SANAE 50 Newsletter

MARCH 2011

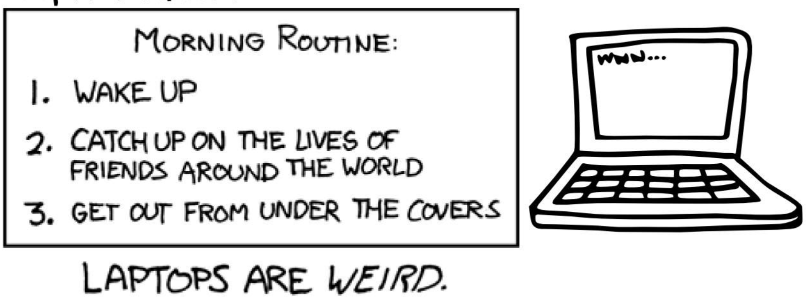
We Dig Six – the Finale

Space Physics Research Institute Engineer

A look at weather from the SANAE Meteorological Observation Station

Bad-hair day at SANAE

http://xkcd.com



The end of February. The nights are drawing in, temperatures are dropping, and now is the time most SANAE teams prepare for the long slowdown of Winter. The fresh fruit is finished, the sleds and dozers are depoted, the skidoos are hoicked into the hanger and the cabooses kitted out for emergency journeys only. SANAE 50, however, hasn't quite got there yet. S 50 still has a Challenger in the field. Still has to get this challenger out of the field, in which she has been stuck, frozen solid, for over three weeks. Still has to make a plan to get this beastie home, because two previous attempts have failed. So, Rescue: Take Three.

This last attempt was made only after extensive consultation with the DEA offices back home, the Barlow World agents for the Challenger, and any other useful source we could think of tapping. The plan of action was deceptively simple: a two pronged approach aimed at firstly releasing the ice under the challenger by that age old method, digging, and secondly using the challenger's own electronics and engine to heat the ice and melt her out. Accessing a long-dormant engine requires several steps:
1)Heat the frozen Electronic Control Module units. The function of these units is communications: with the hydraulic brakes, with the gearbox, with the tractor assemblies. With functioning ECMs, it should be possible to release the brakes, get the machine out of – or into – gear, and achieve mobility. 2)Heat the starter motors (Challenger Six has two). 3)Bring into action a functioning “Wabasto” motor: a small water-heating engine which circulates hot water through the main engine and warms it up. With these three steps effected, it should be possible to start the engine of the challenger and, by running her in neutral for a number of hours, melt the massive block of ice tethering her to the Antarctic continent. Once released, the plan was to tow her – or better, drive her - onto a sled for the journey home.

Everything here is weather dependent. This third trip had to wait until the very last day in February before setting off. An extract from Paul's blog:

On checking the forecasts, we were clear for a 3 day weather window, so we departed on the Monday [28th Feb] in excellent weather. Imagine if you will travelling across an expansive ice sheet, flat to all horizons and no distinguishing features. You reply solely on a compass bearing indicated on your GPS, Steer 242 degrees until next waypoint. There is no possibility of seeing another group of people, and completely unlikely that you will encounter a single living thing. Every now and again along the route we notice the occasional pole planted to demarcate the route. Your mind plays tricks on you as you are sure it looks like a penguin (not possible so far from the sea) or a hitchhiker (only in another Galaxy).

The 1st of March. The previous team's dozer work has paid dividends and the Challenger still stands clear of snow and sastrugi. The Two-Pronged Attack is brought to bear: Johan does his by now extremely familiar digging act, joined by Paul, and Alan and Gerard tackle the electrical systems of the Challenger. It is “good” weather by Antarctic standards, but try digging flat on your back under a challenger for hours at a stretch, in temperatures of minus 12 at best. Imagine fiddling around with small electronic modules requiring precision touch and thus bare hands in these subzero conditions. This time both BarlowWorld (the company providing the Challenger) and the DEA offices are on standby, and the satellite phone allows for ongoing advice and input.

