King Abdullah University of Science and Technology

كاوست KAUST

Establishing an Ocean Observing and Prediction Network for the Red Sea

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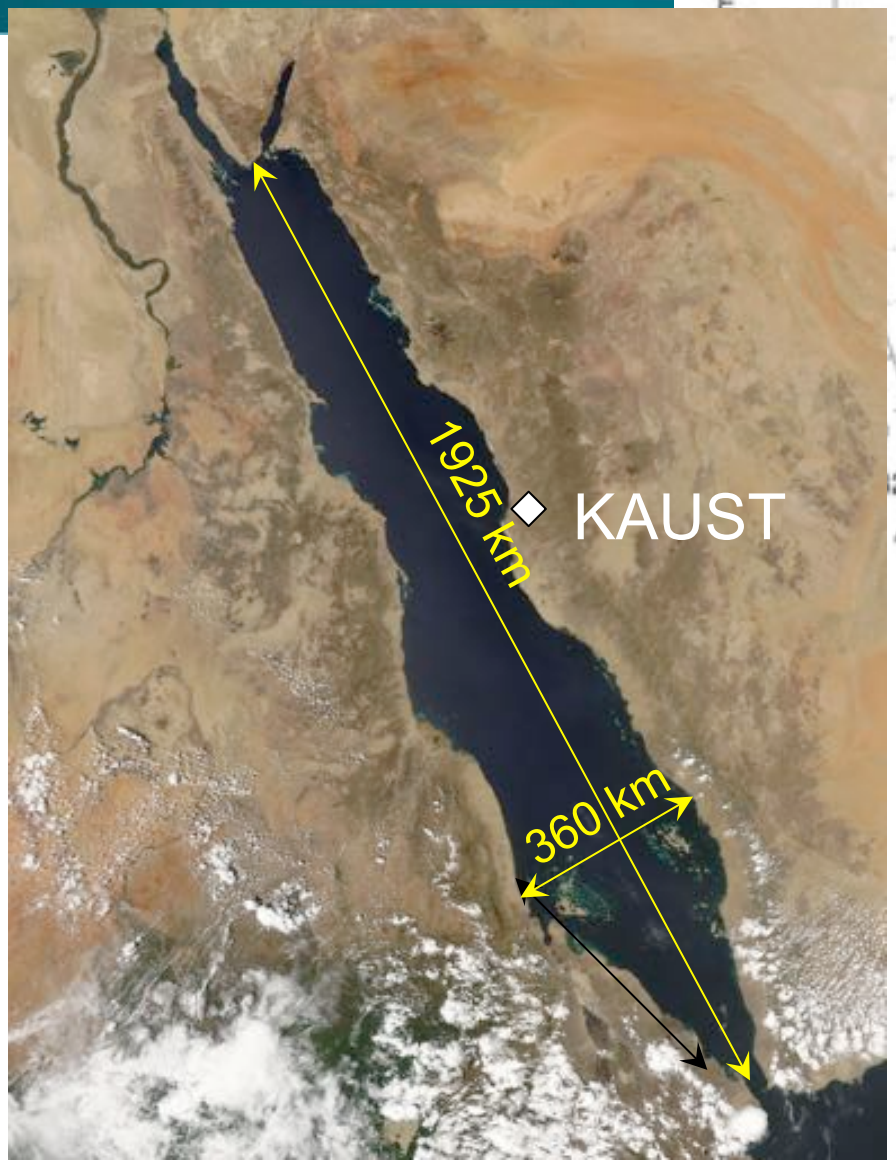
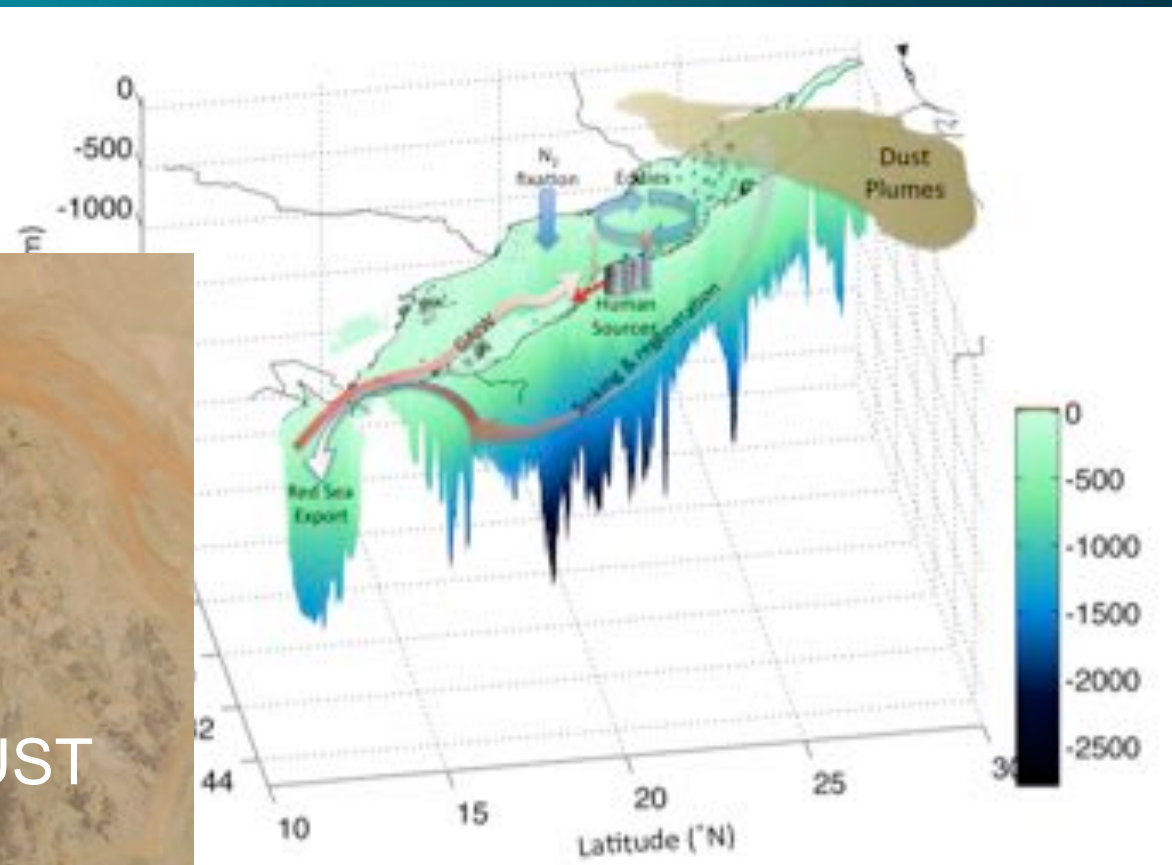
The Red Sea





