

The contribution of the South African
Weather Service (SAWS) to the
economy and society of South Africa

Statements

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About this report and funding

Requested by the SAWS this report is an independent study of the value of the weather and climate services the SAWS provides to the economy and society of South Africa, and regionally to SDAC partners. This study, funded by the Met Office, is one of the outputs informing development activities to help WMO members achieve their vision that “by 2030, we see a world where all nations, especially the most vulnerable, are more resilient to the socio-economic consequences of extreme weather, climate, water and other environmental events; and underpin their sustainable development through the best possible services, whether over land, at sea, or in the air”¹. Completing this report was made possible by the collaboration of the SAWS and from its public and private stakeholders.

About the authors

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Disclaimer

This report was completed following a 7-day visit of the research team to South Africa in July 2025. The analysis presented here builds on this short visit in addition to using an indicative economic model that is under development within the Met Office to help deliver benefit analyses in a timely and cost-effective manner. The analysis here may therefore not reflect the full depth and scale of data gathering or stakeholder engagement that a larger project would allow.

¹ WMO, Strategic Plan 2024-2027 (2023)

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Executive summary

This report **provides an economic benefit analysis and social impact assessment of the South African Weather Service (SAWS) to the government of South Africa.** Conducted independently by the Met Office (the UK's weather and climate service) the report summarises economic analysis and modelling, and discussions held with key national stakeholders from July to September 2025, including a 7-day visit in country. It was **funded by the Met Office recognising the growing need of our WMO (World Meteorological Organisation) member partners to secure sustainable financing for their services.** Weather and climate information can be used by key stakeholders across a diverse range of sectors such as aviation, health, finance and disaster risk management, to mitigate the impacts on lives and livelihoods.

“The public and private sector, and communities at large, are at risk of severe weather and climate impacts”

Disaster Risk Management NPC

South Africa has become increasingly vulnerable to climate-induced extreme weather events, with significant socio-economic and environmental damage to infrastructure, agricultural losses, and worsening health impacts². South Africa is facing more frequent and intense weather events, including tropical cyclones, extreme storms, flooding and drought³. The costs from the impacts of climate change are expected to rise to 1.2% of GDP by 2040⁴. While South Africa is the leading country on the continent in terms of its economic resilience to severe weather⁵, **supporting effective meteorological services both nationally and for the regional partners of the SAWS can play a key role in reducing further loss and damages.**

The analysis shows the substantial value generated by **the SAWS to the government of South Africa. Each South African Rand (R) invested in the SAWS is estimated to generate between R4.4 and R11.4 in benefits, with a central value of around R7.2. Annually this corresponds to a benefit range of approximately R2.8 – 7.3 billion (USD range - \$161m - \$421m), underscoring the strong return on investment of national meteorological services.** These benefits primarily stem from improved weather forecasting, early warnings across all sectors and the benefits to aviation and marine services.

This report provides evidence that **through the provision of timely and accurate weather and climate services, the SAWS enhances and strengthens national resilience and South Africa's ability to proactively plan for climate risks.** Investments in meteorological and hydrological services directly contribute to safeguarding the economic and social stability of South Africa and supporting sustainable development and impact mitigation. It also summarises views from **stakeholders across South Africa and considers the risks and challenges associated with inadequate investment in meteorological and hydrological services, such as the immediate risks to the agricultural sector.**

“We can't operate efficiently without the data provided by the South African Weather Service”

Department of Disaster Risk Reduction

² Nhamo et al., Trends and impacts of climate-induced extreme weather events in South Africa (1920-2023) | Environmental Development | 2025

³ Kusangaya et al., Climate Change Impact on Hydrological Regimes and Extreme Events in South Africa | Climate Change and Water Resources in Africa | 2021

⁴ World Bank, Country Climate and Development Report | 2022

⁵ Climate Change Knowledge Portal | South Africa Risk – Historical Hazards | 2023

Evolution of the South African Weather Service

The South African Weather Service (SAWS) is the authoritative and mandated voice on weather, seasonal and longer-term climate in the country, providing services that protect lives and livelihoods while supporting national safety, economic stability, and sustainable development. Currently it employs over 430 scientists, meteorologists, and other operational staff, **operating with a budget of just R638m.**

The first systematic weather observations were conducted at the Royal Observatory in Cape Town in 1860. At that time, South Africa's economy was focused mainly on agriculture and maritime trade, meaning accurate observations were vital for safe navigation and effective crop planning. By the early 20th century, the expanding sector needs of aviation, shipping, and farming prompted the establishment of a national service, and the South African Weather Bureau was created in 1912.

Throughout the 20th century the Bureau expanded its observation network and embraced new technologies. These innovations contributed to South Africa's economic development, as dependable weather and climate information became essential for most sectors of the economy. Aviation was a particularly powerful driver for meteorological services progress, as safe air travel required increasingly sophisticated forecasting capabilities.

In 2001 the Weather Bureau was re-established as the SAWS a public entity under the Department of Environmental Affairs. This change reflected a growing recognition that weather and climate services are essential public goods with broad social and economic value. The new mandate expanded the role of the SAWS beyond forecasting and warnings, embedding the SAWS into the national efforts around disaster risk reduction, environmental protection, and sustainable development.

The SAWS today operates as an extensive national observation and forecasting network, supported by meteorologists, climatologists, forecasters, technicians, and support staff. Its work underpins resilience and preparedness for disaster mitigation, infrastructure planning, and economic efficiency. Whether enabling fuel savings in aviation and shipping, guiding farmers' planting and harvesting decisions, or reducing losses from floods, droughts, and storms through early warnings, the SAWS is central to building resilience across society, government and the private sector.

The SAWS also plays a leading role at the regional level. Recognised by the WMO as both a Regional Specialised Meteorological Centre (RSMC) and a Regional Training Centre (RTC) among other regional designations, the SAWS is responsible for delivering specialised forecasts, early warnings, climate services and technical training for the wider Southern African Development Community⁶ (SADC). These functions cascade national expertise to member states and foster regional and continental cooperation, strengthening resilience to weather and climate-related risks across southern Africa.

⁶ SADC Member states (2025) – <https://www.sadc.int/member-states>

Severe weather and climate risks to South Africa

South Africa is increasingly exposed to severe weather, seasonal variability, and climate shocks with measurable economic and social impacts. The country ranks second in Africa for the number of weather-related disasters and fourth on the continent. And ranked 92 out of 181 countries in the 2020 ND-GAIN Index⁷, with worsening scores from 2005 onwards, reflecting both increasing hazard frequency and high vulnerability (Fig. 1). Over the past two decades the incidence of recorded weather disasters has risen by more than half, translating into rising costs on households, businesses, and the state.

REGIONAL COMPARISON



South Africa has the **second highest number of weather-related disasters** in all of Africa.

GLOBAL CLIMATE RISK INDEX



South Africa is **ranked 4th** amongst African countries by the **Global Climate Risk Index**.

DISASTER INCREASE RATE



The disaster count in South Africa has **risen by 57%** over the **last two decades**.

Figure 1: South Africa

Figure 2 captures recent events, demonstrating the scale and frequency of severe weather events in South Africa. Beyond the immediate costs of damaged infrastructure, lost productivity, and human displacement, such shocks erode long-term development gains and place growing pressure on public finances.

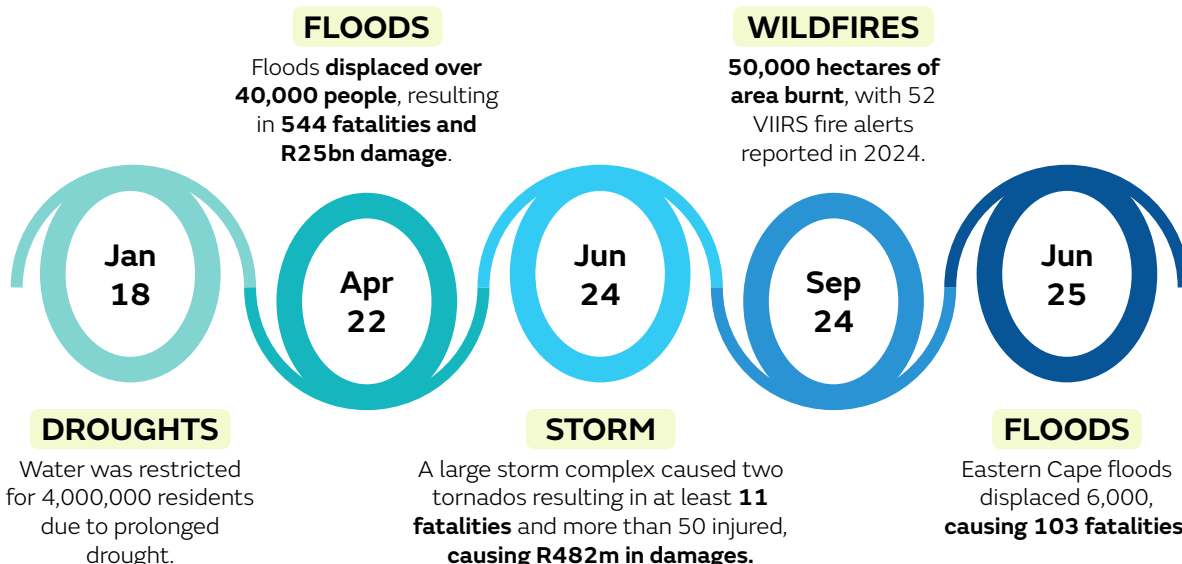


Figure 2: Recent SA Case Studies

⁷ World Bank Group, Climate Risk Country Profile | South Africa (2021)

Services provided by the SAWS

As an operational service, the SAWS provides:

- Daily Forecasts
- Seasonal Forecasts
- Agricultural Training
- Lightning Monitoring
- Satellite & Remote-Sensing
- Air-quality information
- Tailored impact-focused severe-weather warnings

These services are designed to report conditions, reduce uncertainty for data users and inform timely decision making for early.

