CLIMATE RISK COUNTRY PROFILE

MAURITIUS

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This profile is part of a series of Climate Risk Country Profiles developed by Climate Change Group of the World Bank Group (WBG). The country profiles aim to present a high-level assessment of the climate risks faced by countries, including rapid-onset events and slow-onset changes in climate conditions, many of which are already underway, as well as summarize relevant information on policy and planning efforts at the country level.

The country profile series are designed to be a reference source for development practitioners to better integrate detailed climate data, physical climate risks and need for resilience in development planning and policy making.

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Unless otherwise noted, data is sourced from the WBG's Climate Change Knowledge Portal (CCKP), the WBG's designated platform for climate data. Climate, climate change and climate-related data and information on CCKP represents the latest available data and analysis based on the latest Intergovernmental Panel on Climate Change (IPCC) reports and datasets. The team is grateful for all comments and suggestions received from climate and development specialists, as well as climate research scientists and institutions for their advice and guidance on the use of climate related datasets.

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FOREWORD

Development progress has stalled in many countries amid low growth, increased fragility and conflict, pandemic-related setbacks, and the impacts of climate change. Droughts, extreme heat, flooding and storms push millions into poverty annually, causing unemployment and risking unplanned internal and cross-border migration. Every year, an estimated 26 million people fall behind due to extreme weather events and natural disasters. These shocks have the potential to push a total of 130 million into poverty by 2030.

The World Bank Group (WBG) is supporting countries to meet these challenges. As part of our vision to end poverty on a livable planet, we are investing in development projects that improve quality of life while creating local jobs, strengthening education, and promoting economic stability. We are also helping people and communities adapt and prepare for the unpredictable and life-changing weather patterns they are experiencing, ensuring that limited development resources are used wisely and that the investments made today will be sustainable over time.

Having access to data that is accurate and easily understandable is of course critical to making informed decisions. This is where the report you are about to read comes in.

Climate Risk Country Profiles offer country-level overviews of physical climate risks across multiple spatiotemporal scales. Each profile feeds into the economy-wide Country Climate and Development Reports and draws its insights from the Climate Change Knowledge Portal, the WBG's 'one-stop-shop' for foundational climate data.

Guided by World Bank Group data and analytics, developing countries can conduct initial assessments of climate risks and opportunities that will inform upstream diagnostics, policy dialogue, and strategic planning. It is my sincere hope that this country profile will be used to inform adaptation and resilience efforts that create opportunities for people and communities around the world.

Valerie Hickey, PhD
Global Director
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KEY MESSAGES

The main climate change risks for Mauritius are sea level rise, tropical cyclones, storm surge, coastal flooding and flash floods, increased temperatures and extreme weather events, and prolonged droughts.

Historical trends in temperature: Over the past few decades, mean surface air temperatures have risen significantly, with a notably faster increase observed in the last three decades compared to earlier periods. Temperature increased at rate of 0.13°C per decade from 1971 to 2020, and at a rate of 0.38°C per decade from 1991 to 2020. This translates into more days with extreme maximum temperatures.

Projected trends in temperature: Mauritius's temperatures are projected to increase further into the future for all the scenarios. Under SSP3-7.0, the mean temperature nationwide increases from 23.78°C during the historical reference period of 1995–2014 to 24.78°C for the period 2040–2059. The projected average temperature increase is 0.22°C per decade from 2001 to 2050. Under the SSP3-7.0 scenario, the number of hot days (Tmax > 30°C) is projected to increase rapidly towards the end of the 21st century, reaching 53 days by 2080–2099. Mauritius experienced only about 6 tropical nights (Tmin > 26°C) per year during the historical period. This is projected to rise to 40 nights by mid-century (2040–2059). Hot and humid conditions will become significant towards the end of the 21st century, reaching one month of Heat Index > 35°C by 2080–2099.

Historical trends in precipitation: Precipitation consistently declined from 1950 to 2000, with a decrease of 31.21 mm per decade. However, since 2000, it has risen sharply, with an increasing trend of 86.65 mm per decade from 1990 to 2020, mainly due to the September to November season. While this significant change is noteworthy, it is likely attributed to decadal modes of natural variability rather than directly to climate change.

The maximum number of consecutive dry days per year has been increasing significantly and consistently since 1950, at a rate of roughly one additional day per decade. As a result, the longest dry spells, which lasted 10 days in the 1950s, extended to 17 days by 2020—an increase of 70%.

Projected trends in precipitation: In Mauritius, climate change is expected to cause a long-term decrease in the average annual precipitation levels, from 1054 mm during the historical period to 1023 mm for 2040–2059, but interannual variability and inter-model dispersion remains very high, so the annual trends are not significant. The seasonal trend differences suggest that most of the precipitation decrease occurs from November to January (the beginning of the rainy season), indicating a projected delay in the start of the rainy season, along with an increase in droughts during this period.

However, intense precipitation events will likely recur more frequently (e.g. the return period will decrease). Extreme precipitation events with return periods of 50, and 100 years are projected to occur more than twice as often by the end of the 21st century (2070–2099) under the SSP3-7.0 scenario, compared to historical values from 1985–2014.

Finally, Mauritius' marine ecosystems and coastal communities will be impacted by rising temperatures affecting coral reefs and fisheries, along with rising sea levels, which, combined with ongoing cyclones and more extreme precipitation events, will result in higher sea level surges and an increased risk of coastal inundation.

COUNTRY OVERVIEW

The Republic of Mauritius is in the Southwest Indian Ocean. The island of Mauritius (1865 km^2) is located approximately 800 km east of Madagascar and is part of the volcanic chain of Mascarene Islands (approx. 20°S, 57°E). Its outlying territories include Rodrigues Island (109 km^2), about 550 km to the east, the Cargados Carajos Shoals, 400 km to the northeast, the Agalega Islands, situated 930 km north of the main island, and the Chagos Archipelago 2200 km (far to the east).

Mauritius's capital is Port Louis. The island, volcanic in origin, is nearly encircled by coral reefs. The northern region is a flat plain that rises to a central plateau, with elevations ranging between 270 to 730 meters. The plateau is surrounded by small mountains, believed to be remnants of an ancient volcanic rim. The highest peak is Piton de la Petite Rivière Noire, standing at 828 meters in the southwest. The Grand River South East and Black River provide hydroelectric power, while Lake Vacoas serves as a key water reservoir[1] (**Fig. 1**).

FIGURE 1. Topography of Mauritius[2] (main island) and Rodrigues (second biggest island)[3]. The Island's Topography Plays a Crucial Role in Shaping Wind Patterns, Climate, and the Impacts of Sea Level Rise. Rainfall is Generally More Pronounced on the Side of the Mountains Facing the Wind.

[1] Britannica https://www.britannica.com/place/Mauritius, Wikipedia, and https://www.nairobiconvention.org/mauritius-country-profile
[2] Wikipedia https://de.m.wikipedia.org/wiki/Datei:Mauritius_Island_topographic_map-de.svg
[3] Wikipedia https://commons.wikimedia.org/wiki/File:Rodrigues_Island_topographic_map-de.svg

Mauritius has the highest population density in Africa and ranks among the highest globally (population was over 1.25 million people in 2023, according to the World Bank, 40,000 of these in Rodrigues). Mauritius is classified by the UN as a developing small island country, although it has recently become a High-Income Country (July 2020).

Approximately 25% of the total land area is under forestry cover, including about 2% of native forest areas. Over half of Mauritius' land area is arable, primarily used for sugarcane cultivation, which remains the country's main export crop. Although the significance of agriculture has declined with economic diversification, it continues to play an essential role. Other cash crops include tea and tobacco, while subsistence crops like potatoes, tomatoes, and bananas are also grown. Livestock mainly consists of poultry, sheep, goats, pigs, and cattle.

Mauritius' surrounding waters are home to a variety of commercially valuable fish species, including tuna, snapper, and grouper. Aquaculture is also practiced, cultivating species like channel bass and sea bream.

Today, Mauritius boasts a relatively diversified economy, with key sectors including tourism, manufacturing, fisheries, information and communication technology (ICT), and financial services[4].

The main climate change risks for Mauritius are sea level rise, tropical cyclones, storm surge, coastal flooding and flash floods, increased temperatures and extreme weather events, and prolonged droughts. In addition to the impacts of climate change, Mauritius faces significant environmental challenges such as water pollution, deforestation, coral reef degradation, and overfishing. EM-DAT[5] shows storms as the more relevant natural hazards. Think Hazard[6] shows landslides and cyclones as the riskiest natural hazards, followed by coastal flood, tsunami, and extreme heat, most of which are expected to worsen due to climate change.

According to the updated Nationally Determined Contribution of the Republic of Mauritius (2021)[7], Mauritius faces significant climate-related vulnerabilities, exacerbated by rapid urbanization and unplanned infrastructure development. These include increased precipitation variability, rising temperatures, more intense cyclones, and risks from flash floods, landslides, and sea level rise. Coral reefs, essential for biodiversity and coastal protection, are at risk from rising sea surface temperatures, sedimentation, and algal blooms. Landslides, driven by intense rainfall and poor land-use practices, are increasing in frequency, threatening homes and infrastructure in hilly areas. The effects of climate change may lead to a water crisis, reduced agricultural productivity, and loss of biodiversity. Additionally, vector-borne diseases could increase, affecting public health. Rising sea levels and extreme weather events also threaten tourism and infrastructure, with long-term economic repercussions. Urgent adaptation measures, including improvements in infrastructure, flood management, and water conservation, are essential to mitigate these risks and build resilience against climate change impacts.

