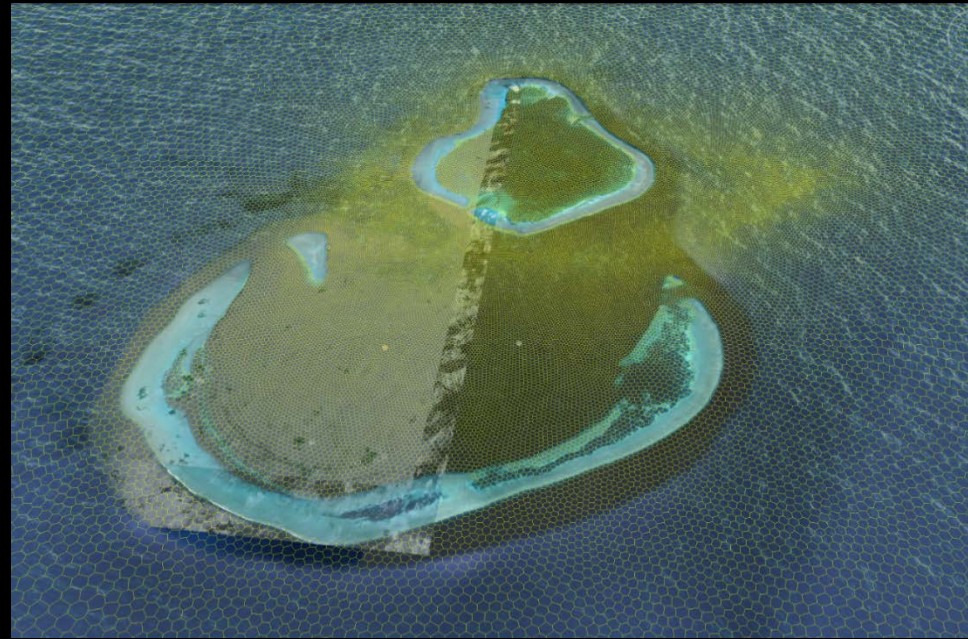


*Observations of high-frequency
internal waves and strong turbulent mixing
in a channel flow between two coral atolls*

VIIIth Int. Symposium on Stratified Flows, San Diego

31st August 2016



Matt Rayson, Cynthia Bluteau, Greg Ivey, Nicole Jones

School of Civil, Environmental and Mining Engineering

Oceans Institute

University of Western Australia

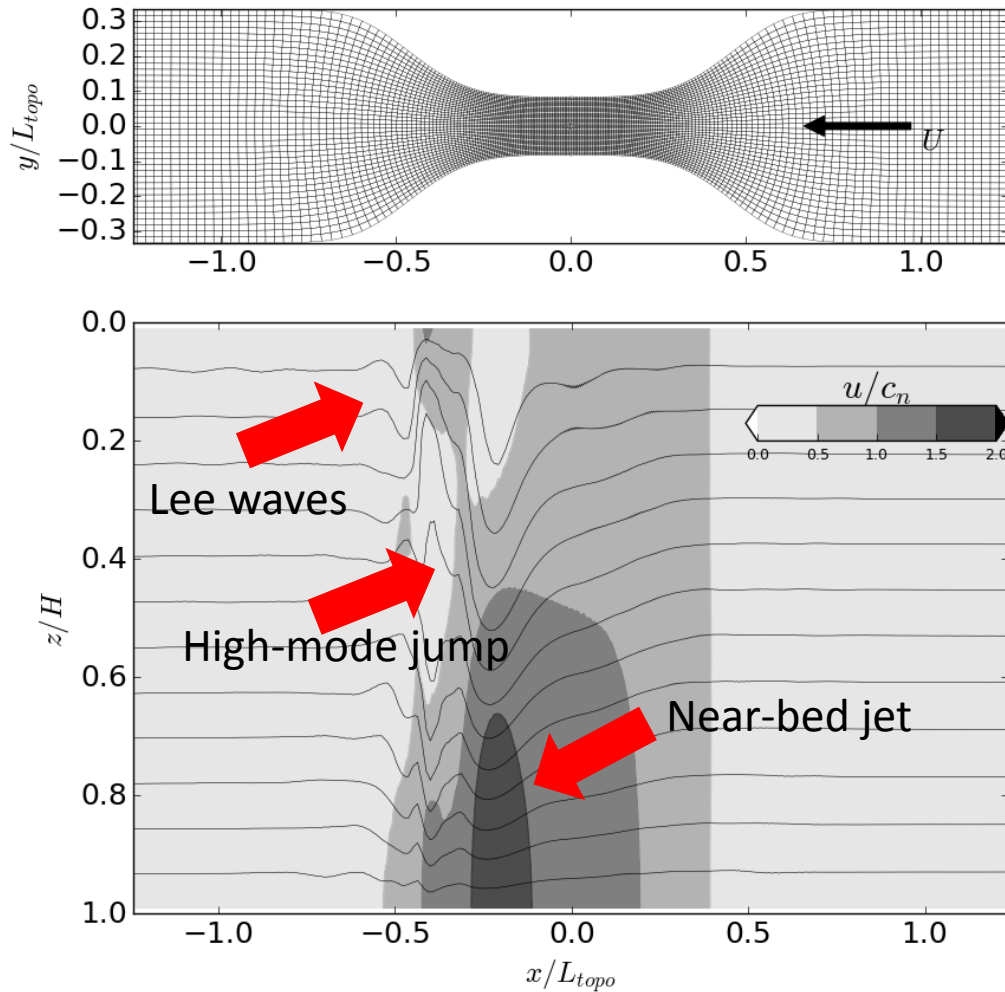


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Acknowledgements

- Schmidt Ocean Institute (SOI)
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- Australian Institute of Marine Science
- Griffith University
- Stanford University

