S-MODE: The Sub-Mesoscale Ocean Dynamics Experiment

2021 IOVWST Meeting
March 2021

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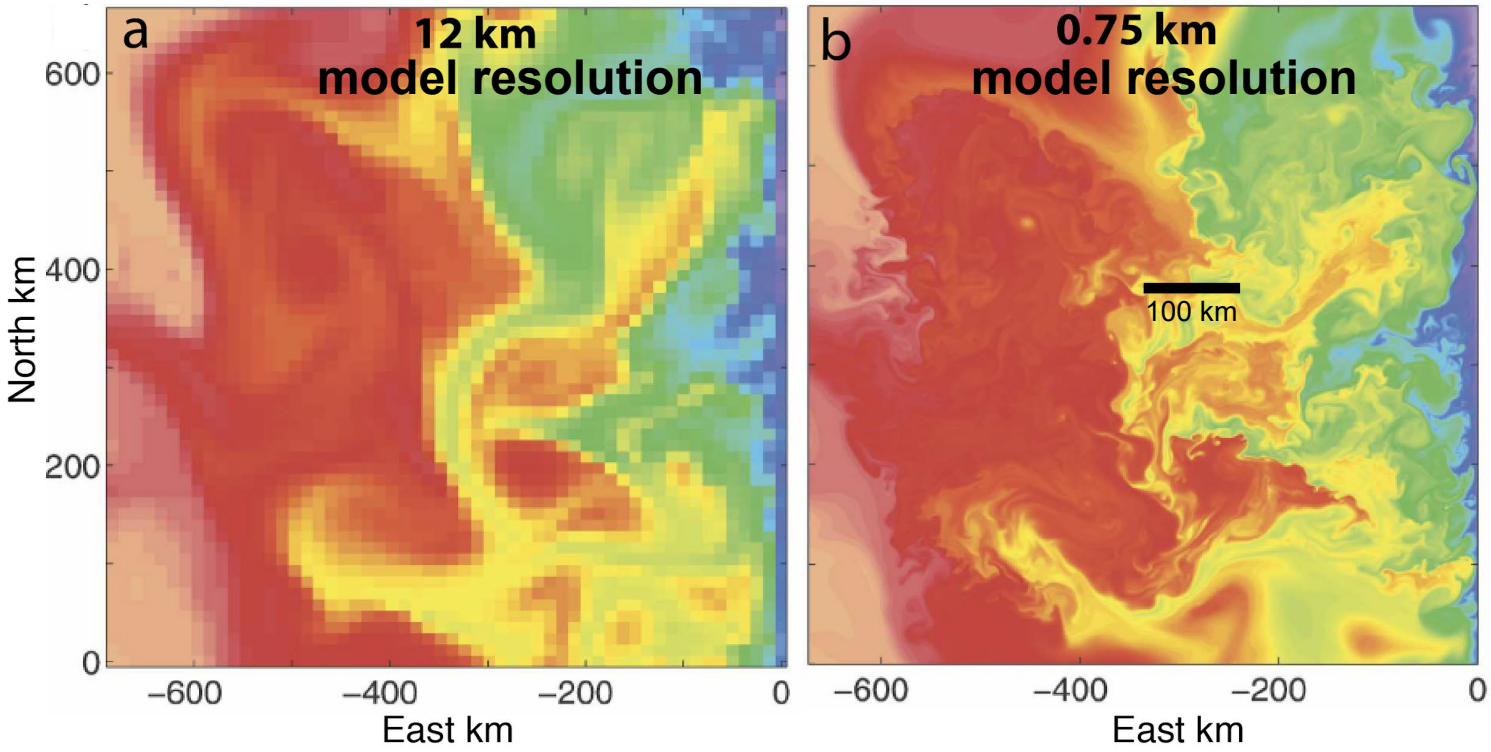
“Submesoscale” ocean eddies (~1-10 km scales)

Sea surface temperature in numerical ocean simulation



Capet et al. (2008)