CLIMATE OVERVIEW

Data overview: Historically, observed data is derived from the Climatic Research Unit, University of East Anglia (CRU), CRU TS version 4.08 gridded dataset (data available 1901–2023). The CRU dataset relies on stations data.

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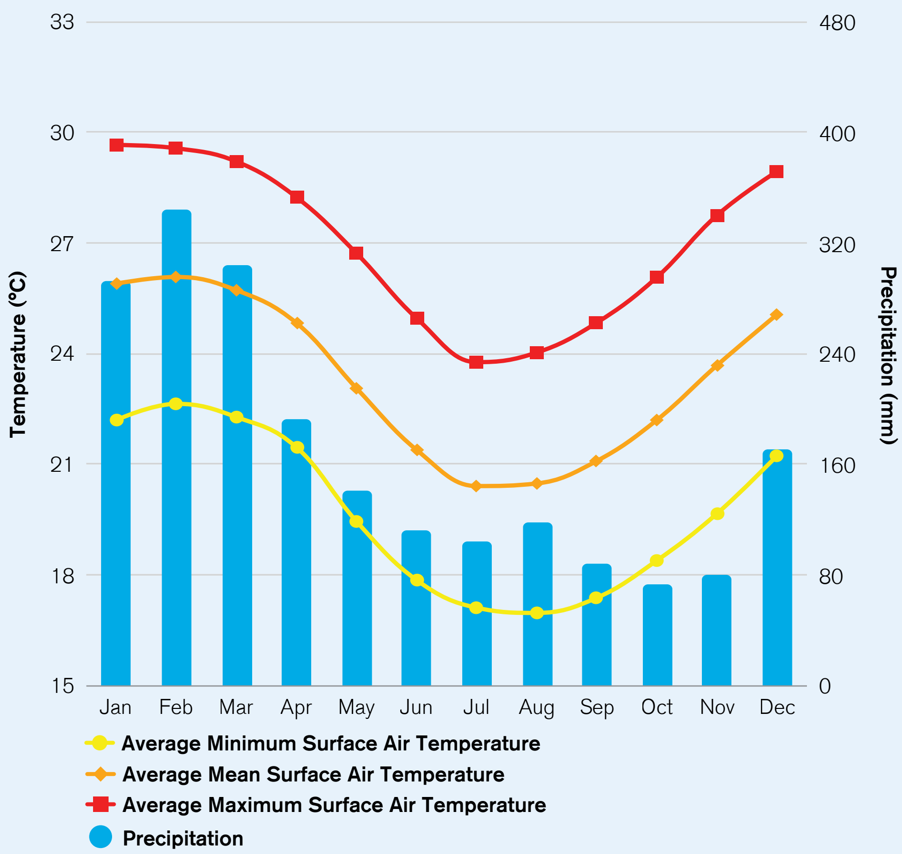
[4] World Bank Development Data
[5] The International Disaster Database https://www.emdat.be/
[6] Think Hazard https://thinkhazard.org/en/report/160-mauritius
[7] NDC Registry https://unfccc.int/NDCREG

Mauritius enjoys a mild tropical maritime climate, classified as tropical rainforest under the Köppen-Geiger system. Its location near the Tropic of Capricorn ensures two distinct seasons: a humid summer from November to April and a mild winter from June to September (**Fig. 2**). The months of May and October are commonly known as transitional months. The mean temperature over Mauritius is around 25°C during summer and 21.0°C during winter. The temperature difference between the two seasons is relatively small. January and February are the warmest months, with January averaging 25.9°C (high of 29.7°C and low of 22.2°C for the period 1991–2020). The coolest months are July and August, with July averaging 20.4°C (high of 23.8°C and low of 17.1°C). On average, rainfall varies from a low of 72.5 mm in October to a peak of 343.7 mm in February. The cyclone season in Mauritius runs from November to mid-May, with tropical cyclones primarily occurring between January and March. These storms usually disrupt weather patterns for about three days, accompanied by heavy rainfall.

FIGURE 2. Monthly Historical Climatology of Average Temperature (minimum, average, and maximum) and Total Precipitation (1991–2020) for the Entire Mauritius Archipelago (CRU dataset)

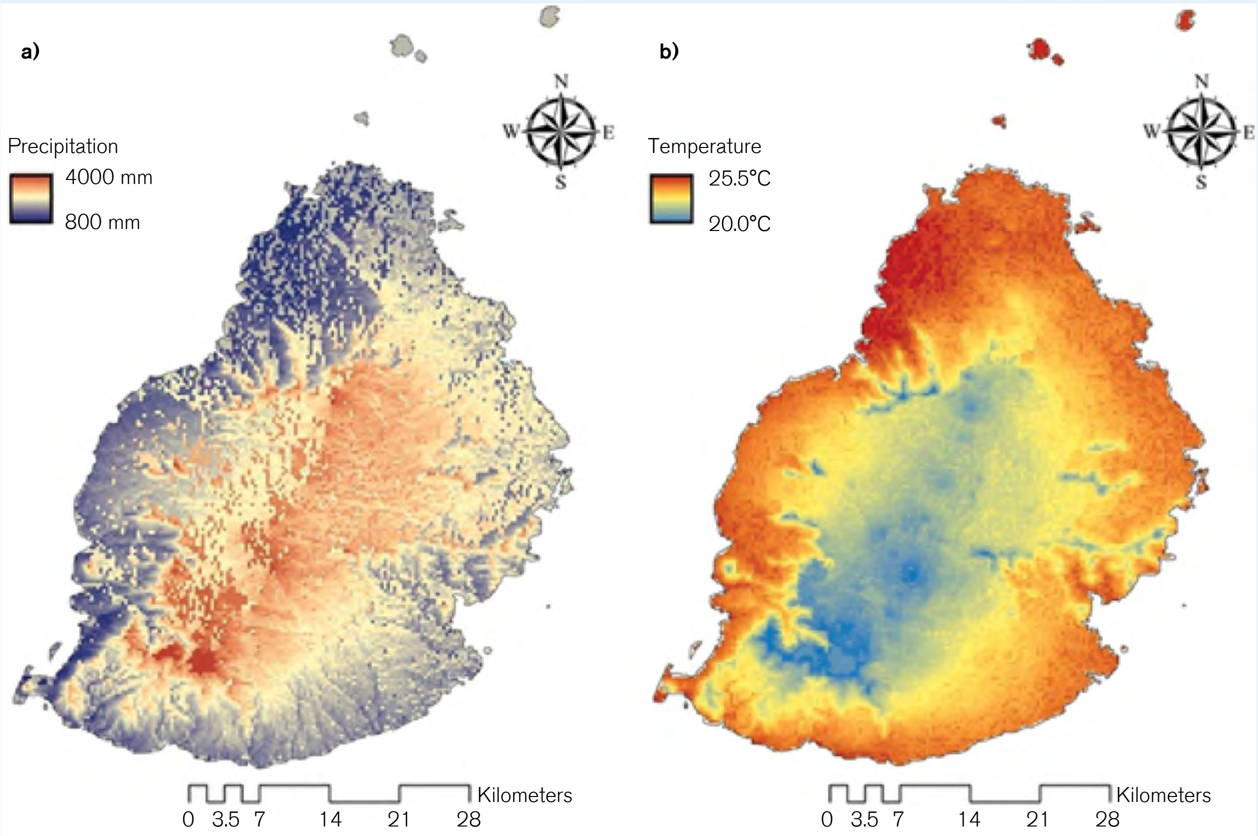


Temperatures and rainfall vary significantly across the main island of Mauritius due to its mountainous terrain and prevailing easterly winds year-round (from the east)[8]. On the plateau and in the mountains, temperatures can be up to 5°C cooler, and rainfall is typically more than double that of sea-level areas. However, CRU data doesn't fully

[8] Weather Spark https://weatherspark.com/y/150261/Average-Weather-in-Mauritius-Year-Round?

capture these variations due to its lower precision. See below (**Fig. 3**) the historical temperature and precipitation average historical levels. Rainfall is heaviest in the eastern part of the mountains, which faces the wind.

FIGURE 3. Distribution of Total Annual Mean Precipitation for the Years 1981–2020, and Annual Mean Temperature for the Years 1971–2020[9] for the Island of Mauritius



Mauritius is affected by several key modes of natural climate variability in the Indian Ocean, which shape its weather patterns, rainfall, temperatures, and cyclone activity. The global El Niño-Southern Oscillation (ENSO) most often leads to warmer-than-usual conditions, which can result in coral reef bleaching and other environmental impacts. The opposite is true during La Niña. Other modes of variability are the Indian Ocean Dipole (IOD) or the Indian Ocean Basin Mode (IOBM). Short-term variability is influenced by monsoon and cyclone systems and the Inter-Tropical Convergence Zone (ITCZ). The ITCZ moves north and south with the seasons, and when it is positioned closer to Mauritius (typically in the austral summer, between November and April), it brings heavy rainfall.

