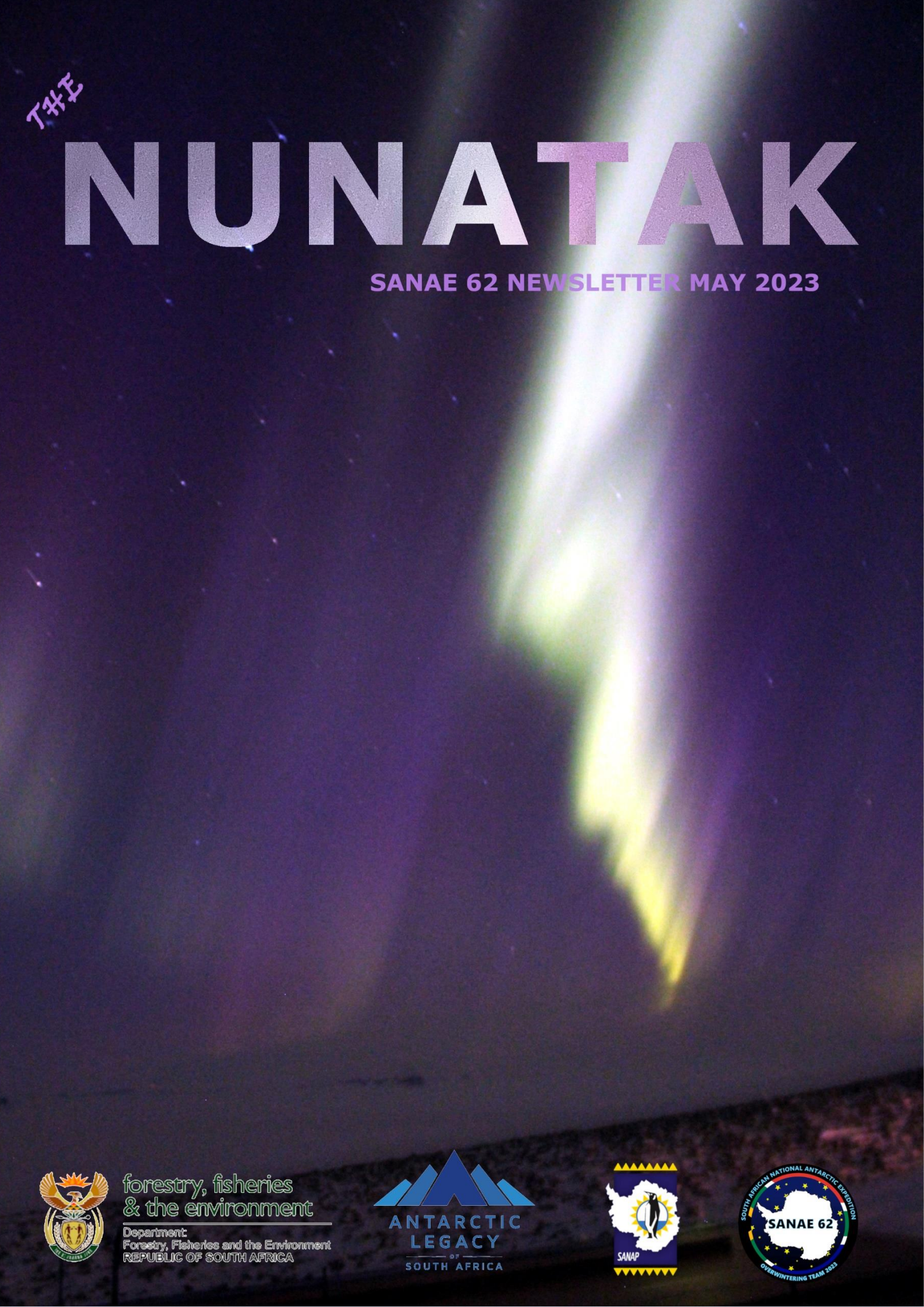


THE NUNATAK

SANAE 62 NEWSLETTER MAY 2023

forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

ANTARCTIC LEGACY OF SOUTH AFRICA

SANAP

SOUTH AFRICAN NATIONAL ANTARCTIC EXPEDITION
SANAE 62
OVERWINTERING TEAM 2023

Letter from the editor

The Nunatak: Introducing the SANAE 62 newsletter second edition, giving a glimpse into the life of an overwintering expeditioner at the South African National Antarctic Expedition research base.

