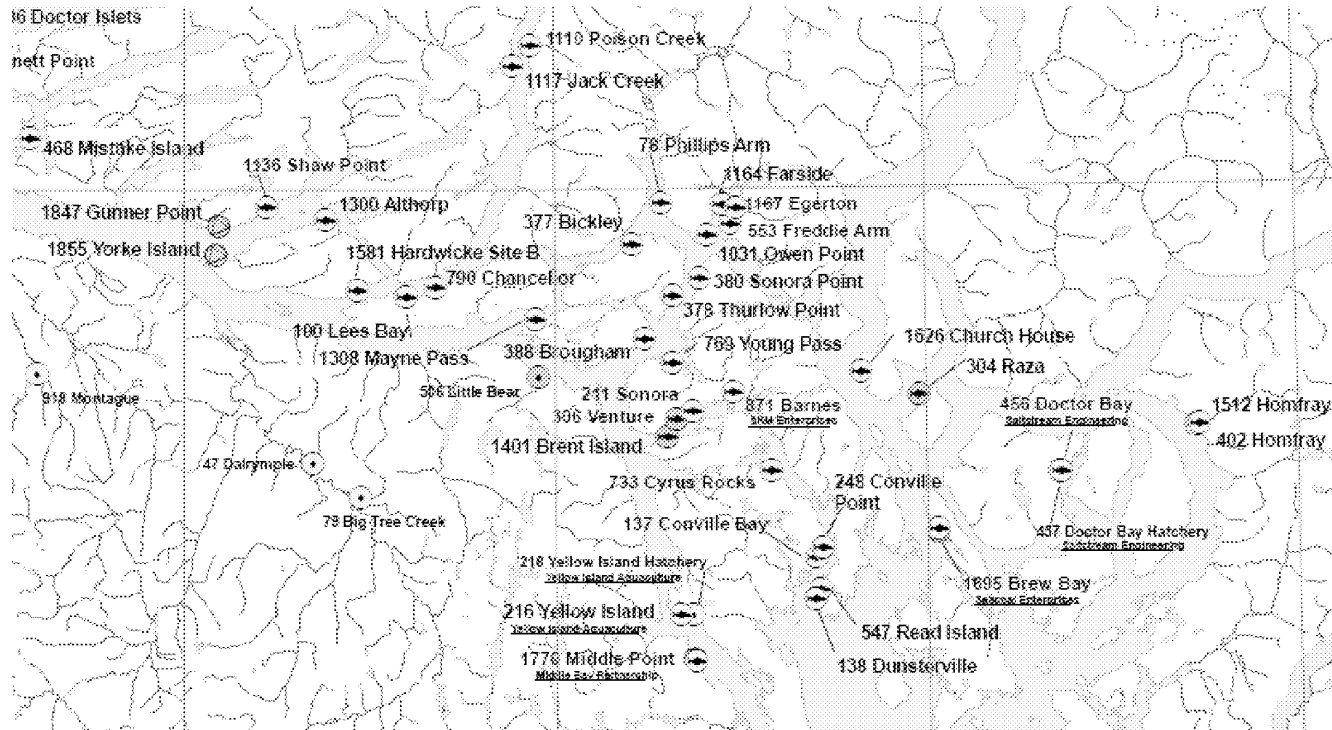
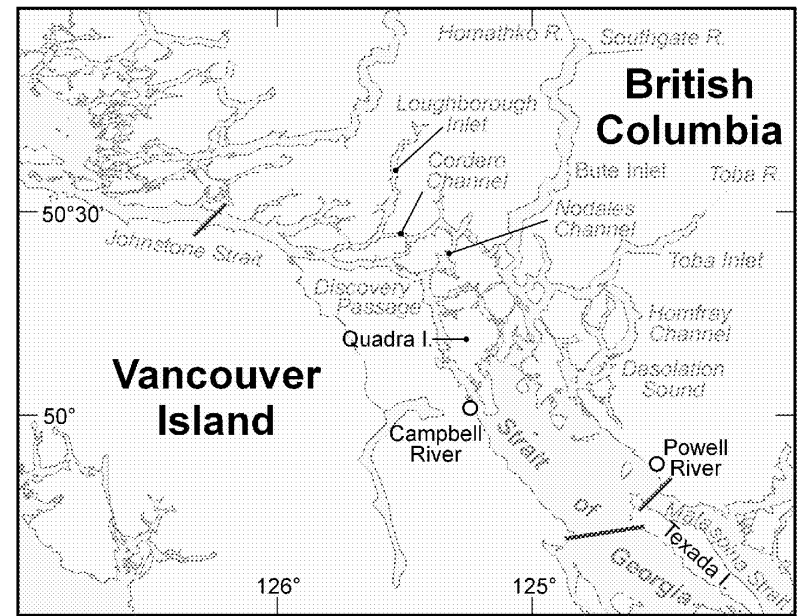


Discovery Islands Modelling Progress Report



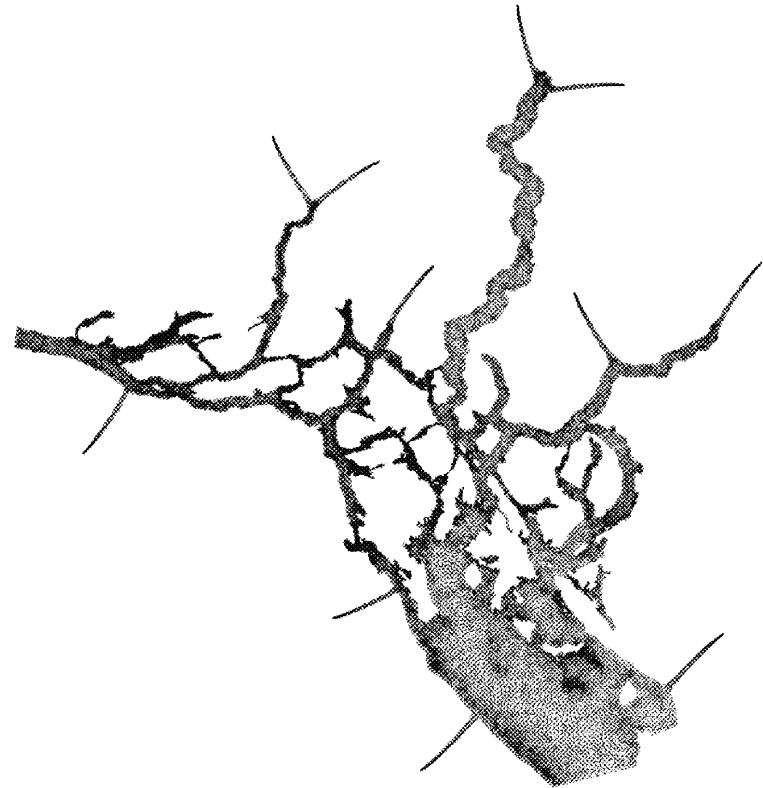
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Models & Grid

1. FVCOM

- *Chen et al.*
- *Used for sea lice modelling in Broughton Archipelago*
- *Also used for DFO aquaculture modelling in NB & NFLD*



2. RiCOM

- *Roy Walters*
- *Used in New Zealand & BC*
- *Possibly faster & more accurate than FVCOM*
- *37596 nodes, 68467 triangles*
- *Resolution down to 90 m*
- *11 rivers*

UVic Coop Students

University of Victoria
Faculty of Engineering
Spring 2010 Work Term Report

1. Thomas Grime

- *Jan - Apr, 2010*
- *Very productive*
- *Great report*
- *FVCOM runs with tides, 3D temperature & salinity, river discharges*
- *Wind observations organized for John Morrison's interpolation*

Applying Multiprocessor Computation to
Evaluate Ocean Circulation of the Discovery Islands

Institute of Ocean Sciences
Fisheries and Oceans Canada
Government of Canada
Sidney, British Columbia

Thomas Grime
V00195732
Work Term 4
Electrical Engineering
tgrime@uvic.ca

April 30, 2010

In partial fulfillment of the requirements of the B.Eng. Degree

Supervisor's Approval: To be completed by Co-op Employer

I approve the release of this report to the University of Victoria for academic purposes only.

This report is to be considered (select one): NOT CONFIDENTIAL CONFIDENTIAL

Signature: _____ Position: _____ Date: _____

Name (print): _____ E-Mail: _____ Ext. #: _____

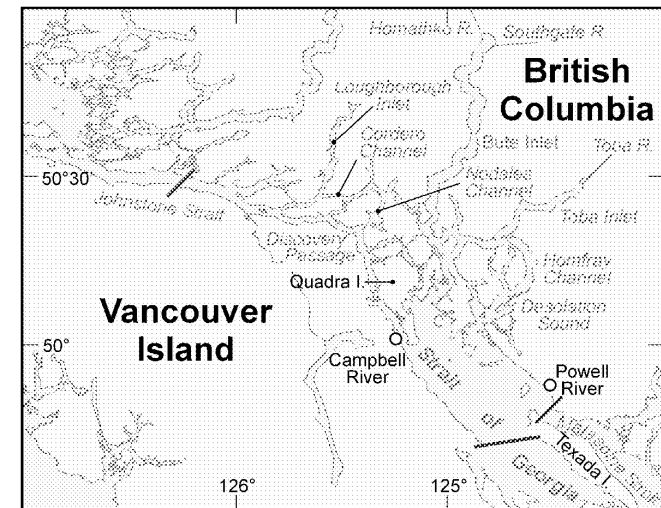
If a report is deemed CONFIDENTIAL, a non-disclosure form signed by an evaluator will be filed to the employer. The report will be destroyed following evaluation. If the report is NOT CONFIDENTIAL, it will be returned to the student following evaluation.

