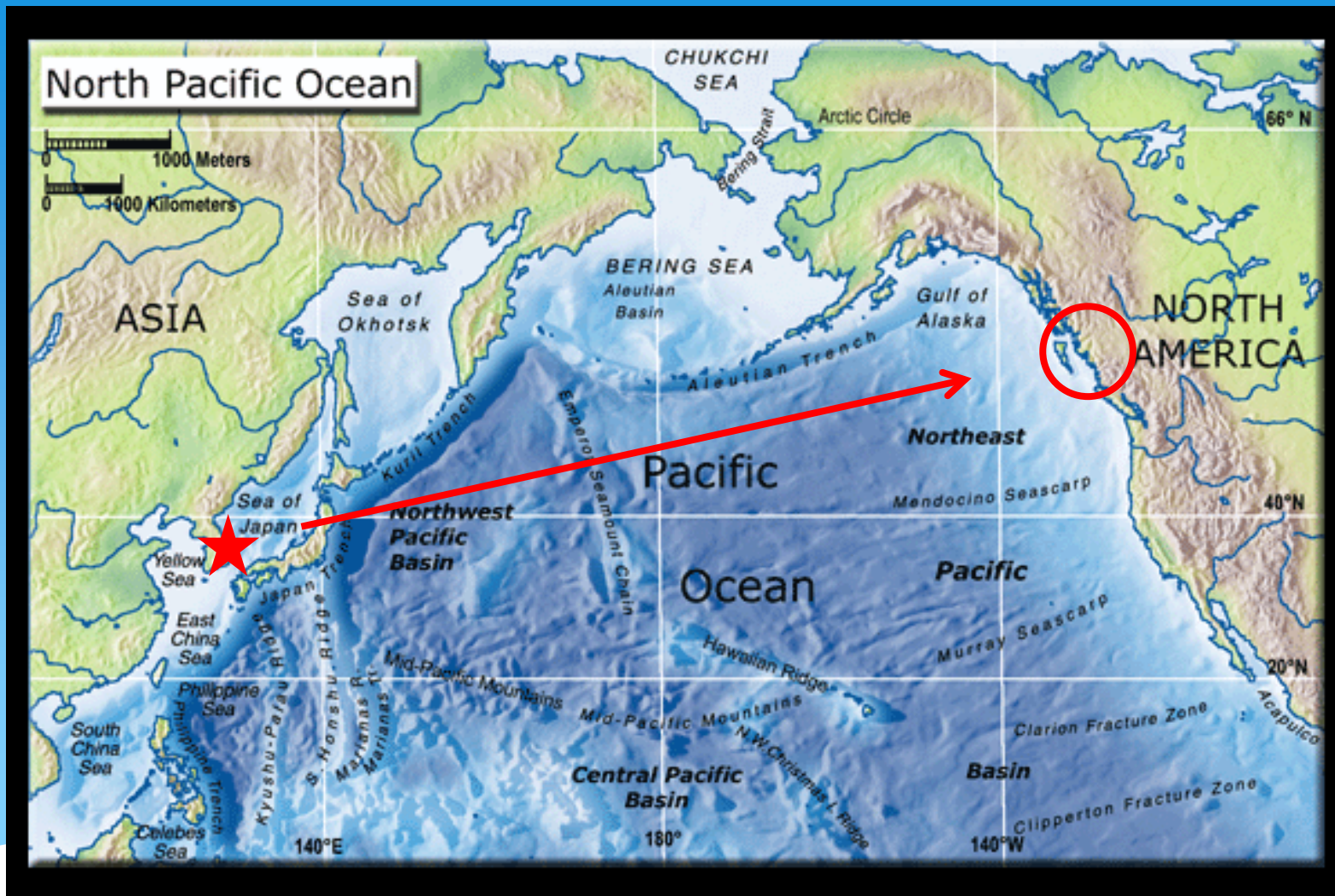
**Charles Hannah, Patrick Cummins, Mike Foreman,
Diane Masson, Pramod Thupaki, Svein Vagle,
Di Wan, Yongsheng Wu, and many others**



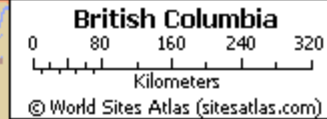
**Fisheries and Oceans Pêches et Océans
Canada Canada**



**University
of Victoria**



Highway Map of British Columbia



320 km

Inside the red circle the 3 largest communities have populations of about 10,000 people each.



SCOPE

Potential Shipping Routes

Kitimat,
Pipeline terminus

Douglas Channel area

Areas of Interest

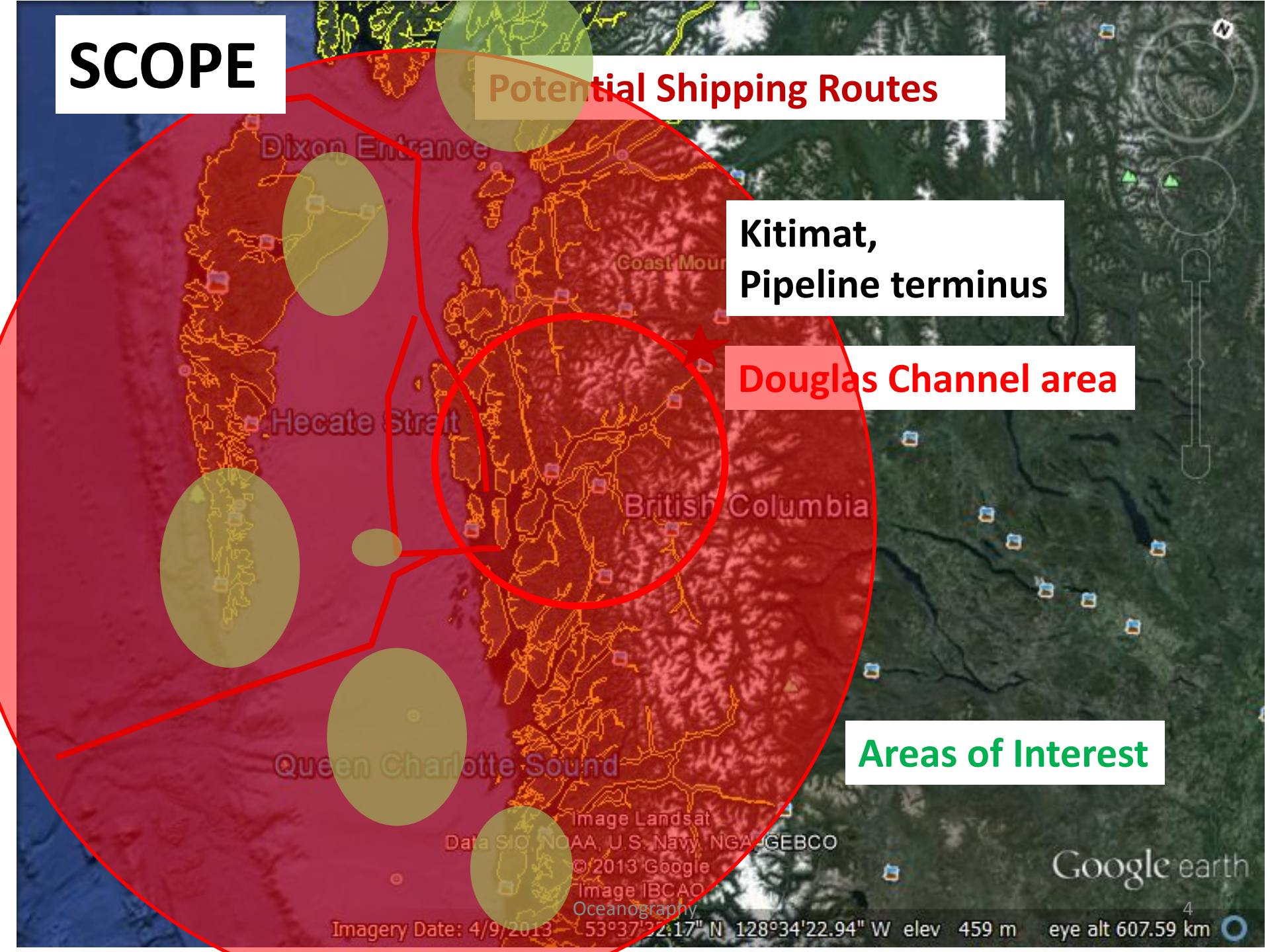


Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Google
Image IBCAO
Oceanography

Imagery Date: 4/9/2013 53°37'22.17" N 128°34'22.94" W elev 459 m eye alt 607.59 km

Google earth

Very Large Crude Carrier (VLCC)

