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Climate change impacts on south African non-life insurance: A comprehensive analysis of natural disaster risk and adaptation strategies

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Abstract: This study investigates the impact of climate change on the South African insurance industry, focusing specifically on the increased frequency and intensity of natural disasters. The escalating threats posed by extreme weather events, including floods, droughts, storms, and wildfires, are analyzed in depth, revealing a significant surge in damages related to property, business interruptions, and agricultural losses. As weather patterns become increasingly unpredictable, the study highlights the challenges faced by South Africa in predicting and managing risks effectively, necessitating a paradigm shift in risk assessment methodologies. Descriptive statistics and time series analyses were used to summarize and observe trends over the period 2000-2024 to provide a comprehensive examination of the intricate relationship between climate change and the South African insurance industry, focusing on the escalating risks posed by natural disasters. The study reveals that droughts are the most significant climatological concern in South Africa, with hydrological disasters being the most common. Meteorological disasters are more frequent, emphasizing the need for robust preparedness and response measures. Floods are the most prevalent disaster type, with KwaZulu-Natal having the highest number of disasters. The Eastern Cape and Northern Cape experience fewer disasters. Overall, climatological, hydrological, and meteorological events are the most prevalent, with droughts dominating the climatological subgroup. This comprehensive analysis contributes to the growing body of knowledge on the intersection of climate change and the insurance industry in South Africa, providing insights into the multifaceted challenges insurers face and outlining potential adaptation strategies. The findings of this study offer valuable guidance for industry stakeholders, policymakers, and researchers seeking to navigate the complex landscape of climate-related risks in the insurance sector.

Keywords: *Climate change, Climatological, Droughts, floods, Geophysical, Hydrological, Insurance, Meteorological, Natural disasters.*

1. Introduction

Climate change is a global issue affecting ecosystems, economies, and societies worldwide. Southern Africa is particularly vulnerable to extreme weather events and natural disasters, leading to the displacement of people. This displacement has profound social, economic, and environmental implications. Efforts to combat climate change focus on lowering emissions, but many vulnerable nations lack the resources and capacity to adopt effective adaptation plans [1]. Climate change refers to long-term alterations in temperature and weather patterns, which can be natural or caused by solar activity or volcanic eruptions [2]. This leaves people, particularly climate refugees and migrants, increasingly vulnerable [3].

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Natural catastrophes have become more common, larger, and more severe on a worldwide scale in recent years. Their rising trends affect the insurance industry through losses exhibited by them, reflecting the increasing impact and their complexity. These disasters are divided into five categories, namely: Geophysical, Climatological, Meteorological, Hydrological, and Biological. *Geophysical events* are natural phenomena that can have significant impacts on the environment, economy, and society. They can occur as a result of physical effects like volcanic super-eruptions or large comet impacts, or from regional events like mega-tsunamis, earthquakes, and landslides [4]. *Climatological events* are those that are caused by changes in the global climate that exacerbate climate hazards and amplify the risk of extreme weather disasters. Increases in air and water temperatures lead to rising sea levels, supercharged storms, higher wind speeds, more intense and prolonged droughts and wildfire seasons, heavier precipitation, and flooding [5]. *Meteorological events* are classified as extreme water-related weather events like excessive precipitation, cyclones, hail, and thunderstorms [6]. *Hydrological events* are extreme events such as droughts, floods, and precipitation events due to anthropogenic impacts [7]. *Biological events* are natural events that cause widespread sickness, disability, or death among humans, animals, and plants as a result of microorganisms such as bacteria, viruses, or toxic substances [8]. Figure 2: The graph shows the number of natural loss events worldwide from 1980 to 2018 explained in the five categories [9].