2. Jared Isaac

- *Mid-Aug - Dec 2010*

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Model Run Details



1. FVCOM:

- *5 largest tidal constituents*
- *11 average summer river discharges*
 - *On mainland side, only Homathko gauged*
 - *Others estimated based on relative watershed areas*
- *Initial 3D temperature & salinities from average summer historical observations*
 - *Very sparse in Discovery Islands; more in inlets*
 - *Darren collected CTDs in April; more planned for August & December (?)*
- *No winds or heat flux yet*
 - *Thomas has processed winds & John has interpolated to model grid*
- *Run for "generic" 25 days*

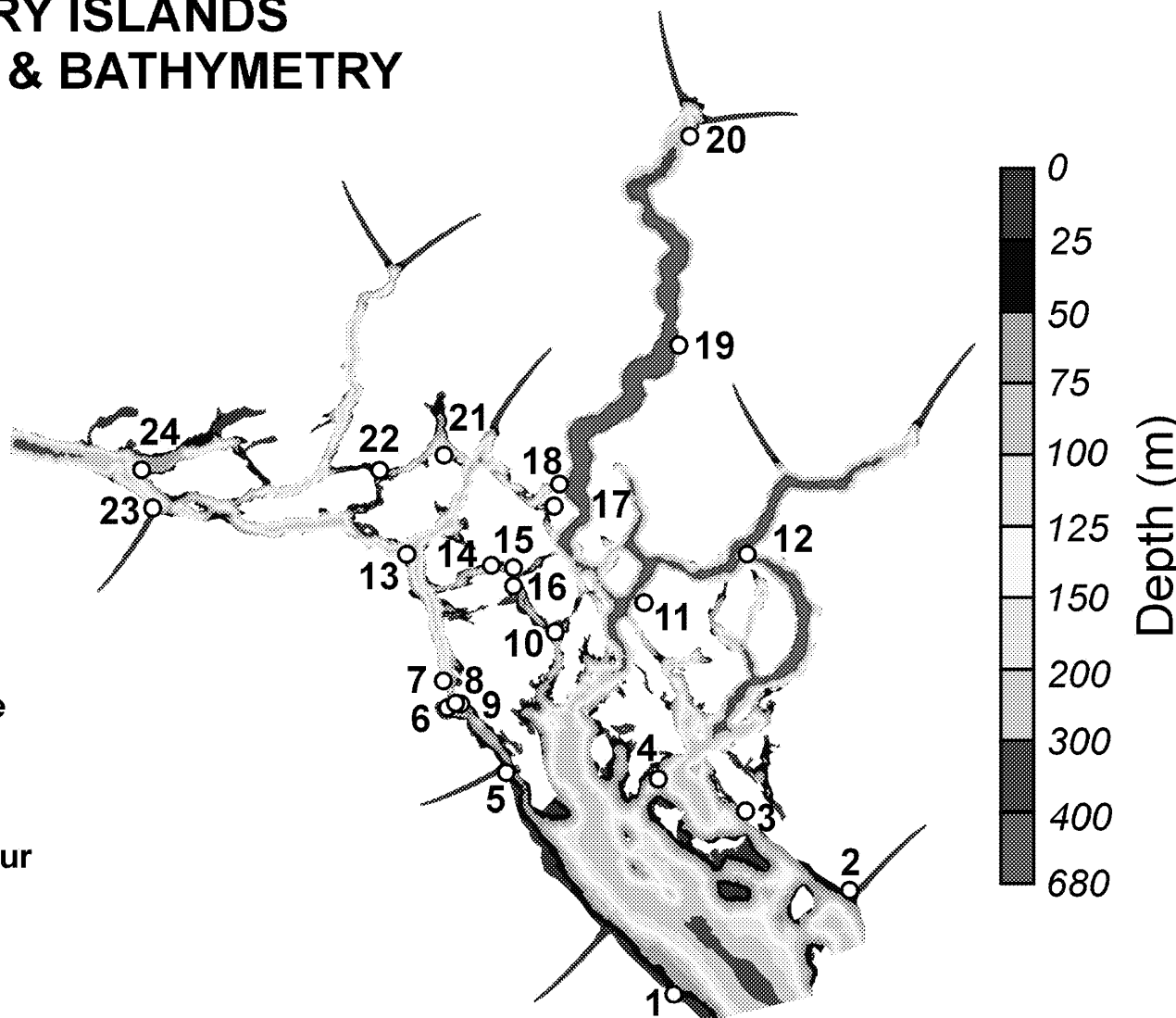
2. RiCOM

- *5 largest tidal constituents*
- *Run for "generic" 25 days*

FVCOM vs RiCOM Tidal Evaluations

DISCOVERY ISLANDS TIDE GAUGES & BATHYMETRY

1. Little River
2. Powell River
3. Lund
4. Twin Islands
5. Campbell River
6. Nympe Cove
7. Brown Bay
8. Seymour Narrows
9. Maude Island East
10. Welsford Island
11. Redonda Bay
12. Channel Islands
13. Chatham Point
14. Okis Islands
15. Owen Bay
16. Bodega Anchorage
17. Big Bay
18. Turnback Point
19. Orford Bay
20. Waddington Harbour
21. Shoal Bay
22. Cordero Islands
23. Kelsey Bay
24. Yorke Island

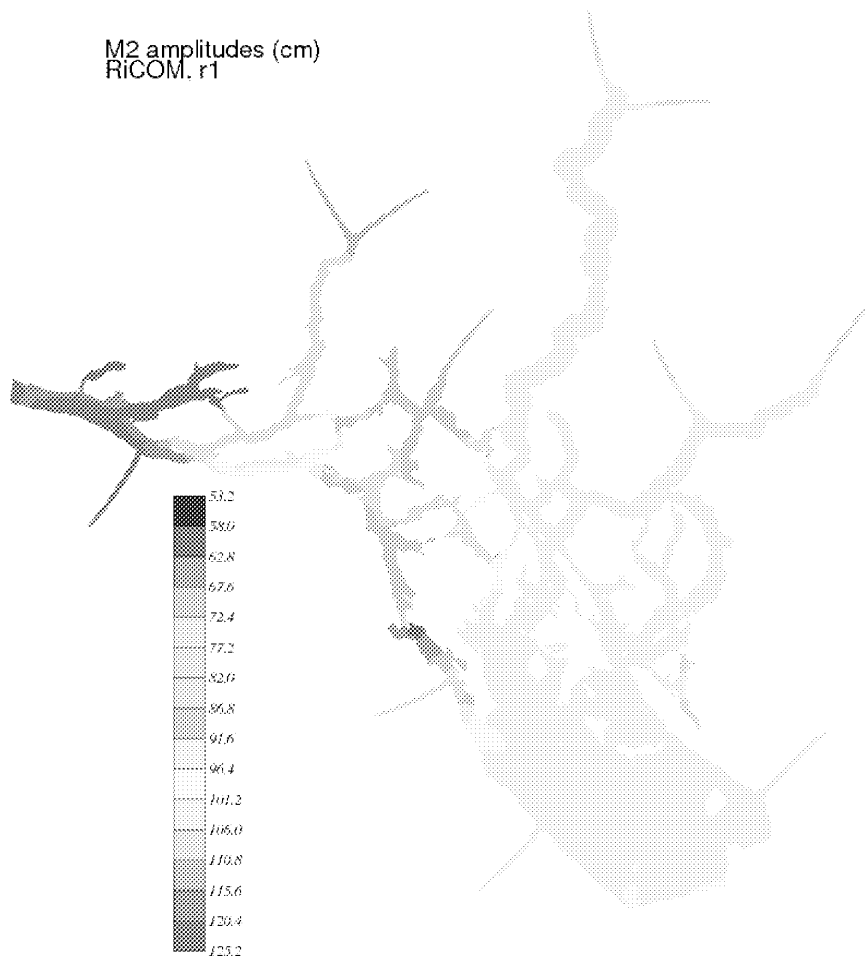


- *24 tide gauges with time series longer than 169 days*

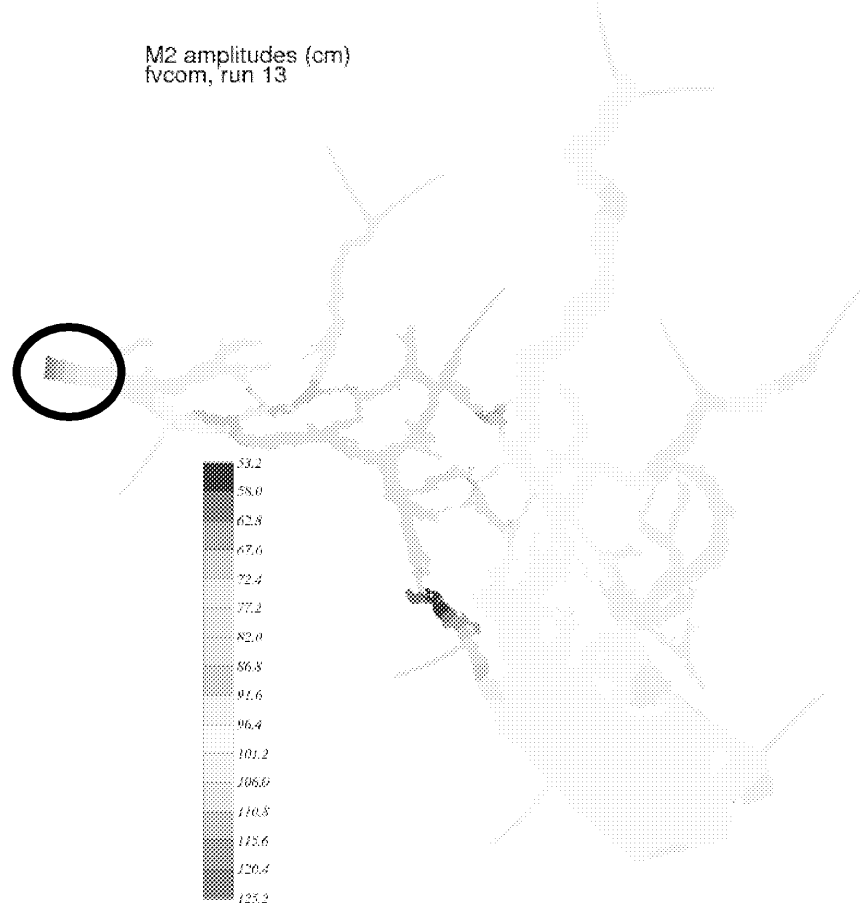
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Preliminary M2 Elevation Amplitude Results