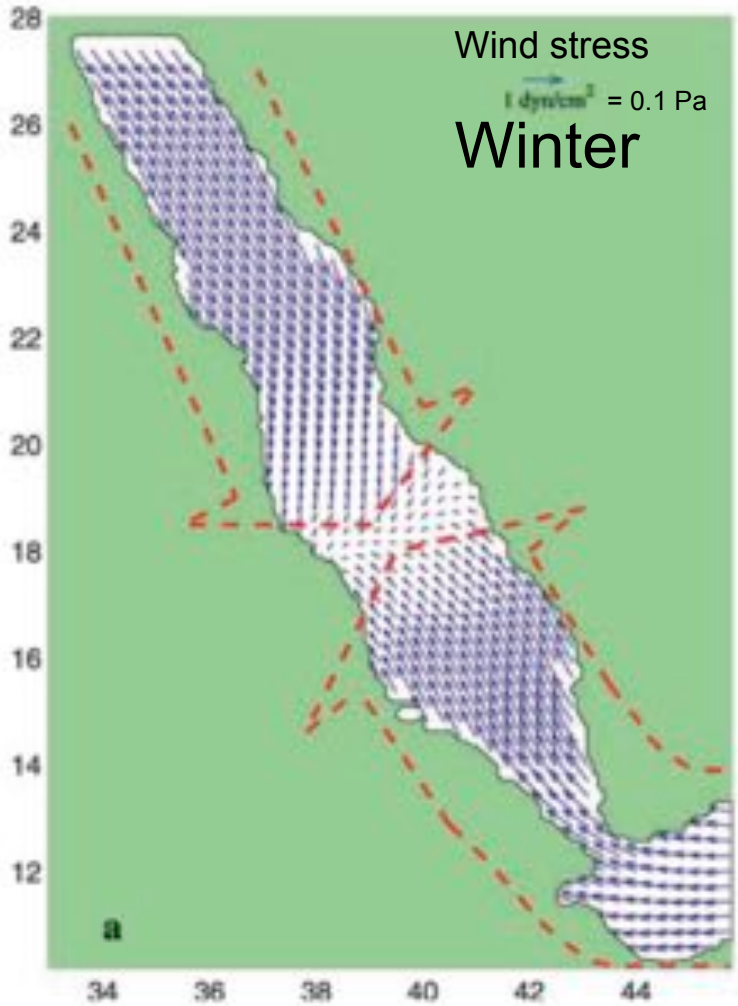
1925 x ~250 km
Max depth ~ 2800 m

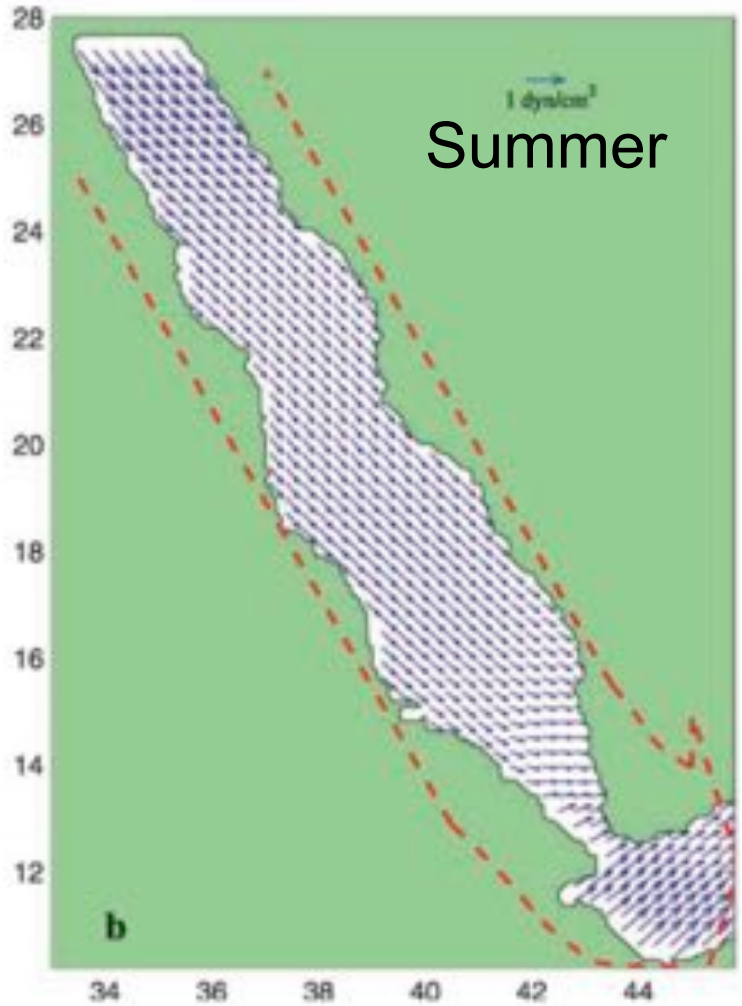
Tmin = 21.5
Smax = 40.6

IOP Research Investigations – Initial Issues & Questions

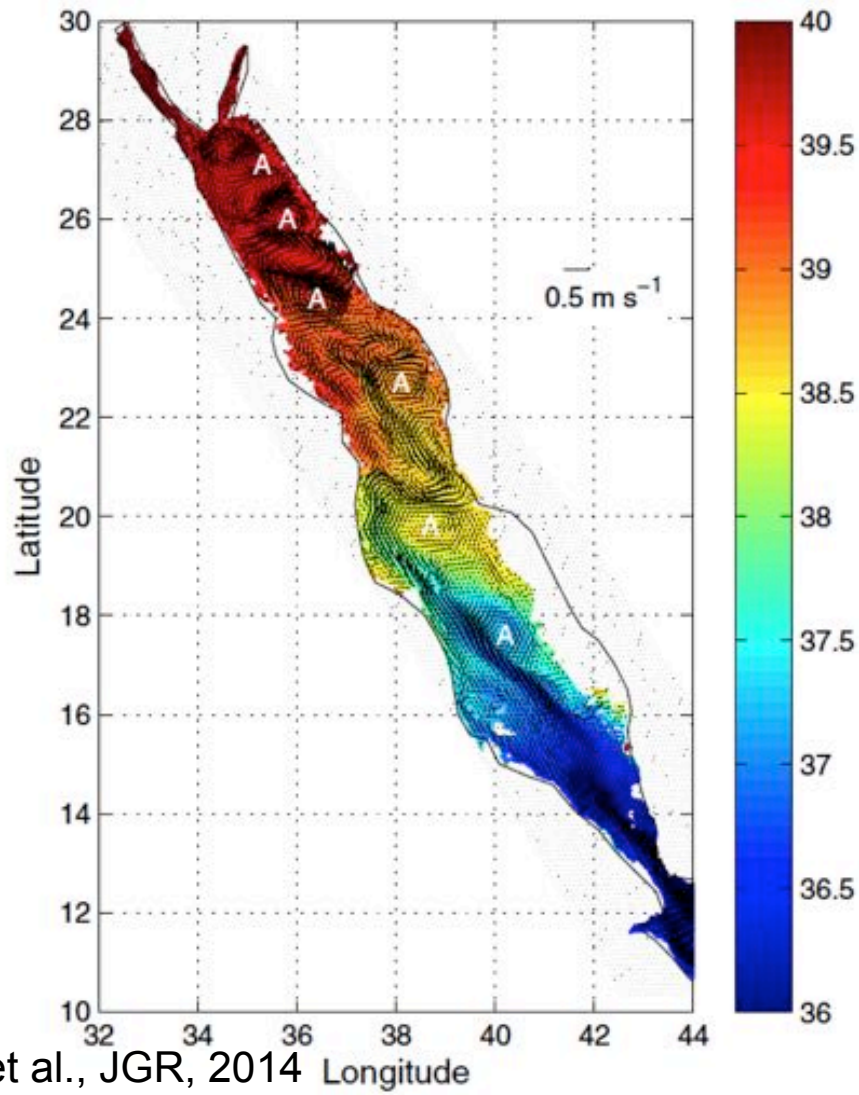
- Determine role of eddies in north-central Red Sea: variability and effects on pelagic biology & coral reef ecosystems;
- Quantify convection and vertical fluxes in the northern Red Sea between the surface and deep Red Sea;
- Resolve the annual cycle of the Red Sea from physical and biogeochemical perspectives;
