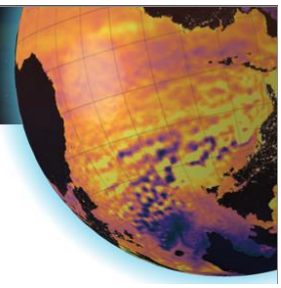

Evaluating the prediction skill of correlative estuarine species distribution models trained with mechanistic model output

Predicting the change in the distribution pattern of estuarine and coastal organisms is critical for mitigating risks associated with climate change and environmental variability. Correlative species distribution models (SDMs), which relate species' abundances to environmental data using machine learning methods, are particularly useful for generating such predictions as they do not require a priori insight into the complex species' dynamics. Although correlative SDMs are typically developed using in situ environmental observations, their predictions are commonly created by forcing SDMs with environmental information generated by mechanistic models. This hybrid data-model approach can expand the temporal and spatial domain of the projections. However, it may decrease the SDM prediction skill because of biases associated with the mechanistic model output. We test the hypothesis that training SDMs using environmental mechanistic model output may enhance model prediction skill by compensating for biases in the mechanistic model. We train SDMs for seven estuarine harmful algal bloom taxa (HABs) observed in the Chesapeake Bay (U.S.A.) using both multi-decadal in situ environmental observations and mechanistic environmental output provided by a 3D hydrodynamic - biogeochemical model. Training the SDMs using mechanistic model output, rather than in situ data, improves the model prediction skill by more than 10 %. This demonstrates that although errors in SDM predictions can be caused by using imperfect environmental fields derived from mechanistic models, these uncertainties may be diminished by training SDMs using these same environmental fields. Our insights will be used to add multiple HABs to our Chesapeake Bay Environmental Forecasting System (www.vims.edu/cbefs).

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