

# NOAA - CALIFORNIA PARTNERSHIP ON NUMERICAL MODELING: HOW CAN WE BUILD ON OUR SUCCESS?

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# NOAA'S SUPPORT OF CALIFORNIA HAS ALREADY RESULTED IN AN UNQUALIFIED SUCCESS

- **NOAA invested funding and staff to develop an ocean numerical model and biological interpretation tools**
  - State and local partners have matched this investment five-fold!
- **Modeling toolkit is now being applied to inform climate change strategies, including**
  - Consideration of how local water quality management actions could build resilience
  - Evaluation of marine carbon dioxide removal technologies
- **Model has been leveraged for multiple new applications, well beyond the original acidification and hypoxia scope**
  - Microplastic fate and transport
  - Kelp aquaculture

# OUR RELATIONSHIP WITH NOAA SHOULD EVOLVE TO BUILD ON THIS SUCCESS

- How can California's modeling enterprise be sustainable over the long-term?
  - Research grant funding is not an appropriate vehicle for routine model maintenance/upgrades needed for a “community model”
- State interest in NOAA partnerships falls well outside routine grantor-grantee relationship
  - We should be partnering on tool development and applications



# OCEAN NUMERICAL MODEL APPROACH



## WRF

Weather forecast system

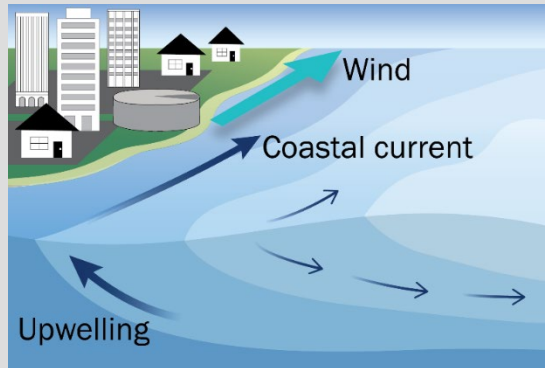
Atmospheric data

- 3-D mechanistic model (not data assimilation)
- West-coast wide, with high resolution nests for coastal applications
- Capable of simulating scenarios

## ROMS

Regional Ocean Modeling System

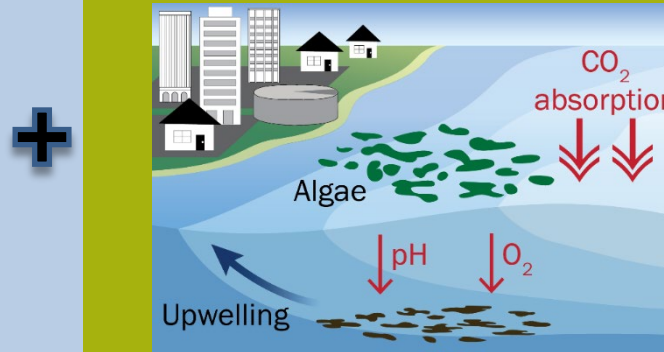
A physical circulation model that predicts how ocean water circulates



## BEC

Biogeochemical Elemental Cycling Model

Predicts how ambient CO<sub>2</sub>, human & ocean nutrient fuel algal blooms that, upon their death, consume oxygen and lower pH