As the designated national authority for regulated aviation meteorology, among many other sectors it supports. This illustrates how climate information is built into economic decision-making. Table 1 takes a deeper look at the breadth of services provided by SAWS, its specific users, and purpose.

SERVICE, USERS, AND PURPOSE
Aviation Meteorological Authority: Aviation (airlines, airports, civil aviation regulators) <i>Ensures safe, efficient flight operations through regulatory aviation weather services and compliance with ICAO standards.</i>
Marine met-ocean services: Shipping, fisheries, offshore energy, ports & harbours <i>Supports safe navigation, offshore operations, and fisheries management through wave, tide, and storm forecasts.</i>
Short and long-range forecasts: Marine met-ocean services: Shipping, fisheries, offshore energy, ports & harbours <i>Informs daily to monthly planning decisions, from planting schedules to energy demand forecasting.</i>
Seasonal forecasts: Agriculture, disaster management, water & energy sectors <i>Guides medium-term risk management (e.g., drought/flood preparation, reservoir management).</i>
Impact based warnings: Cross-sectoral (disaster management authorities, municipalities, emergency services etc) <i>Provides early warnings focused on expected impacts, enabling proactive disaster preparedness and response.</i>
Lighting products and data services: Energy (utilities, transmission), aviation, insurance, disaster management <i>Reduces risks to infrastructure and safety by monitoring lightning activity and supporting loss prevention.</i>
Climate services: Cross-sectoral (policy makers, planners, agriculture, health, energy, mining, water, insurance) <i>Provides historical trends and future climate information to support adaptation planning and resilience strategies.</i>
Satellite observations: Cross-sectoral (aviation, marine, agriculture, disaster management, research) <i>Supplies near-real-time monitoring of weather, climate, and environmental conditions for forecasting and rapid response.</i>
Air quality & environmental solutions: Health, mining, environmental regulators, municipalities, and industry <i>Supports pollution monitoring, health advisories, and compliance with environmental regulations..</i>
Research and development: Cross-sectoral (government, academia, private sector, international partners) <i>Advances innovation in forecasting, climate science, and service delivery to improve societal resilience.</i>

Table 1: Services provided by SAWS

Stakeholders and Users Requirements and Recommendations

Stakeholders, from agriculture and emergency management to aviation, maritime services, and insurance, have consistent and practical needs from their national forecaster to operate efficiently and safely:

1. high-quality and timely forecasts and warnings.
2. reliable and accessible observational and historical data.
3. easy, fit-for-purpose dissemination, data sharing, and engagement; and
4. resilient infrastructure and institutional capacity.

Delivering these consistently depends on sustained funding into SAWS for skilled staff, equipment and digital systems. Figure 3 illustrates how the four groups above deliver value to users:

PUBLIC SAFETY



Accurate, locally actionable warnings actively reduce fatalities by enabling earlier evacuations, defences and by taking protective actions.

SCIENTIFIC IMPROVEMENTS



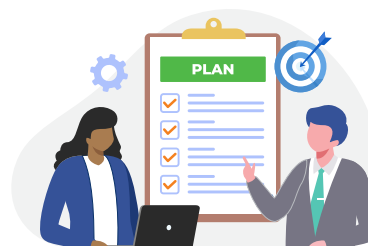
The SAWS' high-quality historical records are the backbone of climate projections. Without it, targeted adaptation is compromised.

RESILIENCE



The SAWS weather and climate data provides sector-wide economic resilience in daily operations and with investment decisions.

PLANNING



The SAWS data is used in government for planning, financing, national economic modelling, and in allocating resources following a disaster.

Figure 3: Wider Benefits of the SAWS Services

Table 2 describes the requirements in more detail, following extensive qualitative user research for this report.

Collated user requirements		
Need	Requirements	Justification
Accurate and timely impact-based forecasts and warnings	Impact-based forecasts that state severity, duration, and location in a language where impacts are easily understood.	Operational users need actionable guidance; emergency managers want clear instructions they can push to the public. “[People/sectors] just want to hear about the severity of the impact, duration and location.” (Department of Agriculture).
Comprehensive, continuous observational networks and historical archives	A well-maintained national observation network and having accessible historical archives.	Public and private stakeholders rely on station records for claim verification, infrastructure planning, hydrological modelling, climate risk mapping and to inform climate adaptation needs.
Data accessibility and two-way data sharing	Easier, secure access routes for users to ingest the SAWS data into their systems with clearer arrangements for sharing external data back into national products. National Treasury, DFFE and other government users emphasised better two-way sharing and clearer MoUs on use and access (ARC).	
Fit-for-purpose dissemination channels and user interfaces	Deliver warnings via channels and file formats for use by and improve usability for community-facing apps. “Early-warnings that are easy to distribute via channels such as WhatsApp, not in pdf format.” (City of Cape Town Planning)	
Sector-tailored products and higher spatial resolution	Products targeted to sector needs (localised frost alerts for fruit growers, precise wind/current forecasts for marine, solar/wind radiation forecasts for energy). Researchers and universities also asked for higher-resolution datasets for modelling and teaching .	
Training, engagement and translated guidance	Capacity building for users (training for interpretation of impact-based warnings, training-of-trainers for agricultural extension officers, materials translated into local languages). Stakeholders repeatedly requested more workshops and simplified advisory text to support action on the ground.	
Resilience, maintenance, and cyber/operational security	Power-resilient station design (solar/back-up), routine maintenance schedules, and strengthened cyber security for critical the SAWS systems, especially considering the recent 2025 data hack of the SAWS it is particularly important to ensure that all systems and infrastructure is resilient to both loadshedding and potential cyber hacks.	

Table 2: Survey responses of user requirements

Economic and operational consequences of not funding user needs

This assessment on the consequences of an underfunded national meteorological service was informed by a comprehensive user-needs study conducted between July and August of 2025, which included semi-structured interviews, open group discussions, and feedback surveys. A total of 42 organisations participated, with multiple experts from each organisation offering different experiences and insights in-to the use and importance of the SAWS. The organisations included were a mixture of public and private stakeholders and users of the SAWS. The findings reflect both quantitative and qualitative insights into the potential economic and operational impacts because of insufficient investment in the SAWS services. The following 6 points were the most frequently mentioned concerns from the user-needs study.

- 1. Degraded operational coverage and blind spots:** Poor maintenance or lack of essential forecasting equipment will lead to gaps in real-time monitoring. This increases false negatives in warnings and reduces trust in the SAWS products.
- 2. Increased economic losses and slower recovery from severe weather events:** Unavailable and untrusted forecasts cause delays in weather and climate-related business decisions, increasing direct damages and recovery costs. Many sectors are explicitly dependent on the SAWS data in their day-to-day operations.
- 3. Higher fiscal exposure:** Government departments face larger contingent liabilities if the SAWS early warnings are absent or ineffective, translating into larger budgets required for disaster relief and slower economic rebound after disasters.
- 4. Weakened multi-sector coordination and policy delivery:** Without the SAWS' leadership and data stewardship, cross-government programs may become riskier, as other agencies may resort to using incompatible datasets for decision-making and further risk making duplicative investments.
- 5. Rising threat to public safety:** The lack of accurate, timely forecasts and robust communication channels for alerts and warnings exposes communities to greater risk from extreme weather events, driving injuries and loss of life.
- 6. Loss of international trust & research value:** Gaps in long-term records weaken South Africa's ability to participate in regional climate cooperation initiatives and to attract funding tied to robust data collection. Additionally, the SAWS Act mandates public service functions which are undermined if the SAWS cannot sustain core observational services which are the bedrock of its research initiatives.

Summary

Stakeholders clearly framed the SAWS products as foundational to safety, economic stability and long-term adaptation planning across South Africa. Surveys and interviews with stakeholders (see annex 2), have emphasised that if the SAWS is fully resourced and its networks, data and communications are sustained, South Africa would benefit from fewer losses, faster recovery from severe weather events and more effective planning (for both public and private actors). The alternative underfunded networks, partial ingestion of observational data, and poor dissemination exposes communities, the economy and public finances to larger, recurring cost shocks.

Literature evidence of the impacts of national meteorological services

The effectiveness of national meteorological and hydrological services (NMHSs) is increasingly being demonstrated through empirical research and case studies across developing and developed contexts. A growing body of interdisciplinary literature highlights the direct benefits of weather and climate services which adapt to the changing needs of sectors exposed to new or more frequent climate extremes.

Table 3 summarises key studies within a similar geographical context to the SAWS. These provide robust evidence for the economic and social value of investing in NMHSs' products and services, with benefit-to-cost ratios frequently surpassing those found in many other areas of public investment. The next section examines these dynamics in greater detail, assessing how the SAWS activities translate into tangible benefits for both the economy and wider society in the context of South Africa.

