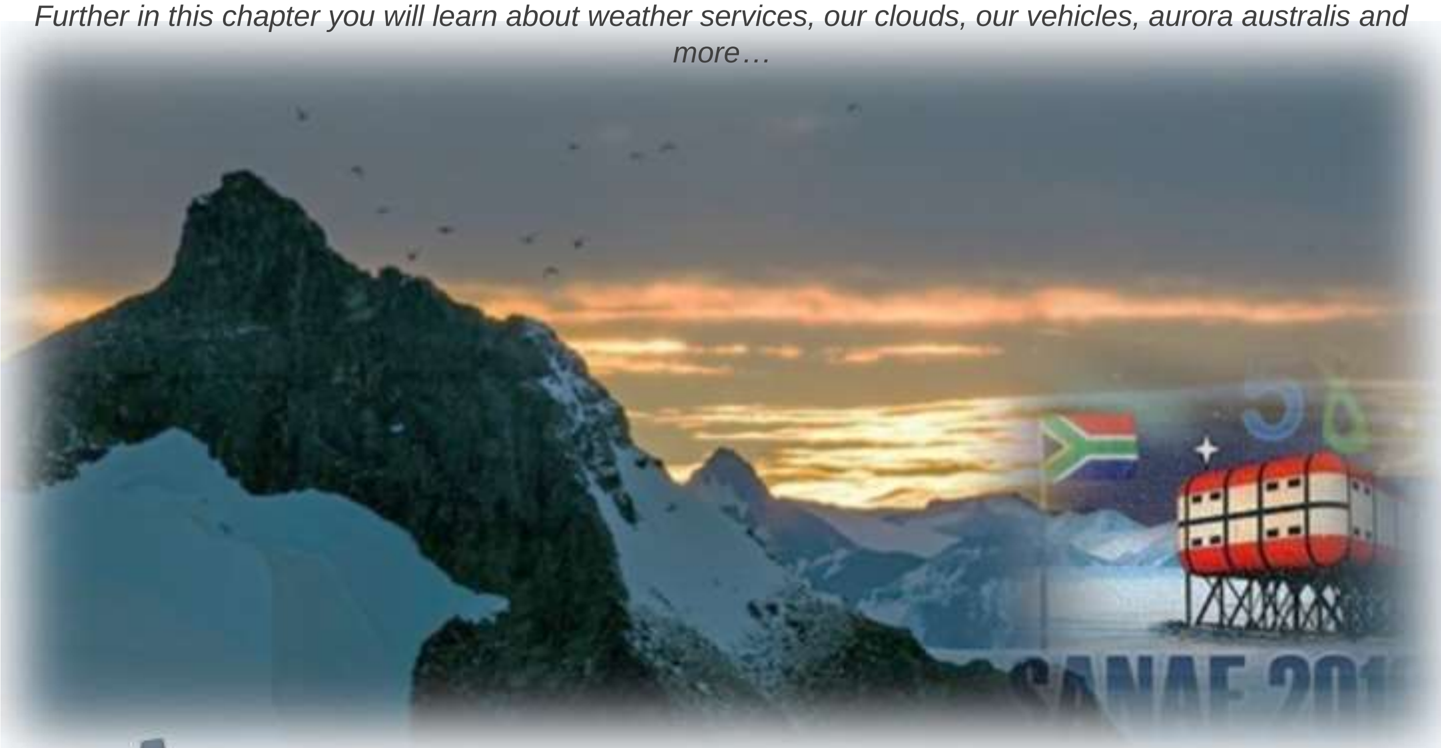
Petrel Post

SANAE 58th Overwintering Team

Chapter 7

In this chapter you will meet our Senior Meteorological Technician, who is our Senior South African Weather Services (SAWS) representative, Mr. Marvin Rankudu. He will tell you more about himself and his responsibilities.

Further in this chapter you will learn about weather services, our clouds, our vehicles, aurora australis and more…



"Lorenzen Piggen" Viewed from the SANAE IV Base (Zoomed), Antarctic Petrel in flight over the top of the mountain.

From left to right: Marvin, Jacques, Bongisipho, Jufter, Mpati, Travis, Sanele, Ewald and Salomé.

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In this issue:

Did you know?

More meteorites are found in Antarctica than anywhere else in the world.