The past few months surely did pass by really quickly with loads of excitement and some exceptional natural phenomena.

You know there's different ways to try and express the vast beauty of this world that can be articulated without a single phase. We don't always consciously realise how magnificent nature can be.

From witnessing auroras for the first time, or an optical phenomenon such as the light pillar effect seen on page 8 and immensely strong winds with temperatures dropping below -45 °C, at wind chill.

The Antarctic cold has definitely made itself known in the past couple of weeks with its icy windstorms gusting above 92 knots and snow freezing to near solid ice.

With all that has been happening, the team is keeping strong. Spending memorable time with games night, where the team partakes in some sort of knowledge testing game or board games. You'll also find some of the team members being consistent at going to the gym and others trying new food dishes or some sugary bakes in the kitchen.

The Sun has also set for the next few months just below the horizon, leaving us with only a glimpse of sun light during the day. That is if it's not overcast, which is mostly the case. Read more about this on page 18.

The team will be celebrating Mid-Winter in the coming month as a tradition for Antarctica research stations. More in the next newsletter.

"Not all those who wander are lost."

~ J.R.R Tolkien

Editor: *DJ van Wyk*

Chasing Auroras

DJ van Wyk

First aurora witnessed at SANAE IV. (01:02 UTC, 2023-03-24)

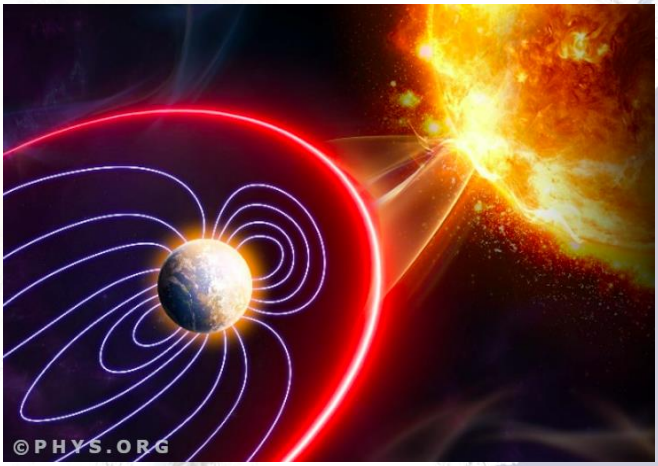
What is an aurora? How do auroras occur? Why do we see these colourful light distortions?

In Antarctica, we can observe the southern lights known as the aurora australis. These brilliant natural phenomena are seen during the night sky. At SANAE IV research base, it is one of the most incredible phenomena to witness when overwintering.

The South African National Space Agency (SANSA) hosts a number of space weather and space physics instruments at SANAE IV. Some of these instruments can pick up solar activity which in turn causes the auroras. An aurora occurs when the Sun is very active, with Sunspots erupting with enormous energy bursts known as solar flares caused by coronal mass ejections (CME).

These solar flares release huge amounts of energy following a very complex mechanism where particles are accelerated to large speeds due to the interaction of the magnetic field.

Some of these high energy particles will hit the Earth's magnetic field, following the magnetic field lines down into the Earth's atmosphere at the magnetic poles. When these solar particles collide with oxygen, they produce red or green light, and when the particles collide with nitrogen, they produce green and purple lights.