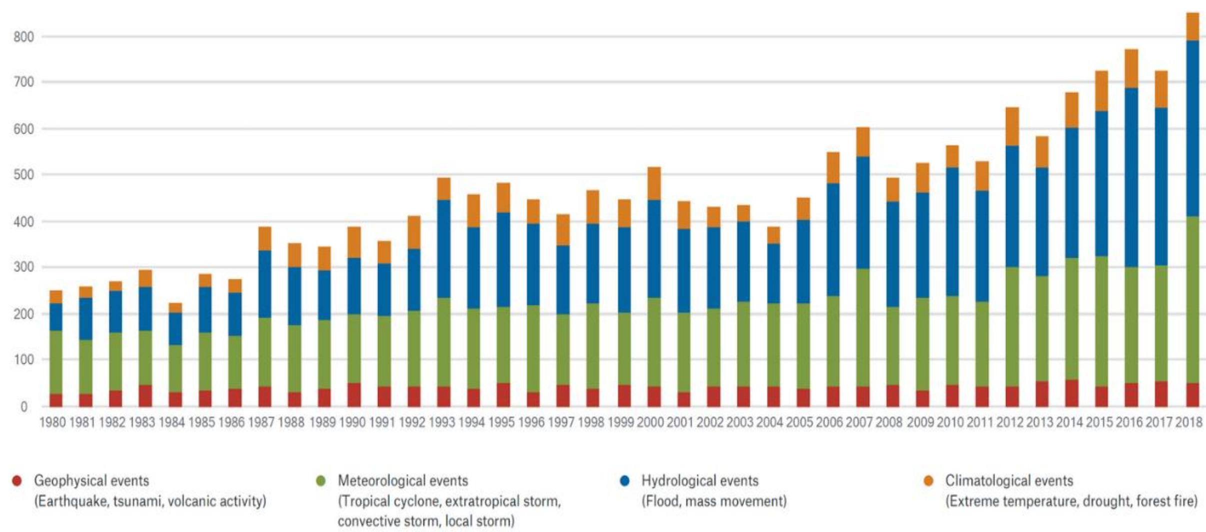

Figure 1.
The graph shows the number of natural loss events worldwide from 1980 – 2018 [9].

The insurance sector is comprised of three subcategories: life insurance, non-life insurance, and reinsurance. A life insurance policy is a contract between a policyholder and an insurer, ensuring payment and provision of services to a beneficiary in case of an insured person's death, life-threatening illness, or other losses. Non-life insurance policies, such as those covering automobiles or real estate, reimburse losses based on specific investments [10]. Reinsurance is insurance for insurance providers, transferring a portion of the financial risk from insurance companies to reinsurers. These policies aim to provide relief during catastrophic events, such as fires, floods, or other natural [11].

Five countries in Africa have tapped into each of these market segments with 84% of an estimated value of $68.15 billion of the continent's total insurance market. South Africa has about 70% of the market share, followed by Morocco, Kenya, Egypt, and Nigeria, while other African countries contribute just under 2% [12]. Insurance has a responsibility to reduce or eliminate lost costs due to large economic risks, maintaining smooth operations for businesses following catastrophic catastrophes, and contributing to the nation's economic progress [13].

One sectoraffected by these changes is the non-life insurance industry which plays a pivotal role in managing and mitigating risks associated with property, businesses, and agriculture. The non-life insurance landscape is inextricably linked to the broader climate context, as insurers grapple with the complexities of predicting, assessing, and adapting to climate-related risks. As extreme weather events become more unpredictable, the industry faces a critical juncture in understanding the evolving risk profiles and enhancing resilience strategies to safeguard against escalating economic losses and disruptions [14].

In the South African context, droughts, floods, pandemics, and storms, among others, have caused enormous social and economic losses. With climate change, these risks are expected to increase [15]. Furthermore, Writer [16] also highlighted that South Africa is long considered a region with low catastrophe risk given the increase in the frequency of these events. Based on the advice of risk experts from around the world, such as the World Economic Forum which have evaluated the impact and possibility of these types of hazards occurring and the findings revealing that all these perils have a higher likelihood of occurring [17]. These findings are further justified by Figure 2 where we see a constant rise of these events over time, especially natural catastrophes.

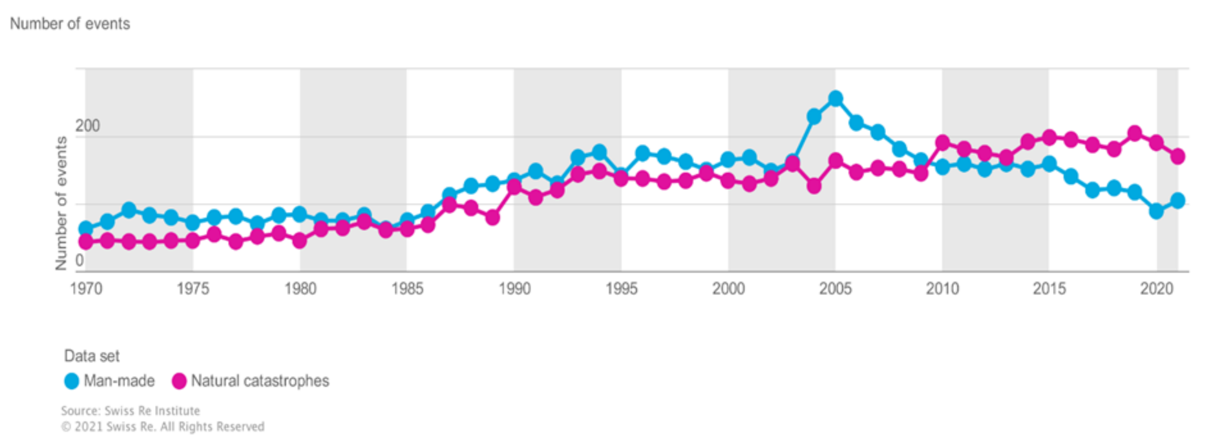

Figure 2.
The graph shows the number of catastrophic events worldwide from the period of 1970 – 2020 [18].

In response to these challenges, this study aims to provide a comprehensive examination of the intricate relationship between climate change and the South African insurance industry, with a particular focus on the escalating risks posed by natural disasters. The frequency and severity of weather-related events, such as floods, droughts, storms, and wildfires have exposed and challenged traditional risk assessment models necessitating a re-evaluation of existing insurance practices.

