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Emergent biogeography of phytoplankton communities in a model ocean

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We present a novel model of marine ecosystems in which a diverse initialized phytoplankton community self-organizes according to relative fitness in the physical, chemical and predatory environment. Community structure and the physiological character of the dominant organisms are emergent properties. Results from idealized one-dimensional models and an ensemble of global simulations, coupled to an ocean general circulation model, show plausible and robust phytoplankton biogeography. In a test case the global model successfully reproduces the observed relationships between the physiology and habitats of ecotypes of the cyanobacteria *Prochlorococcus*. This approach provides a new framework for studies of microbial ecology and genomics and in which to test and examine theories of the relationships between ecology, biogeochemical cycles, variability and climate change.