PhD and postdoc position available

A multi-scale modelling approach for understanding time- and space-scales of variability within the western Indian Ocean.

These projects focus on a couple of work packages of a Bertarelli Foundation funded project that was conceived in collaboration with partners from the University of Plymouth.

Project background:
Dynamical oceanographic processes are increasingly understood as being instrumental in creating biophysical niches that are exploited by animals to increase foraging efficiency and conversely avoid predation, whilst also transporting larvae between seemingly spatially discrete locations. Internal waves encourage fish schooling over submarine banks and seamounts, attracting foraging porpoises [1] and sharks [2]. In the open ocean, basking sharks track thermal fronts [3,4] whose convergent currents accumulate zooplankton. Coherent structures arising through instability of ocean currents are tracked by birds due to increased food abundance within them [5], a dynamical process similar to the generation of warm core eddies preferred by great white sharks due to richer prey fields within them compared to cold-core eddies [6]. The background circulation throughout the ocean, but particularly near to the numerous reefs and atolls where dynamic processes are intensified and particulate matter originates, is further critical to the transport of suspended particles including microscopic larvae from animals and corals but also plastic fragments. The benthic community is directly impacted by internal waves which are implicated in the relief of thermal stress experienced by corals as they are flushed with cooler water upwelled from depth over slopes surrounding atolls and seamounts

Understanding and modelling the spatiotemporal variability in oceanographic processes responsible for generating these biologically-important features is thus critical to the identification of key locations within ecosystems of the western Indian Ocean within which specific species aggregate, rendering them especially susceptible to exploitation. We propose the development of a multi-scale numerical modelling approach to identify the dynamical oceanographic processes and resulting flow fields responsible for shaping regional ecosystems of the western Indian Ocean. The project will identify biophysical ‘hotspots’ and trajectories of particles including larvae, enabling the design of surveys to detect the enhancement in biological activity and informing the results of the observational studies.

This project combines the proven expertise of the University of Plymouth, theUniversity of Cape Town and the South African Environmental Observation Networks’s numerical modelling teams. The UK (Plymouth) team has a track record in the development of high resolution Massachusetts Institute of Technology general circulation model (MITgcm, [9]) simulations to assess ocean dynamics operating at the finescale whilst the South African (Cape Town) team has published numerous papers on their CROCO (Coastal and Regional Ocean Community Model) model simulations of the evolution of dynamics throughout the Western Indian Ocean.The partnership established within this project will see the sharing of modelling approaches, manifested as the use of the basin-scale conditions as boundary conditions for initialising the high resolution regional models.

Postdoc/PhD scope of research

The PhD and postdoc positions available will focus on developing high resolution CROCO simulations (nested from the basin-scale to high resolution regional domains of key localities) applied to the western Indian Ocean (WIO). Various modelling approaches (e.g sensitivity tests, lagrangian particle tracking, biogeochemical coupling, downscaling over individual atolls using Delft 3D at very high resolutions) will be used to understand the implication of climate variability and ocean features and their variability on the biological 'hotspots' of the WIO. The postdoc and PhD should work closely as a team to cover all of the aspects of this project, while the postdoc will additionally be involved with capacity development programs (i.e. numerical modelling training workshops). Both the PhD and Postdoc candidates will contribute to the development of high resolution ocean modelling within South Africa and will be expected to present at national and international conferences and mentor or supervise students where possible.
Given this is a collaborative project with the University of Plymouth there will be scope for the PhD and Postdoc to spend time with the collaborators in Plymouth for skills development and project meetings

Selection criteria:

- **For the postdoc:** PhD degree ,obtained within the past five (5) years, related to physical oceanography or atmospheric science, demonstrable numerical modelling experience (preferably CROCO/ROMS), proficient in coding (python and/or matlab) and a strong publication track record. Expertise in western Indian Ocean dynamics would be a strong advantage. Candidates should not have been in permanent employment or held academic positions.
- **For the PhD:** MSc degree related to physical oceanography or atmospheric science, experience with coding (preferably python and/or matlab)
- Creative, responsible, diligent, critical, analytical and innovative mindset
- Ability to work independently and as part of a team
- Excellent written and oral communication skills in English

Registered: University of Cape Town (UCT)

Supervision: Prof Chris Reason, Prof Juliet Hermes, Dr Jennifer Veitch

Collaborators: Dr Phil Hosegood, Vasyl Vlasenko and Nataliya Stashchuk

Duration: 3 years for the PhD

3 years for the postdoc

Enquiries: ja.veitch@saeon.nrf.ac.za

Deadline: Open until filled

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6. Gaube, P., C.D. Braun, G.L. Lawson, D.J.McGillicuddy, A. Della Penna, G.B. Skomal, C. Fischer, S.R. Thorrold, 2018: Mesoscale eddies influence the movements of mature female white sharks in the Gulf Stream and Sargasso Sea. Scientific Reports, 8, 7363.