VLCC: 200,000 – 320,000 DWT

Length: 350 m

Breadth 60-80 m

Draft 20-22 m

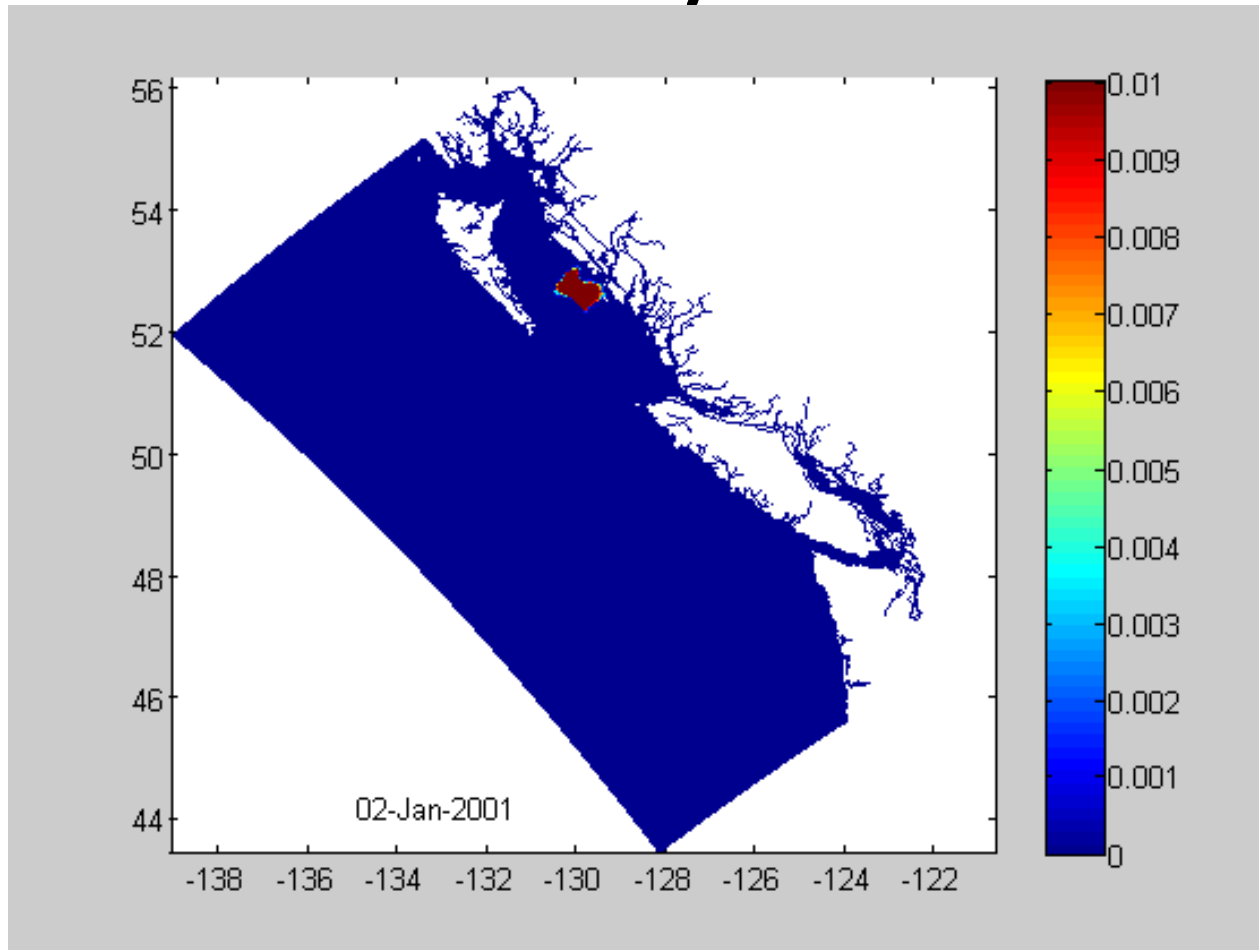
Tully: 66 m x 14.5 m x 4.5 m



Goals

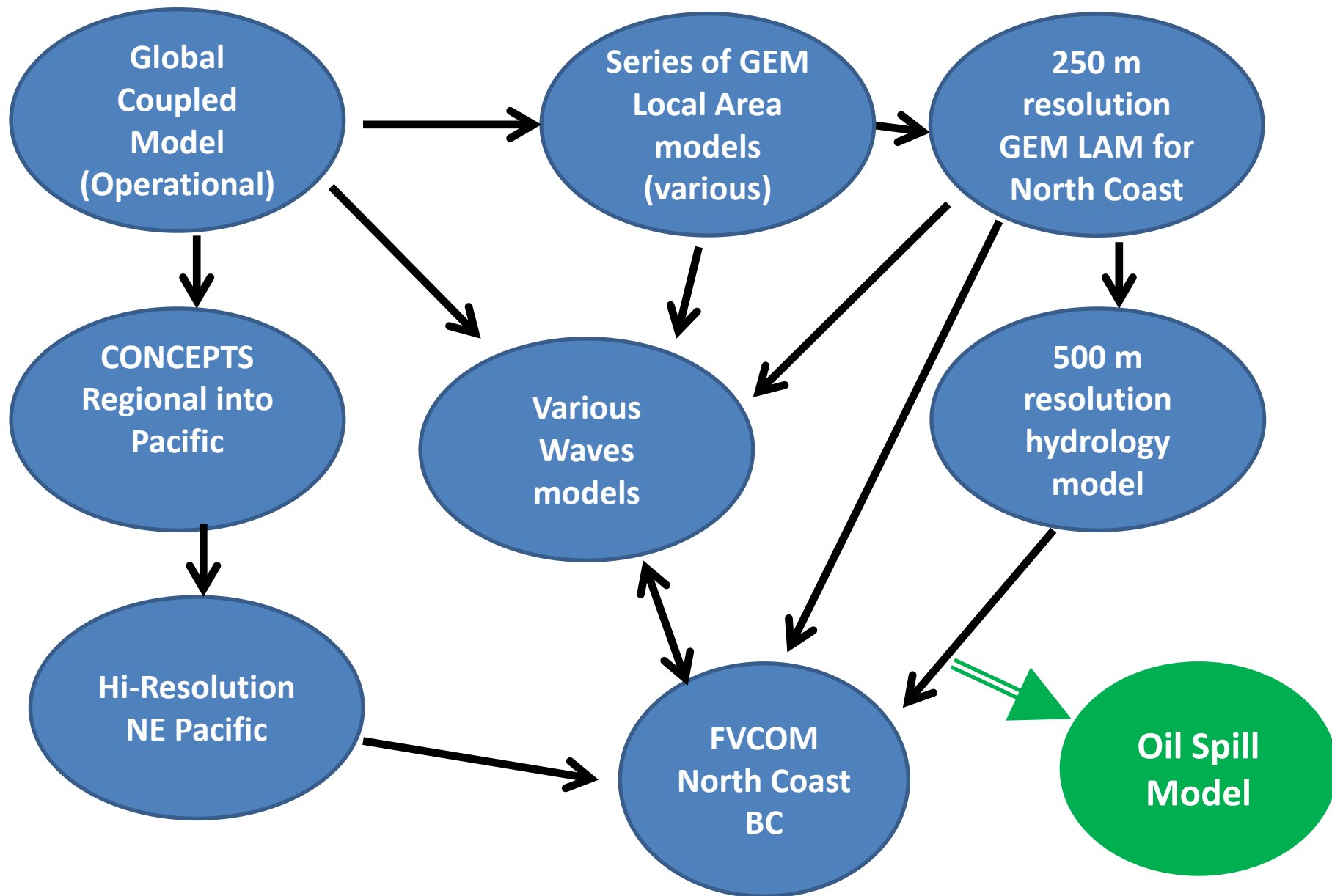
- **High resolution coastal ocean circulation model**
 - Coupled with operational ocean and atmosphere models for lateral and surface boundary conditions;
 - Basis for oil spill model and real time currents to ships.
- **Observations**
 - Almost none since the early 1990s;
 - Need to validate the ocean model;
 - Need understand the circulation so can provide advice on emergency response planning.
- **Data and knowledge**
 - To help others with inventory of marine resources and habitat mapping;
 - To help understand ecology;
 - Emergency response planning.

January 2001



Masson and Fine. 2012. JGR

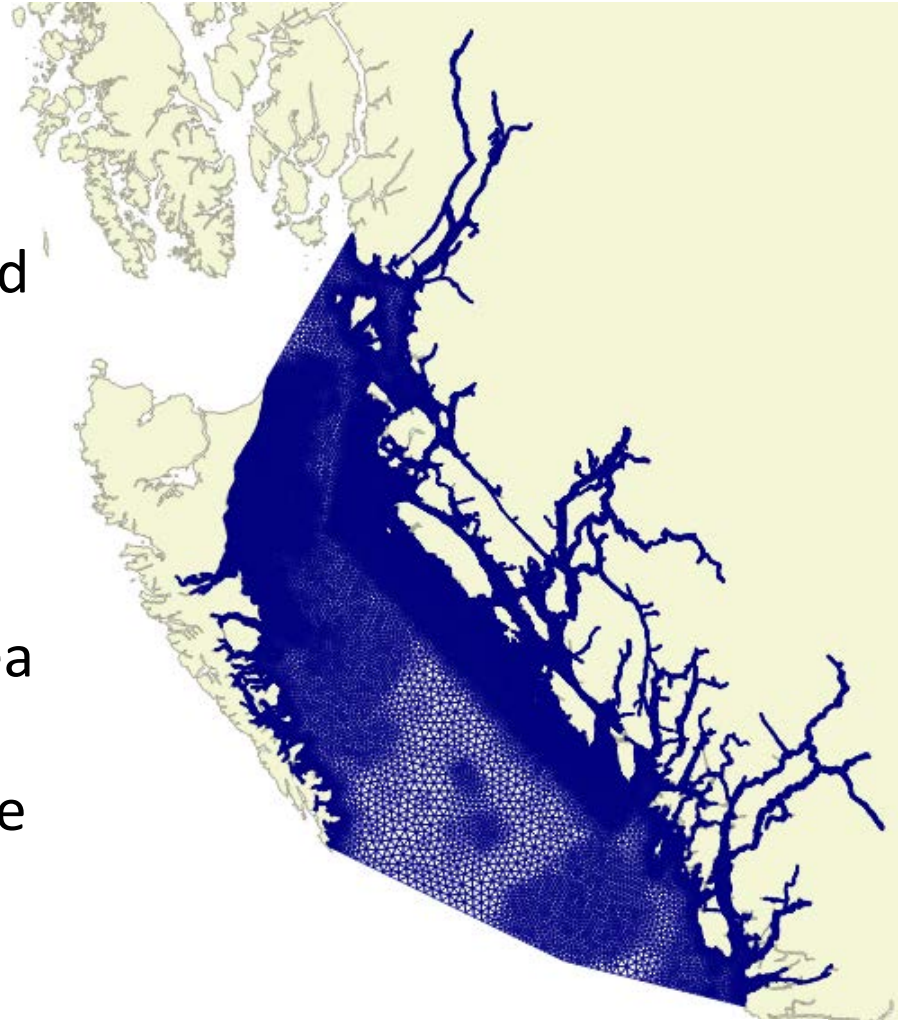
The Government of Canada Modelling System - CONCEPTS