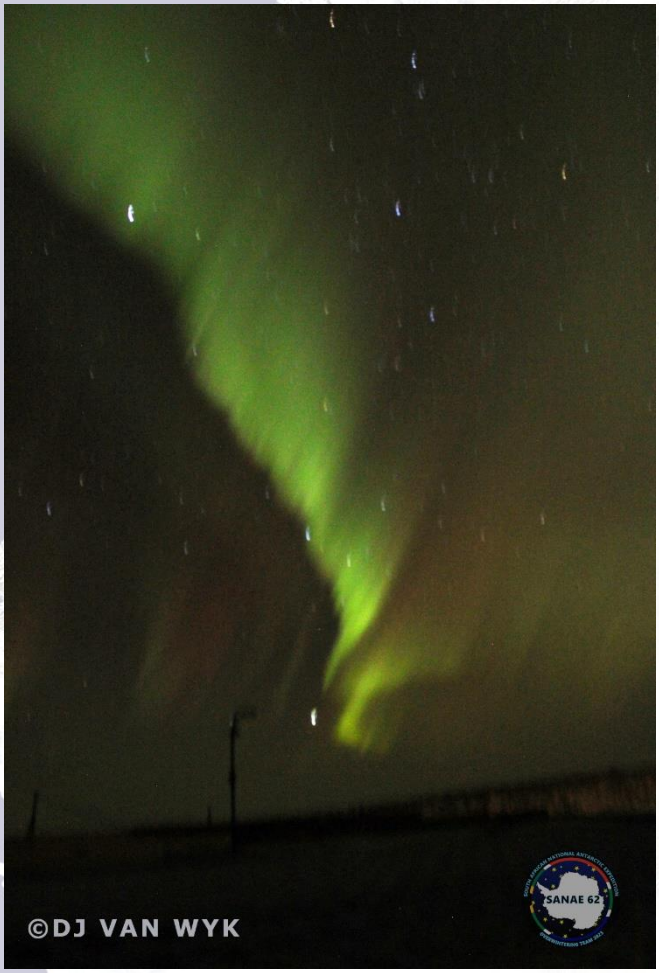


An illustration of solar flare impacts.

A solar flare may have different phases with the most important being the radiation that is produced in the X-Ray spectrum.

These X-ray radiation effects can have an intensity that outshines the sun by several orders of magnitude.

The SANSA electronic engineers are able to observe the solar activity with one of the SANSA space weather instruments known as the UltraMSK (Ultra Minimum Shift Keying). The UltraMSK works with Very Low Frequency (VLF) transmissions that are stable in power and at a set frequency.



Aurora observed at SANAE IV. (01:42 UTC, 2023-05-20)

At SANAE IV research base, there is a VLF antenna that transmits these set frequencies to various ground stations across the globe. Monitoring these transmissions for any interruptions, they can indicate when a solar flare occurs in almost real-time. How do the engineers now that an aurora will be visible and at what time?

The engineers monitor the various instruments activity for any geomagnetic storms resulting from a solar flare. The magnetometer instruments' pick up the magnetic interference immediately. With the observation of the UltraMSK data for any solar flare occurrences earlier, this will give an indication of the possibility to see a visible aurora. There are platforms also used to predict when a aurora will most likely be visible and the strength of the aurora. This can be seen from the predictions done by NOAA Space Weather Prediction Center.

Third aurora at SANAE IV. (01:56 UTC, 2023-05-20)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SANAE IV Weather

Steve Tebele

Antarctica is one of the coldest places on Earth and extremely dry, making it a desert. The weather conditions at SANAE IV research base can often change dramatically and very quickly with no warning. The snow does not melt completely for the most part and varies in different regions. Glacier ice is therefore formed from the snow being compressed over time.

The South African Weather Service (SAWS) hosts a weather observation station at SANAE IV research base with one meteorelogical technician. The met-tech spends the whole overwintering period of 14-months doing weather observations, climate parameters and data analysis.

The metereological technician representing SAWS, under the S62 overwintering team is Tlhonolofatso (Steve) Tebele.

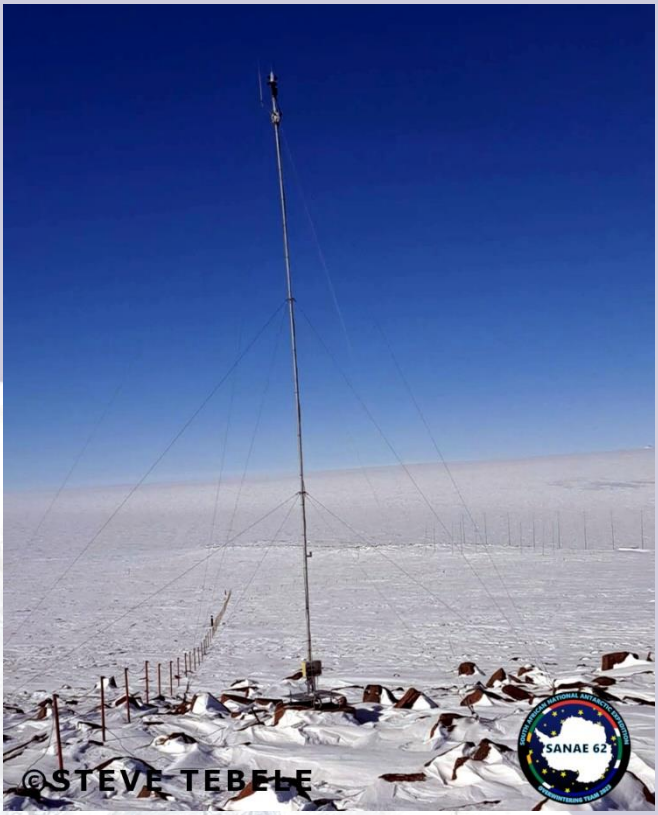
Measurement	Maximum		Minimum		Average
Pressure	896.9 hPa	2023-05-27	856.2 hPa	2023-05-13	877.5 hPa
Temperature	-7.9 ^{o}C	2023-05-27	-26.3 ^{o}C	2023-05-22	-18 ^{o}C
Humidity	81 %	2023-05-27	9%	2023-05-16	55 %
Wind Gust	49.5 m/s	15th			12.3 m/s