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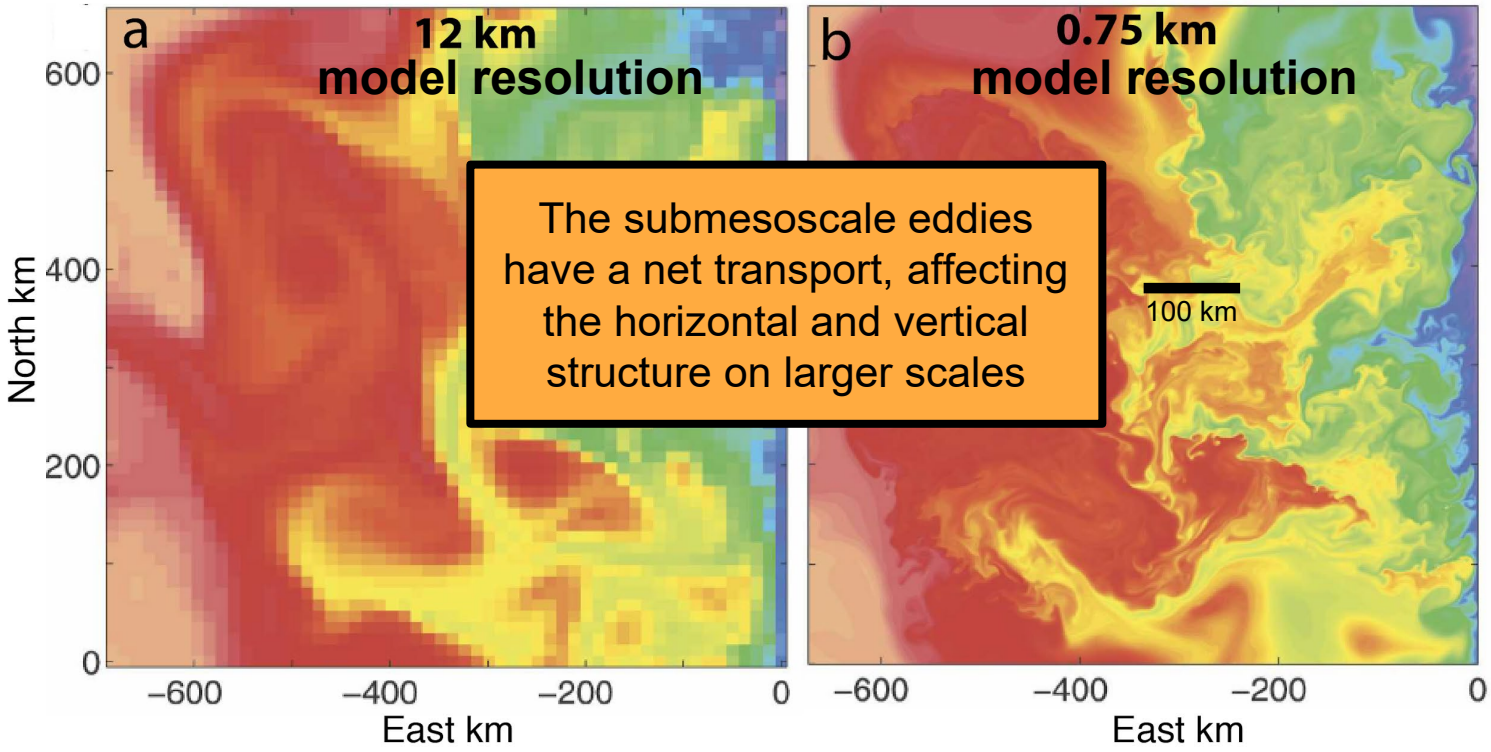