M2 amplitudes (cm)
RiCOM, r1



M2 amplitudes (cm)
fvcom, run 13

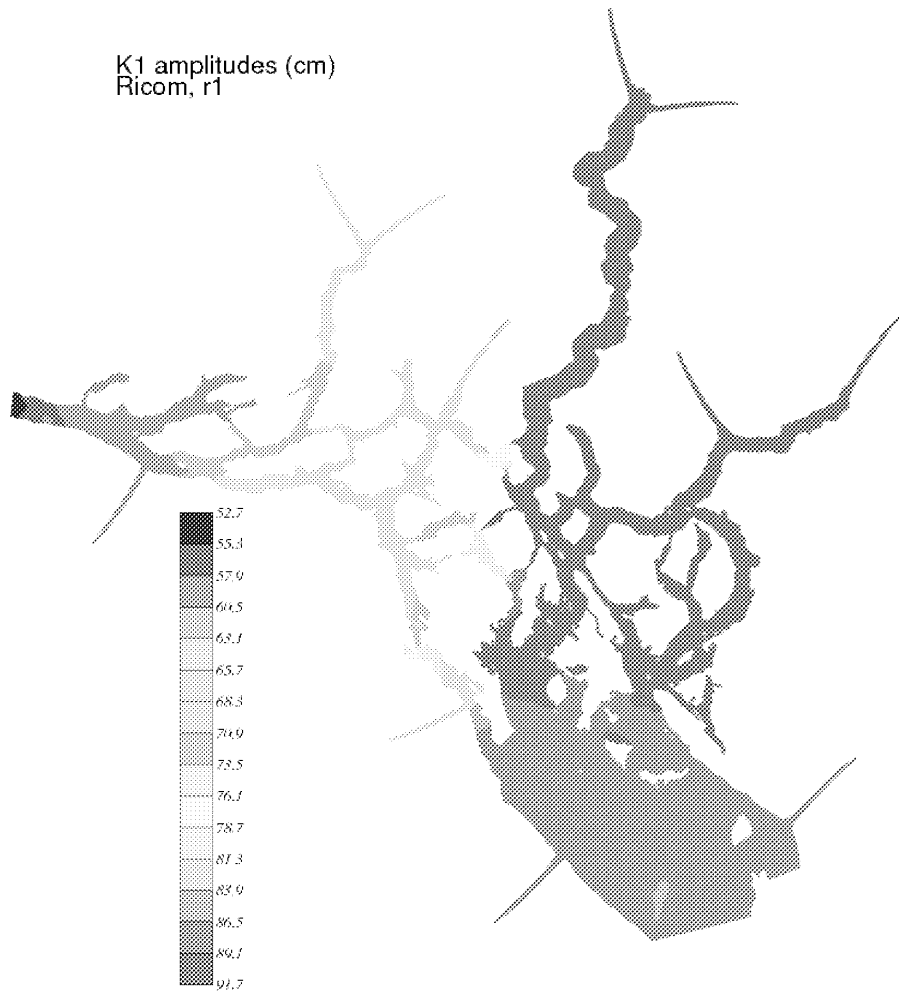


**Average combined M2 amp &
phase errors vs 24 tide
gauge locations**

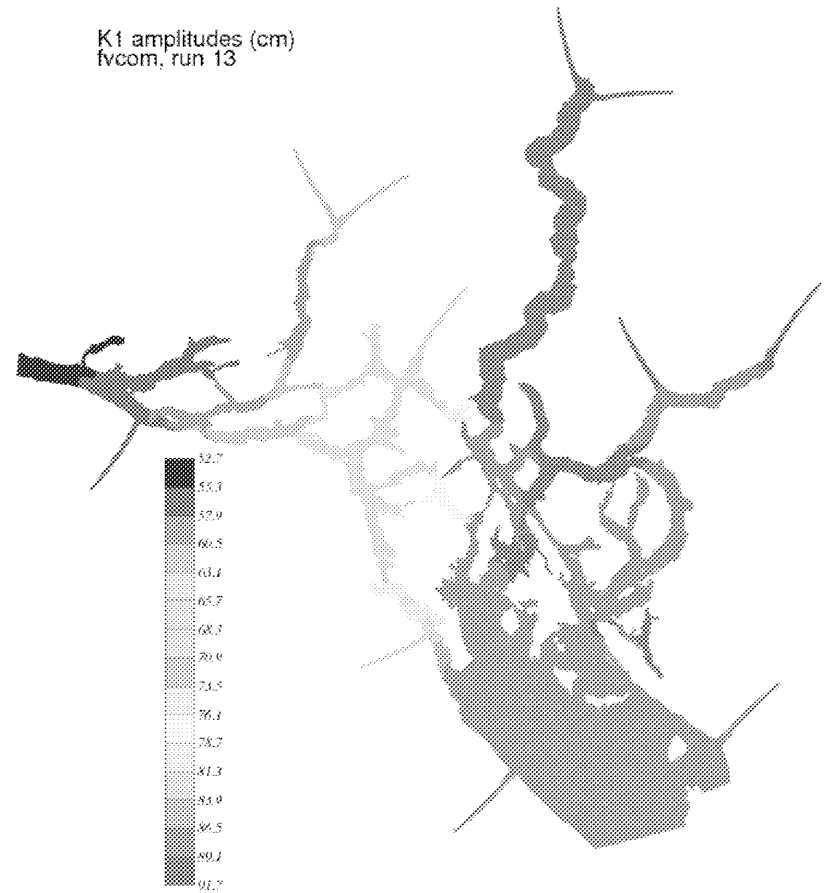
- **FVCOM: 8.5 cm**
- **RiCOM: 8.0**

Preliminary K1 Elevation Amplitude Results

K1 amplitudes (cm)
Ricom, r1



K1 amplitudes (cm)
fvcom, run 13

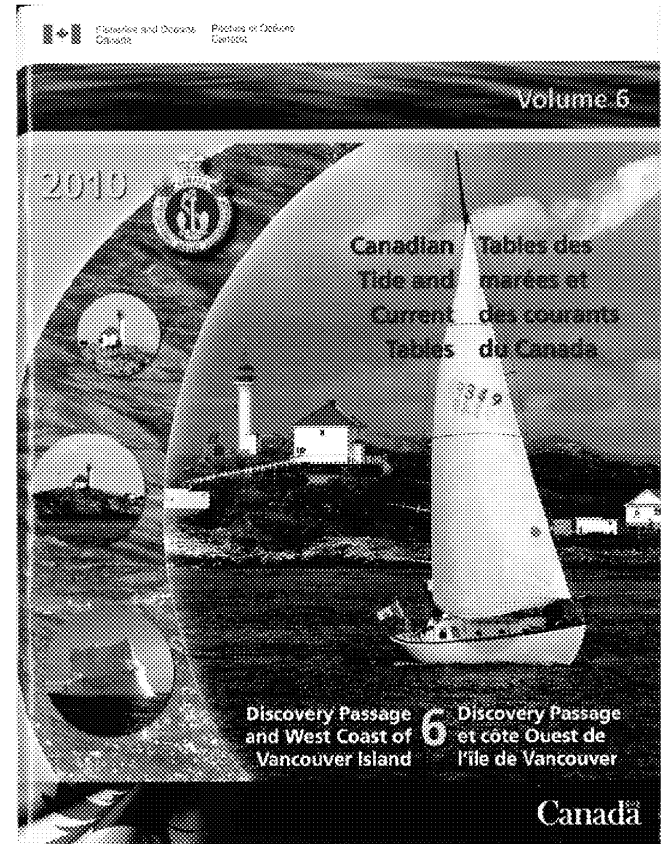
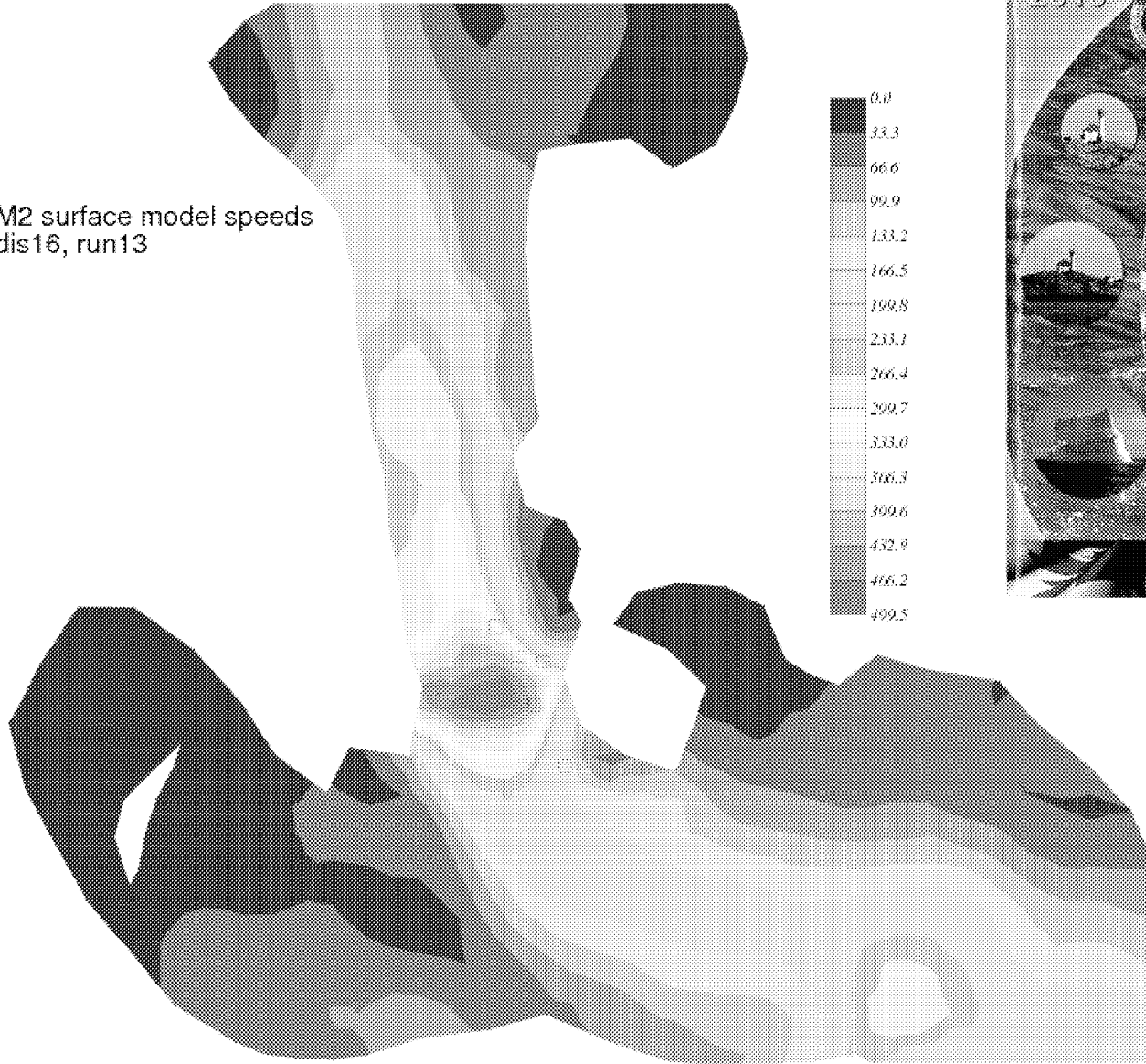