Table 1. SANAE IV Vesleskarvet SAWS weather data for the month of May 2023

May has been a very interesting month indeed, from seeing the auroras to winds gusting over 92 knots. These fierce winds predominantly arise from the south easterly direction. These types of winds are often refered to as Katabatic winds.

The warmest day was observed at -7.9 ^{o}C, where minimum temperatures recorded were roughly -26.3 ^{o}C. The month of May started off with very cold temperatures recorded at -23 ^{o}C with apparent wind chill temperatures being around -49 ^{o}C. The worst is yet to come I presume.

Steve in his weather gear at SANAE IV base.



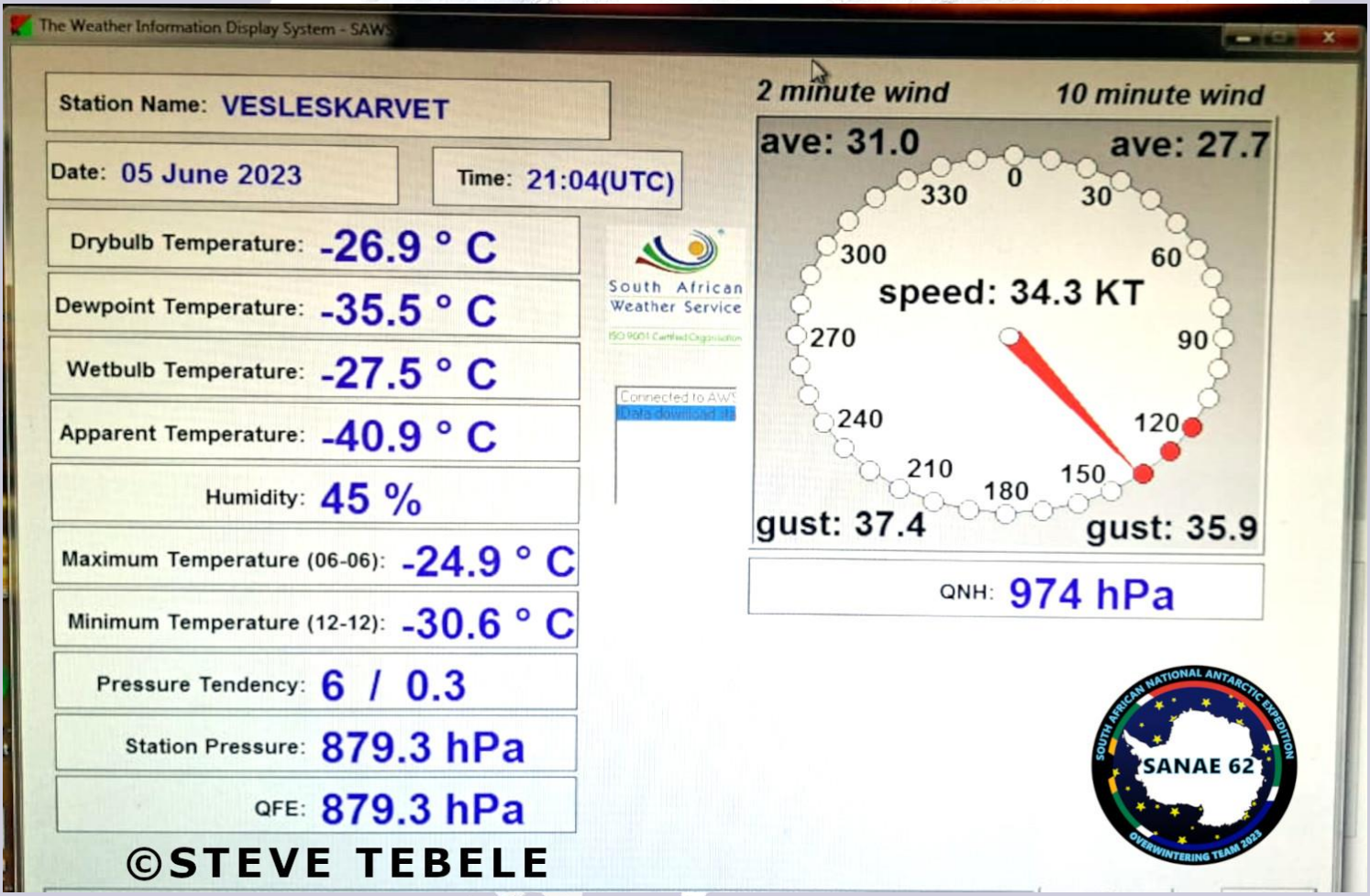
Currently, it is almost 24/7 complete darkness. The pure beauty of a Antarctic sunrise or sunset will defintely be missed during the upcoming weeks.