Study	Geographic Location	Sectors	What was measured?	Benefit-to-cost ratio
Benefits of Ethiopia's LEAP Drought Early-Warning and Response System (Law, 2012)	Ethiopia	Household	Quantification of avoided livelihood losses and decreased assistance costs.	3:1 to 6:1
A Regional Analysis of Weather, Climate, and Early Warning Services in Southern Africa (World Bank, 2021)	Southern Africa	Household Infrastructure Services	Direct benefits derived from reduced infrastructure damages. Increased productivity. And other co-benefits, such as household welfare.	7:1 to 12:1
Strengthening Hydromet and Early Warning Systems and Services in Tunisia (World Bank, 2022)	Tunisia	Construction	Assessed 1) benefits from avoided disaster losses and 2) benefits from increased production	3.8:1 to 18:1
IGAD Climate Prediction and Applications Centre - ICPAC (Owani, 2023)	Uganda Kenya	Climate services	Benefits of the provision of climate services through upgrading / strengthening hydro-met services for early warnings.	5:1 to 9:1
High Impact Weather Lake System (HIGHWAY) in Lake Victoria (WMO, 2021)	East Africa	Fisheries	Reduced annual weather-related deaths on the lake by 30% - thus saving more than 300 lives per year.	16:1
DARAJA: The Inclusive City-Community Forecasting and Early Warning Service (Daraja, 2020)	Kenya Tanzania	Services Households SME's	Avoided climate-related damage/loss and productivity gains from people-centred EWS.	20:1
A Cost-Effective Solution to Reduce Disaster Losses in Developing Countries (Hallegatte, 2012)	Global	All weather sensitive sectors	Benefits between 300 million and 2 billion USD per year of avoided asset losses due to natural disasters.	4:1 to 36:1

Table 3: Literature Evidence of NMS Benefits

Overall benefits to economy and society

Each year the SAWS delivers an estimated total of R4.6bn of social and economic value to South Africa. For every South African Rand spent, the SAWS returns 7.2 Rand in through of safer communities, more resilient businesses, and more efficient industries. This estimate is likely to be an underestimate as not all areas of benefit could be captured in the analysis.

The results are based on economic modelling, outlining the value of each benefit stream (see Table 4), covering ten in total: agriculture, aviation, mining, energy, finance, flooding, health (cold and heat alerts), storms, and marine services. For each sector the analysis considered: “How much efficiency gain, disruption, loss, or damage is linked to weather, and what share of that of this could be enhanced/avoided through accurate and timely forecasts?”

Benefit Stream	Approach	Value
1. Aviation	Improved safety, efficiency, and delay reduction from better forecasts.	R10,710m (23%)
2. Marine	Improved safety, efficiency, and reduced losses from enhanced marine forecasts.	R7,121m (16%)
3. Flooding	Avoided damages and response costs from advanced flood warnings.	R6,071m (13%)
4. Agriculture	Increased yields and reduced losses from improved forecasts.	R5,356m (12%)
5. Health - Cold	Avoided mortality and healthcare costs from extreme cold warnings.	R4,284m (9%)
6. Mining	Enhanced planning, safety, and reduced disruptions from weather information.	R3,545m (8%)
7. Energy	Improved efficiency and reliability from better operational and planning forecasts	R3,112m (7%)
8. Storms	Reduced economic losses from earlier warnings and improved preparedness.	R2,322m (5%)
9. Finance	Reduced risk and improved pricing from enhanced weather data.	R2,064m (5%)
10. Health – Heat	Avoided mortality and healthcare costs from extreme heat warnings.	R1,071m (2%)

Table 4: The SAWS overview - Value to each sector

By combining sector-specific evidence such as flight delays in aviation, reduction in deaths due to heat and cold alerts, or flood losses in communities, with conservative assumptions on how much of the benefit is realistically attributable to the SAWS forecasts, this approach creates an economy-wide picture for the annual value.

The analysis demonstrates that the meteorological and climate services delivered by the SAWS provide large, measurable benefits across transport, primary industries, public safety, and health. Using conservative attribution and exposure assumptions the central monetised benefit is approximately R4.6bn per year, with a plausible range extending from R2.8 to R7.3bn. This implies that for every rand invested in the SAWS, the country receives between R4.4 and R11.4 in avoided costs and wider economic and social benefits, with a central benefit–cost ratio of about R7.2 per R1 invested.

The sensitivity range reflects the uncertainty in the model and the dependence on input assumptions. The central figures are intentionally cautious; Annex 1 contains detailed assumptions, data sources and sensitivity analysis required for full technical review and to support policy discussion.

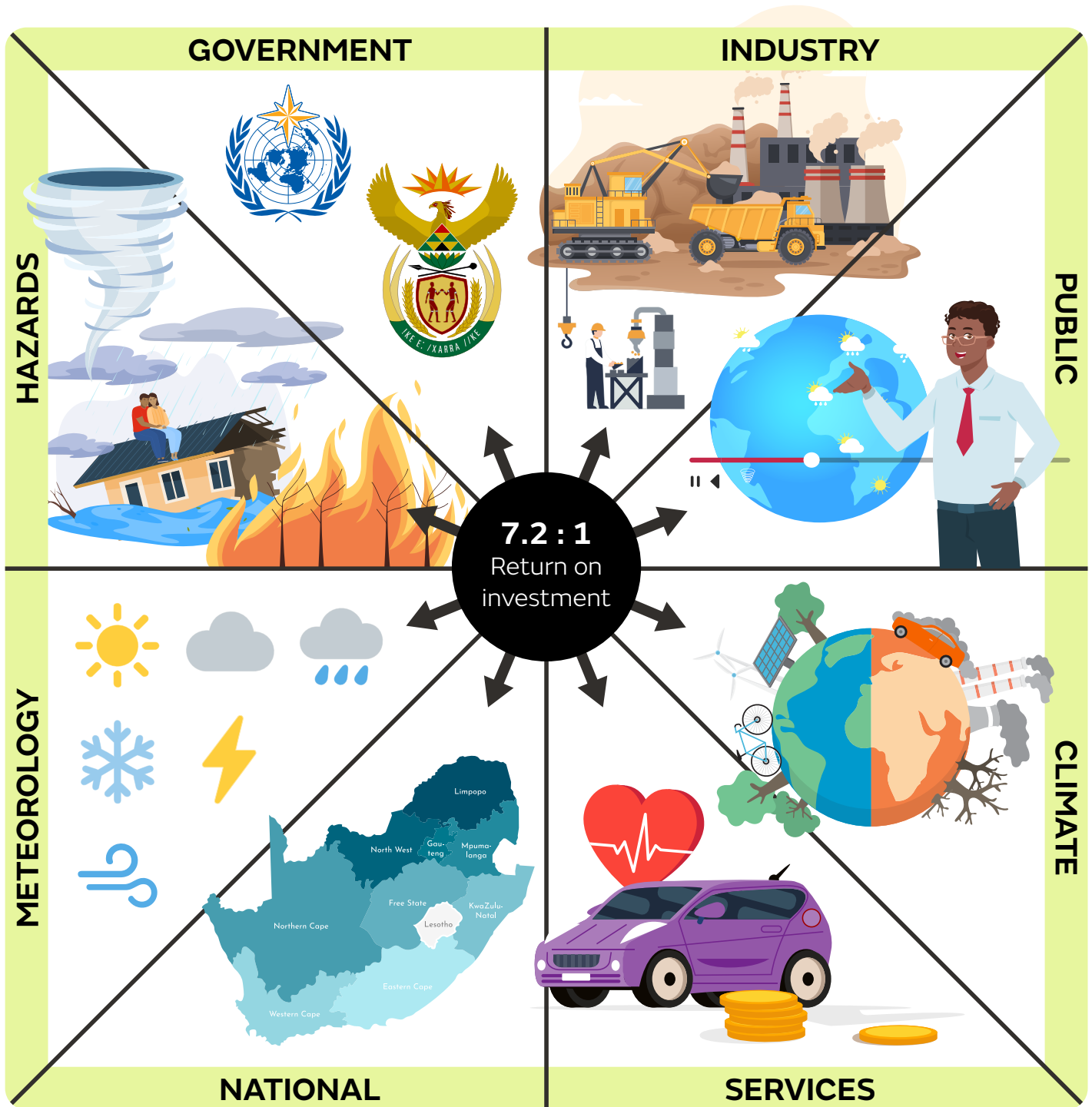


Figure 4: The SAWS Return on Investment

Overview of the methodology

The analysis for this report used a sector-by-sector monetisation approach. For each sector, (agriculture, aviation, energy, mining, finance, health, marine, floods/storms), we estimated the share of activity exposed to weather to the losses or costs that could be reduced through better forecasts and then applied a conservative attribution factor for SAWS. Benefits were then aggregated across sectors to provide a national estimate. This method follows international best practice and draws on peer-reviewed literature, South African data (StatsSA, sector reports), and consultations with the private sector. More details can be found at Annex 1.

Sensitivity Analysis

The sensitivity analysis, where the effects of changing key assumptions are tested to see how much they influence the results, was conducted to reflect the uncertainty inherent in applying sectoral multipliers and attribution factors. For each benefit stream, a **plausible minimum and maximum value** was identified based on variations in the key parameters (e.g. forecast accuracy, user response rates, base values of output weather-sensitivity, and attribution to the SAWS). The **plausible range** was constructed by adjusting these variables within evidence-based bounds:

- **Lower bound (conservative floor):** assumes minimal user uptake of warnings, lower base values, lower forecast skill, and reduced sectoral sensitivity.
- **Upper bound (optimistic but still reasonable):** assumes stronger user uptake, upper base values, higher effective attribution to the SAWS services, and average-to-high estimates from the literature.

The resulting range spans **R2.8 billion to R7.3 billion annually**, compared with the central estimate of R4.6 billion. This range illustrates that while exact figures may vary, the overall benefit of meteorological services remains steadily positive and substantially exceeds costs under all plausible scenarios.

Metric	Estimated benefits (annual, 2024/5)	Benefit: Cost ratio
Central range – lower estimate	R4.57bn	7.15
Plausible range – lower estimate	R2.80bn	4.39
Plausible range – upper estimate	R7.25bn	11.36

Table 5: Central and Plausible Value Ranges

Sector-specific benefits

The SAWS as the national provider of weather and climate services, is a vital organisation for ensuring the lives of South Africans are protected, supporting a thriving economy, and ensuring sustainable development is possible for the nation. In a country marked by climate extremes, from worsening droughts and heatwaves that threaten the agriculture sector to storms and flooding that endanger infrastructure and public health; SAWS' services are essential for reducing vulnerability, enabling early action, and strengthening core resilience.

