BOEM BUREAU OF OCEAN ENERGY MANAGEMENT

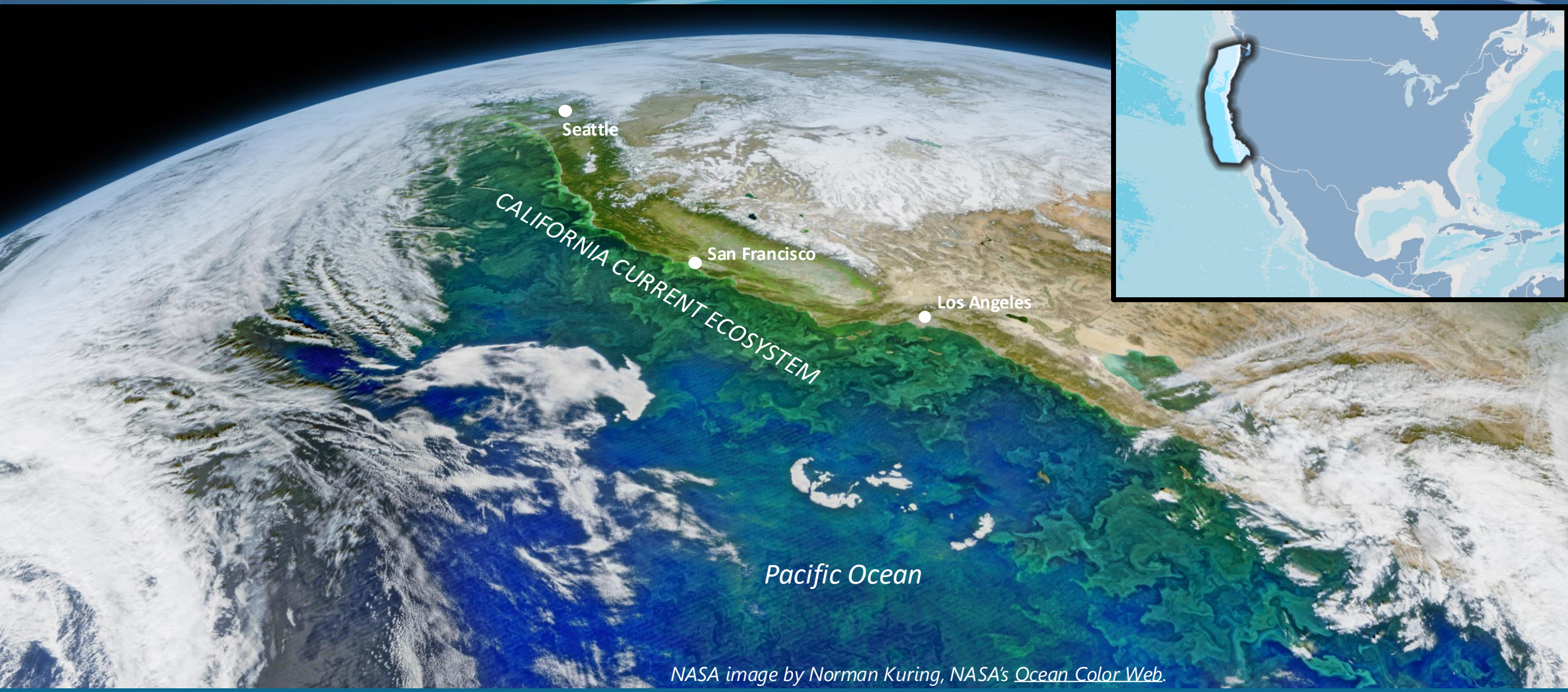
Impacts of Floating Offshore Wind Subsurface Infrastructure to Hydrodynamics, Biogeochemistry, and Primary Productivity in the Pacific OCS

26th Meeting of the Standing Committee on Offshore Science and Assessment

July 11-12, 2024

Alice Kojima | Pacific Region

Background



NASA image by Norman Kuring, NASA's Ocean Color Web.

