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South Africa's winter rainfall zone and its future outlook

Dr Sarah Roffe

ARC-Natural Resources and Engineering

September typically marks the end of South Africa's winter rainfall season, which generally starts in April and is uniquely experienced across the country's southwestern Cape and western coast, a region referred to as the winter

rainfall zone. Much of this winter period rainfall is produced by cold front arms of mid-latitude cyclones (see Figure 1) deriving moisture from westerly winds and originating in the southwest Atlantic Ocean, just off the coast of Argentina.

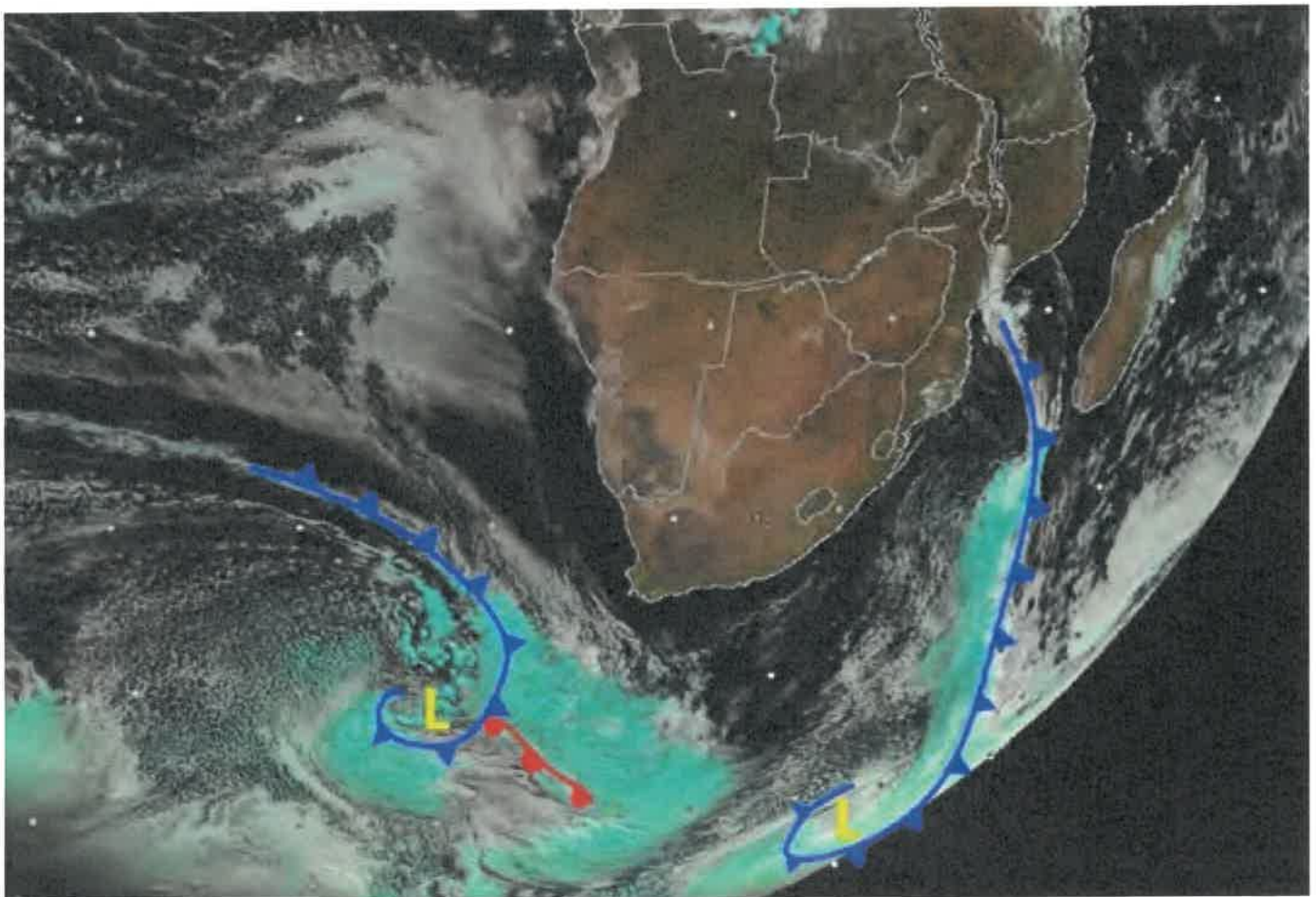


Figure 1: Satellite image of mid-latitude cyclones across the southern African domain (source: South African Weather Service).



