CLIMATE RISK COUNTRY PROFILE

TOGO

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ACKNOWLEDGEMENTS

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.

This effort is managed and led by MacKenzie Dove (Technical Lead, CCKP, WBG) and Pascal Saura (Task Team Lead, CCKP, WBG).

This profile was written by Anna Cabré Albós (Climate Change Consultant, CCKP, WBG).

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
Climate Change Group
World Bank Group

KEY MESSAGES

Temperature Increases:

Togo has experienced significant warming over recent decades, with surface air temperatures rising more rapidly in recent years—up to 0.34°C per decade since 1991. Nighttime temperatures (Tmin) have been increasing faster than daytime temperatures (Tmax), a trend that is projected to continue through mid-century.

- Observed trend (1971–2020): Tmin +0.28°C/decade, Tmax +0.19°C/decade.
- Projected trend (2000–2050, SSP3-7.0): Tmin +0.31°C/decade, Tmax +0.26°C/decade.
- Population exposure to hot days (Tmax > 35°C) is projected to rise from 49% historically to 83% by 2075. From 2000 to 2050, the annual number of hot days is projected to increase by 10 days per decade.
- Tropical nights (Tmin > 23°C) are projected to increase significantly—27 more per decade from 2000 to 2050. Population exposure to tropical nights is projected to rise to 73% of the population by 2075, up from 35% during the historical period.
- Population exposure to high heat index days (humid and hot conditions) was 67% in 2000 and is projected to reach 100% by 2075. The frequency of hot and humid days (Heat Index > 35°C) is expected to increase by 10 per decade from 2000 to 2050, accelerating to 29 more per decade after 2050.

Rainfall trends:

- Historically, spring rains have decreased, especially in the coastal Maritime region, with large year-to-year variability.
- Future projections show a modest increase in annual rainfall (+2.6% by 2050), mainly due to more rainfall in the fall (end of the rainy season), indicating an extension of the rainy season.
- However, rainfall will likely become more erratic, as reflected in the projected decline of the annual maximum number of consecutive wet days from 71 (historically) to 64 by 2050.

COUNTRY OVERVIEW

The Republic of Togo is in West Africa, along the Gulf of Guinea, between latitudes 6° to 11°N. The country shares borders with Ghana to the west, Benin to the east, Burkina Faso to the north, and its southern coastline of 56 kilometers (km), lies on the Gulf of Guinea. Togo's topography is diverse, stretching across 54,600 km². In the north, the land consists mainly of gently rolling savannah and hills. The central region features a broad plateau, while to the west, the Togo Mountains (including Mount Agou, the country's highest point) rise and run roughly southwest to northeast. These mountains are part of the Atakora range that extends into neighboring countries. The southern part of Togo descends into a flat coastal plain along the Gulf of Guinea, marked by lagoons, marshes, and low-lying sandy shores. This varied terrain contributes to the country's ecological and climatic diversity (**Figure 1**).

FIGURE 1A. Subnational Boundaries (World Bank cartography)

FIGURE 1B. Topography of Togo (in meters)[1]

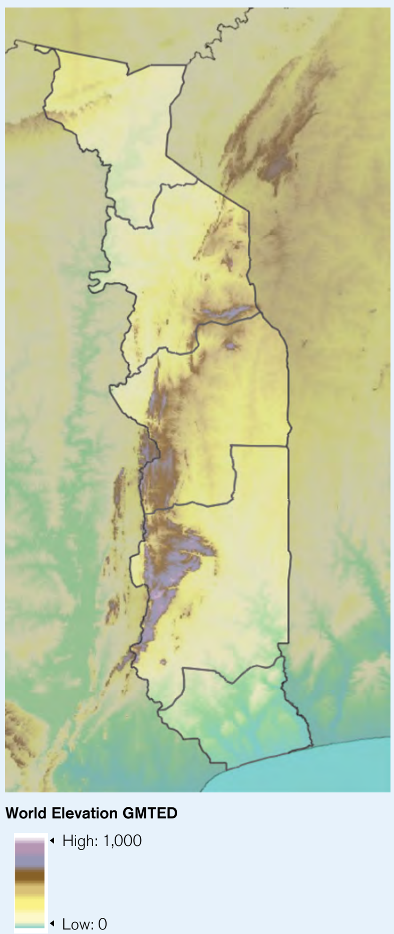
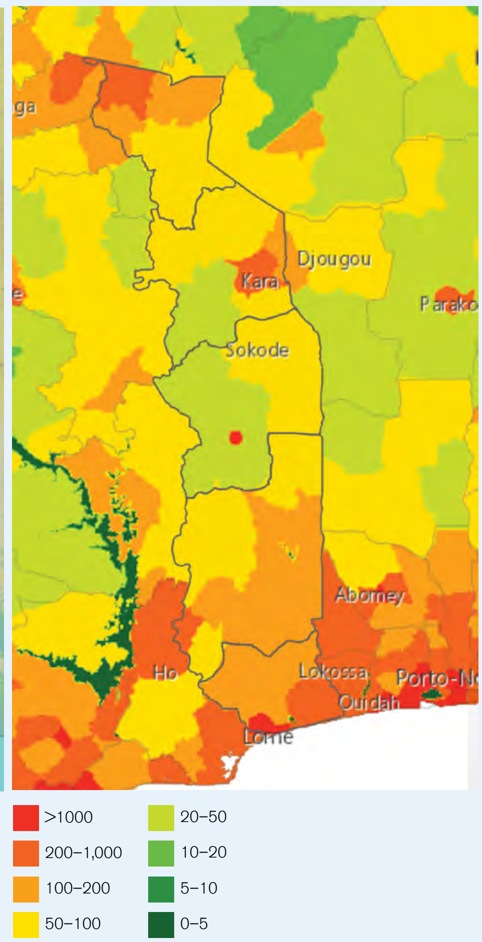


FIGURE 1C. Estimated Population Density (population per square km), 2020[2]



