



Monitoring and Predicting the Export and Fate of Global Ocean Net Primary Production: The EXPORTS Field Program

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Ocean ecosystems play a critical role in the Earth's carbon cycle and its quantification on global scales remains one of the greatest challenges in global ocean biogeochemistry. The goal of the EXport Processes in the Ocean from Remote Sensing (EXPORTS) science plan is to develop a predictive understanding of the export and fate of global ocean primary production and its implications for the Earth's carbon cycle in present and future climates. NASA's satellite ocean-color data record has revolutionized our understanding of global marine systems. EXPORTS is designed to advance the utility of NASA ocean color assets to predict how changes in ocean primary production will impact the global carbon cycle. EXPORTS will create a predictive understanding of both the export of organic carbon from the euphotic zone and its fate in the underlying "twilight zone" (depths of 500 m or more) where variable fractions of exported organic carbon are respired back to CO₂. Ultimately, it is the sequestration of deep organic carbon transport that defines the impact of ocean biota on atmospheric CO₂ levels and hence climate. EXPORTS will generate a new, detailed understanding of ocean carbon transport processes and pathways linking upper ocean phytoplankton processes to the export and fate of organic matter in the underlying twilight zone using a combination of field campaigns, remote sensing and numerical modeling. The overarching objective for EXPORTS is to ensure the success of future satellite missions by establishing mechanistic relationships between remotely sensed signals and carbon cycle processes. Through a process-oriented approach, EXPORTS will foster new insights on ocean carbon cycling that will maximize its societal relevance and be a key component in the U.S. investment to understand Earth as an integrated system.