Validating drone-derived surface currents at ORE sites (V-SCORES)

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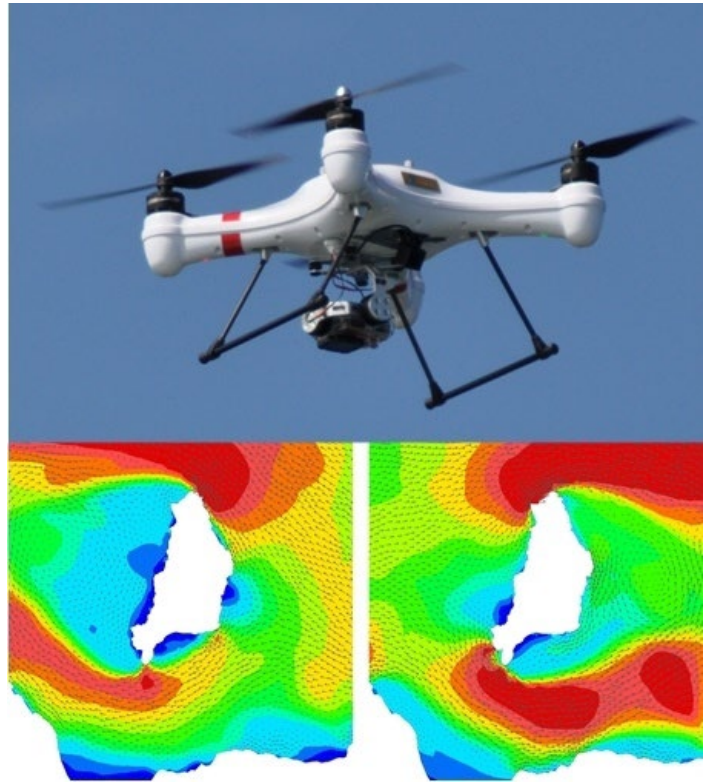
Current measurements important across ORE

Limitations of ADCPs

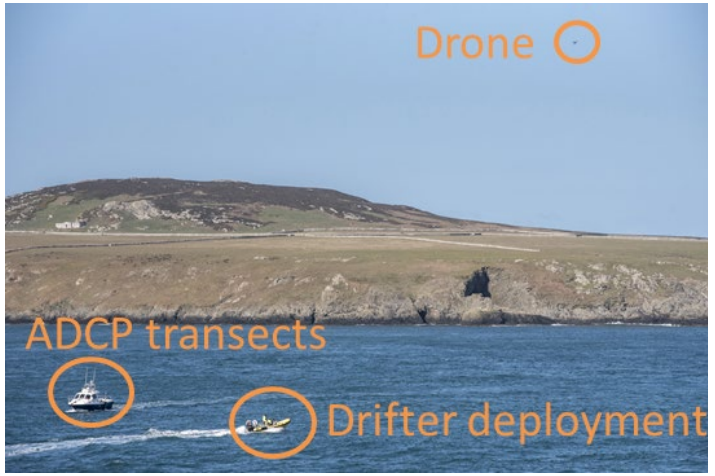
- Cost, risk, vessel / point measurements only…

Challenge: validate low-cost, low-risk drone current mapping



V-SCORES Methodology and Validation

- Drones collect downward-facing video
- Algorithms extract currents
  - Particle Image Velocimetry (PIV)
- GPS drifters and ADCPs for validation