- What nutrients limit and control productivity of the Red Sea? What processes affect nutrients cycling?
- Other issues: Do oceanographic conditions influence aggregation of whale sharks near Shib Habil off Al Lith?

Seasonal wind forcing – Monsoon Driven
(from Sofianos and Johns, JGR, 2003)





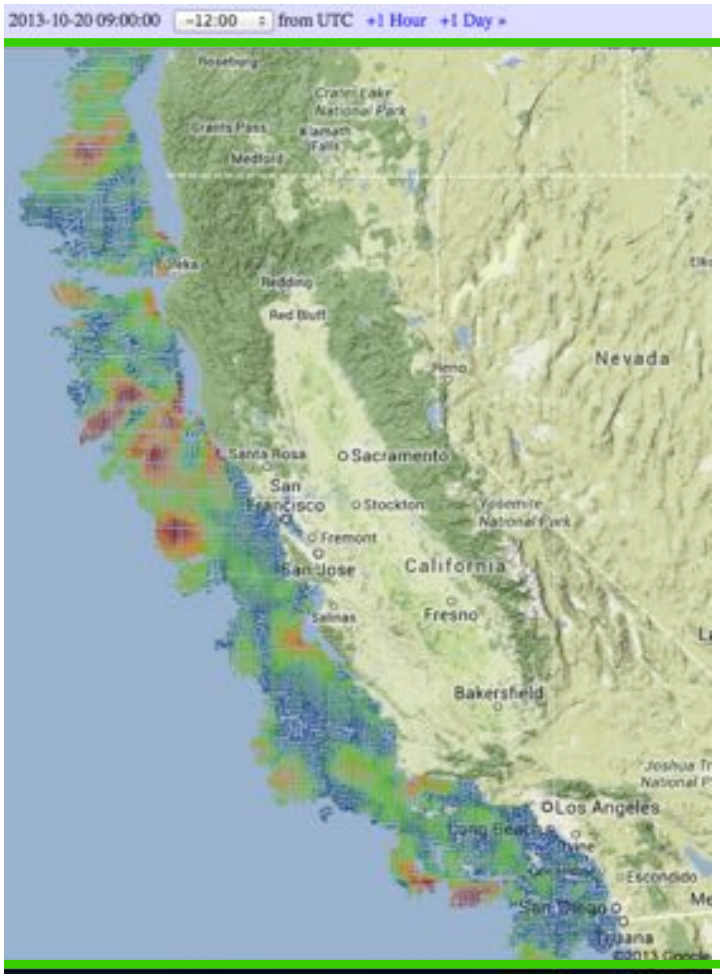
Characteristics of the Circulation



Yao et al., JGR, 2014

- Strong Thermohaline Circulation
- Significant role of eddies in the circulation