[1] Global Multi-resolution Terrain Elevation Data GMTED2010 https://pubs.usgs.gov/of/2011/1073/

[2] Mozambique: Estimated population density (2020) (2 May 2023) https://reliefweb.int/map/mozambique/mozambique-estimated-population-density-2020-2-may-2023

Togo is a low-income country. As of 2023[3], Togo has a population of 9.3 million people, with an annual growth rate of 2.3%. Only 59% of the population has access to electricity. Agriculture remains a cornerstone of the economy, employing 30% of the workforce. Additionally, 56% of the population lives in rural areas, where 69% of households are below the poverty line[4]. Togo's poverty levels, combined with its heavy dependence on rain-fed agriculture and livestock, significantly heighten the country's vulnerability to climate change. Poor households and rural communities often lack the financial resources, infrastructure, and institutional support needed to effectively anticipate, prepare for, and recover from climate-related shocks. This limited adaptive capacity increases their exposure to extreme weather events and climate variability.

Togo submitted its Nationally-Determined Contribution (NDC) to the UNFCCC in 2017[5], which outlines the country's efforts to promote sustainable economic development goals and strengthen the resilience of its production systems and to reduce population vulnerability to climate change and later submitted a revised NDC in 2021[6]. Togo also published its Third National Communication (NC3) to the UNFCCC in 2015[7]. The country has prioritized adaptation efforts in energy, water, agriculture, forestry, land use, human settlements, and coastal zones.

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) - stations data -, and from the ERA5 reanalysis collection from ECMWF (1950–2023).

Togo's climate is shaped by its location in the hot, humid inter-tropical zone and the seasonal movement of the Inter-Tropical Convergence Zone (ITCZ) around the equator. As the ITCZ shifts northward from May to October, it brings moist Atlantic air via the West African Monsoon, resulting in the rainy season. From November to March, the ITCZ moves south, and cooler, drier harmattan winds from the northeast dominate. Seasonal timing and intensity vary due to fluctuations in the ITCZ's position and monsoon strength. Global climate patterns, such as El Niño–Southern Oscillation (ENSO), also affect rainfall, typically reducing it during El Niño events.

Togo's hottest period is in March, with average temperatures around 30°C, ranging from an average minimum of 24°C to a maximum of 36°C. The coolest month is August, during the peak of the rainy season, when average temperatures drop to around 25°C, with a minimum of 21°C and a maximum of 29°C. However, the lowest minimum temperatures are typically observed during the dry season in December and January, dipping to around 20°C. During this period, there is also a larger diurnal temperature range, with more noticeable differences between

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3 World Bank Development Indicators

4 United Nations Development Programme https://climatepromise.undp.org/what-we-do/where-we-work/togo

5 Togo First National Determined Contribution https://unfccc.int/documents/497968

6 Revised National Determined Contribution https://unfccc.int/sites/default/files/NDC/2022-06/CDN%20Revisées_Togo_Document%20intérimaire_rv_11%2010%2021.pdf

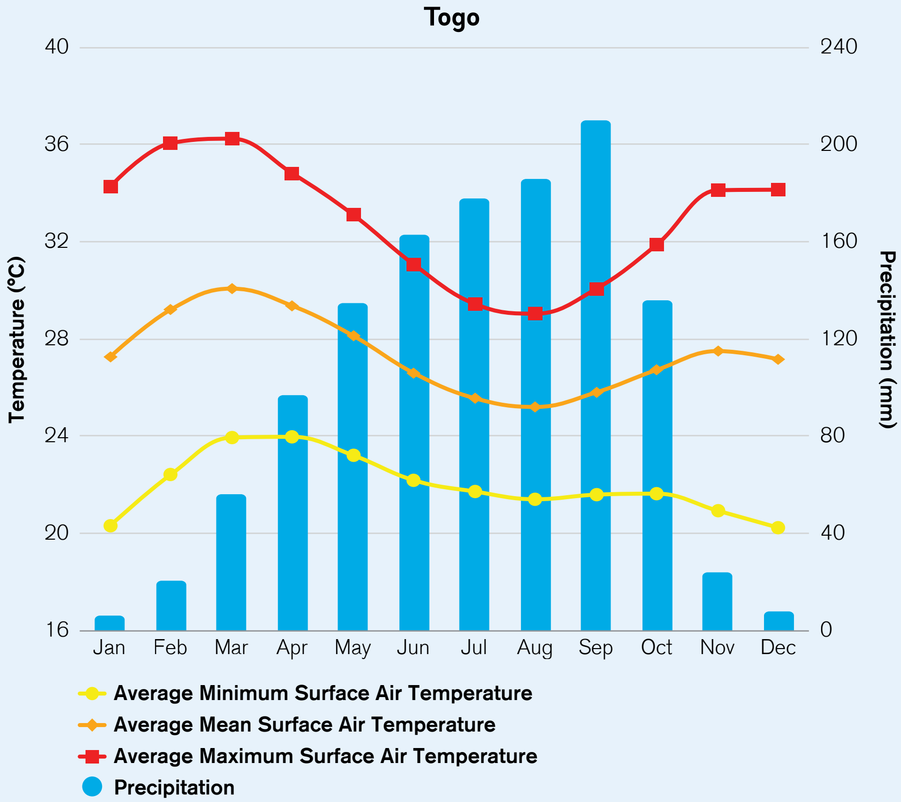
7 Third National Communication https://unfccc.int/sites/default/files/resource/tgonc3.pdf

day and night temperatures. The northern Savanes region records the highest average yearly temperatures at around 29°C, while the cooler central Centrale and Plateaux regions average about 27°C, largely due to their higher elevation. Looking at maximum average temperatures, there is a gradient from north to south, with Savanes reaching up to 35°C, decreasing steadily to about 31.5°C in the Maritime region. Nighttime minimum temperatures tend to be highest in both the coastal Maritime and northern Savanes regions, averaging approximately 23°C.