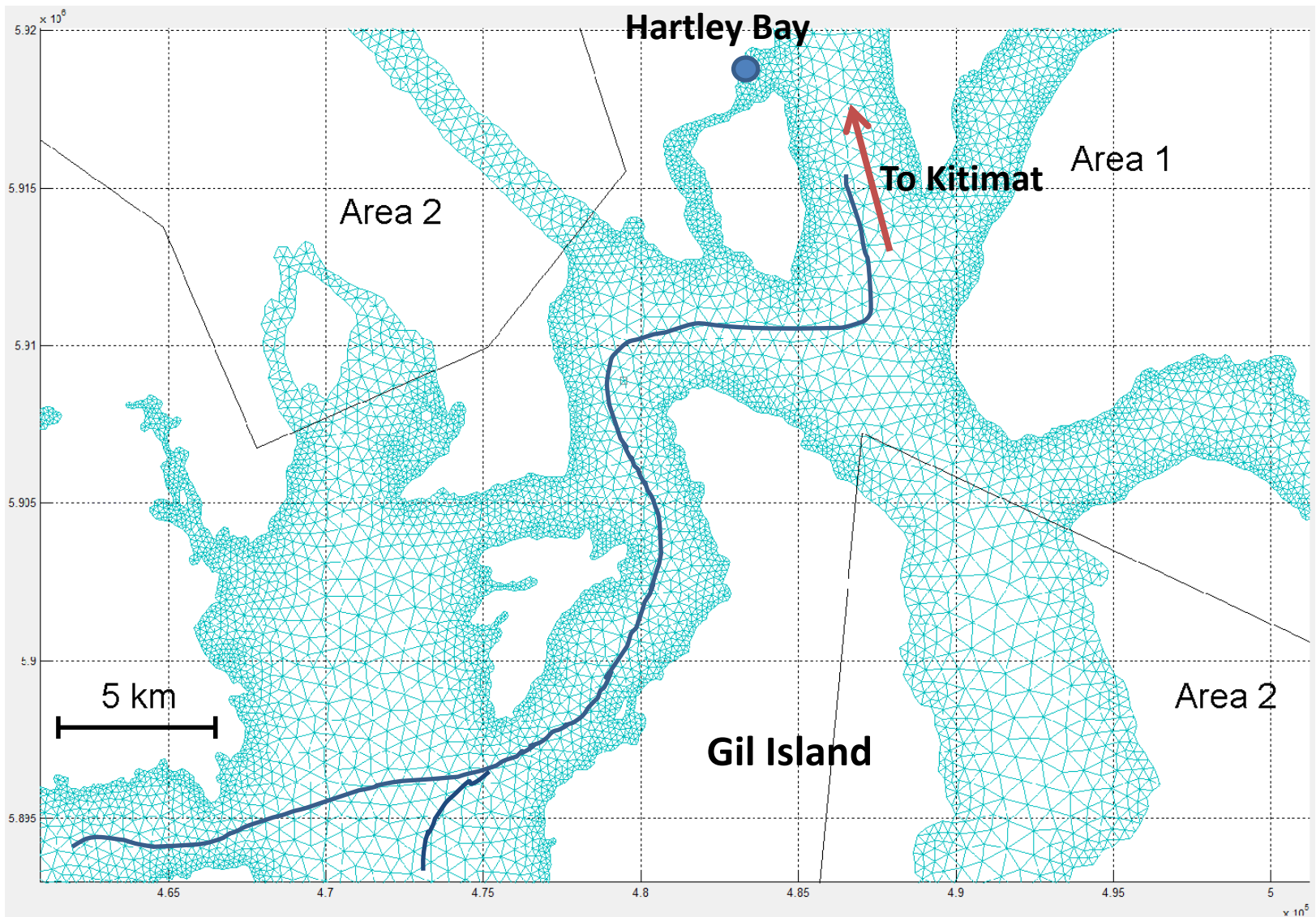


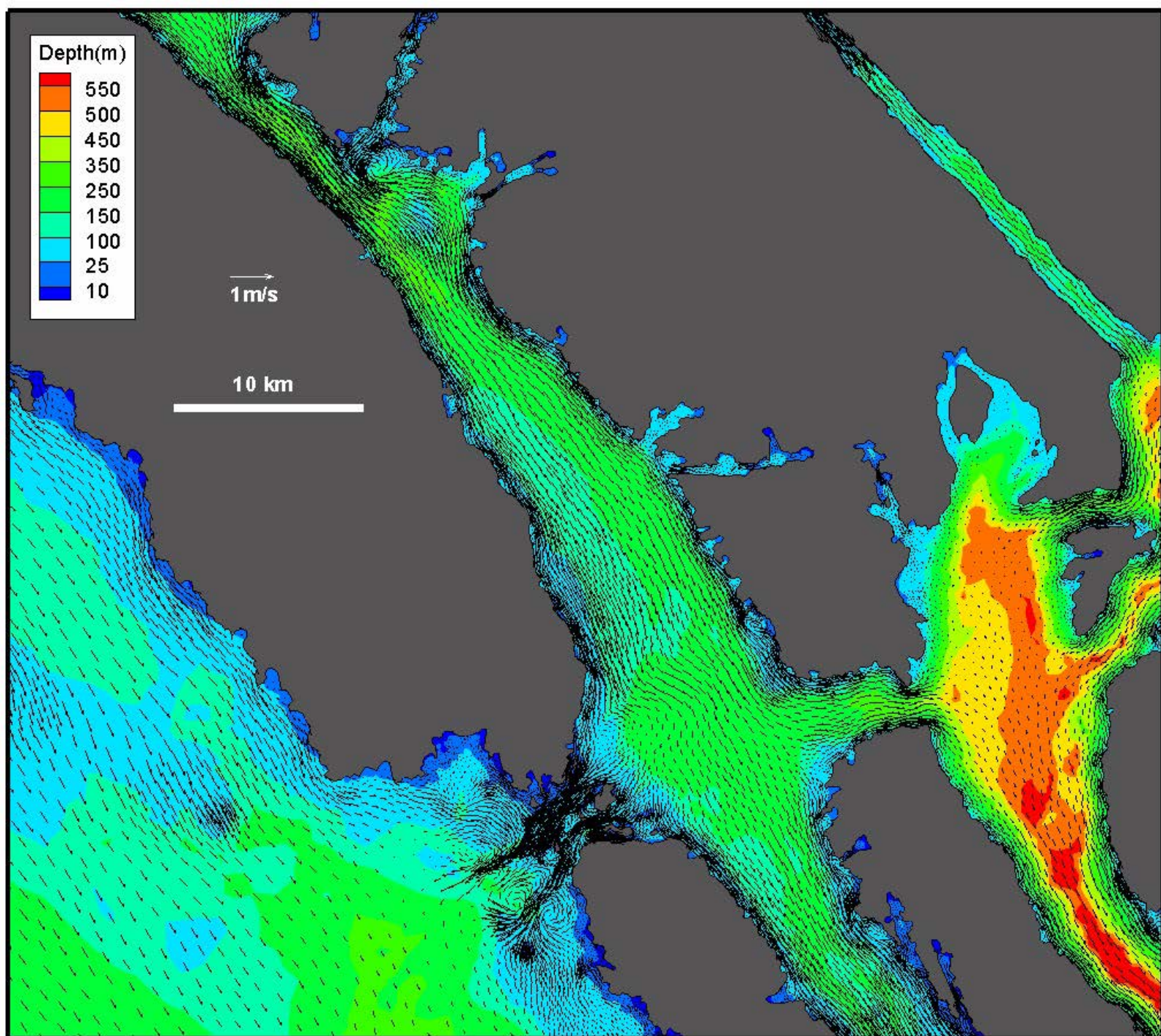
Finite Volume Coastal Ocean Model (FVCOM)

Current grid

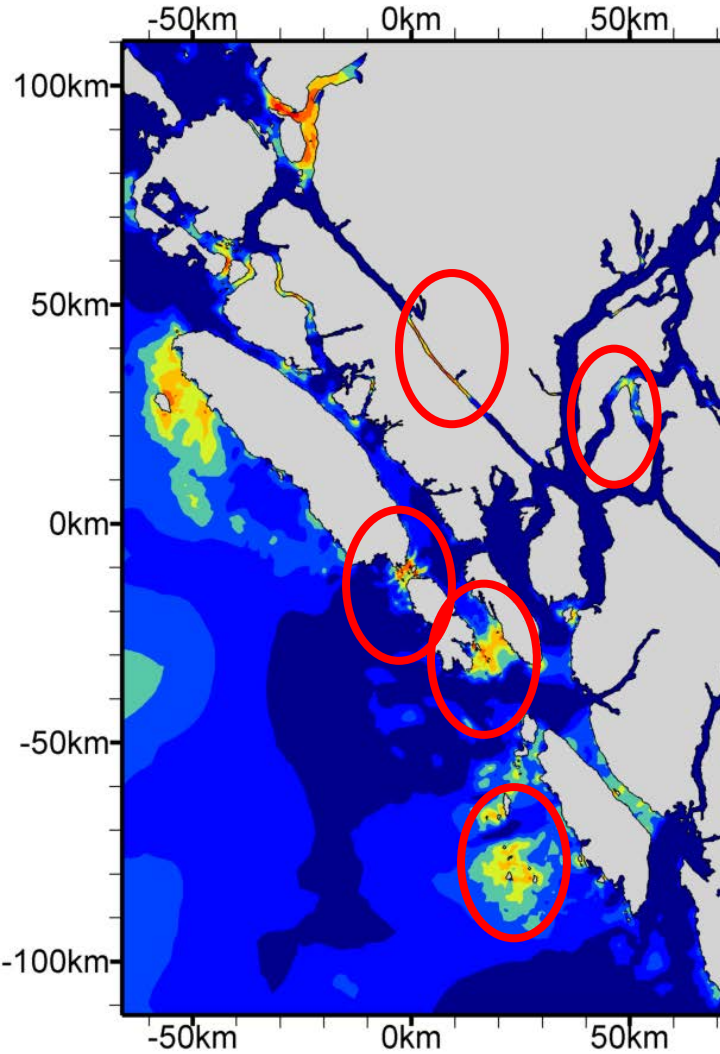
- 118,000 grid points
- Resolution gets down to 100 m in the channels and inlets.
- Presently running 3-D tides and preliminary baroclinic simulations.
- Does not cover entire area identified in earlier slide.
- Mesh designed to operate within our current computer capacity.