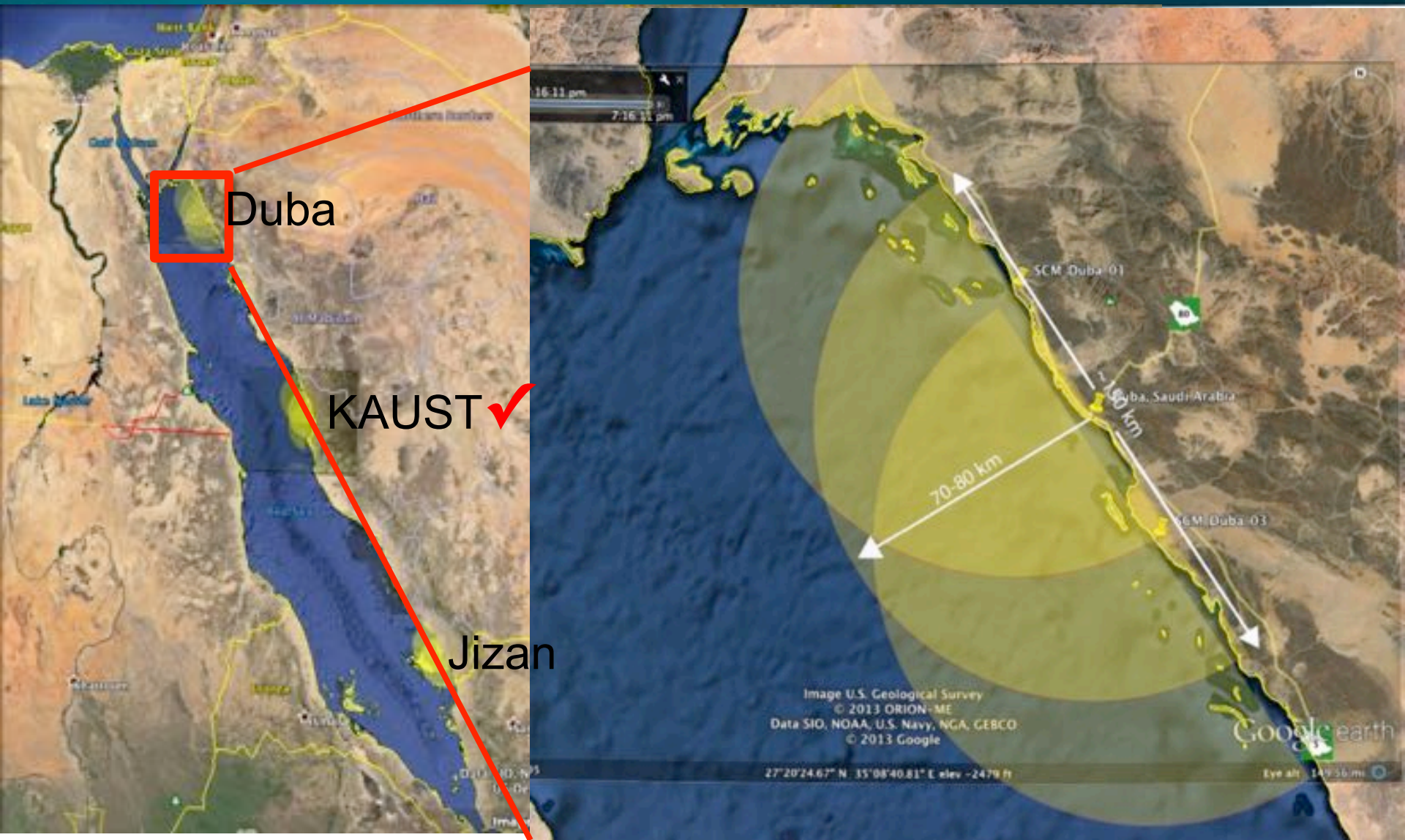
Surface Current Mapping
What is possible?