Togo's average annual precipitation varies slightly depending on the data source, with 1217 mm recorded by CRU and 1309 mm by ERA5. Rainfall peaks in September at around 210 mm, while the driest month is January, with just 6 mm (CRU) (**Fig. 2**). The central regions receive the highest annual rainfall, while the northern (Savanes) and southern (Maritime) regions receive less. The coastal Maritime region of Togo has a bimodal rainfall pattern with two rainy seasons—in June and October—caused by the northward and southward movement of the ITCZ, and separated by a dry spell in August (**Fig. 2**). Moving northward, this shifts to a single summer rainy season in the central and northern regions, as the ITCZ passes through these areas only once per year.

See **Tables A1 and A2** for historical temperature and precipitation values across regions.

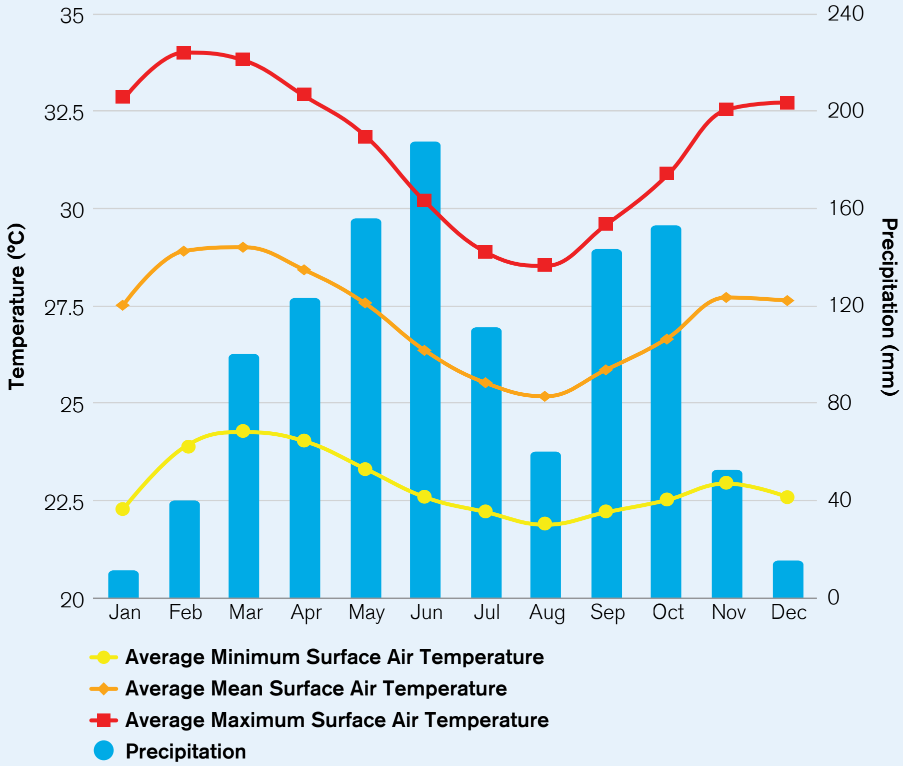
FIGURE 2. Monthly Historical Climatology of Average Temperature (minimum, average, and maximum) and Total Precipitation (1991–2023) for the Full Togo, and Subnational Maritime and Savanes (CRU dataset)



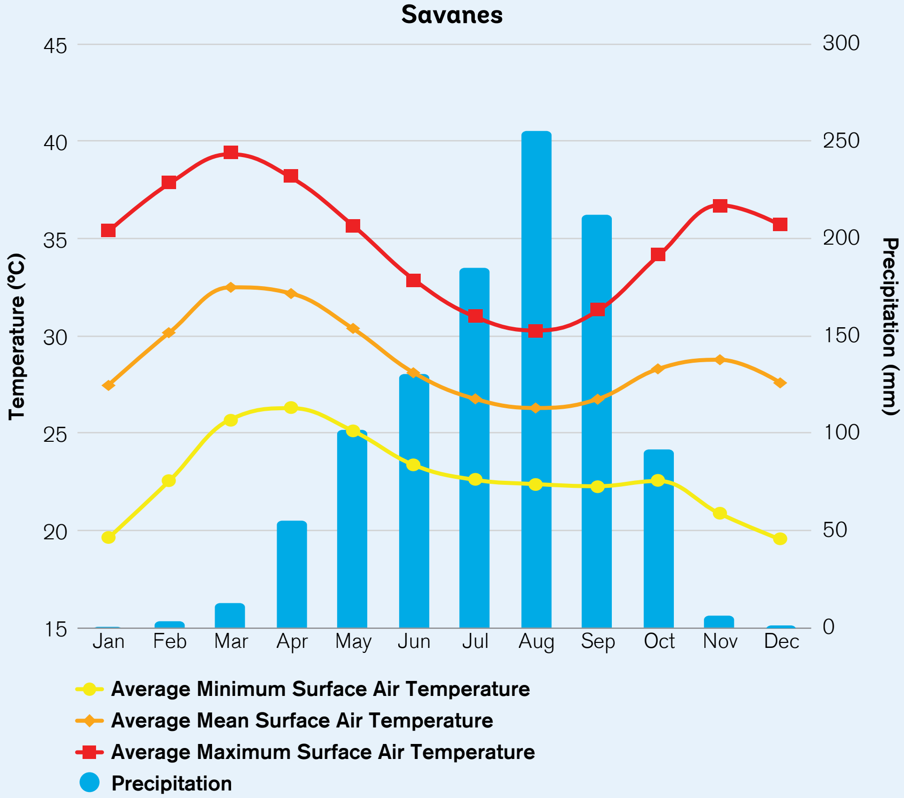
(continues)

FIGURE 2. Monthly Historical Climatology of Average Temperature (minimum, average, and maximum) and Total Precipitation (1991–2023) for the Full Togo, and Subnational Maritime and Savanes (CRU dataset) (*continued*)