Paul in his blog muses on the task confronting the team:

Johan and I took up our spades and ice axes, and began to tunnel under the machine, at a formidable rate, soon to slow down as we realised the job was going to take a full day if not two. Alan and Gerard tackled the mechanical and electrical fault finding. This to me is mind-boggling, I mean how do you actually start a heavy piece of machinery that is frozen and buried for a month under the Antarctic ice cap. I am full of wonder at mechanically minded people who can perform seemingly magically impossible tasks like starting a 747 Jet. Does a Jumbo have a key?

So how DOES the mechanical side of the team get the job done? Firstly, Alan gets to work heating the the ECM units and the starter motors – using a heat gun! The wabasto engine, required to circulate hot water to the main engine and in this case, heat it up very nearly one hundred degrees from minus 26 to plus 70 has to be "transplanted" from Challenger Four and rebuilt into Challenger Six. Finally, after two days of intense work, Alan takes the plunge – one chance only! - and fires up the engine. Paul captures the moment of glory:

At 5.30 pm on the second day the vehicle sprang to life in a shower of snow and profusion of permafrostic explosions. By 10 pm it was out of the hole and safely strapped and chained to a sled, ready for towing 140 km back to the Base. We were too tired to drive that night, although it was tempting to head for home and drive the 10 hours into the night; we knew the storm was coming and we had received messages from an anxious SANAE Base, from our German neighbours at Neumayer and even as far afield as head office in Cape Town saying "get home – the weather is coming".

The 3rd of March. The team rises unreluctently from their frozen slumbers at an unGodly 5 a.m. and bundles into the loyal Challengers Three and Four, Lady Six in tow. Winds and clouds speed them on their way, whispering a promise of Bad Things to Come should they tarry in their flight. They don't. A fitting end to this epic would have been for the rescue team to drive Challenger Six up to Base in glorious sunlight, with the rest of the team lined up on the helideck cheering and throwing ticker-tape. But of course the foul weather had outpaced them, and Challenger Six, overburdened with wind and snow, refused to make it up the steep rise onto the Vesles plateau. The Rescue team was undaunted and would have battled on, save that they had the doctor yelping frantically over the radio about winds gusting to 140 km/h and white-out conditions and "Just get INSIDE!". So the sled with Six on board was uncoupled from the tired Challenger Four and left once again to the quiet contemplation of extreme elemental energies. But at least we could see her from the Base windows. The epic was finally over.

Space Physics Research Institute (SPRI) Engineer

BEATRICE VAN EDEN

(Information comes mostly from the projectswiki site hosted by SANSA Space Science)

I have been appointed as the SPRI engineer and am responsible for those systems under the management of the University of Kwa-Zulu Natal (UKZN). There are six systems all collecting Very Low Frequency (VLF) data. VLF refers to radio frequencies in the range of 3 kHz to 30 kHz. This data is used for research at universities and for observing phenomena in space. These six systems are: the Atmospheric Weather Electromagnetic System for Observation Modelling and Education (AWESOME), belonging to Stanford University; the Digital VLF Recording and Analysis System (DVRAS) belonging to UKZN; the World Wide Lightning Location Network (WWLLN) that contributes to Washington University's network of stations that determine lightning location; the UltraMSK system that collects narrowband information at specified frequencies in the VLF frequency range, for UKZN; the Automatic Whistler Detector System (AWDS), and finally the Pulsation Magnetometer (PM), also belonging to UKZN, that has recently been redesigned and is currently being installed at SANAE.

The data is primarily captured using VLF antennas, of which there are two outside the base. AWESOME is an independent system with its own loop antenna (Figure 1). The WWLLN, UltraMSK, DVRAS and AWDS systems are all connected to the big loop antenna in Figure 2. The Pulsation Magnetometer has two coils in hatches underground and is in the magnetically "quiet" area (Figure 3).

