Name(s)

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Project Number

S0914

Project Title

Developing Coupled Physical-Biogeochemical Models of Mesozooplankton Dynamics in the California Current System

Abstract

Objectives

Mesozooplankton play an important role in the global ocean. They are intricately intertwined in the pelagic food web and are major contributors to biogeochemical element cycling through vertical migration. However, much is unknown about the quantitative distribution and biomass of mesozooplankton in the ocean. Our limited knowledge of mesozooplankton dynamics impairs the development of ecological models, which are used to understand interactions of marine resources with functioning of the earth. In the upwelling system of the California Current System (CCS) and other productive regions throughout the ocean, these models are integral in developing sustainable environmental policy. In this study, I aim to assess ecological dynamics of mesozooplankton in the CCS and analyze the accuracy of current simulative models of these dynamics.

Methods

Standardized and synthesized datasets accessed from MARine Ecosystem DATa (MAREDAT), a global database of zooplankton pigments, and the World Ocean Atlas, a database of observed ocean statistics. Extracted climatological fluctuations of mesozooplankton biomass, sea surface temperature, chlorophyll levels, salinity, and photosynthetically active radiation in the CCS. Compared observational analyses with model output from a coupling of the Regional Ocean Modeling System (ROMS), modeling ocean physics, and Biogeochemical Elemental Cycling (BEC), modeling biogeochemical dynamics. Evaluated model accuracy through spatial, seasonal, and yearly scales.

Results

Observational climatologies of mesozooplankton biomass and oceanic stressors verified the significance of upwelling dynamics in the CCS. Model outputs underestimated mesozooplankton biomass during upwelling seasons and in regions of coastal upwelling. Regions of overestimation aligned with oligotrophic offshore regions.

Conclusions

Current simulative models misrepresent mesozooplankton dynamics in the CCS. Compartmental modifications of models that consider diversity and variation in mesozooplankton may yield more accurate estimations of mesozooplankton dynamics. With increasing perils of anthropogenic climate change, accurate reforms of simulative models reflecting observed biological dynamics are essential for future development of sustainable fishery management, regulation of wastewater nutrient outfall, and robust climate policy.

Summary Statement

I find that current models of mesozooplankton dynamics underestimate impacts of upwelling in the California Current System and suggest compartmental reformation of simulations that may yield more accurate representations of these dynamics.

Help Received

I received guidance from Jérôme Guiet, Ph.D., and Professor Daniele Bianchi of the UCLA Department of Atmospheric and Oceanic Sciences in narrowing my research questions and analyzing datasets through MATLAB.