

Heatwave events and increasing temperatures in South Africa



Katlego Ncongwane

South African Weather Service

Climate and Environment Research & Monitoring Unit

Katlego.ncongwane@weathersa.co.za

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Introduction

- Heatwave is one of the leading weather-related killers in the world resulting in hundreds of fatalities each year (Filleul et al, 2003; Tertre et al, 2006).
- The frequency, intensity and duration of heatwaves are increasing in many parts of the globe (Coumou & Rahmstorf, 2012; Perkins & Alexander, 2013). This has also been attributed to human induced climate change (Robinson, 2000; Peel & Osofsky, 2015).
- Increase in heatwave events translate to greater health impacts such as heat stroke, heat exhaustion, heat cramps and heat rash (Coumou, Robinson & Rahmstorf, 2010; Perkins Alexander & Nairn, 2012; Tong et al, 2014).
- Climate change has altered the geographical distribution of heatwaves and are now occurring in regions where they have not previously occurred (Coumou & Rahmstorf, 2012).
- Nearly every scientific study supports the near certainty that heatwaves are going to be an increasing part of the world's future climate (Orr, 2013).

Facts about heatwave

- There is no universal definition of heatwave in terms of magnitude, duration and rapidity (Robinson, 2001; Tong et al, 2014).
- What will constitute a heatwave in one area might not in another location.
- Health effects of heatwave on an individual are relative to a range of risk factors. The local acclimatisation and adaptation influence the impact of extreme heat.
- For a hot weather event to qualify as heatwave, temperatures have to exceed the average historical temperatures for a given area at that time of year.

Some definitions of heatwave

- A prolonged period (can be days or weeks) of extensive heat.
- An extended period of unusually high atmosphere-related heat stress, which causes temporary modifications in lifestyle and which may have adverse health consequences for the affected population.
- A period of hot weather when ambient temperatures are high enough to pose a serious risk to the health of exposed individuals and populations and to public and private infrastructure.
- Heatwaves are anomalous episodes with extremely high surface air temperatures, lasting for several days with serious consequence.
- 5 or more days that are above 90th percentile average temperature.
- The daily maximum temperature $\geq 35^{\circ}\text{C}$ (about top 1%) for 3 or more consecutive days.
- Some regions use fixed indices (5 days $> 35^{\circ}\text{C}$, 3 days $> 40^{\circ}\text{C}$).
- Heat wave occurs when temperatures for a place are 5°C or more above the average of the hottest month of that place, and that carries on for 3 days or more.

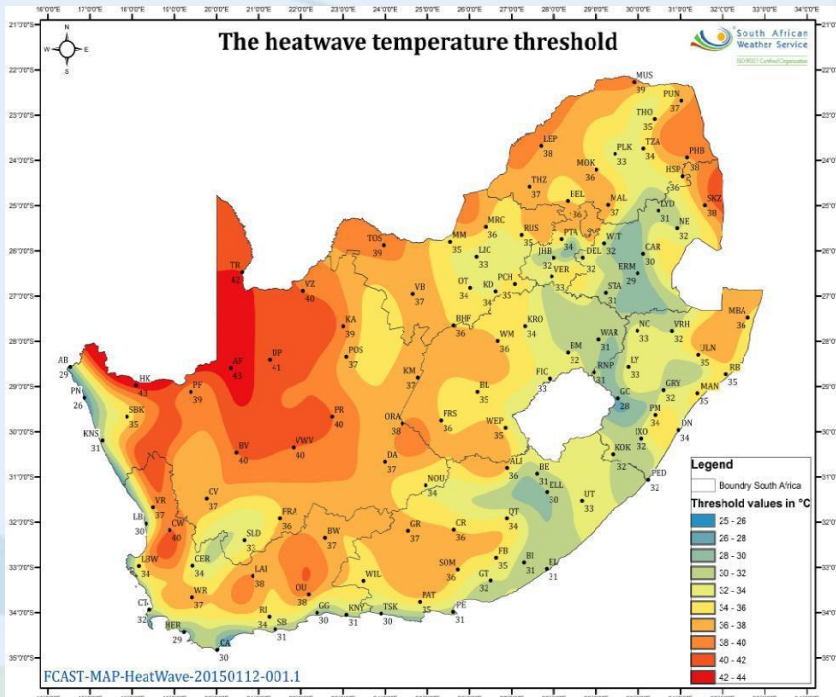
Even at a local level there can be multiple heatwave definitions, 

based on varying temperature levels or time periods (Tong, Wang & Barnett, 2010) 5

SAWS definition of heatwave

- Meteorological services around the world have developed operational definitions of heatwave to forecast and issue early warnings to the public.

The South African Weather Service (SAWS) declares a heatwave “when for three (3) days the maximum temperature is five degrees (5°C) higher than the mean maximum for the hottest month for that particular place”.



SAWS established local thresholds based on this definition

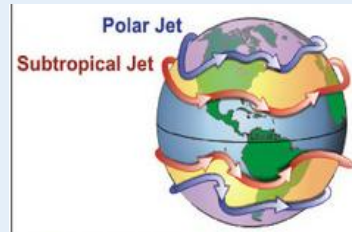
Causes heatwave

- **Climate change/global warming (Stern, 2007)**

It is difficult to directly attribute a specific heatwave to climate change. However scientists/researchers see a strong correlation.

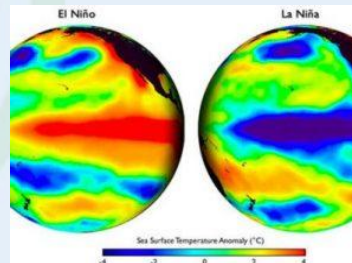
- **The position of the jet stream**

Causes air on one area to be significantly warmer than another.



- **El Niño and La Niña phenomenon**

El Niño is a climate cycle in the Pacific Ocean with a global impact on weather patterns. The cycle begins when warm water in the western tropical Pacific Ocean shifts eastward along the equator toward the coast of South America.



La Niña is a coupled ocean-atmosphere phenomenon that is the counterpart of El Niño as part of the broader El Niño–Southern Oscillation climate pattern.

Impacts of heatwave

- The impacts of severe heatwaves vary across many sectors from the general public to government organisations and industries, health, utilities, commerce, agriculture and infrastructure.
- Heatwave may have negative effects to human beings, animals and plants when they experience difficulties in adaptation.

Impacts can be directly or indirectly accountable for:

- ✓ Increased human morbidity and mortality, particularly among the poor, elderly, children and the infirm;
- ✓ Stress for outdoor workers;
- ✓ Increased risks for sporting and outdoor recreation activities;
- ✓ Shifts in tourism preferences due to higher temperatures and Increased drought;
- ✓ Increased bushfire risk;
- ✓ Stress in animals;
- ✓ Damage to crops and vegetation;
- ✓ Increased energy demand, e.g. greater demand for air conditioning;
- ✓ Stress on energy supply infrastructure;
- ✓ Increased demand for water, e.g. human consumption, cooling in power stations;
- ✓ Evaporative cooling in homes and offices;
- ✓ Infrastructure stress: buildings, roads, rail and other infrastructure.