[9] Jay Rovisham Singh Doorga (2022). Climate change and the fate of small islands: The case of Mauritius. Environmental Science & Policy. Volume 136. 282–290. https://doi.org/10.1016/j.envsci.2022.06.012

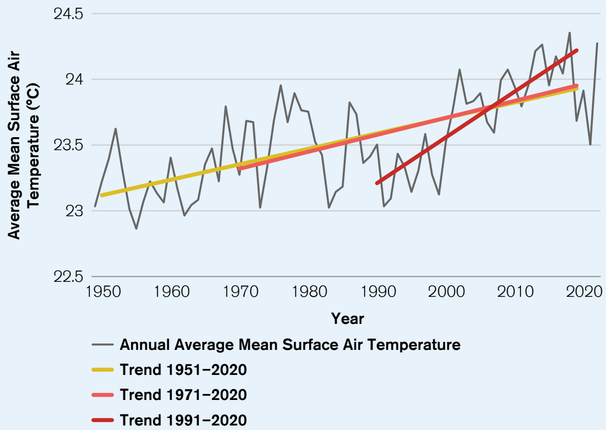
TEMPERATURE AND PRECIPITATION HISTORICAL AND PROJECTED TRENDS

Data overview: Historical observed data is derived from the ERA5 reanalysis collection from ECMWF (1950–2020). Modeled future climate data is derived from CMIP6, the Coupled Model Intercomparison Project, Phase 6. This risk profile focuses primarily on SSP3-7.0[10], which projects a doubling of CO_2 emissions by 2100, a global temperature change of approximately 2.1°C by mid-century (2040–2059) and 2.7°C (likely 2.1°C to 3.5°C) by the end of the century (2080–2099), with respect to pre-industrial conditions (1850–1900).

Historical Temperature Changes

Over the past few decades, mean air surface temperatures have risen significantly, with a notably faster increase observed in the last three decades compared to earlier periods (**Fig. 4**). The temperature trends are as follows: from 1951 to 2020, the trend is 0.12°C per decade; from 1971 to 2020, it increases to 0.13°C per decade; and from 1991 to 2020, the trend rises a lot to 0.38°C per decade (ERA5 dataset). The largest temperature increase has occurred during the dry and cold season, particularly from June to October, with a trend of 0.44°C per decade from 1991 to 2020. The average minimum temperatures are increasing at a similar rate, while the average maximum temperatures are rising slightly more slowly, at a rate of 0.34°C per decade from 1991 to 2020. This trend is also evident seasonally in the growing frequency of days with extreme maximum temperatures.

FIGURE 4. Historical Average Surface Air Temperature (1950–2023) and Linear Trends for Different Periods as Labelled, ERA5 Dataset



Projected Temperature Changes

Mauritius's temperatures are projected to increase further into the future for all the scenarios (**Fig. 5**). Under SSP3-7.0, the mean temperature nationwide increases from 23.78°C during the historical reference period of

[10] Climate scientists may prioritize SSP4.5 and SSP8.5 to cover a range of potential futures, but SSP8.5 is frequently avoided in policy discussions due to its extreme nature. SSP3-7.0 is understood as a balanced compromise—sufficiently pessimistic yet in line with current policies. Note that patterns of change are generally consistent across scenarios, differing only in timing and impact intensity. For example, impacts projected under SSP3-7.0 by 2070 (2.8°C warming) are projected to occur by 2060 under SSP5-8.5, given the same level of warming. This approach allows scenarios to be translated by focusing on the warming signal rather than specific timelines. Please see the attached tables, which illustrate the relationship between warming levels and future periods for different scenarios. For more information see: IPCC AR6 https://data.ceda.ac.uk/badc/ar6_wg1/data/spm/spm_08/v20210809/panel_a

1995–2014 to 24.29°C (24.02°C, 10th percentile, 24.66°C, 90th percentile) for the period 2020–2039, and to 24.78°C (24.51°C, 25.34°C) for the period 2040–2059. Minimum temperature nationwide increases from 22.20°C during the historical reference period to 22.71°C (22.43°C, 23.09°C) for the 2020–2039 period, and 23.21°C (22.92°C, 23.76°C) for 2040–2059. Maximum temperature increases from 25.36°C to 25.88°C (25.58°C, 26.23°C) for the 2020–2039 period, and 26.35°C (26.08°C, 26.92°C) for 2040–2059. Projected warming under SSP2-4.5 and SSP1-2.6 is lower, and under SSP5-8.5, higher (**Fig. 5a**).

FIGURE 5A. Projected Average Mean Surface Air Temperature for Different Climate Change Scenarios as Labeled

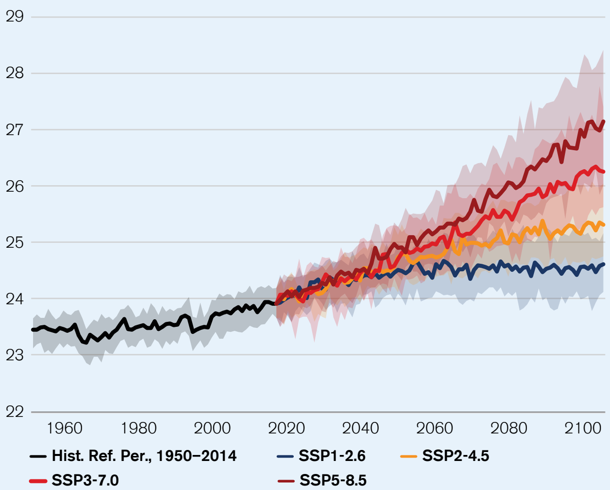
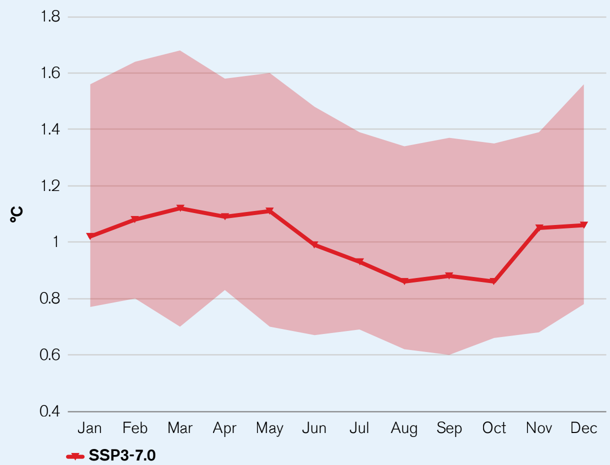


FIGURE 5B. The Projected Monthly Anomaly of the Average Mean Surface Air Temperature for 2040–2059 (relative to the reference period 1995–2014) Under SSP3-7.0, Along with the 10th–90th Percentile Dispersion Across Models



The projected average temperature increase is 0.22°C per decade from 2001 to 2050 and 0.33°C per decade from 2051 to 2100 under SSP3-7.0. The projected temperature increase is slightly larger in November to May (summer rainy season and fall transition season) compared to August to October (cooler drier season) but note the high uncertainty across models (**Fig. 5b**).

The minimum and maximum temperatures exhibit similar seasonal trends throughout the year.

Historical Precipitation Changes

Precipitation consistently declined from 1950 to 2000, with a decrease of 31.21 mm per decade (3% decrease per decade with respect to 1990–2020 reference period). However, since 2000, the precipitation trend in Mauritius shifted from a decreasing to an increasing pattern. Precipitation has risen sharply, with an increasing trend of 86.65 mm per decade (or 8.6%) from 1990 to 2020 (**Fig. 6a**). While this significant change is noteworthy, it is likely attributed to decadal modes of natural variability rather than directly to climate change.

FIGURE 6A. Historical Precipitation (1950–2022) and Linear Trends for Different Periods as Labelled, ERA5 Dataset

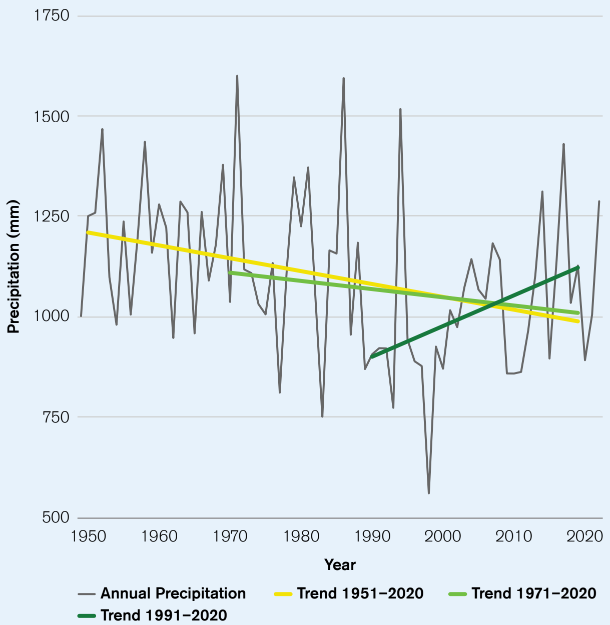


FIGURE 6B. Seasonal Variation in the Intensity of Precipitation Events During the Historical Period. ERA5 Dataset

Fig. 6b suggests an historical decline in the most extreme precipitation events during the typically drier winter months, particularly from May to July, and fewer changes during other seasons.

