# 71° Below

SANAE 57 Newsletter
June 2018

Greetings to all! Here is the latest newsletter, almost on time! We celebrated midwinter this month, and so the countdown to summer begins, as well as the preparations for the coming take-over. In the coming newsletters I will be including some information about the actual research at SANAE IV, starting with the oceanographic research that takes place in the ship voyage to the ice shelf and back again. But first meet more of the team!

## Hloni Rakoteli

**Background:** I am 34 years old married with two children. I am a BTech Electrical Engineering graduate. I served the South African National Defence Force (SANDF) in various positions for over twelve years before joining the Department of Environmental Affairs in 2015. My first Expedition was on Gough Island with the G61 team. I was the expedition team leader and communications engineer.

At the end of the expedition I joined the South African National Space Agency (SANSA) as an instrumentation technician. I moved from SANSA and later joined The Institute of Mine Seismology.

**Job title at SANAE**: Communications Engineer

**Description:** I am responsible for the operation, maintenance, fault-finding and repairs of all the communication services and equipment of our Antarctic Base, including the satellite, radio, IT, GPS, alarm and telephone systems. Being part of SANAE 57 one is also responsible for base skivvies such as cleaning, cooking and snow smelter filling up.

**Toughest challenge this year:** This place is cold, working outside in the cold is difficult back home where he temperature drops to only around -5 degrees Celsius, imagine doing the same thing in temperatures below -30 degrees Celsius.

**Best experience so far:** This continent is hostile but yet beautiful. You see nothing for miles except the pure white and nunataks here and there. I enjoyed the summer excursions and the 24 hours sunshine, the beautiful sunrises and sunsets. The last time I saw lots of snow back home was in the 90's so snow has been one of the great things I experienced so far.

**What I miss back home?** I miss driving long distances, I find the experience refreshing and I miss the great landscapes of my beautiful country. I miss chicken with bones LOL, we only have chicken fillets here. And of course it goes without saying, my family, relatives and friends.

**Lastly, what have I done in the past 15 years?** I have been pretty much everywhere one can possibly be, or at least worked in the harshest conditions one can think of. I was a soldier for over 12 years; I trained under some extreme conditions and had to sleep in trenches, walked 90 kilometers in three days with over 50kg on my back, slept in a bivvy with an R4 riffle next to my side. I went down the world's deepest mine, Mponeng gold mine, worked in the most extreme conditions underground with temperatures above 50 degrees Celcius. I stayed for over a year in one of the most remote and uninhabited islands in the world, Gough Island. I am currently on the coldest continent in the world, the only and last wilderness in the world

# Midwinter

On June 21 we celebrated the winter solstice, the longest and darkest day in the southern hemisphere. There is a tradition where the bases send out greeting cards to the other Antarctic and southern ocean bases. This is the card we sent out.

# Cobus Van Der Merwe

Hi my name is Cobus van der Merwe. You would think that spending a year in the most remote place on Earth, with nothing to distract you but you, will leave you with countless hours to fill. This has not been the case. I was busy with my Masters degree in electrical engineering when I first saw the job being advertised. I thought it would be an amazing experience but decided not to apply as I was engaged in other pursuits. The job was advertised for a second time much later in the year and I very impulsively decided that I will apply and see what happens. Once I accepted the job offer it felt like the next five months was one big blur with me frantically trying to keep all the pieces of my life together.

Before I knew it I was trying to finish my research project at Stellenbosch while also being the new cosmic ray researcher for the University of North West. Suddenly I was switching between developing hardware for the Neutron monitors at SANAE and getting to know the systems I have to install for my year ahead and still trying to focus on my thesis. Needless to say I might have bit off a little too much to properly cope with the workload. Never the less, I convinced myself that I am only young and stupid enough to think that I can do everything once. I was on the SA Agulhas II with lots of unfinished business back home and nothing I can do about it. I was heading into the unknown with adrenaline pumping as we left Cape Town behind.

You know when you stress so much that you stop caring and nothing seems to be stressful any more. I was that guy. I put my feet up and embraced the futility of my attempts to control what was happening around me. Instead I made new friends on the ship with the marine biologists and became accustomed to the jaw dropping sights I saw every time you go out onto the deck of the SA Agulhas II. The further south we went the more surreal it became. I never realized what it actually meant to spend a year on ice.