*Average combined K1 amp &
phase errors vs 24 tide
gauge locations*

- *FVCOM: 2.7cm*
- *RiCOM: 3.2*

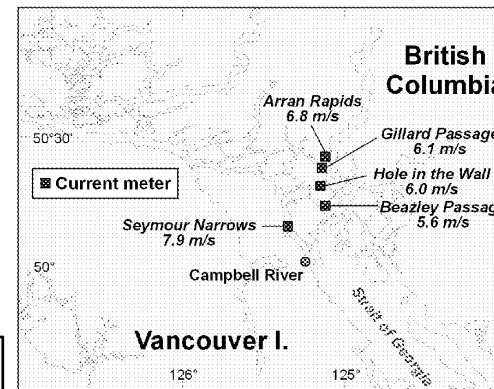
Model Currents Evaluation vs Tide Table Observations

M2 surface model speeds
dis16, run13



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RiCOM/FVCOM M2 Surface Current Evaluation



site	Model speed	Model inclin	Model phase	Observed speed	Observed inclin	Observed phase
Arran Rapids	392.0 373.2	28.9 27.7	264.7 264.4	456.4	30.	266.7
Beazley Passage	294.2 335.5	158.1 153.6	88.4 91.4	369.4	150.	85.4
Gillard Passage	128.5 154.0	165.2 168.2	88.4 88.0	355.8	175.	91.2
Hole-in-the-Wall	378.0 380.8	28.4 21.5	266.4 267.1	373.3	50.	269.0
Johnstone Central	41.4 17.3	173.5 169.9	79.6 101.7	26.9	172.3	88.4
Seymour Narrows	356.6 374.8	105.6 102.6	103.8 110.8	466.1	90.0	112.9
Ripple Rock	411.7 491.9	102.8 100.4	106.2 115.6	???		

• Pretty good except at Gillard (?)

• Observed currents need to be re-analysed

• Current locations used in Tide Tables need more accuracy

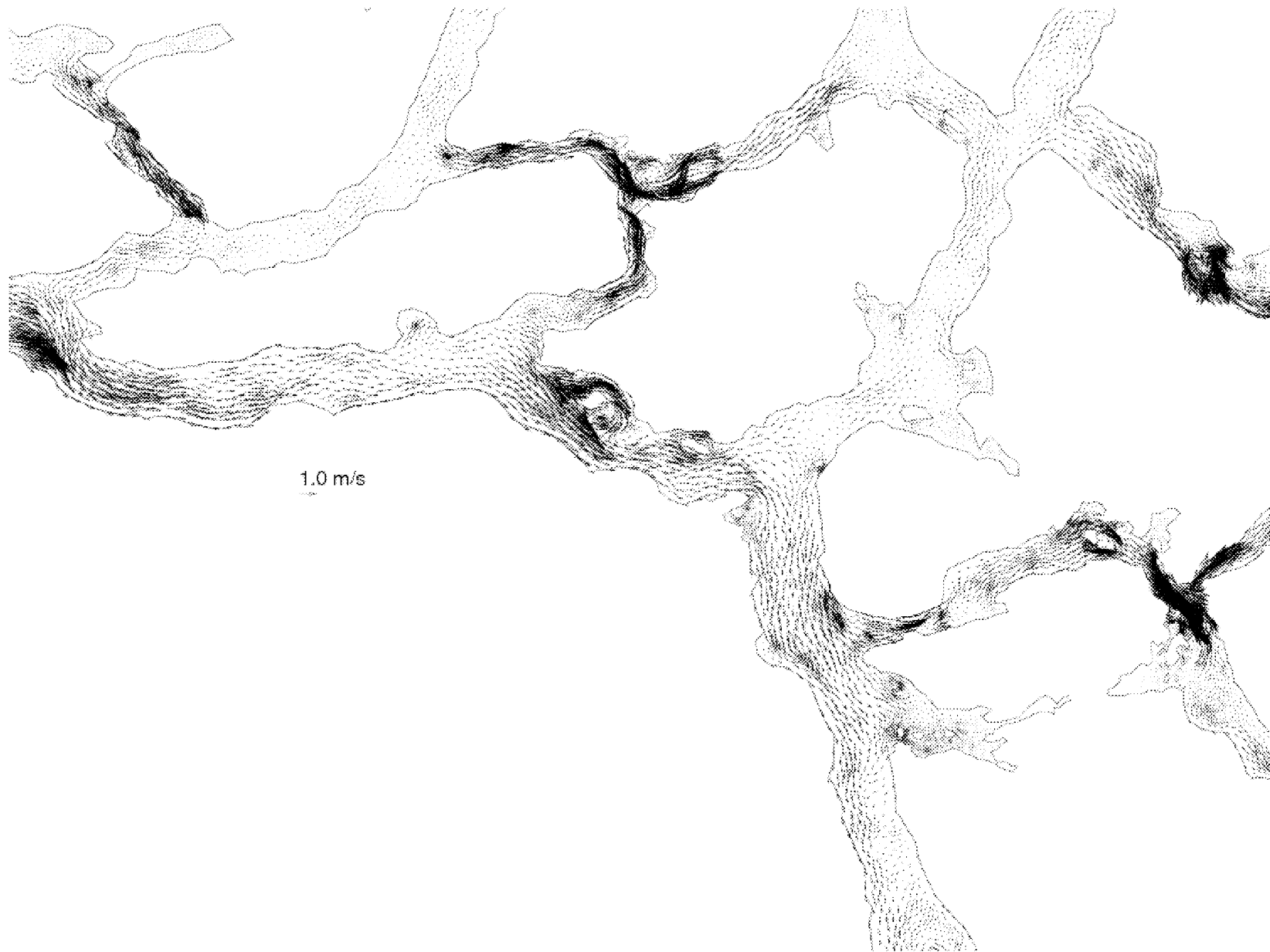
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FVCOM Ebb Snapshot at 10m Depth



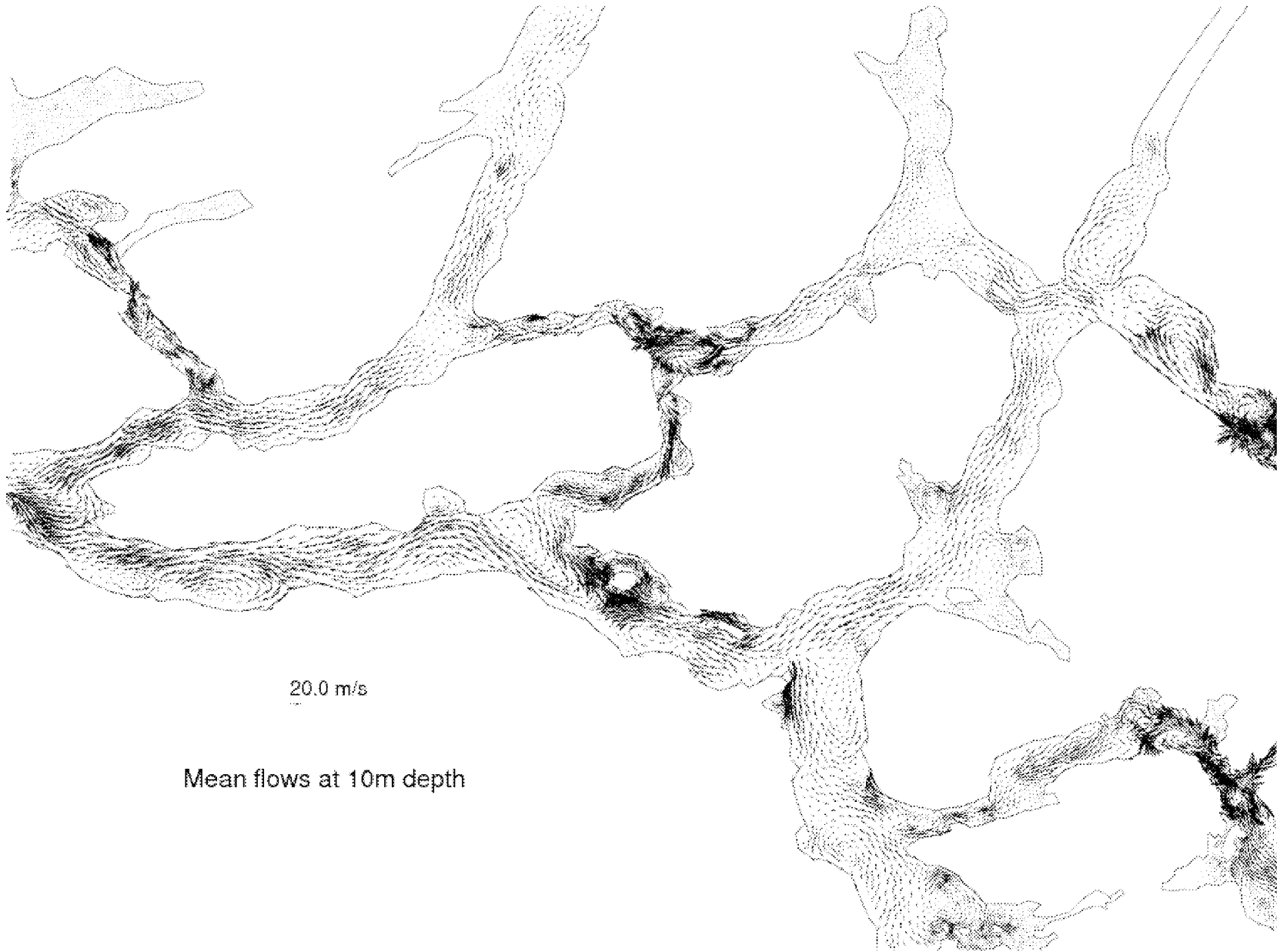
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FVCOM Flood Snapshot at 10m Depth