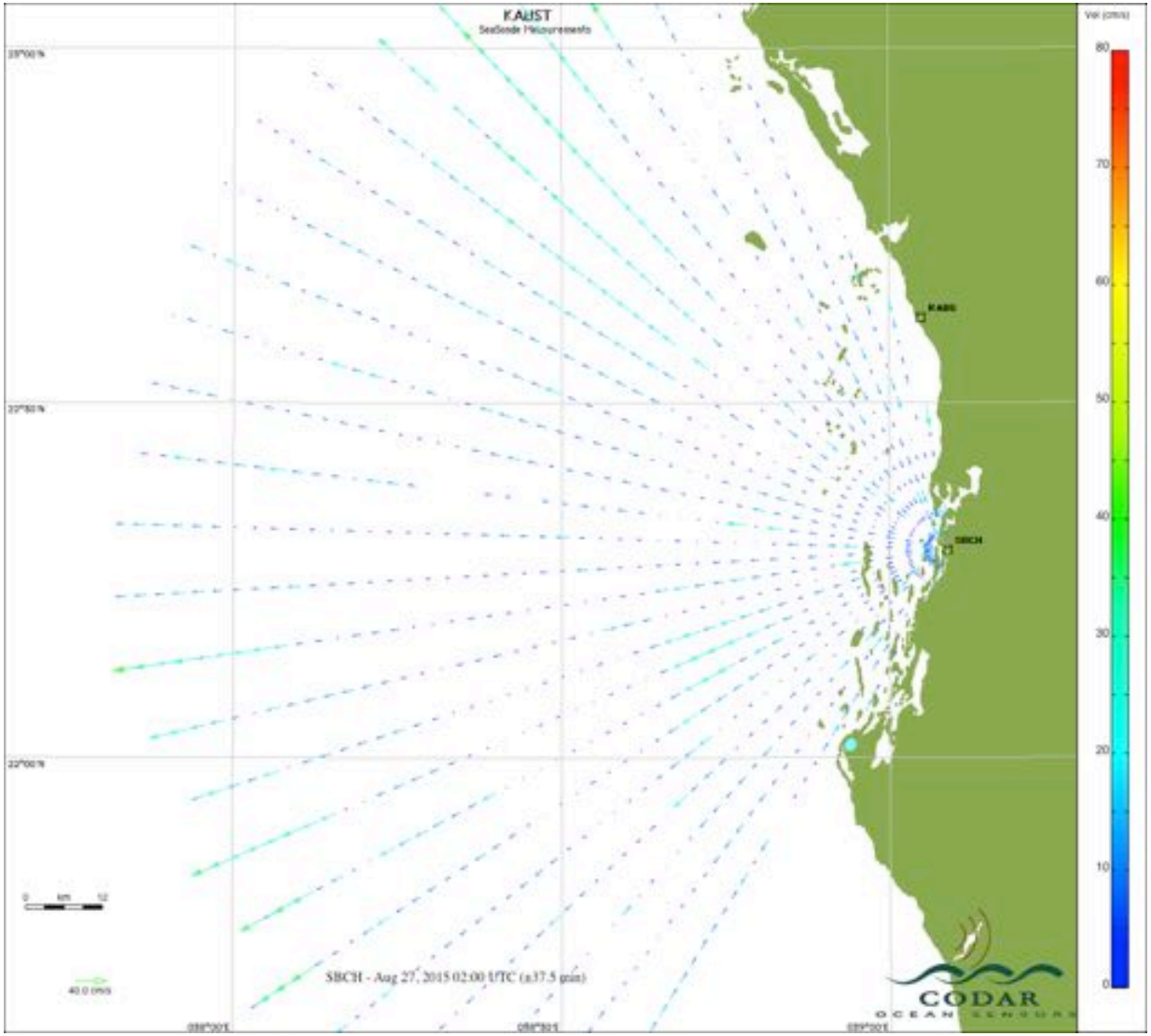
US West Coast Snapshot for October 20, 2013, 0900 GMT