Once we made it to SANAE IV, I quickly put up my hand to do all the jobs that was very far removed from my job description. I was eager to gain “Antarctic Skills” and ensure survival in

case of an emergency. You do not want to be the pathetic “Scientist”(it is Antarctic slang for someone who is not a diesel mechanic or electrician) who cannot start the bulldozer when the paw-paw hits the fan. Before long I was a very competent “Dozer” (someone who can push ice around with heavy machinery) and really embraced the job of artistically sculpting the parking lot of SANAE IV into one of my greatest achievement to date.

I also helped researchers from University of Cape Town to operate their ground penetrating radar, used to detect crevasses in the ice. This was right up my alley, give my engineering background. This gave me the opportunity to accompany a field party on a two day camping trip. Camping on ice with five people in the middle of nowhere with only a “Caboose” (snow caravan on a sled) and a generator to keep you safe. THAT is what i signed up for! Having a braai on ice with a white horizon as far as the eye can see is a memory I will keep with me for a long time to come.

So it’s six months in, the novelty has worn off. The cold is getting too cold to keep on laughing about it. You are stuck on a rock and you can literally go nowhere. Imagine your standard size plot in a city and make it three times bigger. That is the space you have to move around in. On top of that, the obligations you calmly pushed aside to have the ultimate “Antarctic Experience” (rubbish term thrown around by over winterers to make people think we are constantly having playful snow ball fights) have not gone anywhere and it’s time to deal with them.

I am currently working around the clock to try and complete the tasks I have both here and back home. Hopefully this will allow for some time to enjoy the Antarctic summer which is fast approaching. My goal is to leave Antarctica with a fully automated neutron monitor system, my Masters degree done and dusted and a whole lot more unique Antarctic experiences stored in memory. I hope that anyone reading this can get a better idea of the type of person I am without me having to give a boring explicit list of facts about myself to try and convince you of the type of characters that come and overwinter in Antarctica.

A little bit of wisdom from a 25 year old. Take it with a pinch of salt, I am only 25 and I am fully aware that isolation can skew your perspective on things. This experience is amazing and thinking back on it years later, it will still be amazing. While you are here it is not that great at all. You are emotionally isolated; everything that happens back at home it out of your control and the darkness really messes with your sleeping pattern (the highlight of the winter was when we redesigned a sauna controller from scratch). But you have to live through these difficult times to make the experience mean something. If it was easy, no one would think that you are crazy to do it when you tell them about it.

# Research at SANAE

A huge thanks to Mark Weston for this section. Mark was the team leader of the oceanographers on board the SA Agulhas 2 during this voyage.

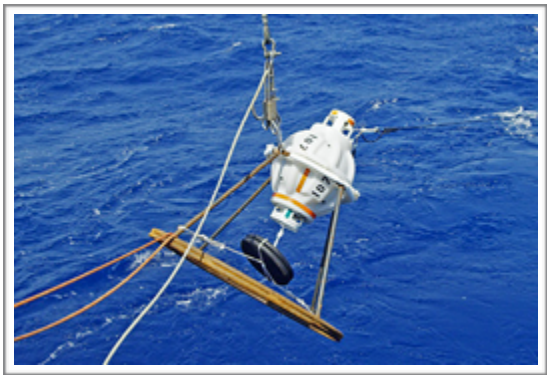
**SANAE 57 Ship-Based Activities**

**Introduction**
The global thermohaline circulation, or Meridional Overturning Circulation (MOC), is vital in distributing heat and salt across oceanic basins and is consequently fundamental in the regulation of the global climate (Clark et al. 2002). The largest current associated with this circulation is the Antarctic Circumpolar Current (ACC) which flows continuously around the Antarctic Continent and forms a large constituent of the Southern Ocean. This current is the primary means by which heat and salt is distributed across various oceanic basins. The MOC is largely influenced by the dynamics of interbasin water mass exchange (Gordon 1986), therefore as the ACC is such a vital link in the thermohaline circulation, it is imperative to understand water mass formations and their respective paths within the Southern Ocean in order to comprehensively understand the variability in both salinity and temperature in the ocean. Fluctuations in water mass heat content may have a