## Land-Based Inputs

Rivers  
Ocean Outfalls



## Atmospheric Inputs

Atmospheric deposition  
Atmospheric CO<sub>2</sub>



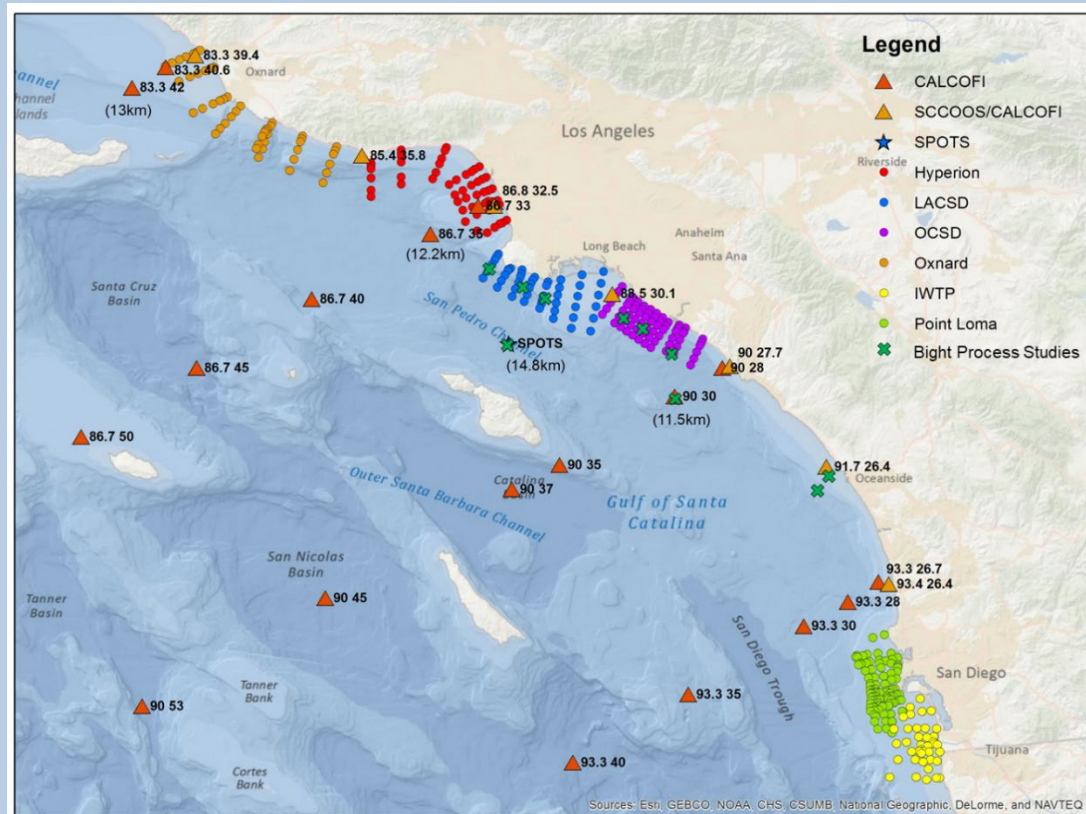
# MODEL VALIDATION RELIED HEAVILY ON NOAA SUPPORTED OBSERVATIONS

## NOAA Data Sources

- CALCOFI (data + published studies)
- NOAA NCEI data (e.g., World Ocean Data)
- West Coast ocean acidification cruises

## Local Data

- Ocean discharger monitoring
- Bight 2008, 2013 Process Studies



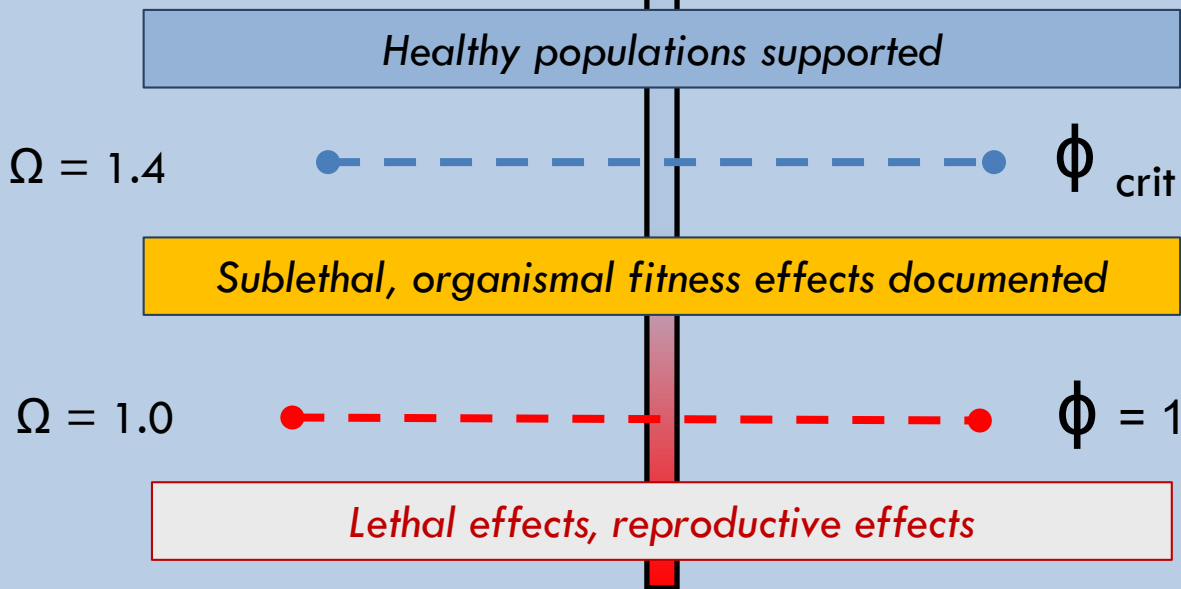
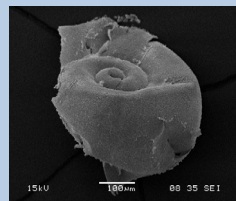
# THROUGH JOINT FUNDING, WE DEVELOPED OA THRESHOLDS AND OXYGEN INDICES TO TRANSLATE OCEAN CHEMISTRY TO BIOLOGICAL EFFECTS



Calcifier Habitat Capacity  
Aragonite Saturation State

Aerobic Habitat Capacity  
Metabolic Index

Pteropods



Oxygen breathing organisms (e.g., fish)



**HOW CAN CALIFORNIA'S RELATIONSHIP WITH NOAA  
EVOLVE TO BUILD ON THESE SUCCESSES?**

# HOW CAN CALIFORNIA'S MODELING ENTERPRISE BE SUSTAINED OVER THE LONG TERM?

*NOAA Funding and Staff Support Can Help Us Transition This Model From “Research and Development” to Maintaining ROMS-BEC “Application Ready”*

- **Research grant funding is not an appropriate vehicle for activities needed to support that transition (and ongoing model maintenance/upgrades)**
  - Model validation and uncertainty assessments should be routine
- **NOAA has been producing operational modeling products for decades**
  - How can NOAA funding and staff support mechanistic “community” models?



# WE WANT TO ENSURE THAT SHARING OF NEW SCIENCE/TOOLS IS ROUTINE

*California Wants to Make Sure that We Take Advantage of NOAA Investments in Science and Technology*

**For example...**

- New scientific paradigms
- Improvements in model forcing
- Model visualization tools
- Optimization in high performance computing

***.....And that California's investments in modeling science are shared back!***

# **WE WANT JOINT COLLABORATIONS ON APPLICATIONS**

## **Example: Marine Carbon Dioxide Removal (mCDR)**

- **Modeling is central to support the growing mCDR industry and how it is implemented in both State and Federal waters**
  - Direct support of technology partners as they optimize their approach
  - Measurement, verification and reporting (for carbon crediting)
  - Model based evaluations of mCDR co-benefits and disbenefits
- **Can we develop a common scientific toolkit for application in state and federal waters?**
  - Scientific framework and model-based visualizations
  - Federal-state coordination on siting, permitting, monitoring, etc.

**QUESTIONS?**

**THANK YOU!**