~1500 km

Surface Current Mapping Phase 1

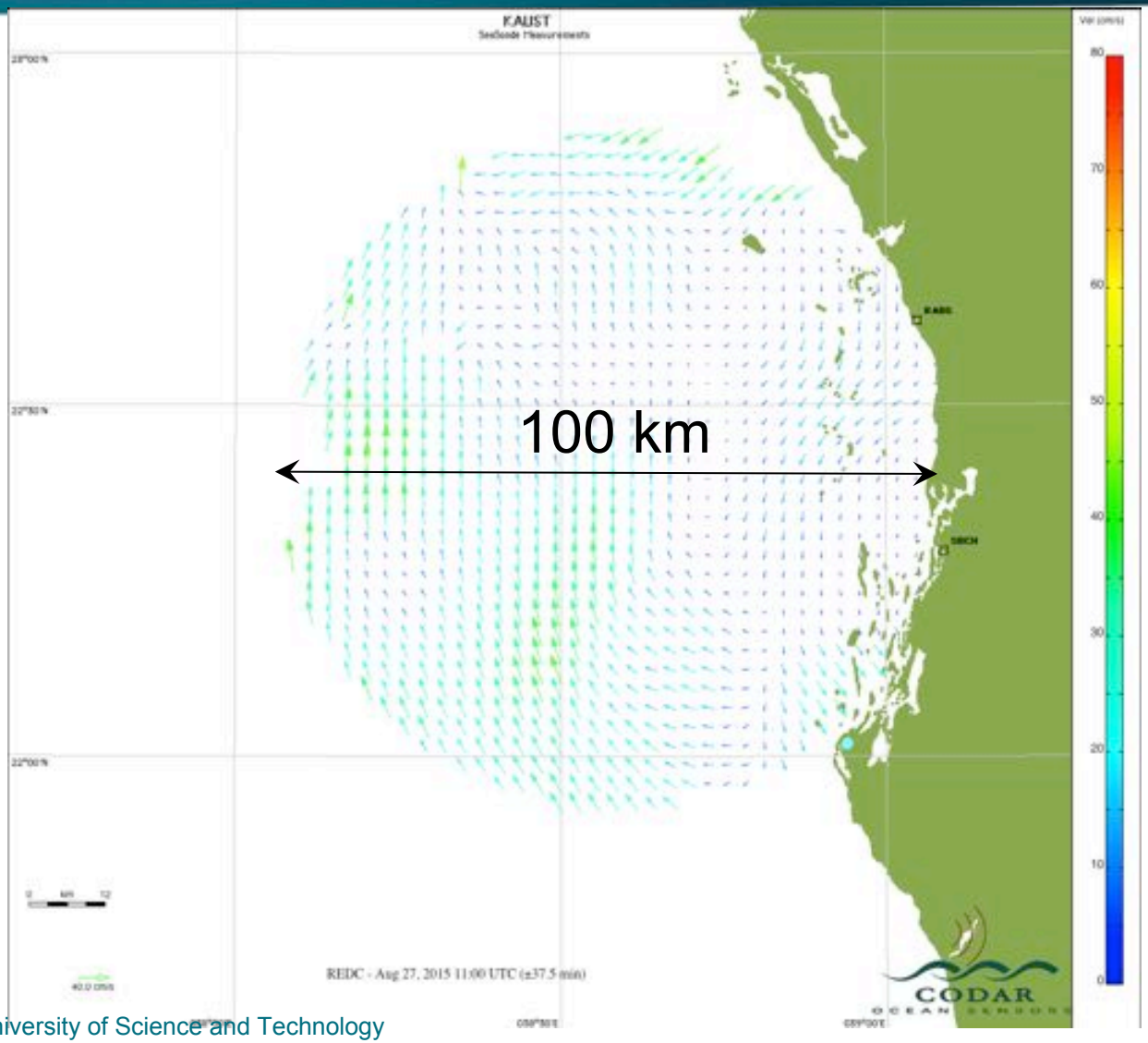


First Radial Patterns – 8/27/2015



- APMs excellent
- Radials range
  - Expected 70-80 km
  - Realized 100-120 km

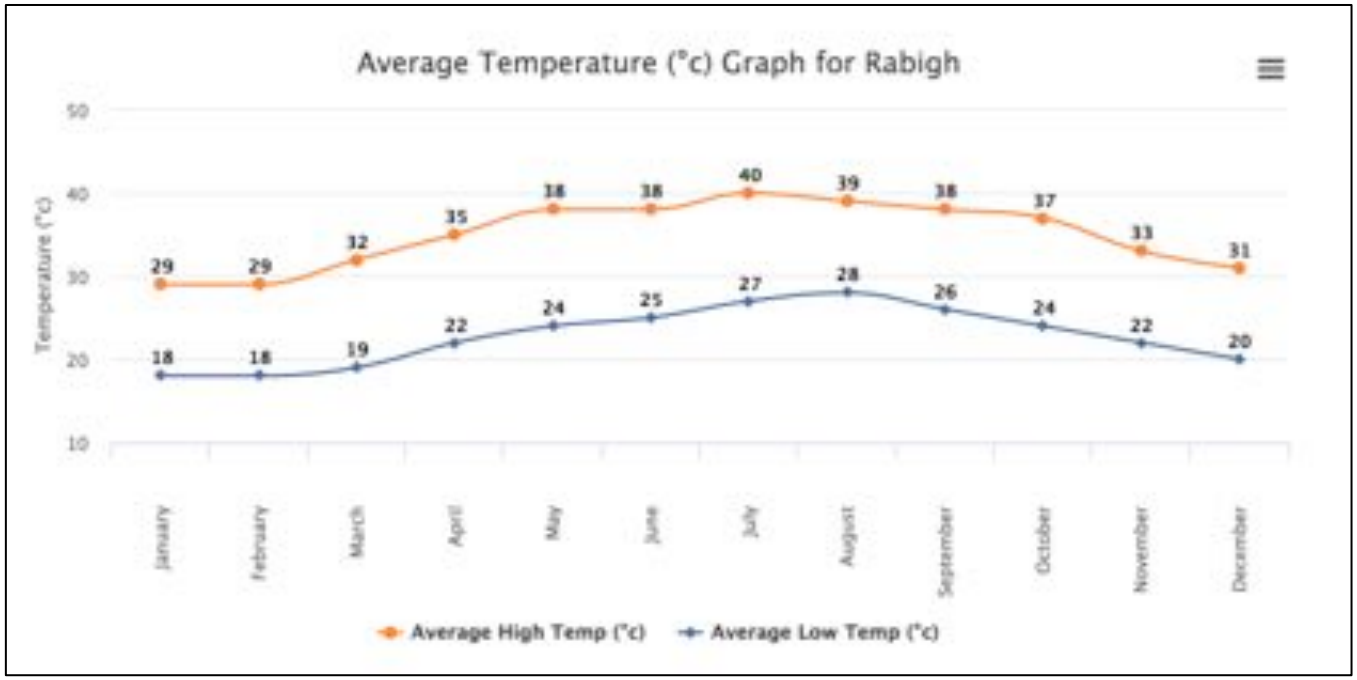
First Vector Map on August 27, 2015



Challenges

- Temperature:

  Most extreme environment that CODAR has installed



Challenges

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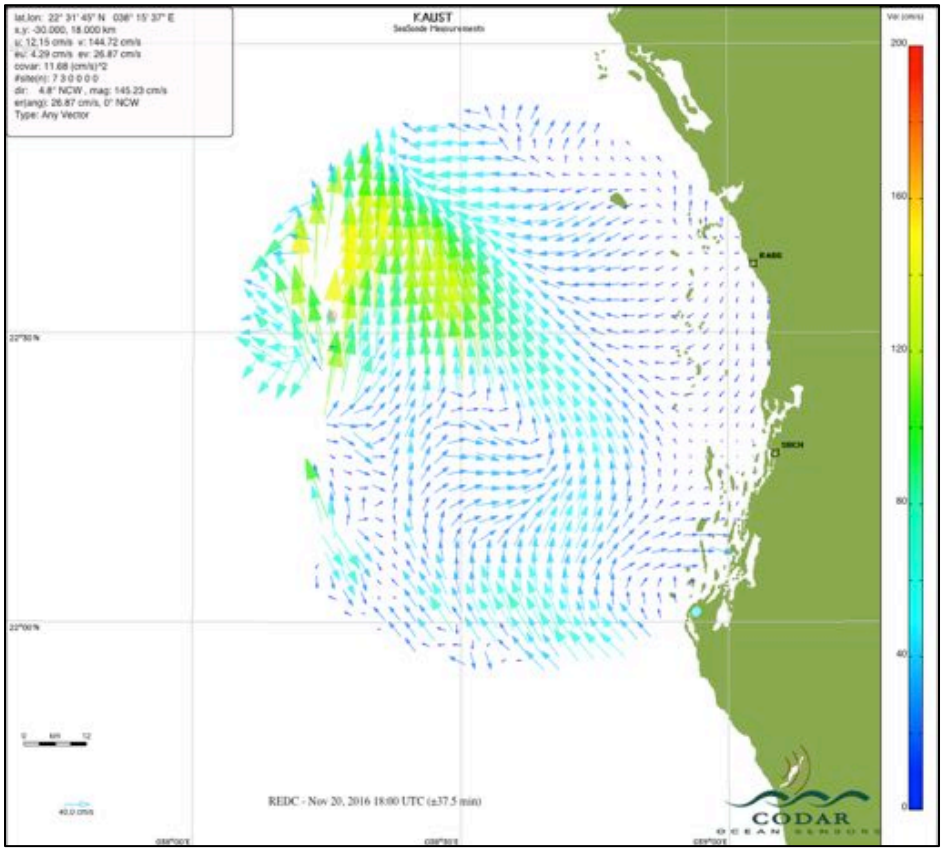
- High velocity problems

