Institution	Principal Investigator	Short Title	Short Description of the Project	Primary Research Fields: Secondary Research Field-Fields of Specialisation
Bayworld Centre for Research and Education	Lamont, T DR - tarron.lamont@gmail.com	SAMOC-SA	Maintenance of an extensive array of continuous measurements across both the North and South Atlantic, and its neighbouring basins, has been highlighted as crucial to attaining a better understanding of the Atlantic Meridional Overturning Circulation (AMOC), and its impacts on global climate. The MOC is the primary mechanism for transport of heat, salt and carbon between ocean basins, and past changes in the strength of the MOC have been linked to substantial climate variations. Future predictions suggest that the MOC will continue to modulate climate change on timescales from decades to centuries, but recent observations have stressed the importance of short-term fluctuations from days to years. Recognition of the critical importance of the South Atlantic led to the creation of an international community initiative on the South Atlantic Meridional Overturning Circulation (SAMOC). The local branch of this initiative, SAMOC-SA, has been underway since 2013 and consists of diverse South African observational platforms aimed at monitoring long-term physical-chemical changes within the ocean current systems around South Africa, as well as their impact on local and global climate. The SAMOC array consists a combination of tall moorings, CPIES, full depth CTD stations, Argo deployments, sea time on the RS Algoa and the SA Agulhas II, as well as a multitude of underway and surface measurements extending across the Greater Agulhas Current system and its inter-basin leakage. SAMOC-SA fulfils the core objectives of the 2014 DST Plan for Antarctica and the Southern Ocean, the national Marine and Antarctic Research Strategy (MARS), and the DST 10-year Innovation Plan. Through partnerships with participating SAMOC countries, we seek to achieve implementation of the Galway Statement on Atlantic Ocean Cooperation and the Belém Statement on Atlantic Research and Innovation Cooperation. This application is for on-going support to continue SAMOC-SA's current monitoring capabilities.	Physical sciences	Earth and marine sciences : Environmental studies	Oceanology - Physical oceanography	Satellite oceanography	Bio-Optics	Ocean colour remote sensing

| CSIR - Natural Resources and the Environment | Nicholson, S DR - snicholson@csir.co.za | Contemporary and Future Drivers of CO2 and Heat in the Southern Ocean | The contemporary Southern Ocean mitigates the effects of anthropogenic climate change through its disproportional uptake of carbon and heat. However, it is not well understood how this role will evolve under different emission and mitigation scenarios. The Southern Ocean also remains the largest source of global ocean uncertainty in the global estimates of CO_2 and heat fluxes. While much has been achieved globally and regionally in constraining the variability and some of the mechanisms that drive Southern Ocean CO_2 and heat fluxes separately, we propose that a significant part of the challenge lies in the lack of research on CO_2 and heat together to better understand the feedback and the mechanisms that drive those feedbacks. This project aims to examine the changing role of the Southern Ocean in global climate by looking at the two main drivers CO_2 and heat, in an integrated way using an unprecedented 10-year high resolution glider dataset from the 2012-2022 SOSCEx experiments, including two new experiments planned for this proposal, in combination with an established eddy resolving model BIOPERIANT12. We aim to gain a better understanding of how the interaction of atmospheric synoptic cycles (storms) and fine-scale (0.1-100 km) ocean processes influence seasonal-decadal variability of CO_2 and heat fluxes. This will include the extent to which they feedback on each other and ultimately contribute to a better understanding of the role of the Southern Ocean in the global carbon-climate system.

