

Shipboard Acoustic Doppler Current Profiler Surveys to Assess Tidal Current Resources

Jeff Epler, Brian Polagye, Jim Thomson

University of Washington

Northwest National Marine Renewable Energy Center

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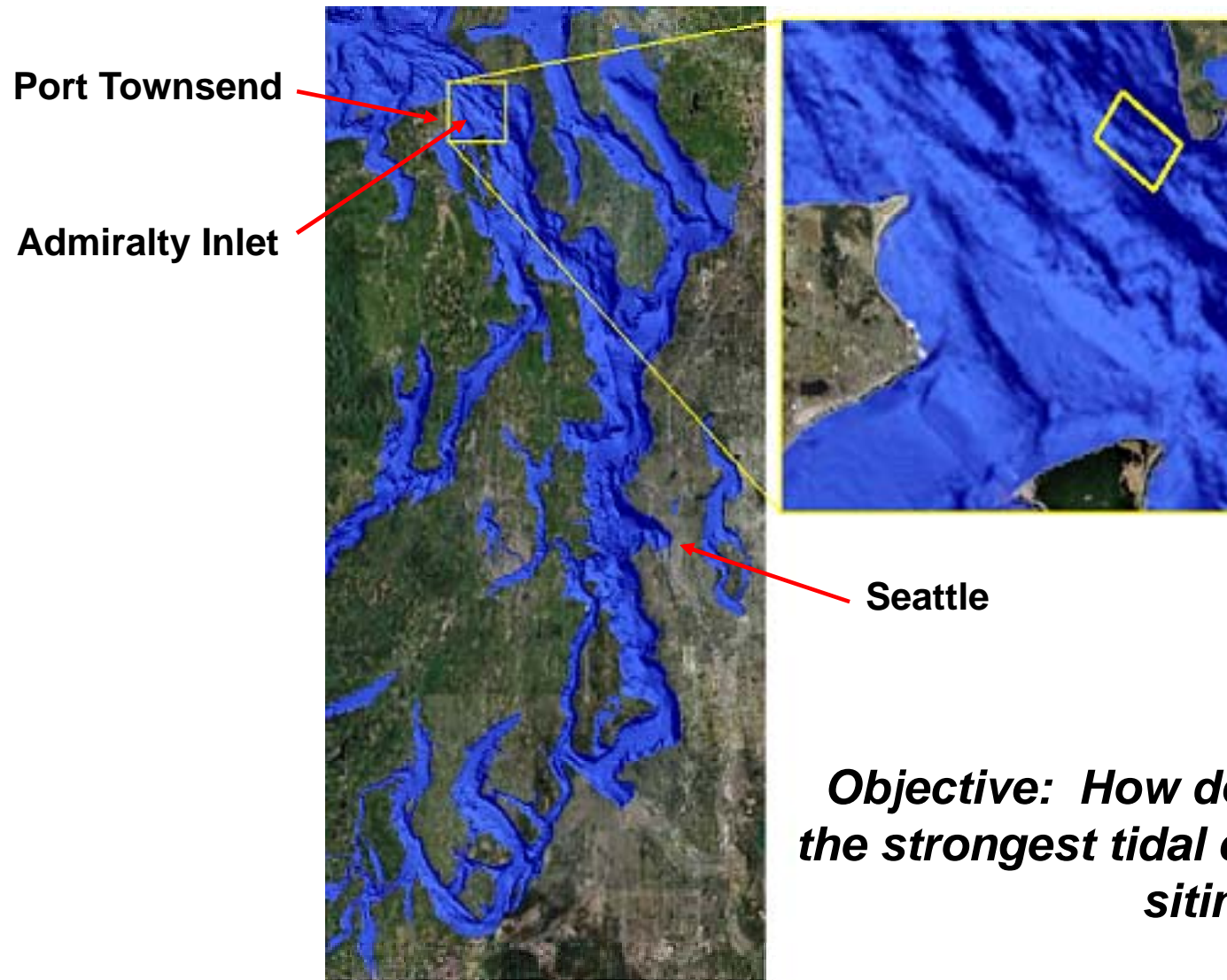


NNMREC

Outline

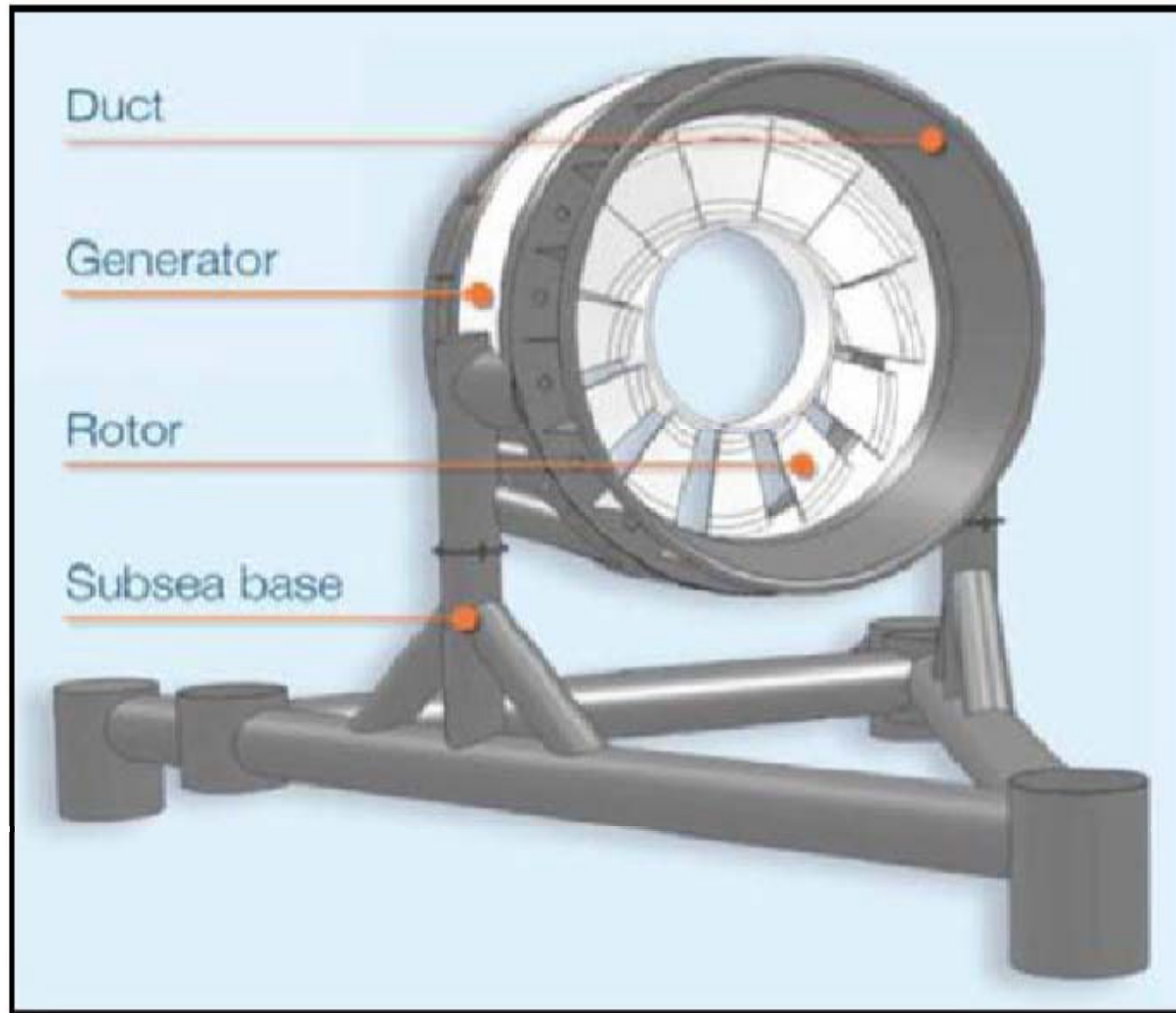
- Motivation & Background
- Shipboard Acoustic Doppler Current Profiler
 - Methodology
 - Results
- Conclusion

Puget Sound & Admiralty Inlet



Objective: How do we characterize the strongest tidal currents for device siting?