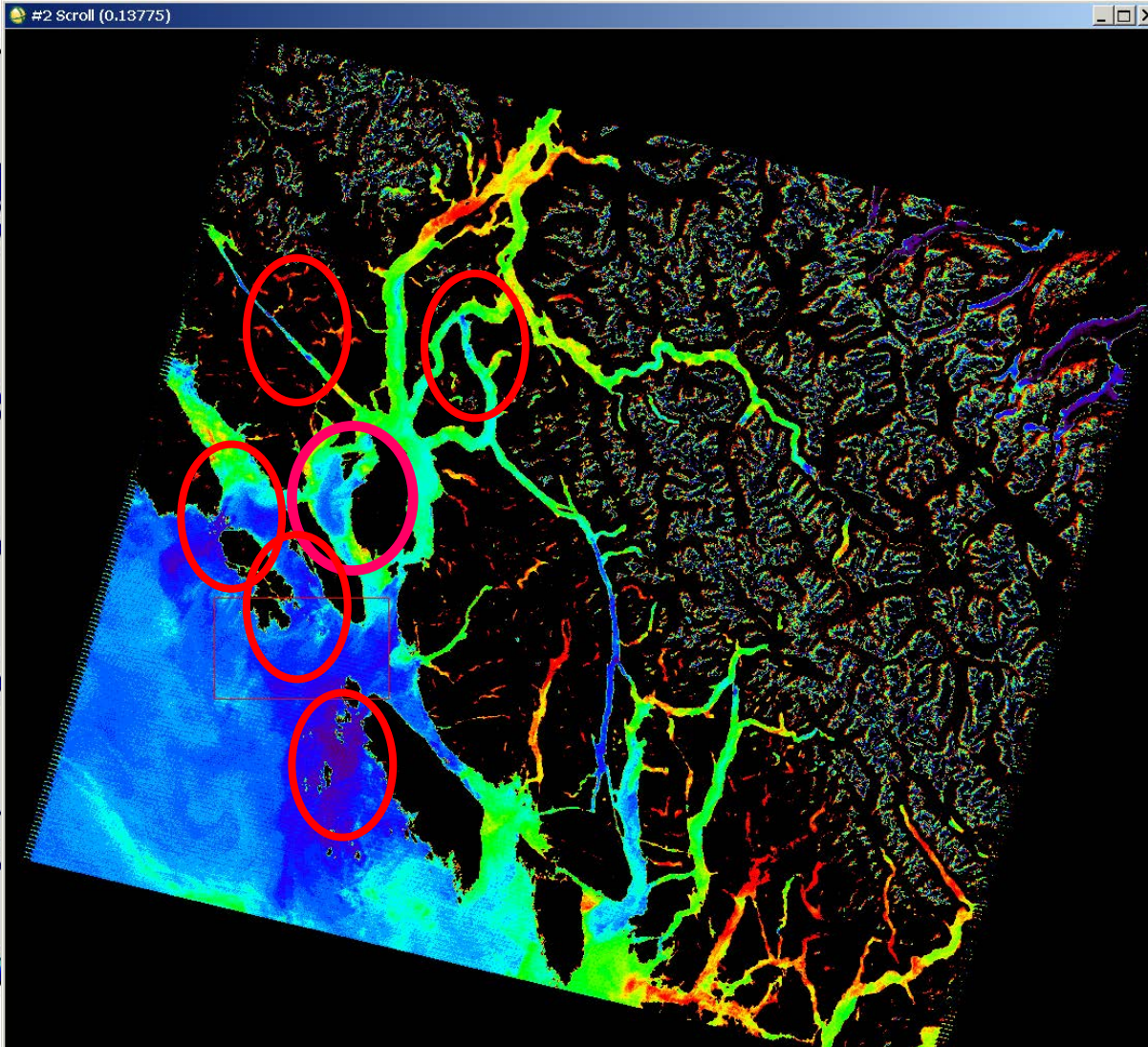




Tidal mixing parameter $\text{Log}(h/U^3)$



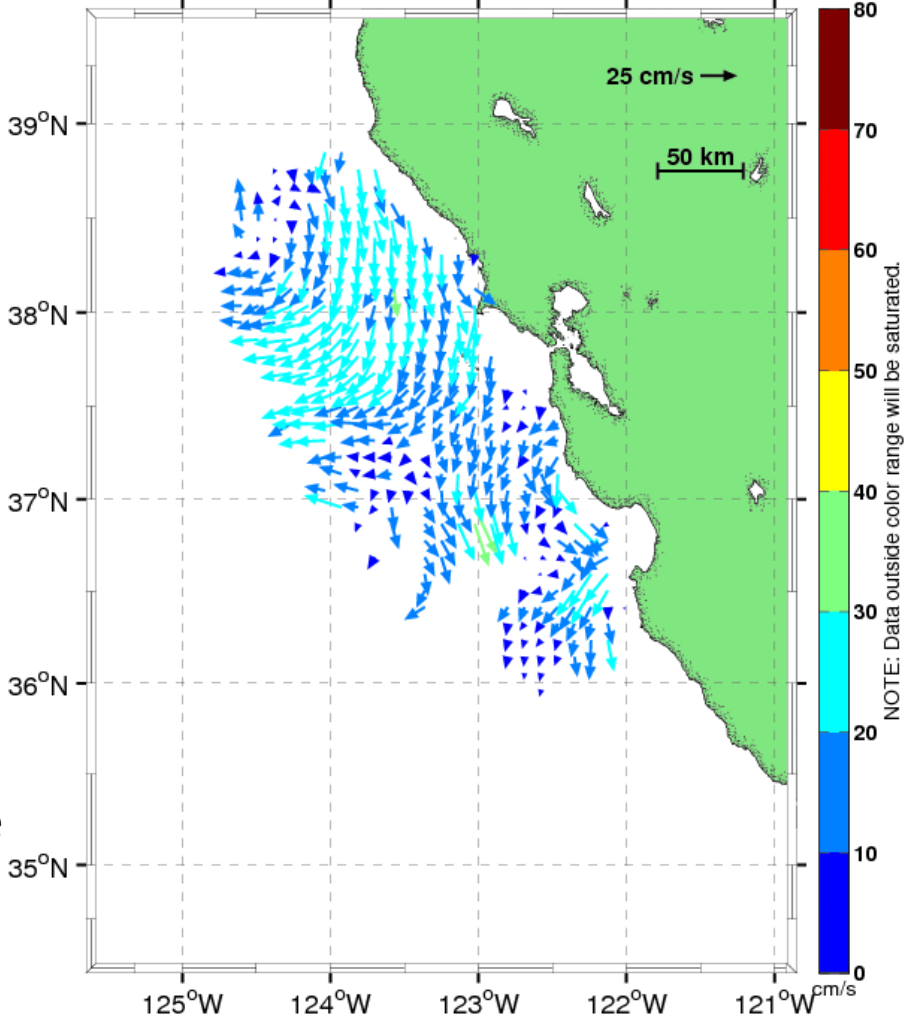
SST – uncalibrated LANDSAT image Purple - cold; Red - warm





Typical CODAR deployment with transmit/receive antennae and electronics enclosure

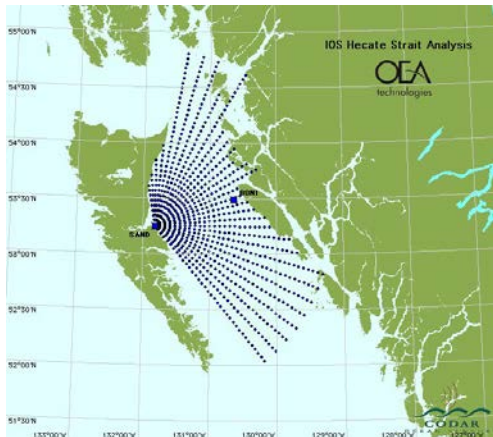
BLND Totals 25hr mean: From 03-Feb-2014 19:00 to 04-Feb-2014 19:00 GMT+0.000



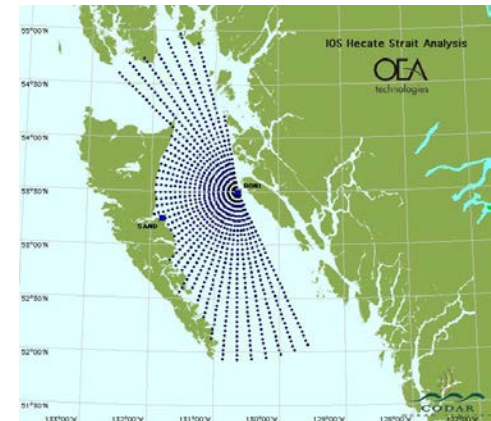
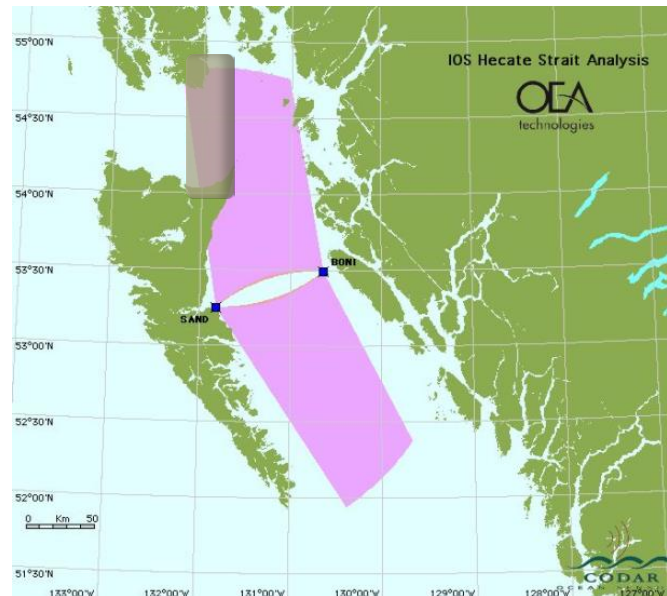
Blended map of 25-hr mean currents off central California

Hecate Strait deployment

- Long-range (5Mz) CODAR system
- Hourly surface currents at nominal 5 km resolution
- Expected to be accurate to within a few cm/s
- Extension of coverage is possible, but ...
- Availability of power is a major consideration in site selection



Sandspit airport: radial currents

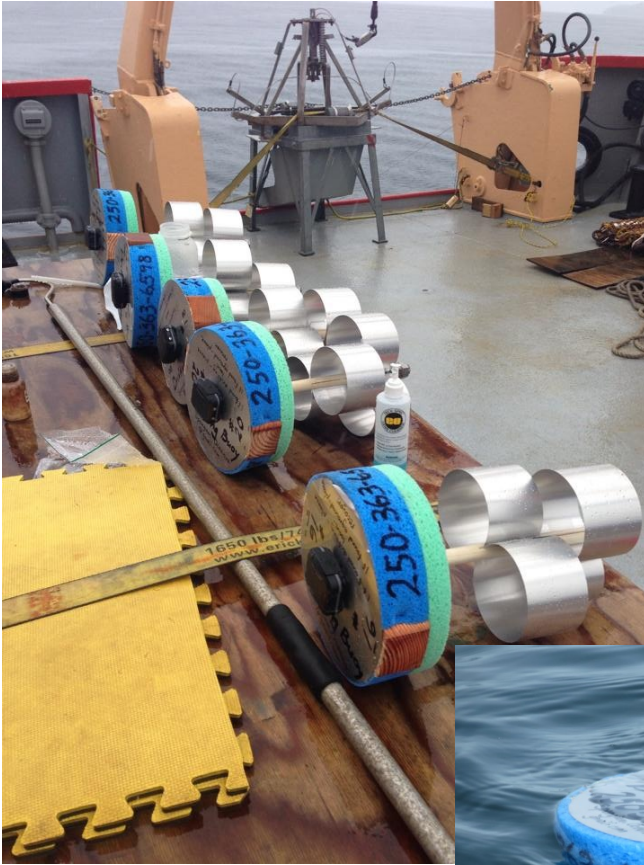


Bonilla Is: radial currents



Projected coverage for
vector currents from
combined radials

Sponge bobbers



Global Coverage (orange area)



2.69 in
(6.83 cm)



2.02 in
(5.13 cm)

Vibration sensor in the SPOT Trace1 senses motion and it activates.



It acquires information from the GPS satellite constellation, (up to 24 Middle Earth Orbit Satellites).



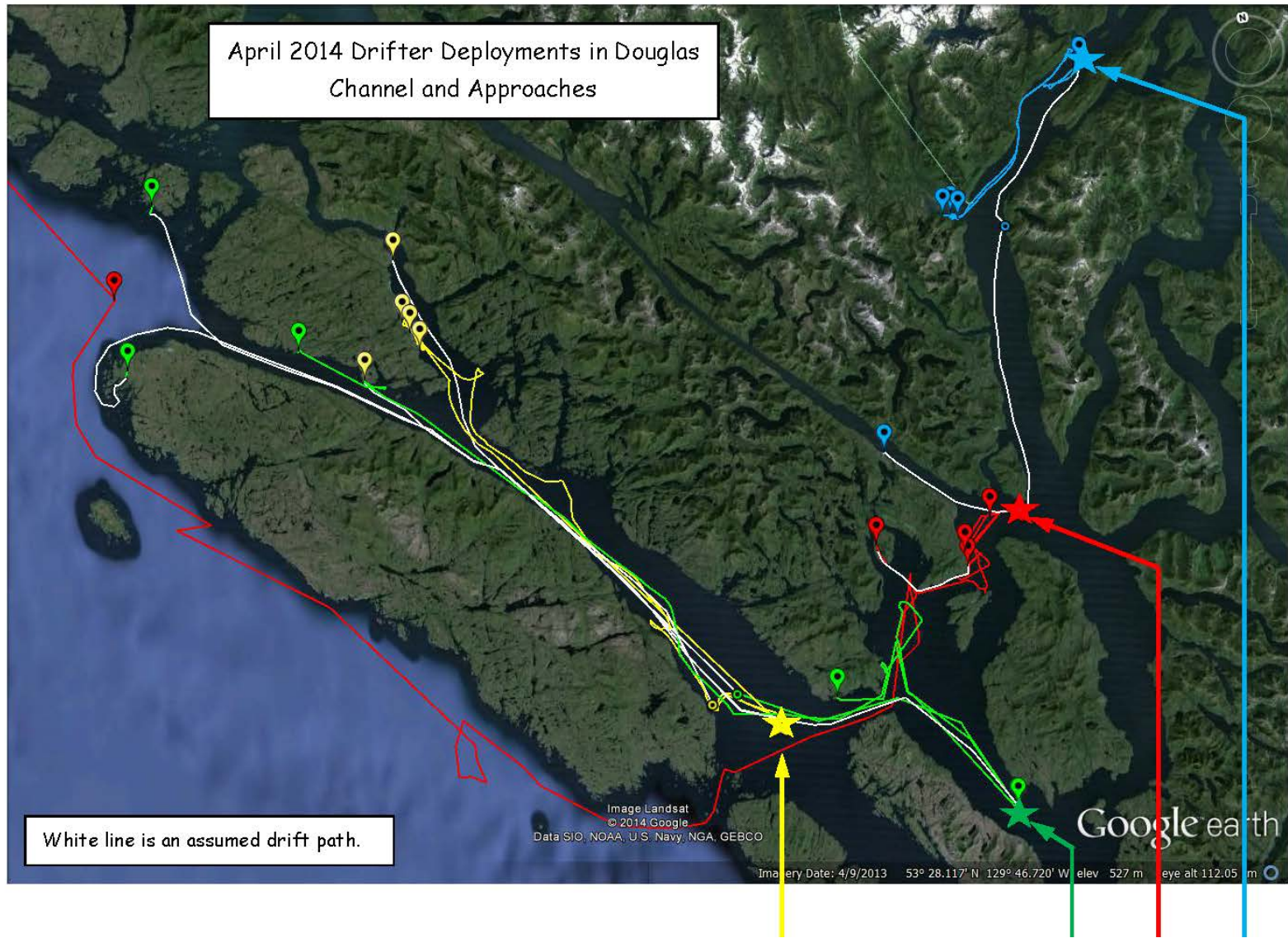
GPS Time / Date / Position is transmitted to Globalstar satellite constellation, (up to 32 Low Earth Orbit Satellites), and then to ground stations for distribution.