The expected three outcomes are
1. Improved observational constraints for the contemporary seasonal-interannual variability of CO_2 and heat fluxes.
2. Understanding of how storms and their interaction with fine-scale dynamics influence the seasonal and interannual variability of CO_2 and heat fluxes.
3. Identify the potential mechanisms that could explain the decadal anomaly in CO_2 fluxes at the end of the 20th century. | Physical sciences : Biological Sciences - Ocean biogeochemical modelling \| Physical oceanography \| Biogeochemistry - Southern Ocean \| Ocean modeling \| Southern Ocean research |

| Department of Environmental Affairs | Mtshali, TN DR - tmtshali@environment.gov.za / thato.mtshali64@gmail.com | Seasonal Iron speciation in the Southern Ocean, from open ocean environments to naturally fertilized sub-Antarctic Islands (Marion and Gough Islands) | The Southern Ocean (SO) is one of the largest high-nutrient low-chlorophyll regions in the World's Ocean, where primary productivity (PP) is limited by iron (Fe) bioavailability, thereby impacting the strength and efficiency of biological carbon pump. There are, however, exceptions with large phytoplankton blooms persistently observed downstream of the Sub-Antarctic Islands. While extensive research has focussed on Fe-biogeochemistry around Kerguelen and Crozet islands, no such studies have been conducted at Marion and Gough islands. Furthermore, while our previously funded SANAP/NRF proposal has made substantial advances toward addressing the gaps in seasonal data coverage through SCALE 2019 winter and spring cruises, there is still a paucity of dissolved Fe data in the SO, especially from autumn to late-spring. This is severely hampering our understanding of the full seasonal biogeochemical Fe cycle and its impact on PP. This project aims to continue its focus on seasonality by expanding seasonal coverage of Fe measurements to include autumn (Marion) and late-spring (Gough) cruises for more comprehensive coverage of the SO seasonal cycle, with a particular focus on quantifying biogeochemical cycling of Fe-pool around these understudied islands. To strengthen this project further, we propose to investigate temporal Fe dynamics and the drivers of naturally-fertilized regions downstream of both islands; with the aim to quantify cycling processes of Fe and organic speciation in order to improve our knowledge on Fe bioavailability. We aim to quantify (regionally and seasonally) an array of parameters that have not previously been reported during autumn or late spring in this region, including Fe (and Cu) organic speciation, particulate Fe, humic substances and Fe(II) oxidation-kinetics. In addition, we will use a state-of-the-art ocean biogeochemical model and run novel simulations within the high resolution BIOPERIANT12 configuration to complement the field work. | Earth and marine sciences | Chemical sciences : Analytical chemistry -Marine chemistry | Biogeochemistry - Southern Ocean |

| Nelson Mandela University | Connan, MA DR - maelle.connan@gmail.com | Avian scavengers as indicators of recovery of an island biota | Ecosystem processes are changing worldwide, especially with the impacts of invasive species being exacerbated by climate change. This is particularly obvious in the Southern Ocean where a warmer and dryer environment allows the proliferation of species once limited by the cold climate. South African Special Nature Reserve, Marion Island is no exception. A recent proliferation of invasive House Mouse Mus musculus attacks on endangered breeding seabirds suggests a profound alteration of the natural ecosystem. This has led to the planned eradication of mice at Marion Island. The only viable approach is likely to result in the poisoning of some non-target fauna, especially three data deficient species of avian scavengers: Black-faced Sheathbill Chionis minor, Kelp Gull Larus dominicanus and Brown Skua Stercorarius antarcticus. By focusing on these three species and some of their prey, we intend first to fill identified scientific gaps that are crucial for best planning of the eradication and development of appropriate mitigation measures. Second, we propose to use the three scavengers as indicators of recovery of the terrestrial ecosystem post-eradication by establishing baselines for the scavenger guild and their prey against which the impact of a successful mouse eradication can be measured in years to come. By using avian scavengers as indicators of terrestrial ecosystem functioning, we will be able to infer the recovery of lower trophic levels and, through this holistic approach, how the whole island ecosystem recovers. Over the three years of the project we aim at filling gaps in genetics, phenology, demography, trophic ecology and disease ecology of these three species. Science of a high standard will be completed by an international team, while data will be swiftly shared with the eradication team and other stakeholders to ensure the application of the results. We envision our project to be at the forefront of research driven conservation in the Southern Ocean. | Biological sciences : Zoology | Marine biology | Biochemistry -Trophic interactions | Marine top predators | Seabird ecology | Seal ecology | Lipids | Stable isotope ecology | Genetic analysis | Antarctica and Southern Oceans | Marine ecology | Coastal ecology |