Comparison against Drifters

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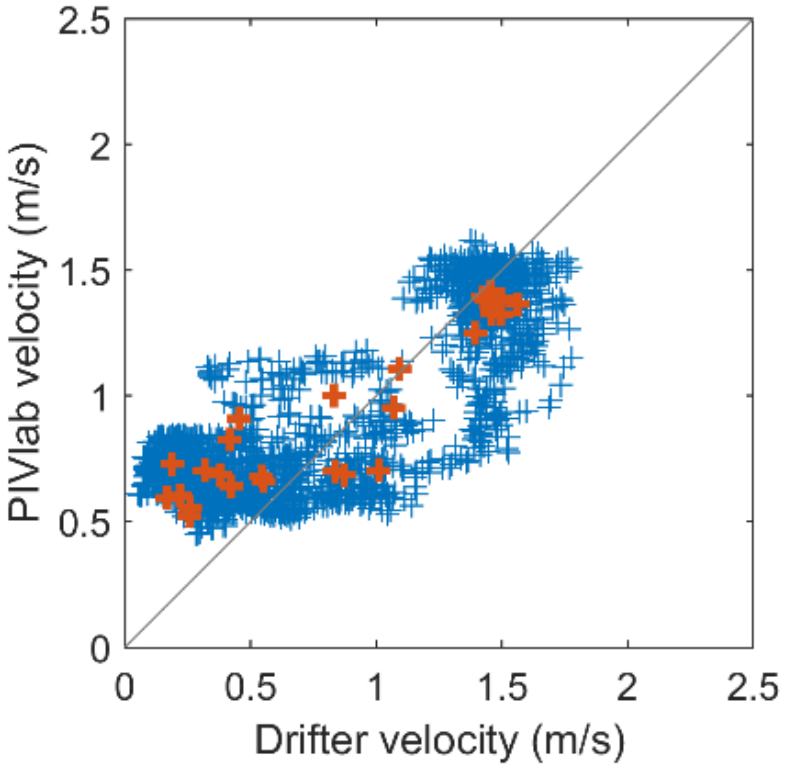