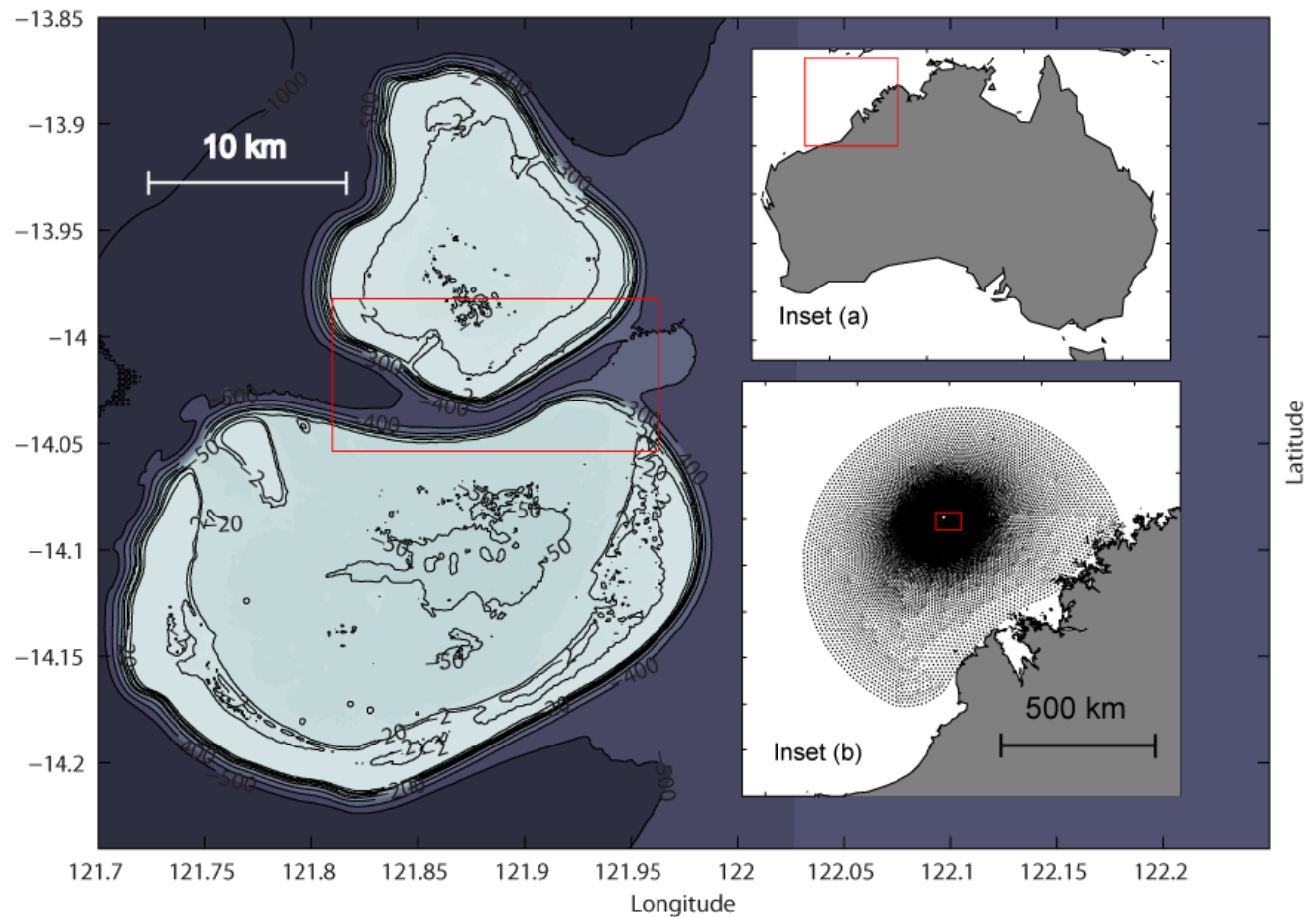
Flow through a contraction



3D nonhydrostatic RANS (SUNTANS) solution w/ $dx = 50$ m & $dz = 10$ m

Scott Reef Overview

- Flow parameters: $\frac{U_0}{\omega L} \sim 1$; $Fr = \frac{U}{c_n} \sim 1$



Aims / Motivation

- Quantify turbulent fluxes of heat, nutrients, etc around coral ecosystems

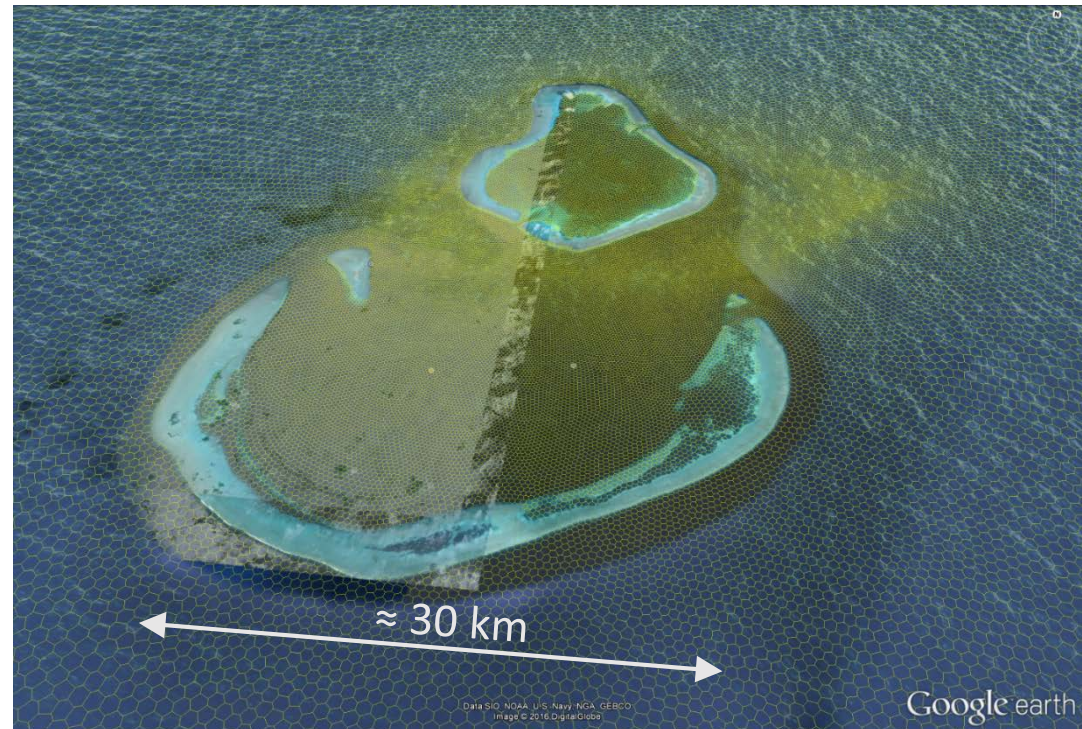
In this talk, I will:

- Show that a jump-like mechanism occurs using modelling and observations
- Quantify associated dissipation rates from microstructure measurements

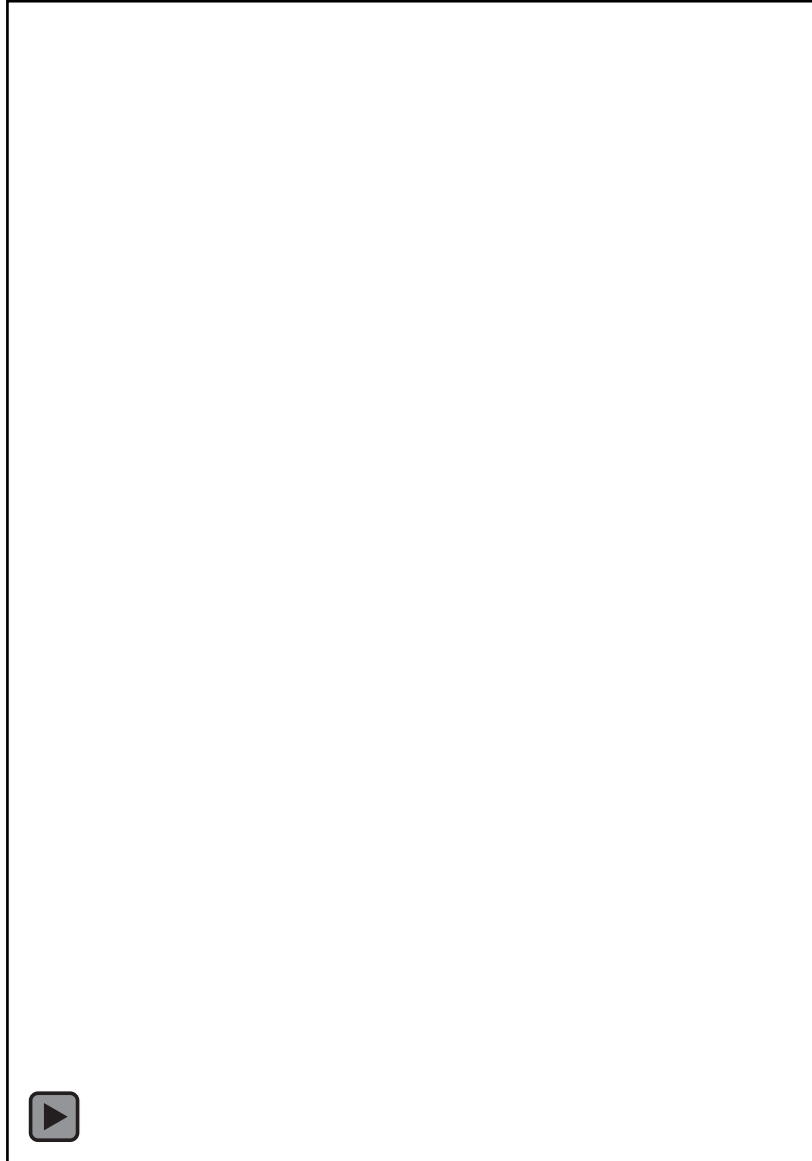
Numerical Model Overview

SUNTANS:

- Unstructured RANS
- Nonhydrostatic
- $dx \sim 100$ m
- $dz \sim 10$ m
- Realistic ICs and BCs