OpenHydro Tidal Turbine

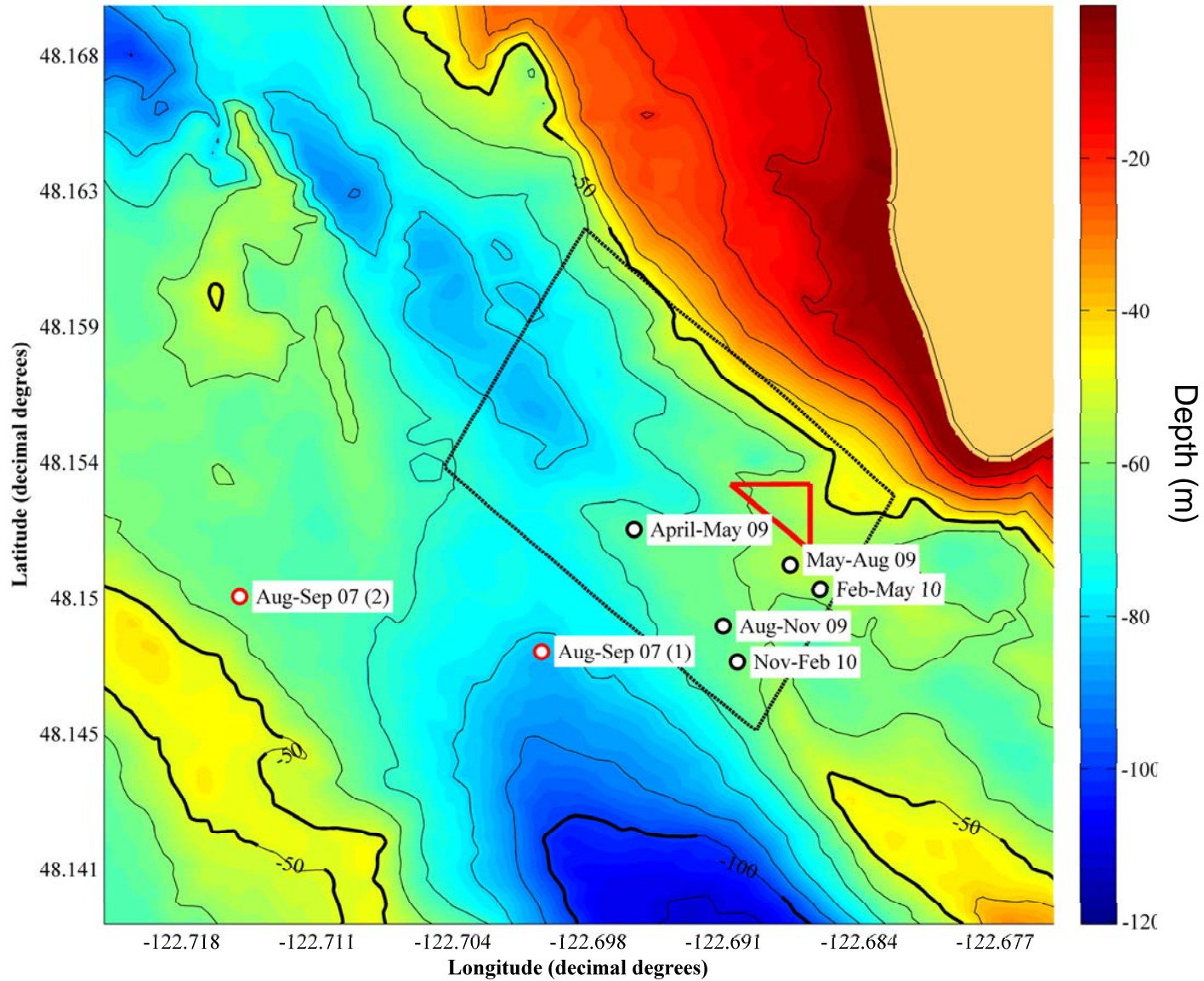


Kinetic Power Density

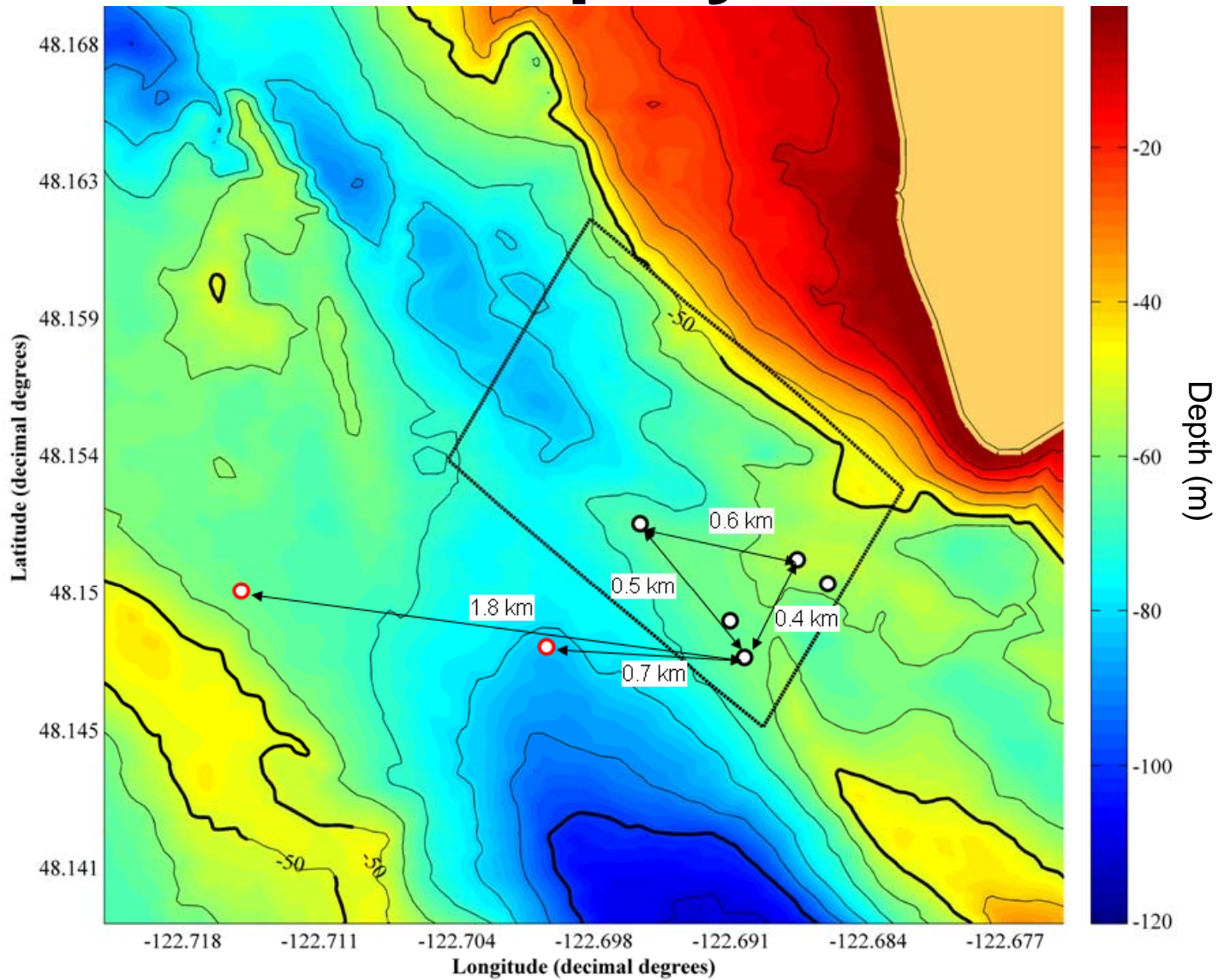
$$P = \frac{1}{2} \rho v^3$$

Source: http://www.snopud.com/Site/Content/Documents/tidal/ai/11-ExhibitF_LargeFormat.pdf