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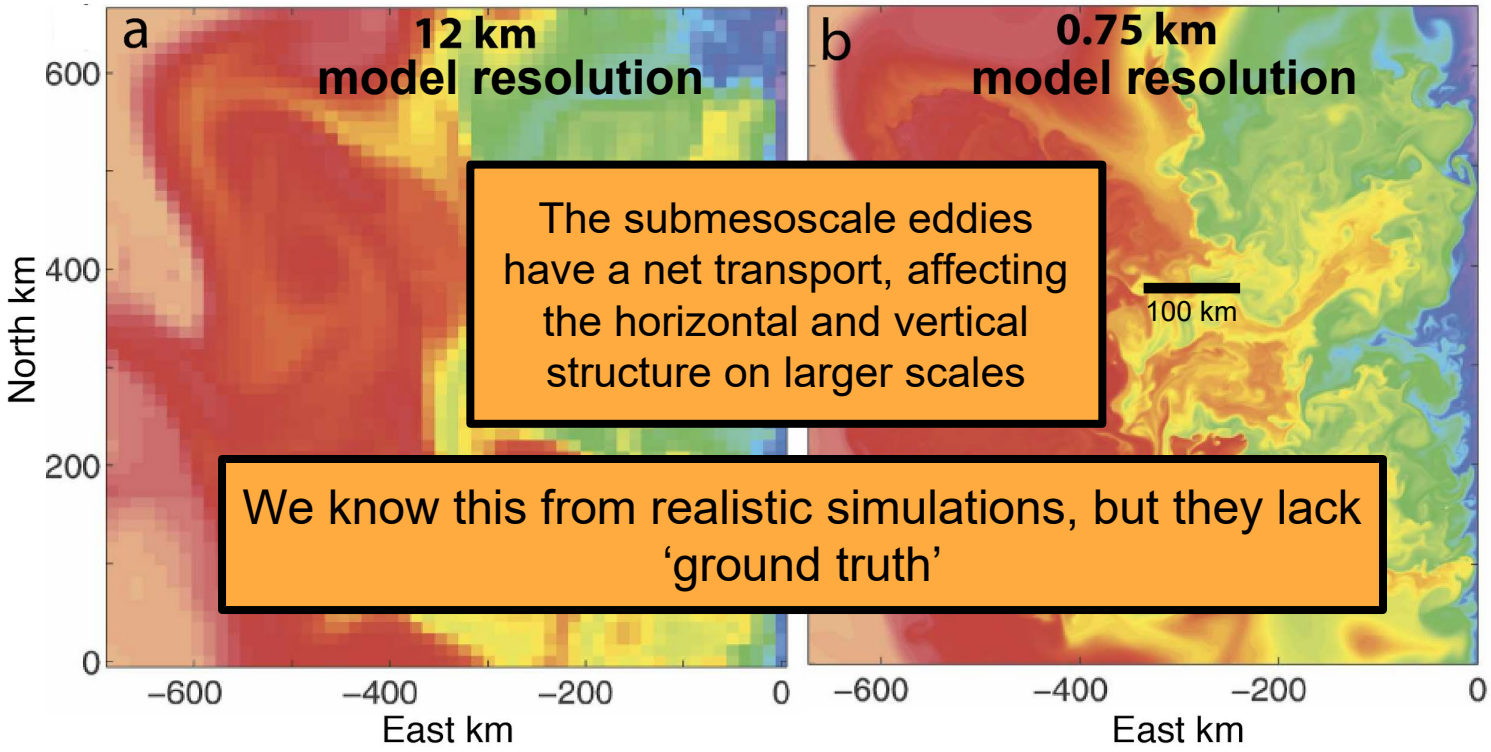