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FVCOM Mean Flows

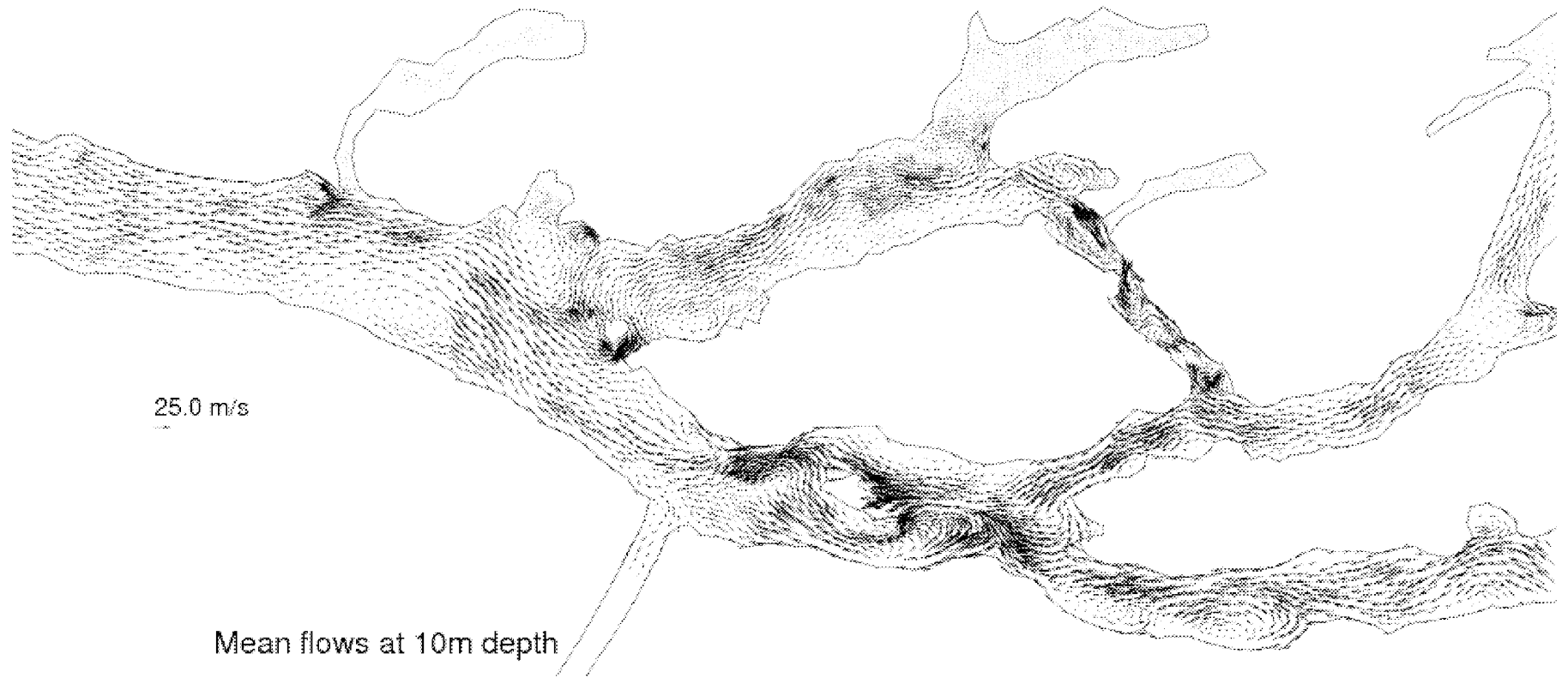


20.0 m/s

Mean flows at 10m depth

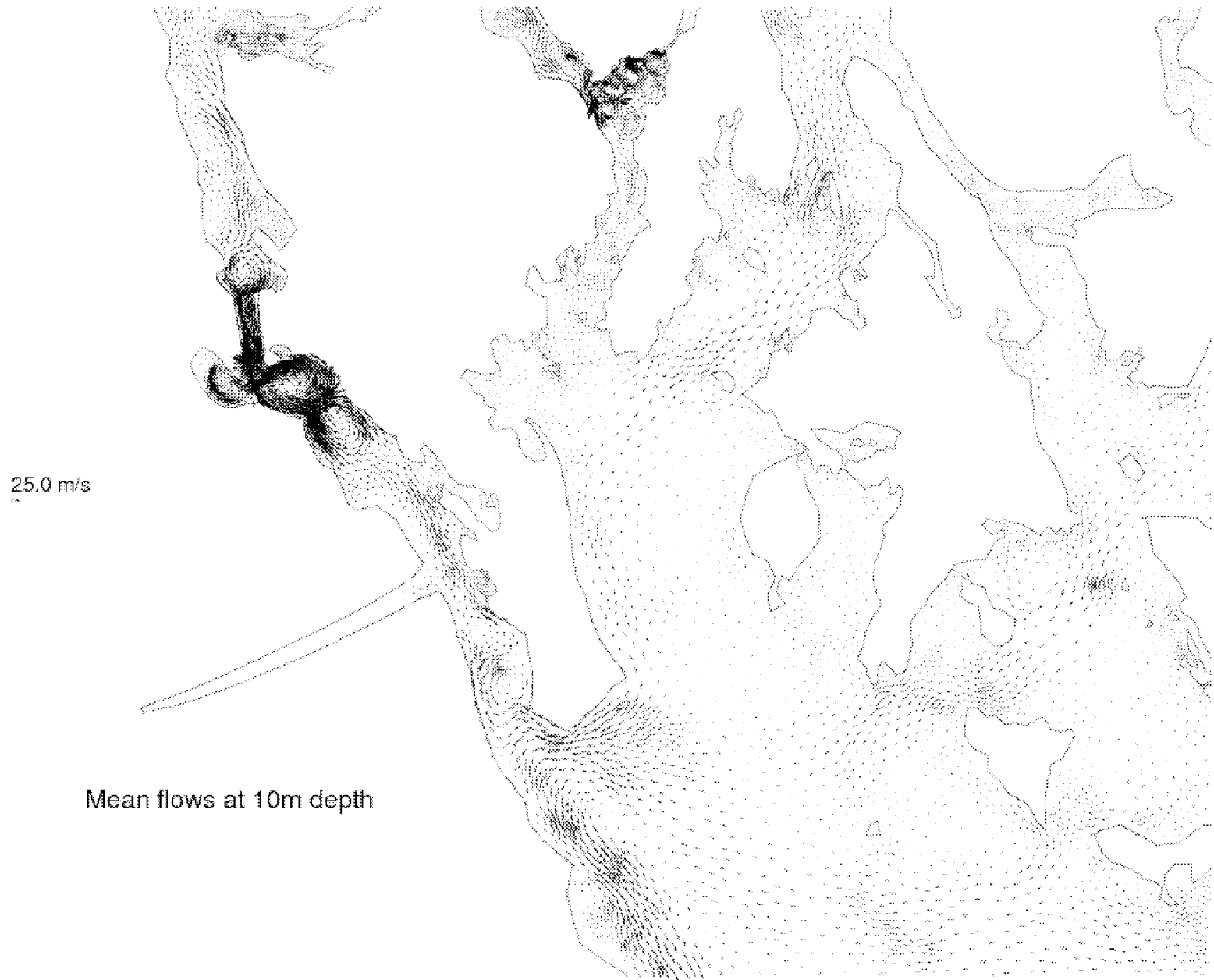
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FVCOM Mean Flows



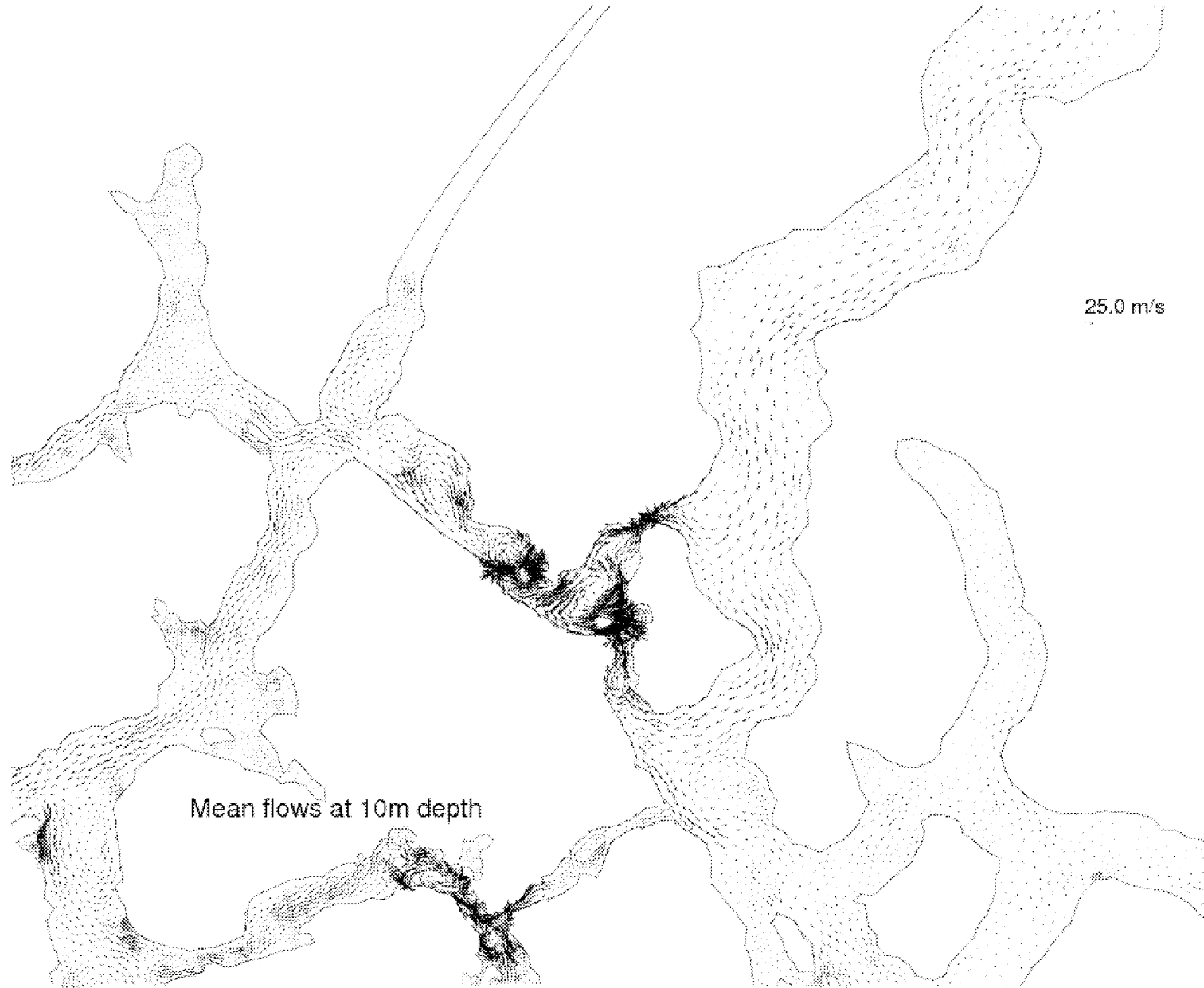
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FVCOM Mean Flows