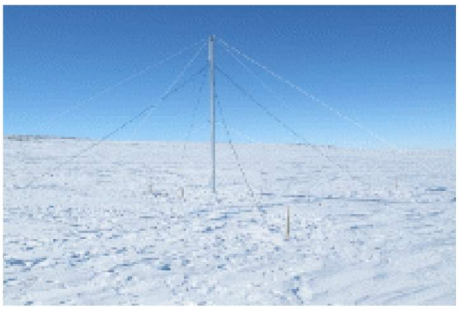


Fig. 1: AWESOME

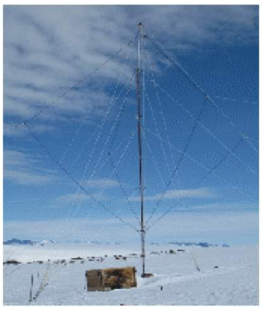


Fig. 2: DVRAS

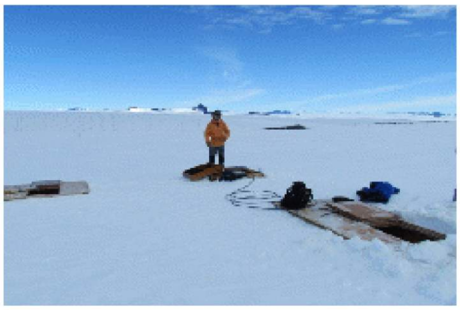


Fig. 3: Pulsation Magnetometer

AWESOME (Atmospheric Weather Electromagnetic System for Observation Modelling & Education)

The Stanford University VLF Group investigates the Earth's electrical environment, its upper atmosphere, lightning discharges, radiation belts, and the ionized regions of the earth's upper atmosphere known as the ionosphere and magnetosphere. Much of their work involves the use of VLF electromagnetic waves which are generated by lightning discharges, by man-made transmitters and by the energetic radiation belt electrons. We use VLF waves as diagnostic tools to investigate physical processes in the vicinity of the Earth's low and high altitude plasma environment. This data is collected from ground stations located across the globe. There are two principle types of data collected: broadband and narrowband. Broadband data is full waveform data sampled at 100 kHz (frequency range of 300 Hz to 40 kHz) (see figure 4). Narrowband data refers to the demodulated amplitude and phase of narrowband VLF transmitters (see figure 5). Both Broadband and Narrowband are collected on two orthogonal antennas orientated in the North/South and East/West directions. The AWESOME system at SANAE is a broadband and narrowband low power VLF receiver. (For more information go to http://vlf.stanford.edu/vlfdata/).

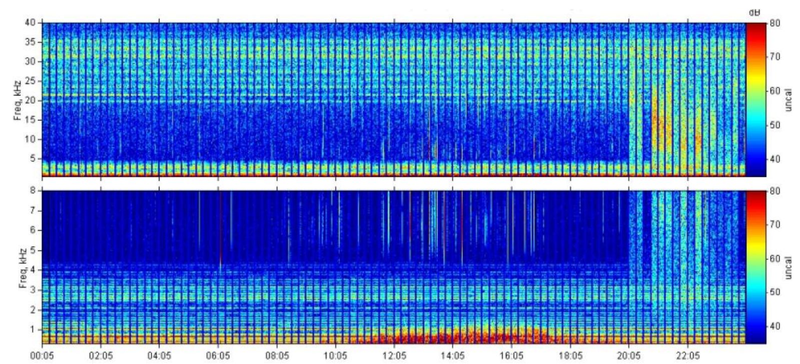


Fig. 4: Broadband data summary plot

DVRAS (Digital VLF Recording and Analysis System)

This system collects VLF wave data. The analysis of VLF wave data at high latitudes is a powerful tool for remote sensing of processes in the magnetosphere and provides data complementary to other techniques which monitor parameters such as particle precipitation and magnetic field variations. The wave data is captured every five minutes and plotted as one spectrogram for the East/West channel (see Figure 5) and another for the North/South channel (see Figure 6).

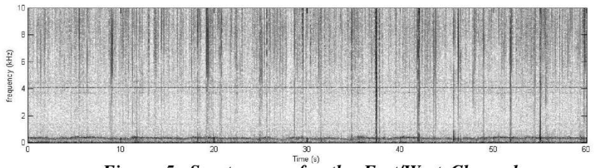


Figure 5: Spectrogram for the East/West Channel

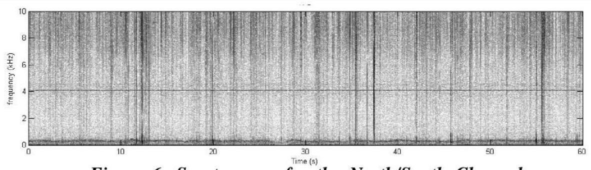


Figure 6: Spectrogram for the North/South Channel

WWLLN (World Wide Lightning Location Network)