significant influence on sea ice formation and on the regional atmospheric conditions. For that reason, consistent and repetitive hydrographic sampling and observations are required for a comprehensive understanding of the processes and drivers affecting the variability of the ACC. In 2004, Professor Isabelle Ansorge from the University of Cape Town through the SAMOC initiative introduced the GoodHope monitoring line which aimed to provide long-term observations of the Southern Ocean, south of South Africa (**This was the cruise path that we were on**). The programme makes use of high density XBT sampling from Cape Town to Antarctica and the deployment of CPIES moorings from 35°S to 43°S. The Goodhope monitoring line has therefore produced repeated observations along a single transect on an annual basis, providing crucial insight into the year to year variability of physical fluxes as well as enabling the monitoring of leakage through the shedding of filaments and eddies into the south Atlantic from the Agulhas Current System (Ansorge et al. 2014).

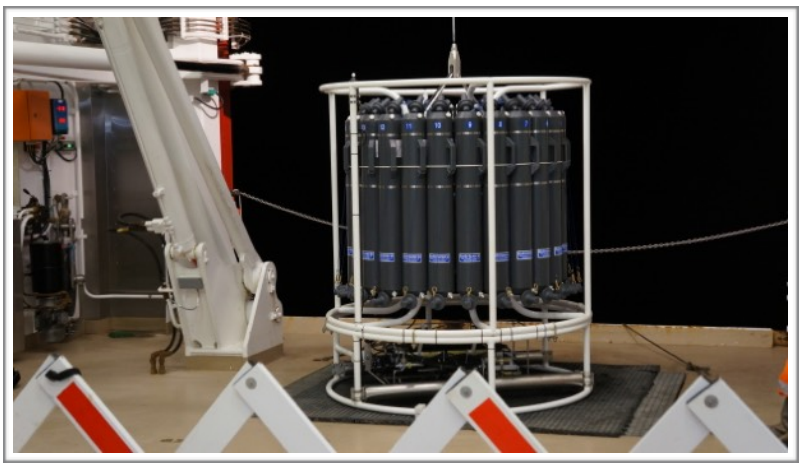
**Methods and sampling procedures**
As touched on in the introduction, this is sampling we do annually, adding to a database which can then be used for further studies. As it is on an annual time scale and is sampled during a similar period every year, we can use the data and look for changes in the system as well as look for general patterns.
We were kept pretty busy while on board with a number of different sampling protocols running concurrently. I have just indicated the instrument we used and what it does and how often we deployed them etc.

**XBTS:** Expendable Bathythermographs are expendable temperature probes. We deploy them from a hand held launcher and as they fall out of the tube and descend, an extremely thin copper wire unravels, sending back data for the upper 900m of the water column. This provides us with a temperature-depth profile at each location that we deploy them. These XBTs were funded by NOAA's Office of Global Programs as part of their High Density XBT project at NOAA/AOML. The actual XBTS we used were called Sippican Deep Blue XBTS.
It's tough work on the ship as we deployed one XBT every 90 minutes from when we left Cape Town until we reached the pack ice, 24 hours a day as well as on the return trip from Bouvet back to Cape Town. So we ended up taking shifts with poor Jono and Kurt on the graveyard shift from midnight until about 8am.
For more information have a look at: http://www.aoml.noaa.gov/phod/goos/xbtscience/faqs.php
**ADCP:** Acoustic Doppler Current Profiler is an instrument we use to detect the velocity and direction of the current 500m below the ship. It achieves this by sending a number of "pings" out and then records the time it takes for the pings to return after bouncing off of particles in the water. Depending on the speed and direction of the current, the pings will shift different due to the Doppler Effect.
SA Agulhas II has a drop-keel which we can lower whilst underway below 16 knots. This keel lowers about 3m out of the bottom of the vessel and the ADCP is mounted on this keel. The exact model is a 75kHz Teledyne RD Instruments Ocean Surveyor and we switch it on as we drop the keel outside of Cape Town and then lift it when we hit the ice.



**CPIEs:** Current and Pressure Inverted Echosounders are similar to ADCPs in that they record current velocities and directions but these have been deployed in an array along the GoodHope line. They sit in frames on the sea-floor (depths of over 5000m) and record the current data for the water column above them. This data is stored inside the instrument and so every few years, we have to go and retrieve them. This is achieved by placing a transducer into the water and pinging the CPIE which is fitted with an acoustic release. When the acoustic release is triggered, it burns through the wire attaching the CPIE to the frame and the CPIE then surfaces.