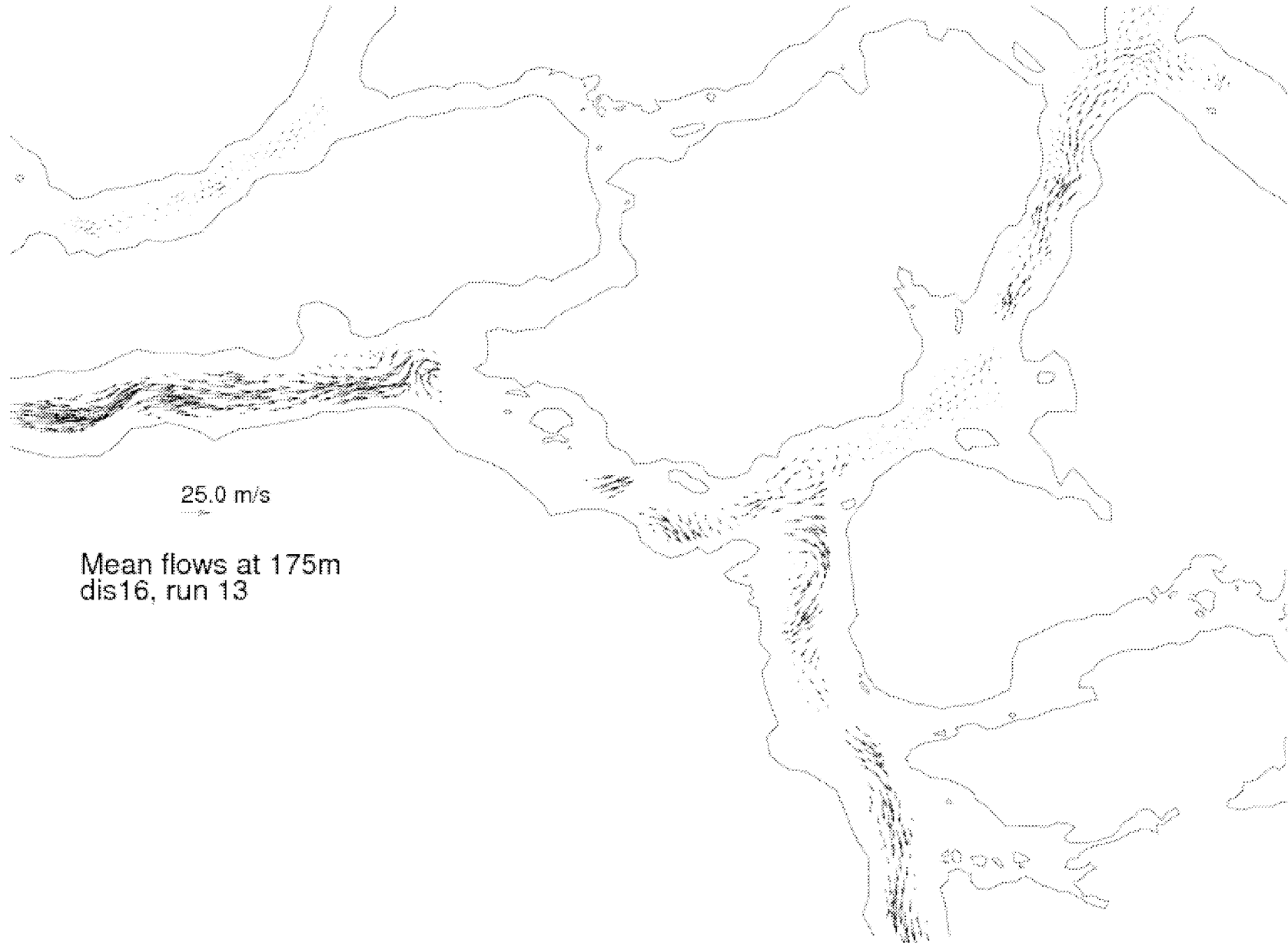
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FVCOM Mean Flows



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FVCOM Mean Flows



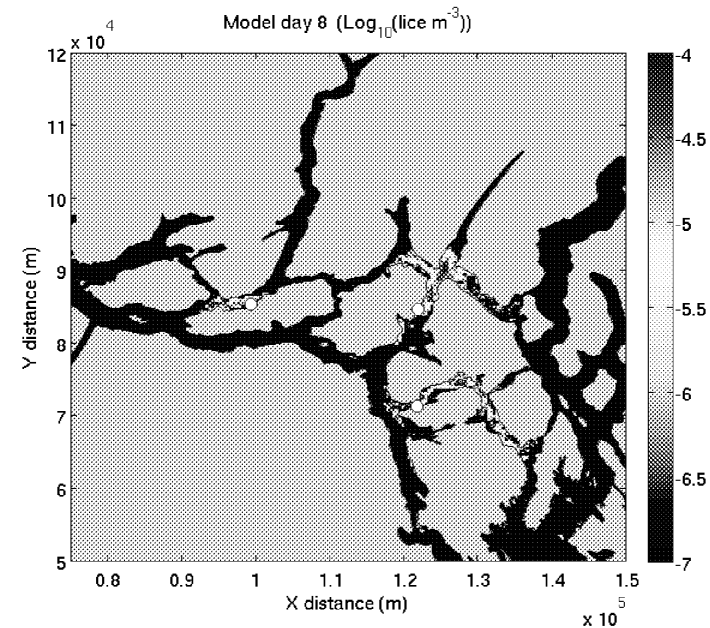
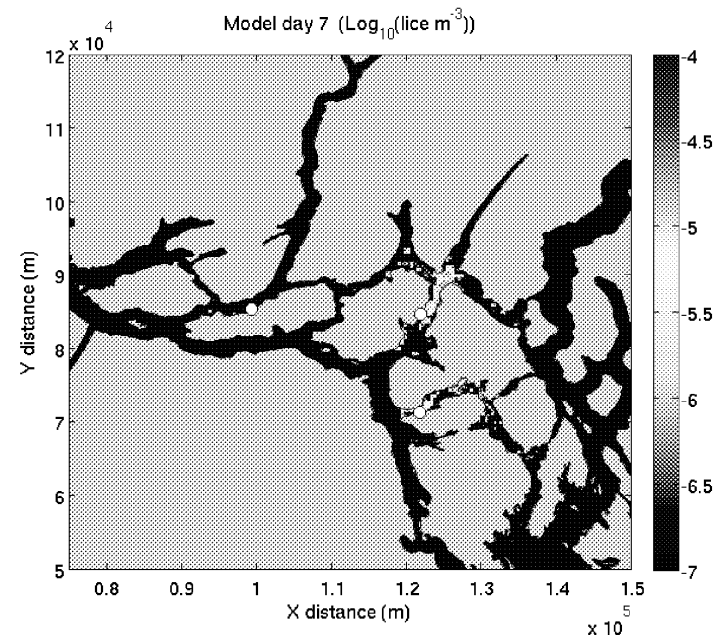
25.0 m/s