Projected Precipitation Changes

In Mauritius, climate change is expected to cause a long-term decrease in the average annual precipitation levels, mostly driven by changes from November to January as the region transitions from spring to the rainiest summer months, but interannual variability and inter-model dispersion remains very high, so the annual trends are not significant (e.g. trends do not emerge significantly above natural variability) (**Fig. 7**).

Under SSP3-7.0, Mauritius's average annual precipitation is predicted to change minimally nationwide the following decades: from 1054.00 mm (925.58 mm, 10th percentile, 1182.64 mm, 90th percentile) during the historical period (1995–2014, historical scenario) to 1044.12 mm (846.57 mm, 1319.07 mm) for 2020–2039, and to 1023.55 mm (792.56 mm, 1269.64 mm) for 2040–2059.

Figure 8 illustrates the percentage change in precipitation from the historical period (1995–2014) to mid-century (2040–2059) under the SSP3-7.0 scenario for the entire region during December, which is the month projected to experience the highest decrease. While the models don't show strong agreement on trends for individual pixels, distinct patterns emerge: an increase in precipitation to the north of the western Indian Ocean and a decrease to the south. Mauritius falls within the area of decreased precipitation from November to January.

FIGURE 7A. Projected Annual Precipitation for Different Climate Change Scenarios as Labeled

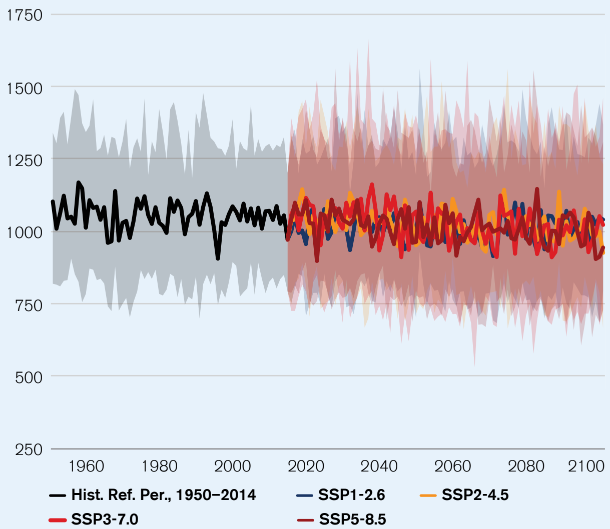


FIGURE 7B. The Projected Monthly Anomaly of Precipitation for 2040–2059 (relative to the reference period 1995–2014) Under SSP3-7.0, Along with the 10th–90th Percentile Dispersion Across Models

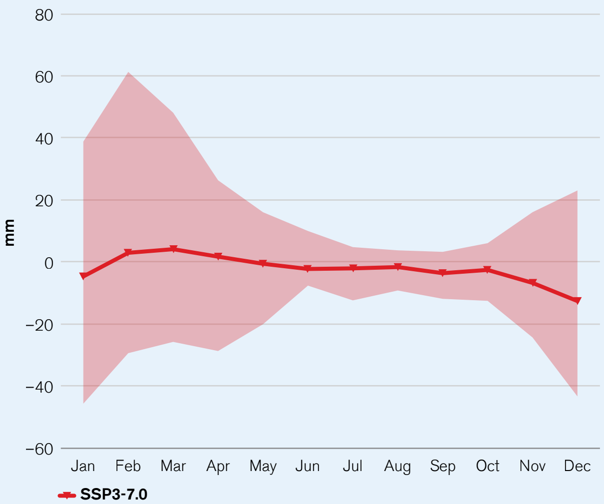
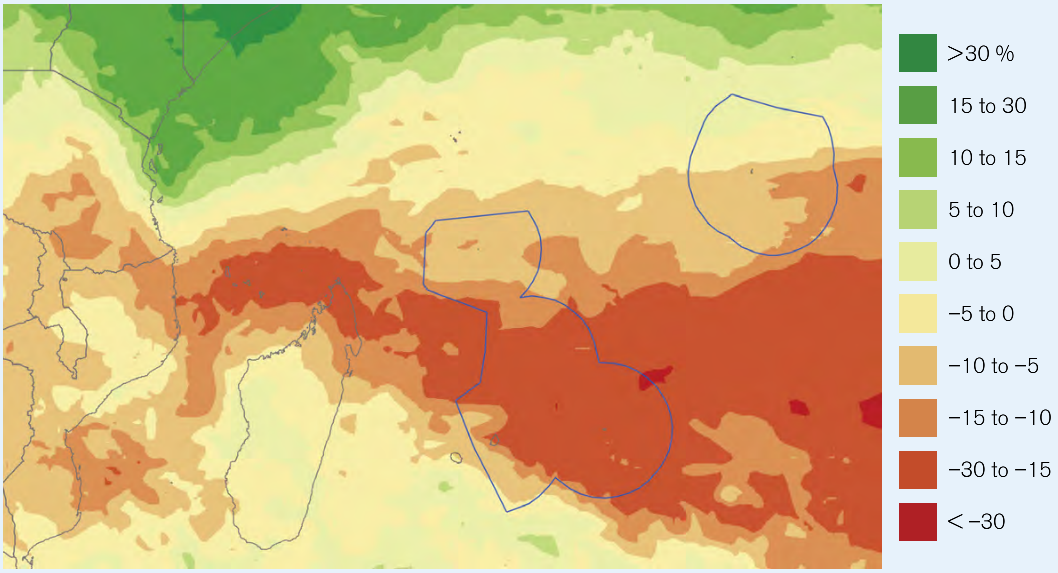


FIGURE 8. Projected Percent Change in December Precipitation for the Period 2040–2059 with Respect to the Historical Period (1995–2014) for SSP3-7.0. In Blue, the Exclusive Economic Zones (EEZ) of Mauritius (Mauritian EEZ to the west and Chagos EEZ to the east).



Hot Days

Hot days pose significant risks to both human and animal health, increasing the likelihood of heat-related illnesses, while also heightening the threat of wildfires, damaging crops, straining water supplies, increasing irrigation needs, and driving up energy demand, all of which can disrupt infrastructure, ecosystems, food security, and livelihoods.

During the historical period, roughly half of the year (about 190 days annually) was classified as summer (Tmax > 25°C). Due to climate change, summer-like temperatures will extend into the traditionally cooler winter months, adding two more months of summer by 2050 and potentially lasting nearly all year by the end of the century under high-emission scenarios.

The number of hot days (Tmax > 30°C) is projected to increase rapidly from 2060 due to increasing temperatures, reaching 53 days by the end of the 21st century under the SSP3-7.0 scenario. However, hotter temperatures above 35°C are not projected to be reached in Mauritius, even by the end of the century.

Higher temperatures mean higher demand for energy, which is captured by the variable cooling degree days - The cumulative number of degrees that the daily average temperature over a given period is above a specified threshold (here 65°F), which is a measurement designed to quantify the demand for energy needed to cool a building. This variable is projected to increase from 3577.5 (1995–2014) to 4229 (2040–2059), at a rate of 142 cooling degree days more per decade (2001–2050) under the SSP3-7.0 scenario.

Hot Nights

Hot nights pose risks to sleep quality, human health, and agricultural crops, as the lack of cooling during the night can exacerbate heat stress on plants, hindering growth and reducing yields, while also increasing the risk of heat-related illnesses, higher energy consumption, and greater strain on power grids.

The number of tropical nights (Tmin > 26°C) in Mauritius is increasing rapidly. Historically, Mauritius experienced only about 6 tropical nights per year. Under the SSP3-7.0 scenario, this is projected to rise to 19 nights annually by 2030 (2020–2039), 40 nights by mid-century (2040–2059), and 110 nights (nearly 4 months) by the end of the century (2080–2099). Similarly, tropical nights with a lower temperature threshold of 23°C (Tmin > 23°C) were about 150 days annually (roughly 5 months) during the historical period. This is expected to increase to 174 days by 2030 (5.7 months), 193 days by 2050 (6.3 months), and 246 days (8 months) by 2090. The linear trend from 2000 to 2050 indicates an increase of 9.9 tropical nights (Tmin > 23°C) per year per decade.

By 2050, low-threshold tropical nights (Tmin > 20°C) will occur year-round (**Fig. 9a**). Tropical nights with higher minimum temperatures (Tmin > 23°C) are projected to become common from December to May by 2040–2059 (**Fig. 9a)**. By 2080–2099 (**Fig. 9b**), these warmer nights will extend into typically cooler months, such as June and October. Additionally, by the end of the century, much of January through March is expected to experience even hotter tropical nights, with minimum temperatures exceeding 26°C.