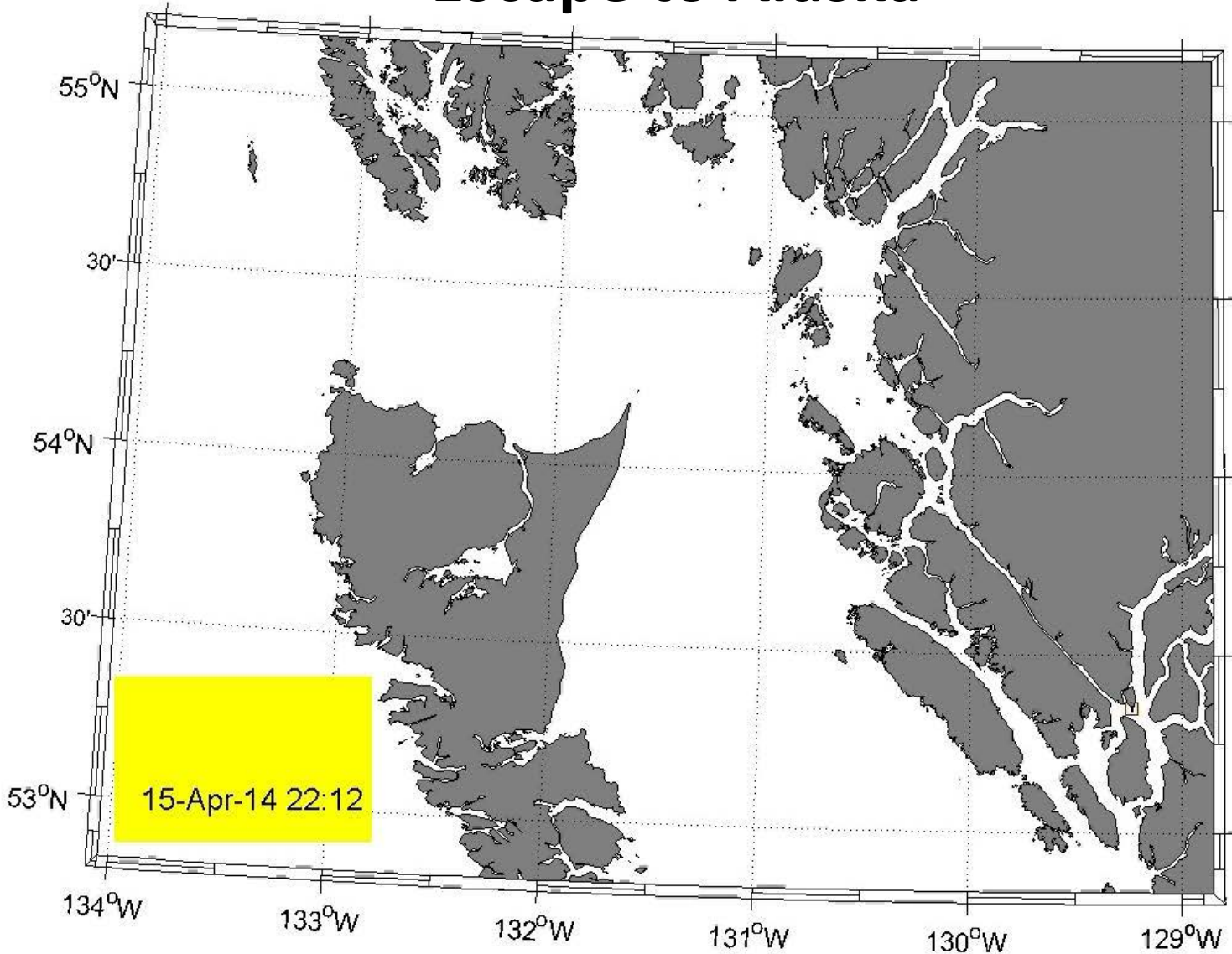
Our experience tracking SPOTs; locally walking, driving, kayaking; Paulatuk ski-doing; StnP – the open ocean; test launches Saanich Inlet & Juan de Fuca Strait; drifter studies in Douglas Channel, Cowichan Bay, Strait of Georgia, Hecate Strait.

To date 84 buoys deployed.