Background

Article | Open access | Published: 13 April 2023

Projected cross-shore changes in upwelling induced by offshore wind farm development along the California coast

Kaustubha Raghukumar, Timothy Nelson, Michael Jacox, Christopher Chartrand, Jerome Fiechter, Grace Chang, Lawrence Cheung & Jesse Roberts

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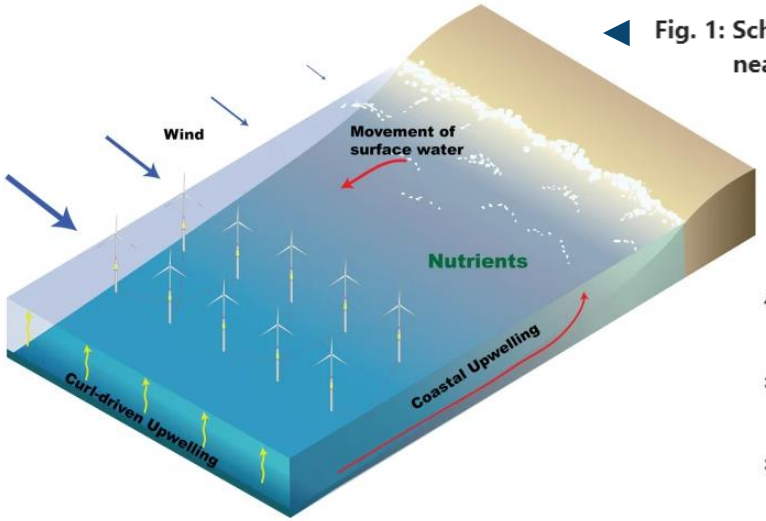

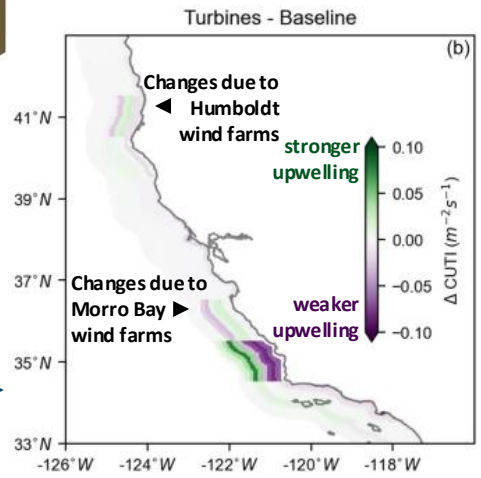

Fig. 5: Change in strength of upwelling due to presence of turbines. Upwelling strength is represented by the Coastal Upwelling Transport Index (CUTI).

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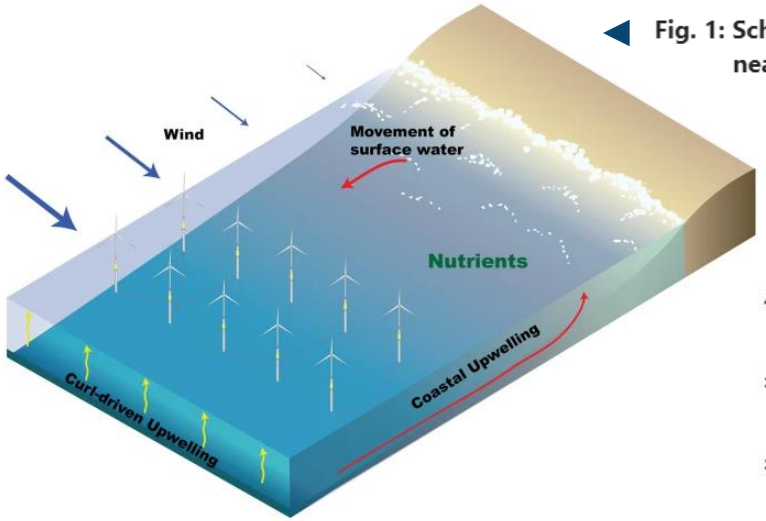

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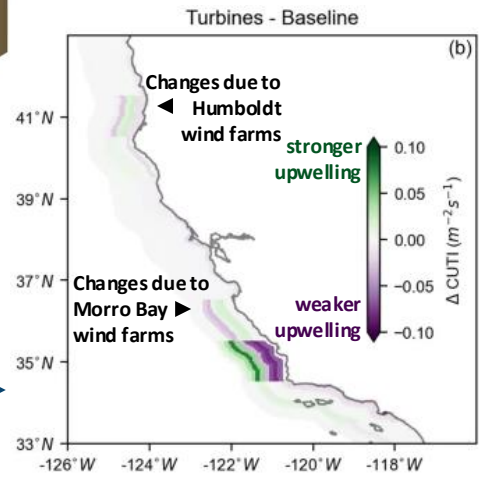