Maritime



Savanes



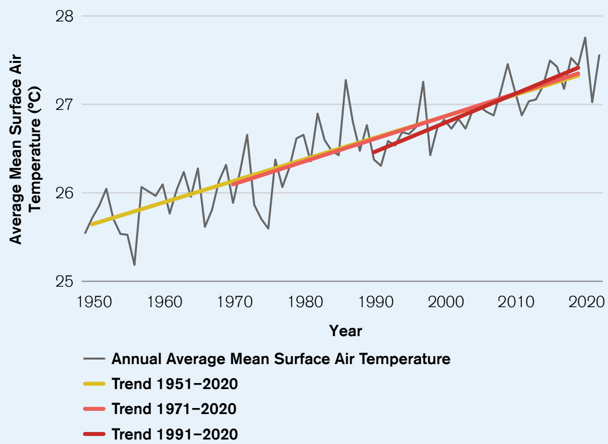
TEMPERATURE AND PRECIPITATION HISTORICAL AND PROJECTED TRENDS

Data overview: Historical observed data is derived from the ERA5 reanalysis collection from ECMWF (1950–2023). Modeled climate data is derived from CMIP6, the Coupled Model Intercomparison Project, Phase 6. This risk profile focuses primarily on SSP3-7.0[8], which projects a doubling of $CO2$ 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 surface air temperatures have increased significantly, with a trend of 0.24°C per decade from 1951 to 2020, 0.26°C per decade from 1971 to 2020, and a higher trend of 0.34°C per decade from 1991 to 2020 (ERA5, **Fig. 3**). From 1971 to 2020, the trend shows a higher increase in nighttime temperatures (Tmin) at 0.28°C per decade, compared to daytime temperatures (Tmax), which have risen by 0.19°C per decade over the same period (**Table A1**).

FIGURE 3. Togo's Annual Mean Surface Air Temperature Time Series and Decadal Trends for Different Periods between 1951 and 2020 as Indicated, ERA5 Data



The district Maritime experienced the largest 50-year temperature trend at 0.28°C per decade from 1971 to 2020. Maritime, Savanes, and Kara experienced the largest trend in minimum temperature, at 0.29°C per decade. The highest increase in maximum temperature was experienced in Maritime (at 0.28°C per decade) from 1971 to 2020 while the lowest increase was experienced in Savanes (0.13°C per decade).

Seasonally, the most significant temperature rise has been observed at the start of the rainy season, with an increase of 0.28°C per decade during spring (March to May). In contrast, the smallest increase, 0.25°C per decade, occurs during summer (June to August), which coincides with the peak of the rainy season. Maximum temperatures

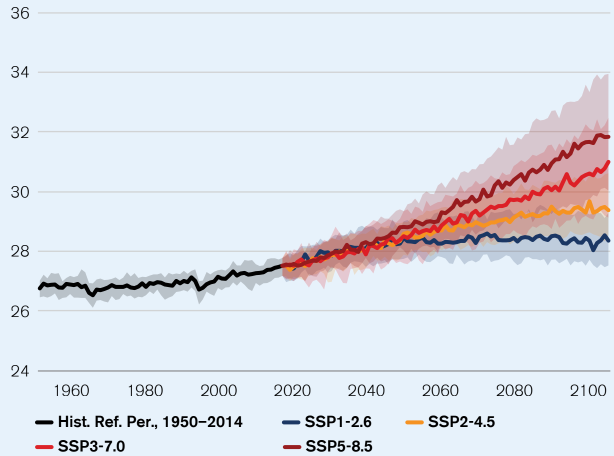
[8] Climate scientists may prioritize SSP4.5 and SSP8.5 to cover a range of potential futures, but SSP8.5 is frequently avoided in policy discussions due to its extreme nature. SSP3-7.0 is understood as a balanced compromise—sufficiently pessimistic yet in line with current policies. Note that patterns 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

have risen most during summer, at 0.2°C per decade, while minimum temperatures show the greatest increase in the fall (September to November), at 0.32°C per decade, toward the end of the rainy season.

Projected Temperature Changes

Togo's temperatures are projected to increase further into the future for all the scenarios (**Fig. 4**). Under SSP3-7.0, the mean air surface temperature nationwide increases from 27.23°C during the historical reference period of 1995–2014 to 28.63°C (10th percentile 27.70°C, 90th percentile 29.40°C) for the period 2040–2059, and to 30.32°C (28.78°C, 31.72°C) for the period 2080–2099. The minimum temperature nationwide increases from 22.55°C during the historical reference period to 24.05°C (23.25°C, 24.75°C) for 2040–2059 and 25.83°C (24.46°C, 27.12°C) for 2080–2099. Maximum temperature increases from 31.93°C to 33.19°C (32.05°C, 34.12°C) for 2040–2059 and 34.83°C (32.95°C, 36.49°C) for 2080–2099.

FIGURE 4. Projected Average Mean Surface Air Temperature for Different Climate Change Scenarios as Labeled, Along with the 10th–90th Percentile Dispersion Across Models



The projected temperature increase in Togo from 2000 to 2050 under the SSP3-7.0 scenario is 0.28°C per decade, slightly higher than the historical trend of 0.26°C per decade observed over the past 50 years. This warming rate is expected to accelerate further to 0.45°C per decade between 2050 and 2100 under the same scenario. As in the historical period, the trend is stronger for minimum temperatures (0.31°C per decade) than for maximum temperatures (0.26°C per decade). Regionally, the highest projected warming from 2000 to 2050 occurs in the northern Savanes region at 0.31°C per decade, with a gradual decrease moving southward, reaching the lowest rate in the Maritime region at 0.26°C per decade. This spatial distribution is primarily driven by trends in minimum temperatures. See **Table A3**.