Significant radiated electromagnetic power exists from a few hertz to several hundred megahertz, with the bulk of the energy radiated at VLF (3-30 kHz). The University of Washington in Seattle operates a network of lightning location sensors at VLF. Most ground-based observations in the VLF band are dominated by impulsive signals from lightning discharges called “sferics”. With their network of sferic sensors the University of Washington is producing regular maps of lightning activity over the entire Earth (Figure 7) (See also their website at; http://wwlln.net/.). Lightning stroke positions are shown as coloured dots which "cool down" from blue for the most recent (occurring within the last 10 min) through green and yellow to red for the oldest (30-40 minute earlier). Red asterisks in white circles are active WWLLN lightning sensor locations. The terminator (day-night boundary) is shown, with the daylit section of the globe in grey.

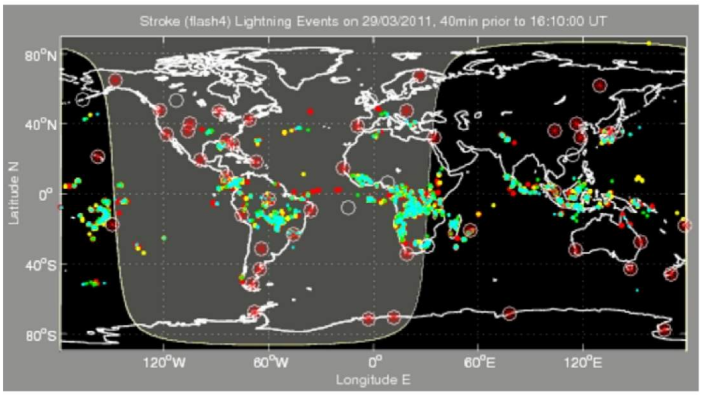


Figure 7: lightning activity over the entire Earth

The WWLLN located at SANAE forms part of this network. The data from SANAE is represented in a Wideband VLF Spectrogram, which can be seen in Figure 8.

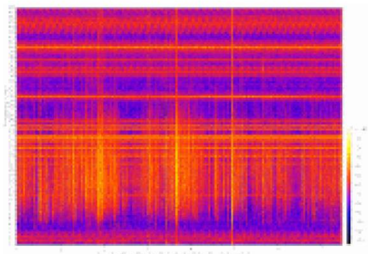


Figure 8: Wideband VLF Spectrogram

AWDS (Automatic Whistler Detector System)

The AWDS extracts portions of the VLF broadband waveform which contains whistlers. A Whistler is a very low frequency electromagnetic (radio) wave which can be generated by lightning. Although they are electromagnetic waves, they occur at audio frequencies, and can be converted to audio using a suitable receiver. They are produced by lightning strikes (mostly intracloud and return-path) where the impulse travels away from the earth and returns to the earth travelling along magnetic field lines. They undergo dispersion of several thousand kHz due to the slower velocity of the lower frequencies through the plasma environments of the ionosphere and magnetosphere. Thus they are perceived as a descending tone which can last for a few seconds. The study of whistlers allows categorization into Pure Note Whistlers, Diffuse, 2-hop, and Echo Train types. A summary of the data can be seen in Figure 9.

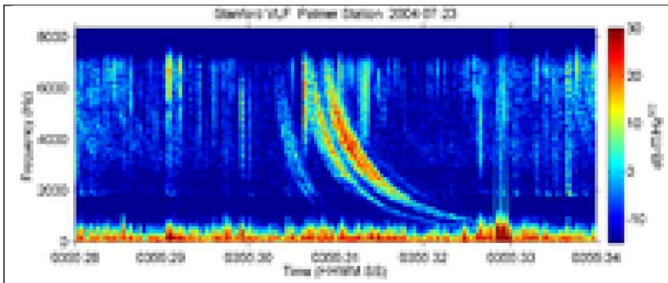


Figure 9: VLF spectrogram of an electromagnetic whistler wave, as received by the Stanford University VLF group's wave receiver at Palmer Station, Antarctica.