Effects of rising temperature on a human body

| Temperature | State of body |
|-------------|---|
| 20 °C | Normal – Heart rate normal, body comfortable. |
| 25 °C | Still normal – Heart rate normal, body sweats slightly. |
| 30 °C | Mildly comfortable – Moderate sweating keeps body cool when it evaporates from our skin, but concentration is reduced. |
| 35 °C | Heat cramp – Heart rate and sweating increase, body loses water and salts causing muscles to ache. |
| 40 °C | Heat exhaustion – Heart rate becomes rapid, the body feels tired and nauseous and sweating becomes heavier. |
| 45 °C | Heat stroke – Core temperature raised, sweating stops, skin becomes dry. Fainting, organ damage and death possible. |

Important to note:

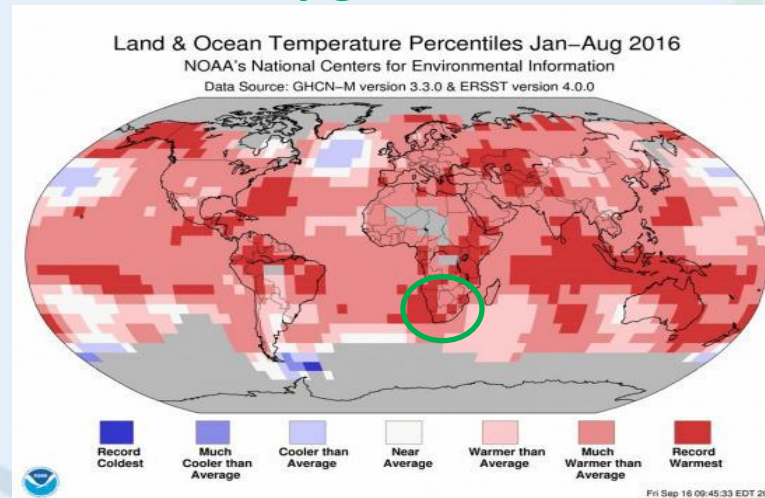
- Temperature is not the only parameter that influence human heat balance, other weather conditions such as humidity and wind also play an important role.
- Non-meteorological components: fitness and activity level of an individual, clothing type, and physiologic adaptation to a particular environment also have an effect.
- Babies and young children, the elderly and the infirm as well as people with mobility problem, outdoor workers and those doing outdoor sport, are most vulnerable.
- Social and cultural practices turn to influence human perception of and response to heatwave.

Heat related illness and first aid interventions

| | Symptoms | First Aid intervention |
|---|--|--|
| <ul style="list-style-type: none"> Heat Stroke | Confusion Fainting Seizures Excessive sweating or red, hot, dry skin Very high body temperature | <ul style="list-style-type: none"> ✓ Call an ambulance while you wait ✓ Place the affected person in a shady, cool area ✓ Loosen clothing ✓ Fan air on the affected person; cold packs in armpits ✓ Wet the affected person with cool water; apply ice packs, cool compresses, or ice if available ✓ Provide fluids (preferably water) as soon as possible ✓ Stay with the affected person until help arrives |
| <ul style="list-style-type: none"> Heat Exhaustion | Cool, moist skin Heavy sweating Headache Nausea or vomiting Dizziness Light headedness Weakness Thirst Irritability Fast heart beat | <ul style="list-style-type: none"> ✓ Sit or lie down the affected person in a cool, shady area ✓ Give the affected person plenty of water or other cool beverages to drink ✓ Cool the affected person with cold compressed/ice packs ✓ Take to clinic or emergency room for medical evaluation or treatment if signs or symptoms worsen or do not improve within 60 minutes. |
| <ul style="list-style-type: none"> Heat Cramps | Muscle spasms Pain Usually in abdomen, arms, or legs | <ul style="list-style-type: none"> ✓ Have the affected person rest in a shady, cool area ✓ The affected person should drink water or other cool beverages ✓ Wait a few hours before allowing the affected person to return to strenuous work ✓ Have the affected person seek medical attention if cramps don't go away |
| <ul style="list-style-type: none"> Heat Rash | Clusters of red bumps on skin Often appears on neck, upper chest, folds of skin | <ul style="list-style-type: none"> ✓ Sit or lie down the affected person in a cooler, less humid environment when possible ✓ Keep the affected area dry |

World Meteorological Organization

“Extraordinary global heat continues”



<http://public.wmo.int/en/media/news/extraordinary-global-heat-continues>

“We have witnessed a prolonged period of extraordinary heat, which is set to become the new norm,” said WMO Secretary-General Petteri Taalas....

“Hotter, drier, wetter. Face the future”

<http://www.wmo.int/worldmetday/content/hotter-drier-wetter-face-future>

“Each of the past several decades has been significantly warmer than the previous one. The period 2011–2015 was the hottest on record, and the year 2015 – with an extra boost from a powerful El Niño – was the hottest since modern observations began in the late 1800s”.

Some of the international media reported heatwave events (2015)

A number of mega heatwaves were reported

Large parts of the Middle East and North Africa were gripped by heatwaves....

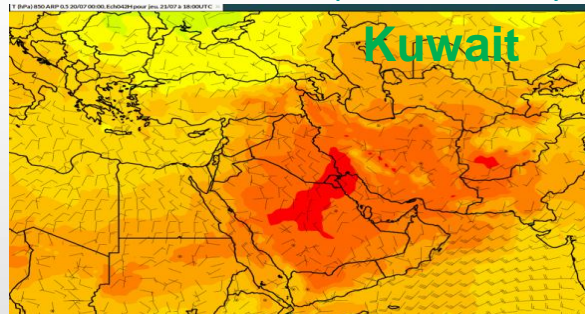
Temperatures exceeding by a large margin the seasonal averages, and over a sustained period. This affected, in particular, the northern part of countries in the Arabian Gulf and North Africa.

<http://public.wmo.int/en/media/news/wmo-examines-reported-record-temperature-of-54%C2%B0c-kuwait>

2 Middle East locations hit 129 degrees, a record in Eastern Hemisphere and maybe the world

The temperature in Mitribah, Kuwait, surged Thursday to a blistering 129.2 degrees (54 Celsius). And on Friday in Basra, Iraq, the mercury soared to 129.0 degrees (53.9 Celsius).

<http://heralddemocrat.com/news/international/2-middle-east-locations-hit-129-degrees-record-eastern-hemisphere-and-maybe-world>



Record heat scalding the Southwest in extreme weather pattern

Temperature records of 45°C, 43°C and 40°C for Yuma Phoenix and Tucson.

A widespread heatwave has affected the central and eastern United States of America, with temperatures of 95-100 °Fahrenheit (35-38°C), and heat index values to reach 110°F (43°C), with some areas reaching 115 °F (46°C), according to the US National Weather Service.

Met office issues heatwave alert for Karachi

“Day temperatures will gradually increase on Friday from 38°C to 40°C on Sunday....”.