2. Background

Natural disasters have become more frequent and intense because of climate change Coronese, et al. [19]. Davis-Reddy and Amelia [9] also highlighted that between 1998 and 2017, climate-related disasters dominated the disaster risk landscape, accounting for up to 91% of all 7,255 large, recorded incidents globally. Furthermore, climate-related calamities account for 76% of total economic losses recorded in the same period. While these events account for the majority (87%) of natural catastrophe events in South Africa. Flooding has been the most common type of natural catastrophe. However, droughts have also resulted in the biggest economic cost of damages and affecting a greater proportion of the region's population. This is also evidenced in Figure 1 above as we see that most of the fatal events are due to meteorological and hydrological events.

Rising insurance claim payouts due to natural disasters are explored as a driving force behind the upward trajectory of insurance premiums, demanding a reassessment of industry norms [20]. In the report written by Munzhedzi [21] it is highligted that the drought of 1991–1992 is considered the worst. The government had to import corn as a result of almost 70% of the harvests failing. A total of around 250,000 individuals were impacted by the projected 50,000 jobs lost in the agriculture industry and an additional 20,000 jobs lost in allied sectors. An estimated R 5 billion in financial damages were incurred. In March 2003 and April 2005, the Western Cape experienced floods as a result of cut-off lows, resulting in damages of up to R 260 million [21]. The April 2022 flood in Durban was the most catastrophic natural disaster in KwaZulu-Natal, resulting in 459 deaths, 4000 homes destroyed, 40,000 homeless, and 50,000 unemployed [22]. The KZN coastal zone, including Durban and the South Coast, received over 300mm of rain in 24 hours, causing a significant economic impact. The estimated cost of infrastructure and business losses was R 37,5 billion [22].

In 2002, fires in Mpumalanga damaged 24,000 acres of grassland and killed four people, causing losses of more than R 32 million. Between 2007 and 2008, KwaZulu-Natal and Mpumalanga had fires that resulted in a considerable loss of revenue, estimated at R4.3 billion [21]. In 2017, the Western Cape fires cost the insurance industry R3bn to R4bn, leading to higher insurance premiums in affected areas. The damage to property and infrastructure was estimated at R 1 billion and losses of up to R 12.5 million were also experienced in the period of 2003 and 2007 in the same province [21, 23]. In November 2013, Pretoria experienced a major loss event, with Annual Financial Statements revealing two significant hailstorms in Gauteng, with the second being one of the most severe catastrophe events in South Africa. The storms occurred just 12 months after two similar storms in October and November 2012, resulting in an estimated 25,000 insurance claims and a R1 billion loss event [24]. Furthermore, in November 2023, the insurer's sector received over 2,000 claims with over R60m payments in hailstorm-related claims following the Gauteng hailstorm [22].

According to Bechard [25] South Africa's short-term insurance sector saw a 28% drop in profit after tax (PAT) in the year 2020, As a result, R8.3 billion was reduced to R6 billion, owing to credit defaults, an increase in net claims, and a higher claims ratio. Some of these rate increases are caused by high global natural, man-made catastrophic events and poor investment gains. In the report that was done in 2022, climate risks are shown to be becoming more prevalent, necessitating a greater emphasis on sustainability and insurance risks. Insurance is a critical socioeconomic sector that provides society with protection and a financial lifeline [26]. Singh [27] investigated weather index insurance (WII) as a tool to manage the climate change impact and the findings indicated that climate change risk significantly impacts the pricing and design of WII. Zhou, et al. [28] highlighted that natural disasters and climate change risks impact insurer profitability, bank stability, stock market returns, and international lending, with mitigation strategies involving income levels, financial regulations, and capital abundance.

On the other hand, Akuba [29] investigated the effects of climate change policies on insurance industry stability and the findings showed that climate change policies influence insurance industry practices, leading to climate-resilient strategies and modifying risk assessment methodologies. Moreover, this leads to innovation and the development of climate-specific insurance products, emphasizing the need for collaboration between policymakers and insurers to enhance industry stability in the face of climate-related challenges.

3. Methodology

The study uses quantitative methodology. The climate dataset from the period of 2000 to January 2024 was drawn from the Emergency Events Database (EM-Dat) portal. Data clean-up and imputation were further done to improve the quality of the data.

Descriptive statistics and time series were used to summarise and observe trends over the period of concern. Time-series analysis is a technique used in research to extract useful knowledge from organised data collected over time [30]. A line chart, often known as a time plot, is a standard method for examining a regular time series. In general, and for most time series data, this plot discloses the nature of the trend instantly and can even indicate the absence of a trend [31]. Moreover, when a time series is broken down into its simple components known as decomposition, it becomes much easier to describe and understand. The decomposition of a time series is a statistical procedure that deconstructs a time series into nominal components [32]. Decomposition seeks to determine seasonal impacts, resulting in seasonally adjusted results. They are identified in four components for time series movement: trend (Tt), seasonal (St), cyclical (Ct), and irregular (It) [31, 33].