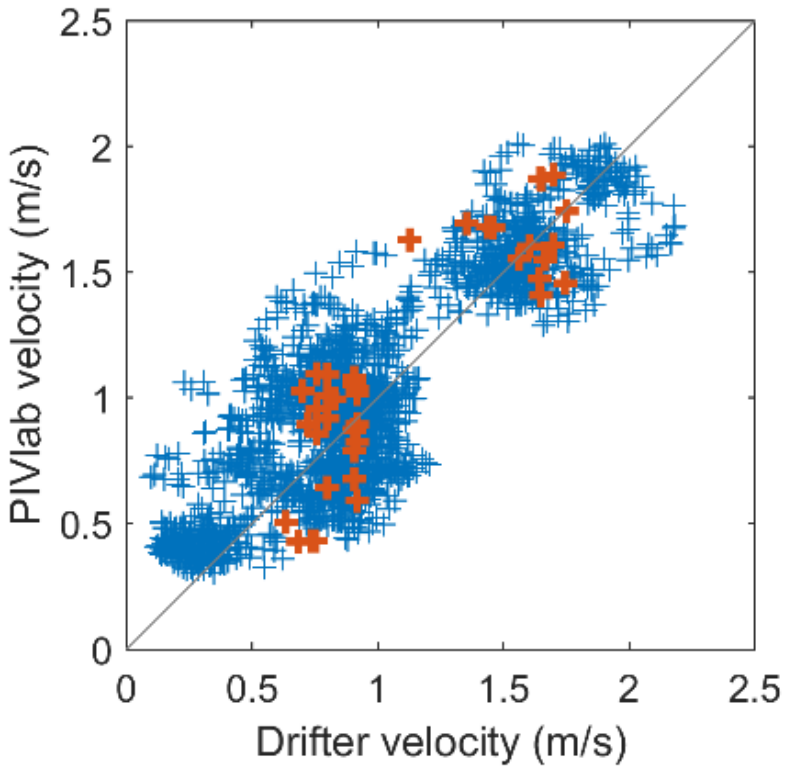
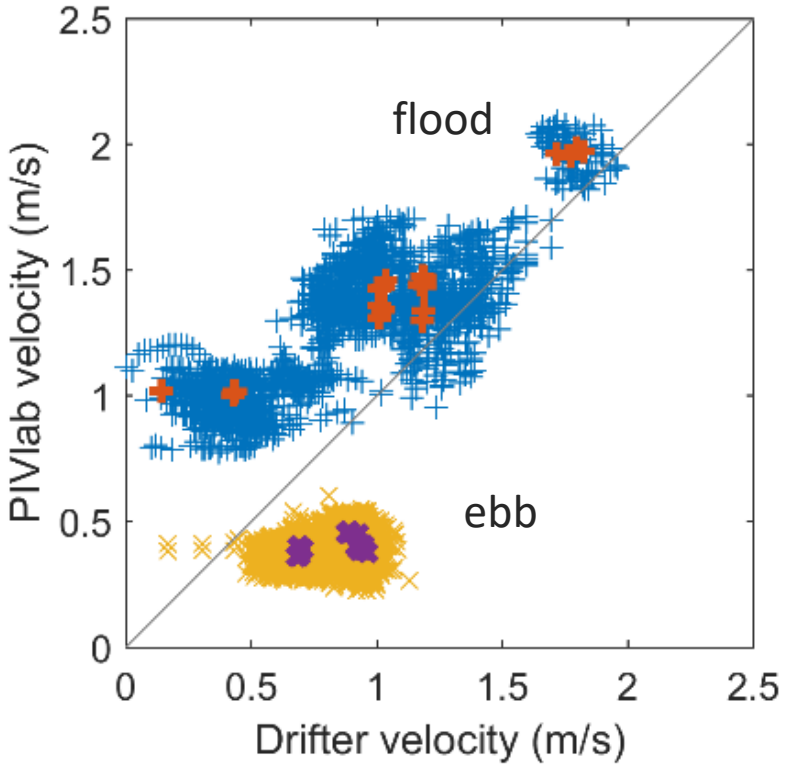
Mumbles Head (12 mph wind)