Historical Precipitation Changes

From 1950 to 2023, historical annual precipitation in Togo ranged between 1000 and 1700 mm, showing significant interannual variability, with an average of 1309 mm from 1990 to 2020 (ERA5). The 50-year trend from 1971 to 2020 indicates a significant decrease of 38 mm per decade, or a 2.9% reduction in rainfall per decade (with respect to 1990–2020) (**Fig. 5**). However, this downward trend is not consistent across all periods, as no significant trends were found in the 30-year and 70-year analyses. Regionally, the 50-year decline is most pronounced in the Maritime region (4% decrease), while the Savanes region shows the smallest change (0.4% decrease) (**Table A2**). The most substantial seasonal decrease occurs in spring, suggesting a delay in the onset of the rainy season.

Projected Precipitation Changes

Total rainfall in Togo is expected to increase by mid-century (**Fig. 6**), contrary to the declining trend observed during the historical period. Under SSP3-7.0, Togo's average annual precipitation is predicted to change nationwide from 1365 mm (1,61 mm, 10th percentile, 1509 mm, 90th percentile) during the historical period (1995–2014, historical scenario) to 1385 mm (1155 mm, 1814 mm) for 2040–2059 and 1,373 mm (1057 mm, 1817 mm) for 2080–2099.

The median precipitation anomaly projected for 2040–2059 compared to 1995–2014 is 36 mm, reflecting a 2.6% increase with respect to the historical period (1995–2014), and 3.8% anomaly by 2080–2099. The percentage increase is highest in Savanes, with a 7.3% increase by 2040–2059, followed by Kara (3.3% increase), Central (2.4% increase), Maritime (2.3% increase), and Plateaux (1.2% increase) (**Table A5**). Importantly, this increase is primarily driven by changes in the fall (late rainy season) and early winter, indicating an extension of the rainy season. While rain is projected to keep increasing in Savanes, Kara and Centrale during the second half of the 21st century, it is projected to then decline in southern Plateaux and Maritime.

FIGURE 5. Togo's Annual Precipitation Time Series and Decadal Trends for Different Periods between 1951 and 2020 as Indicated, ERA5 Data

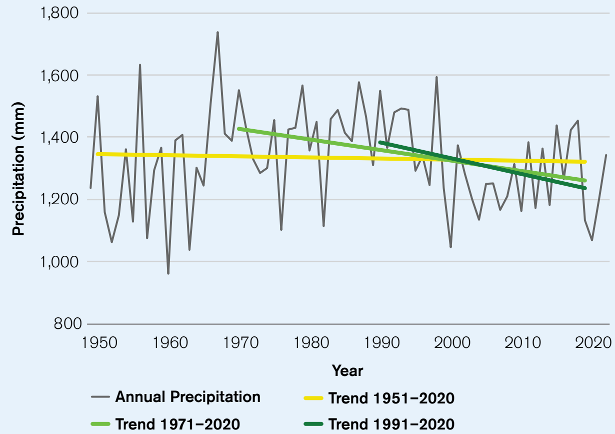
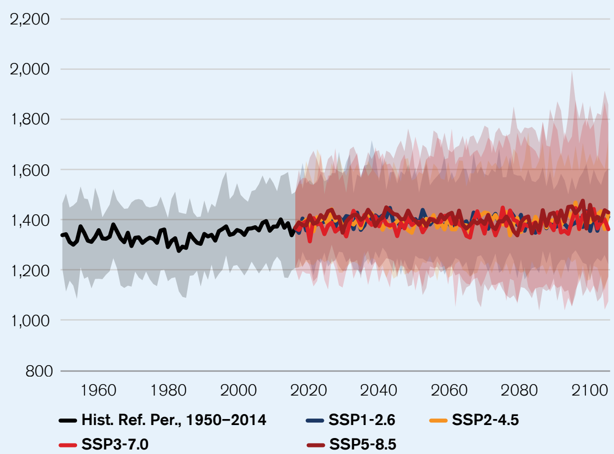


FIGURE 6. Projected Annual Precipitation for Different Climate Change Scenarios as Labeled, Along with the 10th–90th Percentile Dispersion Across Models



IMPACTS OF A CHANGING CLIMATE

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.

Future projections show a significant rise in the number of extremely hot days (Tmax > 35°C), driven by increasing temperatures (**Table A3**). During the historical period (1995–2014), Togo experienced an average of 57 hot days per year (46 to 65 days). Under the SSP3-7.0 scenario, this number is expected to increase to 105 hot days per year (47 to 149 days) by 2040–2059, which is equivalent to approximately 3.5 months. By the end of the century (2080–2099), the number of hot days could reach 174 (69 to 238 days), nearly 6 months per year. The greatest anomaly is expected during the dry season, from November to April. From 2000 to 2050, the number of hot days is projected to increase by 10 more days per decade, with the northern regions (Savanes, Kara, and Centrale) experiencing a higher rate of 12 more days per decade. The trend accelerates in the second half of the century (2050–2100), with an increase of 17 additional hot days per decade, impacting the southern regions more significantly.

Next, we examine the percentage of the population at high health risk due to extremely hot days. For the calculation of population exposure, high-risk areas are locations where the 50-year return level[9] of the annual number of days with maximum temperatures exceeding 35°C is greater than 30[10] (**Table A7**). As a result of rising extreme temperatures, the proportion of Togo's population exposed to high heat is projected to increase throughout the 21st century. Exposure is expected to rise from 49% during the historical period (1975–2024, centered on 2000) to 68% by 2035 (2010–2059), and could reach 83% by the century's end (2050–2099, centered on 2075).

Historically, the northern regions of Savanes and Kara have been exposed to dangerous heat levels, with exposure rates of 100%. Centrale has had 89% historical exposure, which is projected to rise to 100% by 2035. Plateaux's exposure will increase from 49% to 79% by 2035, reaching 100% by 2075. Although Maritime has not experienced extremely high temperatures historically, exposure is expected to rise to 24% by 2035 and 49% by 2075.

We also assessed population exposure at a higher temperature threshold. Areas with a 50-year return level of more than 20 days per year with Tmax > 40°C are considered high-risk. By 2035, 100% of the population in Savanes is projected to be exposed, up from 49% historically. Kara will see a significant rise in exposure, reaching 99% by 2075, up from 10% in 2035. Centrale and Plateaux will experience exposure only by 2075, with rates of 51% and 7%, respectively. Maritime will remain unexposed to this risk throughout the 21st century.