Agriculture	Risk reduction: Early warnings reduce crop losses and livestock deaths from drought, floods, or cold spells.
	Resource efficiency: Weather data helps optimise fertiliser, water, and pesticide use.
Aviation	Flight safety: Real-time forecasts support safe take-offs, landings, and in-flight routing.
	Efficiency savings: Weather information improves scheduling, ground operations, contingency planning and can reduce fuel consumption by optimising routes.
	Compliance: Forecasts ensure alignment with ICAO aviation standards and regulations.
Construction	Risk management: Warnings reduce safety risks to workers during extreme heat, wind, or rain.
	Cost control: Accurate forecasts reduce losses from delays, downtime, equipment damage and are referenced in claims for weather delays.
DRR	Reduced losses: Timely and understandable severe weather warnings enable advanced mobilisation and community resilience before weather events reducing damage and fatalities.
	Planning support: Climate data informs disaster risk reduction, emergency services strategies and national adaptation plans across all sectors for increased resilience and preparedness.
Energy	Infrastructure protection: Forecasts inform solar, wind, and grid infrastructure management to prepare for, and protect against, the impacts of storm and lightning damage.
	Demand management: Seasonal forecasts and proactive mitigation planning guide and optimise energy demand projections and load balancing, reducing downtime and maintenance costs.
Finance	Claims verification: The SAWS weather records provide trusted confirmation for insurance claims.
	Fraud reduction: Verified storm, flood, or lightning data reduces fraudulent claims.
	Risk pricing: Historical weather patterns support accurate risk modelling and premium setting.
Health	Health monitoring: Climate data supports monitoring of weather-sensitive diseases such as malaria, cholera, and dysentery.
	Risk awareness: Heatwave, cold, and flood alerts inform public health campaigns, messaging and ensures the safety of workers and the public.
Marine	Search & rescue: Forecasts support MRCC (Maritime Rescue Co-ordination Centres) and NSRI (National Sea Rescue Institute) in planning maritime rescue operations.
	Worker safety: Storm and wave warnings protect fisheries, port workers, and coastal users.
	Operational planning: Oceanographic data informs shipping schedules and port logistics.
Mining	Planning & compliance: Weather and climate data influences the development of environmental impact monitoring initiatives and supports management planning and long-term sector strategies.
	Safety: Weather plays an important role in determining if it is safe for teams to enter mining sites.
Tourism	Event planning: Forecasts support scheduling of outdoor events and sporting activities for both service providers and tourists themselves.
	Safety assurance: Warnings for example protect tourists during expeditions, safaris, and with regards to marine and aviation activities.
Water	Resource management: Rainfall data informs the allocation of water resources, supporting services in compliance and resilience.
	Infrastructure protection: Warnings help safeguard dams, pipelines, and local supply systems.

Table 6: The SAWS Benefit Pathways for Each Sector

Agriculture

The agriculture sector in South Africa is highly sensitive to weather and climate. Worsening droughts, heatwaves, floods, and frosts devastate annual crop yields and cause livestock losses. For example, the 2023–24 El Niño drought caused maize yields to fall below expectations in South Africa, reducing national maize output by 15%⁸.

“All commodity producers need to be aware of what is happening with the weather on daily, weekly, monthly, and seasonal basis”

Department of Agriculture

Table 7 uncovers the outcomes from conversations with operational experts and scientists directly from the SAWS as well as from the interviews with service users in the agricultural industry. These conversations had a focus on the gaps in the products and service of the SAWS and the growing risks to the agricultural sector in South Africa.

Gap	Risk
Forecast cover	The meteorological network is sparse in remote farming regions, and automatic stations may report data that is not fully integrated into forecasting models due to events such as loadshedding.
Dissemination barriers	The SAWS is now offering services in some of the 12 official languages of South Africa. However, forecasts are often highly technical, whereas farmers need guidance that is easy to understand to be able to better respond.
Service reach	Services lack funding for reach into rural areas. Incomplete coverage and short-range forecasts mean some farmers rely solely on local or indigenous knowledge.
Climate change	Future climate scenarios with warming of 2–3°C by 2050 will impede risk and resilience planning without enhanced, high-resolution climate projections.

Table 7: The SAWS Gaps and Risks to Agriculture

The SAWS do however currently provide tailored seasonal forecasts and targeted agrometeorological advice. Farmers and agricultural agencies use the SAWS rainfall and temperature data and tailored forecasts to plan planting, irrigation, and track the risks of frost or heat stress on their crops or livestock⁹. The SAWS disseminates data and forecasts through portals, media, and via extended partnerships such as relayed messages to extension officers and farmers via the Department for Agriculture. An impact-based forecast service is being developed for community level warnings and advice. The SAWS also maintains vital historical climate records that inform long-term planning tools such as drought-risk maps, to better inform policy change.

The SAWS guidance underpins national food security and export revenue. South Africa, a major grain exporter in the region, avoided severe food shortages due to improved forecasting during recent droughts, by transferring knowledge through agricultural network to enable farmers to adjust planting and irrigation strategies. The broader economy also benefits with agri-businesses and food processors using weather data to manage supply chains, reduce waste and import costs. Investment in the SAWS yields downstream savings and improves resilience.

⁸ Glauber & Anderson., Southern Africa drought: Impacts on maize production (2024)

⁹ Franke et al., Climate Change and Potato Production in Contrasting South African Agro-Ecosystems 2. Assessing Risks and Opportunities of Adaptation Strategies (2013)

Aviation

Aviation operations in South Africa are highly sensitive to adverse weather conditions, with thunderstorms, fog, strong crosswinds, and turbulence creating safety hazards and operational delays. The SAWS aviation meteorological services are integral to safe flight operations, especially as weather-related delays account for up to 30% of aviation disruptions nationally. International studies have shown that climate change may further exacerbate these risks, with increased frequency and severity of convective storms affecting air traffic management¹⁰. High-quality, timely weather forecasts and advisories are thus essential in supporting safe, efficient, and cost-effective aviation services, ensuring passenger safety and minimising economic losses for the sector.

“Airline operators need to know and have good weather information to ensure safe flight routes”

Virgin Atlantic Airways

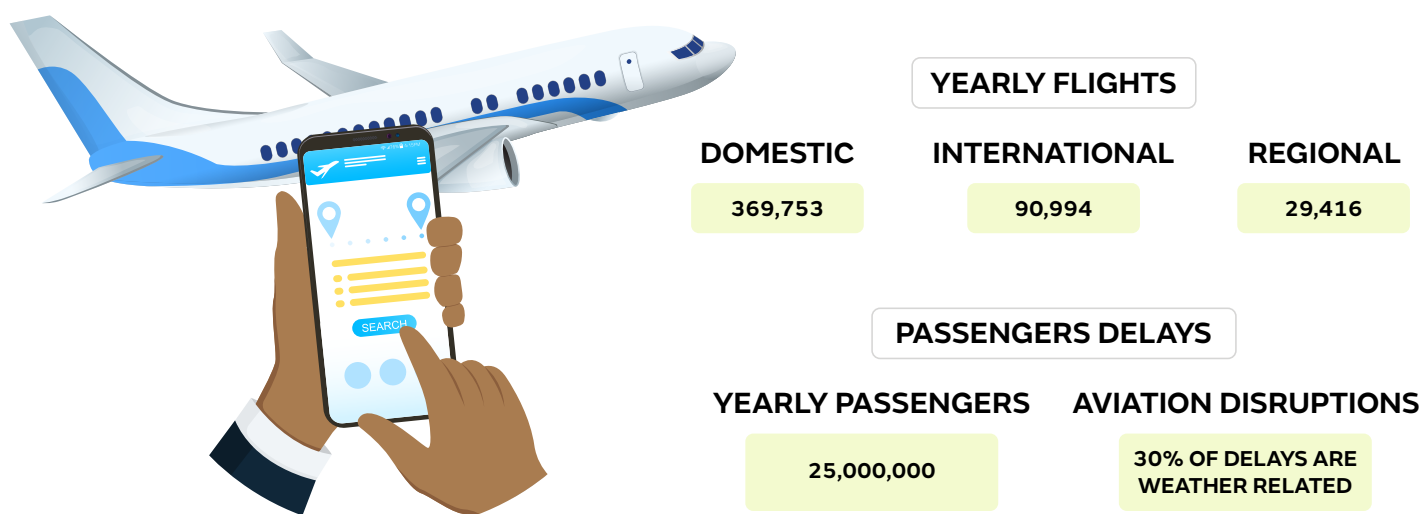


Figure 5: Aviation overview

The Airports Company South Africa data shows that 13.22% of all flights were delayed, 30% being weather related, resulting in **1.2 million passengers being delayed annually because of severe weather and climate**. The SAWS value is identified as being the highest quantified benefit of the SAWS to the economy and society of South Africa, **amounting to 23% of the total benefits calculated**, which is indicated to be **R10.7bn annually**.

AWS delivers ICAO-compliant forecasts, real-time radar storm tracking, lightning alerts and space-weather/ash advisories that pilots, air traffic control, airlines and ground crews rely on every day. These services decrease accident risk, protect refuelling and maintenance teams, reduce fuel burn through better routing, and minimise costly diversions and delays, preserving millions in operational value and keeping tourism, trade and cargo flowing.