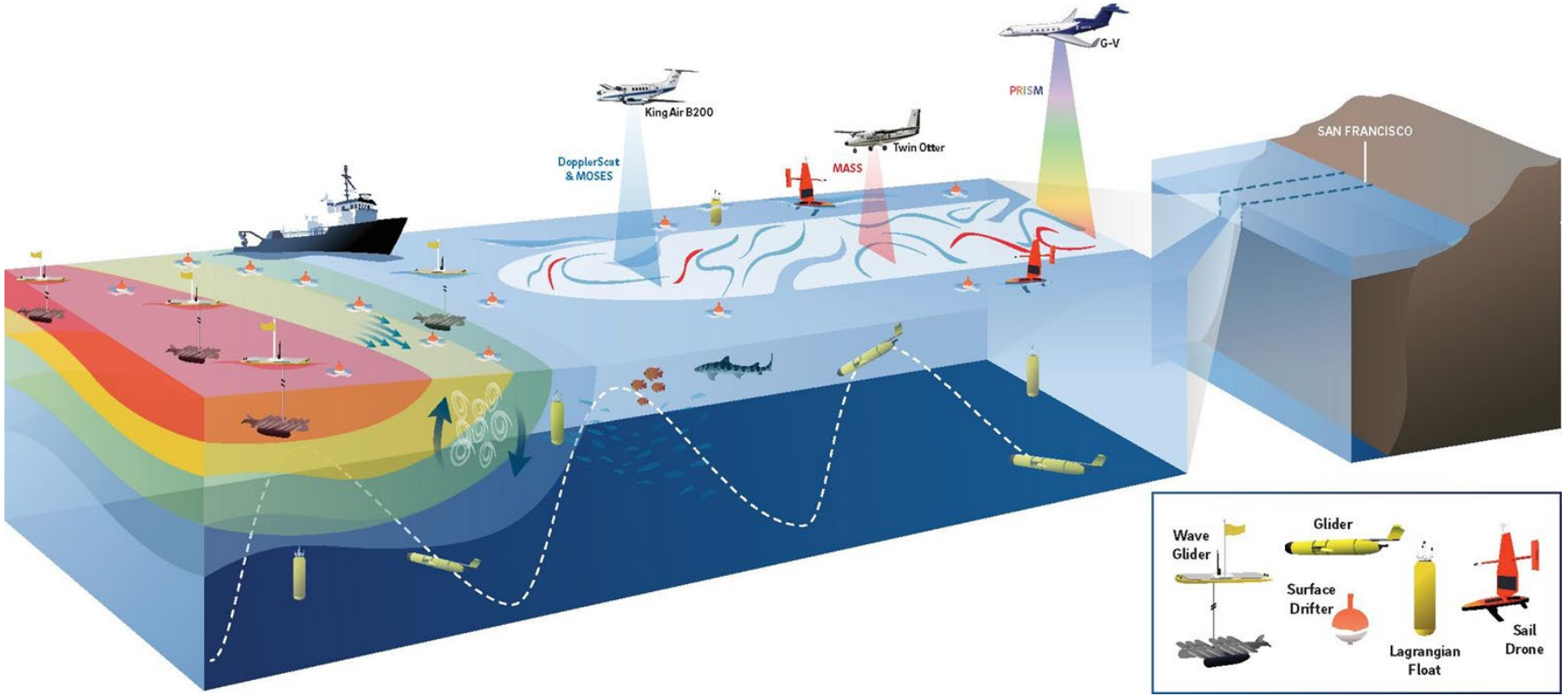
The submesoscale eddies have a net transport, affecting the horizontal and vertical structure on larger scales

We know this from realistic simulations, but they lack ‘ground truth’

Capet et al. (2008)

The Sub-Mesoscale Ocean Dynamics Experiment (S-MODE)

Science: Test the hypothesis that kilometer-scale ("submesoscale") ocean eddies make important contributions to vertical exchange of climate and biological variables in the upper ocean.