4. Results

Table 1 provides a detailed breakdown of disaster occurrences in South Africa, offering insights into the distribution of disaster types across different subgroups. Droughts emerge as the most significant climatological concern, with 12% of instances reported, highlighting the profound impact of prolonged periods of aridity on agriculture and communities. Geophysical disasters, represented solely by earthquakes with 2% instances, appear relatively infrequent, indicating a lower seismic risk compared to other regions. In contrast, hydrological disasters, primarily floods with 45% instances, underscore the country's susceptibility to water-related catastrophes, particularly during heavy rainfall events or cyclonic activity. Meteorological disasters, predominantly storms with 29% instances, reflect the frequent occurrence of severe weather phenomena such as thunderstorms and hailstorms, emphasising the importance of robust preparedness and response measures. These insights are invaluable for policymakers and disaster management authorities in implementing targeted strategies to mitigate risks, enhance resilience, and protect lives and livelihoods across South Africa.

Table 1.
The summary of the disaster subgroup segmented into disaster types.

		Disaster Subgroup				**Total %**
		Climatological %	**Geophysical %**	**Hydrological %**	**Meteorological %**	
Disaster Type	Drought	12	0	0	0	12
	Earthquake	0	2	0	0	2
	Extreme temperature	0	0	0	2	2
	Flood	0	0	45	0	45
	Storm	0	0	0	29	29
	Wildfire	10	0	0	0	10
Total		22	2	45	31	100

Table 2 provides a comprehensive overview of the distribution of different types of disasters across provinces. It shows the percentage of each disaster type by province. In summary, floods are the most prevalent disaster type, with 44.6% occurrences, followed by storms with 29.1% occurrences. Notably, KwaZulu-Natal has the highest number of disasters overall, with 28.0% instances, primarily driven by floods (13.9%) and storms (10.2%). The Eastern Cape also experienced a significant number of disasters, particularly floods (5.1%) and storms (3.5), totaling 12.0% incidents. Other provinces like the Northern Cape and North-West experienced fewer disasters overall, with 3.6% and 7.3% instances respectively. These findings suggest varying levels of vulnerability to different types of disasters across provinces, underscoring the importance of tailored disaster preparedness and response strategies at the provincial level.

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Table 2.
The summary of the disaster Type segmented into Provinces.

		Disaster Type						Total %
		Drought %	Earthquake %	Extreme temperature %	Flood %	Storm %	Wildfire %	
Province	All Provinces	0	0	0	0.7	0	0	0.7
	Cape Town	0	0	0	0.7	0	0	0.7
	Eastern Cape	1.5	0	0.7	5.1	3.6	1.5	12.0
	Free State	1.5	0	0	0.7	2.2	1.5	5.8
	Gauteng	1.5	0	0.7	5.1	3.6	0.7	12.0
	KwaZulu-Natal	0.7	0	0	13.9	10.2	2.2	28.0
	Limpopo	1.5	0	0	2.9	2.9	1.5	9.0
	Mpumalanga	1.5	0	0	3.6	2.2	1.5	9.0
	North-West	1.5	1.5	0.7	2.9	0.7	0	7.3
	Northern Cape	1.5	0	0	1.5	0.7	0	3.6
	Western Cape	1.5	0	0	5.8	3.0	1.5	12.0
Total		12.7	1.5	2.1	44.6	29.1	10.2	100

Table 3 sheds light on the distribution of disaster subgroups across South African provinces, highlighting both commonalities and disparities in vulnerability. Overally, the data reveals a diverse spectrum of disasters impacting the nation, with climatological, hydrological, and meteorological events being the most prevalent. KwaZulu-Natal emerges as a particularly susceptible region, experiencing a high frequency of disasters across multiple subgroups, notably hydrological and meteorological events. Geophysical disasters are relatively rare, occurring primarily in the North-West and Northern Cape provinces. These findings underscore the importance of targeted disaster preparedness and response efforts tailored to the specific risks faced by each province. By understanding the unique patterns of disaster occurrence, authorities can implement more effective mitigation strategies and enhance resilience to future events, ultimately safeguarding communities and infrastructure across the country.

Table 3.
The summary of the Disaster Subgroup segmented into Provinces.

		Disaster Subgroup				Total %
		Climatological %	Geophysical %	Hydrological %	Meteorological %	
Province	All Provinces	0	0	0.7	0	0.7
	Cape Town	0	0	0.7	0	0.7
	Eastern Cape	2.9	0	5.1	4.3	12.4
	Free State	2.9	0	0.7	2.1	5.8
	Gauteng	1.5	0	6.6	4.4	12.4
	KwaZulu-Natal	3.6	0	13.9	10.2	27.7
	Limpopo	2.9	0	2.9	2.9	8.8
	Mpumalanga	2.9	0	3.6	2.2	8.8
	North-West	1.5	1.5	2.9	1.5	7.3
	Northern Cape	1.5	0	1.5	0.7	3.6
	Western Cape	2.9	0	5.8	2.9	11.7
Total		22.6	1.5	44.5	31.4	100

Table 4 delves into the intricate landscape of disaster occurrences in South Africa, offering a granular analysis of various disaster subtypes within distinct disaster subgroups. Across the nation, a diverse array of disasters has been recorded, with climatological, hydrological, and meteorological events standing out as primary categories. Notably, droughts dominate the climatological subgroup, highlighting the significant impact of prolonged periods of aridity on the country's landscapes and communities. Additionally, hydrological disasters, particularly riverine floods, and flash floods, underscore the vulnerability of South Africa to water-related catastrophes, with a total of 44.5%

instances reported. These findings emphasise the importance of proactive measures to manage water resources and mitigate flood risks, especially in provinces prone to such events.

