

Bursaries and Fellowships

Extreme Climatic Events in the Coastal Zone

We invite suitably qualified individuals to apply for MSc, PhD and Post-Doctoral research positions within the above research theme at the Department of Biodiversity and Conservation Biology, University of the Western Cape (UWC). The projects will be supervised and coordinated by A/Prof. AJ Smit (UWC), A/Prof. Tommy Bornman (South African Environmental Observation Network, SAEON), Dr Rakhee Lakhraj-Govender (Tshwane University of Technology, TUT), and Dr Christo Rautenbach (South African Weather Service, SAWS).

To apply, submit via email to A/Prof. AJ Smit (ajsmit@uwc.ac.za) a single PDF comprised of 1) a one-page cover letter discussing your skills and experience, and why you want to apply for the bursary/fellowship; 2) a current CV; 3) copies of your qualifications; and 4) the names of three professional referees.

Closing date 18 January 2019. Details below.

General background

Coupled atmosphere-marine climates affect ecologically and socio-economically important coastal systems. Our aim is to use various sources of data to assess the evidence and potential for change in this zone. This multidisciplinary research will take place under two themes, *i.e.* i) the physical climate dynamics with a view of slow-pace long-term change and rapid-onset extreme events, and ii) the biotic (ecosystems and human societies) responses.

We propose to take advantage of contrasting conditions integrated in the physical climate record of the South African regional atmospheric and marine environment. Coastal seas are mediated by oceanic influences stemming from the dynamical properties of the Agulhas and Benguela Currents. Although the geophysical conditions in question relate specifically to the coastal water column thermo- and hydrodynamics (*i.e.* seawater temperature, and wave and swell conditions, respectively) and their attendant local influences, we by necessity need to simultaneously consider the regional and hemispheric atmospheric and marine context. Within this framework, we ask:

- (1) *Are there signs of change in the dynamical signals embedded within the existing marine and atmospheric data record?*
- (2) *How do we project these changes into future scenarios (up to 100 years), which coastal areas are most at risk, and how?*
- (3) *What portion of change is attributable to anthropogenic and natural drivers?*
- (4) *Is there corresponding change the biology, ecology, tolerances and biogeography of the biota associated with representative and key ecosystems?*
- (5) *What are the consequences for our natural ecological engineer species and societies around the South African coastline, and in particular the Western Cape?*
- (6) *What does the future landscape around our coast look like after having undergone the above-mentioned changes?*

Simply stated, the above translates to, *what are the relative roles of change in storminess, rising water-levels, and change in temperature as drivers on biotic and socio-economic processes and prospects in the coastal zone?*

Project-specific details

MSc projects (x2): 2019-2020

Project A.3–This MSc research project is a statistical investigation of changes in the South African atmospheric record (NOAA, *etc.* vs. SAWS data) using a variety of suitable analytical techniques. The applicant should ideally have a background knowledge of regional and hemispheric atmospheric processes. Supervisors: Lakhraj-Govender and Smit.

Project A.4–This MSc research project investigates teleconnections between extreme events at the South African coastline and large-scale atmospheric drivers (*e.g.* ENSO and SAM). The ideal candidate will have an interest in applying machine-learning approaches to complex data sets. Supervisors: Rautenbach, Lakhraj-Govender, and Smit.

PhD projects (x3): 2019-2021

Project A.1–This PhD-level project will incorporate wide-ranging inquiries around multiple climatic data sets that we deem suitable to provide the kinds of outputs that can be used as predictors for biotic/socioeconomic responses. It addresses the question, *are there signs of change in the dynamical signals embedded within the existing marine and atmospheric data record?* Supervisors: Rautenbach, Lakhraj-Govender, and Smit.

Project B.1–This PhD project will take promising signals produced by Project A.1 and couple it with a signal-finding mission centered around the biological data. As with Project A.1, the research (thesis) structure is also partitioned around the multiple climatic data sets. Specific research questions are, *i) linked to the climatic/environmental changes, are there corresponding changes in the biology, ecology, environmental tolerances and biogeography biota associated with representative and key ecosystems; and ii) what are the consequences for our natural ecological engineer species and societies around the South African coastline, and in particular the Western Cape?* Supervisors: Smit, Bornman, and Rautenbach.

Project C.2–This PhD project will run concurrently with, and draw from the outcomes of Projects A.1 and B.1; additionally, it will ask, *what does the future landscape around our coast look like after having undergone the above-mentioned changes?* The main outcome of this work will be around Sensitivity Mapping and Coastal Zone Management and Marine Spatial Planning, and it will target the necessary and relevant stakeholders with the intent to inform policy and assist planning. The ideal candidate will have some GIS experience. Supervisors: Rautenbach and Smit.

Post-doctoral: 2019-2020, with the possibility of an extension into 2021

Project C.1–This project is suitable for a Post-Doctoral Fellow, and will form the basis of the overall synthesis (coupling and overarching Themes A and B). It will add the forward-looking components, and include machine learning approaches that relate to the questions, *i) how do we project these changes into future conditions (up to 100 years); ii) what does the future landscape around our coast look like after having undergone the above-mentioned changes; and iii) what portion of change is attributable to anthropogenic drivers and natural drivers?*

Qualifications, experience, and skills

- BSc (Hons), MSc, or PhD (as appropriate) degrees in Earth, Environmental, Biological, or related sciences.
- An aptitude for creatively solving numerical/data analytical problems.
- Experience with the use of a programming/scripting language such as R, python, MATLAB, etc., for the analysis of large climatic data sets.
- Experience with (at PhD and Post-Doc levels), or willingness to learn (for MSc level) Amazon Web Services (AWS) or other Linux-based high-performance computing systems.