| South African National Space Agency (SANSA) | Kosch, MJ Prof - mkosch@sansa.org.za | SANAE HF radar | The scientific goal of the SANAE HF radar programme is to increase understanding of important aspects of the dynamics of the high latitude ionosphere, thermosphere and magnetosphere, magnetosphere-ionosphere coupling; the interaction of the magnetosphere with the solar wind and the energy transfer mechanisms between the solar wind, the magnetosphere, the ionosphere and the upper atmosphere; as well as the impacts of the above processes. The SANAE HF radar is part of an international network of 35 similar radars in both hemispheres that work together to provide global coverage and unified data products, and is Africa's only contribution. By virtue of the fact that there are relatively few HF radars in the southern hemisphere, and that the SANAE radar was upgraded to the most advanced technical version in the network, we find ourselves in a relatively unique position to tackle new and interesting scientific problems. At the same time, this radar project is the most successful worldwide in terms of graduating postgraduate students, who learn a wide range of transferable skills at a high level. A major part of this proposal is for technical and engineering developments as well as radio wave propagation studies, and also operations in a challenging environment. | Physical sciences : Geospace physics | Particle and plasma physics | Space and earth science - Geospace physics |

South African National Space Agency (SANSA)	**Lotz, SI DR - slotz@sansa.org.za**	Polar Space Weather Studies	The main of goal of the Polar Space Weather Studies (PSWS) project is to enable the observation of high latitude space physics phenomena for research and operational purposes through the South African National Space Agency (SANSA).	Physical sciences : Geospace physics	Space and earth science - Geomagnetically induced currents	Geomagnetic pulsations (ULF waves)
			Therefore, the requirements set out in this proposal are mainly to provide for the maintenance and installation of instruments and the the dissemination of data from these instruments.	
			The lack of suitable locations in the southern high latitudes makes the South African footprint in the southern ocean and on the Antarctic continent a valuable asset for space physicists and the general public through the space weather applications described below. South Africa's geographically advantageous position allows for a unique suite of instruments placed on the Marion Island (MI), Gough Island (GI), and SANAE IV bases, and on board the SA Agulhas II research vessel (SAA).	
			The data collected by this network of instruments allows SANSA and its partners to conduct cutting edge research, develop products for industry while developing human capital through post-graduate student supervision, appointments of technicians and engineers, and science outreach efforts.	
			Research is done on a variety of topics within space physics, broadly outlined as	
			1. GNSS perturbation studies	
			2. Low frequency waves as ionospheric and magnetospheric probes	
			3. Geomagnetic field observations	
			4. Investigating conjugate auroras with optical instruments	
			5. Radiation belt studies with riometer observations	
			6. Cosmic ray and dosimetry studies	
			This proposal outlines ongoing and new research efforts in collaboration with national and international partners. We will highlight how existing and new research and partners, from academia and industry, will fit in to the project and the broader themes and aims of the National Research Foundation.	

Stellenbosch University	Bekker, A PROF - annieb@sun.ac.za	The Digital SA Agulhas II - Flagship for Vessel 4.0	Today, the SA Agulhas II (SAAII) is equipped with +200 engineering sensors. She boasts an unparalleled full-scale data history which has proven its crucial utility to validate the POLARIS Risk Index for the International Maritime Organization and has led to internationally published research on ice-induced propeller moments, wave slamming and human task performance.	Engineering sciences : Mechanical engineering -Human exposure to vibration	Drive train vibration	Vibration measurement	High strain rate material characterisation	Mechanical vibration transmission	Vibration analysis	Digital signal processing

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It is proposed to fully leverage the unique advantage of scarce operational full-scale data towards new research contributions in shipping. Additionally, to push the SAAII to yet another frontier by transpiring her evolution as a digital asset, hinging off Maritime 4.0.

New engineering models for ships require validation against real data. The SAAII, her working environment, her sensors and her access culminates to data and matchless practical traction. On board, research ideologies are pruned by the "school of practice" and first-hand experience of the needs of officers, crew and passengers.