UltraMSK

The Ultra MSK system does frequency monitoring using software based demodulation on known VLF frequencies. A Power against Frequency plot is made to determine the best frequencies to record. Transmitters do change and the best ratios need to be updated at regular intervals. Figure 14 shows such a plot.

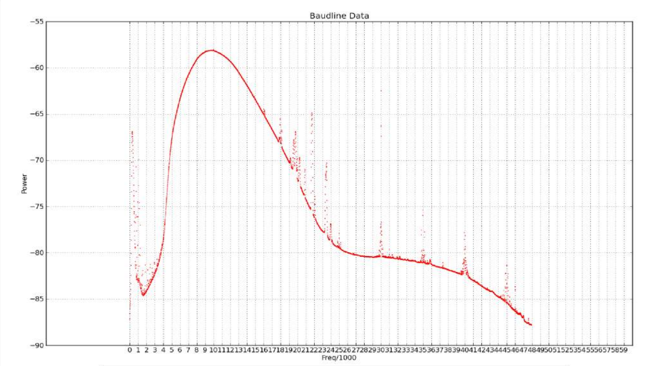


Figure 11: Phase and amplitude of VLF data for UltraMSK at the 16.4 KHz Frequency

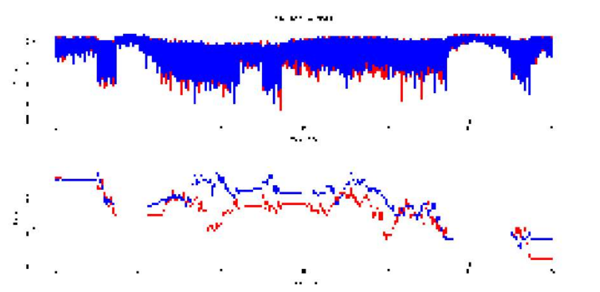


Figure 15: Power against Frequency plot

The frequencies currently recorded are:
16.1 kHz,16.4 kHz,18.0 kHz,19.6 kHz,20.27 kHz,20.9 kHz,21.8 kHz,22.1 kHz,23.4 kHz,24.0 kHz,25.0 kHz,30.0 kHz,35.0 kHz,40.0 kHz.

In Figure 15 a summary of the day's data for the 16.4 kHz frequency can be seen.

PM (Pulsation Magnetometer)

The pulsations (or variation) magnetometer is an instrument designed to measure changes in the earth's magnetic field. The magnetic field changes, which can be seen as pulsations, are due to changes of the sun – solar flares, coronal holes, sunspot activity level and the likeand can be linked to magnetic storms and auroral displays. The heart of the magnetometer is its two induction coils, placed at 90 degrees from one another, aligned in the magnetic N/S and E/W directions. A changing magnetic field induces a voltage across the primary windings of the induction coils. These small voltages are amplified and filtered and fed to a dedicated computer. A new Pulsation Magnetometer was designed by Kevin [van Eden] and was installed during Take-Over. The software is almost complete; once it is finished, data will be captured. For the past few years UKZN has not had any PM systems.

Aurora Camera

The Aurora Camera was under the management of the North West University (NWU) in Potchefsrtoom. This system has now been taken over by SANSA Space Science [formerly known as the Hermanus Magnetic Observatory], and is an additional part of my responsibilities for this year. There are usually two Aurora Cameras: one wide angle and one narrow angle, but unfortunately we are currently able to use only the narrow angle camera. The wide angle system is awaiting repair or upgrade.

An Aurora is a natural light display in the sky but only visible during the hours of darkness. These lights are particularly observed in the Polar Regions and have peak periods of incidence during the year. April and September usually have the most intense and frequent number of occurrences.

Editors' note:
As yet we have not had any aurora this year. We are hoping that April will have a number of displays and Beatrice will discuss the science behind the aurora, with photographs of our own sightings, in the April newsletter.