Meteorites land everywhere with almost equal probability. However, in a humid jungle climate the moisture and oxygen would corrode them. In Antarctica, where the climate is extremely dry, the likelihood of corrosion is almost non-existent. Additionally, the rocks are easier to spot on the white, icy surface of Antarctica. Sometimes the East Antarctic ice sheet's path to the sea is clogged by mountains or other obstructions and if the sheet stays in one spot for a long time, the strong winds and sunlight can evaporate the top layers and reveal the much older ice underneath and large meteorite concentrations within it. Reportedly, more than 20,000 samples of rock from unknown sources were collected since 1976.

Neringa - https://www.boredpanda.com/interesting-antarctica-facts-south-pole/

MEET OUR SENIOR METEOROLOGIST TECHNICIAN FROM SAWS: MARVIN RANKUDU

Marvin Rankudu (Senior Meteorology Technician / SAWS Representative)

As a first time overwintering expedition member, I was excited to begin the voyage to Antarctica and experience all the interesting stories I'd heard about the world's iciest continent. Everything about the South African National Antarctic Expedition (SANAE) program is extra ordinary – from mentally preparing yourself for a year's worth of isolation from family and friends, multiple plane rides to and from home, to purchasing a year's supply of toiletries, favourite drinks and entertainment – it is hectic. The voyage to the SANAE base comprises a two-week long journey by the South African Agulhas II followed by a 45-minute helicopter ride from the ice shelf to the base. Luckily the seas were calmer than usual, I'd heard, and upon arrival to the base we were met by several days of good weather. Good weather in Antarctica is defined as such, "no wind today".

So far, the team and I have generally adapted to the Antarctic environment well. The team-building orientation at base did a great job at ensuring that we all settle in well to our new roles and new home. The base has a variety of convenient built in features, notably under floor heating in every room, a games room, movie theatre lounge room, sauna and plenty more. With the addition of personal projects, work and fun activities with the team there should be enough business in the base to get us through a whole year in the ice.

At base, my responsibility is to continue with quality meteorological observations and reporting on behalf of the South African Weather Services. My role involves ensuing all quality control measures are adhered to when reporting current weather, accurate retrieval of weather data and general upkeep of the various sensors and components used to keep the Meteorological Office running. All data collected is used to continue accurate weather forecasting for the SANAE base region and is used in the research of the Antarctic weather by SAWS and related organizations.

SOUTH AFRICAN WEATHER SERVICE - ANTARCTICA

Marvin Rankudu (Senior Meteorology Technician / SAWS Representative)

The South African Weather Service (SAWS) has been a part of the South African National Antarctic Program (SANAP) since the country's first expedition voyage to the icy desert in 1960. The year 2020 will mark the 80th anniversary of SAWS involvement in the program. This milestone will be of great significance in terms of weather and climate science archiving and records. For its period involved in SANAP, the SAWS has a comprehensive database of weather data collected between the RSA Bukta ice shelf (where the initial three bases were located) and the region in and around Vesleskarvet (the location of the current SANAE IV base), 166km inland from the ice shelf. The magnitude of the SAWS archives regarding Antarctica's weather and climate makes it one of the largest sources of climate data for the region.

The SAWS collect its data through an Automated Weather Station (AWS) exposed to the Antarctic atmosphere. This data comprises records for temperature, humidity, wind speed, wind direction and atmospheric pressure. The daily atmospheric observations by a SAWS meteorological representative ensures that meteoric events of significance (i.e. snow-fall and its duration, cloud type and their extent) can be associated with the qualitative data recorded by the AWS at the time of occurrence of such events.

Below, Figure 1A and B illustrate the basic AWS components.