Mean flows at 175m
dis16, run 13

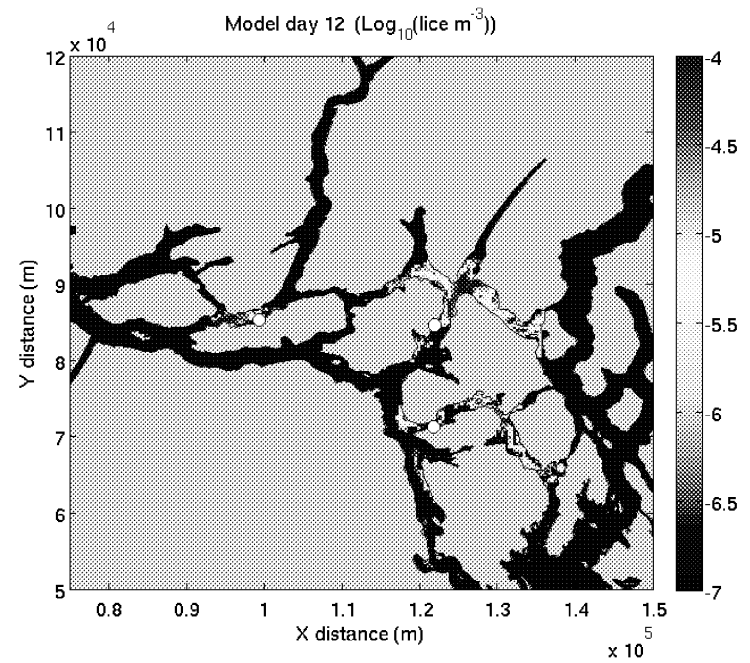
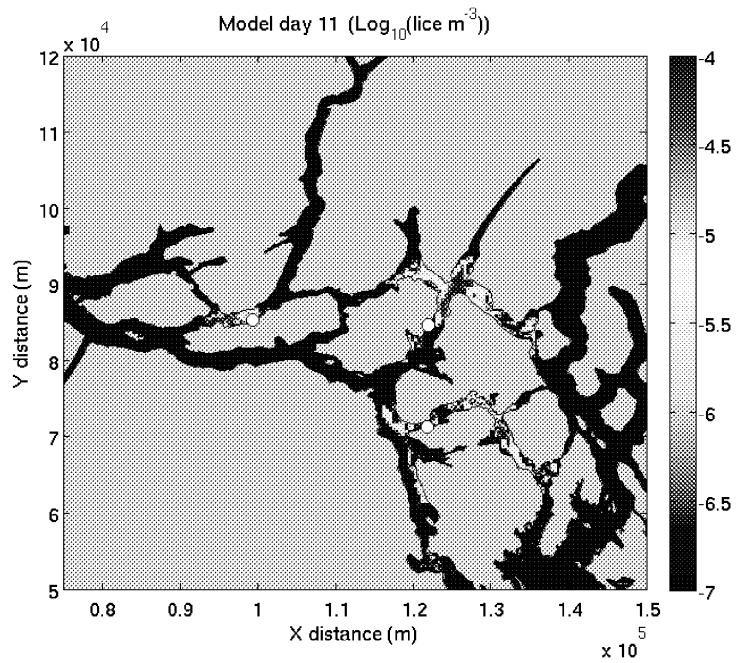
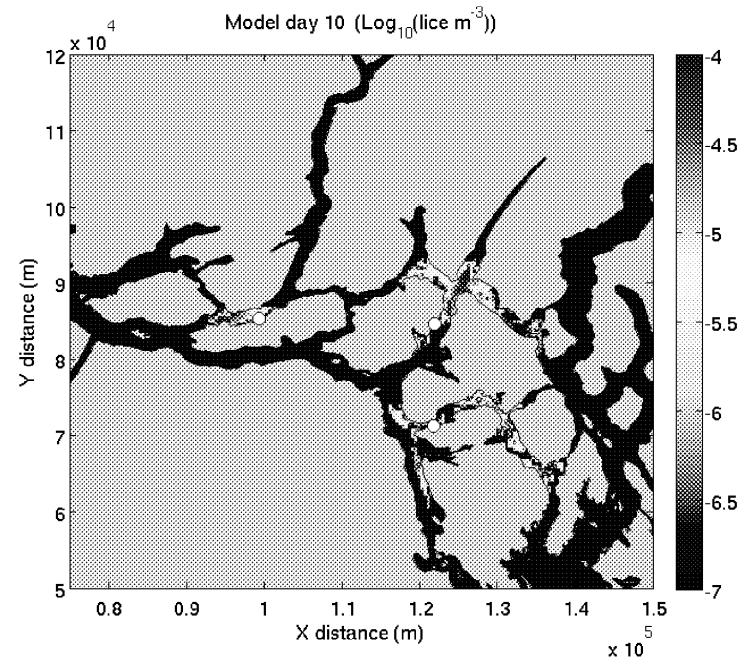
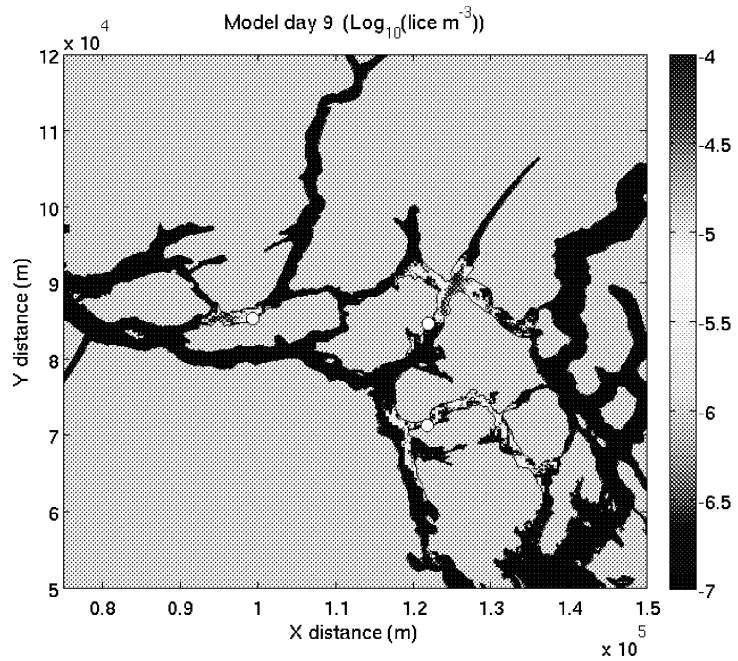
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Preliminary Particle Tracking

- 20 particles released hourly for 6 days from the 3 farms
 - Thurlow (Nodales Channel, MHC)
 - Chancellor Channel (MHC)
 - Brent Is (Okisollo Channel, Mainstream)
- Passive particles
- each farm is 50m by 50m by 20m & particles released randomly within that box
- tracked for 10 days

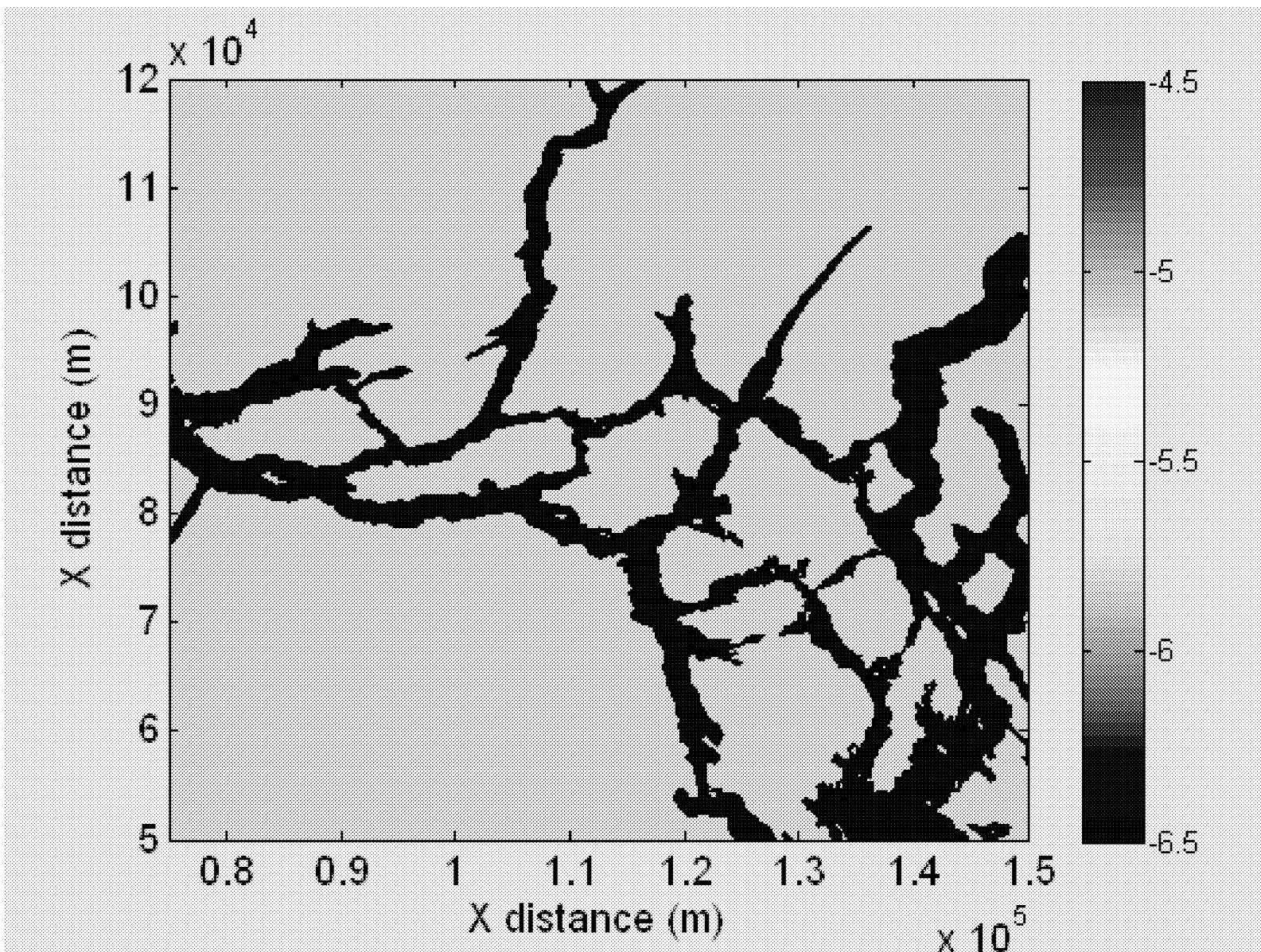


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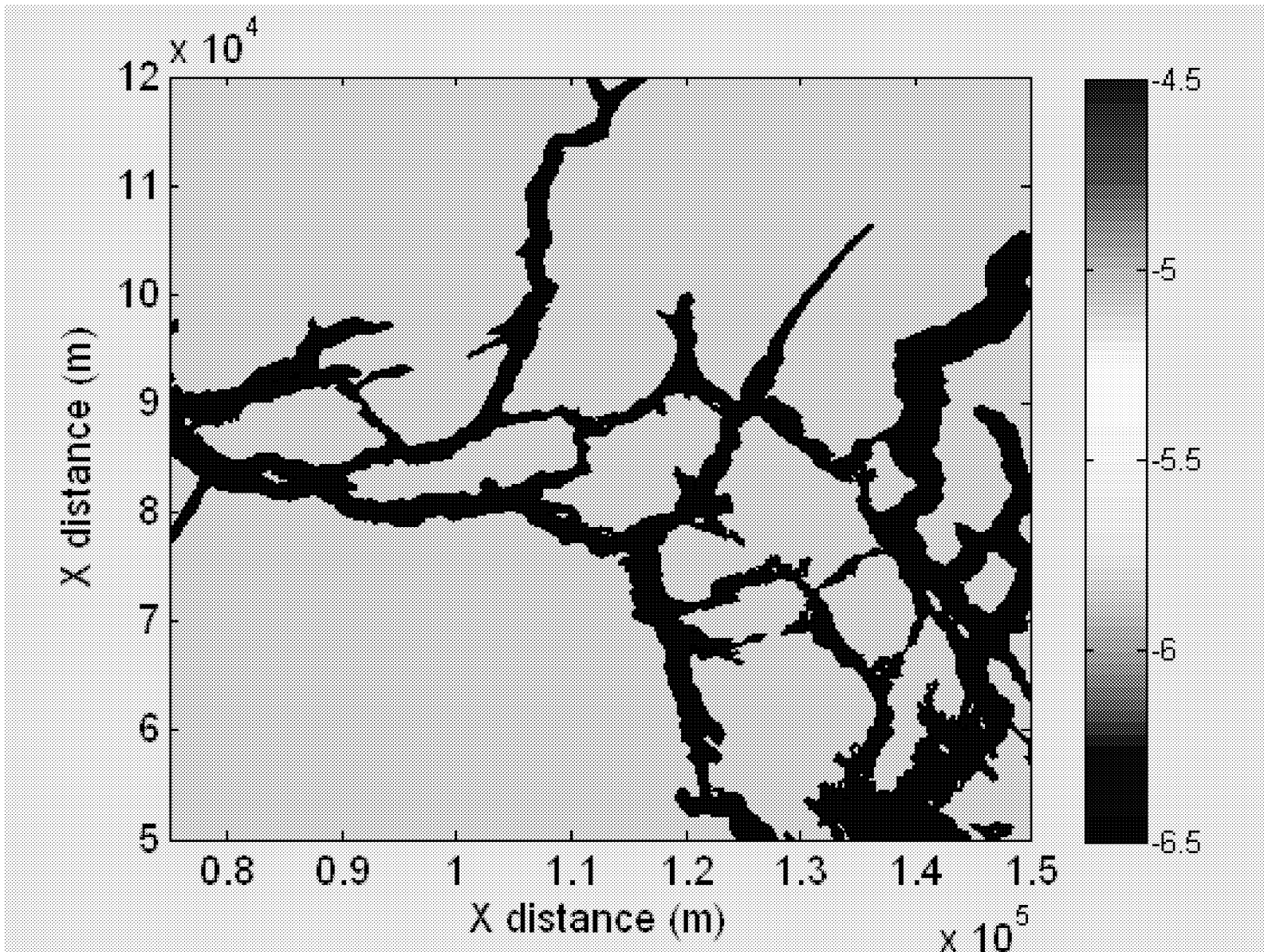
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Particle Concentrations from Thurlow Releases