  Interferences? Software?



Challenges

- Temperature:

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  Interferences? Software?

- Remote sites

  600-700 km transit to remote sites

- Reliable mobile network

  successful communications

Long Term Glider Lines

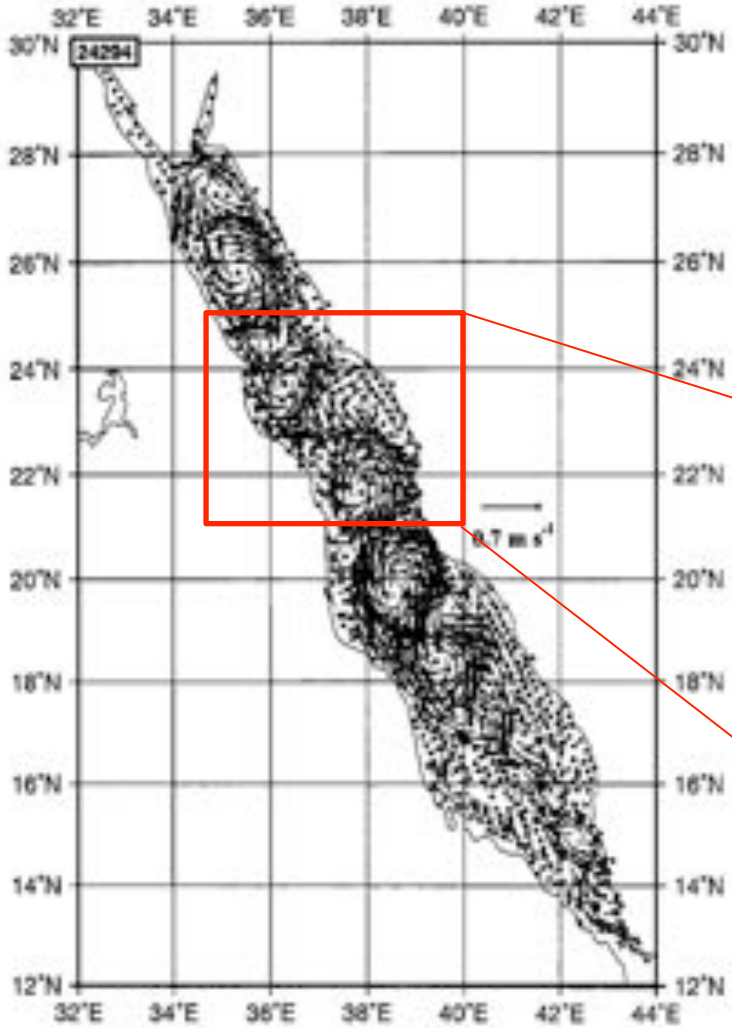
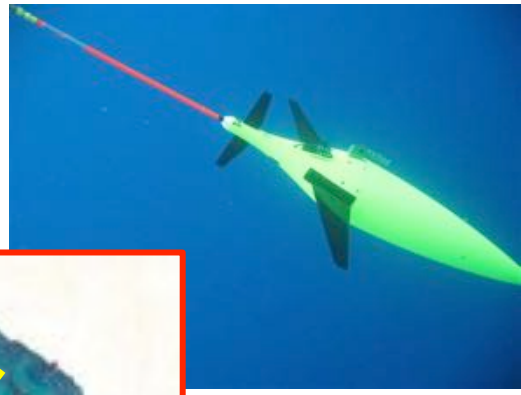


Figure 10. Surface velocity for J.D. 242, 1994. Same as Figure 9 (MCSST, XBT, and CTD assimilation) except that orographically modified winds were used as forcing.

CLIFFORD ET AL.: OCEANOGRAPHIC NOWCAST/FORECAST SYSTEM FOR THE RED SEA

25,111

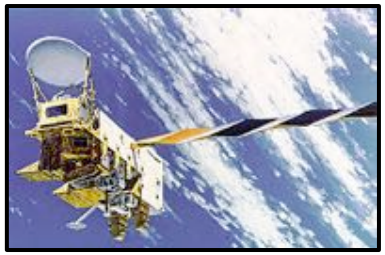
Wind forced model with AXBT and MCSST assimilation