<http://www.samaa.tv/pakistan/2016/04/met-office-issues-heatwave-alert-for-karachi/>

Some of the international media reported heatwave death tolls

Heatwaves claimed many lives in 2015

Heatwave kill 2,000 people in Southern Indian States

Devastating heatwaves occurred in many places, killing 2,000 people in the southern Indian states of Telangana and Andhra Pradesh alone <http://news.nationalpost.com/news/world/summer-heat-wave-eases-in-parts-of-southern-india-after-killing-nearly-2000-people>

Pakistan heatwave death toll climbs past 1,200

About 65,000 heatstroke patients treated in Karachi hospitals during heatwave, with nearly 2,000 still being treated <http://www.aljazeera.com/news/2015/06/pakistan-heatwave-death-toll-climbs-1200-150627153012878.html>

Heatwave kills 66 in India's Telangana state

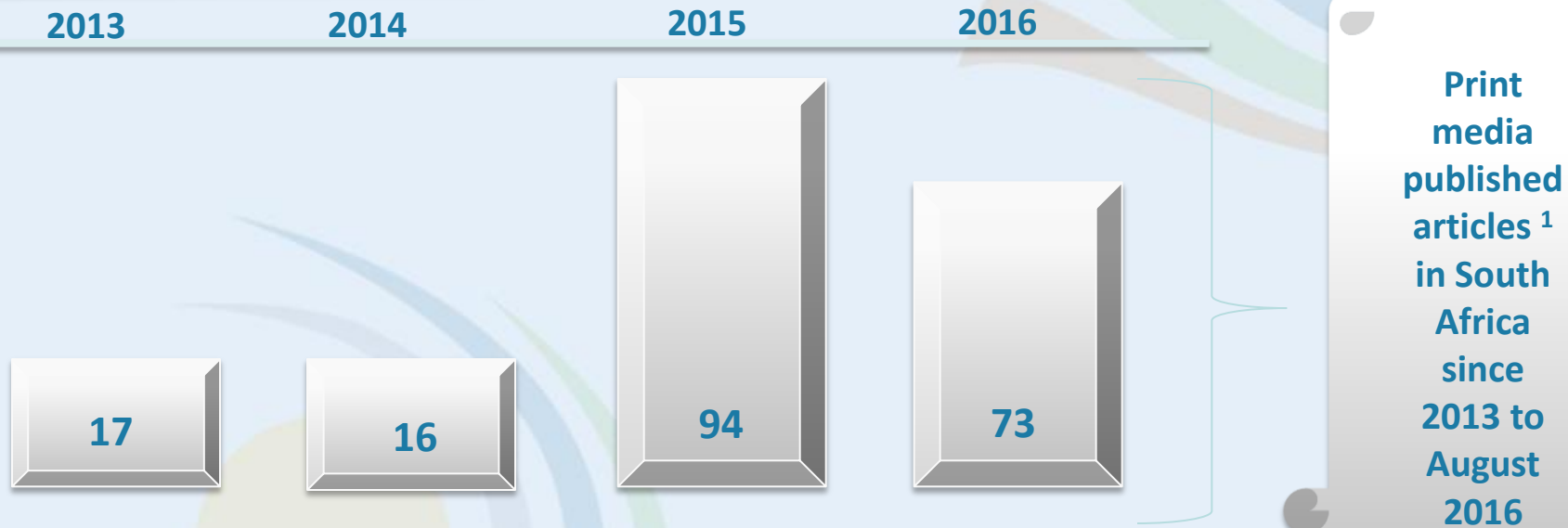
The highest number of deaths, 28 were reported from Mahbubnagar, followed by 11 in Medak and 5 each from Karimnagar and Khammam. Telangana continues to be the hottest area in the state with maximum temperatures of 43.4°C followed by Medak and Karimnagar with 43°C. Hyderabad recorded 41°C <http://gulfnews.com/news/asia/india/heatwave-kills-66-in-india-s-telangana-state-1.1705446>

Historic shocking death tolls due to heatwaves

Western Europe experienced the deadliest heatwaves causing almost 70 000 human deaths in 2003 between July and August (Tertre et al, 2006). Heatwave resulted in more than 500 deaths in Australia (Akompab et al, 2013) and 15 000 deaths in Russia in 2009 (Dole et al, 2011).

Print media published news articles on heatwave in South Africa

- A large number of print media news articles on heatwaves, hot conditions and high temperatures were published in **2015/2016** as compared to **2013/2014** period.



¹**Sources:** Beeld, Business Day, Business Report, Cape Argus, Cape Times, Citizen, City Press, Die Burger, Mail and Guardian, New Age, Pretoria News, Rapport, Sowetan, Star, Sunday Independent, Sunday Times, The Witness, Times.

Print media published news articles on heatwave in South Africa

- Heatwaves are a common **summertime** experience in South Africa, also spring, in particular the month of October.



Print media published news articles on heatwave in SA (2013-2014)

| Newspaper source | Page | Date | Headline | Author | Area |
|------------------|------|------------|--|---------------------|------------------------|
| 2013 | | | | | |
| Pretoria News | 3 | 2013-01-08 | Pretoria in grip of heatwave, weather service warns | van Zuydam, Lali | Gauteng |
| Star | 6 | 2013-01-08 | Heatwave warning for Gauteng until Thursday | van Zuydam, Lali | Gauteng |
| Beeld | 2 | 2013-01-09 | SA Sweet | | |
| New age | 9 | 2013-01-09 | Hot weather still has revellers flocking to province beaches | Makhaye, Chris | KwaZulu-Natal |
| New Age | 22 | 2013-01-09 | Here comes the heatwave | Luphahla, Zandisile | Northern Cape |
| Star | 3 | 2013-01-10 | Bafana fans brave the heat to show support | Tau, Poloko | Sandton |
| Star | 2 | 2013-01-10 | Respite from heat in sight | Tau, Poloko | Gauteng |
| Beeld | 3 | 2013-01-11 | Kraaie kry te warm om in Gauteng te gaap | Matipa, Piet | Gauteng |
| Star | 6 | 2013-01-11 | That's really cool | | Johannesburg |
| Citizen | 2 | 2013-01-14 | Heat set to return | Tau, Steven | Gauteng |
| New age | 25 | 2013-01-14 | Heatwave to subside a little | Luplala Zandisile | Northern Cape |
| Die Burger | 1 | 2013-01-16 | Hitte in Wes-en Noord-kaap sal van more of begin wyk | Mare Annelie | West and Northern Cape |
| Beeld | 16 | 2013-01-19 | -35°, end an, Afrika-hitte | Jordaan, Pieter | Gauteng |
| Beeld | 1 | 2013-01-24 | Erge hitte hier, dan hom reen | Tempelhoff, Elise | |
| The witness | 3 | 2013-01-24 | A sweltering 44° C today, then lots of wet and cold | | |
| Beeld | 2 | 2013-03-06 | Krisis drieg oor hittwe en min reen | Van der walt, Sarel | Northwest |
| Beeld | 10 | 2013-11-21 | Ergste hitte in Gauteng vir eers verby | van Rooyen, Fanie | Gauteng |