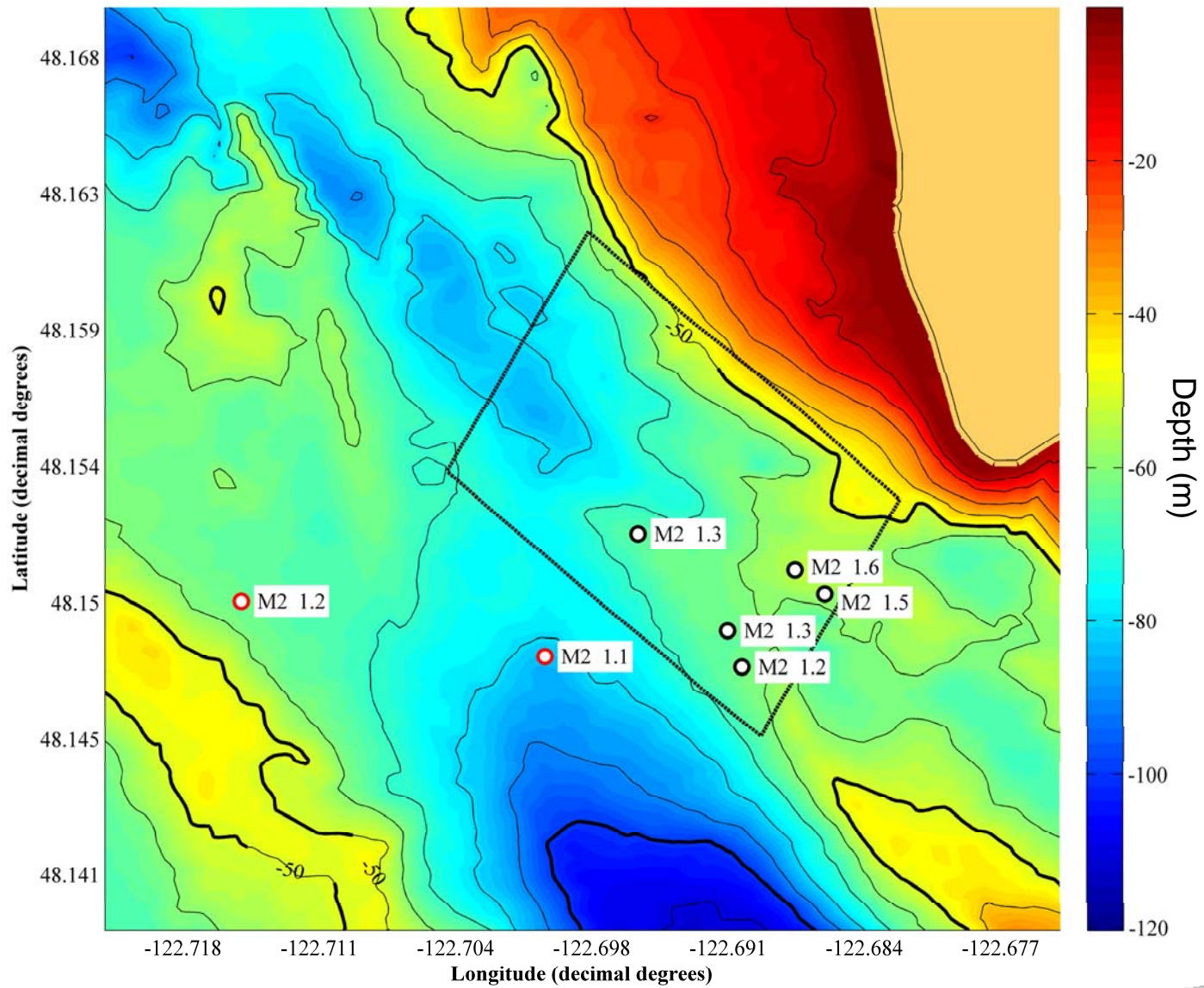
Stationary ADCP Deployments



ADCP Deployments



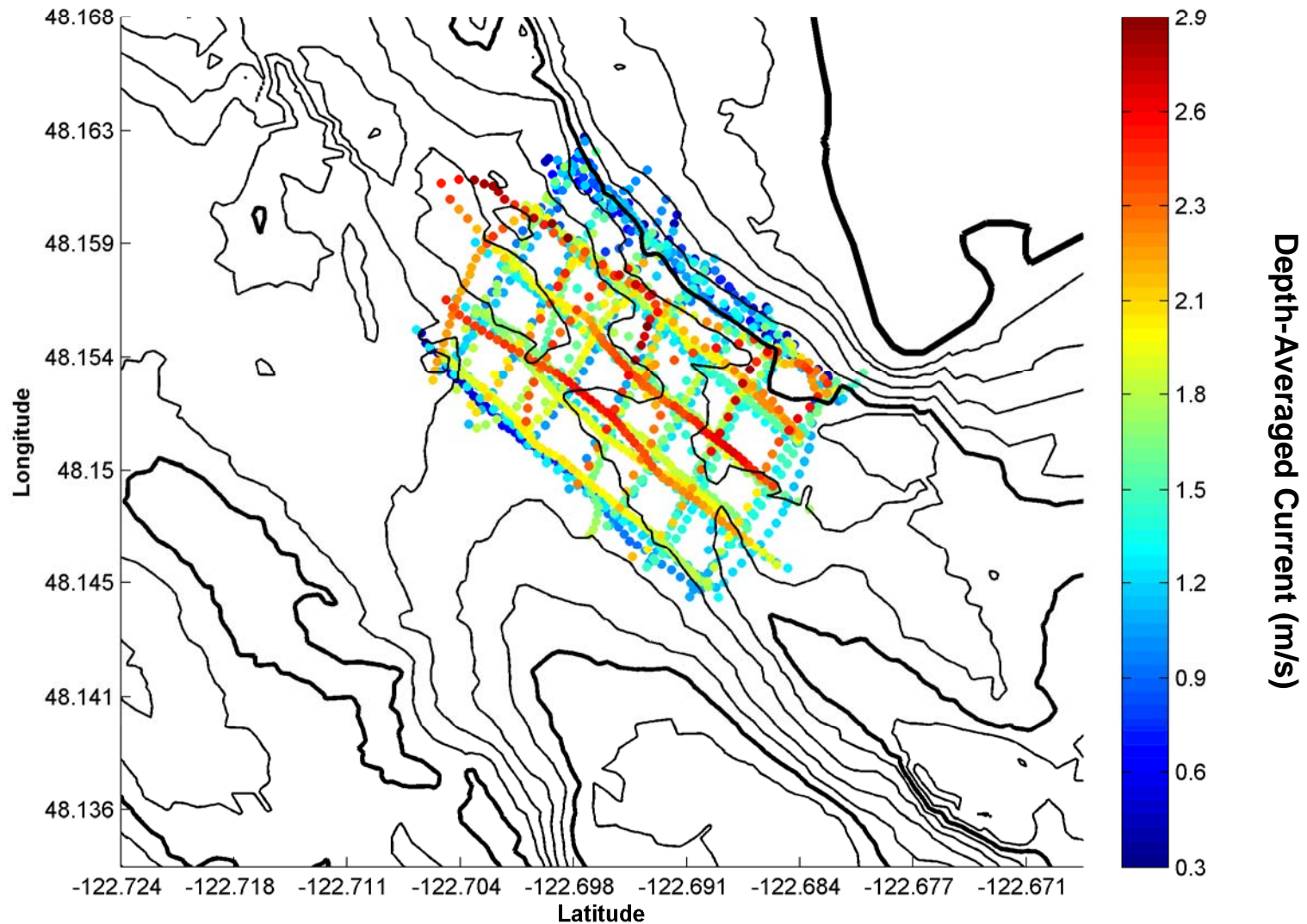
M2- Amplitude Map



Outline

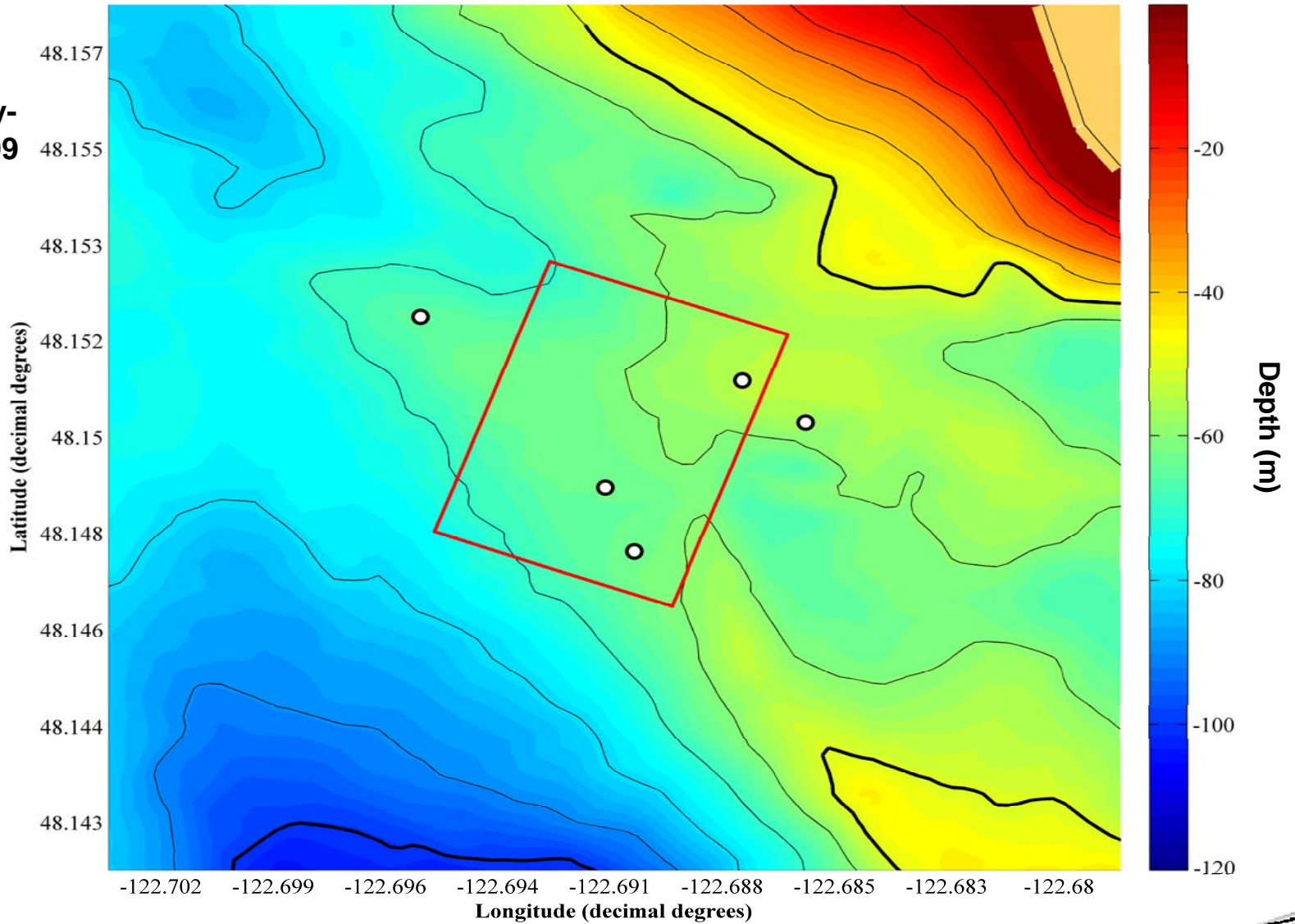
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Shipboard ADCP Survey- April 2009