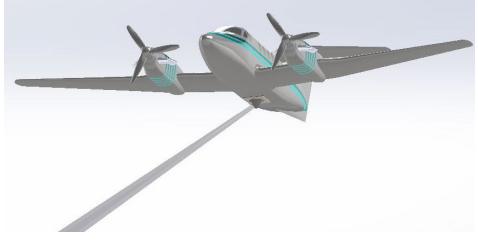
S-MODE: Overview

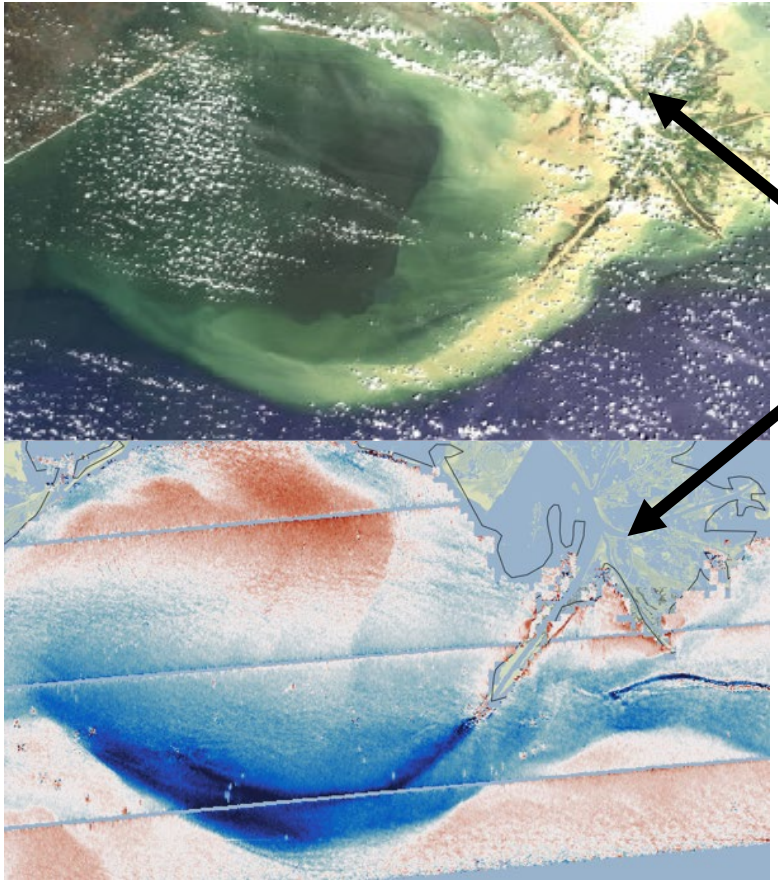
- NASA Earth Venture Suborbital Investigation
- S-MODE is a large multi-institutional field campaign studying the role of submesoscale (~1-10 km scale) ocean dynamics in vertical exchange in the upper ocean
- 3 campaigns:
  - Pilot campaign (21 days in Oct-Nov 2021)
  - Two Intense Operations Periods of ~25 days (TBD but nominally Oct 2022 and April 2023)
  - Study region ~150 km offshore of San Francisco
  - 3 aircraft with remote sensing (lidar/SSH, Doppler scatterometer, infrared and hyperspectral imagery), ~10 Saildrones, 4 Wave Gliders, ~100 drifters, and gliders (NAVO and U. Washington)

DopplerScatt measurements off New Orleans

DopplerScatt scanning Doppler Ka-band radar measures surface currents over 25-km swath

Ernesto Rodriguez,
Dragana Perkovic-Martin
(NASA JPL)





Sentinel 3 2017-04-18
Courtesy of Copernicus Sentinel/ESA

Mississippi River Delta

DopplerScatt surface current eastward component.

Circulation pattern matches Sentinel 3 color pattern very closely.

S-MODE Measurements

All variables measured in multiple ways

- Ocean velocity: DopplerScatt, MASS, Gliders, Wavegliders, Saildrones, ship, drifters
- Vertical velocity: Lagrangian floats and indirectly from velocity measurements
- Ocean temperature: MOSES, MASS, Gliders, Wavegliders, Saildrones, ship, satellite
- Ocean color/chlorophyll: PRISM, MASS, Gliders, Wavegliders, Saildrones, ship, satellite
- Surface meteorology: DopplerScatt (wind), Saildrones, Wavegliders, Ship, satellite

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