NASA MUREP/SMD Ocean Biology and Biogeochemistry Awards (OCEAN)

Title: Linking genomic and remote sensing observations to quantify the physiological nutrient stress dynamics in ocean ecosystems

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Summary: Future intensified nutrient stress is one of the main threats to marine pelagic biodiversity and productivity. Climate warming and thermally driven water column stratification reduce the supply of nutrients and drive an expansion of oligotrophic environments. The different growth-limiting elements have unique ocean biogeochemical cycles, residence times, and predicted future changes. However, we only have a rudimentary understanding of changes to nutrient stress across time and space due to methodological constraints. One big challenge in understanding global production and development of ecosystem-based management strategies is understanding drivers of changes to nutrient stress across time and space. To date, methodologies have been limited.

The proposers have developed a novel metagenomic method that can detect the type and severity of nutrient stress in different ocean regions. Using this approach, they will attempt to link genomic nutrient stress biomarkers with a to-be-developed diagnostic satellite remote sensing data product(s) of phytoplankton physiological status and community composition regionally. This is foundational work for missions such as PACE. Regional shifts in nutrient limitation and the vulnerability of coastal and pelagic ecosystems to future water column stratification may be linked to climate change and management solutions. The team will recruit a diverse UCI student group to participate in all aspects of the research, providing mentoring and developing new educational modules and co-teaching a class, and continuously evaluate mentoring effectiveness with metrics. The project anticipates outcomes including: (i) training of underrepresented UCI students in generating and linking genomic and remote sensing observation to describe ocean biogeochemistry, (ii) raise the capacity at UCI in analyzing ocean color data, (iii) a student led global-scale quantification of oceanic nutrient stress and (iv) identifying the sensitivity of ocean ecosystems to future changes in nutrient stress.