Ramsey (6.3 mph wind)



Ramsey (19.5 mph wind)



Comparison against ADCP

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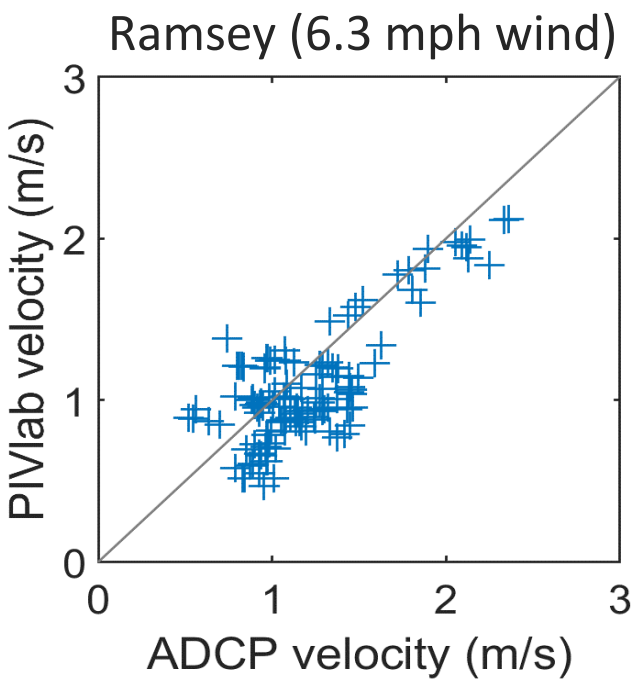
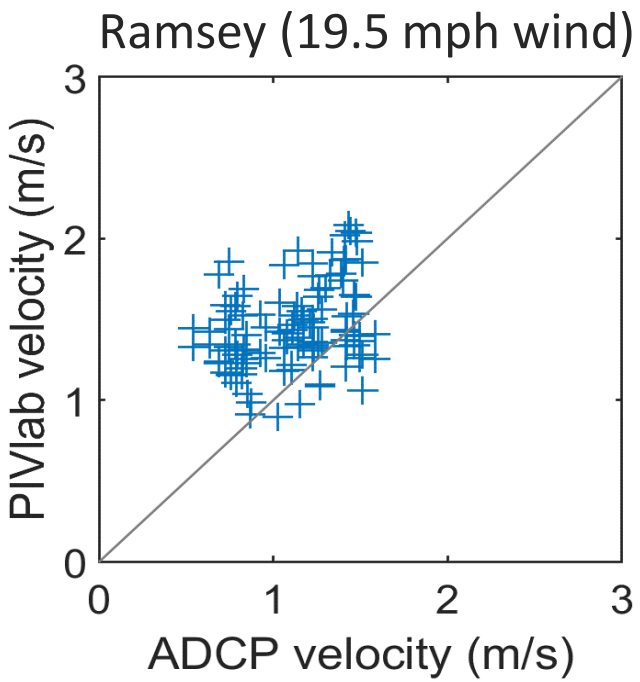
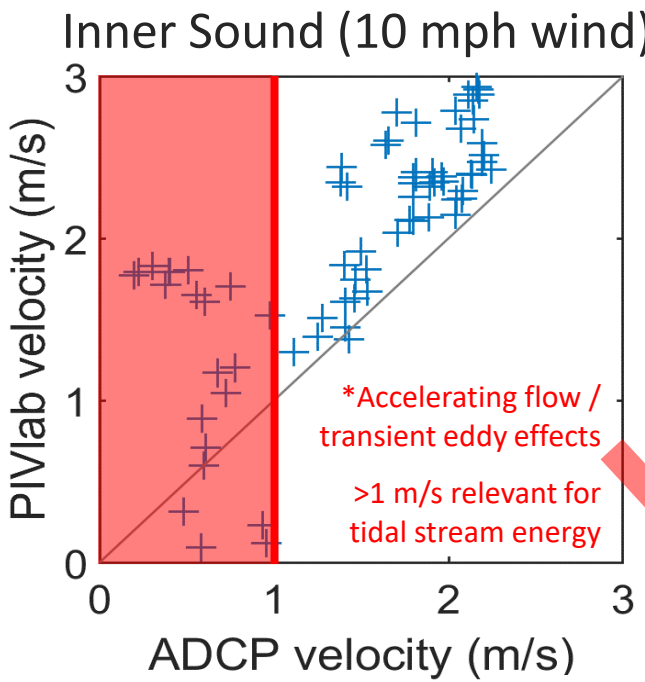
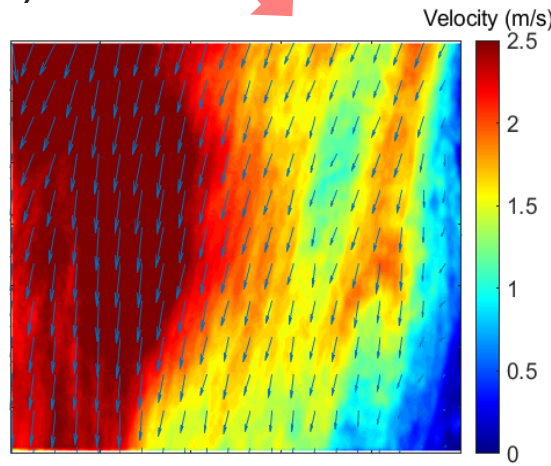