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.

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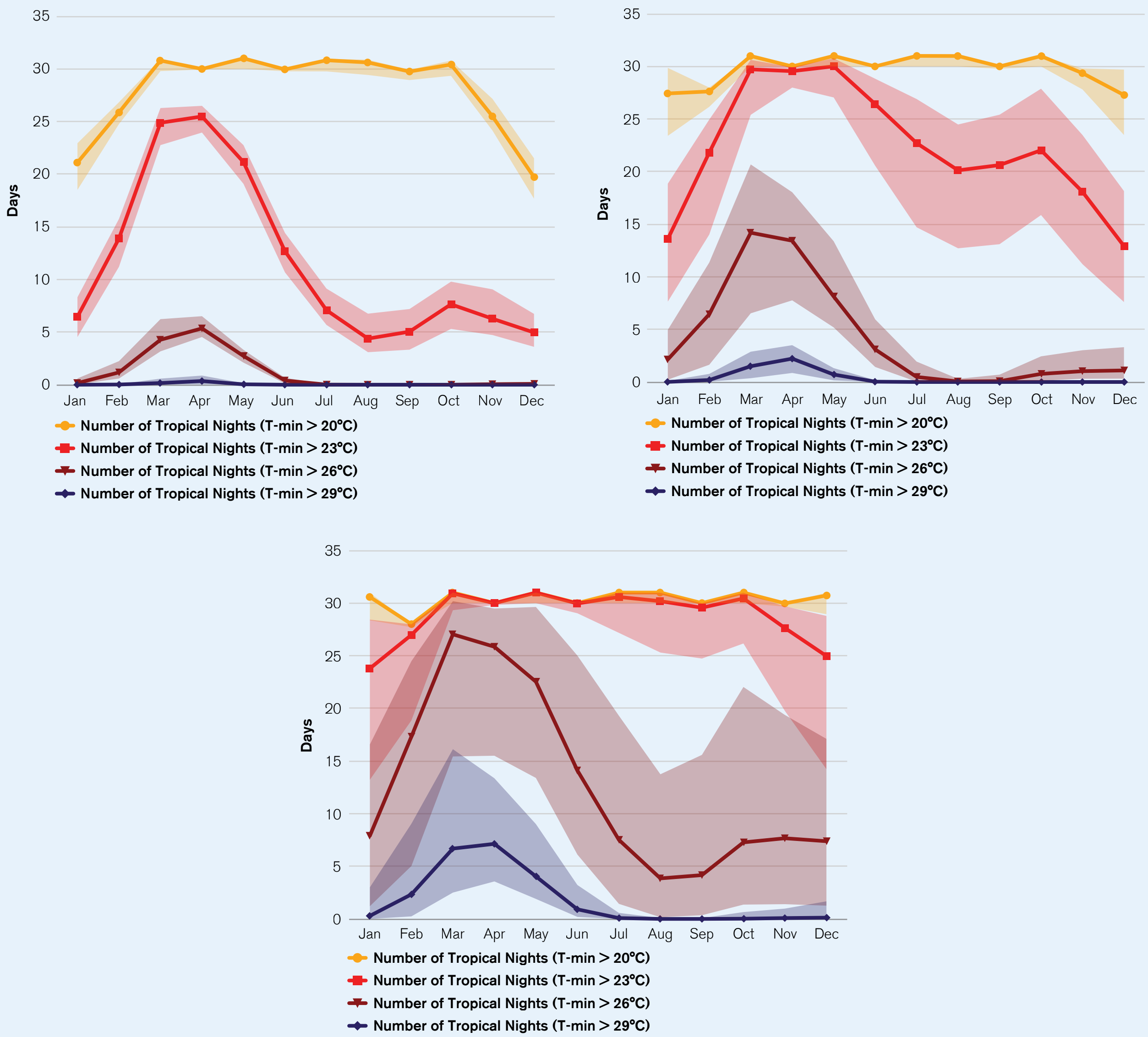
[9] A 50-year return level refers to an event that is expected to occur, on average, once every 50 years.

[10] 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 to the time series. 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 (1).

The number of hot (tropical) nights (Tmin > 23°C) is projected to rise significantly (**Table A4**). Historically (1995–2014), Togo experienced an average of 140 (118 to 163) tropical nights per year (4.5 months), reaching their peak in spring (**Fig. 7**). Between 2000 and 2050, the projection shows an increase of 27 additional tropical nights per decade, reaching 268 (198 to 310) tropical nights annually (almost 9 months) by 2040–2059 expanding into the other seasons. The trend will continue, leading to 346 (288 to 360) tropical nights annually (full year) by the end of the century (2080–2099). Plateaux and Centrale will experience the fastest increase in the annual number of nights with Tmin > 23°C, with a decadal rate of about 30 more nights per decade from 2000 to 2050. This will raise the number of such nights from 118 and 72, respectively, in the historical period to 278 and 212 by 2040–2059.

FIGURE 7. Seasonal Cycle of the Number of Nights Exceeding Selected Temperature Thresholds, Shown for Three Time Periods: Historical (1995–2014), Mid-Century (2040–2059), and End-of-Century (2080–2099)



The number of tropical nights exceeding the threshold of Tmin > 26°C is also projected to increase. Historically, Togo experienced an average of 14 tropical nights per year (11 to 20). This is expected to rise to 51 nights (24 to 86) by mid-century and 153 nights (63 to 262) by the end of the century, equivalent to about 5 months. The increase is projected to be 30 more tropical nights per decade between 2050 and 2100. By mid-century, Savanes will see 116 nights (almost 4 months) with Tmin > 26°C, up from 59 in the historical period, while Maritime will experience 102 nights (more than 3 months) compared to just 18 nights historically. The remaining regions will follow suit, with significant increases starting after 2050.