For more information check out: https://www.coastalstudiesinstitute.org/would-you-like-pies-with-that/



**CTDs:** Conductivity, Temperature and Depth, is an instrument which we lower down the side of the vessel and is fitted not only with salinometers, temperature gauges and pressure sensors but also with a variety of other sensors including dissolved oxygen sensors and fluorometers. This is arranged in a sampling rosette which is basically a frame with the sensors in the centre which are then surrounded by a number of bottles. These bottles are called Niskins and we cock and load them at the surface and then can remotely trigger them to close, collecting water samples from different depths depending on who needs the water. The CTD is lowered on a live data feed cable, the ship has a 6000m cable on it, and this enables us to get a live data feed as the instrument descends.
As we were hoping to retrieve the CPIEs, we deployed a number of CTDs over each CPIE location. These were full depth casts so we lowered the CTD to within 10m of the seabed (A pretty mean feat when the water is over 5000m deep and our maximum depth we lowered it to was just under 5200m!!). We can then use this information to calibrate the CPIE at each location.

**ARGOS Floats:** Argos floats are long lasting expendable CTDs and measure the temperature and salinity of the upper 2000m of the water column. We deploy them from the stern of the ship where they remain at the surface for a period of time whilst communicating with a land-based station via satellite. They then descend to 1000m by altering an oil-filled bladder and then at 1000m the halt their descent and track sideways for a period of time. They then descend another 1000m and when they reach their final depth of 2000m, they again shift the oil-filled bladder and begin to surface. Whilst surfacing, they record the temperature and salinity of the water column. As they reach the surface, they them send the data back to the land-based station and commence another decent. They can typically last 2-3 years depending on the region in which they are deployed and then on their final ascent they will send their data, then send out its final message and descend into the abyss ( *sniff sniff).
We deployed a number of these on the return leg from the Ice back to Cape Town and so they should still be happily pinging away in the ocean somewhere.

For more information check out: http://www.nke-instrumentation.com/products/profilers/products/arvor.html

**TSG:** Thermosalinograph is an instrument that measures the temperature and salinity of the surface waters. This is achieved by diverting water from the engine cooling pipes, through the instrument.
Again, we turned this on as we left Cape Town and only switched it off when we got back to South Africa (Beside a few maintenance issues).

**Other Oceanographic Science on Board**
**CO2 sampling:** This is an instrument called a Licor gas analyzer that is used to investigate the interaction between the ocean and atmosphere in terms of carbon dioxide sequestration. We switched it on in Cape Town and it basically samples the carbon dioxide present in the atmospheric air above the ocean while also sampling the carbon dioxide present in the surface

waters by means of a number of valves and filters which remove the air from the water and sample it.

For more information check out: https://www.licor.com/env/products/gas_analysis/LI-7000/

**Wave Glider and Slocum Glider:** These were the two yellow things that we waited so long for…The wave glider looks like a little boat which has a 7m umbilical which is connected to some fins. The glider sits on the surface of the water and then, through wave action on the fins, is pushed along its path. It collects surface data including temperature and salinity and communicates this back to a land-based station. The glider can be remotely controlled and has a little propeller and rudder on it to steer it and keep it on course.

The Slocum glider looks like a little submarine and this too collects data such as temperature and salinity, but of the upper 1000m of the water column. It shifts a bladder inside which, along with its wings, causes it to dive at an angle and then when it reaches 1000m, the bladder shifts and it surfaces while collecting data.
We deployed both of these gliders on the way down to the ice and retrieved them en route back to Cape Town.

**Ice Observations:** This was some work we did for a student back at UCT where we were on shift to record ice type, percentage cover, thickness and other attributes while we travelled through it. This is important information, especially for ship transit routes and for better ice forecasting.

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# Weather news

The weather this month was relatively mild. The big storms seem to occur at the change of seasons. That being said we have had several weeks of strong winds (not quite a storm, but constant winds of 30-40 knots) with apparent temperatures frequently -50°C and below.

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| Maximum temperature: | -6.2°C |
| Minimum temperature: | -28.8°C |
| Strongest wind gust: | 48.5m/s (174.6 km/hr or 94.27 knots) |

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