Those benefits, however, are not guaranteed. Radars and stations vulnerable to load-shedding, limited-resolution forecasts, and cyber or service single-points-of-failure are critical gaps which reduce the value of the SAWS' products. To realise larger gains the SAWS needs sustainable, ring-fenced funding to build up infrastructure, invest in higher-resolution models and turbulence tools, strengthen cybersecurity and increase staffing capacity. Without this investment, safety margins shrink, delays rise, and the economic connectivity the SAWS supports will be at risk. Investing in the SAWS is therefore not a discretionary cost but a high-return safeguard for South Africa's aviation sector and the wider economy.

¹⁰ Ofremu et al., Exploring the relationship between climate change, air pollutants and human health: Impacts, adaptation, and mitigation strategies ([Green Energy and Resources, 2025](#))

Disaster Risk Management

South Africa is highly exposed to natural hazards such as floods, severe storms, droughts, and wildfires **causing more than R1bn (\$55 million) in losses each year**¹¹. National data show approximately 60% of declared disasters are weather, climate or water related. The benefit the SAWS brings to combined disaster risk management efforts is estimated at **R8.4 billion per year, or 19% of total quantified benefits**.

“Lack of effective early warnings from an authority such as the SAWS would result in far more significant impact among communities as people would not get the opportunity to move out of harm’s way”

Disaster Risk Management NPC

These impacts fall hardest on vulnerable communities, particularly those in informal settlements and rural areas, where climate vulnerability and limited resources make recovery more difficult.

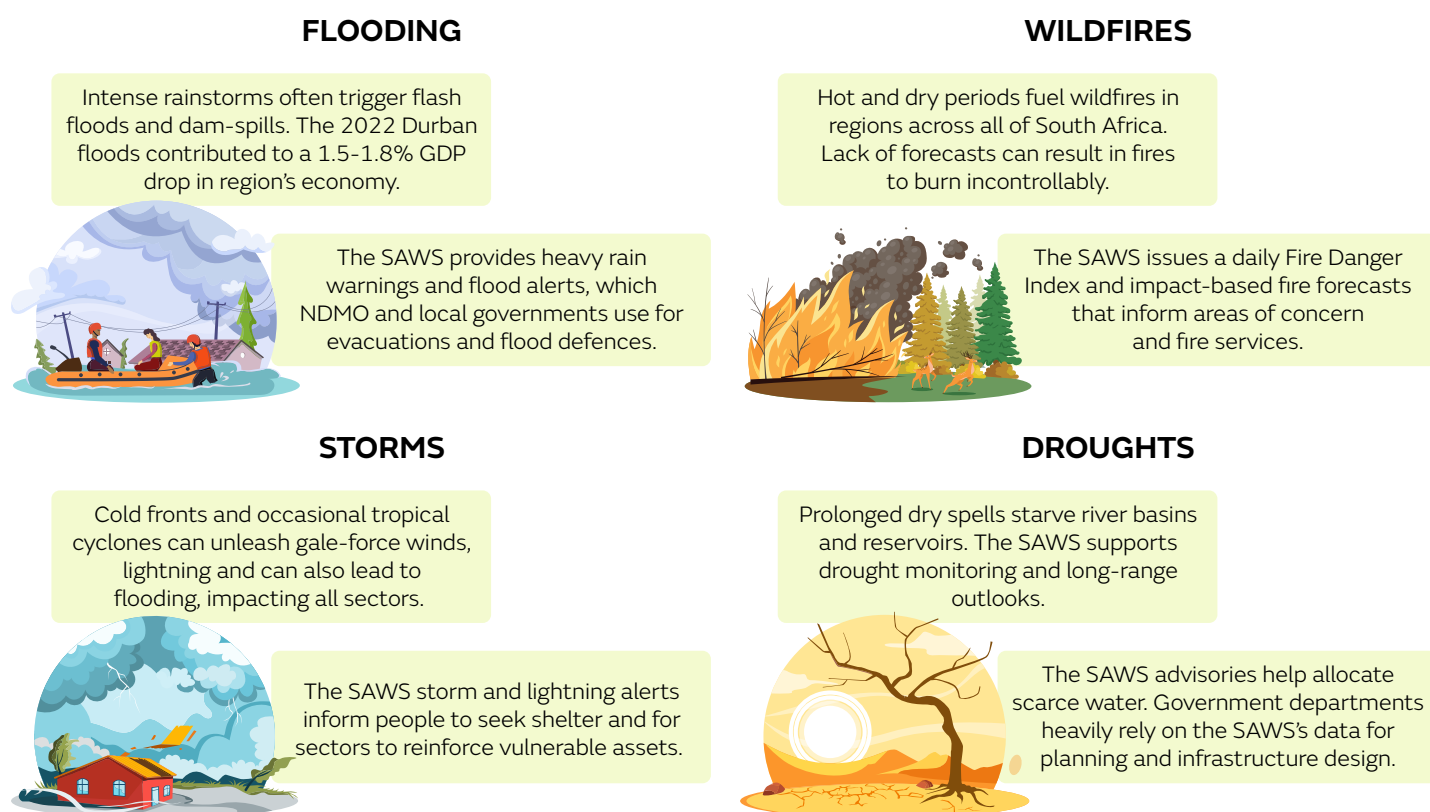


Figure 6: DRR Overview

Strengthening South Africa's multi-hazard early warning systems is an effective way to strengthen the nation's ability to be prepared and reduce disaster losses, protecting economic stability and building long-term resilience.

¹¹ CRED & UNDRR, The Human cost of disasters: an overview of the last 20 years (2020)

Energy & Water

The energy and water sectors are highly interdependent and vulnerable to weather and climate variability in South Africa. Electricity production, plant cooling efficiency, and dam water levels are affected by rainfall variability and temperature extremes. Climate projections indicate increased risks of droughts, floods, and heatwaves. The WRC (Water Research Commission) find that this is placing further strain on water resources, and this similar is the case for energy security when it comes to climate vulnerability¹². There is also a resultant strain on the health sector as the SAWS supports the water industry in mitigating the risks of water related diseases. Integrating seasonal and decadal climate forecasts into water resource planning and energy operations is therefore critical to maintaining reliable and efficient access to essential resources.

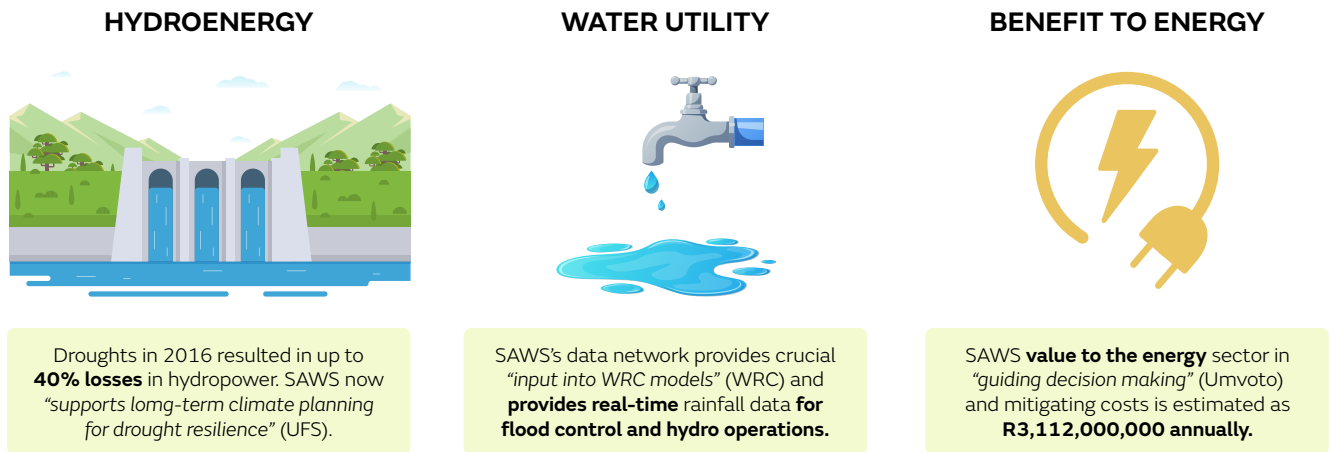


Figure 7: Utilities Overview

South Africa’s utilities infrastructure is already stressed by the impacts of climate change and the capacity for the SAWS to support these mitigation efforts needs bolstering. Some facilities do not have backup power so during load shedding data availability in certain regions is considerably reduced.