Within the meteorological subgroup, lightning/thunderstorms emerge as a prominent concern, with 10.5% instances recorded. These events pose immediate threats to both infrastructure and public safety, necessitating robust preparedness and response mechanisms to minimise their adverse effects. Moreover, the occurrence of severe weather and tropical cyclones, reported with 8.0% and 3.6% instances, respectively, highlights the dynamic and unpredictable nature of meteorological phenomena in South Africa. Addressing these challenges requires a comprehensive approach that integrates early warning systems, community education, and infrastructure resilience measures to enhance the country's ability to withstand and recover from meteorological disasters. By leveraging these insights, policymakers and disaster management authorities can develop targeted strategies to build resilience and safeguard lives and livelihoods against the diverse range of disaster subtypes encountered across the nation.

Table 4.
The summary of the disaster subgroup segmented into disaster subtypes.

		Disaster Subgroup				**Total**
		Climatological	**Geophysical**	**Hydrological**	**Meteorological**	
Disaster Subtype	Blizzard/Winter storm	0	0	0	1.5	1.5
	Cold wave	0	0	0	1.5	1.5
	Drought	12.4	0	0	0	12.4
	Flash flood	0	0	6.6	0	6.6
	Flood (General)	0	0	22.6	0	22.6
	Forest fire	4.4	0	0	0	4.4
	Ground movement	0	1.5	0	0	1.5
	Hail	0	0	0	0.7	0.7
	Heat wave	0	0	0	0.7	0.7
	Land fire (Brush, Bush, Pasture)	5.1	0	0	0	5.1
	Lightning/Thunderstorms	0	0	0	10.2	10.2
	Riverine flood	0	0	15.3	0	15.3
	Severe weather	0	0	0	8.0	8.0
	Storm (General)	0	0	0	2.9	2.9
	Tornado	0	0	0	2.2	2.2
	Tropical cyclone	0	0	0	3.6	3.6
	Wildfire (General)	0.7	0	0	0	0.7
Total		22.6	1.5	44.5	33.4	100

Table 5 reveals a notable discrepancy in disaster declarations across South African provinces. While the majority of instances, totalling 88.5%, are not deemed disasters, there are still significant occurrences where disaster declarations aremade, totalling 17.5% instances. This suggests a varying level of susceptibility to events warranting formal declaration across different provinces. Notably, KwaZulu-Natal emerges as the province with the highest frequency of disaster declarations, indicating a greater propensity for events of significant impact. Provinces like Gauteng exhibit lower occurrences of such declarations. These findings underscore the importance of understanding provincial vulnerabilities and preparedness measures to effectively mitigate and respond to disasters. Further investigations into the specific nature and severity of these events, as well as the efficacy of response mechanisms, would provide valuable insights for enhancing disaster resilience across the country.

Table 4.
The summary of the Disaster Subgroup segmented into Provinces.

		Disaster Declaration		Total %
		No %	Yes%	
Province	All Provinces	0	0.7	0.7
	Eastern Cape	10.9	1.5	12.4
	Free State	4.4	1.5	5.9
	Gauteng	11.7	0.7	12.4
	KwaZulu-Natal	24.8	2.9	27.7
	Limpopo	6.6	2.2	8.8
	Mpumalanga	6.6	2.2	8.8
	North-West	5.1	2.2	7.3
	Northern Cape	1.5	2.2	3.7
	Western Cape	10.9	1.5	12.4
Total		88.5	11.5	100

Figure 3 shows the number of people affected per million from the year 2000 to 2024 by the disaster subgroup. In the results, we observe that hydrological, meteorological, and geophysical have affected the least number of people as compared to climatological. Climatological disaster which consists of droughts and wildfires emerge as the most significant natural disaster concerns in the history of the South African context with the number estimated at 1.2 million people affected. The peak is also evident in the period of 2004, where about 2.1 million people were affected, though it dropped over time until the peak in the period of 2017 to 2024. Since the year 2017, the peak has continuously grown exponentially. This disaster subgroup reveals a significant surge in damages posed by business interruptions, agricultural losses, and people at large by climatology and the need for agent interception by policymakers and the government at large.