| Newspaper source | Page | Date | Headline | Author | Area |
|--------------------|------|------------|--|----------------------|----------------------------|
| 2014 | | | | | |
| Pretoria News | 3 | 2014-01-03 | Miracle | | Pretoria |
| Sowetan | 14 | 2014-01-06 | Solo Journey | | Pretoria |
| Times | 5 | 2014-01-06 | Drownings spike in the sizzling heat | Nair, Nivashni | |
| Beeld | 1 | 2014-01-15 | Kraaie flou' Kakamas se 50°C | Burger, Anena | Kakamas |
| Citizen | 2 | 2014-01-17 | Heatwave set to scorch SA for days | Venter, Carla | |
| New Age | 7 | 2014-01-17 | Heat wave hits Gauteng | Nkosi, Ntombi | Gauteng |
| Pretoria News | 1 | 2014-01-17 | Heatwave is here for the weekend after 38°C scorcher | van Zuydam, Lali | Gauteng/Northern Cape |
| Star | 3 | 2014-01-17 | Heatwave is set to continue for the next few days | Cox, Anna | Gauteng |
| Times | 2 | 2014-01-17 | Heatwave bakes Gauteng | Mouton, Schalk | Gauteng |
| Beeld | 2 | 2014-01-18 | Hitte sal ons nog tot môre laat swêet | Sieberhagen, Charlea | Gauteng/Limpopo/North West |
| Star | 7 | 2014-01-18 | Heatwave over country to continue until Monday | | |
| Sunday Independent | 2 | 2014-01-19 | Beating the heatwave | | Soweto |
| Pretoria News | 11 | 2014-01-20 | Much of South Africa sweltered | | |
| Pretoria News | 21 | 2014-01-21 | Athletes brave the heat | Mashaba, Anastacia | Pretoria |
| New age | 8 | 2014-01-28 | Blazing Heat | | Durban |
| Die Burger | 1 | 2014-02-17 | Ergste hitte neem eers die wyk | Beerwinkel, Esté | Western Cape |

Print media published news articles on heatwave in SA (2015)

| Newspaper source | Page | Date | Headline | Author | Area |
|------------------|------|------------|--|------------------------|----------------------|
| 2015 | | | | | |
| Pretoria News | 3 | 2015-02-10 | Gauteng heatwave to ease today | | Gauteng / North West |
| Pretoria News | 2 | 2015-02-11 | Last of the city heatwave today | | Pretoria |
| Times | 1 | 2015-02-11 | Joburg sweating on a record | Smillie, Shaun | Johannesburg |
| Star | 3 | 2015-02-11 | Heatwave almost over | Dipa, Karishma | Gauteng / North West |
| Beeld | 9 | 2015-02-12 | Kwik daal so effens, maar die hitte bly | van der Heever, Vania | |
| Beeld | 1 | 2015-02-18 | Uitspattig | | Pretoria |
| Beeld | 3 | 2015-09-30 | Kraaie gaan teen naweek nog gaap | Otto, Hanti | Pretoria |
| New Age | 2 | 2015-09-30 | Heat wave for Tshwane | Nkosi, Ntombi | Pretoria |
| Times | 1 | 2015-10-05 | It's really hot up here | | Gauteng |
| Star | 3 | 2015-10-05 | Brace for a scorching next few days | Chernick, Ilanit | Gauteng |
| Star | 3 | 2015-10-05 | What should you do during a heatwave? | | |
| New Age | 1 | 2015-10-05 | Public warned of killer heatwave | Mhlana, Zodidi | |
| Pretoria News | 1 | 2015-10-05 | The heat will be on for some days so do your best to keep cool | | Pretoria |
| Beeld | 2 | 2015-10-06 | Maak deure toe, die diewe kom! | Habelgaarn, Tarren-Lee | Johannesburg |
| Beeld | 3 | 2015-10-06 | Kwik gaan hierdie week nog lélik styg | Mageza, Simvuyele | |
| Star | 3 | 2015-10-07 | Pets, other animals at risk in sweltering heat, NSPCA warns | | |
| Beeld | 12 | 2015-10-07 | Gee my nooooooog! | | Pretoria |

| Newspaper source | Page | Date | Headline | Author | Area |
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| 2015 | | | | | |
| Citizen | 8 | 2015-10-07 | Northern provinces will sweat this week | Mitchley, Alex | |
| New Age | 2 | 2015-10-08 | Heat 'no Eskom concern' | Matodzi, Mavhengani | |
| New Age | 23 | 2015-10-08 | Heatwave threatens water supplies | Matlala, Montsho | Polokwane |
| Star | 4 | 2015-10-09 | Cooling down amid heatwave | | Johannesburg |
| Business Report | 13 | 2015-10-09 | Power Alert | | |
| Pretoria News | 1 | 2015-10-09 | Heat over heels | | Soshanguve |
| New Age | 26 | 2015-10-09 | Boys drown trying to beat the heat | Matlala, Montsho | Limpopo |
| Pretoria News | 3 | 2015-10-10 | Temporary break in heat, but it's returning | | |
| Beeld | 27 | 2015-10-10 | Kyk, 'n nat warmbrak! | | Pretoria |
| Rapport | 2 | 2015-10-11 | El niño is hier en water is oral in SA skaars | Paries, Chante | |
| City Press | 15 | 2015-10-11 | Plunging in to escape the heat | | Soweto |
| Star | 3 | 2015-10-12 | The heat is on in Gauteng until later this week | Germaner, Shain | Gauteng |
| Beeld | 1 | 2015-10-12 | Waterbeperkings in talle dele van Pretoria ingestel | | Pretoria |
| New Age | 1 | 2015-10-12 | Concern over drownings | Moloi, Karabo | |
| Business Report | 13 | 2015-10-12 | Water restrictions for Tshwane | | Pretoria |
| New Age | 23 | 2015-10-12 | Heat wave fuels wild fires | Matlala, Montsho | Limpopo |
| Beeld | 5 | 2015-10-12 | As kraaie gaap, gaan Jackie dam toe | Pretorius, Wim | |

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|------------------|------|------------|--|------------------------|--------------|
| 2015 | | | | | |
| Pretoria News | 3 | 2015-10-13 | Rain, cooler weather on and after Heatwave | Makhubu, Ntando | Pretoria |
| New Age | 3 | 2015-10-05 | Heatwave to continue | Mhlana, Zodidi | |
| Citizen | 8 | 2015-10-13 | Gauteng heatwave nears end | Mitchley, Alex | Gauteng |
| Star | 2 | 2015-10-14 | Cool relief after heatwave that left fireman dead, factories burnt | Chernick, Ilanit | Gauteng |
| Beeld | 4 | 2015-10-14 | Waterbeperkings in Pta opgehef | van Zyl, Seugnet | Pretoria |
| New Age | 2 | 2015-10-15 | Effects of heatwaves on the body | Diale, Lerato | |
| Sowetan | 6 | 2015-10-19 | Killer heat leaves farmers destitute | Mashopo, Zoë | Thohoyandau |
| Pretoria News | 1 | 2015-10-20 | Boy's death at public pool not in vain | Makhetha, Tankiso | |
| Beeld | 8 | 2015-10-23 | Pretorianers moet krane toedraai, waarsku metrorraad | van Zyl, Seugnet | Pretoria |
| Die Burger | 1 | 2015-10-28 | Hittegolf laat kraaie gaáp in Wes-Kaap | Nienaber, Malherbe | Western Cape |
| Cape Times | 3 | 2015-10-28 | Scorcher | | |
| Die Burger | 3 | 2015-10-29 | Swembaddens in Paarl weer oop | van den Berg, Samantha | Paarl |
| Times | 6 | 2015-11-2 | Flame-grilled restaurants | Masombuka, Siphon | Centurion |
| Citizen | | 2015-11-07 | Heatwave to hit Pretoria | Madumo, Nthabiseng | Pretoria |
| Rekord | | 2015-11-07 | Heat wave expected in Pretoria | | |
| Times | 1 | 2015-11-09 | The heat is on at 38°C | Smillie, Shaun | Gauteng |
| Alberton Record | | 2015-11-09 | WATCH: Heatwave hits Alberton | | Gauteng |