FIGURE 9A. Projected Seasonal Cycle of the Number of Tropical Nights, Tmin Exceeding 20°C, 23°C, 26°C, 29°C, for SSP3-7.0 by 2040–2059

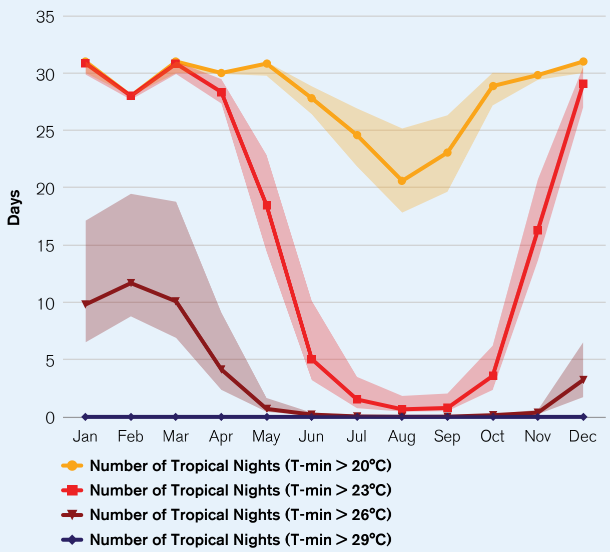
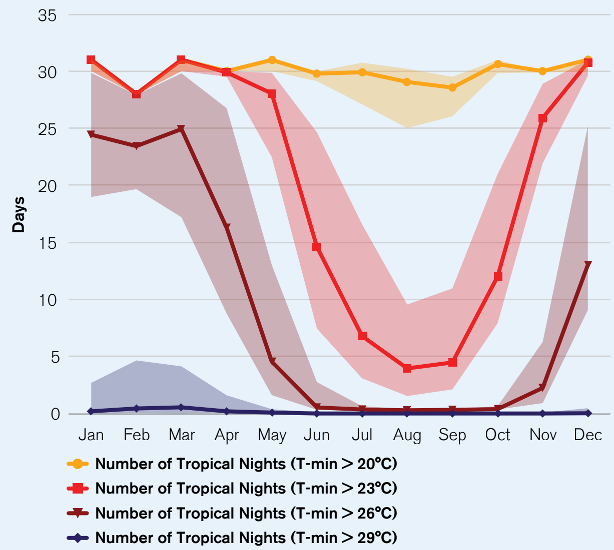


FIGURE 9B. Projected Seasonal Cycle of the Number of Tropical Nights, Tmin Exceeding 20°C, 23°C, 26°C, 29°C, for SSP3-7.0 by 2080–2099



Next, we examine the percentage of the population at high health risk due to hot nights. High-risk areas are locations where the 50-year return level[11] of the annual number of days with night temperatures exceeding 26°C is greater than 30[12]. Mid-term (2010 and 2059, central year 2035), the entire population will be exposed to dangerous levels of tropical nights (from 4.5% exposed during the historical period, 1975–2025).

Humid Heat

The Heat Index is a measure of perceived temperature that combines both air temperature and humidity in the shade[13]. When both are high, the Heat Index rises, significantly increasing the risk to human health. In such conditions, the body's ability to cool itself through sweating is impaired, which can lead to heat-related illnesses or even fatalities.

The number of days when the Heat Index reaches or exceeds 35°C is projected to become significant starting around 2060, particularly during the hot months of January to May. By mid-century (2040–2059), the number

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[11] A 50-year return level refers to an event that is expected to occur, on average, once every 50 years.

[12] Population dataset: Gridded Population of the World, Version 4: GPWv4; Revision 11, Dec 2018. For each pixel (at approximately 25 km resolution), the return level for a given return period is calculated by fitting a Generalized Extreme Value (GEV) distribution. A pixel is classified as "too risky" (1) if the return level exceeds the specified threshold, and "not too risky" (0) otherwise. The reported population exposure represents the percentage of the total population in each region that is exposed to risk.

[13] Heat Index as defined by US-National Weather Service - Steadman R.G., 1979: The assessment of sultriness, Part I: A temperature-humidity index based on human physiology and clothing science. J. Appl. Meteorol., 18, 861–873, doi: http://dx.doi.org/10.1175/1520-0450

of days with a Heat Index above 35°C is expected to be approximately 0.33 days per year (almost zero), but the number increases to 30 days by the end of the century (2080–2099) under the SSP3-7.0 scenario.

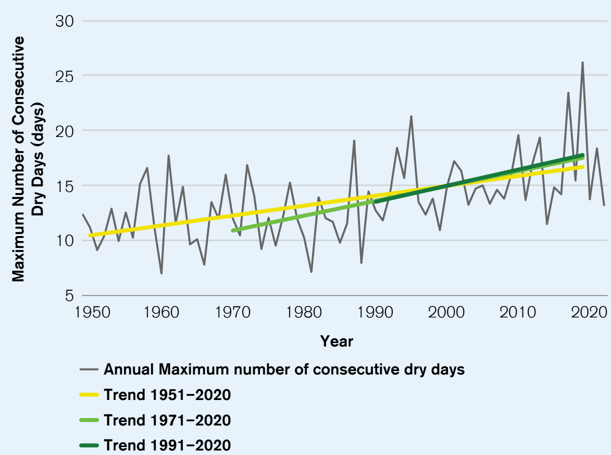
We next examine the percentage of the population at high health risk due to the heat index. High-risk areas are locations where the 50-year return level of the annual number of days with heat index exceeding 35°C is greater than 20—a threshold considered particularly dangerous for health. For Mauritius, this exposure goes from 0% during the period 1975–2025 (historical + SSP3-7.0) and between 2010 and 2059 (central year 2035) to 100% exposure between 2050 and 2099 (central year 2075), so all population are exposed to dangerous heat indices by the end of the century. Similarly, by the end of the century (2050–2099, central year 2075), 100% of the population is projected to be exposed to dangerous wet bulb temperatures under the SSP3-7.0 scenario, where the 50-year return level of the annual number of days with wet bulb temperatures exceeding 27°C is greater than 15. Wet bulb temperatures[14] also indicate extreme heat and humid conditions, which are particularly hazardous for outdoor workers.

Drought

Even though precipitation has experienced a sharp increase during the last 20 years, the maximum number of consecutive dry days per year[15] has been increasing significantly and consistently since 1950, at a rate of roughly one additional day per decade. As a result, the longest dry spells, which lasted 10 days in the 1950s, extended to 17 days by 2020—an increase of 70% (ERA5 data) (**Fig. 10**).

Between 1951 and 2020, the trend in the yearly maximum number of consecutive dry days shows an increase of 0.81 days per decade. This trend intensifies slightly when considering the period from 1971 to 2020, with an increase of 1.18 days per decade. More recently, from 1991 to 2020, the trend remains elevated at 1.05 days per decade, indicating a persistent rise in the duration of dry spells over the decades.

FIGURE 10. Yearly Maximum Number of Consecutive Dry Days for the Historical Period (1951–2020) and Linear Trends Over the Labeled Periods, ERA5 Dataset



In the future, the maximum number of consecutive dry days is not expected to change significantly due to climate change. However, extended periods of drought are likely to become slightly longer from September to December, during the transition from the dry season to the rainy season. This suggests a potential delay in the onset of the rainy season, which aligns with the projected decrease in precipitation during those months.

14 Wet Bulb Temperature formulation by Stull (2011) - Stull R., 2011: Wet-bulb temperature from relative humidity and air temperature. J. Appl. Meteorol. Climatol., 50(11), 2267–2269, doi: 10.1175/JAMC-D-11-0143-1

15 This statistic measures the maximum length of a dry spell, computed sequentially for the entire time series, then taking the maximum value during each year in the data period (a dry day is defined as any day in which the daily accumulated precipitation < 1 mm)

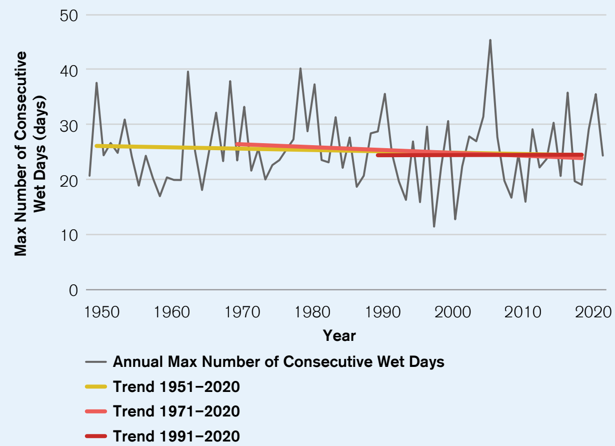
Extreme Precipitation

The yearly maximum number of consecutive wet days[16] has remained steady at an average of 25 days per year for the last 70 years, despite interannual variability ranging from 10 to 40 days annually (**Fig. 11**).

In the future, the maximum number of consecutive wet days is not expected to change significantly with climate change. However, there is a trend towards fewer consecutive wet days towards the end of the century, particularly from September to December, which agrees with a projected decrease in precipitation and extended drought periods during those months.

On the other hand, intense precipitation events are expected to become more frequent, with their return periods decreasing. This will likely increase the risk of flooding and pose significant threats to infrastructure, human safety, and agriculture. In Mauritius, extreme precipitation events with return periods of 50, and 100 years are projected to occur more than twice as often by the end of the 21st century (2070–2099) under the SSP3-7.0 scenario, compared to historical values from 1985–2014 (see **Table 1**). In Mauritius, a 100-year precipitation event equates to 242 mm of rain falling in a single day, an amount typically observed over 40 days during the rainiest January and February months.