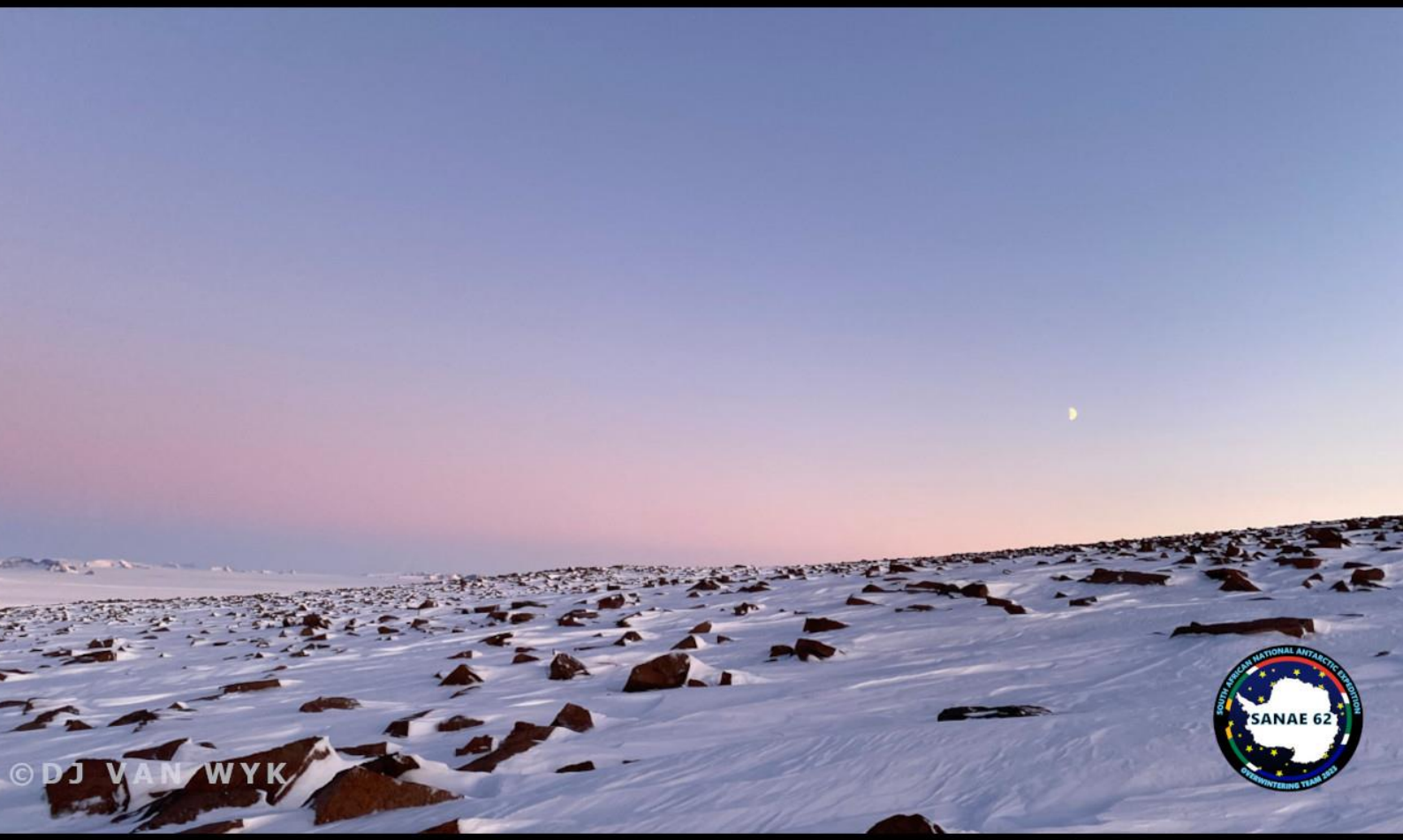
"Anyway, I now struggle a bit when I have to do my 06h00Z weather observations in the morning due to the darkness.

