Extreme Events and Emergent Trends in Marine Ecosystem Stressors under a historical/RCP8.5 Climate Change Pathway

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It is important to identify the degree to which climate change will impact ocean ecosystems over the 21st century. Over the last decade there has been increasing application of Earth System Models (ESMs) to project changes in ecosystem stressors (acidification, warming, and de-oxygenation) with a focus on surface and/or thermocline-integrated conditions. Recent efforts have made combined use of CMIP5 models, large ensemble simulations, and/or scenario sensitivity experiments to estimate uncertainties in future projections. Nevertheless very little to date has been done to evaluate how the frequency of extreme events with ecosystem stressors will respond to future climate perturbations. Here we consider for an ensemble suite of simulations with GFDL's ESM2M changes in the frequency of marine ecosystem extreme events over the 21stcentury. We focus on the contrast between the behavior at the ocean's surface vs. base of the ocean's euphotic zone, as these are both important horizons for ocean ecosystems, and on the contrast between the Time of Emergence of decadal trends vs. frequency changes of extreme events, as these are both important ecological timescales. Particular attention is devoted to acidification at the base of the euphotic zone, as this pertains to the life cycle of pteropods. Preliminary results indicate that in addition to the subpolar Northern Oceans and the Southern Ocean, the Large Marine Ecosystems (LME) regions of the eastern Pacific become increasingly exposed to corrosive waters over the 21stcentury.

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