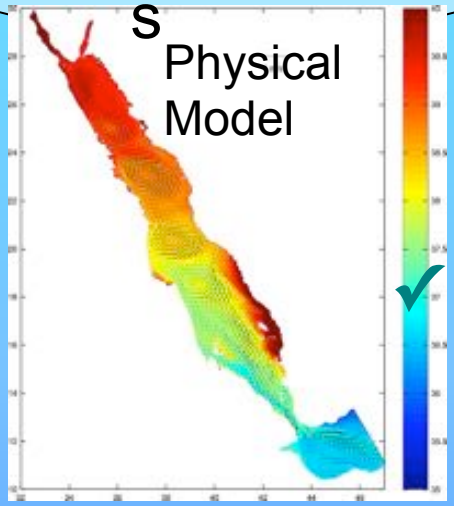
MODIS ocean color image

Modeling and Forecasting

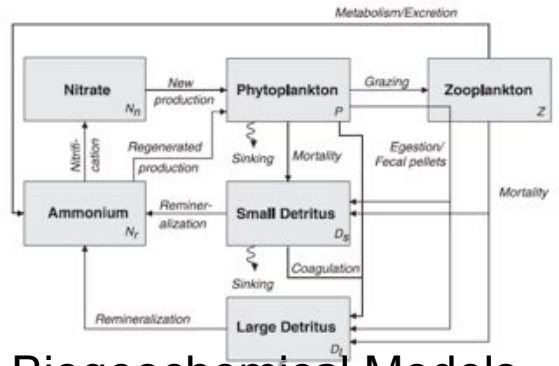
Collaborators: I. Hoteit



Models



Physical Model



Biogeochemical Models

Progress

- Permanent Installation of KAUST-Rabigh sites ✓
  - Temperatures problems are solved

- Permanent Installation of Duba sites by Dec 2016 / Jan 2017
- Permanent Installation of Jizan sites in early 2017

Summary

- Initiated Red Sea Observing System with CODARs, Gliders, and profiling floats
- First CODAR systems to use16.14 MHz
- Good range and performance (beyond expectations)
  - Perhaps explainable by higher salinity of Red Sea
- Future goals: Operational real-time modeling and prediction system for currents and surface waves for:
  - Oil spill response (drilling, shipping, coastal terminals)
  - Data products for ports and shipping
  - Improve understanding of biological systems
    - Reef connectivity
    - Basin exchange processes in Red Sea

End

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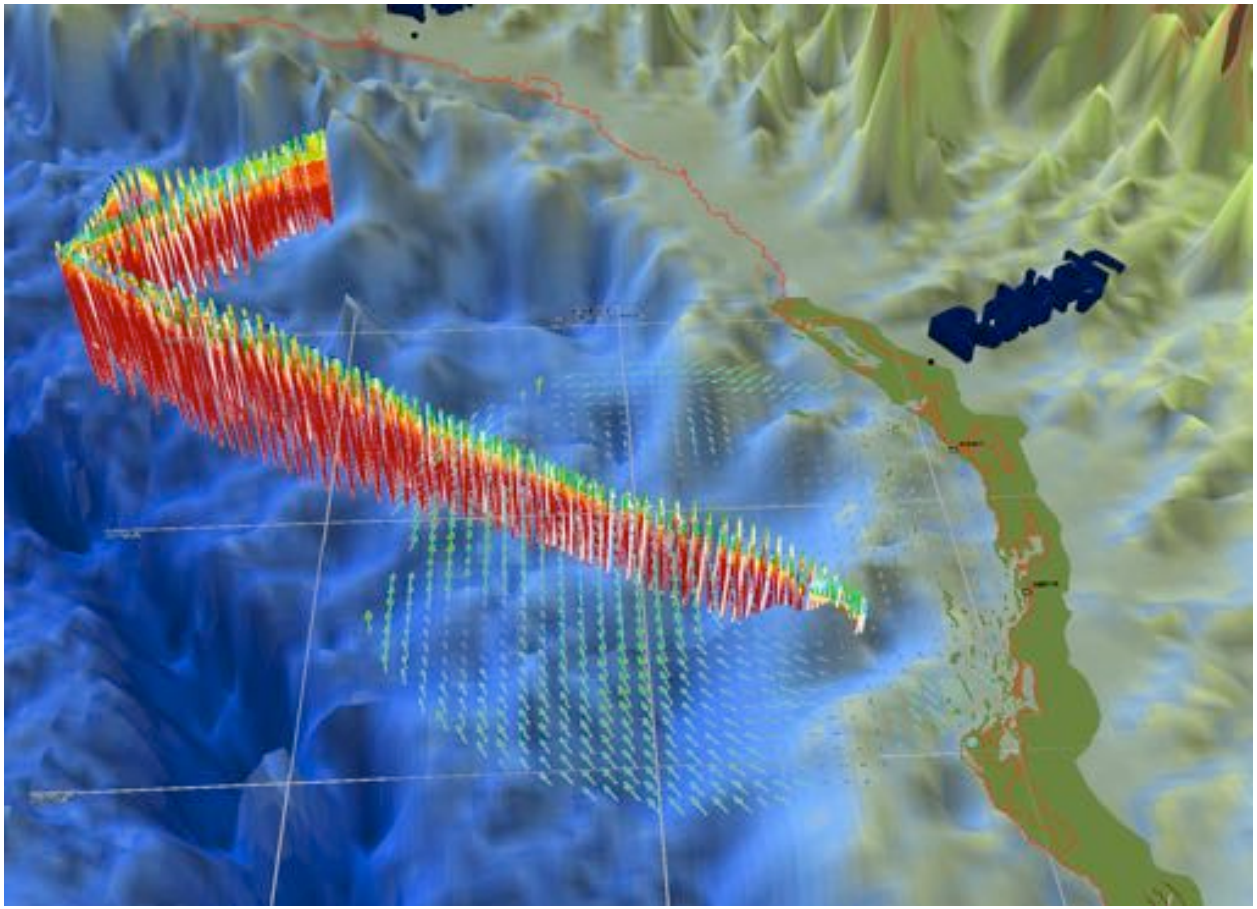
Ocean Sensing and Observing