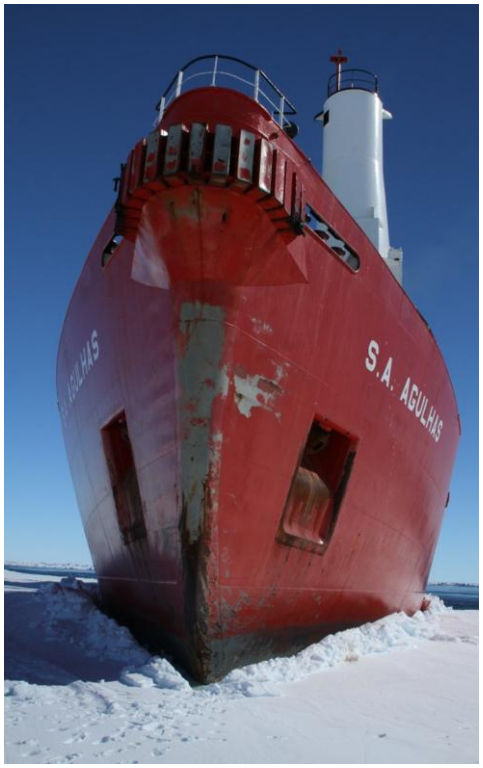
# Studentship Opportunities in Southern Ocean Carbon and Climate Research




The Southern Ocean plays a very important role in the global carbon-climate system. Recent estimates indicate that ~50% of all $CO_2$ emitted by human activity (anthropogenic $CO_2$) is stored in the Southern Ocean. The future trajectory of atmospheric $CO_2$ concentrations, and thus the constraints on the minimum emissions reduction rates, thus depends critically on how the Southern Ocean carbon cycle will adjust to climate change.

The Southern Ocean Carbon and Climate Observatory (SOCCO) is a CSIR-led, multi-institutional South African initiative aiming to understand the link between climate and the carbon cycle in the Southern Ocean. The programme comprises a number of focus areas that aim to develop an integrated physical and biogeochemical understanding of the coupled carbon–climate system in the Southern Ocean through measurement and modelling.

SOCCO is advertising a number of studentships, in association with the University of Cape Town and Stellenbosch University, relating to various research areas within the multidisciplinary approach to understanding the Southern Ocean carbon – climate system.

SOCCO
Southern Ocean Carbon and Climate Observatory

SPES BONA

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## MSc and PhD Studentships on the seasonal cycle of carbon in the Southern Ocean

Global efforts to mitigate the rise of atmospheric $CO_2$ and associated climate change rely on the ocean – atmosphere carbon cycle in two important ways. Firstly, its uptake of anthropogenic $CO_2$, which is presently estimated to be approximately 1.8 – 2.5PgCy-1. This annual climatological uptake corresponds to approximately 25% of global $CO_2$ emissions. In this way the ocean has taken up 45 – 50% of all industrial age $CO_2$ emissions. Secondly, the oceans and the atmosphere experience a much larger (~ 90PgCy-1) annual exchange of natural $CO_2$, which is largely in balance and reflects the "pre-industrial" status quo of the natural system. Any long term changes in the magnitude of either or both these fluxes are likely to be important factors in constraining the trajectory of atmospheric $CO_2$ in the 21st century.

We are looking to make four (4) studentships available to support MSc and PhD studies in this area. In this study we will focus on advancing our understanding of seasonal – mesoscale physics – carbon links in the Sub-Antarctic Zone (SAZ) of the South Atlantic – South West Indian Ocean by using a

novel field and modelling study. This is a key part of the negative feedback to both increasing anthropogenic $CO_2$ emissions and potential increased outgassing through the upwelling of Central Deep Water (CDW). This work will be undertaken through the Southern Ocean Seasonal Cycle Experiment (SOSCEx 2012).

If this research interests you, please apply by sending a detailed copy of your CV and academic transcripts to pmonteir@csir.co.za.

**Qualifications, skills and experience**

**Required:**

For MSc: An honours or equivalent four year BSc degree (R80,000)

For PhD: A Masters BSc degree (R120,000)

**Recommended:**

- A background in oceanography and or chemistry is essential.
- Experience of analytical chemistry skills would be advantageous.
- Experience in experimental design and data processing techniques would be advantageous.
- Proven ability to conduct independent research.
- Good communication and interpersonal skills.
- The ability to work in a cross-disciplinary project team environment.
- Highly self-motivated.

