VPR follow up from Thursday

Dear Vincent,

Good talking with you Thursday. As promised, I offer the following materials for further consideration. This summary and the supplementary information are available at:

Please let me know if I can provide any additional information.

Best Wishes,

Dennis McGillicuddy

(1) Funded VPR project - “Hotspots”

PIs McGillicuddy, Stanley, and Purcell were awarded a project from the Dalio Explore Fund in 2015 to explore hotspots in plankton productivity. The mission was originally envisioned for deployment on Alucia, was subsequently shifted to Umbra, only to have that vessel retired. An opportunity arose to carry out the hotspots research in concert with a separate NSF-funded project (PI McGillicuddy) and the VPR was used successfully on voyage #29 of the R/V Neil Armstrong in April 2018 (link to video below). Two more cruises will be carried out in 2019, one in May (R/V Ron Brown) and the other in July (R/V Thomas G. Thompson).

Supplementary materials

(a) Dalio Explore Fund Proposal (Funded for a total of $477K, excluding ship time)

(b) NSF Proposal (Funded for a total of $2.9M, excluding ship time)

(c) Video highlighting VPR work on AR29:

<http://science.whoi.edu/users/olga/SPIROPA/video/ar29vpr.mp4>.

(d) Video on shelf break front productivity:

<http://www.whoi.edu/oceanus/feature/life-at-the-edge>

(e) Manuscript in early stages of preparation: “A regional bloom of *Phaeocystis* on the southern New England Shelf.”

(2) Funded VPR project - Coccolithophore blooms in the South Indian Ocean

PI McGillicuddy is funded to use the VPR to survey physical and biological variability in the South Indian Ocean. This area is of particular interest because of the coccolithophore blooms that occur there. Coccolithophores play an important role in the ocean’s carbon cycle not only because of the organic carbon they fix, but also because of the inorganic carbon they use to make their shells. These organisms are under threat because ocean acidification tends to be corrosive to their calcium carbonate shells, thus the need to understand their blooms in the present ocean is particularly pressing. The VPR has been outfitted with additional bio-optical sensors in order to distinguish blooms of coccolithophores.

Cruises to the South Indian Ocean (Durban to Durban) are scheduled for January 2020 and January 2021.

Supplementary materials

(a) NSF proposal (Funded for a total of $3.3M, excluding ship time)

(3) Prior publications by PI McGillicuddy using the VPR

The VPRII has led to a number of important scientific discoveries concerning planktonic organisms, which constitute the base of the marine food web and also play a role regulating global climate through the so-called biological carbon pump. Key insights provided by observations from the VPRII include (1) the impact of mid-ocean eddies in supplying nutrients to upper ocean plankton ecosystems (McGillicuddy et al. 2007), (2) the role of nitrogen-fixing organism *Trichodesmium* spp. in driving productivity (Davis and McGillicuddy 2006; McGillicuddy 2014; Olson et al. 2015a; Olson et al. 2015b), (3) the distribution and variability of a *Phaeocystis antarctica*, keystone species of phytoplankton in the Ross Sea (Smith et al. 2017), and (4) characterization of small scale hotspots in productivity (Stanley et al. 2017).

Supplementary materials:

PDFs of the following

Davis, C. S., and D. J. McGillicuddy, 2006: Transatlantic abundance of the N2-fixing colonial cyanobacterium *Trichodesmium*. *Science*, **312,** 1517-1520.

McGillicuddy, D. J., 2014: Do *Trichodesmium* spp. populations in the North Atlantic export most of the nitrogen they fix? *Global Biogeochemical Cycles*, **28,** 2013GB004652.

McGillicuddy, D. J., L. A. Anderson, N. R. Bates, T. Bibby, K. O. Buesseler, C. A. Carlson, C. S. Davis, C. Ewart, P. G. Falkowski, S. A. Goldthwait, D. A. Hansell, W. J. Jenkins, R. Johnson, V. K. Kosnyrev, J. R. Ledwell, Q. P. Li, D. A. Siegel, and D. K. Steinberg, 2007: Eddy/wind interactions stimulate extraordinary mid-ocean plankton blooms. *Science*, **316,** 1021-1026.

Olson, E. M., D. J. McGillicuddy, S. T. Dyhrman, J. B. Waterbury, D. C.S., and A. R. Solow, 2015a: The depth-distribution of nitrogen fixation by *Trichodesmium* spp. colonies in the tropical-subtropical North Atlantic. *Deep-Sea Research I*, **104,** 72-91.

Olson, E. M., D. J. McGillicuddy, G. R. Flierl, C. S. Davis, S. T. Dyhrman, and J. B. Waterbury, 2015b: Mesoscale eddies and *Trichodesmium* spp. distributions in the southwestern North Atlantic. *Journal of Geophysical Research: Oceans*, **120,** 4129-4150.

Smith, W. O., D. J. McGillicuddy, E. B. Olson, V. Kosnyrev, E. E. Peacock, and H. M. Sosik, 2017: Mesoscale variability in intact and ghost colonies of Phaeocystis antarctica in the Ross Sea: Distribution and abundance. *Journal of Marine Systems*, **166,** 97-107.

Stanley, R. H. R., D. J. McGillicuddy Jr, Z. O. Sandwith, and H. M. Pleskow, 2017: Submesoscale hotspots of productivity and respiration: Insights from high-resolution oxygen and fluorescence sections. *Deep Sea Research I*, **130,** 1-11.