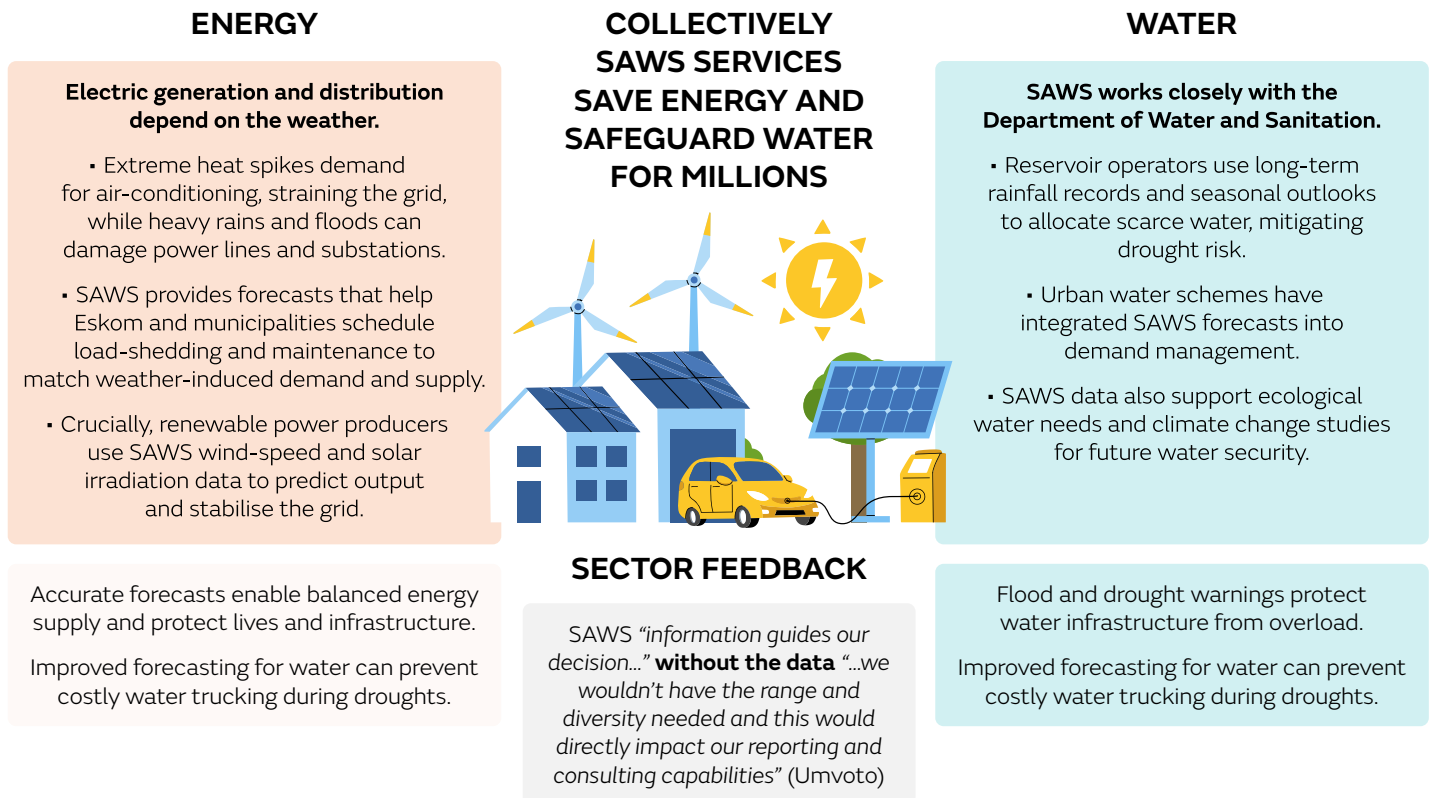


Figure 8: SAWS Benefits to Utility

¹² Schaeffer et al., Energy sector vulnerability to climate change: A Review (2012)

Finance & Insurance

The finance and insurance sectors are exposed to significant weather and climate risks through insured losses, agricultural finance portfolios and investment returns. Climate change is expected to intensify these impacts, posing systemic risks to financial stability and insurance markets. Feedback from the SAWS users shows that access to high-quality climate data and hazard risk assessments is vital for underwriting, pricing, and for developing innovative risk transfer solutions (see Table 6).



Figure 9: Finance overview

Weather and climate intelligence underpin the stability of South Africa's financial system. Banks, insurers, and investors use the SAWS data to price risk, design products and protect clients. Accurate storm and flood warnings allow insurers to reduce losses and even waive excesses when damage is unavoidable. Flood maps, hail and lightning indices help insurers set fair premiums and banks to decide where to finance infrastructure, protecting investments, preventing future defaults and to "track weather related incidents" (Abacus Assessors). Reliable climate data also supports stress testing of loan portfolios, guiding capital allocation and improving resilience in the face of increasing extreme weather events.

“As insurance claims handlers, we deal with weather-related events continuously and require accurate weather data.”

Associated Loss Adjusters

Climate exposure is growing and gaps in meteorological coverage raise the risk of mispriced assets, uncovered losses and larger systemic economic shocks. Many small businesses still operate without hazard insurance and mitigation plans, partly due to limited awareness that a better resourced weather service could provide. Demand is rising for finer-scale data, climate-risk scenarios, and portfolio stress tests that the SAWS is uniquely placed to deliver (Referring to the level of finance involvement in Annex 2). Sustained, predictable funding would enable the SAWS to expand data resolution, enhance hazard mapping and build the tools financial institutions need to stay ahead of risk.

FINANCE USE CASE

SAWS data “provides confirmation to insurance claims” (Independent claims), this is essential in fraud prevention and price structuring.

INSURANCE CLAIMS

Weather-related insurance claims are on the rise and **exceeded R2 billion** in 2022 due to floods and storms.

THE SAWS BENEFIT

SAWS overall-benefit to the finance sector is estimated to be **R2,064,000,000 per-annum**, or 5% of the total SAWS benefits.

Health

Weather and climate variability significantly impact public health outcomes in South Africa, with risks arising from heatwaves, cold spells, vector-borne diseases, and air pollution. Heatwaves have been associated with increased mortality rates of up to 5–10% during peak events in South African cities. Climate change is projected to exacerbate these health risks, particularly among vulnerable populations such as the elderly, outdoor workers, and those with pre-existing conditions. Effective weather and health early warning systems are therefore critical for timely public health interventions, emergency preparedness, and reducing climate-sensitive health burdens. Of all extreme temperature related mortality, almost 9 in 10 **(88%) are due to cold spells.**

HEALTH USE CASE

SAWS forecasts and warnings save lives, provide resilience to the health sector, and protect the economy. Without SAWS weather data environmental “*monitoring results would be impacted*” (EOHS)

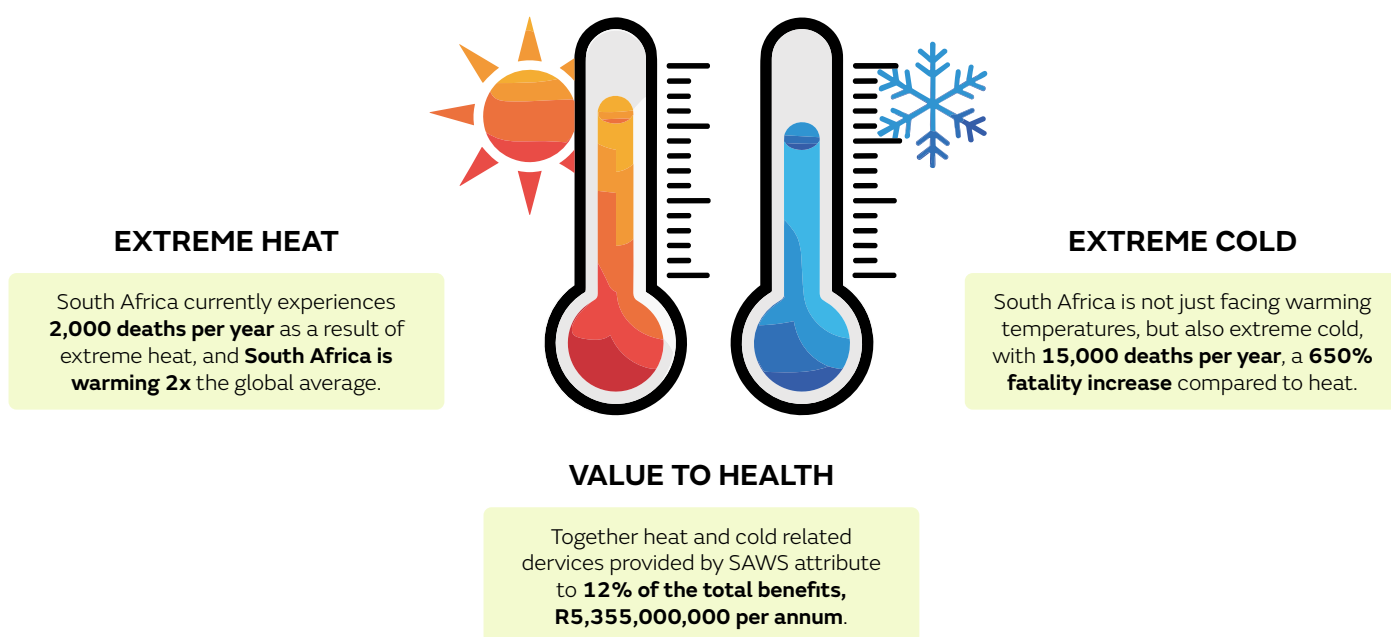


Figure 10: Health Overview

The SAWS's weather intelligence is a frontline health safeguard, enabling authorities to act before crises escalate. Heat alerts trigger provincial action plans, flood warnings inform clinics and emergency teams preparedness plans, and seasonal forecasts guide malaria spraying schedules, saving lives, preventing hospital surges, and reducing outbreaks. Long-range projections also inform national health adaptation plans, supporting resilient policy.

Gaps remain: many vulnerable communities miss alerts, and health planners lack granular data linking weather to illness trends. Demand is rising for more localised forecasts and longer-range health-climate services. Without sustainable funding, hospitals and Emergency Management Services would face heavier strain during extreme events, raising costs and reducing preventable deaths. Strengthening the SAWS' forecasting skills, specifically for health requirements, and strengthening its ability to conduct outreach and health-sector partnership engagement offers an opportunity for high returns in avoided health crises and economic losses.

Marine

The marine sector, including fisheries, ports, and shipping, is highly exposed to adverse weather conditions such as storms, high waves, and strong winds. Port closures due to adverse marine weather can cause daily economic losses in the millions. With climate change expected to increase sea level rise and storm intensity, effective marine forecasting services are vital to support safe navigation, protect coastal economies, and sustain livelihoods dependent on marine resources.