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|------------------|------|------------|---|-------------------|--------------|
| 2015 | | | | | |
| Citizen | 6 | 2015-11-10 | Water restrictions starts in Joburg | Tau, Steven | Johannesburg |
| New Age | 2 | 2015-11-10 | Take precautionns against heat wave | Mhlana, Zodidi | |
| Sowetan | 7 | 2015-11-10 | More deaths feared as heat wave pummels the country | Selebi, Mogomotsi | Free State |
| Beeld | 1 | 2015-11-11 | Hittegolf bly tot reën Vrydag ver wag Word | Pretorius, Wim | |
| Business Report | 17 | 2015-11-11 | The Heatwave... | | |
| New Age | 5 | 2015-11-11 | Call to scale down water use. | Madisha, Kutullo | Gauteng |
| New Age | 15 | 2015-11-11 | Hot weather hitting maize belt hard | | |
| Star | 2 | 2015-11-11 | Friday may see relief from heat | Chernick, Ilanit | Gauteng |
| Star | 2 | 2015-11-12 | How to keep your car cool in the heat | | |
| Business Day | 3 | 2015-11-12 | Heat wave blamed as taps run dry | Mashego, Penelope | Johannesburg |
| Beeld | 6 | 2015-11-13 | Lafenis in hitte | | |
| Star | 6 | 2015-11-13 | Hospitals are feeling the heat | | Gauteng |
| Star | 6 | 2015-11-13 | Rustenburg gets restrictions | | |
| Mail & Guardian | 11 | 2015-11-20 | Records tumble as drought goes on | | |
| Citizen | 16 | 2015-12-04 | Another heatwave not expected | Tau, Steven | |
| Business Day | 3 | 2015-12-08 | Country simmers as heat wave sears | | |
| Citizen | 10 | 2015-12-08 | Hot weather expect to linger longer | Tau, Steven | |

| Newspaper source | Page | Date | Headline | Author | Area |
|------------------|------|------------|--|------------------------|------|
| 2015 | | | | | |
| Times | 1 | 2015-12-08 | Heat reaches beer levels | Hosken, Graeme | |
| Star | 3 | 2015-12-08 | Expect to cook until Friday | Mbangeni, Lerato | |
| Pretoria News | 3 | 2015-12-08 | It's too hot to handle... until Friday | Mbangeni, Lerato | |
| Business Report | 15 | 2015-12-08 | Drought and heatwave become farmers' Nightmare | | |
| Beeld | 3 | 2015-12-08 | Lafenis vir honde wyl kraaie gaap | van Zyl, Seugnet | |
| Citizen | 6 | 2015-12-10 | Chances of rain increase as heat fades | Tau, Steven | |
| Beeld | 9 | 2015-12-19 | Nog 'n hittegolf op pad: Só bly jy kpeler as eke | Habelgaarn, Tarren-Lee | |
| Beeld | 4 | 2015-12-22 | Nóg 'n hittegolf tref dié Provinsies | Habelgaarn, Tarren-Lee | |
| Star | 6 | 2015-12-22 | Make sure pets don't suffer in heat | | |

Print media published news articles on heatwave in SA (2016)

| Newspaper source | Page | Date | Headline | Author | Area |
|------------------|------|------------|--|---------------------|---------------|
| 2016 | | | | | |
| Beeld | 1 | 2016-01-04 | Jy gaan braai | Steyn, Pieter | |
| Pretoria News | 3 | 2016-01-05 | Searing heat forecast for city | Tlhabye, Goitsewang | |
| Star | 2 | 2016-01-05 | Residents warned to save water as heatwave sets in | Mbangeni, Lerato | Johannesburg |
| Star | 2 | 2016-01-05 | Not a day for warm woollen coats | | Greyton |
| Cape Times | | 2016-01-05 | Keeping cool in the heatwave | Petersen, Carlo | Cape Town |
| Cape Times | 6 | 2016-01-05 | Soaring temperatures set to stay 'for long time' | Petersen, Carlo | Western Cape |
| New Age | 2 | 2016-01-05 | Hot weather in store for SA | Selapisa, Lillian | |
| Times | 1 | 2016-01-01 | Gauteng to bake in record heatwave | Smillie, Shaun | Gauteng |
| Citizen | 2 | 2016-01-05 | Heatwave sizzles across province | Tau, Steven | |
| Cape Times | 7 | 2016-01-06 | Revelling in heat, enjoying cricket action in city | | Cape Town |
| Pretoria News | 3 | 2016-01-06 | Record 41°C heat tomorrow | | Pretoria |
| Business Report | 8 | 2016-01-06 | Cape tightens restrictions | | |
| Cape Argus | 4 | 2016-01-07 | Keep out of the sun during heatwave - experts | | |
| Star | 3 | 2016-01-07 | Good for a laugh | Mbangeni, Lerato | |
| Star | 3 | 2016-01-17 | Keeping cool can save your life | Mkize, Vuyo | |
| Star | 3 | 2016-01-07 | N Cape sizzles to record highs | Wildenboer, Norma | Northern Cape |
| Business Day | 2 | 2016-01-07 | Drought is catastrophic for SA's maize production | Stoddard, Ed | |

| Newspaper source | Page | Date | Headline | Author | Area |
|------------------|------|------------|---|-------------------------|----------------------------|
| 2016 | | | | | |
| Business Report | 12 | 2016-01-07 | Heat wave will only intensify | | |
| Pretoria News | 1 | 2016-01-07 | 41°C scorcher the hottest since 1860 | Maravanyika, Babington | Pretoria |
| Cape Times | 3 | 2016-01-07 | Warning to be on heat stroke alert | Nkalane, Michael | |
| New Age | 3 | 2016-01-07 | Severe heat today serious threat to health | | |
| New Age | 7 | 2016-01-07 | Public told beware of heatwave | | |
| New Age | 18 | 2016-01-19 | Impact of drought and heat taking its toll | | Free State / Northern Cape |
| Citizen | 4 | 2016-01-07 | Heatwave poses major health risk | Mitchley, Alex | |
| Citizen | | 2016-01-07 | Protect workers: Cosatu | | |
| Citizen | 19 | 2016-01-07 | The heat is on | | |
| Daily Sun | 15 | 2016-01-07 | Heat wave alert! | Ntanzu, Thabani | |
| Daily Dispatch | 1 | 2016-01-07 | Heatwave may run until early winter | Loewe, Mike | |
| Sowetan | 5 | 2016-01-08 | Reprieve from searing heat | Appasamy, Youlendree | Johannesburg |
| Star | 5 | 2016-01-08 | #Heatwave survival tactics for a hot city slicker | Sandison, Karen | |
| Star | 5 | 2016-01-08 | Record of 42°C set for Pretoria | | |
| Pretoria News | 1 | 2016-01-08 | Sizzling hot | | Pretoria |
| Landbouweekblad | 13 | 2016-01-13 | Kleiner oes in noorrdeleke besproeiingsgebiede | Norval, Johan | |
| New Age | 1 | 2016-01-08 | Unbearable heat to persist | Motseothata, Kebothhale | |

