



Multi-month forecasts of marine heatwaves and ocean acidification extremes

Marine heatwaves (MHW) and ocean acidification extreme events (OAX) are periods during which temperature and acidification reach extreme levels, endangering ecosystems. As the threats from MHW and OAX grow with climate change, there is need for skillful predictions of events months-to-years in advance. Previous work has demonstrated that climate models can predict marine heatwaves up to 12 months in advance in key regions, but no studies have attempted to predict OAX. Here we use the Community Earth System Model (CESM) Seasonal-to-Multiyear Large Ensemble (SMYLE) to make predictions of both MHW and OAX events. We find that CESM SMYLE skillfully predicts discrete MHW and OAX events up to 1 year in advance. Skill is highest in the tropical and northeast Pacific, reflecting the contribution of El Niño-Southern Oscillation. A forecast generated in late 2023 during the 2023-24 El Niño event found high likelihood for widespread MHWs and OAX in 2024.

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