At the national level, population exposure to dangerous levels of tropical nights (Tmin > 26°C) is projected to rise from 36% during the historical period (centered at 2000) to 45% by 2035 and 73% by 2075 (**Table A8**). For the calculation of population exposure, high-risk areas are locations where the 50-year return level of the annual number of days with night temperatures > 26°C is greater than 30. Historically, only Savanes was fully exposed to hot night temperatures (Tmin > 26°C). Maritime had 78% exposure, which is projected to reach 100% by 2035. Kara had 20% exposure, expected to rise to 79% by 2035. Centrale and Plateaux had no exposure historically, but are projected to have 27% and 79% exposure, respectively, by 2035. By 2075, all regions are expected to be fully exposed. This dramatic increase in exposure will significantly raise risks to both health and agriculture.

At a higher threshold, where high-risk areas are defined as those with a 50-year return level of more than 20 days per year with night temperatures > 29°C, no exposure is expected at the national level historically. However, population exposure is projected to rise to 13% by 2035 and 55% by 2075. Savanes will be fully exposed by 2035 (98%), up from 4% exposure historically. The other regions will experience significant exposure by the end of the century, with projections of 75% exposure in Kara and Maritime by 2075, and 13% in Plateaux and 12% in Centrale.

Humid Heat

The Heat Index is a measure of perceived temperature that combines both air temperature and humidity in the shade[11]. 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.

During the historical period, Togo experienced only 13 days (7 to 21) with a Heat Index above 35°C. From 2000 to 2050, the trend shows an increase of 10 more days per decade, with the number of days projected to rise to 72 (26 to 121) by 2040–2059. High heat index values are most common in the spring, but also observed more occasionally during the fall. From 2051 to 2100, the trend is expected to accelerate, adding 29 additional days per decade. By 2081–2100, the total number of days with a Heat Index above 35°C could reach 191 per year (87 to 282), resulting in more than six months of extreme humid heat that was only occasionally experienced in the historical period (**Table A4**).

This risk is particularly severe in Maritime, where the number of days with a Heat Index above 35°C is projected to rise 22 more days per decade under the SSP3-7.0 scenario from 2000 to 2050 and at a higher rate of 33 more days per decade from 2050 to 2100. By 2080–2099, this region is expected to experience 263 days (almost 9 months) per year. In comparison, during the historical period (1995–2014), the region only used to experience 9 days per year with high humid heat.

[11] 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

Next, we examine the percentage of the population at high health risk due to increased humid heat. 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 (**Table A7**). Historically (2000), 67% of the population was exposed to a high heat index. By 2035, this exposure is projected to rise to 97%, and by 2075, it is expected to reach 100%. Historically, Savanes and Maritime are already fully exposed to this risk, while Kara is 48% exposed, Plateaux 43%, and Centrale 13%. By 2035, all the regions are fully exposed, except from Plateaux, 90% exposed.

Drought

Drought can disrupt crop growth, leading to failures and reduced yields, especially where irrigation is limited. This affects both agricultural productivity and the livelihoods of small farmers who depend on their crops for nutritious food.

The annual maximum number of consecutive dry days (<1 mm daily), or CDD, reflects the duration and severity of the dry season. Changes in CDD can signal either an extension or reduction of the dry season, as well as shifts in weather erraticity. Historically, the number of consecutive dry days has ranged between 30 and 70 days per year, with an average of 49 days annually from 1990 to 2020 (according to ERA5 data). Over the past 70 years (1951–2020), the duration of the dry season has not changed significantly (**Fig. 8a**). However, from 1971 to 2020 (50-year-long-period), the trend is of 1.24 more CDD per decade, but only significant at a 91% level. This drying trend is more evident in the southern provinces of Plateaux and Maritime, at a trend of 1.91 and 1.51 more annual CDD per decade, compared to the reference period (1991–2020) of 38 and 20 CDD, respectively (**Table A2**). This is consistent with the historical reduction in precipitation. In accordance, the maximum number of consecutive wet days (>1 mm daily), which has historically varied between 20 and 70 days per year, with an average of 37 days annually from 1990 to 2020, has followed an opposite trend (**Fig. 8b**). There has been a non-significant reduction of 1.38 fewer days of continuous wet spells at the national level, with a significant decline of 2.83 days per decade in Maritime (**Table A2**).

FIGURE 8A. Togo's Historical Annual Maximum Number of Consecutive Dry Days, Along with Decadal Trends for Various Periods between 1951 and 2020, Based on ERA5 Data

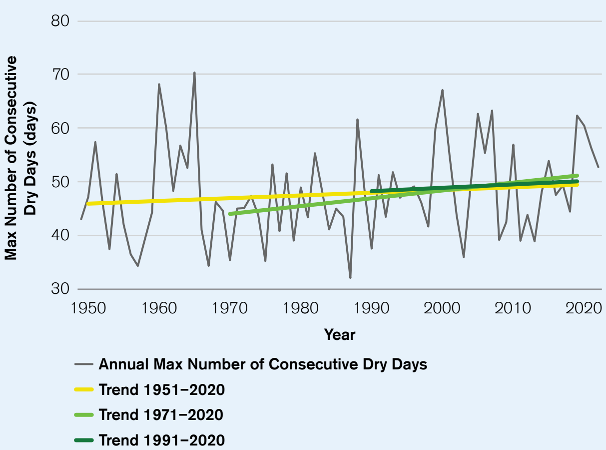
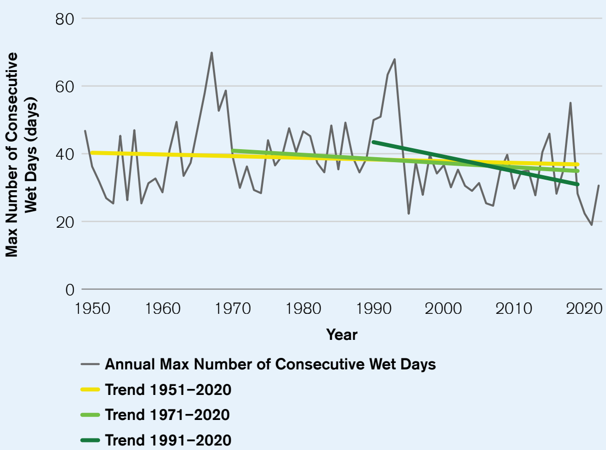