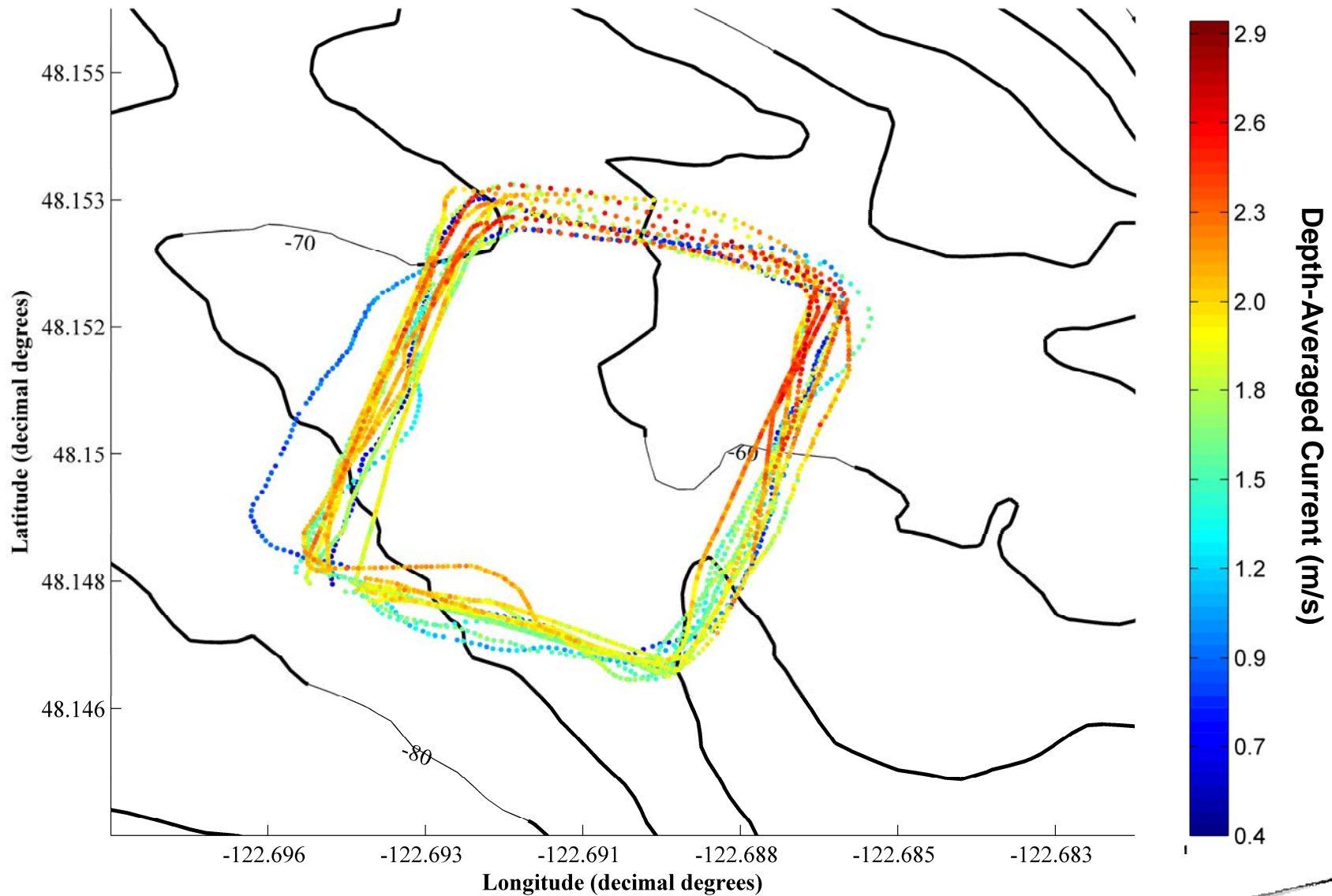


Survey Track Design

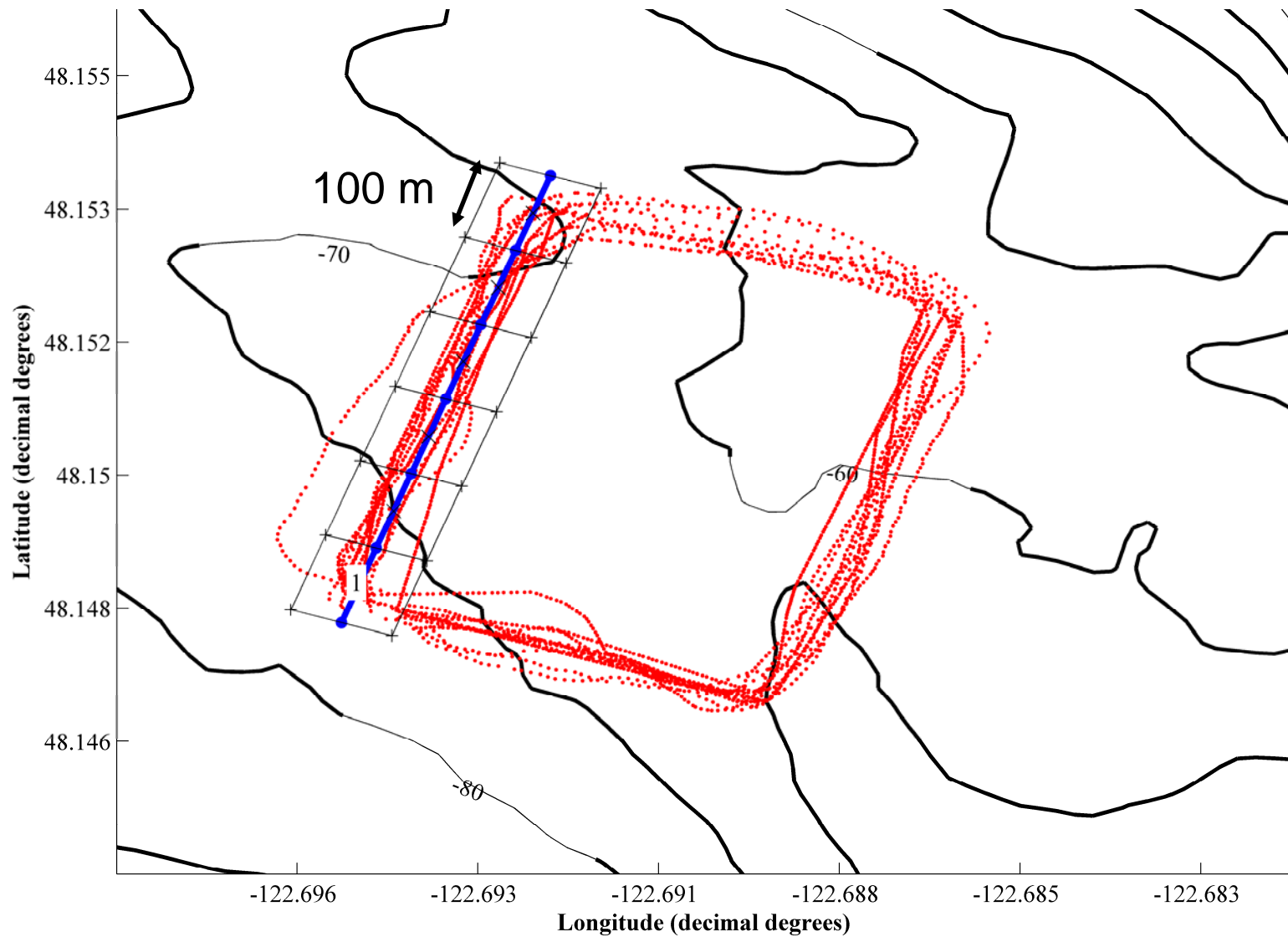
Ebb Survey-
August 2009



August 2009 Ebb Survey

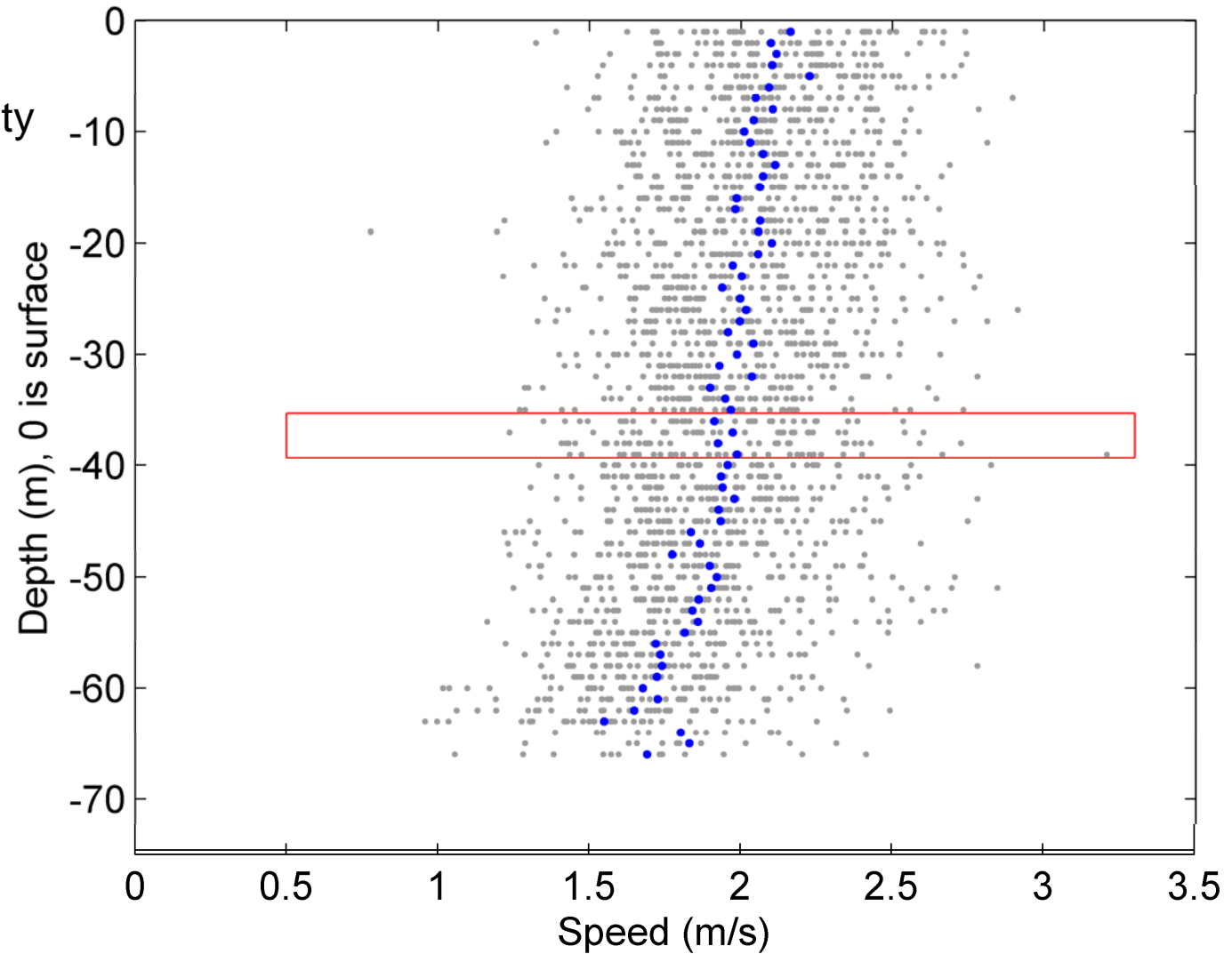


August 2009 Ebb Survey



Volumetric Averaging

34 ADCP Velocity Profiles



Velocity PDF