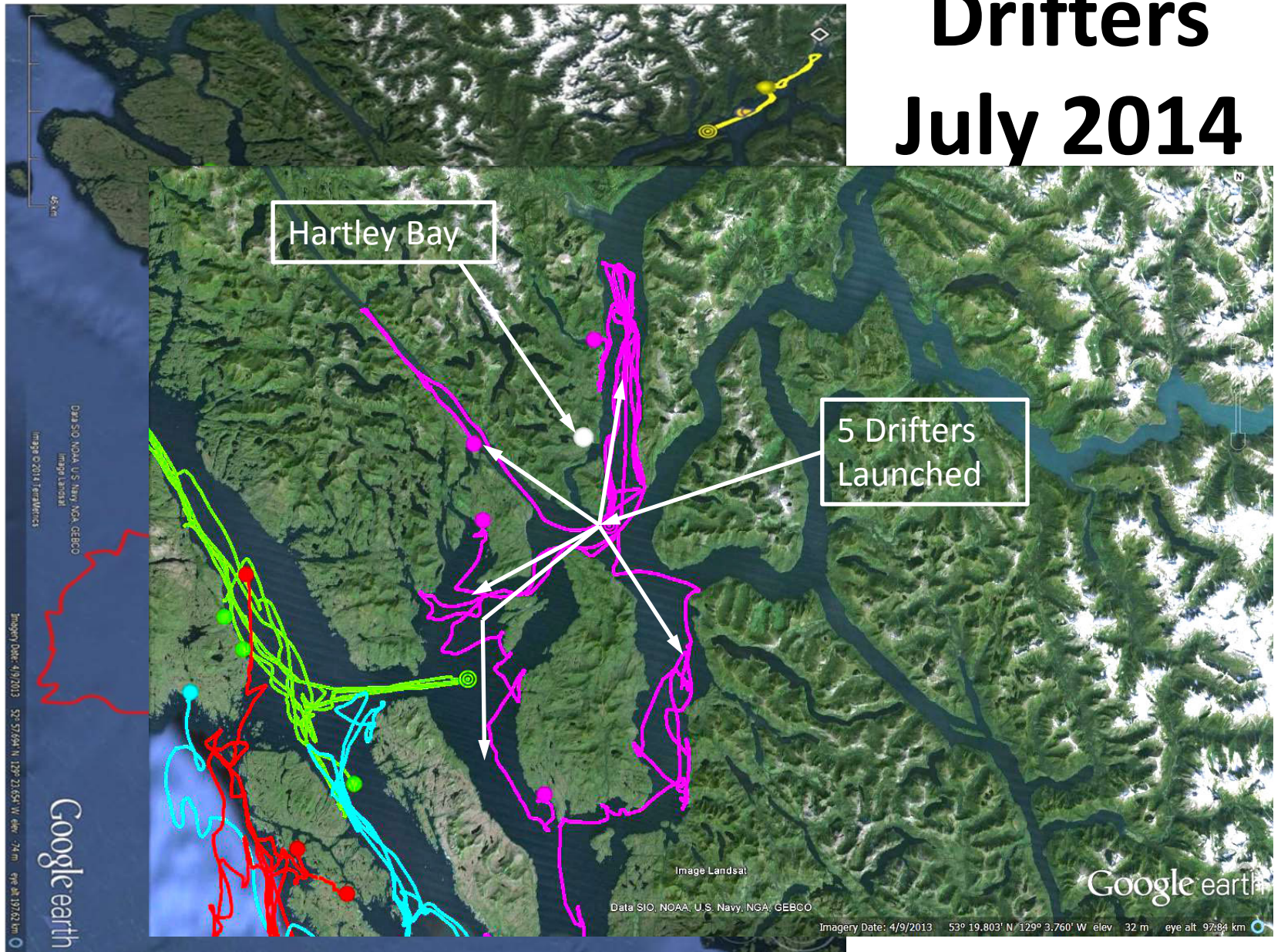
Drifters. April 2014



Escape to Alaska

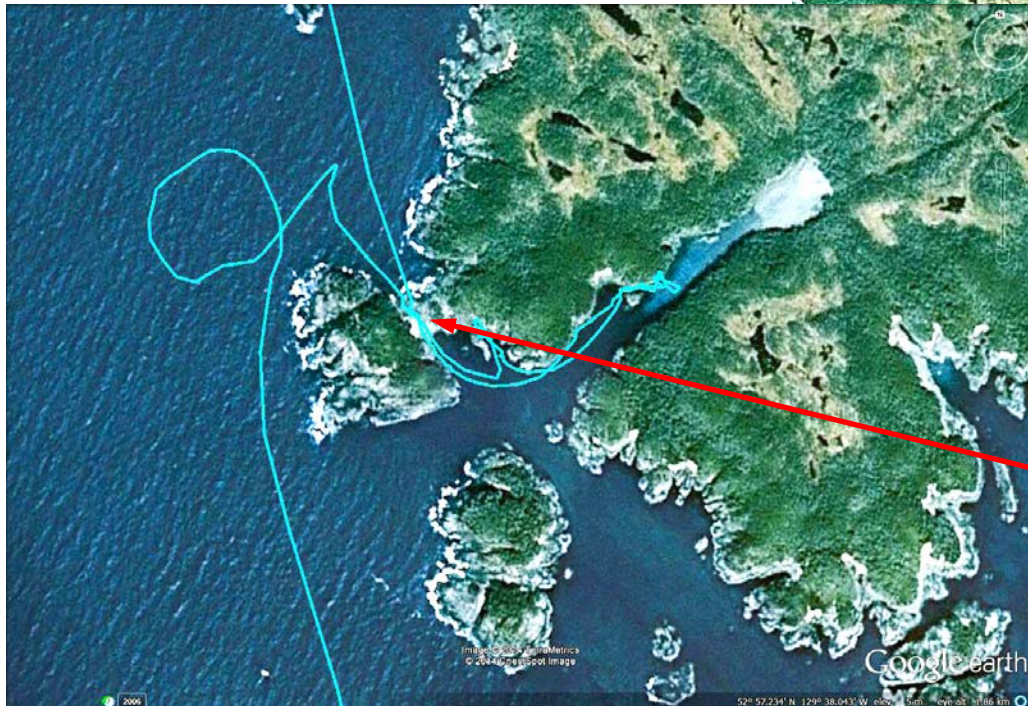


Drifters July 2014



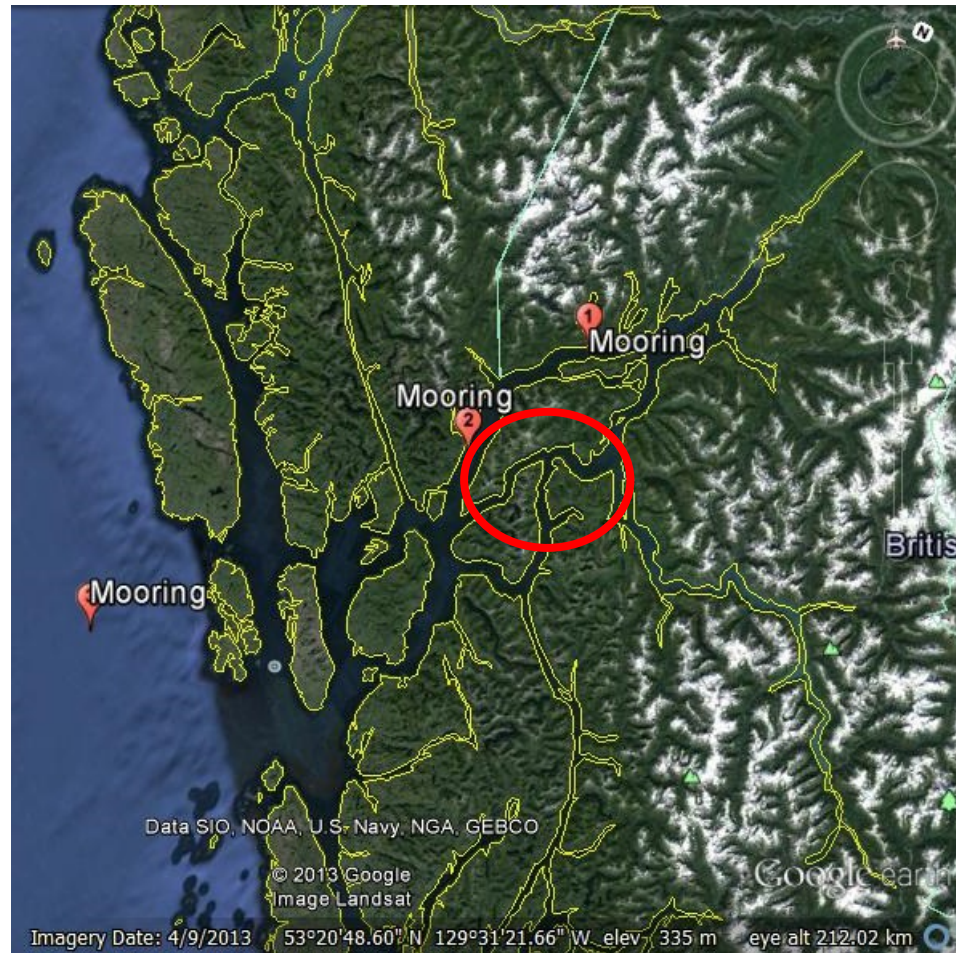
Improbable Pathways

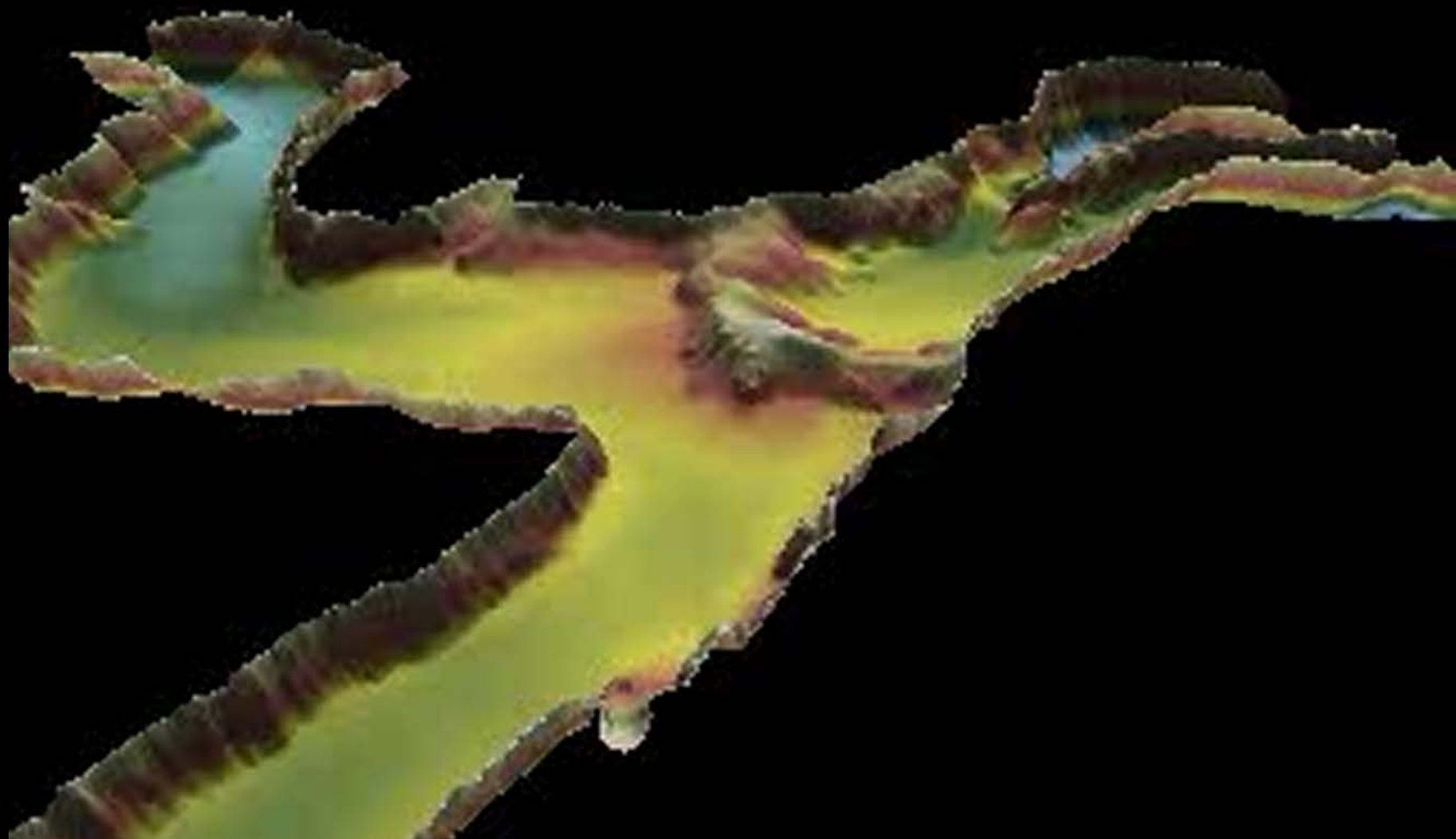
Along a stream in a tidal flat.



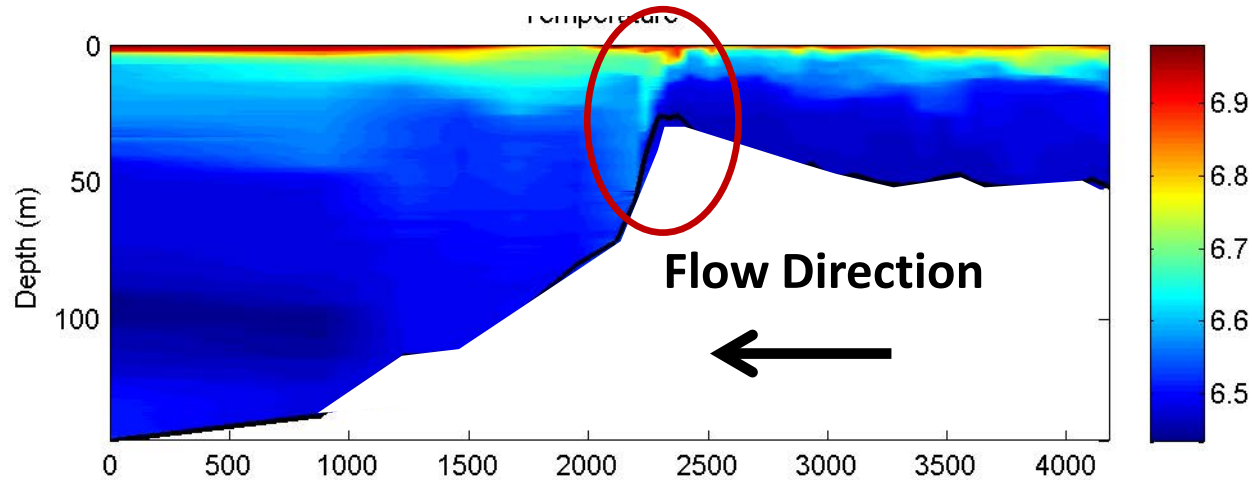
Through a rock pile and then through it again.