The digitization deliverables for the SAAII fall in the ambit of three criteria:
1. The novelty required for engineering research impact;
2. Digital services with benefits to ship stakeholders;
3. Digitization with commercial prospects;

Subject to these criteria, four focus areas are identified:
1. A digital twin for the remaining useful life of propulsion components impacted by propeller loads in ice.
2. A smart digital hull for the prediction of ship motion, fatigue and environmental hull loads.
3. Mariner 4.0, a human digital twin to evaluate human task performance and safety.
4. "Google maps for ice" - Navigational assistance for navigators through data aggregation, optimization and machine vision.

The present proposal seeks investment to:
1. Develop novel engineering models and data products;
2. Equip the SAAII for data aggregation; storage & communication;

| Stellenbosch University | **Oliver, R Ms - riaolivier@sun.ac.za** | Antarctic Legacy of South Africa | South Africa, through SANAP, is the only African country with involvement in the Antarctic region, and the main aim of the project is to preserve material of South Africa's involvement in Antarctica, at the Prince Edward Islands, at Gough Island and at sea in the Southern Ocean through photographic, written, oral and other records from 1948 until today. Ria Olivier, the principal investigator, is supported by a multi-disciplinary academic team from SU, Monash University in Australia, the Iziko museums of South Africa, and the University of Cape Town.

Stories, memories, photographs and other documents including personal collections of many of South Africa's finest scientists and explorers in Antarctica and on the sub-Antarctic Islands are collected and stored at the archive repository on Dspace at Stellenbosch University. The envisaged final product will be an online open-accessed digitised information source and a reference to all scientific material published under the auspices or funded by SANAP and of related publications by South Africans who work outside of SANAP.

It is hoped that the database will give recognition to the role that South Africans have played in scientific, biological and meteorological research in the sub-Antarctic Ocean. | History (Humanities): - |

| Stellenbosch University | **Versfeld, DJJ PROF - djjversfeld@sun.ac.za** | Signal Processing and Control of a long-range Unmanned Surface Vehicle for Cetacean Detection in the Antarctic and Southern Seahttps://www.ee.sun.ac.za/djjversfeld/ | A good proxy of overall marine ecosystem health is the abundance and state of marine mammal populations. These ecosystems can be impacted by various factors including but not limited to climate change and human activities. However, the effective monitoring and management of marine living resources - where these living organisms inhabit a vast, mainly inaccessible and hostile environment - requires innovation and the use of the best available technologies and methods [1]. Specifically, monitoring of cetacean populations in the Antarctic and Southern Ocean prove to be very difficult due to the sheer remoteness and harshness of the area.

Systems relying on acoustic signals have an effective reach which can exceed thousands of meters. Therefore, various studies have implemented passive acoustic monitoring (see for instance [2] and [3]) and found these techniques to be very effective, while not causing any significant environmental harm or damage when studying studying aquatic animals and their environment.

Another field of research is the research and development of unmanned surface vehicles. Unmanned surface vehicles have been developed for many diverse applications, ranging from military use, to environmental monitoring and sampling. A very inspiring case study is the recent circumnavigation of Antarctica, with a wind-powered unmanned surface vehicle, collecting data on wind, temperature, ocean currents, salinity, pH, chlorophyll, as well as atmospheric and dissolved gasses.

The aim of this project is twofold. The first aim is to investigate, research and design control algorithms for a fixed sail unmanned surface vehicle, with the aim of long-range missions to the Southern Sea and Antarctica. The second aim is to investigate, research and design detection algorithms for Cetacean vocalisations, making use of passive acoustic monitoring as a dedicated sensor pack on the unmanned surface vehicle. | Engineering sciences : Electronic engineering -Digital signal processing | Error correction coding | Algebraic coding theory | Modulation and coding |