FIGURE 11. Yearly Maximum Number of Consecutive Wet Days for the Historical Period (1951–2020) and Linear Trends Over the Labeled Periods, ERA5 Dataset



This trend aligns with the Clausius-Clapeyron equation, which states that in a warmer climate, the air's capacity to hold moisture increases exponentially, leading to a higher potential for heavier rainfall. However, the uncertainty in these projections remains high. As a result, the entire population will continue to be exposed to dangerous levels of extreme rainfall. High-risk areas are locations where the 25-year return level of the largest 5-day precipitation exceeds 130 mm.

Sea Surface Temperatures

Since the 1950s, the Indian Ocean and western boundary currents have experienced the most rapid surface warming. Additionally, there has been a noticeable trend of decreasing salinity in the Indian Ocean[17].

The West Indian Ocean maintains a warm average sea surface temperature of approximately 27°C. Sea surface temperatures typically range from around 26°C in August–September to approximately 28°C in April (historical, 1995–2014, multi-model CMIP6 average). The high temperatures in February and March are known to fuel

[16] This statistic measures the maximum length of a wet spell, computed sequentially for the entire time series, then taking the maximum value during each year in the data period (a wet day is defined as any day in which the daily accumulated precipitation ≥ 1 mm)

[17] IPCC AR6 WGI, Chapter 9: Ocean, Cryosphere, and Sea Level Change

TABLE 1. Future (2035–2064) and (2070–2099) Return Period (years) for Extreme Precipitation Events that Correspond to the Return Levels for the Largest Single-Day Event During the Historical Period (1985–2014) for SSP3-7.0. Change in Future Exceedance Probability Expressed as Change Factor for Extreme Precipitation Events that Correspond to the Return Levels for the Largest Single-Day Event During the Historical Period (1985–2014) for Future (2035–2064) and (2070–2099) SSP3-7.0.

Time Period	Historical Return Period (1985–2014, center 2000)					
1985–2014 center 2000	5-yr	10-yr	20-yr	25-yr	50-yr	100-yr
	Future Return Period (years) - Median (10th, 90th)					
2035–2064 center 2050	4.50 (3.37–5.93)	8.46 (5.99–11.30)	15.57 (10.22–21.45)	18.57 (11.79–26.36)	33.44 (17.77–50.67)	61.56 (28.52–101.48)
2070–2099 center 2085	4.11 (3.15–6.00)	7.34 (5.38–11.67)	12.86 (8.65–21.34)	14.89 (10.17–25.85)	25.10 (16.56–47.44)	44.63 (24.65–90.54)
	Fractional Change - SSP3-7.0 - Median (10th , 90th percentiles) - SSP3-7.0					
2035–2064 center 2050	1.11 (0.83–1.44)	1.18 (0.86–1.64)	1.29 (0.87–1.89)	1.35 (0.88–2.01)	1.50 (0.90–2.49)	1.64 (0.90–3.16)
2070–2099 center 2085	1.22 (0.75–1.47)	1.36 (0.81–1.77)	1.56 (0.85–2.14)	1.68 (0.86–2.24)	2.00 (0.91–2.82)	2.25 (0.96–3.69)

For example, a fractional change of 1.64 indicates a 64% increase in the probability of suffering 100-year extreme precipitation events in the future, or 1.64 more likely.

more intense cyclones. With climate change, the West Indian Ocean is already suffering more marine heatwaves, with fatal consequences for coral reefs and impacts and marine biota. Under the scenario SSP3-7.0, sea surface temperatures are projected to increase 1.2°C (0.9°C, 10th percentile, 1.4°C, 90th percentile) near-term (2021–2040), 1.7°C (1.4°C, 2.1°C) by mid-century (2041–2060), and 3.2°C (2.4°C, 3.9°C) long term (2081–2100), relative to the pre-industrial period (1850–1900)[18].

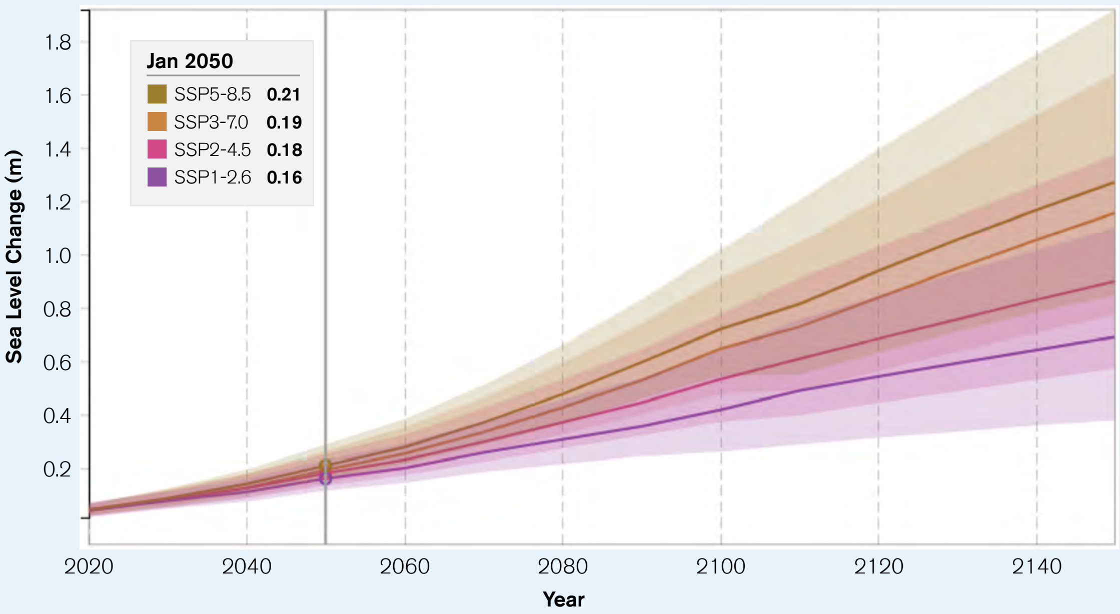
Sea Level Rise

Tide gauge measurements indicate an historical increase of 6.02 ± 1.39 mm per year in Port Louis (in the island of Mauritius) from 1993 to 2019[19]. According to altimetry (satellite) data, sea level rose 13 centimeters in total from 1993 to present in Port Louis[20]. Under the SSP3-7.0 scenario, sea level is expected to rise 15 centimeters from 2020 to 2050 in Port Louis, with a likely range from 12 to 20 centimeters, and is expected to rise 18cm (15 to 24cm) for the same period in Rodrigues Island. This means that by 2050, sea level rise in Port Louis, in the main island, is projected to reach 0.19 meters, and by 2100, it is expected to reach 0.84 meters, under the SSP3-7.0 scenario relative to the historical period (1995–2014) (**Fig. 12**)[21]. Over the next three decades,

[18] Data/plots from the IPCC Interactive Atlas WGI, https://interactive-atlas.ipcc.ch/regional-information
[19] NASA https://sealevel.nasa.gov/sea-level-evaluation-tool
[20] NASA https://earth.gov/sealevel/sea-level-explorer/
[21] NASA https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool?psmsl_id=477&data_layer=scenario, Port Louis, Mauritius, 1995–2014 baseline

sea level rise is expected to be roughly the same across all emission and warming scenarios. However, beyond that period, high-emission scenarios predict significantly higher sea level rise. Although there are still high uncertainties, it is certain that sea levels will continue to rise in all scenarios for centuries, driven by the long-term inertia of the oceans. This makes long-term planning essential.

FIGURE 12. Sea Level Rise Projected to 2150 for Different Scenarios in Port Louis, Mauritius[22]



Under the SSP3-7.0 scenario, there is a 92% chance of global sea level rise exceeding half a meter, and a 9% chance of surpassing 1 meter by 2100. This rise in sea levels will contribute to increased inundation. On average across the coastlines of Port Louis there were 0 days total exceeding the minor high-water level between 1980 and 1990 and between 2005 and 2015, but in 2050 under the SSP3-7.0 scenario, Port Louis will have up to 14 minor high-water days per year[23]. In Rodrigues Island, there were 13 days total exceeding the minor high-water level between 1980 and 1990, and 118 between 2005 and 2015. In 2050 under the SSP3-7.0 scenario, Rodrigues Island will have up to 80 minor high-water days per year. The minor high-water level is defined as 40 cm above the average high tide (mean higher high water, MHHW) and serves as an indicator of potential flooding impacts. The Chagos Archipelago, mostly comprised of atolls, is even more vulnerable to sea level rise.

Note that he human-induced influence on regional sea level changes is expected to become apparent first in areas with relatively low internal variability, such as the tropical Indian Ocean[24]. Extreme sea level surge events are projected to become significantly more frequent across much of the tropics.