A look at weather from the SANAE Meteorological Observation Station

by Paul Lee

Overview

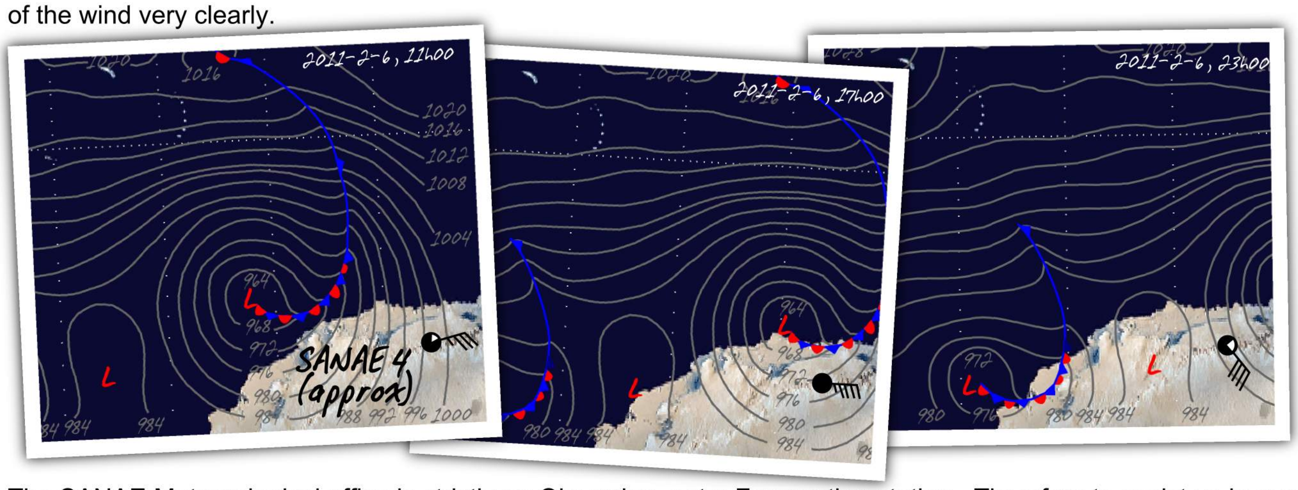
March has provided us with modest weather; we could call it an “Indian Summer”! Ambient temperatures have dropped and are regularly below minus 20 degrees. Our record minimum to date is -26 degrees on 14 March. But with the exception of temperature, weather in February was far more intense.

Wind speeds in February were consistently higher than in March, averaging 11.5 m/s and 9.5 m/s respectively. The maximum wind gust in February was 59.4 m/s (213 km/h) as opposed to a lower maximum in March of only 43.2 m/s (155 km/h). Reviewing the surface pressure maps, this moderate March weather was a consequence of frontal systems being deflected to the north away from the Weddell sea and into the South Atlantic as the Antarctic Plateau High Pressure system to the South of us intensified. Average station pressure for March was running at 885.4 hPa while the February average was lower at 883.8 hPa.

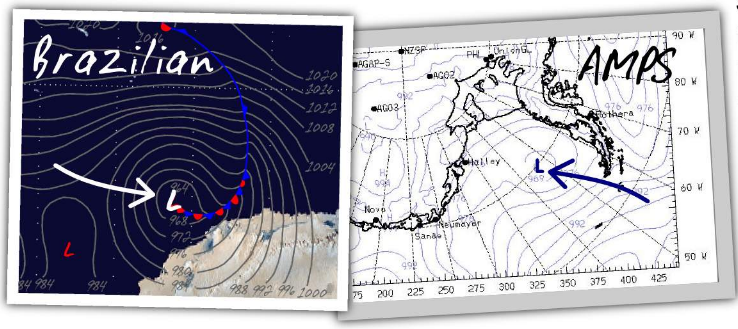
In terms of severe blizzards, there was little in March that came close to the mid-February storm we experienced. A closer look at this February storm shows some interesting statistics.

Analysis of Frontal System 6 February

Typically, NE/ENE winds at SANAE IV indicate that a low pressure system is passing over the ocean to the north. Wind from this direction indicates the arrival of a frontal system, usually coupled with high wind speeds. As the front and low pressure system passes over to our east, the wind veers to the east and when the low pressure system has passed, the wind direction returns to the predominant ESE/SE. The synoptic for this system, derived from the Hydrographical Centre of the Brazilian Navy, illustrates this veering of the wind very clearly.