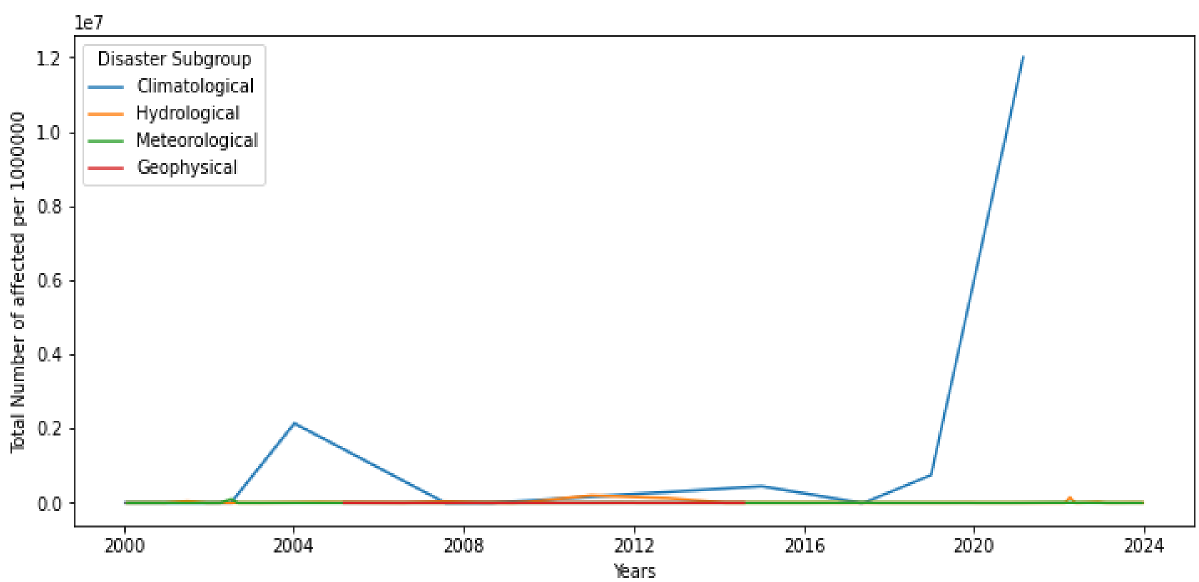

Figure 3.
Number of people affected per Mil segmented into disaster types over time.

Figure 4 Shows the number of events in the time intervals from the period 2000 to 2024. Different time intervals have exposed different peaks in the number of events that occurred over time. Between the years 2004 to 2023, the highest peaks of occurrences total seven events while the lowest is two, with a mean average of two events per year. The figure also reveals that these events happen in seasonal patterns, and from 2020 to 2024 there was also a spike.

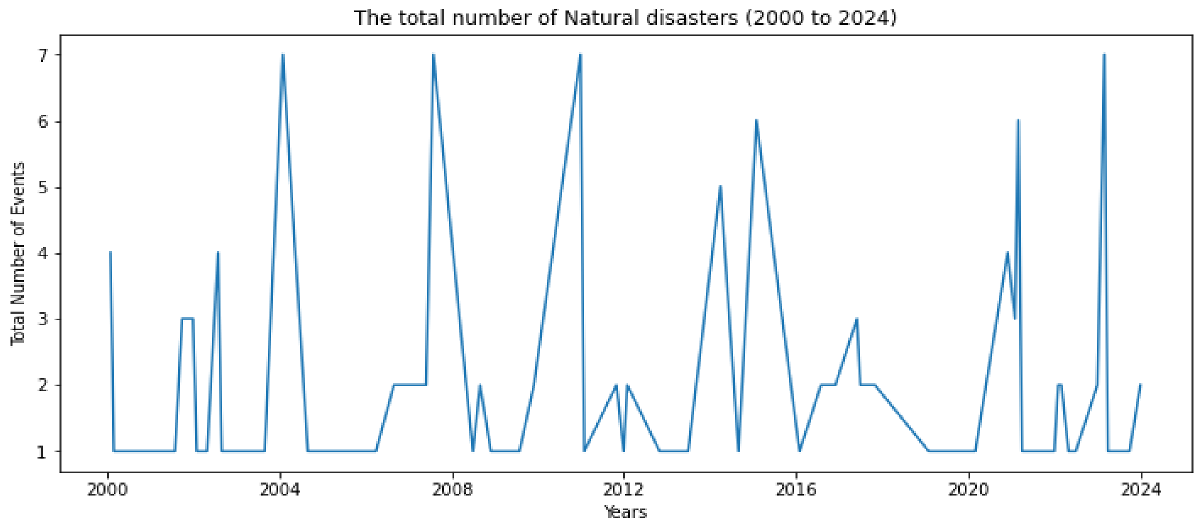

Figure 4.
Number of people affected per Mil segmented into disaster types over time.

Figure 5 reveals that Jan, Nov, Dec, and Feb months are the prevalent months with the likelihood of disaster occurrence. The months of Mar, Jun, and May are also shown to be the most common months of disaster occurrences between the period of 2016 to 2024. Overall, the observations reveal that summer and winter seasons are the seasons with the most likelihood of disaster occurrence over time. These results illustate the patterns seen in Figure 4.