| University of Cape Town | Ansorge, IJ PROF - isabelle.ansorge@uct.ac.za | SEAmester-South Africa's Floating University | The Department of Science, Technology and Higher Education requires platforms to "attract young researchers to the region and retain them by exciting their interest in aspects of global change". Working in conjunction with SAEON's ASCA array, SEAmester introduces marine science as an applied and cross-disciplinary field to students. Its long-term vision is aimed at building capacity within the marine sciences by co-ordinating cross-disciplinary research projects through a highly innovative programme. The strength of SEAmester is that postgraduate students combine theoretical classroom learning with the application of this knowledge through ship-based and hands-on research. The state-of-the-art research vessel, SA Agulhas II, provides the ideal teaching and research platform for SEAmester; its size, comfort and shipboard facilities allow large groups of students and lecturers to productively interact over a period of 10 days. Started in 2016, SEAmester is now into its fifth year. Furthermore, this application will provide an update on the challenges and successes experienced by the SEAmester programme and more importantly provide an assessment on how SEAmester has influenced the lives of many of its students. | Earth and marine sciences : Oceanology -Antarctic/Southern ocean |

| University of Cape Town | Fawcett, SE DR - sarah.fawcett@uct.ac.za | Parallel cycling of nitrogen and iron in the upper Southern Ocean: implications for biological CO2 drawdown and global ocean fertility | Thirty years ago, John Martin proposed that the high nutrient concentrations left unconsumed in Southern Ocean (SO) surface waters result from iron (Fe)-limitation of phytoplankton growth. Extensive culture and field work have since confirmed the central role of Fe in photosynthesis and nitrate assimilation. Given the implications for CO2, most studies of coupled Fe and nitrogen (N) cycling have focused on nitrate assimilation, with little attention paid to the role of Fe in mixed-layer N (re-)cycling. Our preliminary data suggest that Fe exerts a strong control on N regeneration; if verified, this has implications for our mechanistic understanding of the N cycle, now and in the future as the Fe supply to SO surface waters changes. To interrogate the role of Fe in the upper SO N cycle, we propose to measure 1) N uptake, regeneration, and oxidation rates at varying initial Fe concentrations ([Fe]); 2) coupled N and Fe uptake by different phytoplankton groups, separated via size fractionation and flow cytometry, at variable [Fe]; 3) kinetic parameters associated with N uptake, regeneration, and oxidation as a function of [Fe]; 4) the taxonomy and functioning of the associated planktonic (auto-, mixo- and heterotrophic) community. Diverse aspects of SO physics and chemistry are already undergoing climate-induced changes; a major motivation for this proposal is thus to develop expectations for SO fertility and ecology in response to such changes. Our work is also relevant for the nutrient supply to the low-latitude ocean, which is controlled by both the extent of nutrient uptake in SO surface waters and the ratios in which these nutrients are consumed; the latter is strongly affected by Fe availability and species composition. Through this new collaboration, we will train postgraduate students in the application of novel, cutting-edge techniques, thus building research capacity in analytical biogeochemistry that can be exploited beyond the specific aims of our proposal. | Earth and marine sciences : Geochemistry | Oceanology | Ecology and environmental science -Nitrogen - Biogeochemistry | Chemical oceanography | Marine phytoplankton | Environmental biogeochemistry | Isotope geochemistry | Environmental isotopes | Antarctic/Southern ocean | Upwelling studies | Biological oceanography | Climate |

| University of Cape Town | Rampai, T - tokoloho.rampai@uct.ac.za | Influence of physical and biogeochemical processes on the Mechanical properties of Antarctic Sea Ice | Predictive computational models of Antarctic sea ice through metocean thermodynamics are used to determine sea ice extent and break up. These models are also used for input into climate models and for analysis of the effects upon ships and offshore structures (Feltham, 2008). However, these models need to be able to account not just for the thermodynamic fluxes occurring within the sea ice and ocean, but also the dynamic effects on the ice and its resultant fracture mechanics (Rampal et al., 2011). At present, there is a lack of data for the mechanical properties of sea ice within the Marginal Ice Zone (MIZ), which means it is not possible to calibrate and verify computational models.

Sea ice physical and mechanical properties vary greatly due to the meteorological and oceanic conditions experienced, as well as with time (Cox et al., 1984; Petrich and Eicken, 2010). The physical properties such as grain structure, temperature, salinity and brine volume results all affect the measured mechanical properties such as compressive strength, failure envelope, Elastic Modulus and Poisson's ratio.