The SANAE Meteorological office is strictly an Observing, not a Forecasting station. Therefore to assist us in our own planning around the Base, we use AMPS (Antarctic Meso-scale Prediction System) as an indicator of expected weather. AMPS is a real-time numerical weather forecasting product created in the United States. They cover the entire continent of Antarctica as well as the sub-Antarctic regions, providing support for the United States Antarctic Program, Antarctic science, and international Antarctic efforts. AMPS produces numerical guidance from the Weather Research and Forecasting (WRF) model with twice-daily forecasts covering Antarctica.



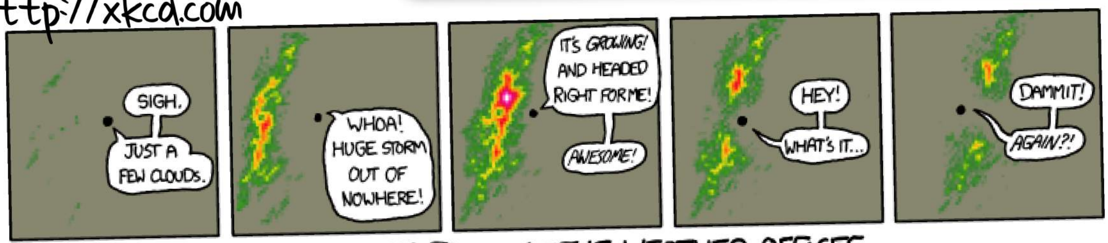
The AMPS surface level predictions for the 06 February are shown here and correlate well with the actual weather shown in the Brazilian synoptic chart.

Over the period of 6th to 8th February, the predicted frontal system passed north of Queen Maud Land slamming our Base on Vesleskarvet with blizzards of snow and wind of an intense force and vengeance, new to most of us “pre-winter-rookies”. Three days before the storms we could recognise the traces of high cirrus and lenticular (almond–shaped) clouds in the sky, which are typical precursors to the onset of severe weather. The graphs below taken from our Automatic Weather Recorder (AWS) illustrate the trend of of the various weather conditions and parameters on the day the front made its closest approach.

Although March has not proved quite so exciting, we have no doubt that there is more in store for us as Winter approaches, and the excellent weather recording systems of the South African Weather Service combined with accurate forecasting models provide for fascinating work here at SANAE.

For those of you who are interested, you can find the AMPS model at:
www.mmm.ucar.edu/rt/amps/

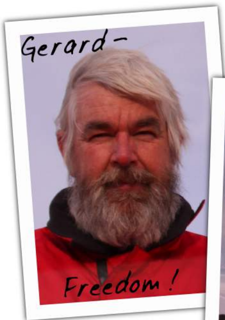
http://xkcd.com

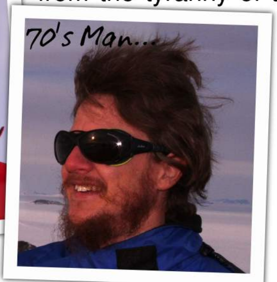


WHEN THE FOLKS AT THE WEATHER OFFICES SEE YOU REFRESHING THE RADAR TOO OFTEN, THEY START TEASING YOU.

Antarctica. Isolation. Extreme environment. Intense cold. Physical and social deprivation. How many cakes of soap do I need? How many T-shirts? Do I still wax my legs? (girls only). Do I still shave my beard? (boys only). You may have been contemplating us asking rather Larger Questions: How will I cope with the loneliness, How will I manage not seeing my family for over a year, how will I react to 24 hours of darkness, How will I handle the bl—dy space weather crowd talking computerese 24/7 without assassinating them? Well, yes. Of course we ask ourselves these things. But what we really, really ask ourselves is, “Who's going to cut my hair?”.

The South African Antarctic teams have a reputation in this regard. We grow our beards and hair. HOW we grow hair! Some of us are incapacitated genetically from growing beards, but usually even the women go in for a slightly shaggy-headed look. And SANAE 50? Well, some of us have gone for the Full Monty. Johan is pure Seventies, and Tiki and Gerard are thoroughly enjoying their release from the tyranny of the razor-blade. But Paul just doesn't do beards. And Renier's still too much of a puppy to do the beard thing properly (actually, this isn't entirely true – it's just that his beard is too blonde to see). Beat has told Kevin firmly that marriage and beards are incompatible. But to a man their hair is growing famously.