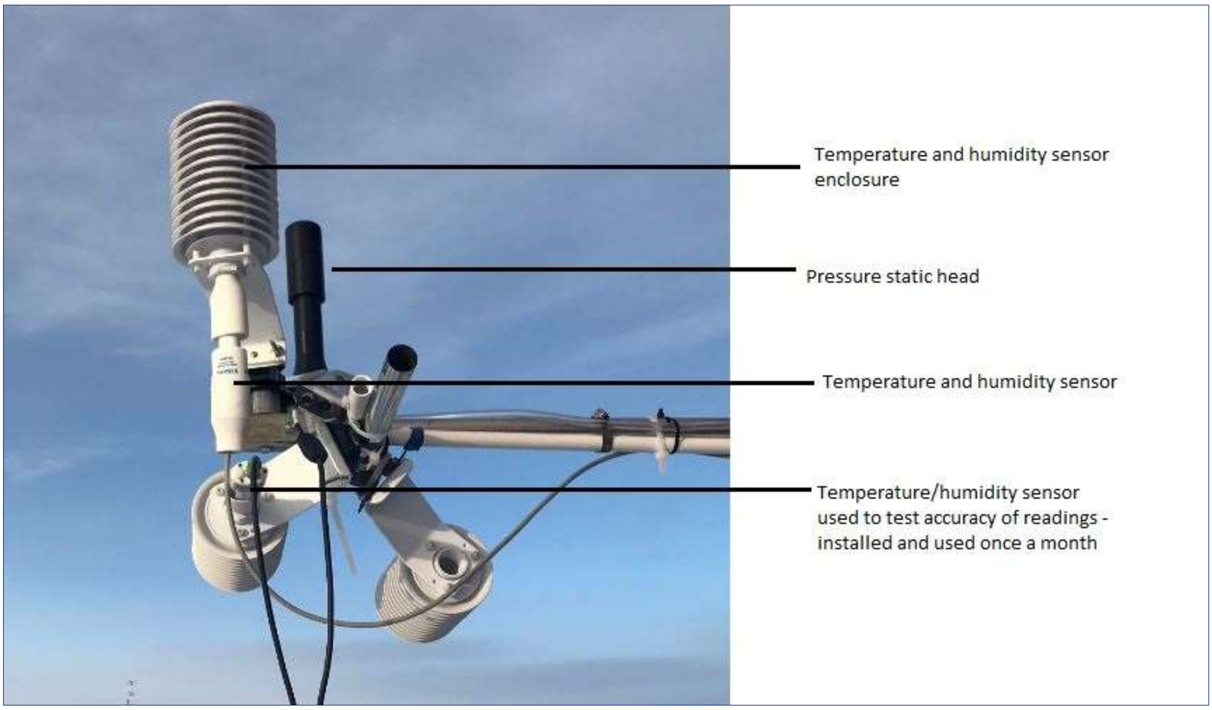

Figure 1A. The automatic weather station set-up exposed to the Antarctic atmosphere.
The weather station is installed 2m from the ground and is at an elevation of 865m above sea level.