Mean = 1.95 m/s

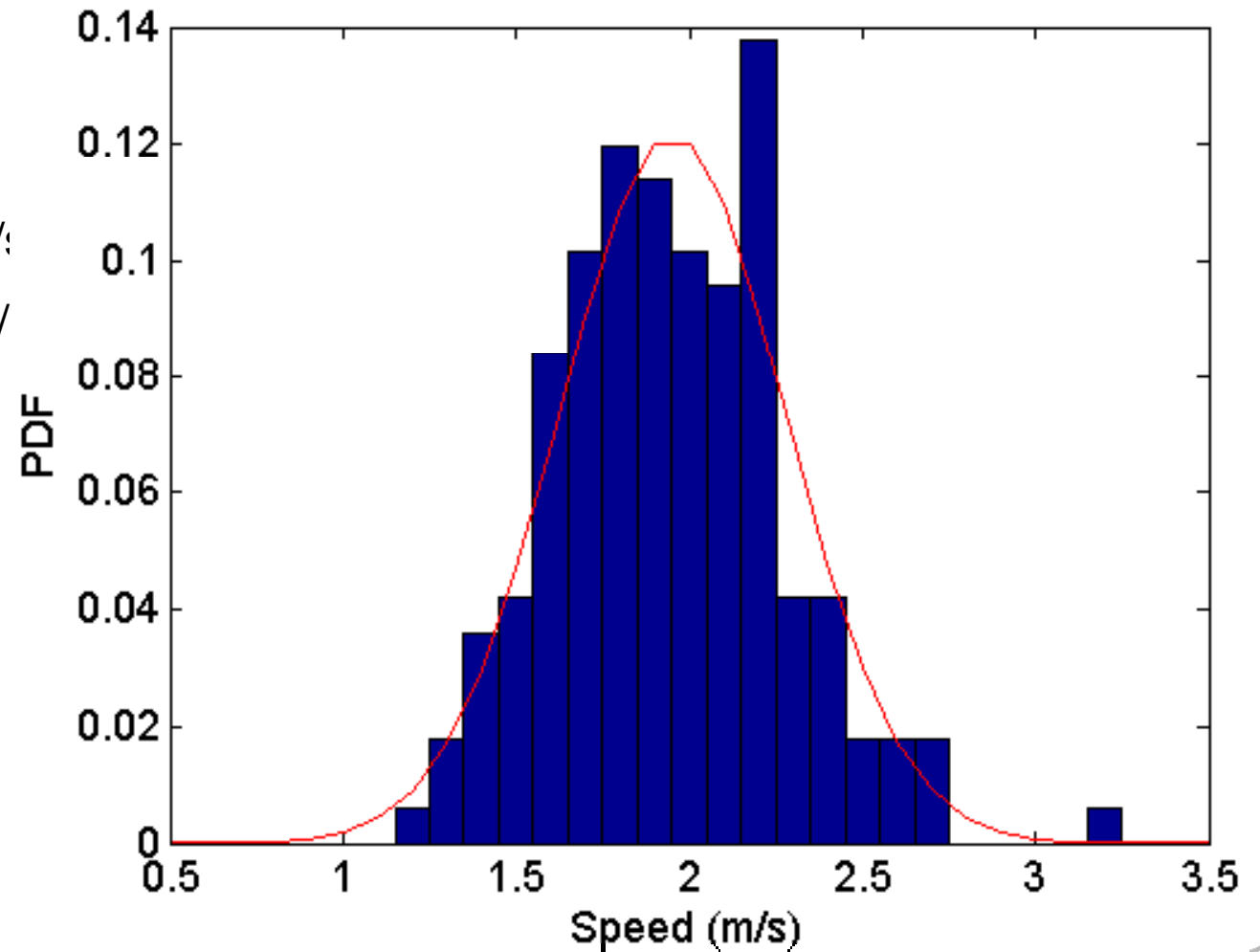
Max = 3.21 m/s

Min = 1.24 m/s

Data Std. Dev. = 0.33 m/s

ADCP Std. Dev. = 0.2 m/s

Ensemble Size = 167



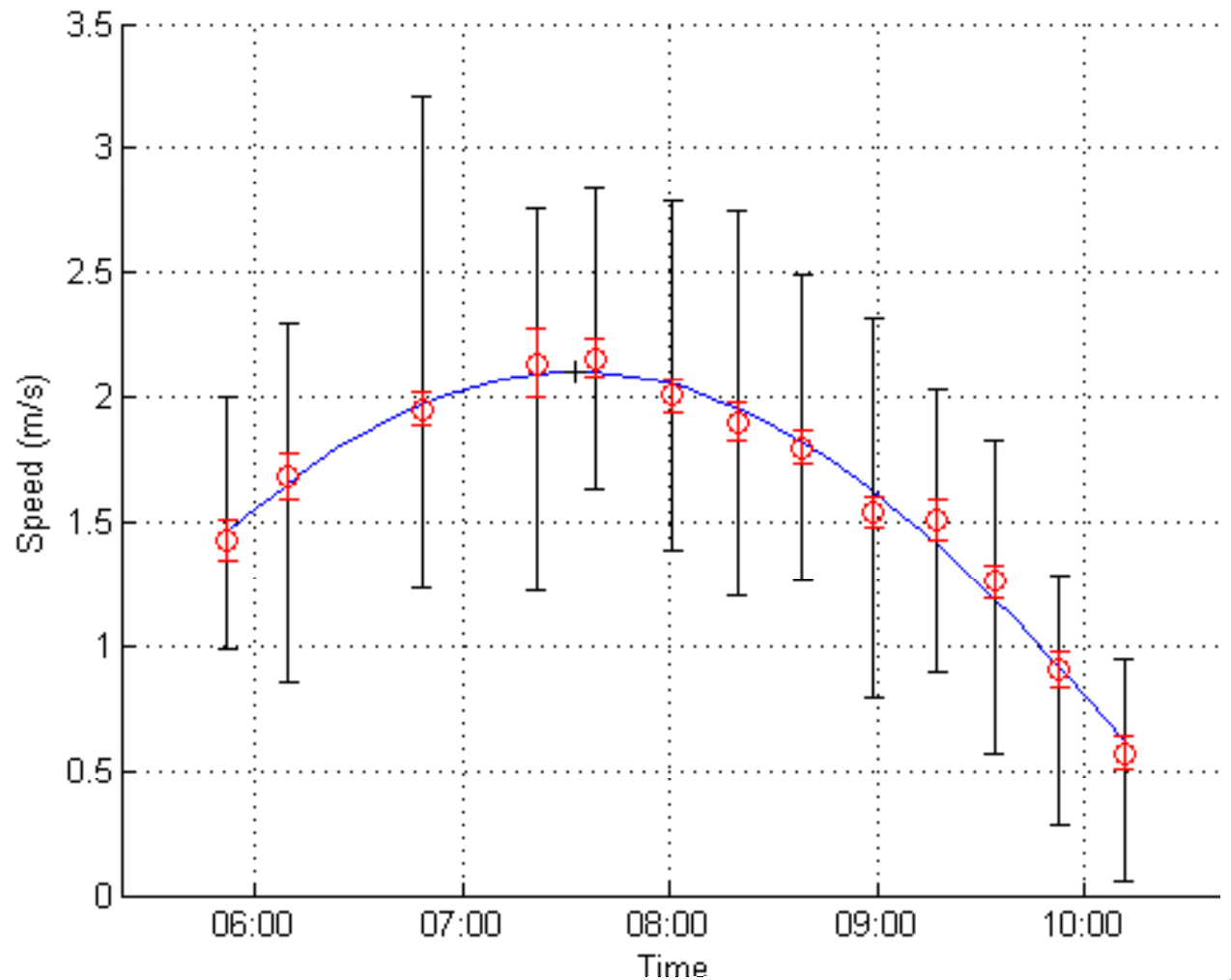
Sinusoidal Fit to Averaged Data

$$u(t) = A \sin\left(\frac{2\pi t}{T} + \phi\right)$$