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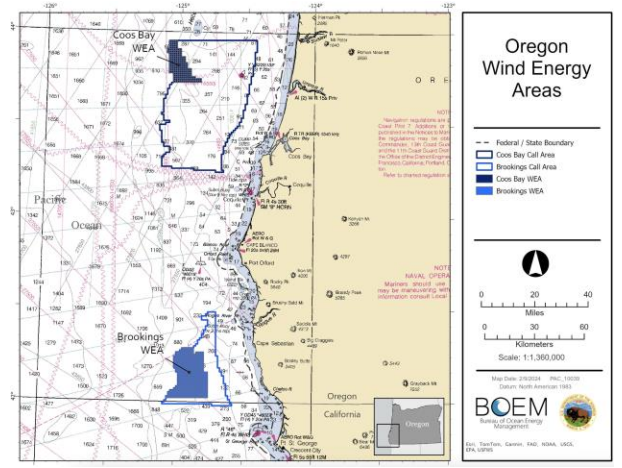
NT-23-09:
Offshore Wind Farm Impacts on Pacific Upwelling, Nutrients, and Productivity



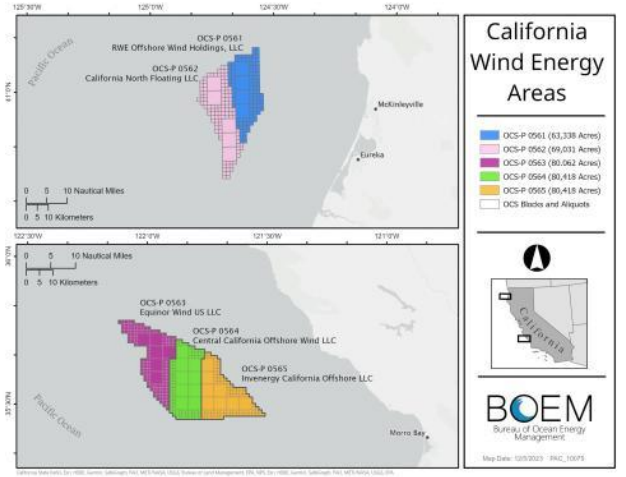
atmospheric model

+

ocean model (ROMS)

+

biogeochemical model



BOEM Information Need

ROMS: floating offshore wind farm = reduction in wind stress at the sea surface

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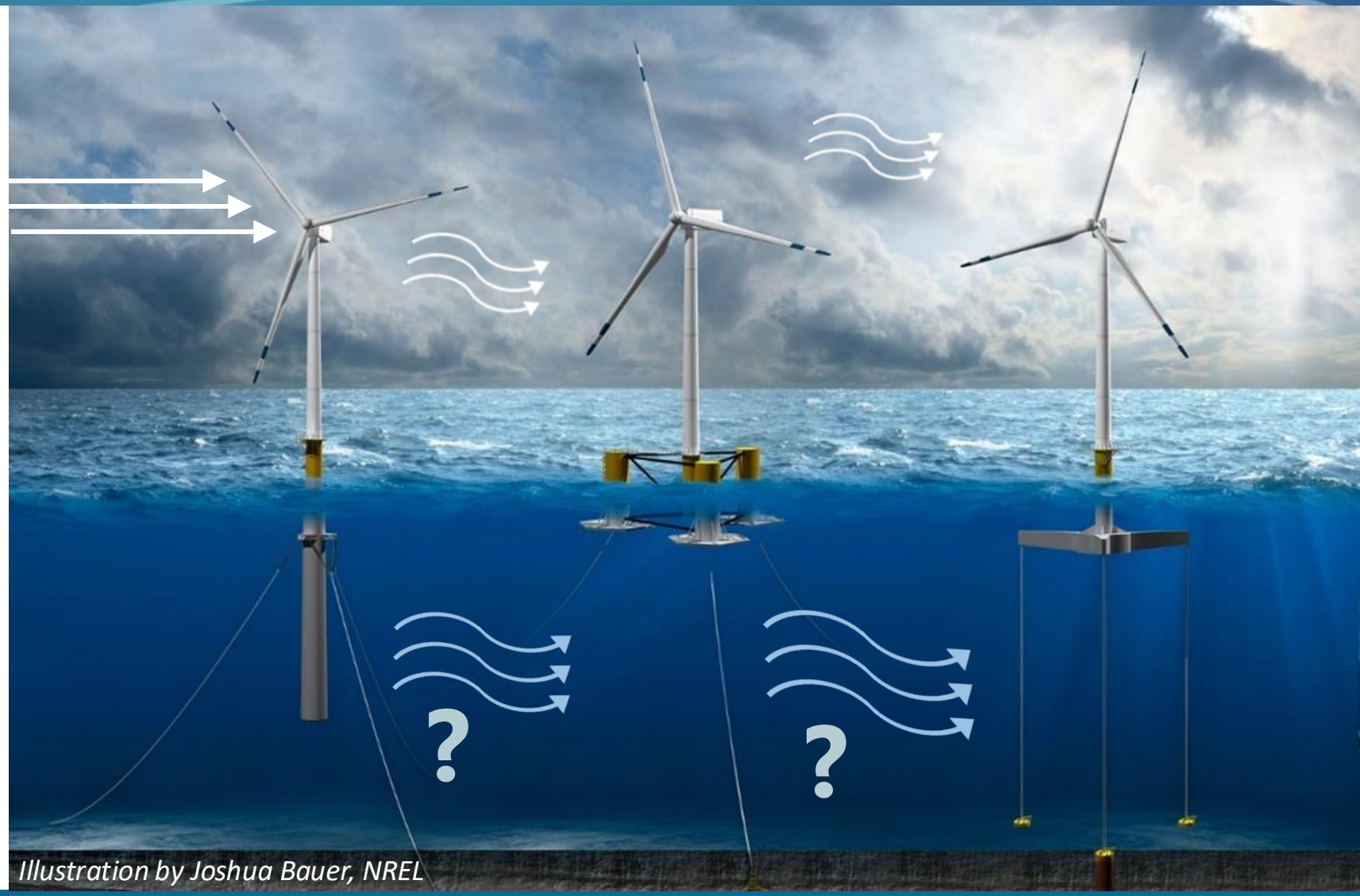