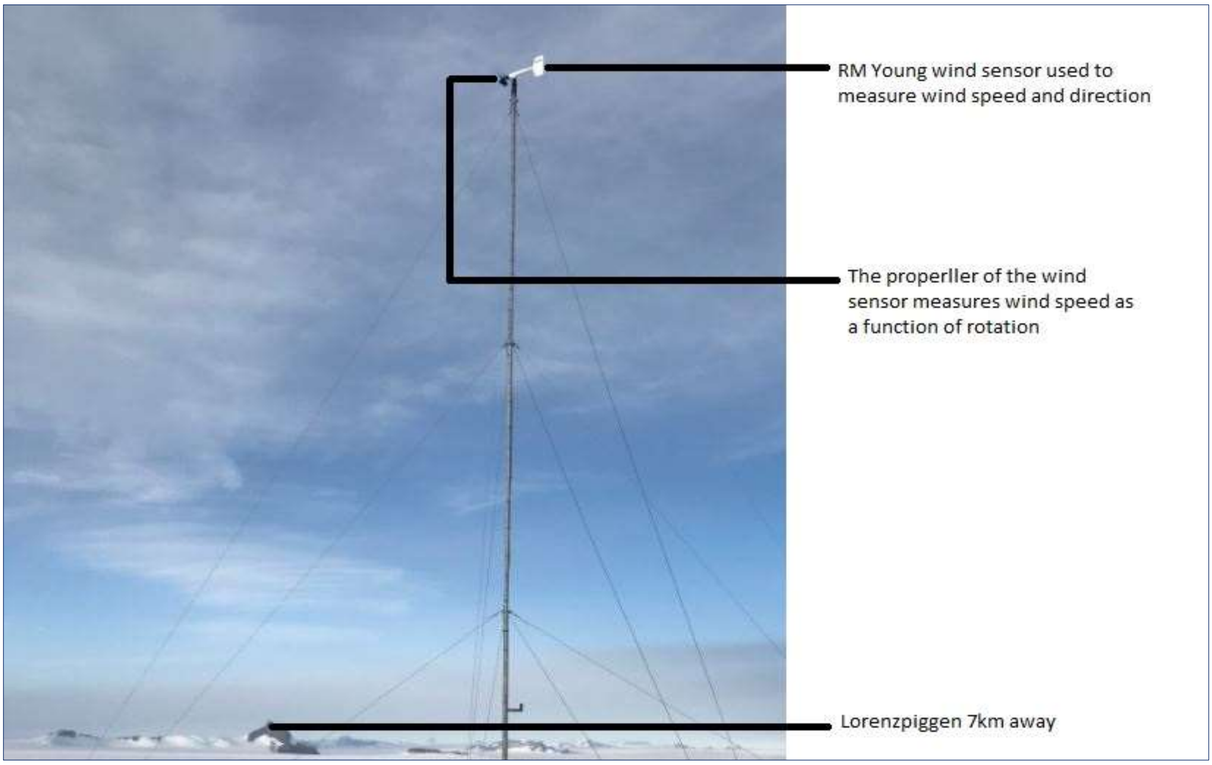

Figure 1B. An anemometer installed 10m clear of the ground, used to measure wind speed and direction.
The propeller always faces in the direction from which the wind is blowing, i.e. as depicted here East of South East.

To ensure that the most accurate data is collected, the SAWS sends newly calibrated sensors each year to the Meteorological Office at the SANAE IV base. Usually three sets of each component are brought as spares in case a sensor is rendered dysfunctional by weather conditions above their respective specification thresholds.

COMMON CLOUD TYPES - ANTARCTIC REGION

Marvin Rankudu (Senior Meteorology Technician / SAWS Representative)

Cloud formation in Antarctica is driven by turbulence – when a mass of warm air is turbulently mixed with a cool air mass at some altitude above the ground, forming a nearly evened out layer of vapour-laden air that condenses to form a layer of cloud. Some common cloud types are illustrated below:

Figure 2A. Altostratus clouds around 2km above the earth's surface

Figure 2B. Corona forming around Cirrostratus clouds around 5km from the earth's surface

Figure 2C. Stratocumulus clouds about 600m from the earth's surface

Figure 2D. Nimbostratus clouds about 600m from the earth's surface. It is quite common for snow to reduce visibility, as is the case in the picture.

Stratocumulus and Nimbostratus are the main snow producing clouds in Antarctica. The difference between the two is that stratocumulus clouds can easily be seen moving across the sky whereas the latter is not as easily discernible from nimbostratus clouds. Also, nimbostratus clouds are much darker in colour (dark grey as opposed to near clear-white) than stratocumulus clouds.

VEHICLES

Jacques Robbertze (DEA Diesel Mechanic and Team Leader)

In the South African National Antarctic Programme's (SANAP's) Antarctic base we make use of Caterpillar equipment for various tasks. I'm going to give a short description of the vehicles used and a few facts about each of them.

First, we will look at the Challengers. The original model was a Challenger 65 featuring the Mobil-Trac System (MTS) consisting of rubber tracks and a suspension system. The MTS combined the flotation and traction of steel tracks with the versatility of rubber tires. The use of tracks gave the machines increased tractive performance compared to traditional four-wheel drive tractors equipped with tires. Build originally as robust and no-nonsense agricultural machines, they have undergone a few minor amendments for the harsh and unforgiving environment that we are dealing here with in Antarctica. First is a bigger, more comfortable "sleeping" cab. The reason for this is that since the distances are far and wide and given the speed one can maintain being 15km/h when towing 60+ tonnes over the ice, it allows for non-stop driving. 200km may take you approximately 25hrs to complete. Second is a Webasto, originated from Canada, this is a pre-heater (Diesel burner) that in effect warms up the coolant fluid in the engine block, once it reaches anything form 20-30 degrees Celsius it switches off and you are ready for start-up. Bigger fuel tanks (1250 L) for those prolonged trips over the ice and HF radios to be in communication for when you away from base. We have 2 models here at SANAE and herewith a short intro to the bad boys!

MT865C – NEW MODELS	65/75 B&C – OLDER MODELS
CAT C18 ACERT Engine – 6 cylinder	CAT 3306 DITA Engine – 6 cylinder
Rated engine power - 510HP/380kW	Rated engine power - 300HP/224kW
Max torque @ 1,400 rpm - 2,525 Nm	Max torque @ 1,300 rpm - 1,212 Nm
Engine displacement - 18.1 Litres	Engine displacement – 10.5 Litres
Aspiration – Turbo Charged with air-to-air after cooled	Aspiration - Turbo Charged with air-to-air after cooled
Fuel Tank Capacity - 1,250 Litres (mod)	Fuel Tank Capacity – 850 Litres (mod)
Transmission - CAT PowerShift Forward and reverse speeds – 16 FWD x 4 REV – semi automatic	Transmission - CAT PowerShift Forward and reverse speeds – 10 FWD x 2 REV – semi automatic
Max transport speed - 40 Kph	Max transport speed - 30 Kph
Steering Type – Caterpillar speed sensitive differential steering	Steering Type - Hydrostatic differential steering

Figure 2 . An example of the original configuration of a Challenger.