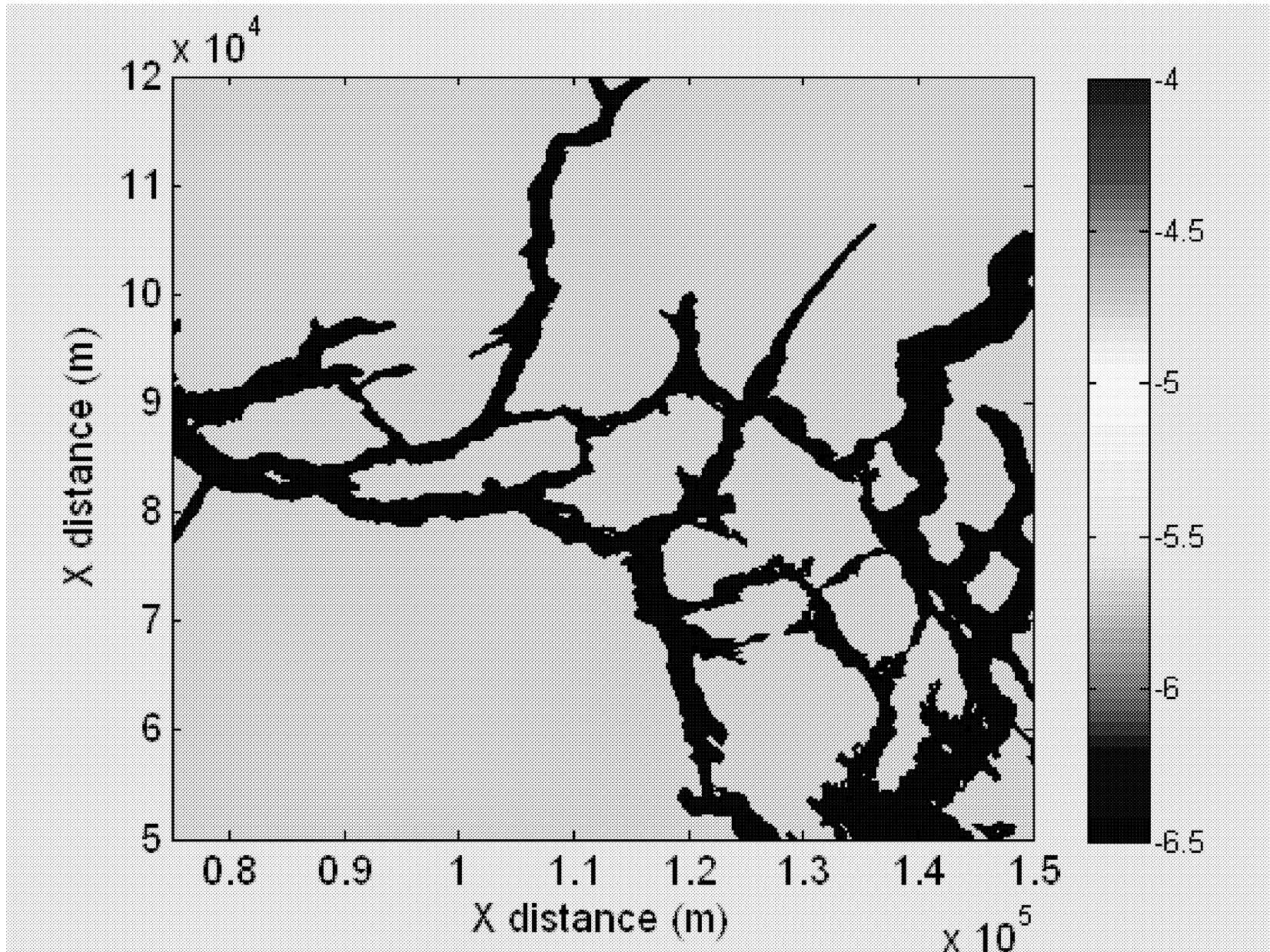
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Particle Concentrations from Chancellor Releases



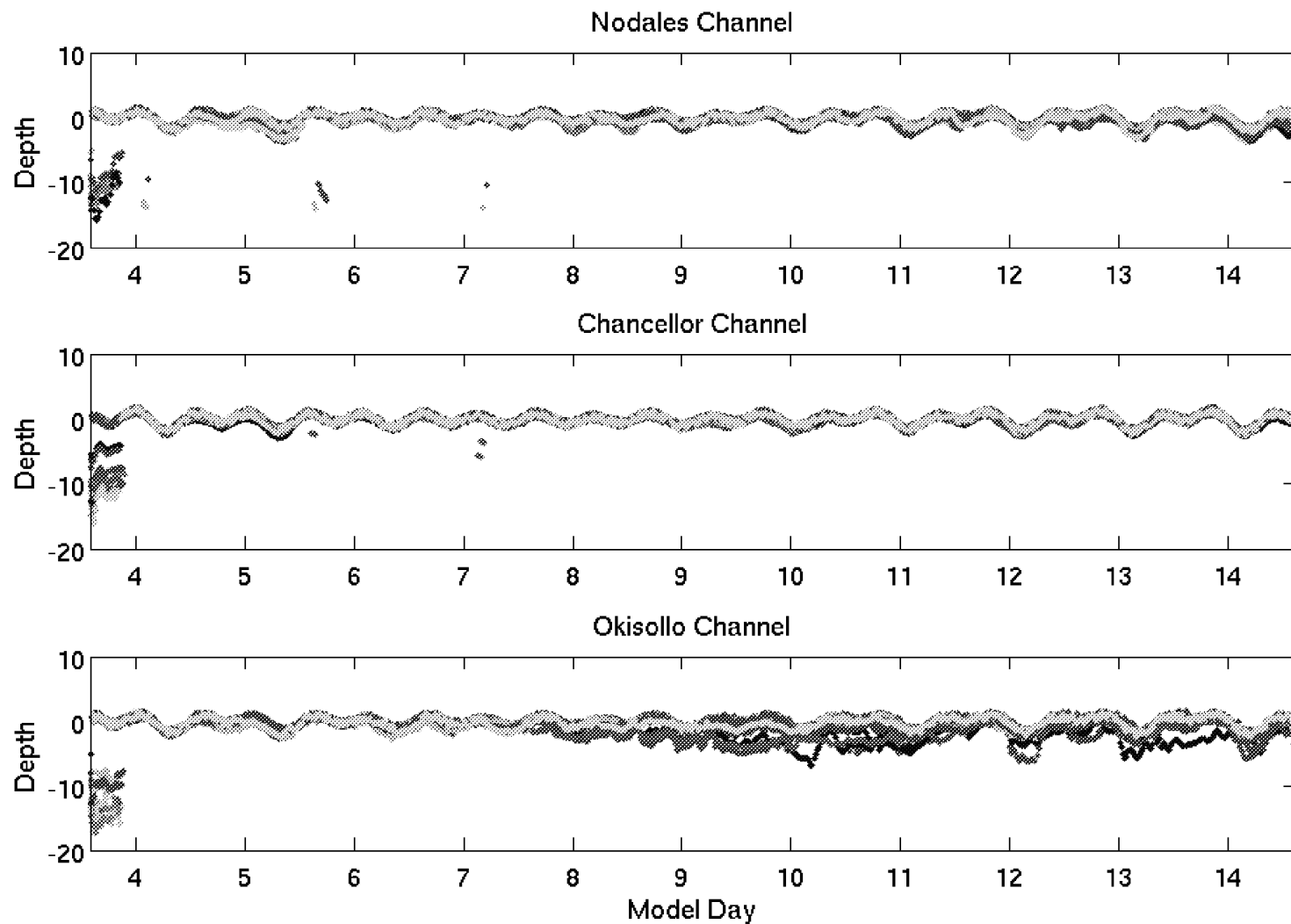
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Particle Concentrations from Brent Releases



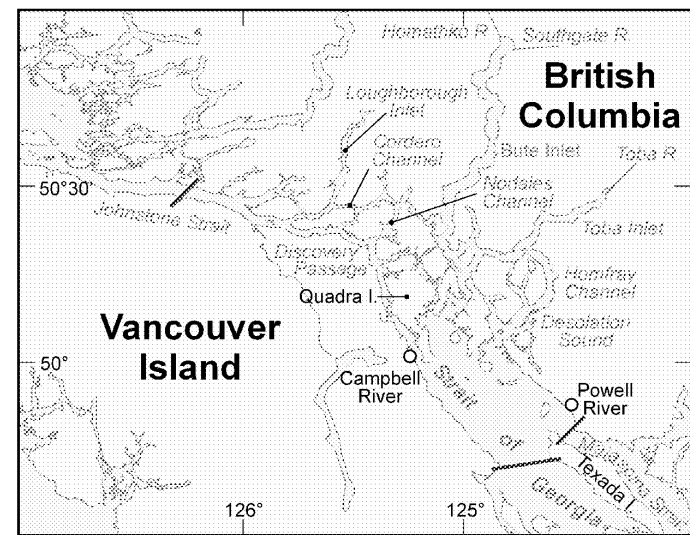
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Particle Depths



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Future Plans



1. FVCOM:

- *Incorporate winds & heat flux*
- *Run for specific period of weather observations & current measurements so can evaluate both tidal & non-tidal model currents*
- *Where possible evaluate model temperatures & salinities*
- *Incorporate biology into particle tracking*
 - *Understand dispersion directions*

2. RiCOM

- *Incorporate rivers & salinity/temperature effects as Roy develops that capability*

3. Re-analyse historical current measurements