Illustration by Joshua Bauer, NREL

BOEM Information Need

KNOWLEDGE GAPS

1) Oceanic flow-substructure interactions of floating wind farms
2) Ocean wake + wind wake effect on upwelling, biogeochemistry, primary productivity

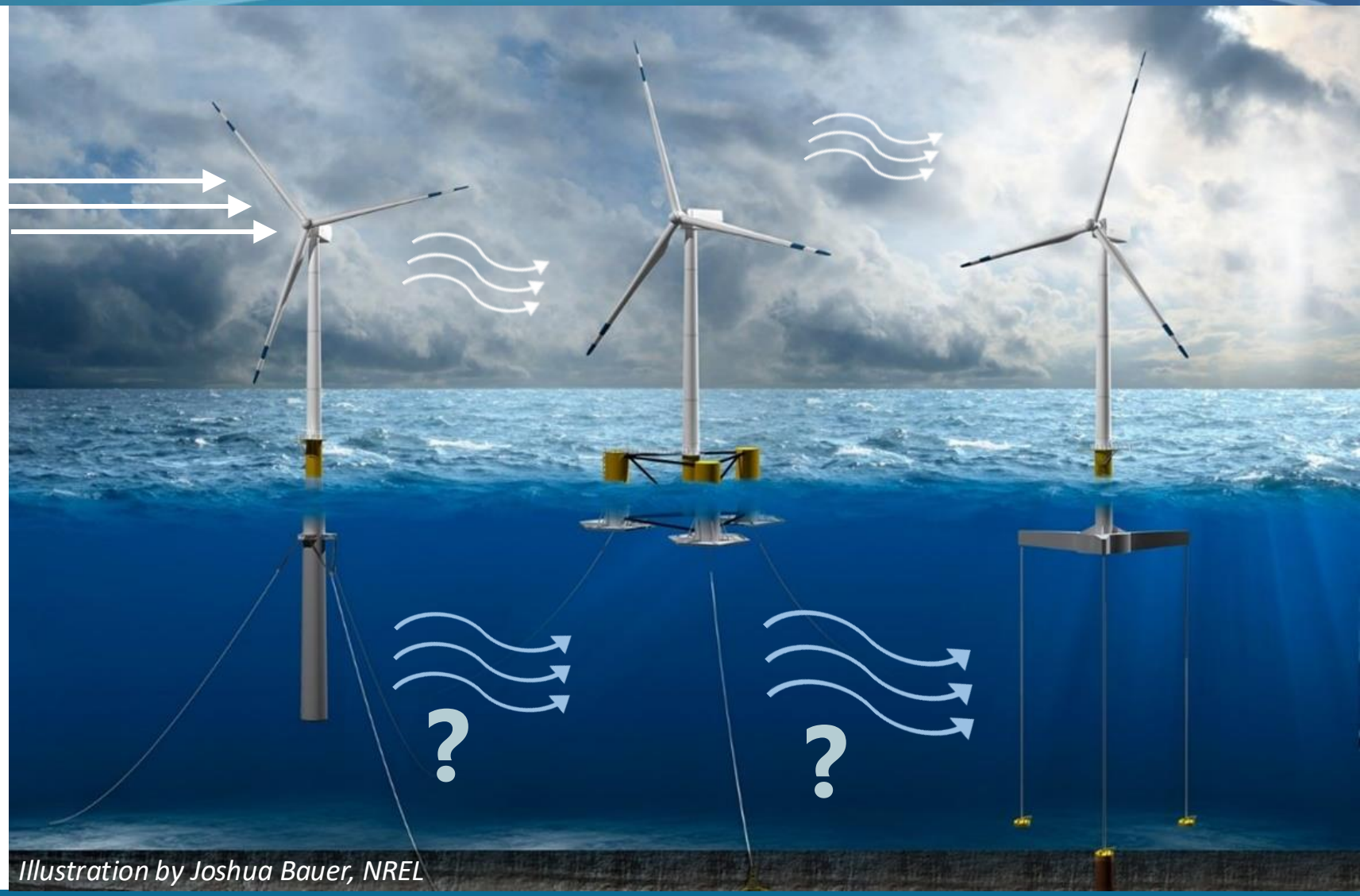

Illustration by Joshua Bauer, NREL

Methods

- MITgcm + ecosystem model: simulate hydrodynamics, biogeochemistry, primary productivity
  - Compare against “no turbine” control
  - Compare against “no ocean wake” control
  - Compare “no ocean wake” to previous ROMS studies
  - Validate with relevant observational data

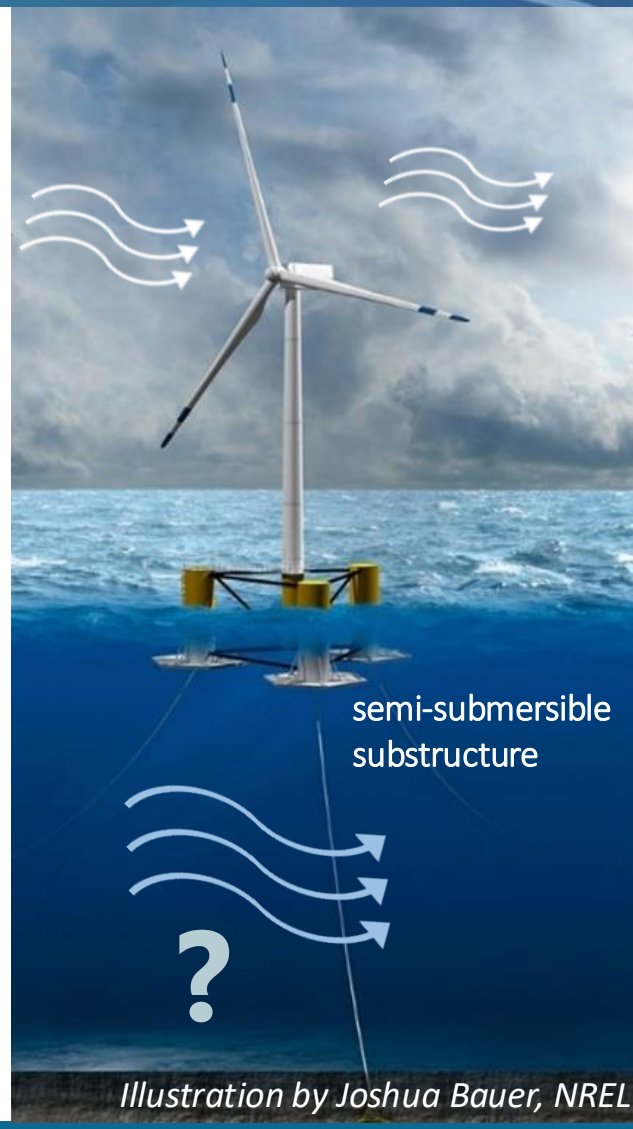

Illustration by Joshua Bauer, NREL

Research Questions

- How will interactions between oceanic flow and floating substructures influence **ocean stratification** and **thermocline depth**?
- How do these changes compare to those that occur due to **natural variability** and **climate change**?
- How can these modeling results inform a **monitoring effort** focused on **turbine-scale** oceanic flow-structure interactions?

Requested Input from COSA

We welcome any insights or suggestions about the model configuration and framework that would best suit this study.

How do you recommend we balance the focus on small-scale, high-resolution changes in hydrodynamics with the ability to evaluate downstream impacts on primary productivity and potentially higher trophic levels?

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