Model flow through the channel



Depth-averaged current speed

Eastward velocity w/
0.5 °C isotherms

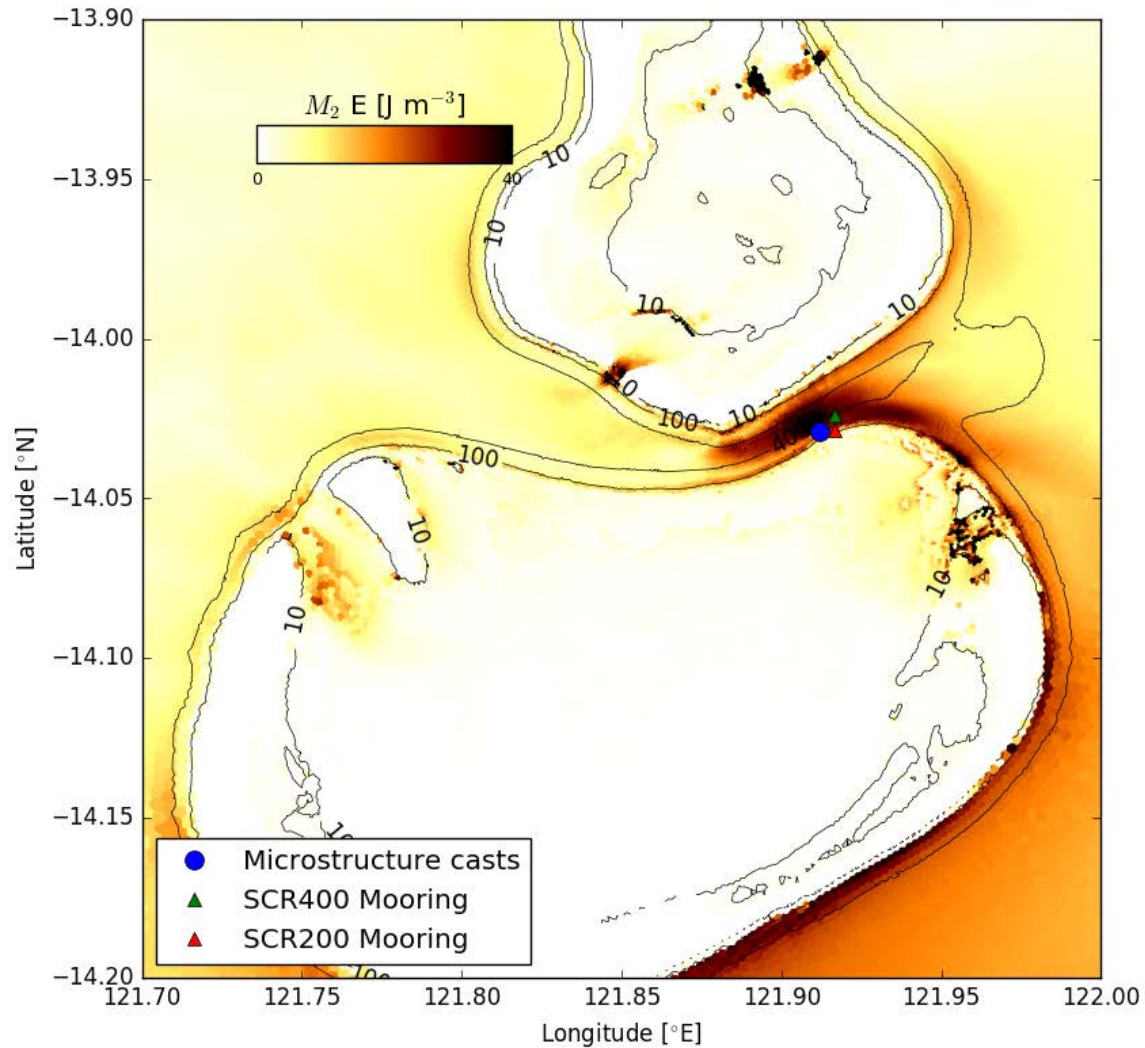
SOI Timor Sea Reef Connections

- 10th April – 4th May 2015
- 2 vertical moorings (400 m and 200 m)
 - Velocity ($dz = 10$ m)
 - Temperature ($dz = 20$ m)
 - Pressure ($dz = 50$ m)
 - 15 days
- 25 hr microstructure station
 - Upper 150 – 200 m
 - Spring tides