Print media published news articles on heatwave in SA (2016)

| Newspaper source | Page | Date | Headline | Author | Area |
|--------------------|------|------------|---|-------------------|-----------------------|
| 2016 | | | | | |
| Beeld | 5 | 2016-01-08 | Lafenis in hitte kos tienjarige sy lewe | Viljoen, Buks | Waterval-Boven |
| Beeld | 1 | 2016-01-08 | Rekords smelt | | |
| Beeld | | 2016-01-08 | Beskerm jou só in hittegolf | | |
| Beeld | 2 | 2016-01-08 | Rekordhitte in Pta, Jhb lei tot talle noodgevalle | Human, Rochélie | Gauteng |
| Beeld 2 | 2 | 2016-01-08 | Man sterf in ry vir water | Khalane, Selloane | Senekal |
| Beeld | 7 | 2016-01-09 | Waaiers vlieg van rakke af | | Gauteng |
| Beeld | 7 | 2016-01-09 | Ergste hitte eers verby | Otto, Hanti | |
| Citizen | 6 | 2016-01-10 | Relief after scorching weather | Tau, Steven | |
| Sunday Independent | 7 | 2016-01-10 | Nine die of heatstroke in central North West | | North West |
| Sunday Times | 2 | 2016-01-10 | Waterbabies | | Alexandra |
| Sunday Times | 1 | 2016-01-10 | Heatwave smashes 50-year record as it kills 11 in North West | Zulu, Thembalethu | North West |
| New Age | 10 | 2016-01-11 | Ongoing heatwave water levels threat | Torerai, Elfias | Tlokwe, Potchefstroom |
| New Age | 18 | 2016-01-11 | When heat is a killer | | |
| New Age | 6 | 2016-01-11 | Heatwave makes perfect breeding ground for flies and rodents - city | | Cape Town |
| Sowetan | 3 | 2016-01-11 | Heat wave keeps Mshoza indoors | Lekgau, Mashoto | |
| Cape Times | 8 | 2016-01-11 | Summit needed on drought | | |
| New Age | 10 | 2016-01-13 | Dehydration protection needed in heatwave | Sithole, David | |

| Newspaper source | Page | Date | Headline | Author | Area |
|------------------|------|------------|---|------------------------|---------------------------|
| 2016 | | | | | |
| Citizen | 11 | 2016-01-13 | First heat, now flood warnings | Mitchley, Alex | |
| New Age | 10 | 2016-01-14 | Another heatwave warning issued | | North West |
| Die Burger | 3 | 2016-01-16 | Nóg 'n hittegolf is hier | Nienaber, Malherbe | Western Cape |
| Star | 8 | 2016-01-16 | Hot as hell | | |
| Cape Times | 3 | 2016-01-18 | Heatwave reprieve expected later in the week | Isaacs, Lisa | Cape Provinces |
| Die Burger | 7 | 2016-01-19 | Mark koel as oor swakker rand | Botha, Romantha | Western Cape |
| Beeld | 11 | 2016-01-25 | Hitte vat blos weg van dié vrug se uitvoer | Williams, Francois | |
| New Age | 26 | 2016-01-29 | Wate available for City, Cosmos clash | Matlala, Montsho | Polokwane |
| Die Burger | 1 | 2016-01-30 | Wes-Kaap gaan (weer) braai - in tot 43°C | Barnard, Marelize | |
| Business Day | 3 | 2016-02-01 | Heatwave the 'new normal' | Farber, Tanya | |
| Citizen | 1 | 2016-02-01 | Déjà vu: the heat is back | Tau, Steven | |
| Times | 6 | 2016-02-01 | Heat waves the new normal | Farber, Tanya | |
| New Age | 23 | 2016-02-01 | Matsila Trust gets relief from drought | Matlala, Montsho | hohoyandou |
| Die Burger | 1 | 2016-02-01 | Hitte neem teen môre die wyk | Nienaber, Malherbe | Northern and Western Cape |
| Beeld | 3 | 2016-02-02 | Hittegolf op pad vir Limpopo, Gauteng | Habelgaarn, Tarren-Lee | Gauteng / Limpopo |
| Star | 3 | 2016-02-02 | Heatwave in Gauteng, Limpopo | Chernick, Ilanit | |
| New Age | 9 | 2016-04-09 | Why hot weather is more likely to affect people in developing countries | Wichmann, Janine | |
| New Age | 10 | 2016-02-05 | Heatwave threat not over | Sithole, David | North West |
| Star | 6 | 2016-02-10 | Heatwave cause diarrhoea cases to soar in Western Cape | Abbas, Gadeeja | Western Cape |
| Citizen | 8 | 2016-02-16 | Heatwave set to break | Tau, Steven | |
| Beeld | 22 | 2016-02-19 | Hitte, siektes laat Nuwelandse gras yl | Nell, Stephen | Cape Town |
| Landbouweekblad | 15 | 2016-02-19 | Wes-Kaapse vrugtebedryf ly ook onder droogte | Uys, Fredalette | Western Cape |

Print media published news articles on heatwave in South Africa

- Not all the heatwave “warnings/alerts” published in the newspapers were correct as per definition by SAWS, it cannot be conclusively verify.
- Articles in the print media contribute significantly to the education of the community about risks associated with severe weather and ways to mitigate severe weather impacts.
- Print, broadcast, web based and social media are a effective tools to inform and educate the public about important weather issues.
Important: According Amendment Bill [B22-2011], SAWS is the only legal body in South Africa that can issue severe weather warnings.
- Collaboration between SAWS and the media will enhance the dissemination of information, however the media must issue correct information and not create unnecessary panic.

**“The media is the primary means of achieving swift dissemination”,
WMO.**

Examples of SAWS media release on heatwave conditions

12 February 2016

HEAT WAVE CONDITIONS OVER THE NORTH-EASTERN PARTS OF THE COUNTRY (12 – 16 FEBRUARY 2016)

The South African Weather Service anticipates that heat wave conditions, associated with persistently high temperatures can be expected over a large portion of the interior of South Africa. This heat wave phenomenon will extend from today, Friday 12th February 2016, persisting every day over the coming weekend and into next week, until at least Tuesday, 16th February 2016. The provinces likely to be directly affected are Gauteng as well as the Western Bushveld and Lowveld portions of Limpopo, while the Lowveld of Mpumalanga as well as the north-eastern parts of the North-West province are also forecast to be affected by the heat wave.

3. DISCUSSION

The circulation pattern that drives the heat wave phenomenon in southern Africa is primarily due to the persistent presence of an upper-air high pressure system over the interior of the country. Such a circulation pattern is not at all unusual and occurs frequently over the country, in summer as well as in the winter months. Occasionally, as is currently the case, an upper-air high stagnates and dwells over one particular portion of the country for a few days or even a week or more. Under such conditions, the dry, negatively buoyant air associated with the upper high begins sinking back towards the Earth.

Bolepi House, 442 Rigel Avenue South, Erasmusrand, 0181 Private Bag X097, Pretoria, 0001

Tel: + 27 (0) 12 367 6000 Weatherlines 083 123 0500 USSD: *120*7297#

Board Members

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| Ms. Ntsoeki Mngomezulu (Chairperson) | Prof. Elizabeth Mokoteng | Adv. Derick Block | Dr. Jasper Rees |
| Dr. Nkululeko Gwagwa (Deputy Chairperson) | Mr. David Letsoa | Mr. Keabetswe Modiroeng | Ms. Judy Beaumont (DEA Rep) |
| Mr. Jonty Tshibe | Ms. Selly Mudy-Pedeyachie | Ms. Nandipha Madiba | Dr. Linda Makueni (CEO) |
| Mr. Rowan Nicholls | | | Ms. Zandile Nene (Company Secretary) |

COR-MEDREL-009.1

Medrel12Feb2016

10 November 2015

Heat wave conditions over north-eastern parts of RSA.