## MSc studentship in bio-optics research

Ocean colour remote sensing can provide routine, synoptic and highly cost-effective observations of biological and biogeochemical response to physical drivers across oceanic ecosystems, over decadal time scales and at high frequency. In many cases, remotely sensed data are the only systematic observations available for chronically under-sampled marine systems (e.g. the polar oceans), and there is thus a need to develop and apply emerging techniques to derive information from ocean

colour that will allow new insight into the Southern Ocean ecosystem function. A key focus is the ability to assess the event, seasonal and inter-annual variability in ecosystem physical drivers and their biogeochemical response.

The bio-optics group within SOCCO has funding for one MSc student to take on this research. The aim of the research is to develop new ocean colour-based phytoplankton assemblage products and apply these to the ± 8 year times series of ocean colour data, in order to derive routine synoptic data on phytoplankton biomass, assemblage type and physiology. Ocean colour phytoplankton assemblage and physiology products will be analysed in conjunction with relevant physical driver data (e.g. sea surface height, temperature, and satellite derived wind fields) to determine the response of phytoplankton biomass, community structure and physiology to changes in the underlying driving mechanisms over seasonal and inter-annual time scales. In addition to the use of remotely sensed ocean colour products, in situ optical and biogeochemical measurements will be made using autonomous technology, such as gliders and bio-optical floats, which will be used to investigate the variability in ecosystem physical drivers and their biogeochemical response at high resolution temporal and spatial scales over the seasonal cycle.

If this research interests you, please apply for either the MSc or PhD studentship by sending a detailed copy of your CV and academic transcripts to s.thomalla@csir.co.za

**Qualifications, skills and experience**

**Required:**

An honours or equivalent four year BSc degree (R80,000)

**Recommended:**

- A background in plant physiology, fluorescence, oceanography or marine biology would be advantageous.
- Experience of analytical chemistry skills would be advantageous.
- Experience in experimental design and data processing techniques would be advantageous.
- Proven ability to conduct independent research.
- Good communication and interpersonal skills.
- The ability to work in a cross-disciplinary project team environment.
- Highly self-motivated.

## Fe biogeochemistry in the Southern Ocean using culture experiments of Antarctic phytoplankton coupled with biogeochemical modeling: MSc and PhD scholarship for 2012 / 2013

The Southern Ocean is acknowledged to be a key component of past, present and future variability in the global carbon cycle, air-sea $CO_2$ exchange and the evolution of atmospheric $CO_2$ concentrations. In this context, biological productivity by phytoplankton and its variability plays a crucial role in the regional carbon cycle, as well as controlling species diversity and Antarctic food webs, thereby impacting important ecosystem services, such as fisheries, alongside biogeochemical cycles and climate. Since phytoplankton productivity is known to be regulated by both light and iron then the observed or predicted variability in response to climate change must be controlled by these two limiting factors. While biogeochemical models can quantify the large scale impact of such factors on carbon and nutrient cycling they necessitate a number of assumptions about how the role of light and Fe in governing primary production is represented. Indeed, these assumptions mean IPCC-class models have a large uncertainty in how the Southern Ocean is predicted to respond to future climate. The over-arching aim of this project is to contribute to evaluating and reducing this uncertainty by conducting a coupled model-laboratory culturing study focussed on understanding the physiological responses of relevant Antarctic phytoplankton to the factors limiting their growth and the quantitative impact on the cycles of carbon and other nutrients.

If this research interests you, please apply for either the MSc or PhD studentship by sending a detailed copy of your CV and academic transcripts to TMtshali@csir.co.za

**Qualification, skills and experience**

We seek candidates for one MSc (with honours or equivalent BTech degree) and PhD (with MSc degree) positions with the following:

- A background in chemistry, chemical oceanography, bio-geochemistry, environmental chemistry, botany or related fields with an emphasis on metal cycling, trace element speciation and plant physiology.
- General skills of good laboratory work (**especially under trace clean conditions**), culturing marine phytoplankton and some degree of numerical flexibility in analysing datasets and computer programming would be helpful.
- Use of analytical techniques such as Flow Injection Analyser (FIA) or ICP-MS, Water PAM, FRRF, electron microscope, x-ray absorption spectroscopy, electrochemical methods and/or UV-Vis spectroscopy would be desirable.
- Proven ability to conduct independent research.
- Good communication and interpersonal skills.
- The ability to work in a cross-disciplinary project team environment.
- Highly self-motivated.