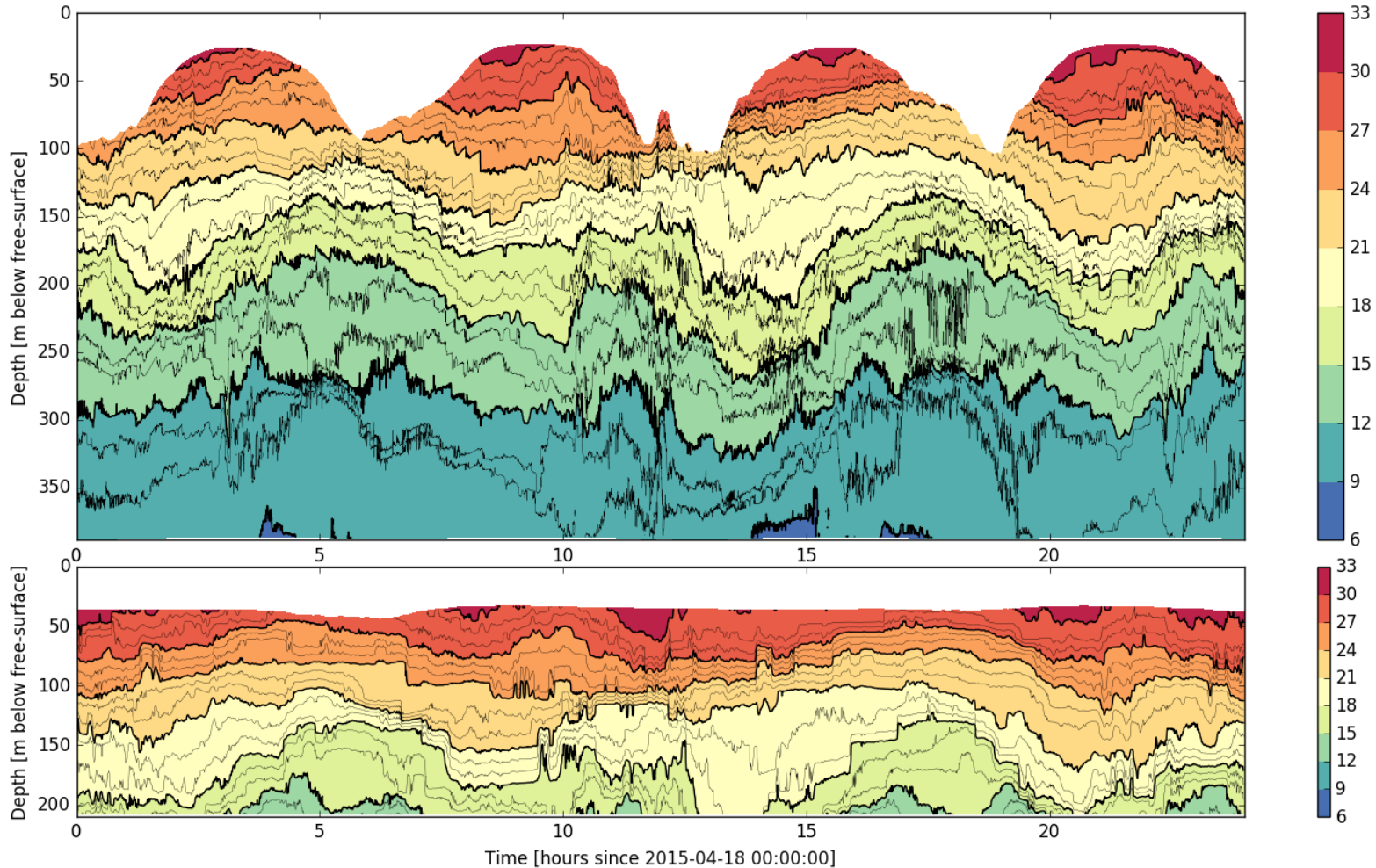


Field Site Selection

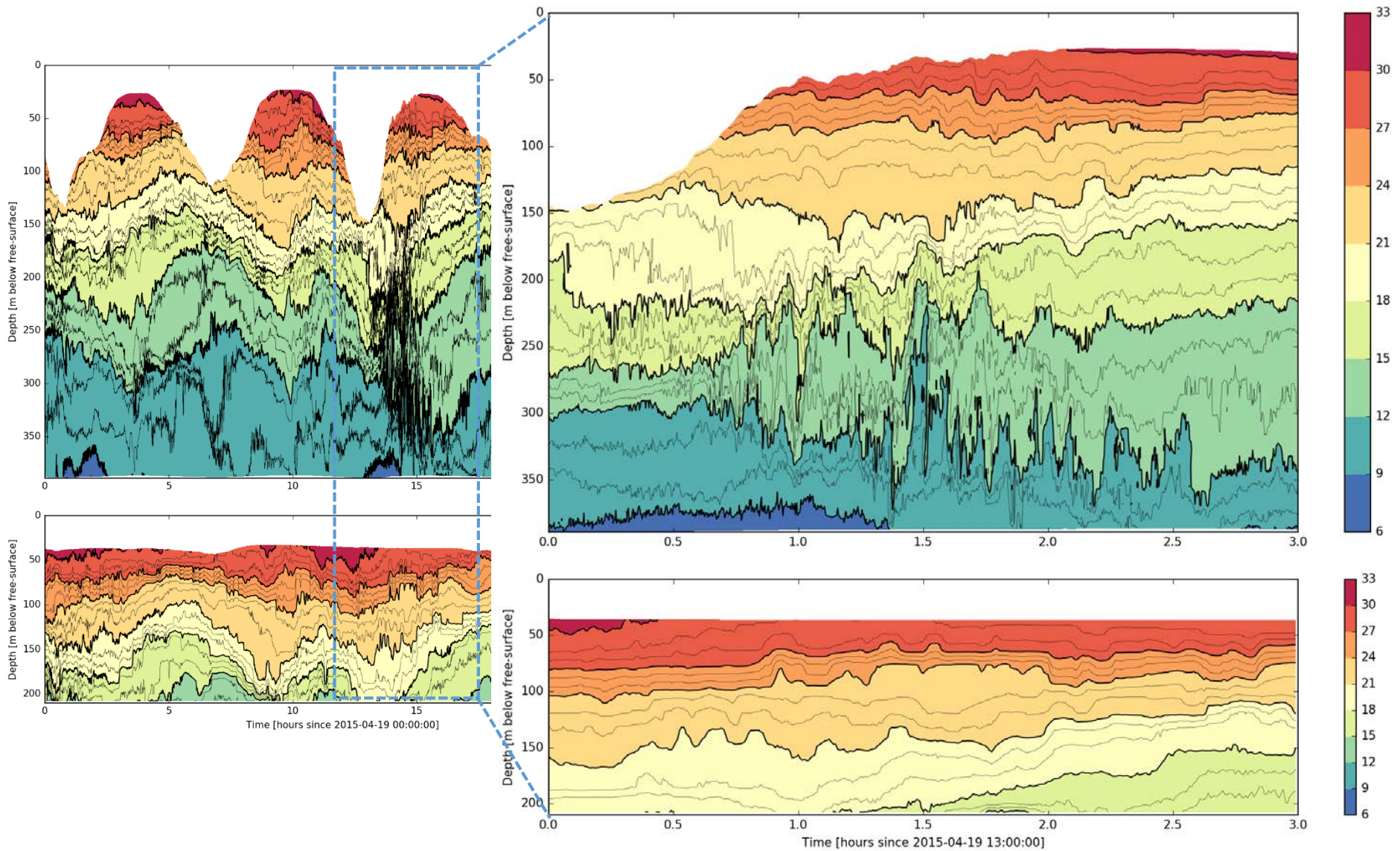
Semidiurnal baroclinic energy density



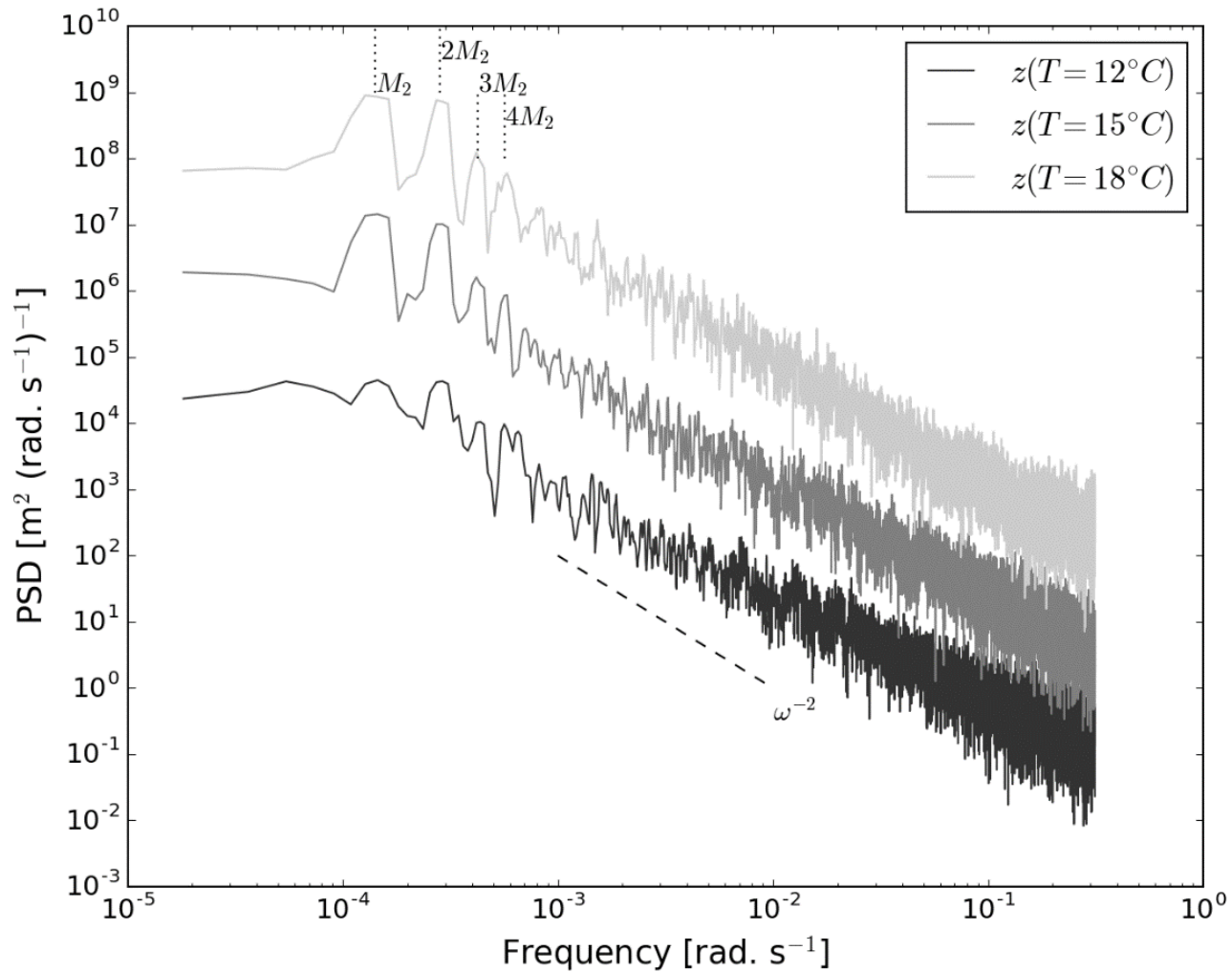
Temperature Observations



