

Several MSc and PhD research opportunities are available within the NRF Earth System Science Research Programme (ESSRP) project, Effect of Coastal Ocean Extremes (ECOE)

The ECOE project aims to assess trends, drivers of change, and their contribution to the Coastal Ocean System (COS) variability, emphasising extreme events. We will focus on the impact of wind variability and its interaction with ocean dynamics, as wind is a primary driver of changes like upwelling intensity and has significant economic consequences on coastal operations.

We will investigate how shifting wind and ocean temperature regimes affect the East Agulhas Bank, the area between Cape Agulhas and Cape Hanglip, and the Benguela Upwelling System (BUS). We will address questions on wind dynamics' pressure on the Agulhas Current (AC) and BUS and local ocean parameters' impact on regional wind fields and atmospheric processes, as well as the response of people and industries in the region.

Recognising changes occurring at various scales, our research seeks to understand this changing variability, extremes, and impacts, assessing effects on ecological, sociological, governance, and macroeconomic systems. We contend that management practices should align with ocean dynamics' appropriate scale, aiming to enhance evidence-based management over relevant spatial and temporal scales, projecting up to 2070.

Our transdisciplinary team will offer unique insights to enhance our understanding of system dynamics. These insights will inform the application and communication of findings, supporting the development of an ecosystem-based management framework.

Research projects are available within three sub-projects

Sub-Project 1 develops a view of marine ecosystems. It takes a comprehensive approach that extends from **physics to fish**. SP1 will focus on the East Agulhas Bank, a region of high ecological and economic importance. We will investigate the impact of changing wind patterns via modulations of and interactions with the AC and how these changes affect the resilience and behaviour of fish species, which in recent years have been experiencing mass mortalities due to thermal shocks. The major impact will be on scientific knowledge generation, as our work will provide a comprehensive understanding of the physical and biological processes that underpin the region's marine ecosystems. The research team include IMR (Norway), SAEON's Egagasini Node, Rhodes University's Department of Ichthyology and Fisheries Science, and the Biodiversity and Conservation Biology Department at the University of the Western Cape (UWC).

SP1 candidate requirements (1 PhD + 1 MSc): Candidates will have an oceanography or biological sciences background.

Sub-Project 2 will focus on the human dimension—**fish to people**—examining how coastal communities (fishers) respond to changing wind patterns, ocean dynamics, and temperature fluctuations on small spatial and temporal scales. We will investigate how these changes affect how representative fishers adapt their fishing practices to accommodate the shifting resources they feel are being managed due to policies developed for far larger spatial scales over longer periods. The major impact here will be on policy, with applications extending to supporting the development of adaptive strategies for coastal communities and industries. Additionally, this sub-project will provide insights into the socio-economic impacts of environmental changes on coastal livelihoods, enabling the development of targeted interventions and support mechanisms for vulnerable communities. Involved parties leading the research are from UCT's African Climate and Development Initiative (ACDI) and Future Water, the Applied Centre for Climate and Earth System Science (ACCESS) hosted at the CSIR, and the UWC.

SP2 candidate requirements (1 PhD + 1 PhD or MSc): Candidates will have a background in biological, environmental, or geographical sciences and have an interest in the socio-economic or socio-ecological aspects of ocean-dependent communities.

Sub-Project 3 will focus on the economic dimension, from **physics to finances**. The problem being addressed in this study stems from the fact that certain wind conditions in Table Bay and at the Port of Cape Town (PoPCT) periodically exceed operational safety thresholds in various sections of the PoCPT, resulting in the suspension of specific operations (e.g. ship movement, crane movement, container loading etc.). The need exists to understand (and forecast) the distributional dynamics of winds in and around the port on a short-term operational basis to develop a high-resolution spatially distributed wind field forecast system for a wind management plan. The study will use Computational Fluid Dynamics and other modelling approaches (part of the work will be to assess and select optimal approaches). The partners in the project will be the Transnet Port Authority and Transnet Port Terminals, the CSIR, UWC, SAWS, and VITO (based in Belgium).

SP3 candidate requirements (1 PhD + 1 PhD or MSc): The candidates will need a background in an appropriate research discipline (mathematics, applied mathematics, physics, meteorology, oceanography, or engineering), experience in appropriate modelling systems, and preferably a background in and familiarity with fluid dynamics or meteorology.

Supervision and Project Management

ECOIE is co-managed by Profs. AJ Smit (UWC) and Neville Sweijd (ACCESS). The postgraduate research projects will be supported by a committee of experts within the ECOIE project, with an official supervisor from an appropriate academic institution where the research will be situated.

Applications and Enquiries

To apply, kindly send your CV, academic transcript, the names of two referees, and a cover letter addressed to AJ Smit or Neville Sweijd. In your cover letter, please specify the sub-project you are interested in. Additionally, feel free to reach out with any questions regarding the research before formally submitting your application.

Prof. AJ Smit: ajsmit@uwc.ac.za

Prof. Neville Sweijd: nsweijd@access.ac.za

Application closing date: 31 January 2025