Research shows that the winter period rainfall regimes and characteristics of associated weather systems are changing and will continue to do so as a result of human-induced climate change – negatively impacting surface water resources and agricultural activities across the winter rainfall zone. Due to global warming trends, the westerly winds are migrating poleward, which in turn is among the drivers of a trend towards drier conditions during the April-September winter period. Despite a somewhat wetter than normal month in June 2022, with some flooding in the southwestern Cape, rainfall index maps from the May-July 2022 editions of the Agricultural Research Council’s Umlindi Newsletter (<https://www.arc.agric.za/arc-iscw/Pages/News-Articles.aspx>) suggest that drying trends are already manifesting as the winter rainfall region has experienced slightly drier than normal conditions, particularly during the April-May months. This is similar to what happened during the so-called “Day Zero” drought period from 2015-2017, which was consistently characterized by drier than normal conditions during the early winter months. As for the rest of the 2022 winter season, forecasts from the South African Weather Service suggest drier than normal conditions are likely.

Quantifying rainfall trends from weather station observations

Although there is difficulty in definitively

detecting trends from long-term rain gauge records due to substantial year-to-year variability in rainfall, scientists have found that overall, the winter rainfall season has become drier, at least since the 1980s. This is linked to an increasing intensity of subtropical high-pressure systems and a poleward migration of the westerlies, which are manifesting as a decline in the intensity and duration of cold front rainfall events together with a long-term decline in the number and intensity of winter rain days. The strongest drying trends are, however, observed for the April-May months, resulting in delayed onset of the winter rainfall season. This has caused a reduction in the length of the winter rainfall season, coupled with trends towards a longer and drier dry season. Research has shown that dry season rainfall events are particularly important to maintain dam levels, especially during drier winter periods, but these events have reduced in size and frequency, largely due to the increasing strength of the subtropical high-pressure belt that sits across South Africa and causes dry, stable conditions.

Future outlook

To gain insight into what future climatic conditions may be like, scientists turn to climate model projections. For South Africa’s winter rainfall zone, these reflect a gloomy outlook for the coming decades. Research shows that the westerly winds will continue migrating poleward and the subtropical

anticyclones will continue increasing in intensity and size. Consequently, the winter rainfall region is expected to continue becoming drier during both the wet and dry seasons, and the spatial extent of the winter rainfall zone might even reduce. Shorter and fewer consecutive wet day periods are expected to occur during the winter rainfall season, while longer and more frequent consecutive dry day periods are expected. The winter rainfall season will likely become even shorter, particularly due to drier early winter (April-May) conditions leading to later onset dates. One of the most concerning findings is that multi-year droughts like the "Day Zero" event are expected to become more intense and occur more frequently.

Implications of expected winter rainfall changes

The expected rainfall changes across South Africa's winter rainfall zone are concerning and will bring significant negative impacts. During the "Day Zero" drought period we saw just how severe these impacts could be, with research showing that crop yields and the quality thereof were negatively impacted, while surface water resources were almost depleted to a level where potable water was no longer available. Ultimately, these activities (agriculture and water resource management) that depend heavily on winter rainfall will experience the most severe negative impacts from the expected rainfall changes. Later onset of the rainfall season with drier conditions will have large negative implications on crop production as these changes will likely influence irrigation practices, the types of crops that can be grown, the timing of planting, and the quality and quantity of yields. On the other hand, drier conditions in a water management context will require additional planning and monitoring, especially during the dry season, to ensure that water supplies adequately meet household and industry needs across the winter rainfall zone.

For more information:

Dr Sarah Roffe
ARC-Natural Resources and Engineering
E-mail: RoffeS@arc.agric.za

21st CENTURY AGRICULTURAL WATER STORAGE TANKS

The logo for Oasis Tanks features the word "oasis" in a lowercase, bold, sans-serif font, with a stylized blue wave icon above the letter 'i'. Below "oasis" is the word "TANKS" in a larger, uppercase, bold, sans-serif font. The entire logo is enclosed in a white rectangular frame with a blue border.

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