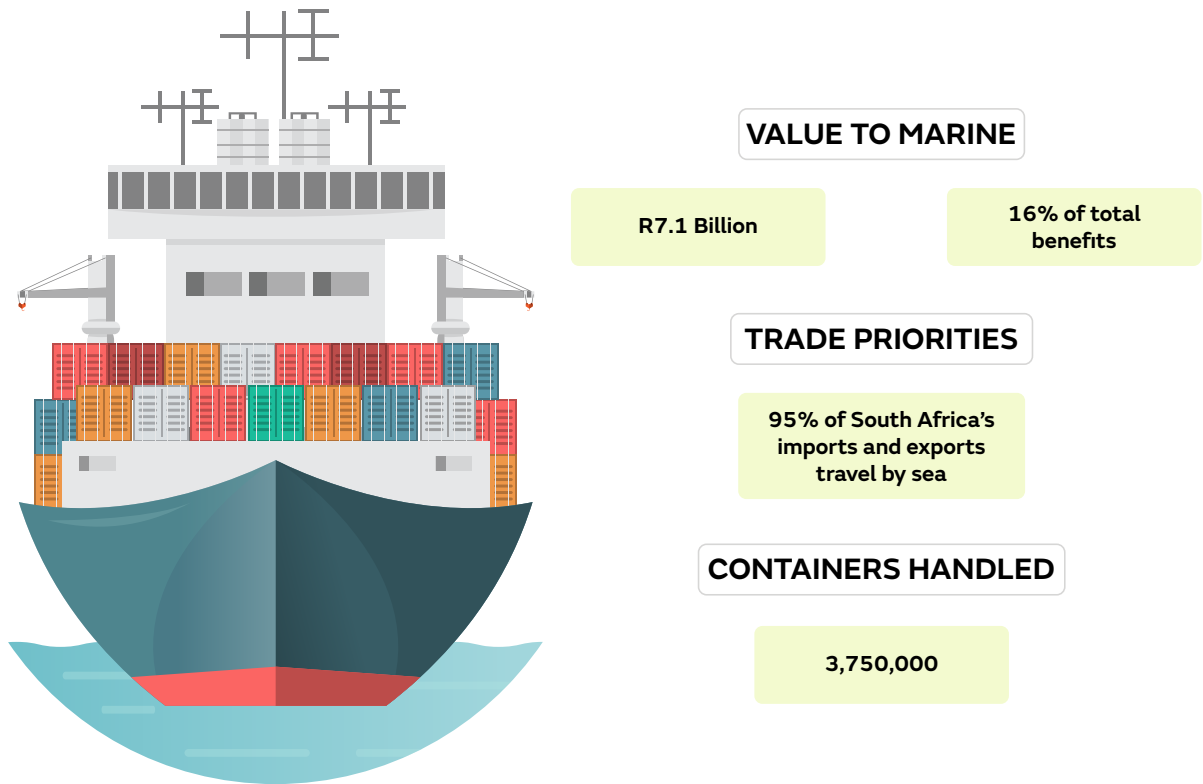


Figure 11: Marine overview

South Africa's maritime economy, including ports, shipping, fishing, and marine conservation; depends heavily on reliable weather information. The SAWS provides specialised forecasts through its Marine and Coastal Branch, informing safe navigation, port operations, and environmental protection. Ships departing South Africa use the SAWS synoptic and route forecasts to avoid storms, while port authorities rely on wave and wind predictions to safely berth large vessels. Fishing communities and offshore energy projects also use forecasts to reduce risks, optimise operations, and plan (i.e.: renewable energy development). The SAWS forecasts help prevent and manage environmental incidents as they happen, such as oil spills, contributing to cleaner oceans and sustainable fisheries.

“The lack of the SAWS data will need us to depend on international sources, and this isn't always accurate”

National Sea Rescue Institute

Accurate marine forecasts reduce delays, safeguard lives, protect valuable cargo, and support economic activity in ports and coastal industries. Yet gaps remain, including and challenges in forecasting tropical cyclone remnants. Consistent investment in the SAWS supports maritime safety and efficiency, reducing risks and potential disruption to shipping, fishing, energy projects, and environmental protection. Strengthening the SAWS marine services is therefore essential to South Africa's Blue Economy¹³.

¹³ Sustainable Blue Economy, United Nation Development Programme (2025)

Mining

Mining is a cornerstone of South Africa's economy, contributing around 6.3% of GDP in 2022/23 and employing nearly half a million people. Operations are highly weather-sensitive: heavy rainfall can flood open pits, erode haul roads, and damage tailings dams, while lightning and severe storms pose direct safety risks to workers and equipment. Extreme heat increases health hazards both above ground and underground. Water scarcity affects ore processing and dust suppression. With climate change expected to increase rainfall variability and local temperatures by up to 3°C under a 1.5°C global warming scenario, the sector's exposure to weather and climate hazards will intensify. The April–May 2022 KwaZulu-Natal floods, which temporarily halted coal production and reduced mining output, highlighted the vulnerability of supply chains and communities reliant on mining.

South Africa's mining industry depends heavily on the SAWS services for operational planning and safety. Daily forecasts guide blasting schedules and shift planning, while lightning and storm alerts trigger the suspension of outdoor work to protect workers. Seasonal and climate outlooks support long-term water management strategies in semi-arid mining regions. The SAWS radar and satellite data feed into company dashboards and mobile applications, providing accessible, real-time warnings across both large-scale and smaller mines. Stakeholders note they are “very reliant on the SAWS” to inform operational reports and avoid losses during extreme events.

Mining Benefits	
Safety	Storm and lightning alerts reduce accidents and fatalities by allowing timely evacuation and shutdowns.
Efficiency	Rainfall forecasts enable pit dewatering and drainage management, avoiding costly damage and downtime.
Resilience	Stable production sustains jobs, royalties, and local economic activity in mining towns.
Continuity	Weather guidance reduces export delays and logistical disruptions, especially for raw-material shipments.
Planning	Climate projections inform resilient infrastructure design for long-term planning.

Table 8: Mining Benefits

Despite the value of the SAWS' services, limitations remain. Radar coverage and forecast accuracy are occasionally compromised by power outages and cyber incidents. Warnings are often broad rather than site-specific, leaving some mines seeking more tailored, impact-based products. Smaller and remote operations may lack reliable access to the SAWS' data. Long-term datasets (50–100 years) are needed for planning around water security and climate change adaptation. Without robust, well-funded SAWS services, the sector faces higher risks of worker injury, costly shutdowns, and lost export earnings, undermining mining's role as a pillar of the South African economy.

The SAWS contribution to the Southern Africa Development Community (SADC)

The Southern African Development Community (SADC) is a regional organisation of 16 member states (Angola, Botswana, Comoros, Democratic Republic of the Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe) committed to advancing economic cooperation, regional integration, and political and security collaboration, visualised in Figure 13¹⁴. Recognising that weather and climate know no borders, SADC places a strong emphasis on coordinated meteorological services to support regional resilience, reduce disaster risks, and enable sustainable development across diverse sectors.

The South African Weather Service (SAWS) plays a leading role in achieving these objectives. As both a Regional Specialised Meteorological Centre (RSMC) and a Regional Training Centre (RTC), designated by the World Meteorological Organization (WMO), the SAWS provides services and expertise that extend far beyond South Africa's borders. Its contributions to the SADC region can be grouped into four main areas:

1. Regional Forecasting and Early Warnings

The SAWS provides specialised forecasting products and disseminates early warnings for severe weather events such as tropical cyclones, floods, heatwaves, and droughts. These services are shared across SADC member states, supporting national meteorological services with their own products and services leading to enhanced abilities to prepare and respond effectively. By coordinating regional alerts and ensuring that information flows quickly and consistently, the SAWS helps to save lives, protect property, and reduce economic loss.

2. Capacity Building and Training

As an RTC, the SAWS delivers training and professional development for meteorologists, technicians, forecasters, and climate scientists from across the SADC region. This includes both formal qualifications and continuous professional training in areas such as numerical weather prediction, climate modelling, aviation meteorology, and the use of radar and satellite data. By strengthening local expertise, the SAWS ensures that SADC member states are better equipped to generate and apply accurate, science-based weather and climate information within their own national contexts.

3. Climate Services for Sustainable Development

Beyond short-term forecasting, the SAWS provides seasonal and climate services that support socio-economic planning and long-term resilience. These include seasonal climate outlooks and impact-based forecasts that guide agricultural decisions, inform water resource planning, support renewable energy generation, and help protect public health. In a region where many economies are highly climate-sensitive, these services contribute directly to food security, energy stability, and economic growth.

4. Regional Cooperation and Data Sharing

The SAWS acts as a hub for collaboration and knowledge exchange across SADC and also internationally. Through its networks, it promotes the sharing of meteorological and climatological data, harmonisation of standards, and the adoption of best practice. This regional integration strengthens collective capacity, reduces duplication of effort, and ensures that all member states, regardless of size or resources, can access high-quality weather and climate information.

A Cornerstone of Regional Resilience

Through its work as an RSMC and RTC, the SAWS has become a cornerstone of climate and disaster risk management in southern Africa. Its services directly support the implementation of SADC's regional policies on climate resilience, disaster preparedness, and sustainable development. By safeguarding communities from extreme weather, supporting key sectors such as agriculture and energy, and building technical capacity across the region, the SAWS contributes not only to South Africa's national resilience but also to the shared prosperity and stability of the wider SADC community.