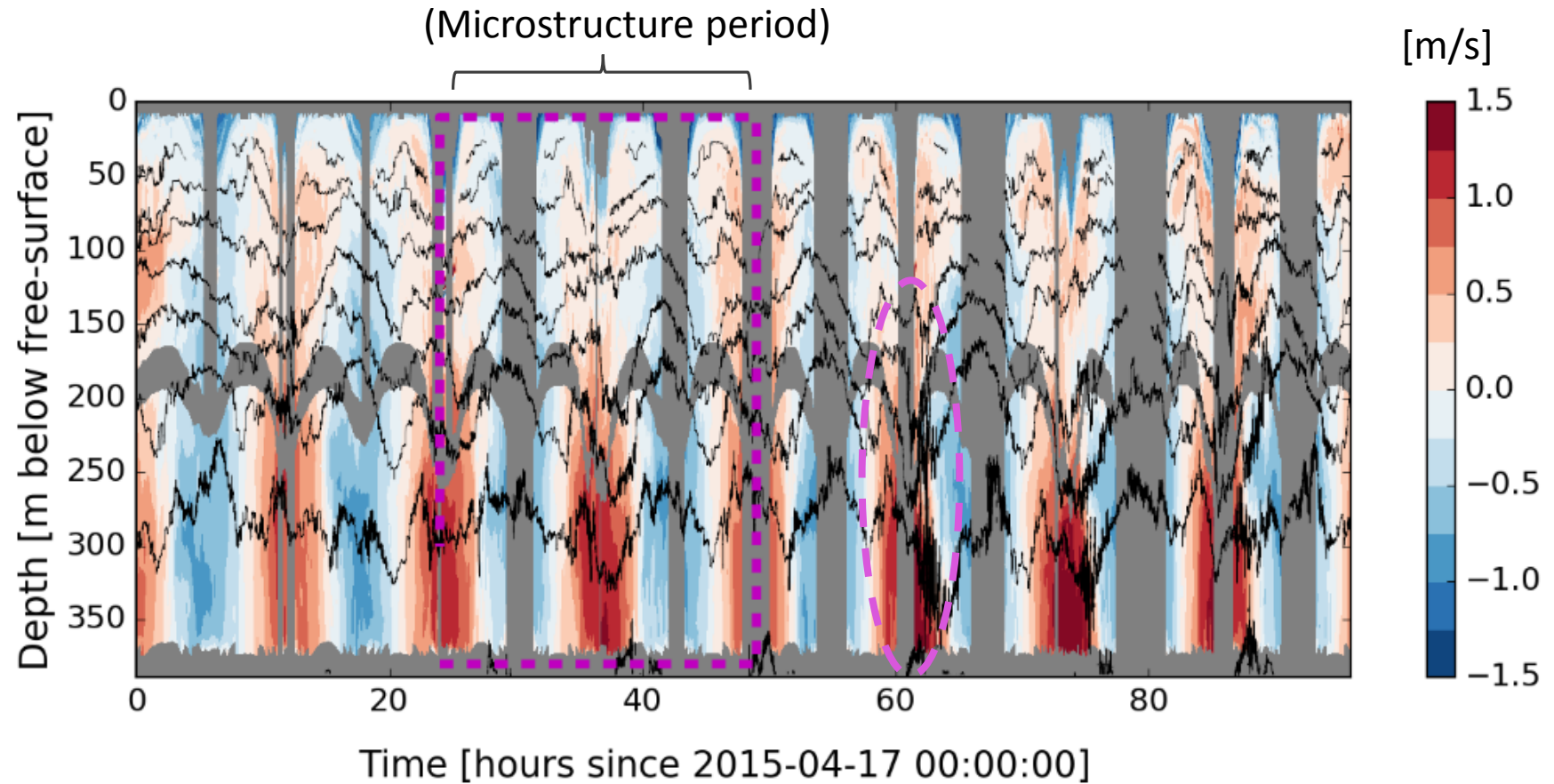
Turbulent Bore Example



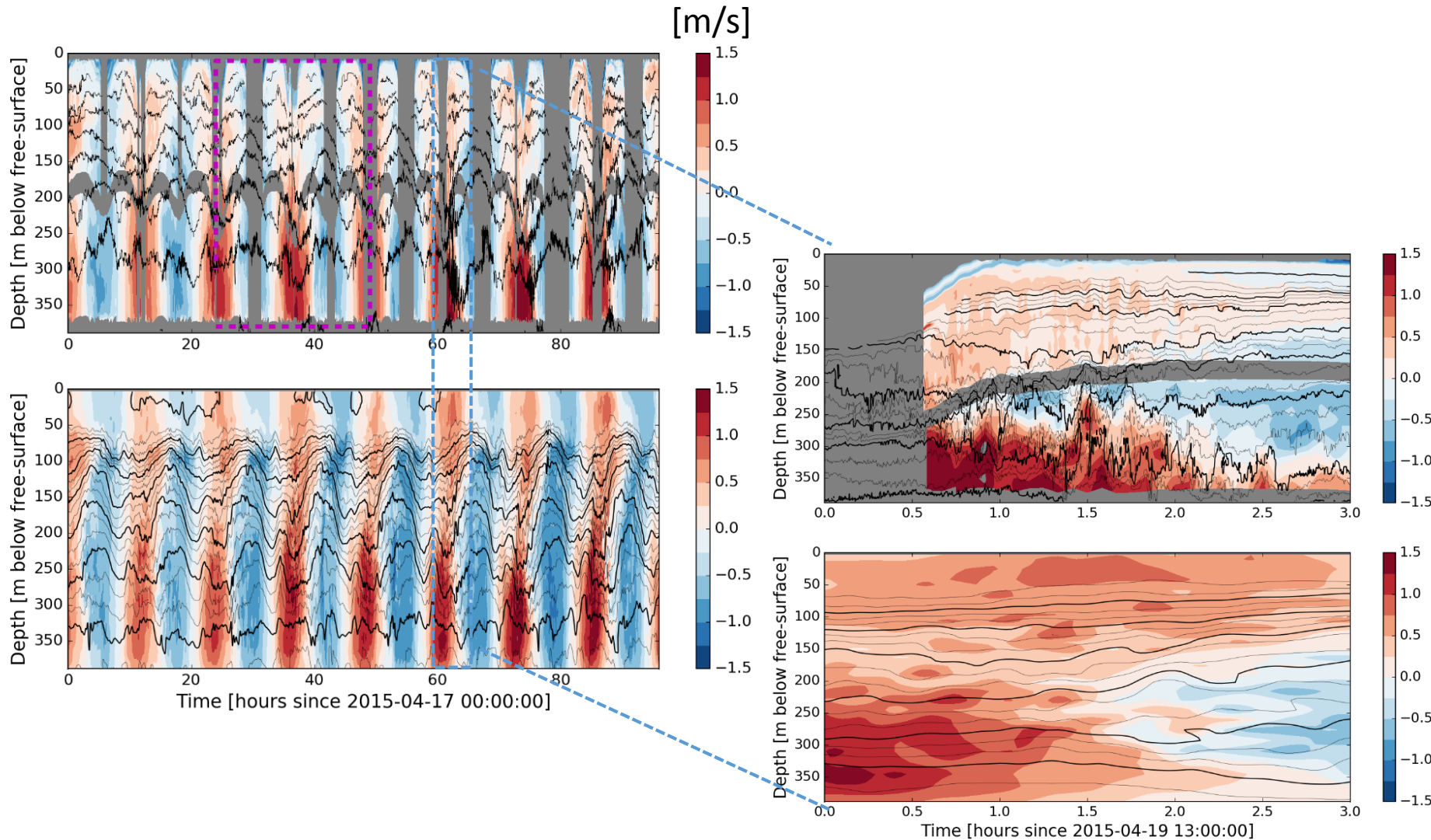
Displacement Spectra



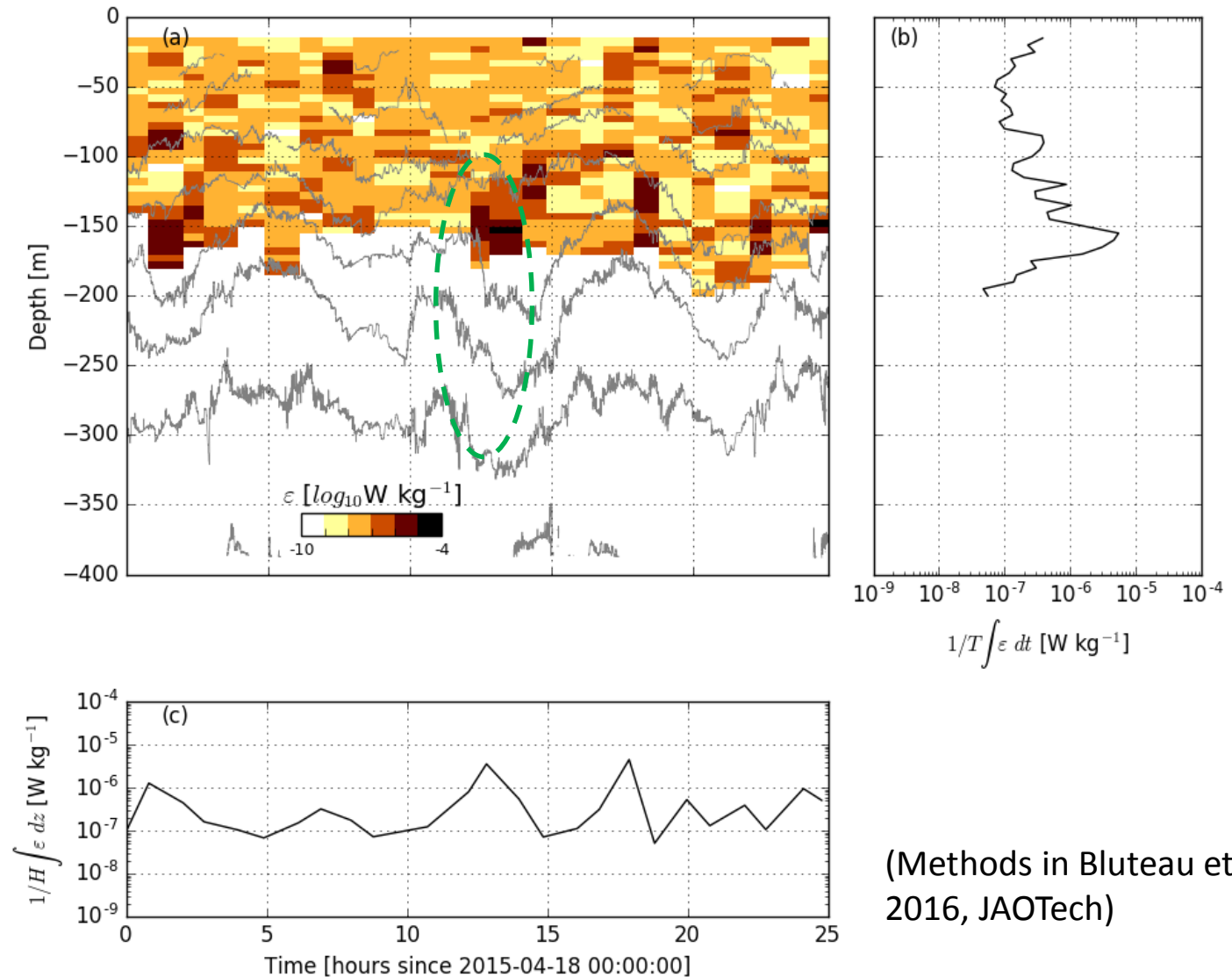
Velocity Observations