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[22] NASA https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool?psmsl_id=477&data_layer=scenario, Port Louis, Mauritius, 1995–2014 baseline

[23] NASA https://earth.gov/sealevel

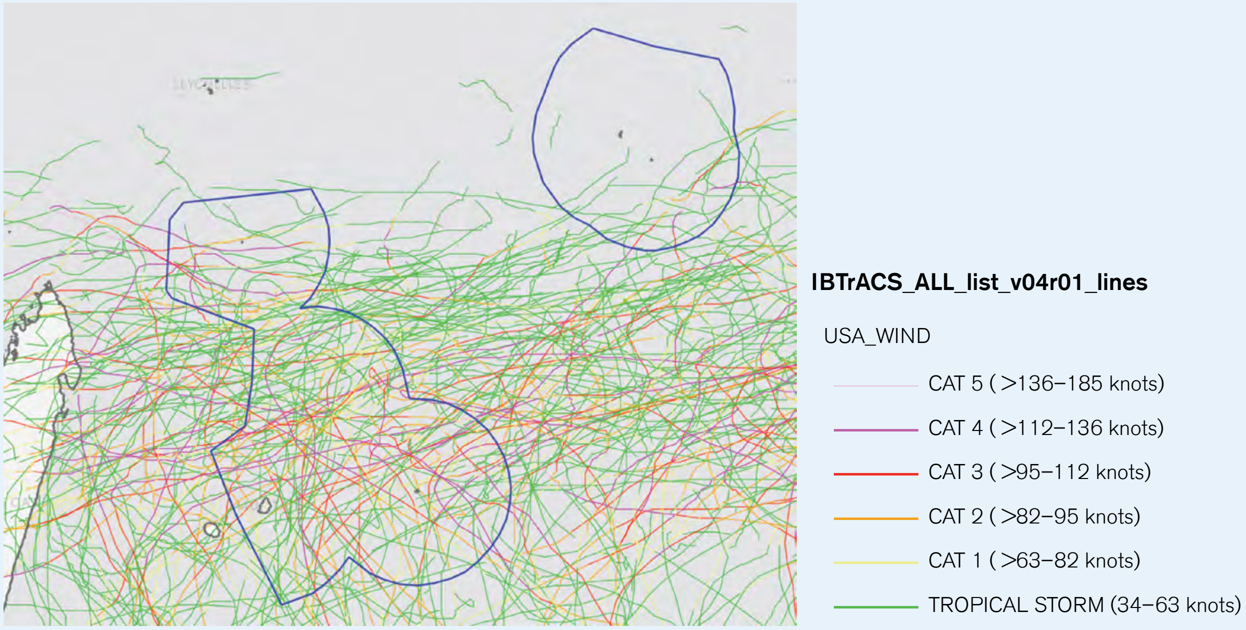
[24] IPCC AR6 WGI, Chapter 9, Ocean, Cryosphere and Sea Level Change

In the island of Mauritius, a sea level event with a 100-year return period, currently reaching between 1.73 and 1.94 meters, is expected to occur as often as once every 75–80 years by 2050 under the RCP4.5 scenario, with approximately 2°C of warming[25].

Tropical Cyclones

Mauritius lies within the core cyclone zone and is significantly affected during the cyclone season, which spans from October to May (**Fig. 13**). Cyclonic events often lead to severe coastal damage, destruction of infrastructure, loss of biodiversity, landslides, and the displacement of communities.

FIGURE 13. Observed Historical Cyclones from the International Best Track Archive for Climate Stewardship (IBTrACS)[26]. All Recorded Cyclones have been Classified According to the Saffir-Simpson[27] Scale Using the Variable "USA_wind", which Records Sustained Maximum Winds Every 3 Hours (in knots). The IBTrACS Historical Data Covers Cyclones Recorded from 1840 to the Present, with the Caveat that Records Prior to 1980 may be Incomplete. In Blue, the Exclusive Economic Zones of Mauritius (Mauritian EEZ to the west and Chagos EEZ to the east).



[25] Vousdoukas, M.I., Mentaschi, L., Voukouvalas, E. et al. Global probabilistic projections of extreme sea levels show intensification of coastal flood hazard. Nat Commun 9, 2360 (2018). https://doi.org/10.1038/s41467-018-04692-w

[26] International Best Track Archive for Climate Stewardship (IBTrACS) https://www.ncei.noaa.gov/products/international-best-track-archive

[27] We classify Tropical Cyclones using the Saffir-Simpson Hurricane Scale, which uses maximum sustained wind speed.
Tropical Storm (green): 34 to <64 knots (63 to <118.5 km/h)
Cat 1 (yellow): 64 to <83 knots (118.5 to <154 km/h)
Cat 2 (orange): 83 to <96 knots (154 to <178 km/h)
Cat 3 (red): 96 to <113 knots (178 to <209 km/h)
Cat 4 (pink): 113 to <137 knots (209 to <254 km/h)
Cat 5 (light pink): ≥137 knots (≥254 km/h)

Data overview: The occurrence of tropical cyclones in any specific location remains a rare event, making historical records too limited to reliably estimate recurrence intervals for these storms. This historical uncertainty can be partially addressed using models that simulate large ensembles of tropical cyclones. One such tool is the Columbia HAZard Model (CHAZ[28]), which generates an extensive synthetic catalog of potential cyclone tracks by simulating tropical cyclones across the oceans and their impacts upon landfall. This approach provides a more comprehensive perspective compared to observational data alone. The findings presented here rely exclusively on the CHAZ model, utilizing the column relative humidity (CRH) configuration to represent moisture. These simulations are informed by 12 different Global Circulation Models from the CMIP6 ensemble and project tropical cyclone activity during the historical period (1951–2014) and into the future under the SSP2-4.5 scenario, focusing on the period 2035–2064 (centered around 2050). We apply a footprint to the CHAZ tracks to capture the full extent of the cyclones. This is especially important for small islands to ensure that the cyclone's impact is not underestimated. The footprint is based on modeled horizontal wind profiles and latitude, using a dual-exponential decay function derived from 380 observed storms, as detailed by Willoughby et al. (2006)[29].

Tropical Cyclones are classified using the Saffir-Simpson Hurricane Scale, which is based on maximum sustained wind speeds (see **Fig. 13**). Historically, the frequency of tropical cyclones (maximum wind speeds above 34 knots) in the entire Mauritian Exclusive Economic Zone (EEZ) is 7.6 cyclones per year, corresponding to a return period of 0.13 years. The Chagos Archipelago EEZ, situated further from the cyclone belt, receives fewer cyclones, 2.1 cyclones per year, with a return period of 0.47 years. Of these, 1.6 cyclones per year make landfall into the islands, equivalent to a return period of about 0.63 years. Half of the cyclones that intersect with the Mauritian EEZ are tropical storms, 19.6% are Category 1 cyclones, and only 2.4% reach Category 5 intensity. At landfall, the proportion of lower-intensity cyclones increases, with tropical storms accounting for 68%, while the proportion of high-intensity cyclones, such as Category 5, decreases to below 1% (**Fig. 14 and Table 2**).

In this region, the CHAZ model does not project any significant changes in the frequency of tropical cyclones in the future.

The IPCC AR6 report[30] states that in a warming world, the average and maximum rainfall rates associated with tropical cyclones (TCs), extratropical cyclones, atmospheric rivers, and severe convective storms in some regions are projected to increase (high confidence). Peak rainfall rates from TCs are expected to rise with local warming, at least at the rate of mean water vapor increase over oceans (approximately 7% per 1°C of warming), and in some cases, may exceed this rate due to increased low-level moisture convergence driven by stronger TC winds (medium confidence). It is likely that the global proportion of Category 3–5 tropical cyclones has increased over the past four decades. As global warming intensifies, the proportion of intense TCs, average peak TC wind speeds, and the peak wind speeds of the most intense TCs will continue to rise (high confidence). However, the total global frequency of TC formation is expected to either decrease or remain unchanged with increasing global warming (medium confidence).

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[28] Lee, C.-Y., Tippett, M. K., Sobel, A. H., & Camargo, S. J. (2018). An environmentally forced tropical cyclone hazard model. *Journal of Advances in Modeling Earth Systems*, 10, 223–241. https://doi.org/10.1002/2017MS001186

[29] Willoughby, H. E., R. W. R. Darling, and M. E. Rahn, 2006: Parametric Representation of the Primary Hurricane Vortex. Part II: A New Family of Sectionally Continuous Profiles. *Mon. Wea. Rev.*, 134, 1102–1120, https://doi.org/10.1175/MWR3106.1.