I am unfortunately not used to it yet, but I have to adapt. Other than the weird weather phenomena here, we still doing okay onto our 6th month into the overwinter year. Gym is still keeping us sane and the muscles are growing (FunFact).
Looking forward to summer."

~ Steve Tebele.

South African Weather Service




SANAE 62
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SuperDARN Radar

DJ van Wyk

The South African National Space Agency (SANSA) hosts one of the globally connected HF Radar Antenna projects known as the SuperDARN array. The Super Dual Auroral Radar Network is part of a international network to study the ionosphere in greater detail. With 12 countries and 35 radars present in both hemispheres, looking through the window into geospace. Making South Africa a global space player and contributor through international participation.

SuperDARN Radar Transceiver System.

The HF Radar measures ionospheric dynamics by receiving scatter from field aligned irregularities or scatter from the ground. The field lines at the poles reach out furthest into space, and gives the best measure of linkage between solar winds and the magnetosphere.

SANSA Engineer, Nivek Ghazi, doing repairs on the radar array.

The SuperDARN antenna array transmitts at roughly 100 m/s per pulsation, reaching distances of 3000 km. The radar array consists of 16 horizontally polarised Twin Terminated Folded Dipole (TTFD) antenna. Each antenna is connected to a coresponding transceiver box.

The SANSA electronic engineers overwintering are responsible for the optimal operation and upgrades to the SuperDARN Radar. The Radar's operation and data collection is monitored on a daily bases through a dashboard system conviently accessable anywhere within the base's network.

The SuperDARN array at SANAE IV research base.

The engineers are responsible for the calibration of the transceiver boxes which includes the required modification on board level and repairs where needed.

One radar antenna mast is 18 meters in height. The SANSA engineers climb these towering masts with climbing gear and certificied training to inspect the antenna while doing repairs on broken items due to extremely strong winds. The harsh Antarctic environment makes it definitely a challege to work at heights or even do ordinary outside work. It is such a surreal experience to be able to work in these types of environments.

Caution needs to be taken seriously when working in these extreme cold weather conditions as frost bite is not shy.

SANSA Engineer, DJ van Wyk, at the highest point of a radar antenna mast.

SANSA Engineers doing repairs during takeover.

The main reason for research in space weather utilising instruments such as the SuperDARN Radar, is our ever increasing dependency on satellite communication and various other forms of technology.

Satellites operating within the space environment are often affected by space weather effects and storms causing damage which in turn disrupts infrastructure.

Scientists use the data from the SuperDARN to determine how the Earth interacts with the space environment and provides insight into the dynamics of space weather.

Visit: www.sansa.org.za/research/

SANSA
SOUTH AFRICAN NATIONAL
SPACE AGENCY


SANAE 62
#S62PICTIONARYNIGHT


#SMELLYMAY2023

Winter Solstice

Abby Paton

The Sun peaking over the horizan, 2023-05-22. (11:46 UTC)

That tiny, tiny speck just to the right of our smoking exhausts, and almost due North, is the last we will see of the Sun for the next two months. Don't think that we are going to spend all this time in complete darkness. We shall still have a glow on the horizon, just not any direct sunlight. That glow, however, lasts for three to fours hours at the best, so we now are truly in Polar Night. It happens very fast.

Summer seems to go on forever, then suddenly we lose light at the rate of 20 to 30 minutes daily, until half-way through May there is no Sun.