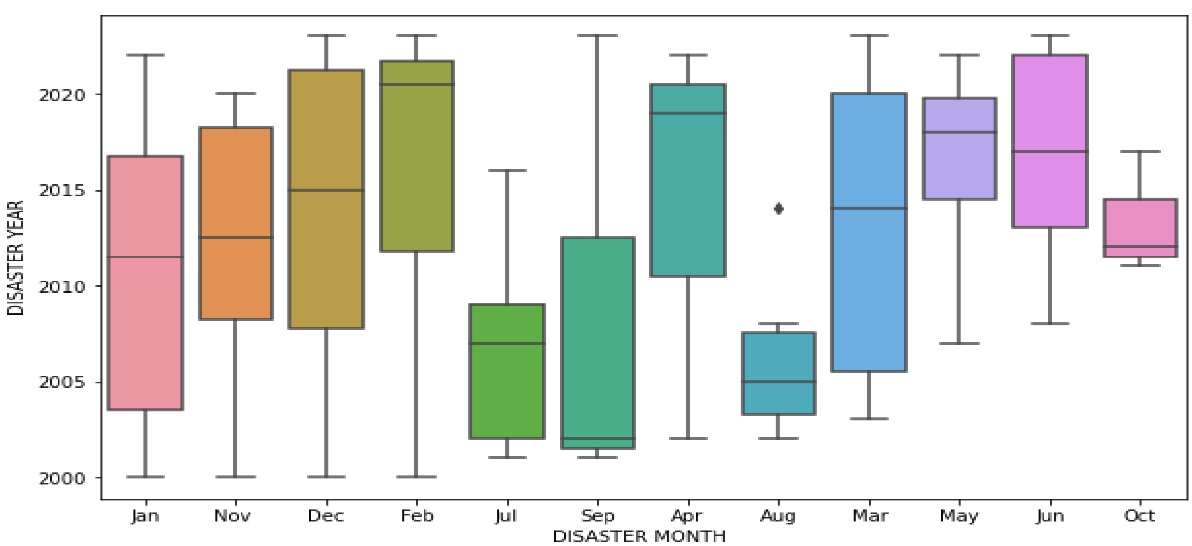

Figure 5.
Shows the boxplot of months of disaster occurrence segmented into different years.

Figure 6 shows the trends and seasonality of the events over time and the figure shows that the numbers of events have a direct influence on the disaster occurrences. Furthermore, these occurrences

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are shown to happen in seasonality. In the period of 2020, we further observe the high frequency of these events occurring. This suggests that the likelihood of these disaster events occurring has increased.

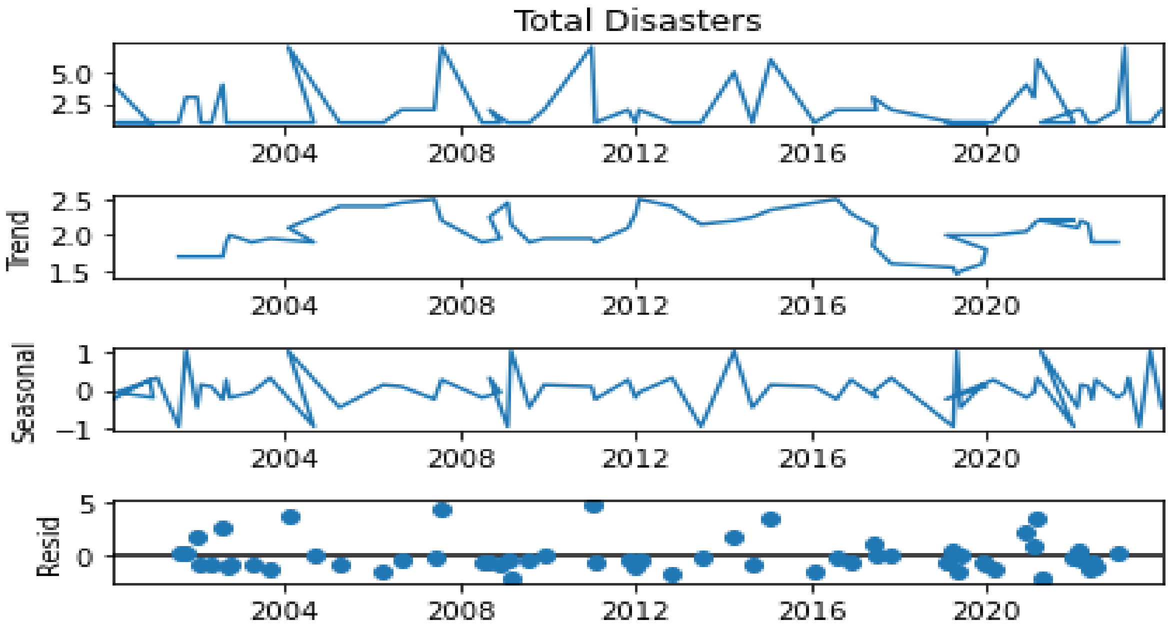

Figure 6.
Decomposition that reveals seasonal impacts.

