# Integrating biogeochemical cycles across scales: A unified approach for regional predictions.

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It is recognized that even though climate models show significant skill in simulating both physics and biogeochemistry on global scales, they are not necessarily designed for regional studies. In the physical environment, significant effort has been devoted to downscaling techniques both in the atmosphere and the ocean. There are considerably less attempts at downscaling biogeochemistry. This is partly a consequence of the different models being used by the global and regional physical and biogeochemical communities. This disconnect leads to limited high-resolution regional projections of ecosystem dynamics. In this work, we present the recent development of a multi-scale coupled bio-physical model used for this purpose. The framework is based on the NOAA-GFDL earth system model and the regional ROMS circulation model. The same biogeochemical model, COBALT, has been implemented in both models for a consistent integration across scales. We present results from regional, high-resolution implementations in the California Current System and the northwest Atlantic. We show that improved representation of the physics is a critical step towards more skillful predictions of the ecosystem in coastal areas.

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