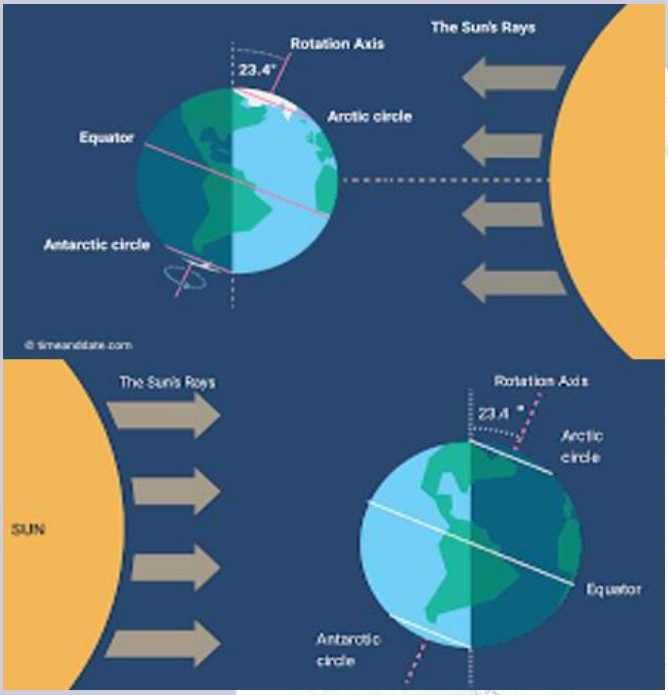
Here is a similar view taken on the 3rd of May, at 14h29.09, showing the Sun still (just) above the horizon, much further West:

Here it is on the 13th of May at 13h39:

After a 10 day period, even though this picture is taken 50 minutes earlier, the difference is very clear: the Sun is much further North and is almost below the horizon.

The reason for losing direct sunlight for a good two months of our stay here is due, simply, to the fact that the Earth is tilted on its own axis of rotation by around 23.5°. The Poles are designated at being at 90° latitude North or South. 90° minus 23.5° puts us at a latitute of 66.5°: the Arctic or Antarctic circles.

Anything North of the Arctic Circle (officially designated as 66.30° N) or South of the Antarctic Circle (66.30° S) has alternatively 24 hours of sunlight or 0 hours of sunlight. The following diagramme presents it nicely:

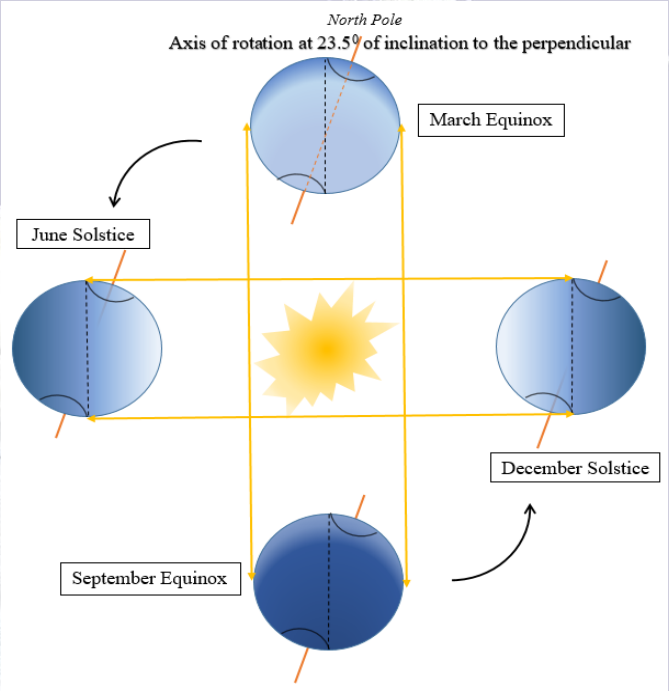


This top image shows the position of Antarctica on the Southern Winter Solstice – the 21st of June.

As can be seen, Antarctica is pointed away from the Sun throughout a full rotation or 24 hour period.

The Northern Pole lies completely within sight of the Sun at this time and thus has 24 hours direct sunlight where the Sun never dips below the horizon. This is the Northern hemisphere's Summer Solstice.

This next diagramme gives a dynamic representation of why the daylight shifts so much throughout the year.



As the Earth revolves around the Sun, the axis is exactly parallel to the Sun twice in the year, at the Equinoxes. At the Equinoxes the entire globe experiences a roughly equal amount of sunlight and darkness. As the Earth continues to revolve, the angle of inclination of the axis in relation to the Sun increases until the Solstices, at which furthest point the Arctic and Antarctic regions experience continuous sunlight or no sunlight, resepectively. As the Earth transitions from the Equinox to Solstice, clearly the amount of daylight will change also.

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