Figure 4. Glimpse of Ewald on the inside of one of our Challengers at SANAE IV.

Next up the trusty old Dozers. ☺
In the early days before the Challengers, the Dozers were used to cart / tow equipment and supplies from the ship to the base. Now these grand old ladies are semi-retired here at the base. If they have to go on long hauls, they get loaded on sledges and away they go. Modifications to them are the same as the Challengers in a sense that they have Webasto`s as well as a semi-type “sleeper” cab, but due to the noise they generate I will not suggest it! So, herewith a bit of technical info on them.

D6H	D4E
CAT 3306 Engine – 6 cylinder	CAT 3304 Engine – 4 cylinder
Rated engine power – 180Hp/130kW	Rated engine power- 95Hp/71kW
Max torque @ 2,000 rpm – 794 Nm	Max torque @ 1,800 rpm – 376 Nm
Engine displacement – 10,5 Litres	Engine displacement – 7,0 Litres
Aspiration - Turbocharged	Aspiration - Naturally
Fuel Tank Capacity – 400 Litres	Fuel Tank Capacity – 230 Litres
Transmission - Planetary PowerShift Forward and reverse speeds – 3 FWD x 3 REV	Transmission - Planetary PowerShift Forward and reverse speeds – 3 FWD x 3 REV
Max transport speed – 11 Kph	Max transport speed – 9 Kph
Steering Type - Differential steering	Steering Type - Differential steering

The D4E was paramount in the construction of SANAE IV, it has a TLB (Tractor-Loader-Backhoe) style set-up with the only difference that she has tracks and not wheels. The D6`s is getting split up in 2 categories namely – blade and bucket dozers. The blade dozer is a conventional bulldozer without the ripper attachment. In its place is a powerful winch. These machines are basically used for clearing snow build up from around the base and for clearing the ice road. They are also used for building the winter depot and for moving sledges around. Maintenance of the runway is also done with these machines.

The bucket CAT is a dozer with a difference. Instead of a blade, the bucket dozer is fitted with a front-end loader type bucket. It is also fitted with a 5-ton Palfinger crane. The bucket attachment is essentially used for making a stockpile of snow at the smelly and for throwing snow into the smelly during take over when plenty water needs to be made. However, the bucket attachment can be used to assist with many other tasks. The Palfinger crane is used for the loading and offloading of containers and during take-over she is in constant demand. It is also used to assist the scientists with the erecting and removal of different projects. A man-basket (“cherry picker”) can also be fitted in order to work safely at heights. These machines are without a doubt the hardest worked and great care is taken to ensure their reliability.

Figure 3. CAT train: a Challenger pulling a loaded, 6-meter container and 2 x 25 000 litre polar diesel bowsers.

Figure 6. Blade dozer at work.

NATIONAL BRAAI DAY – 24 SEPT 2019

Figure 7. South Africa's National Heritage Day on 24 September 2019 was also celebrated as our National Braai Day at SANAE IV.

OUR WEATHER

Marvin Rankudu (Senior Meteorological Technician / SAWS Representative)

Table 1. SANAE IV weather statistics, as recorded for the month of Sept. 2019.

Weather Statistics: September 2019								
SANAE IV - VESLESKARVET								
	Minimum		Q1	Median	Average	Q3	Maximum	
Temperature (°C)	-33,2	(9th)	-27,2	-24,6	-24,7	-22,6	-13,3	(19th)
Humidity (%)	18	(7th)	48	57	57,4	70	82	(3,4,15th)
Wind Speed (m/s)	0	(8th)	7,4	11,2	11,4	14,3	36,0	(20th)
Pressure (hPa)	859,6	(18th)	872,0	876,3	876,3	880,6	892,5	(23rd)

°C, degrees Celsius; Q1, first quartile or 25th percentile; Q3, third quartile or 75th percentile; %, percentage; m/s, meter per second; hPa, hectopascal

ANTARCTICA MATTERS

Salomé Odendaal (Team Medical Doctor)

Figure 8A and B. Aurora australis, captured late at night on 27 September 2019 at SANAE IV.