The unique contribution from a materials engineering approach is:
1. performing lab based experiments to calibrate/test the designed equipment's' suitability for the intended research.
2. the equipment will be used to investigate sea ice dynamics in a controlled and isolated approach (understand the influences of different variables on sea ice properties). This will be done with the reactors we have to make artificial sea ice.
3. use the acquired equipment to test the relevant sea ice properties in situ. | Engineering sciences \| Chemical sciences : Material sciences and technologies \| Metallurgical engineering \| Chemical engineering \| Earth Science - Ceramics \| Physical metallurgy \| Minerals \| Sea-ice Dynamics \| Antarctic/Southern ocean \| Glaciology \| Material science and technology |

| University of Fort Hare | Nel, W PROF - wnel@ufh.ac.za | Landscape and climate interactions | In the Southern Hemisphere, sub-Antarctic islands are the only sentinels to preserve the geomorphic past for the vast Southern Ocean. They are unique not only in size, but also in geographic context when compared to the ice-capped southern continent of Antarctica, and the towering mountain ranges of Patagonia and New Zealand. The sub-Antarctic islands provide the only terrestrial record of Quaternary glaciations and climate within thousands of kilometres of ocean. These are primarily driven by changes in moisture delivery by the southern hemisphere westerly winds, and temperature, which is linked to past concentrations of carbon dioxide in the atmosphere, and the capacity of the oceans' carbon sinks. This project aims to investigate landscape and climate interactions in a changing sub-Antarctic environment: past, present and future through (i) obtaining the ages of the basaltic lava through Ar-Ar dating to place it within a geological chronology which constrains landscape development and glaciation on Marion Island, (ii) to define Marion Island's glacial history within more accurate temporal and spatial scales by using cosmogenic 36Cl surface exposure dating to explain how deglaciation has facilitated landscape development and impacted the colonisation and dispersal of biota, (iii) analyse novel dust and sea salt aerosol proxies in peat deposits to quantify changes in the Southern Hemisphere Westerly Wind regime during the last major reorganisation of the climate system (Termination 1: 18,000–11,000 years ago) to assist in determine how changes in the strength and position of the Southern Hemisphere Westerly Wind belt have controlled moisture delivery, and impacted on the ability of the Southern Ocean to modulate CO2 and (iv) to determine how aspects of the contemporary landscape (aeolian landforms) interact with the current dominant westerly wind patterns to predict for future landform change. | Earth and marine sciences : Physical geography - Geomorphology | Climatology |

| University of KwaZulu-Natal | **MOODLEY, K PROF - moodleyk41@ukzn.ac.za** | Observing Dawn in the Cosmos | A few hundred million years after the big bang, the first stars in the universe were born during a period known as "cosmic dawn." This epoch is uncharted territory: the first and only tentative detection of cosmic dawn was reported in 2018, thus opening a new window into the universe's past that is ripe for discoveries.

Telescopes aiming to study cosmic dawn must observe at radio frequencies (<150 MHz). These frequencies are exceptionally difficult to measure because of contamination from terrestrial radio frequency interference and ionospheric effects. Our team has demonstrated that Marion Island truly offers a South African geographic advantage for low-frequency radio astronomy. The radio-quiet environment of Marion is unparalleled, surpassing even the Karoo desert, which is one of the premier radio observatory sites and the future location of the Square Kilometre Array. With its clean observing conditions, Marion gives us a unique opportunity to deliver high impact science that is impossible to conduct anywhere else in the world.