Heat wave conditions are currently being experienced over Gauteng, Mpumalanga, Northwest and Limpopo, and are expected to persist until Friday, 13 November, and up to Saturday in some parts. Maximum temperatures in these places are expected to be in the mid to high 30's and low 40's.

Table 1 below contains some recorded and forecast temperatures for selected stations for the period 9 to 13 November 2015.

| Station | Temps to be reached for 3+ days for Heat Wave | Recorded Maximum temperature for 9 Nov (deg C) | Forecast Maximum temperature for 9 Nov (deg C) | Forecast Maximum temperature for 10 Nov (deg C) | Forecast Maximum temperature for 11 Nov (deg C) | Forecast Maximum temperature for 12 Nov (deg C) | Forecast Maximum temperature 13 Nov (deg C) |
|------------------------|---|--|--|---|---|---|---|
| Pretoria (UNISA) | 34 | 39 | 39 | 39 | 39 | 38 | 37 |
| Johannesburg | 32 | 36 | 36 | 36 | 36 | 37 | 36 |
| Bela Bela | 36 | 42 | 42 | 42 | 42 | 42 | 40 |
| Polokwane | 33 | 34 | 36 | 36 | 37 | 38 | 36 |
| Lephalale | 38 | 41 | 42 | 42 | 42 | 43 | 40 |
| Musina | 39 | 40 | 40 | 40 | 41 | 42 | 39 |
| Rustenburg | 35 | 38 | 38 | 38 | 38 | 39 | 37 |
| Mafikeng | 35 | 38 | 38 | 38 | 38 | 37 | 36 |
| Mbombela (Old Airport) | 32 | 36 | 37 | 37 | 37 | 33 | 33 |
| Skukuza | 38 | 41 | 42 | 43 | 43 | 36 | 36 |

Table 1: Recorded and forecast maximum temperatures for select stations

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Tel: + 27 (0) 12 367 6000 Weatherlines 083 123 0500 USSD: *120*7297#

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COR-MEDREL-009.1

Medrel10Nov2015

Examples of media releases issued by SAWS in 2015 & 2016

Are heatwaves becoming more prominent in South Africa?

Africa experienced hotter, longer and more extent heat waves than in the last two decades of the 20th century (Ruso et al, 2016)

In the last 15 years in South Africa, the probability of austral summer heatwaves has increased with respect to the period 1961–1980 (Russo et al, 2016)

Increases in average temperatures are projected to make extreme heatwaves more frequent, severe and to last longer (Schar et al, 2004; Coumou, Robinson, & Rahmstorf 2013)

There seem to be a correlation in heatwave events and increasing temperatures

Evidence of increasing temperatures in South Africa

- The first comprehensive study by SAWS on historical temperature trends in South Africa was completed and published in 2004 in the *International Journal of Climatology* (Kruger & Shongwe, 2004). In this paper, time series of 26 South African climate stations were investigated for temporal and spatial trends, for the period 1960 to 2003.
- ✓ **The results** shows that the vast majority of stations showed positive trends in their annual mean maximum temperature series. Trends of mean seasonal temperature showed that temperature trends were not consistent throughout the year, in general, days and nights with relatively high temperatures have increased, while days and nights with relatively low temperatures have decreased.
- Studies by Kruger & Sekele (2012) employed extreme temperature indices developed by the CCI/CLIVAR/JCOMM Expert Team (ET) on Climate Change Detection and Indices (ETCCDI), for the period 1962-2009.
- ✓ **The study found** that since 1960s, warm extreme temperatures have increased, while cold extreme temperatures have decreased, and this pattern has been observed across the country. The results broadly indicated that the western half, as well as the parts of the north-east and east of South Africa, showed relatively stronger warming than elsewhere in the country.

Evidence of increasing temperatures in South Africa

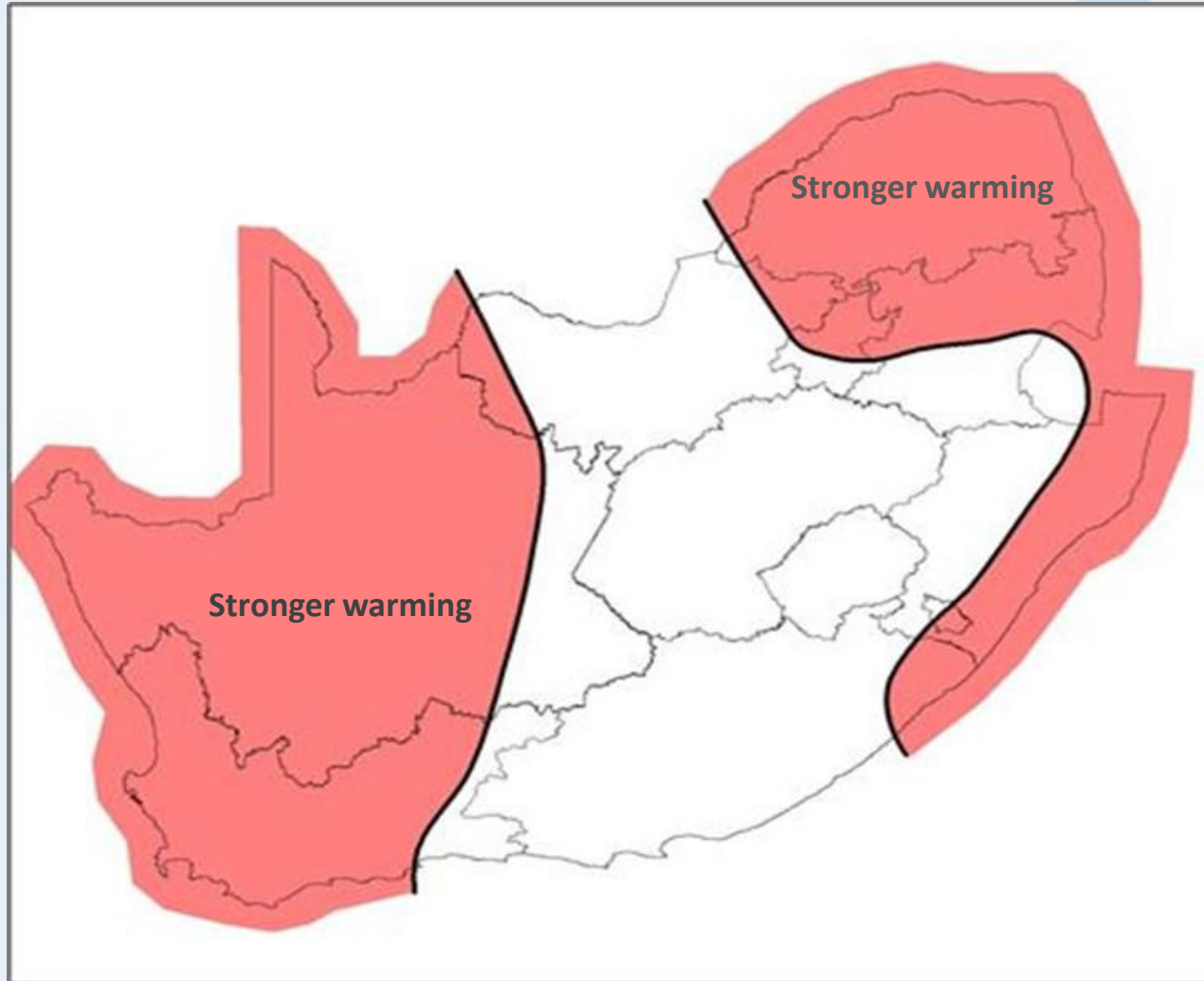


Figure 2: Regions of relatively stronger warming in South Africa over the period 1962-2009 (Kruger & Sekele, 2012)