5. Discussions

The results reveal that droughts are the most significant climatological concern, while geophysical disasters are less frequent and hydrological disasters are the most common. Meteorological disasters are more frequent, emphasising the need for robust preparedness and response measures. Furthermore, the distribution of disaster types across South African provinces reveals that floods are the most prevalent at 44.6% and storms at 29.1%. The diverse range of disasters across provinces shows that climatological, hydrological, and meteorological events are the most prevalent. KwaZulu-Natal is shown to have the highest number of disasters, followed by the Eastern Cape. The Northern Cape and North-West experience fewer disasters. The diverse range of disasters across provinces shows that climatological, hydrological, and meteorological events are the most prevalent. KwaZulu-Natal is particularly susceptible, with a high frequency of hydrological and meteorological events, while geophysical disasters are rare at 1.5%. Droughts dominate the climatological subgroup, with 44.5% of incidents being water-related in total across all provinces. Meteorological events, such as lightning or thunderstorms, pose immediate threats to infrastructure and public safety. Severe weather and tropical cyclones are also significant. In the period 2000–2024, the number of people affected per million was highest in climatological disasters, with 1.2 million people affected. Moreover, the study shows that the most common months for disaster occurrences are January, November, December, and February, with March, June, and May being the most common from 2016 to 2024 (see Figure 6). The number of events with the highest spike was seven events between 2004 and 2023, and the lowest was two, with a mean average of two events per year. Furthermore, it is revealed that the number of events directly influences disaster occurrences, with a high frequency observed in the years 2020–2024, indicating an increased likelihood of such events.

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This highlights the surge in damages from business interruptions, agricultural losses, and property that necessitated policymakers and the government intervening. Anekwe, et al. [34] concurs and states that Southern Africa is facing climate change due to warming and drying trends, causing stresses in a warm, dry, and water-stressed region. Despite uncertainty in rainfall, projections suggest drier conditions. Low mitigation features are likely to lead to increased regional warming, soil moisture availability reductions, heatwaves, and fire-danger days. The region is at risk of tipping off into a new regime, with unprecedented impacts like drought, industry collapse, and tropical cyclone shifts. Jegede, et al. [14] further argued that climate change poses sustainability challenges globally, particularly in Africa, where it is one of the most vulnerable regions. Adaptation policies should be developed by African countries, with insurance playing a crucial role in providing resources for rebuilding societies after extreme weather events. These insights are crucial for policymakers and disaster management authorities to mitigate risks and protect lives.

Addressing these challenges requires a comprehensive approach involving early warning systems, community education, and infrastructure resilience measures. It is high time that the South African government and policymakers adapt early warning systems, like sensors, to potentially warn against catastrophic weather. Furthermore, the insurers need to develop systems that can gather catastrophic data and transmit observations about upcoming disasters. Scientists in the field of statistics and geospacer need to be employed by the government and policymakers to further analyse trends and create algorithms that can help in detecting and forecasting the possible consequences and trends. This will improve the risk and preparedness at all levels to respond to the catastrophic warnings received. Funding for universities to further research these events can also play a great deal. Community education, such as teaching people in the surrounding areas which are at high risk. For example, to educate and inform such residence why they should not build infrastructure next to the river banks and wetlands Above all, new infrastructure development, such as bridges and drainage systems in areas of high risk, needs to be implemented.

Insurers need to start rating for such risks in their premium covers to be able to withstand the severity of these events. This will might help them to sustain their profit margins and improve the insurers, banks' stability, stock market returns and international lending. Even though there is resistance for policymakers to include these events in premium ratings due to fear of overpricing or underpricing of products, new mathematical methods such as machine learning and artificial intelligence can assist in mitigating such risk. Such issues and mitgations are further highlighted in the United Nations' sustainable development goals (SDGs), where insurers can mitigate the risk by providing insurance products for new-generation agricultural policies (SDG2), protecting people and businesses from environmental health risks (SDG3), protecting industrial infrastructure (SDG9), supporting low-carbon development (SDG7), promoting sustainable production and consumption (SDG12), and addressing climate-related weather extremes (SDG13) [35]. This will also be possible if the government is also involved in such discussions.

6. Conclusion

The study reveals that droughts are the most significant climatological concern in South Africa, with hydrological disasters being the most common. Meteorological disasters are more frequent, emphasising the need for robust preparedness and response measures. Addressing these challenges requires a comprehensive approach involving early warning systems, community education, and infrastructure resilience measures. The South African government and policymakers need to adopt a comprehensive approach to mitigate climate change challenges. This includes implementing early warning systems, community education, and infrastructure resilience measures. Insurers should develop systems to gather data and transmit early warning signs about upcoming disasters, and employ statistics and geospace scientists to analyse trends and create algorithms related to mitigation of catastrophic events. Funding for universities to conduct research on such events and community education would go a long way in avoidance of devastating events. Insurers should also include these risks in premium covers to sustain and improve their sustainability.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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