Our team has installed two radio astronomy experiments on Marion. The first, named PRIZM, is searching for the signal from cosmic dawn and has been operating for three years. We propose to continue these observations, coupled with instrument upgrades and rigorous calibration campaigns in order to obtain a robust detection. The second experiment, ALBATROS, is a companion project that aims to image the radio sky at <30 MHz, improving upon the resolution of current results by a factor of 20-30. We have proven the technology with a few pathfinder antennas, and we propose to build and install additional antennas to complete the full ALBATROS array. Our work is well timed to take advantage of the current solar minimum. The reduced ionospheric activity may allow us to probe the sky at particularly low observational frequencies that are otherwise difficult or impossible to access. | Physical sciences | Mathematical sciences : Astronomy - Observational cosmology | Cosmic microwave background | Large scale structures in the universe | Early universe |
| University of Pretoria | **COWAN, DA PROF - don.cowan@up.ac.za** | Comparative microbial ecology of pan-Antarctic soils | We have, or have guaranteed access to, a very large number (>200) of Antarctic and sub-Antarctic island terrestrial soil samples, many of which have been processed for eDNA extraction and/or deep metagenomic DNA sequencing. The composite (existing and new) NG sequence datasets contain an enormous depth of information, encompassing detailed diversity information on representatives of all three Domains (included phage and viruses), on microbial community structure, the extent of endemism, and inter-organismal interactions. Mining such data will provide valuable information on multiple Antarctic continental issues, including a more comprehensive understanding of regional soil biodiversity, data to inform regional conservation strategies, the extent of microbial community resilience and the possible impacts of climate change, and the potential value of the indigenous genetic resource. | Biological sciences : Microbiology | Biotechnology | Biochemistry - Microbial ecology | Metagenomics | Comparative genomics | Applied and Environmental Microbiology | Microbial enzymes |

| University of Pretoria | de Bruyn, PJN PROF - pjndebruyn@zoology.up.ac.za | Marion Island Marine Mammals in Changing Environments: Individual Heterogeneity and Population Processes | This long term ecological research project addresses how individual variability in large mammals affects population processes. Long-term longitudinal studies focussing on large mammal populations are rare, and investigating population changes at these trophic levels are important indicators of environmental change. Critically, this research requires accurate identification and monitoring of individuals, measuring life history variables and understanding interactions between individuals, and their environment. Availability of resources in the Southern Ocean are closely linked to annual climatic variation, ultimately influencing top predator vital rates. Current long term studies of Marion Island's top mammalian predators; southern elephant seals Mirounga leonina (SES), Subantarctic fur seals Arctocephalus tropicalis (SAFS), Antarctic fur seals A. gazella (AFS) and killer whales Orcinus orca (KW), facilitate observation of climate impacts. Mark-recapture in capital breeding SES investigates individual life-history. Body composition changes of SES individuals, a proxy for foraging success, are measured through photogrammetry, whilst satellite tracking of individuals identifies foraging variability. Dietary, hormonal and genetic profiles inform differential individual breeding and foraging of SES females. These investigations collectively aid in disentangling intrinsic and extrinsic drivers of individual heterogeneity. Income breeding sympatric populations of SAFS and AFS are assessed for a different scale of responses to environmental change through long-term dietary composition, individual foraging behaviour and breeding success. Potential top-down pressure on seal prey is investigated by intensive photographic mark-resight observation and foraging assessment of the local KW population. | Biological sciences \| Earth and marine sciences : Ecology and environmental science \| Zoology \| Marine biology \| Biology -Large mammal ecology \| Monitoring - Wildlife populations \| Seal ecology \| Marine top predators \| Large mammal demography \| Mark-recapture population modelling \| Photogrammetry \| Foraging ecology/behaviour \| Mammal ecology |

University of Pretoria	Lavery, CM DR - charne.lavery@up.ac.za	Africa, Antarctica and the Arts	South Africa and Africa have been marginalised in the history of Antarctica. We have a regional responsibility to serve as a springboard for wider African interests in the high latitudes, but run the risk of not fully maximising the benefits of our geographic advantage. This is due not only to a lack of adequate human capital, but also to an inability to tell the story of African-Antarctic interrelationship in ways that speak to both local interests and international concerns. The synthetic capacities of the arts and humanities are able to stimulate systems scale integration of knowledge and understanding, as well as develop advanced skills in cultural analysis, science communication, and representing complex histories and futures. This is particularly important now because, in addition to paleontological and geophysical links, Antarctica has increasing interrelationship with Africa's climactic future. Africa is widely predicted to be the continent worst affected by climate change, and Antarctica and its surrounding Southern Ocean are uniquely implicated as crucial mediators for changing global climate and currents, rainfall patterns, and sea level rise. In the context of a global rise in research on postcolonial Antarctica and the Antarctic humanities, this research aims to bridge the Antarctica–(South) Africa divide. This aim will be pursued by exploring the wealth of South African visual, artistic and literary material through which Antarctica has been represented and imagined and by bringing the decolonial and postcolonial frameworks of analysis to the southern continent.	Humanities	Arts : Languages and literature	Cultural studies	Environmental studies -Environmental Humanities	Oceanic studies	Global south	Indian Ocean literature	African literature	Indian literature	Antarctica and Southern Oceans	Literary criticism	Ecocriticism	Decoloniality