New high temperatures records in South Africa

In 2015, 19 countries set new national high temperature records; this is the largest number of national high temperature records in a single year. South Africa also reached new record high at 20 locations

Daily Maximum Temperature for 27 October 2015

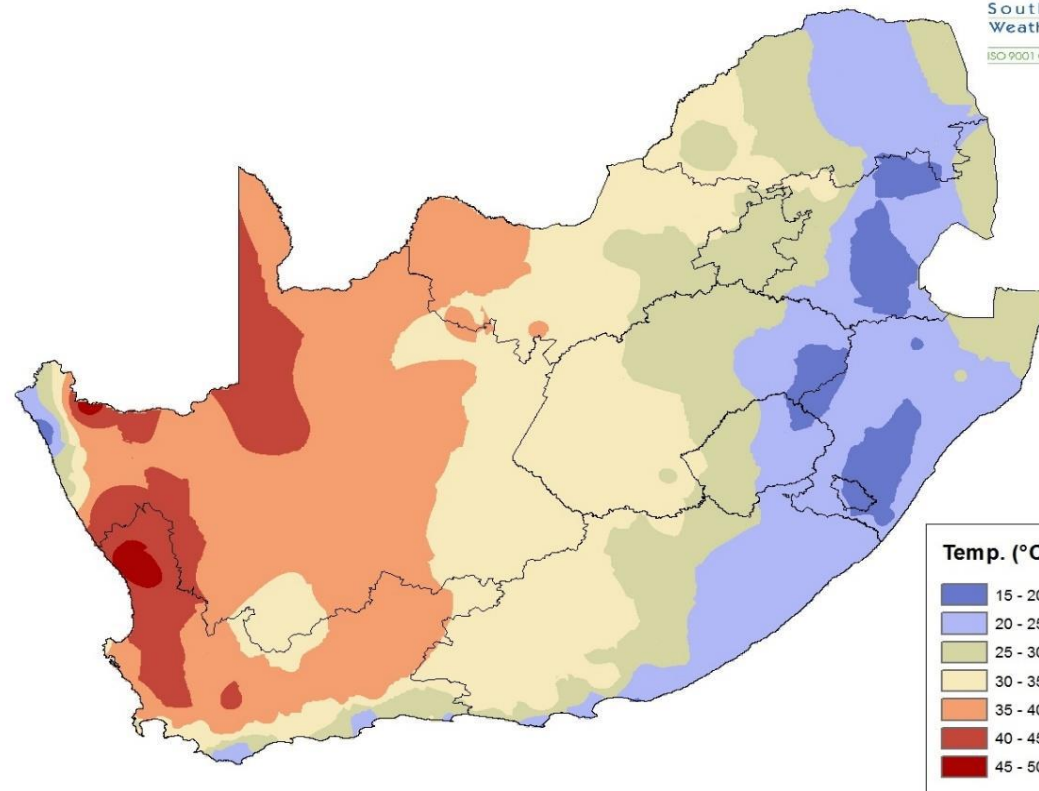


Figure 3: Highest maximum temperature records that were recorded on the 27 October 2015, of which 18 were above 38°C

New high temperatures records in South Africa

| Old Record | Old Date | New Record | New Date | Difference in temp (old _t -new _t) | Years in between | Station |
|------------|------------|---------------|------------|---|---------------------|-----------------------------|
| 42.5°C | 1999-10-30 | 48.3°C | 2015-10-27 | 5.8°C | 16 | Vredendal |
| 39.8°C | 2009-10-20 | 43.4°C | 2015-10-27 | 3.6°C | 6 | Redelingshuys |
| 41.4°C | 1985-10-10 | 42.4°C | 2015-10-27 | 1°C | 30 | Wellington |
| 39.6°C | 1999-10-30 | 42.4°C | 2015-10-27 | 2.8°C | 16 | Poterville |
| 38.6°C | 2014-10-05 | 41.8°C | 2015-10-27 | 3.2°C | 1 | Malmesbury |
| 40.6°C | 2011-10-09 | 41.7°C | 2015-10-27 | 1.1°C | 4 | Clanwilliam |
| 39.9°C | 1985-10-10 | 41.5°C | 2015-10-27 | 1.6°C | 30 | Lammewens |
| 37.4°C | 1999-10-30 | 41.2°C | 2015-10-27 | 3.8°C | 16 | Paarl |
| 39.5°C | 1985-10-10 | 41.1°C | 2015-10-27 | 1.6°C | 30 | Robertson |
| 37.8°C | 2003-10-12 | 40.3°C | 2015-10-27 | 2.5°C | 12 | Cape Town |
| 36.1°C | 1985-10-10 | 39.3°C | 2015-10-27 | 3.2°C | 30 | Jonkerhoek |
| 38.1°C | 2003-10-12 | 38.9°C | 2015-10-27 | 0.8°C | 12 | Atlantis |
| 35.9°C | 2003-10-12 | 38.2°C | 2015-10-27 | 2.3°C | 12 | SA Astronomical Observatory |
| 34.0°C | 2003-10-12 | 35.7°C | 2015-10-27 | 1.7°C | 12 | Robbeneiland |
| 33.4°C | 1985-10-30 | 34.9°C | 2015-10-27 | 1.5°C | 30 | Cape Point |
| 44.2°C | 1999-10-30 | 46.9°C | 2015-10-27 | 2.7°C | 16 | Vioolsdrif |
| 42.3°C | 2014-10-26 | 43.5°C | 2015-10-27 | 1.2°C | 1 | Augrabies falls |
| 36.9°C | 2011-10-09 | 41.1°C | 2015-10-27 | 4.2°C | 4 | Nieuwoudville |
| 36.7°C | 1997-10-01 | 38.4°C | 2015-10-27 | 1.7°C | 18 | Springbok |
| 37.2°C | 2000-10-12 | 38.2°C | 2015-10-27 | 1°C | 15 | Calvinia |

Conclusion

- With climate change, there has been an increase in the frequency, intensity and duration of heatwave events.
- In South Africa there is evidence of increasing temperatures which have been associated with increasing heatwave events.
- Heatwaves are a common summertime experience in South Africa
- The increase in the number of heatwaves have brought the need for heatwave early warning systems (HEWS) designed to reduce the avoidable human health consequences through timely notification of prevention measures to vulnerable populations.
- Early warning systems will allow the society to better prepare itself for and to cope more effectively with heat waves. SAWS is working to develop a heatwave early warning system.
- Mass media can be useful tool in encouraging people to apply protecting measures during heatwave events. Strong collaboration between the media and the weather service is needed to educate and improve understanding of and response to heatwaves.

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