So also, Ruan. Longest hair and thicketest beard of the lot. But he long ago shared a promise with the doctor, sworn under the reaching skies, on Antarctic seas, that, come Cancer Day, the two of them would break with all tradition and shave their hair off in solidarity with cancer patients back home. Not the beard, insisted Ruan. The beard was declared out of bounds. But yes, the long locks were vowed away, and 51 years of tradition challenged by this intrepid duo.

The 5th of March - Cancer Day finally arrives. Before.
The first cut - but our mothers still love us.

The 5th of March. During. Hairdresser Ruan reassures a doubtful Abi

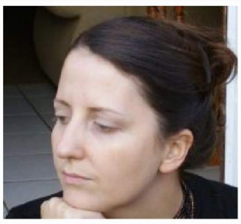
The 5th of March. After. Could our mothers possibly still love us?

So how did we feel about our New lockless Looks? The doctor: "My head's cold, and I don't have the nose for a GI Jane look. Give me back my hair!"
Ruan: "Practical. I LIKE it!"
But he did decide to lose the mohawk... .

Meanwhile, for the rest of the team, the hair just keeps on growing. We seek to emulate, if not surpass, those traditions so firmly laid down by those preceding us.

(Remind you of anybody?)

Our Shavathon gesture gained a deeper poignancy by a personal loss felt by one of the team members. Beatrice van Eden was still in the field on the prolonged Cat Train when one of her best friends died of cancer on 13 February this year. Beatrice writes a brief testimony:



Louise Mostert

Oorlede 13/02/2011 na die groot stryd met kanker.

Louise was 'n wonderlike vriendin en ek was bevoorreg om haar te kon ken.
Ek verlang na jou, vriendin. Ek is so lief vir jou.
Dankie vir die goeie tye, raad en troos.

AWESOME TOOLS CC

OUTWARD ventures

first Ascent
PERFORMANCE TESTED GEAR

RAM
MOUNTAINEERING GEAR

ORMS
PRO PHOTO

MATRIX
WAREHOUSE
COMPUTERS

GRAHAM BECK
WINES

EXCLUS1VE BOOKS

ROTARY INTERNATIONAL
Rosebank

HERON RIDGE

VILLIERA
STELLENBOSCH

NEETHLINGSHOF
ESTATE

CREATiON
Creating Wines of Distinction
www.creationwines.com

JUNO
WINE COMPANY

ORIGIN
COFFEE ROASTING

Le Manoir de Brendel
www.le-manoir-de-brendel.com
SOUTH AFRICA

Hazendal
ANNO 1699
HAZENDAL

JORDAN
STELLENBOSCH

BOUCHARD FINLAYSON

Beacon®

Climate Stats: March 2011

Pressure

Maximum	905.7 hPa
Average Maximum	888.8 hPa
Average	885.4 hPa
Average Minimum	882.2 hPa
Minimum	864.3 hPa

Temperature

Maximum	-7.3 °C
Average Maximum	-13.2 °C
Average	-16.6 °C
Average Minimum	-20.0 °C
Minimum	-26.0 °C

Humidity

Maximum	87 %
Average	60 %
Minimum	15 %

Wind

Maximum Gust	43.2 m/s (155 km/h)

Sunshine

Average Day Length	13:05 hrs

46 days to go until the last Sunset.

SANAE 50 team members:

Abigail Paton - Doctor

Alan Davies - Diesel Mech (Generators)

Beatrice van Eden - Scientist (Spaceweather)

Gerard de Jong - Electrical Engineer

Johan Hoffman - Radio Tech (Dep. Teamleader)

Kevin van Eden - Scientist (Spaceweather)

Paul Lee - Meteorologist (Teamleader)

Renier Fuchs - Scientist (Particle Physics)

Ruan Nel - Scientist (HF Radar)

S'celo Ndwalane - Diesel Mech (Vehicles)

Tiki Jordaan - Mechanical Engineer

Series of the Month:

FARSCAPE

Movie of the Month:

Quote of the Month:
(During a particularly quiet evening meal.)
Moooo... just trying to blend in. - Alan Daniels