| University of Pretoria | Makhalanyane, TP PROF - thulani.makhalanyane@up.ac.za | Enhanced insights regarding the ecology, evolution and function of marine microbiomes | Recent studies on geographically strategic marine environments have revealed several insights regarding their diversity and function. Recently, we have started a series of projects aimed at elucidating the role of microbial communities in the sequestration of carbon dioxide. We noted that such an ambitious target would likely form the basis of at least two decades of continuous multidisciplinary research. Over the past 2.5 years, this first SANAP funded Southern Ocean microbiomics program has made substantial advances towards achieving this ultimate goal and, along the way, has generated several key outputs. The program has been extremely successful at attracting a diverse group of students. Currently, three undergraduates, four honours students and two MSc students have received mentorship and graduated from this program (one MSc with cum laude). We have one PhD student currently writing up with thesis submission planned for mid-year, and one completing at the end of 2020. We have published the first set of manuscripts from the initial studies and through our participation in several community cruises, expanded South African international linkages and generated an incredible microbiomics resource. To strengthen and grow this program, we detail a new series of projects for the 2021 – 2023 SANAP program. Building from our initial studies, we propose a series of studies aimed at understanding the role played by key microbial communities in the Southern Ocean. These studies will use evolutionary theory to explore microbial community dynamics and the effects of nutrient co-limitation. We will also expand our functional analysis of SO microbiomes, including projects aimed at bioprospecting in line with the South African Marine and Antarctic Strategy. | Biological sciences : Microbiology - Microbial ecology | Environmental microbiology |

| University of South Africa | McIntyre, T DR - mcintt@unisa.ac.za | Ross seal ecology, behaviour and physiology in a changing environment | Antarctica and the surrounding Southern Ocean marine ecosystems are changing rapidly due to anthropogenic climate change. Seals, whales and seabirds, i.e. top-predators, are abundant and conspicuous components of the Southern Ocean ecosystem. As far-ranging, numerous consumers, they connect food webs and are influenced by the distribution of their prey. Labelled as sentinels of change, they are well-studied in comparison to other Antarctic and Southern Ocean taxa. Ross seals (Ommatophoca rossii), the least-studied of all the Antarctic pinnipeds, are unique in their foraging behaviour. Unlike other true Antarctic marine predators, they traverse the Southern Ocean four times annually in a narrow longitudinal band. In summer, they forage pelagically while in winter they spend the majority of their time within the Marginal Ice Zone (MIZ). This unique behaviour raises several questions and opportunities to study the impacts of climate change on them and their ocean habitat. This project aims to create an integrative view of Ross seals focusing on foraging ecology, physiology, and interactions with the MIZ. Satellite tracking data and remote sensing will be used to create end-of-century forecast habitat models. Fine-scale dive recorders will measure how Ross seals adapt their behaviour within the water column in response to environmental change. Novel physiological data collected on their aerobic dive limit will determine whether this species is operating at, or close to, its maximum physiological capacity and therefore less capable of compensating for natural or anthropogenic changes in the environment. A time-series created for compound-specific isotope analyses of amino acids using whisker segments will be able discern how specialised these predators are in their diet in relation to changes in a shifting isotopic baseline. Combining these three facets will determine the level of behavioural plasticity in Ross seals and their ability to cope with a changing environment | Biological sciences : Zoology | Marine biology -Behavioural ecology | Marine mammals - Ecology | Animal movement ecology | Data science | Animal behaviour | Ecology and environmental science | Climate change - Adaptation |