[30] IPCC WGI Chapter 11: Weather and Climate Extreme Events in a Changing Climate

FIGURE 14. Simulated Percentage of Cyclone Types for Global Oceans, Indian Ocean, Mauritian Exclusive Economic Zone, Mauritius (landfalls), CHAZ, Historical (1951–2014)

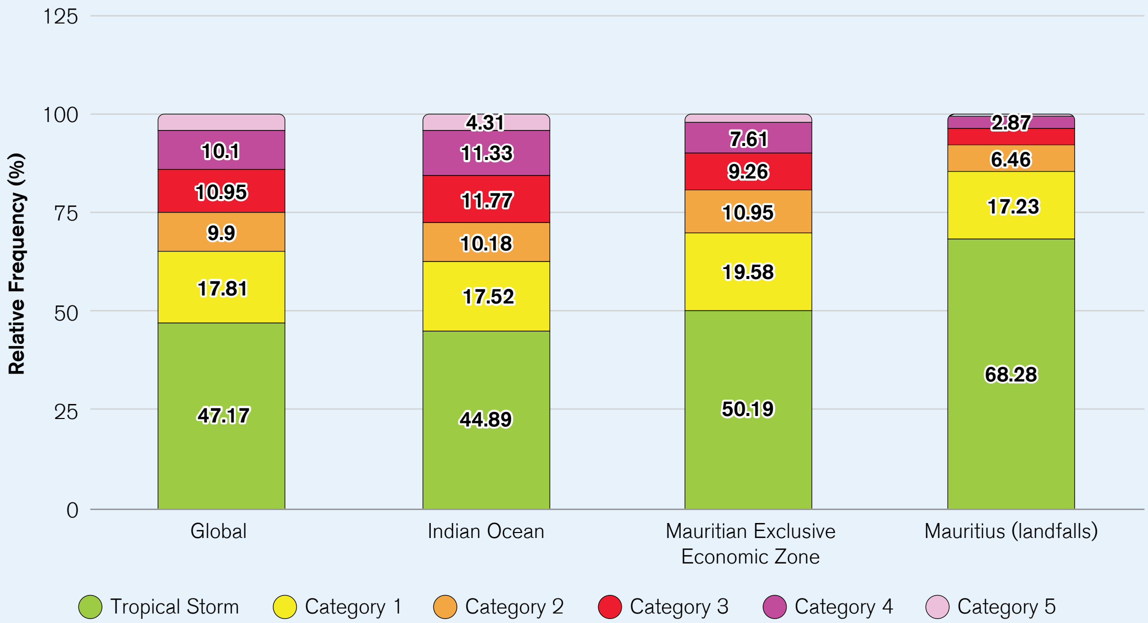

TABLE 2. Median Value (with 10th and 90th percentiles) of Counts of Cyclones per Year for Historical (1951–2014) and Projected Future Period (2035–2064, central year 2050) Along with the Fractional Changes for the Full EEZ Area and for Landfall (< 1 means a decrease in the frequency of storms, > 1 means an increase in the frequency of storms). Note that the Reported Median of Fractional Change is not Necessarily the Future Median Divided by the Historical Median Value. Values are Rounded to One Thousandths.

	Mauritian Exclusive Economic Zone			Mauritius (landfalls)		
	Historical Cyclone Count per Year	SSP2-4.5 Cyclone Count per Year	SSP2-4.5 Fractional Change	Historical Cyclone Count per Year	SSP2-4.5 Cyclone Count per Year	SSP2-4.5 Fractional Change
Category 5	0.184 (0.115, 0.220)	0.184 (0.108, 0.237)	1.040 (0.830, 1.250)	0.011 (0.007, 0.013)	0.011 (0.006, 0.014)	0.990 (0.750, 1.330)
Category 4	0.580 (0.395, 0.616)	0.576 (0.348, 0.631)	0.990 (0.820, 1.170)	0.045 (0.030, 0.052)	0.046 (0.026, 0.052)	0.970 (0.820, 1.160)
Category 3	0.706 (0.533, 0.762)	0.679 (0.467, 0.762)	0.960 (0.810, 1.090)	0.070 (0.050, 0.077)	0.071 (0.043, 0.077)	0.970 (0.840, 1.230)
Category 2	0.835 (0.710, 0.877)	0.772 (0.603, 0.893)	0.970 (0.840, 1.060)	0.102 (0.076, 0.104)	0.099 (0.066, 0.104)	0.940 (0.780, 1.120)
Category 1	1.493 (1.307, 1.605)	1.395 (1.253, 1.642)	0.940 (0.830, 1.070)	0.273 (0.230, 0.304)	0.278 (0.202, 0.299)	0.930 (0.820, 1.160)
Tropical Storm	3.826 (2.884, 3.978)	3.669 (3.115, 4.046)	1.000 (0.920, 1.090)	1.081 (1.024, 1.132)	1.072 (0.863, 1.139)	0.930 (0.860, 1.080)
Total	7.624 (5.945, 8.057)	7.275 (5.894, 8.211)	0.940 (0.890, 1.090)	1.583 (1.418, 1.680)	1.577 (1.207, 1.685)	0.930 (0.820, 1.100)

Caveat: The predictability of future tropical cyclones is accompanied by significant uncertainties due to several factors. These include discrepancies between climate models, the inherent complexity of processes integrated into Tropical Cyclone Models, and regional variations in cyclone formation, behavior, and dispersal. Furthermore, Tropical Cyclone Models are predominantly calibrated for current climate conditions, which could introduce additional biases when applied to future scenarios. In summary, the complex and often conflicting interactions among ocean temperatures, wind patterns, and atmospheric conditions that drive cyclone formation, movement, and landfall are still not fully understood, making it difficult to predict which trends will ultimately dominate. For further details on the current understanding of tropical cyclones and their frequency, refer to Sobel et al. (2021)[31].

Blue Economy Impacts

The main critical marine ecosystems in Mauritius are coral reefs, seagrass beds and mangrove forests. These provide multiple benefits to biodiversity, fisheries, blue carbon, and resilience to floods, and indirectly to tourism.

The IPCC AR6 WGII Chapter 15 on Small Islands[32] states that coral reefs are most at risk. "Scientific evidence has confirmed that globally and in small islands tropical corals are presently at high risk (high confidence). Severe coral bleaching, together with declines in coral abundance, has been observed in many small islands, especially those in the Pacific and Indian oceans (high confidence)."

By the period 2090–2099, marine animal biomass along Mauritius' coast is expected to increase (Tittensor et al., 2021[33]). Under the low emissions scenario RCP2.6 (+1.8°C), there is no projected change, while under the high-emissions scenario RCP8.5 (+4.4°C), the projected increase is about 12%, relative to levels observed during 1990–1999.

The historical maximum sustainable yield from 2012 to 2021 is 127 metric tons for the Mauritius entire Exclusive Economic Zone. By 2100, under the RCP8.5 scenario (with a projected warming of +4.5°C), the maximum sustainable yield is expected to increase by 41% compared to historical levels (Free et al., 2020[34]).

Temperate tuna species such as albacore are anticipated to decline in Mauritius and migrate poleward. Conversely, skipjack and yellowfin tunas are expected to increase in abundance within tropical areas (Erauskin-Extramiana et al., 2019)[35].

Trisos et al. (2020)[36] project that as climate change advances, the risks to biodiversity will intensify, potentially leading to a catastrophic loss of global biodiversity. Using temperature and precipitation projections from 1850 to

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31 Sobel, A. H., Wing, A. A., Camargo, S. J., Patricola, C. M., Vecchi, G. A., Lee, C.-Y., & Tippett, M. K. (2021). Tropical cyclone frequency. *Earth's Future*, 9, e2021EF002275. https://doi.org/10.1029/2021EF002275

32 Chapter 15 - Small Islands, IPCCWG2, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_Chapter15.pdf

33 Tittensor, D.P., Novaglio, C., Harrison, C.S. et al. Next-generation ensemble projections reveal higher climate risks for marine ecosystems. Nat. Clim. Chang. 11, 973–981 (2021). https://doi.org/10.1038/s41558-021-01173-9

34 Free CM, Mangin T, Molinos JG, Ojea E, Burden M, Costello C, et al. (2020) Realistic fisheries management reforms could mitigate the impacts of climate change in most countries. PLoS ONE 15(3): e0224347. https://doi.org/10.1371/journal.pone.0224347

35 Erauskin-Extramiana M, Arrizabalaga H, Hobday AJ, et al. Large-scale distribution of tuna species in a warming ocean. Glob Change Biol. 2019; 25: 2043–2060. https://doi.org/10.1111/gcb.14630

36 Trisos, C.H., Merow, C. & Pigot, A.L. The projected timing of abrupt ecological disruption from climate change. *Nature* 580, 496–501 (2020). https://doi.org/10.1038/s41586-020-2189-9

2100, they assess the exposure of over 30,000 marine and terrestrial species to hazardous climate conditions. The study predicts that climate change will abruptly disrupt ecological assemblages, as most species within any given assemblage will simultaneously face conditions beyond their niche limits. Under a high-emissions scenario (RCP 8.5), these abrupt exposure events are expected to begin before 2030, with tropical oceans, including Mauritius, being particularly affected.

Tropical small islands have particularly rich ecosystems. Protecting biodiversity is essential for adapting to climate change, among other reasons (e.g. Sala et al., 2021[37] or Zhao et al., 2020[38]).

Note that this summary provides a broad overview of external sources and is not an exhaustive list.

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[37] Sala, E., Mayorga, J., Bradley, D. *et al.* Protecting the global ocean for biodiversity, food and climate. *Nature* 592, 397–402 (2021). https://doi.org/10.1038/s41586-021-03371-z

[38] Zhao et al. (2020), Where Marine Protected Areas would best represent 30% of ocean biodiversity, Biological Conservation, Volume 244, 108536, https://doi.org/10.1016/j.biocon.2020.108536

CLIMATE RISK COUNTRY PROFILE

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