¹⁴ South African Development Community, 2025, sadc.int

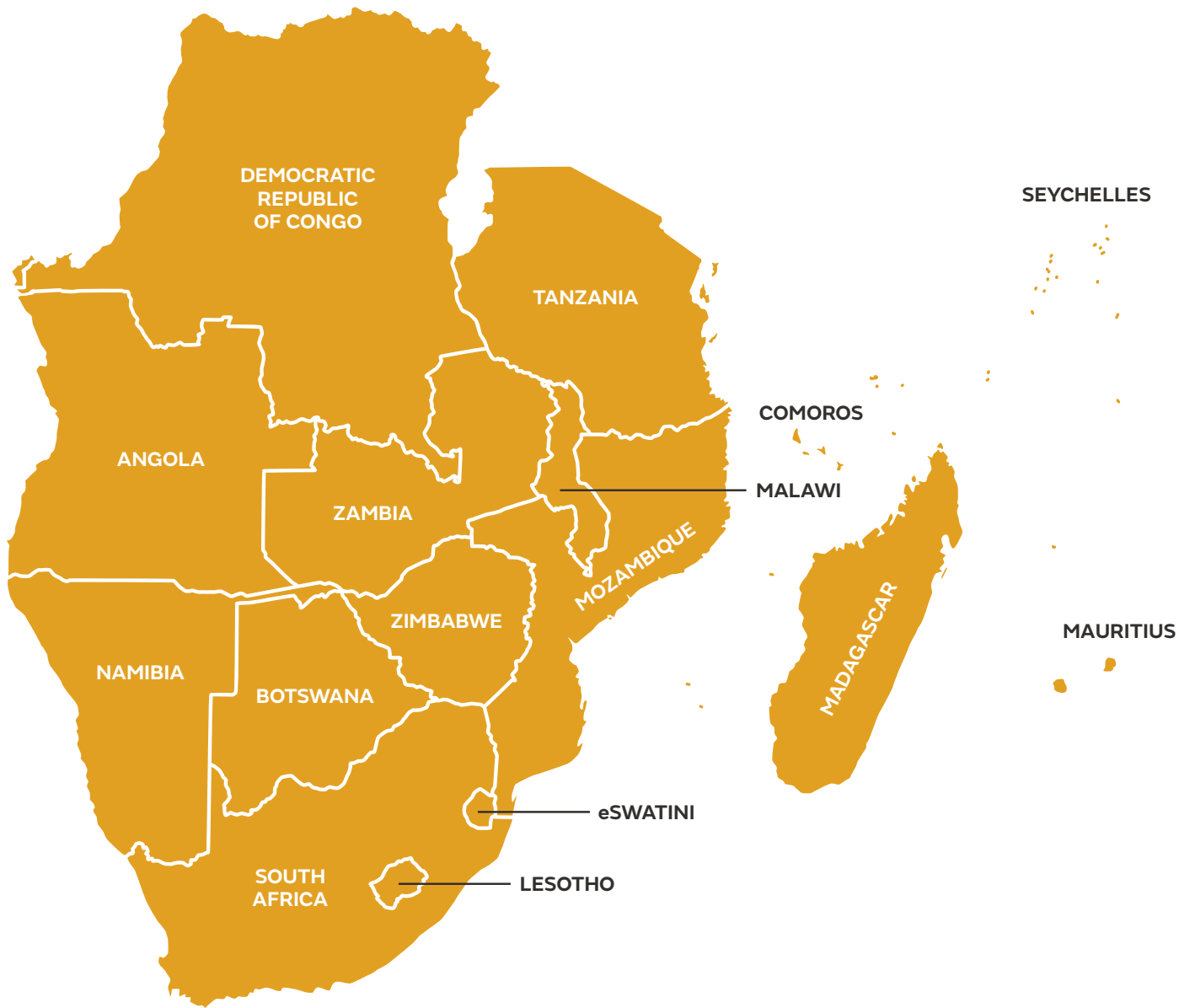


Figure 12: SADC Countries

Conclusion

The South African Weather Service (SAWS) delivers significant, measurable and well evidence value to the South African economy and society. The SAWS is a critical enabler of national resilience, risk management, and economic efficiency, as referenced in the Climate Change Act of the Republic of South Africa¹⁵, ratified in July 2024 by President Cyril Ramaphosa. The analysis indicates that for every rand invested, the **SAWS generates a return of between R4.4 and R11.4, with a central benefit-cost ratio of approximately 7.2 to 1**. This represents a strong return compared to many other public sector investments and confirms that weather and climate services are a fundamental component of South Africa's sustainable development and climate adaptation strategies.

AND WHEREAS implementing an effective climate change response is a national sustainable development priority as set out in the National Climate Change Response White Paper, while the Republic's Nationally Determined Contribution under the Paris Agreement, as may be varied from time to time, anticipates—

- (a) the realisation of significant socio-economic and environmental benefits in a manner that is driven and customised in the light of national circumstances, developmental, transformational, empowering and participatory, dynamic and evidence-based, balanced, cost-effective, integrated and aligned; and
- (b) support for a just transition to a climate-resilient, equitable and internationally competitive low-carbon economy and society, that takes into account the risks and opportunities that are expected to arise as a consequence of implementing the national climate change response;

Figure 13: Climate Change Act of the Republic of South Africa

The value generated by the SAWS is crosscutting, systemic, and spans across key sectors such as agriculture, aviation, mining, energy, finance, health, and disaster risk management. By providing high-quality, timely forecasts and warnings, the SAWS reduces losses from extreme weather, lowers operational costs, and enables more efficient resource allocation. These benefits cascade across the economy, strengthening food security, protecting infrastructure, safeguarding jobs, and supporting the stability of public finances.

The quantified benefits in this study are likely to be an underestimate. Some sectors and co-benefits were excluded, and attribution factors were intentionally set low, meaning the SAWS's true value is likely higher. As climate risks intensify, the marginal value of accurate forecasts will only grow, making investment in the SAWS economically sound and a form of futureproofing.

However, these gains depend on continued, sustainable funding to strengthen the SAWS's infrastructure, expanding coverage, and enhancing resilience would generate additional economic and social returns. Stakeholders have warned that underinvestment risks degrading observation networks, radar gaps, weakened communication, and will result in a decline of service trust, eroding existing benefits and amplifying climate & weather-related costs.

Ultimately, the SAWS is more than a forecast provider, it is a strategic cross-sectoral enabler of climate adaptation, economic growth, and resilience. Continued and enhanced investments will save more lives, reduce economic disruption, and contribute to securing a more resilient and prosperous South Africa.

¹⁵ Government Gazette, The Climate Change Act of the Republic of South Africa (2024)

Annex 1: Methodology

This annex outlines the methodology and assumptions used in this study which is based on a structured tool designed to estimate the **socioeconomic value of meteorological services across key benefit streams**. The model is part of an evolving programme of work aimed at supporting countries to assess the economic benefits their National Meteorological and Hydrological Services (NMHSs) deliver.

Conceptual Approach

The model follows a **top-down, decision-based framework** using known economic impact estimates, probabilities, and behavioural response assumptions to **calculate avoided losses or improved decision outcomes**. This contrasts with “bottom-up” methods that rely on full econometric models or detailed household surveys, which can be too resource-intensive for many NMHSs.

The approach was used across **ten benefit streams for this study** as set out in the report.

The modelling did not attempt to simulate every household or firm in the economy: Each benefit stream follows a structured logic chain, typically using the following elements:

- **Baseline impact:** What are the typical annual losses, costs, or outputs in each sector that are affected by weather (e.g., average annual storm damage, flight operating costs, yield losses)?
- **Forecast accuracy:** measures of forecast skill, timeliness, and relevance. (Probability of Detection or skill score)
- **Dissemination and reach:** How many people or institutions get the information
- **Response:** What actions are taken when a warning or forecast is received
- **Avoidable damage or improved decision efficiency:** What portion of the benefit can be conservatively credited to the SAWS forecasts. (final avoided cost or benefit)?

The logic chain can be described for most sectors as:

Weather risk → Forecast information → User response → Avoided losses or efficiency gains.

Where local data was not available, **evidence-based default values** derived from international studies (WMO, UNDRR, etc.) or historic national data (e.g., from the SAWS, South African Treasury, National Disaster Management Centre (NDMC), or International Civil Aviation Organization (ICAO) for aviation) were used. The modelling draws on international best practice, peer-reviewed mortality attribution, national statistics (StatsSA mortality and GVA statistics), and sectoral proxies (aviation fuel & delay costs; container throughput; recorded flood losses).

¹⁶ [Scovronick et al., The association between ambient temperature and mortality in South Africa: A time-series analysis \(2018\)](#)

Annex 2: Table of stakeholder and user participants of this study

Agriculture	Department of Agriculture, Land Reform and Rural Development Agricultural Research Council University of Free State
Aviation	Virgin Atlantic Airways (BARSAs) Board of Airline Representatives of South Africa
Construction	Babcock Ntuthuko Engineering Milestonecon (Pty) Ltd Peregrine Multiservice
Disaster Risk Reduction	City of Cape Town: Catchment, Stormwater, and River Management Disaster Risk Management NPC (DMS NPC) Durban University of Technology Hexagon Fire Investigation TERRATECH Department of Cooperative Governance
Energy	SMEC South Africa Department of Mineral and Energy
Finance	AfriGIS Associated Loss Adjusters Independent Claims DRM & Associates Hills Forensic Investigations Commercial and Industrial Acceptances Secure Systems Abacus Assessors
Health	Earth and Occupational Health Sciences National Department of Health
Marine	South African Maritime Safety Authority National Sea Rescue Institute MRCC Cape Town SAPS Forensic Services
Mining	Department of Mineral and Petroleum Resources Skyside
Tourism	Bluerock Sport and Recreation
Water	Department of Water and Sanitation Emanti Management (Pty) Ltd Umvoto
Other	National Treasury (SA-TIED) (DFFE) Department of Forestry, Fisheries and the Environment Safetech OFM Radio South African Police Service Airshed Planning Professionals