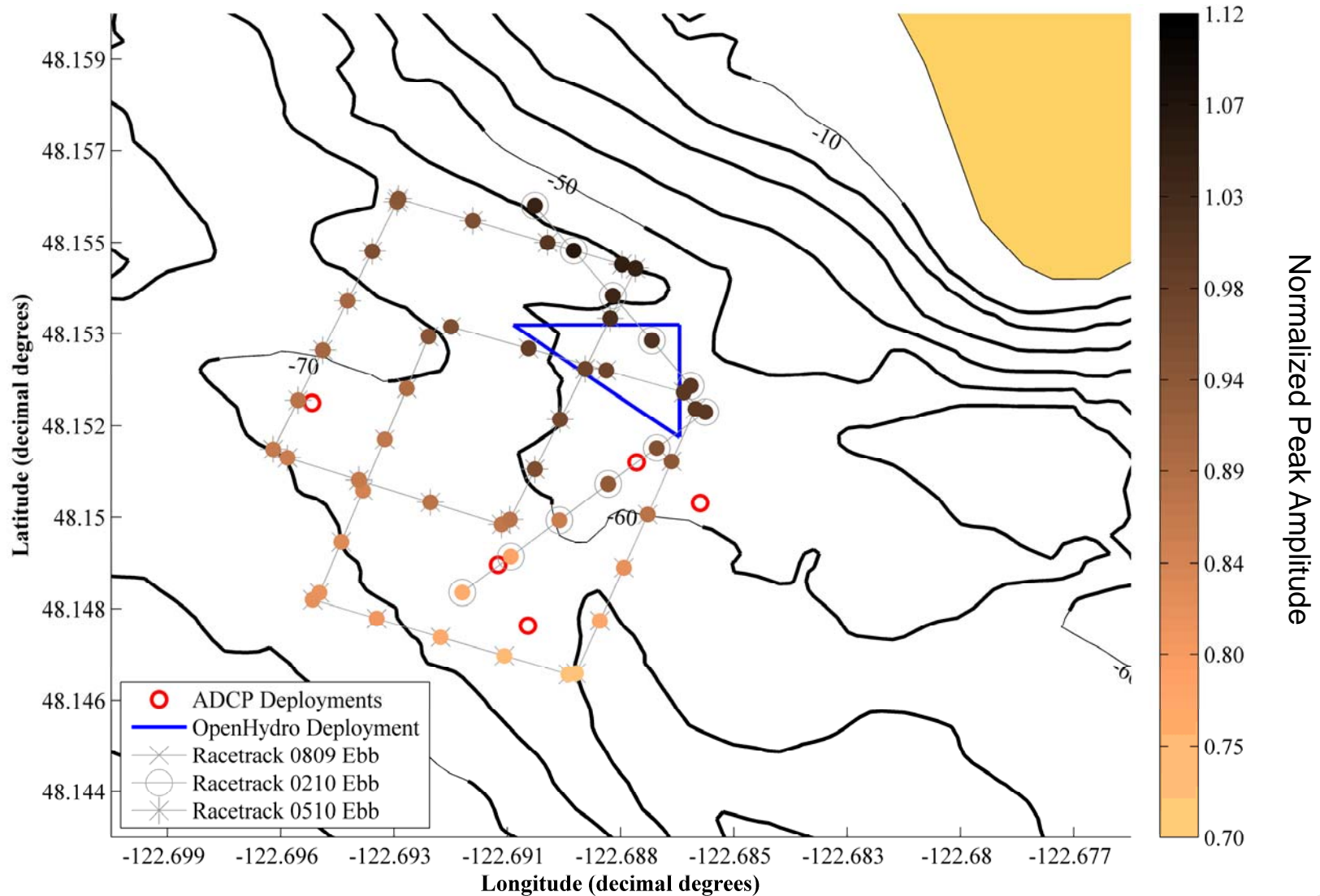
Amplitude = 2.10 m / s

Period / 2 = 6.54 hours

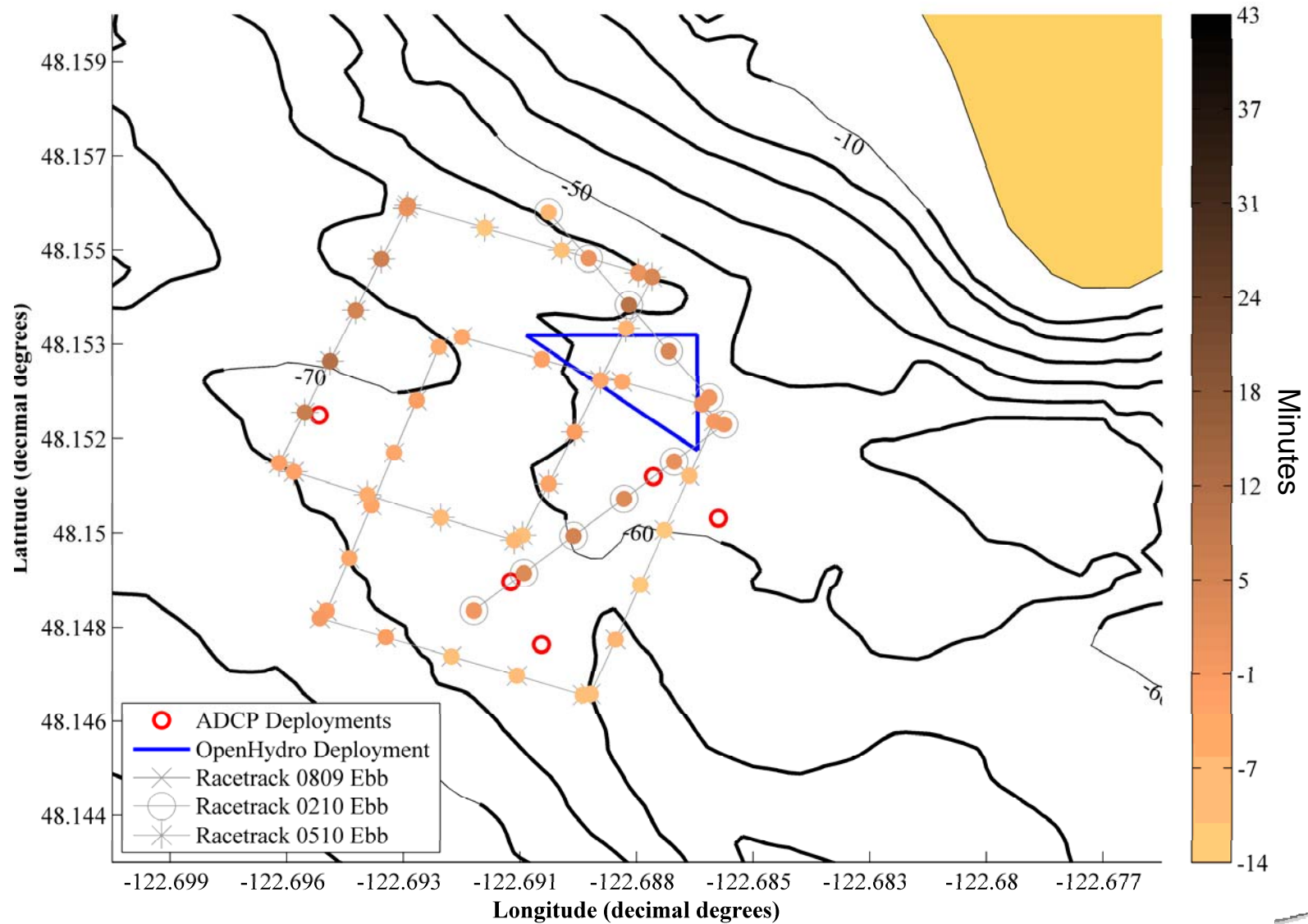
$R^2 = 0.99$



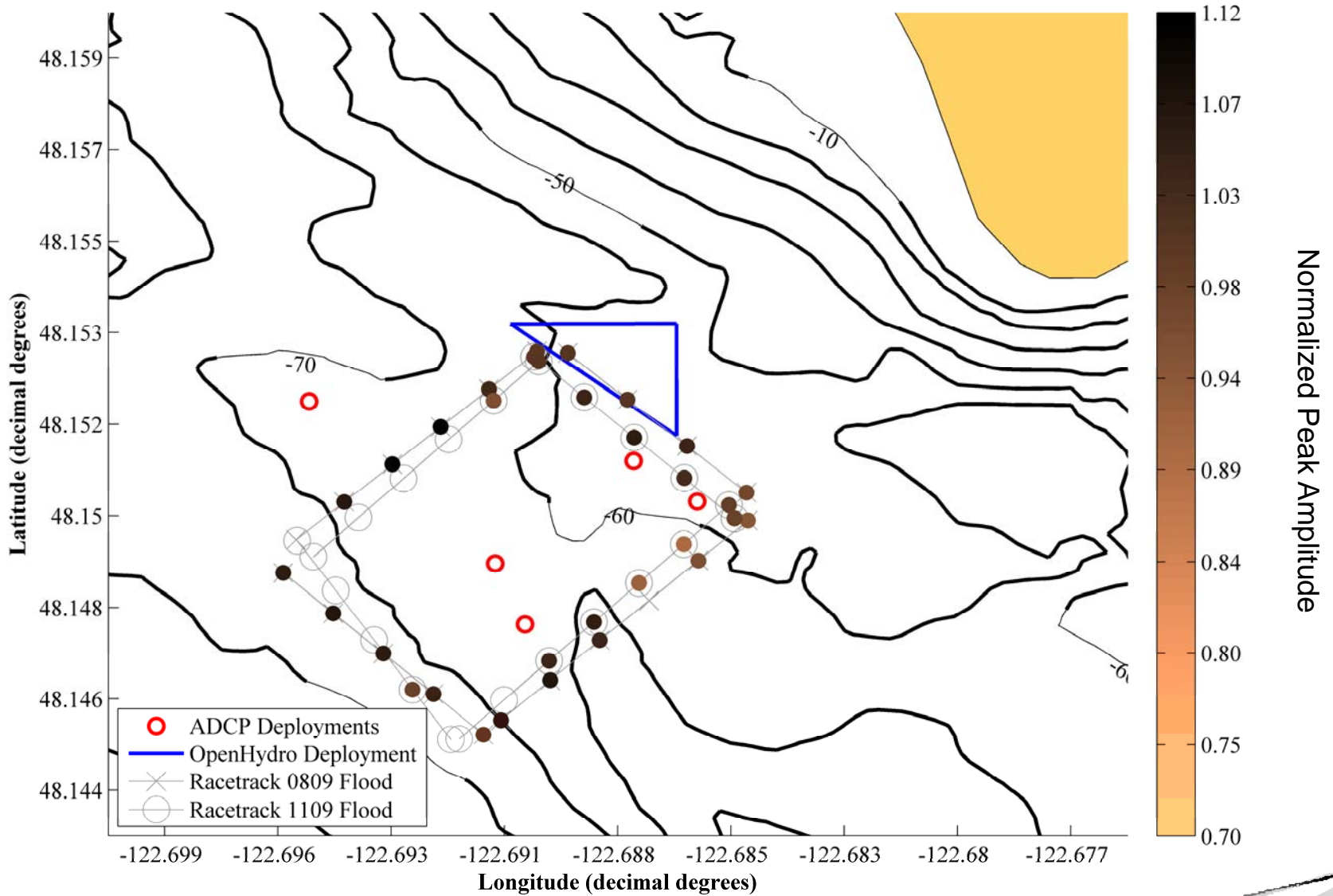
Ebb Survey Amplitude Variation



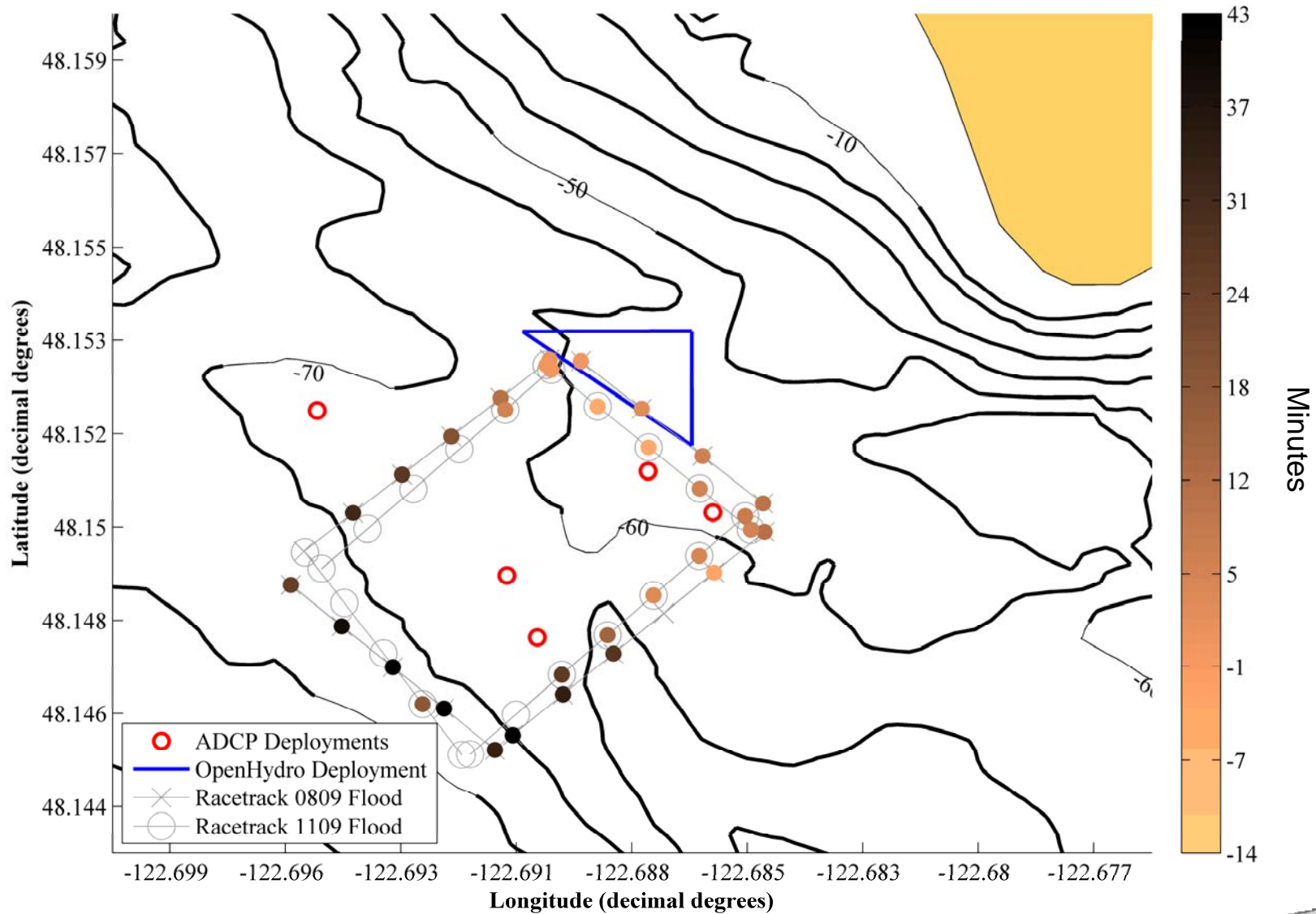
Ebb Survey Phase Variation



Flood Survey Amplitude Variation



Flood Survey Phase Variation



Conclusion

- Shipboard ADCP analysis
 - Efficient spatial characterization
 - Quantitative use of shipboard ADCP surveys
 - Integration of stationary analysis with shipboard surveys
- Future Work
 - $\frac{1}{4}$ Sine Wave Fits for Shipboard Analysis
 - Survey Ebb \rightarrow Flood Transition (Slack Water)

Acknowledgements

- Dr. Brian Polagye
- Dr. Jim Thomson
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- Dr. Roy Martin
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Questions?