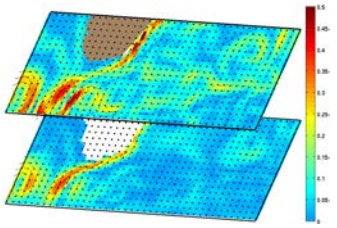
SPITFIRE Training Partnership

Joining the dots: How are the SW Indian Ocean flows linked to the Agulhas Current?

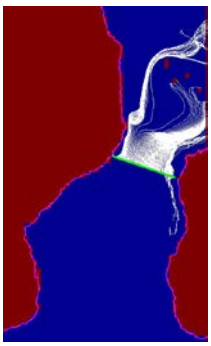
University Supervisors: **Prof. Meric Srokosz & Dr Katya Popova (University of Southampton)**
PML Supervisor: **Dr Graham Quartly (gqu@pml.ac.uk)**



Background: The flow of warm salty water from the Indian Ocean into the Atlantic via the Agulhas Current flowing along the east coast of South Africa is a major part of the global overturning circulation. The Agulhas has been extensively studied, but the circulation of the southwest Indian Ocean, particularly in the vicinity of Madagascar, that feeds the Agulhas is much less well understood. Unanswered questions include:

- How much of the East Madagascar Current (EMC) feeds into the Agulhas and how much recirculates into the Indian Ocean?
- Does this flow vary seasonally and inter-annually?
- How is this flow modulated by the presence of the eddy field to the east and south of Madagascar?
- Does the recirculation involve the South Indian Ocean Counter-Current (SICC)?
- What is the origin and structure of the SICC?

There is a need to "join the dots" of the southwest Indian Ocean circulation to clarify the relative roles of the EMC, the flow through the Mozambique Channel and the mesoscale eddy field in feeding warm salty water into the Agulhas Current and thence into the South Atlantic. This project aims to join the dots.



Methods: The primary tool used in the study will be the Lagrangian particle-tracking software Ariane, applied to the eddy-resolving 1/12˚ resolution global NEMO ocean model to delineate the currents and eddies around Madagascar and linkages with the Agulhas. Both forward and backward tracking will be used to examine where the water masses flowing go (possible pathways to the Agulhas) and where they have originated from. This will allow the determination of the amount of Indian Ocean water feeding the Agulhas and the amount that re-circulates back into the Indian Ocean. It will also allow the study of the seasonal and interannual variability of the flows and the impact of the eddy field in the vicinity of Madagascar on the linkages. In addition, satellite measurements of currents will be compared with the NEMO model to test its accuracy in representing the currents and eddies in this region (noting however that the resolution of the altimeter data at 1/3˚-1/4˚ is poorer than that of the 1/12˚ NEMO). Flows may also be compared with data from current meters on moorings to the south of Madagascar.

Training: The SPITFIRE Training Programme programme provides comprehensive personal and professional development training alongside extensive opportunities for students to expand their multidisciplinary outlook through interactions with a wide network of academic, research and industrial/policy partners. The student will be hosted at the **National Oceanography Centre Southampton**, and will be trained in the use of Ariane particle-tracking software and in satellite data analysis. There may also be opportunities to analyse current meter data and go to sea on a research cruise.

References: Beal L. M. et al., 2011, On the role of the Agulhas system in ocean circulation and climate, *Nature*, 472, 429-436.
Quartly G.D. et al., 2006, Eddies around Madagascar – The Retroflection re-considered, *J. Marine Systems*, 63, 115-129.
Srokosz M.A. et al., 2015, Could the Madagascar bloom be fertilized by ... iron? *J. Geophys. Res* 120, doi: 10.1002/2015JC011075