NB – ADCP not true surface velocity and not concurrent

Ongoing work relating surface to currents at depth

Recap and Applications

Map spatial heterogeneity

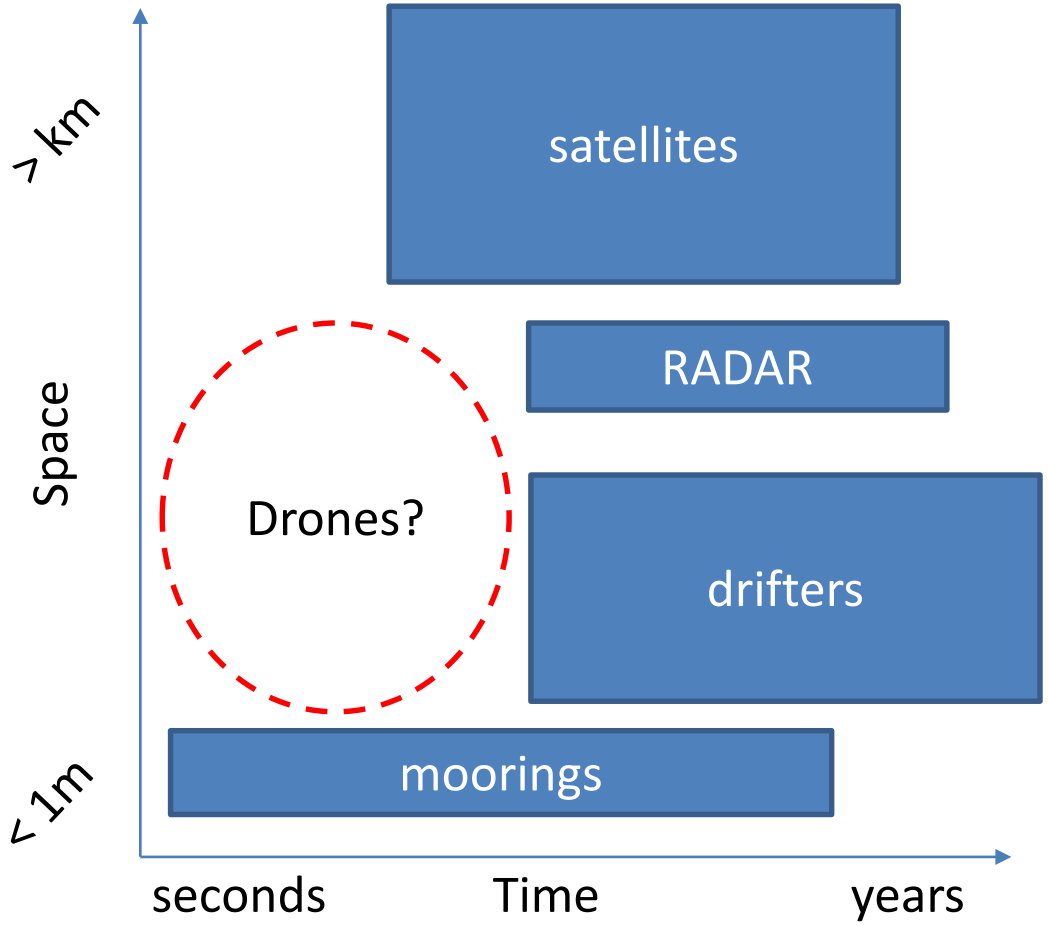
Empirical wake measurements

Model validation across scales

Rapid site selection / sift

Inform micro-siting, including of ADCPs

Quantify flow-animal interactions



Thank you

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Recap of capabilities:

- **Spatial coverage** typically 110 × 205 m in single video (*which can be moved, or multiple mosaiced together*)
- **Recording duration** typically 1-20 minutes
- **Temporal resolution** up to 30-60 Hz, with good results found at 15 Hz
- **Spatial resolution** 5.05 cm per pixel (*can improve with lower altitude, but less coverage*)

I. Fairley, B.J. Williamson, J. McIlvenny, N. King, I. Masters, M. Lewis, S. Neill, D. Glasby, D. Coles, B. Powell, K. Naylor, M. Robinson, D. Reeve (2022). ***Drone-based large-scale particle image velocimetry applied to tidal stream energy resource assessment.*** Renewable Energy. doi.org/10.1016/j.renene.2022.07.030

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