Section over the sill

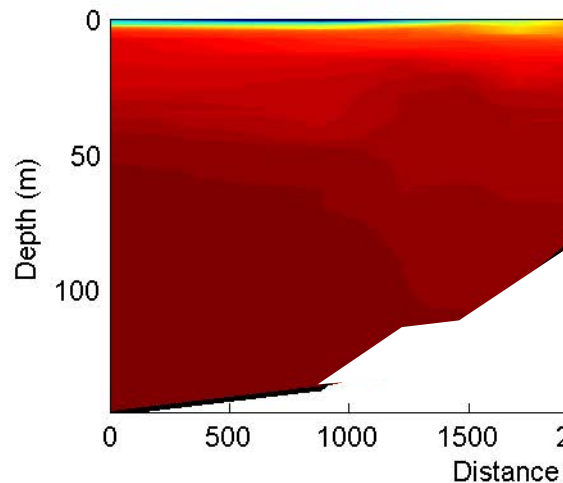




Temperature

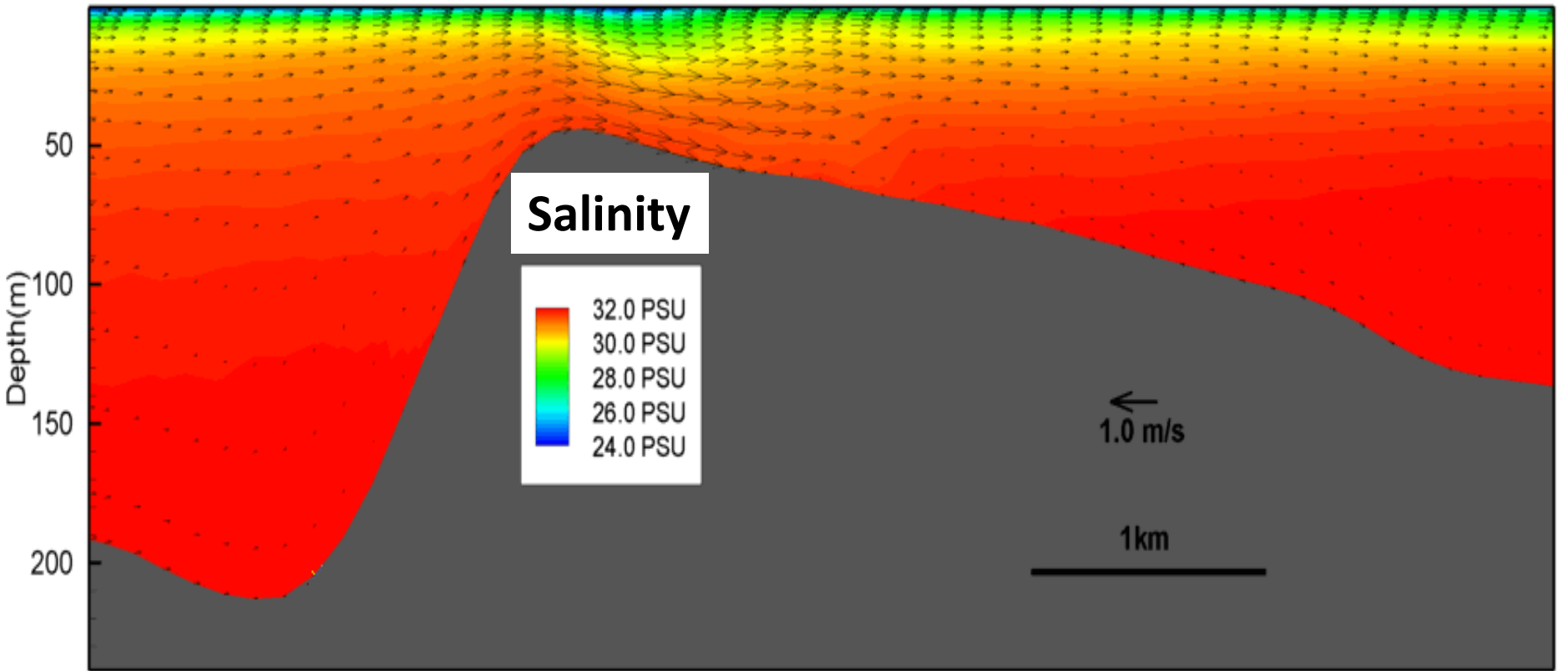


Salinity

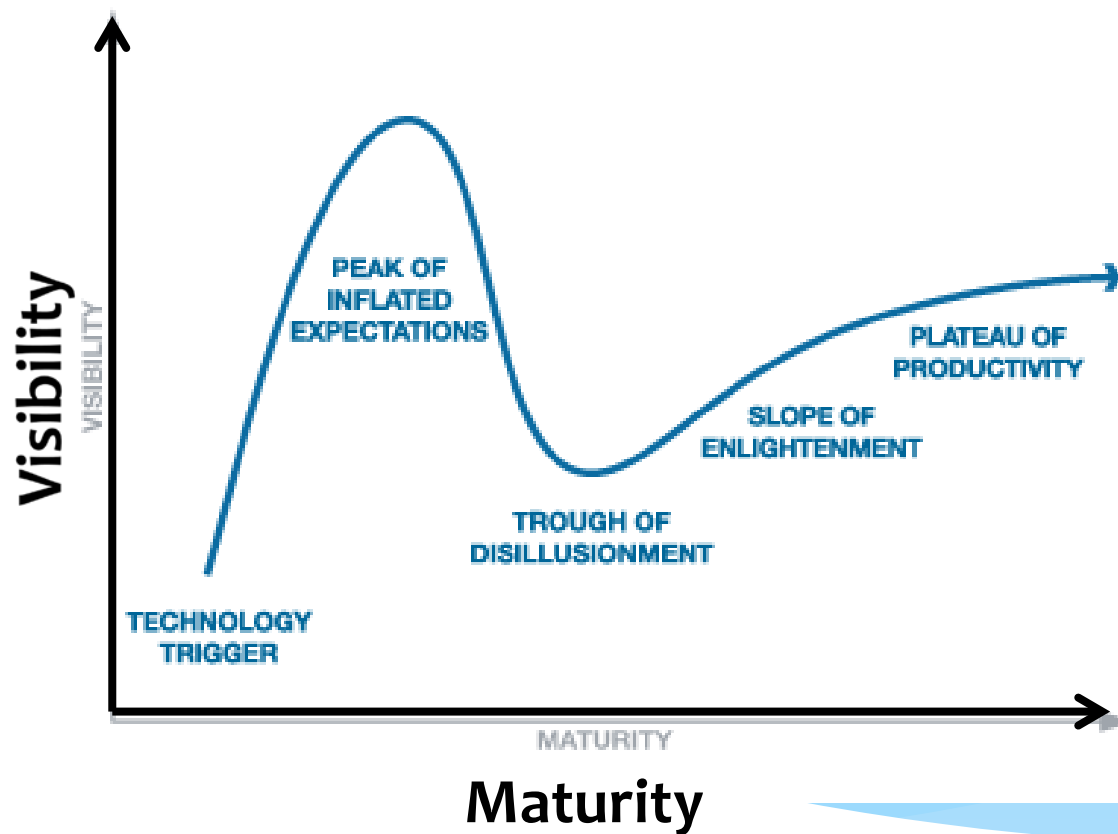


- Surface flows plunging to 50 or 60 m depth over the sill.
- Results in substantial mixing etc.
- Through the chain of mixing, nutrients, phytoplankton, etc., this should be a hot spot for biological production and we expect it to be important for whales .

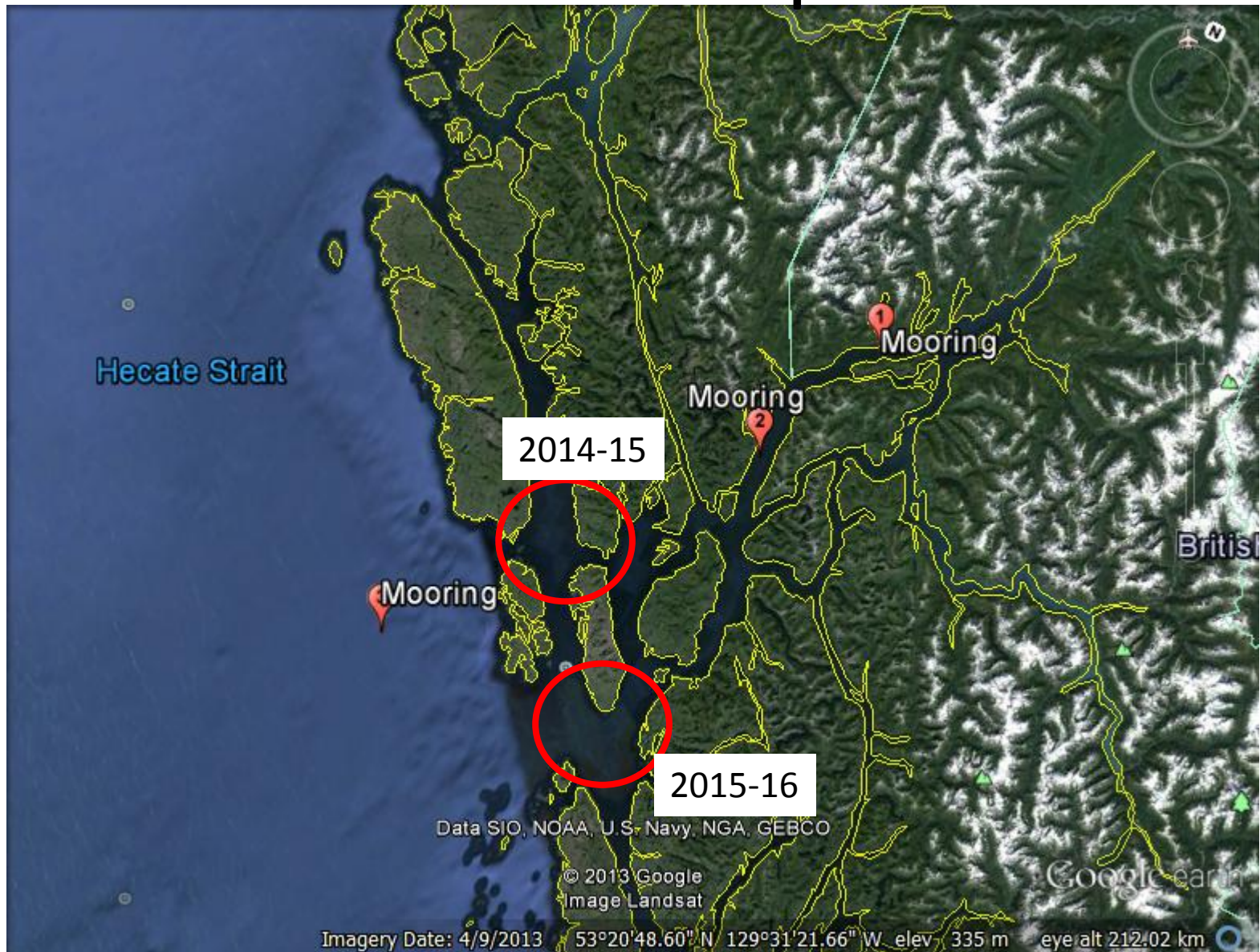
Day of simulation: 10.000



Gartner Hype Curve



Observation plan



DFO Science

- **CHS – multibeam mapping, new charts, bottom substrate maps**
- **COOGER**
 - **properties of diluted bitumen in sea water**
 - **Assessment of countermeasures (cleanup techniques)**
- **MEAD (non salmon people at PBS)**
 - **Inventory of Marine Resources**
 - **Mapping of Benthic Habitats**
 - **Benthic Ecosystem, Research and Advice on Interactions with Ecosystem**
- **OSD (Oceanography)**
 - **Models**
 - **Observations.**