Aurora australis is defined as an aurora that occurs in earth's southern hemisphere, also referred to as southern lights or southern polar lights. An aurora is a luminous phenomenon that consists of streamers or arches of light appearing in the upper atmosphere of a planet's magnetic polar regions. The term aurora australis was first used approximately in 1734 and it is the southern hemisphere counterpart to the aurora borealis. Aurora borealis thus occurs in earth's northern hemisphere. Aurorae are typically 100 to 300 km high but sometimes as high as 500 km or as low as 80 km.

So, what is this luminous phenomenon of streamers and arches of light?

Figure 8C. Aurora australis, captured late at night on 27 September 2019 at SANAE IV.

Aurora australis takes the shape of a curtain of light in the sky, or a sheet, or a diffuse glow. It most often is green, sometimes red, and occasionally other colours too. It is strongest in an oval centred on the south magnetic pole.

It is caused by the emission of light from atoms excited by electrons accelerated along the planet's magnetic field lines. Differently put, it is the result of collisions between energetic electrons (sometimes also protons) and atoms and molecules in the upper atmosphere. The electrons get their high energies by being accelerated by solar wind magnetic fields and the Earth's magnetic field. Thus, aurorae appear as solar wind, which is a gust of charged particles emitted by the sun, blows across Earth's magnetic field. The green and red colour come from atomic oxygen while nitrogen ions and molecules make some pinkish-reds and blue-violet colours.

The motions of the particles are complicated, but essentially the electrons spiral around the Earth's magnetic field lines and 'touch down' near to where those lines become vertical. So, by far the best place to see aurorae in the southern hemisphere is Antarctica, at night!

When the solar cycle is near its maximum, aurora australis are sometimes visible in New Zealand (especially the South Island), southern Australia (especially Tasmania), and southern Chile and Argentina (sometimes in South Africa too).

Figure 8D. Aurora australis, captured late at night on 27 September 2019 at SANAE IV.

Because the charged particles flow along symmetrical lines in Earth's magnetic field linking the north and south poles, one would assume that the atmospheric displays in each hemisphere would mirror each other but, the aurora australis and aurora borealis are not identical. Due to advances in Earth imaging technology, scientists observed in 2009 that the patterns of aurorae drifting simultaneously across the poles didn't match. A study showed that when solar wind approaches Earth from an east-west direction, it creates uneven pressure on Earth's magneto-tail (a windsock-like extension of Earth's magnetic field) and tilts it toward the side of the planet shrouded in darkness. That tilt causes idiosyncrasies of shape and location of the northern and southern lights. The findings could reportedly improve the prediction of solar storms - which can disrupt electricity grids, satellites, and astronauts in space.

Aurorae are also seen on other planets. As there are strong magnetic fields and (not so strong) solar wind plus (really deep) atmosphere on Jupiter and Saturn, they have spectacular aurorae, in rings around their magnetic poles. Aurorae have also been imaged on Venus, Mars, Uranus and Neptune, amongst others.

References:

- Merriam-Webster Dictionary. (2019). Definition of aurora. Merriam-Webster, Incorporated. Available from: https://www.merriam-webster.com/dictionary/aurora [Accessed 2 Oct. 2019]
- Merriam-Webster Dictionary. (2019). Definition of aurora australis. Merriam-Webster, Incorporated. Available from: https://www.merriam-webster.com/dictionary/aurora%20australis#h1 [Accessed 2 Oct. 2019]
- Merriam-Webster Dictionary. (2019). Definition of aurora borealis. Merriam-Webster, Incorporated. Available from: https://www.merriam-webster.com/dictionary/aurora%20borealis [Accessed 2 Oct. 2019]
- Tate, J. (14 Oct. 2009). What is the Aurora Australis? Universe Today, space and astronomy news. Available from: https://www.universetoday.com/42623/aurora-australis/ [Accessed 2 Oct. 2019]
- Fox, A. (25 Jan. 2019). The northern and southern lights are different. Here's why. American Association for the Advancement of Science. Available from: https://www.sciencemag.org/news/2019/01/northern-and-southern-lights-are-different-here-s-why [Accessed 2 Oct. 2019]

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Thanks guys, you made every braai day this year happen for us.

We would like to thank each of our sponsors for making our year that much more durable and comfortable.