Model Comparison



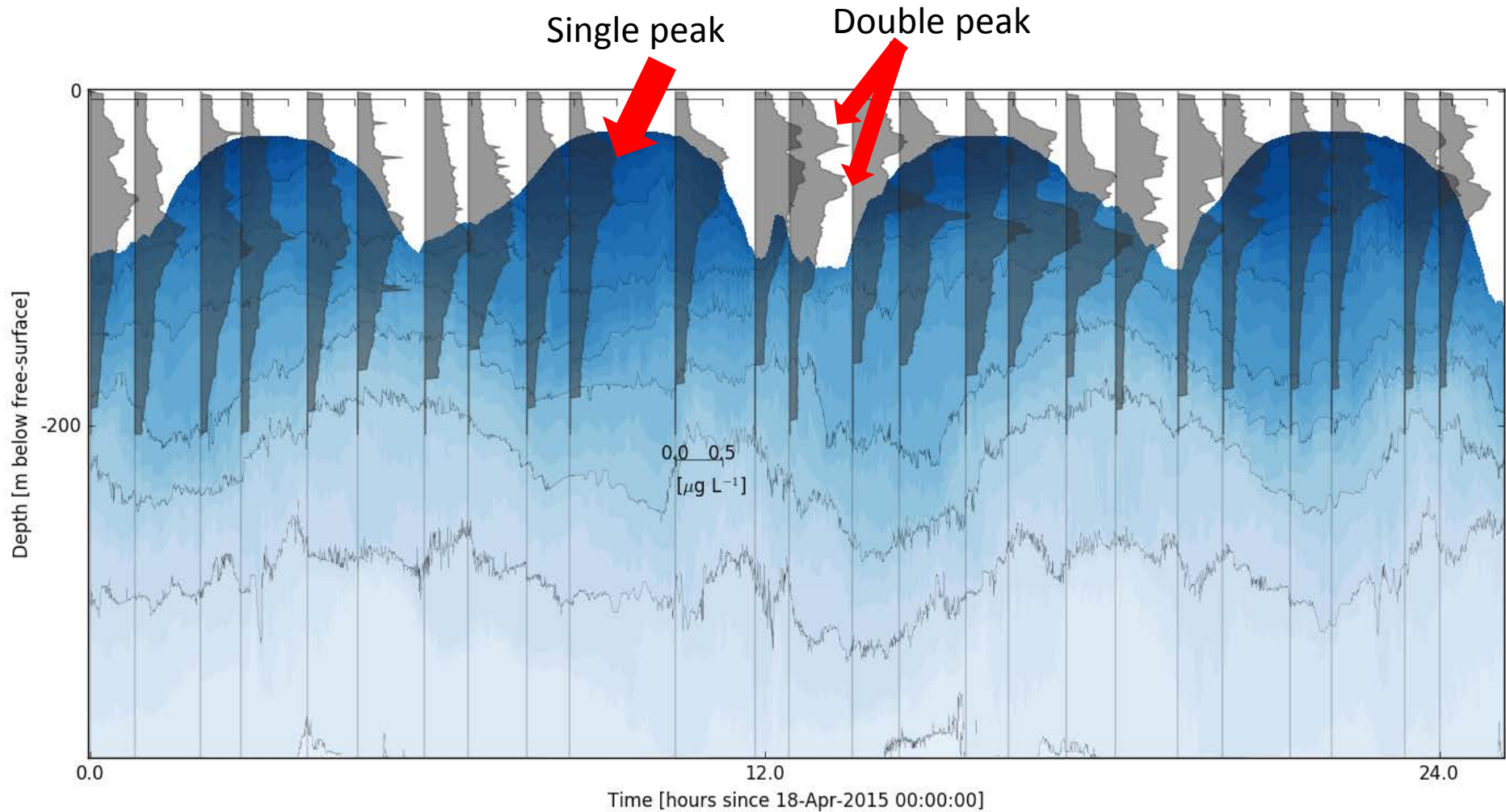
TKE Dissipation Rate - ϵ



(Methods in Bluteau et al.,
2016, JAOTech)

Biological Implications

Fluorescence from the microstructure profiler



Summary

Oscillatory channel flow

- $\frac{U_0}{\omega L} \sim 1$; $Fr = \frac{U}{c_n} \sim 1$

Observed

- Near-bed jet
- High-frequency lee waves
- High mode displacement
- $\varepsilon \sim O(10^{-5}) \text{ W kg}^{-1}$