Seafloor Classification Potential Substrates

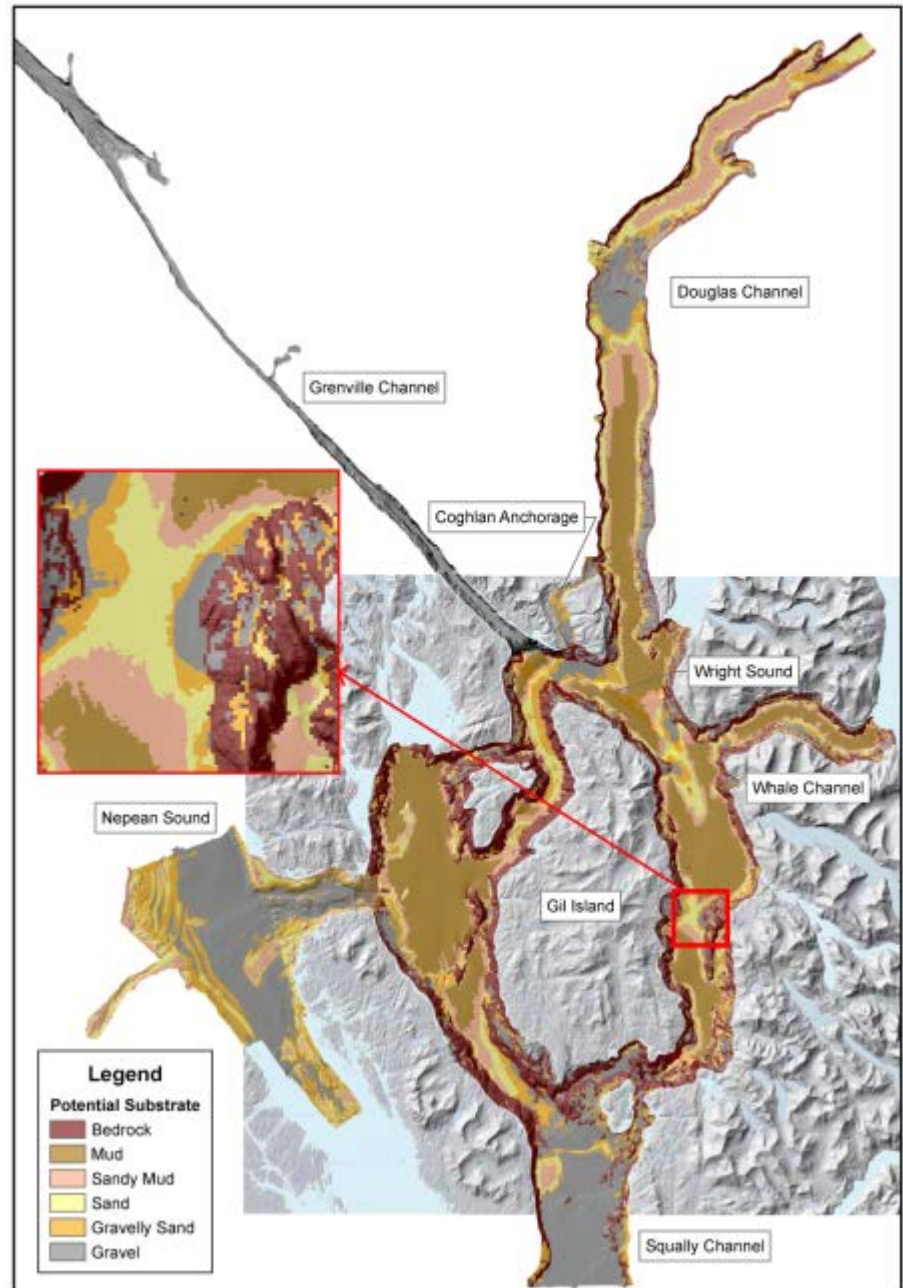
Gil Island Rectangle and Douglas Channel

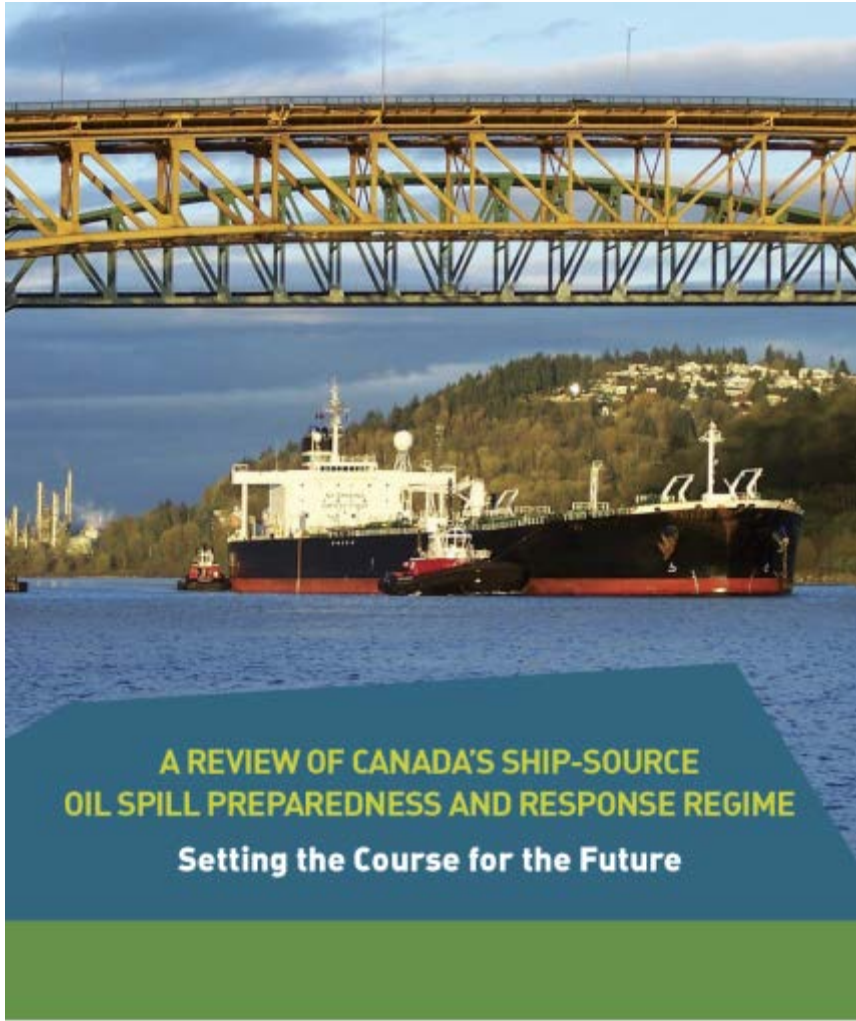
CHS

Estimated Bottom Types
from Multibeam data.

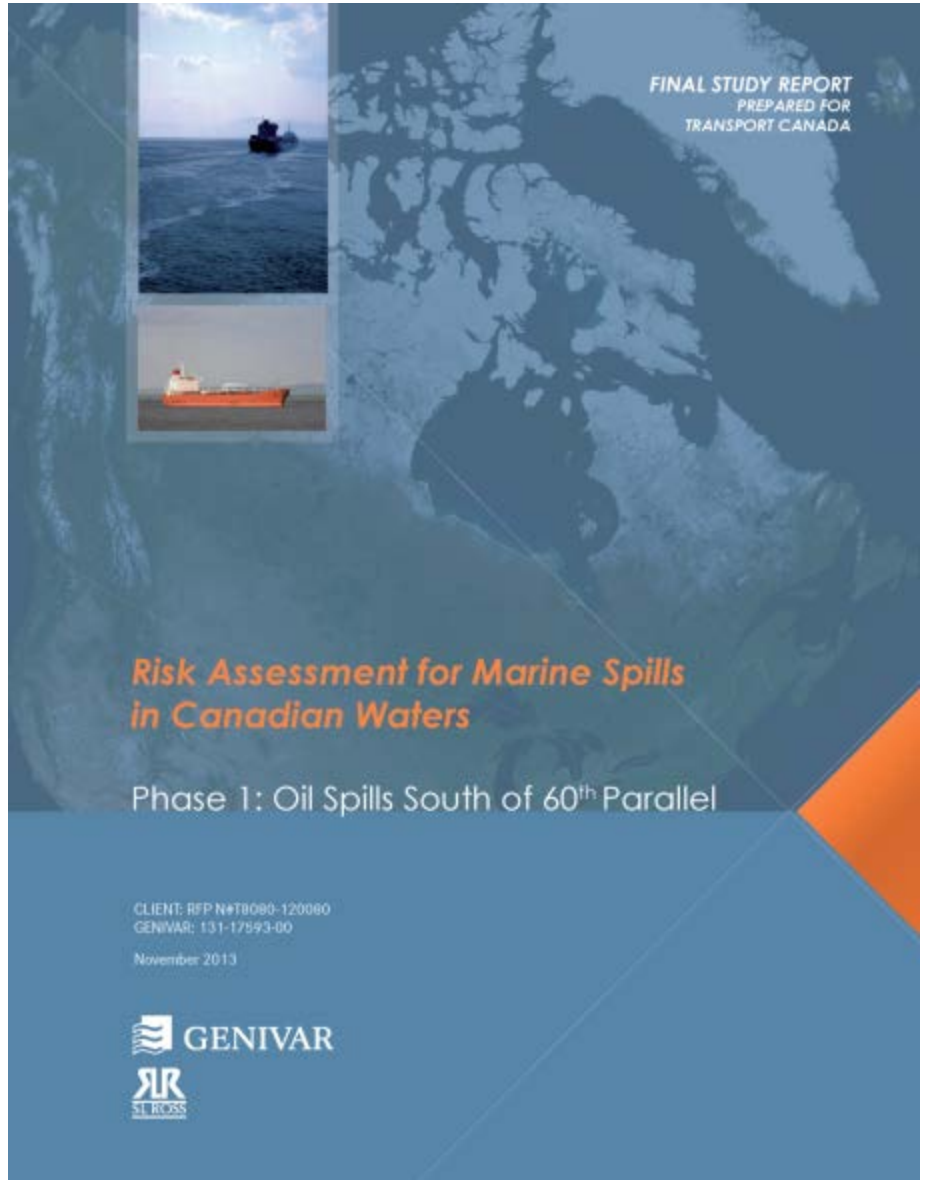
Initial analysis

Cassie Bosma and
Kal Czotter





**A REVIEW OF CANADA'S SHIP-SOURCE
OIL SPILL PREPAREDNESS AND RESPONSE REGIME**
Setting the Course for the Future



FINAL STUDY REPORT
PREPARED FOR
TRANSPORT CANADA

**Risk Assessment for Marine Spills
in Canadian Waters**

Phase 1: Oil Spills South of 60th Parallel

CLIENT: RFP N4TB080-120080
GENIVAR: 131-17593-00

November 2013



**The World Class Prevention,
Preparedness and Response for
Oil Spills from Ships Initiative**

Canada 

- 1) New/Modified Aids to Navigation to Service the Kitimat Area (DFO-CCG)
- 2) Hydrographic/Navigational Products for Kitimat (DFO)
- 3) Tanker Screening Guidelines (TC)
- 4) Transport Canada Centre in Kitimat (TC)
- 5) Amendment to the *Canada Shipping Act*, 2001 and Modernization of the Environmental Response Program (TC)
- 6) Team of International Experts on Tanker Safety (TC)
- 7) Panel Review of Canada's Oil Spill Preparedness and Response Regime (TC)
- 8) Scientific Research and Activities (EC- DFO) ←
- 9) Satellite Based Monitoring (EC)
- 10) Tanker Inspections (TC)
- 11) Modern Charted Navigation System (CCG-CHS)
- 12) Geoscience Studies for Marine Safety in the BC North Coast (NRCan)
- 13) Navigational Plans for High Risk Waters – Review of Navigational Requirements (TC)
- 14) Review of Compulsory Pilotage and Tug Escorts (TC)
- 15) Review of the effectiveness of the Regional Advisory Council Structure (TC)
- 16) Appropriate Governance of Ports with Oil Tanker Traffic (TC)
 - 17) Systematic Surveillance and Monitoring of Ships (TC)
 - 18) Laying the Groundwork for the Arctic (TC, CCG)
 - 19) Public, Private and Community Partnerships (CCG-TC)
 - 20) Incident Command System (CCG- EC)
 - 21) Incident Command Support (EC)
 - 22) Spill Treating Agents and Countermeasures (EC, DFO, TC and NRCan)
 - 23) Science and Technology for Cleanup (DFO, EC and NRCan)
 - 24) Review of Liability and Compensation (TC)