FIGURE 8B. Togo's Historical Annual Maximum Number of Consecutive Wet Days, Along with Decadal Trends for Various Periods between 1951 and 2020, Based on ERA5 Data



In the future, according to CMIP6, CDD is projected to reverse compared to the historical trend and decrease only slightly from 43 (36 to 49) CDD during the historical period (1995–2014) to 41 (31 to 52) by 2040–2059 and 40 (26 to 51) by 2080–2099 (**Table A6**), in accordance with the projected increased precipitation. The maximum number of consecutive wet days, which averaged 71 days (53 to 90) historically according to CMIP6 simulations—higher than ERA5 estimates—is projected to decline to 64 days (45 to 94) by 2040–2059 and 53 days (34 to 89) by 2080–2099. This represents a median decrease of 8.5 days by mid-century and 17 days by century's end, indicating increasing rainfall variability. The sharpest declines are projected in Centrale and Plateaux, with reductions of 13 and 11 days, respectively, by mid-century.

Extreme Precipitation

Intense precipitation events are expected to become more frequent, with their return periods decreasing. In a warmer world, the potential of air to carry moisture goes up, and thus the potential for heavier precipitation goes up. Intense precipitation events, characterized by the largest single-day event during the historical period, will likely recur more frequently (e.g. the return period will decrease, **Table 1**), which can negatively affect the flooding risk, and be dangerous for infrastructure, human safety, or agriculture. In Togo, recurrent flooding, flash floods and landslides will become more frequent due to intense rain. Extreme precipitation events with return periods of 100 years are projected to occur 2.31 times more frequently by mid-century (2035–2064) under the SSP3-7.0 scenario, compared to historical data from 1985–2014. This means that what was historically a 100-year event will occur approximately every 44 years by 2050. In Togo, a historical 100-year precipitation event corresponds to 105.9 mm of rain falling in a single day—an amount that, historically, has been observed on average during all the month of April.

Similarly, 50-year return events are projected to increase 2.16 times, 25-year events 1.98 times, and 10-year events 1.8 times by mid-century. However, there is significant uncertainty in these projections (**Table 1**). By the end of the 21st century, 100-year rare events are projected to occur 5.64 times more frequently, happening every 19 years instead of every 100 years. Similarly, 20-year, 25-year, and 50-year events are expected to occur at least three times as often—3.49, 3.76, and 4.63 times more frequently, respectively. This means rare precipitation events will become normal on a yearly basis.

As a result, the percentage of the population exposed to extreme rain goes from 35% during the historical period (2000) to 51% in 2035 and 56% in 2075 (**Table A8**). Risk areas for population exposure calculation are defined as locations where the 25-year return level of the annual largest 5-day precipitation exceeds 130 mm. Savanes, Kara, and Centrale, are the regions most affected, with historically exposures of 43%, 74%, and 85%, raising to 90%, 98%, and 93% by 2035.

Sea Surface Temperatures

The IPCC Western Africa region, which includes Togo's coastline, has historically experienced an average sea surface temperature of 28.1°C (ranging from 27.5°C to 28.8°C, p10 to p90) between 1995 and 2014

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
	Return Level (mm) - Median (10th, 90th)					
1985–2014 center 2000	61.37 (42.3–165.06)	72.18 (48.35–195.57)	82.75 (54.41–229.4)	86.04 (56.38–239.91)	96.03 (62.43–285.5)	105.9 (68.43–328.84)
	Future Return Period (years) - Median (10th, 90th)					
2035–2064 center 2050	3.03 (1.7–4.59)	5.57 (2.78–9.14)	10.41 (4.51–18.16)	12.71 (5.27–22.69)	23.33 (8.55–45.77)	43.86 (13.87–96.74)
2070–2099 center 2085	2.2 (1.06–3.71)	3.54 (1.58–6.96)	5.81 (2.33–13.43)	6.76 (2.63–16.67)	11.16 (3.85–32.32)	18.68 (5.34–61.89)
	Change in Future Annual Exceedance Probability (change factor) - Median (10th, 90th)					
2035–2064 center 2050	1.65 (0.98–2.79)	1.8 (0.98–3.4)	1.93 (0.96–4.16)	1.98 (0.96–4.45)	2.16 (0.94–5.5)	2.31 (0.92–6.81)
2070–2099 center 2085	2.28 (1.23–4.54)	2.84 (1.25–6.15)	3.49 (1.32–8.55)	3.76 (1.34–9.51)	4.63 (1.43–13.19)	5.64 (1.5–18.75)

Fractional change above 1 indicates increased probability and decreased return period. For example, a fractional change of 1.65 indicates a 65% increase in the probability of suffering 5-year extreme precipitation events in the future, or 1.65 more likely.

(CMIP6 models[12]). With climate change, the region is already experiencing more frequent marine heatwaves. Under the SSP3-7.0 scenario, sea surface temperatures are projected to increase by 0.5°C (with a range of 0.3°C at the 10th percentile to 0.8°C at the 90th percentile) in the near term (2021–2040), 1.1°C (0.9°C to 1.4°C) by mid-century (2041–2060), and 2.5°C (1.9°C to 3.1°C) by the end of the century (2081–2100), relative to recent historical averages (1995–2014), which are already higher than sea temperatures during pre-industrial conditions. This temperature increase is expected to be similar throughout the year.

Due to the inertia of the oceans, these temperature increases are unlikely to reverse anytime soon. A rise of more than 1°C is expected to have catastrophic consequences for fisheries, biodiversity, and coral reefs, which are especially vulnerable to even small increases in sea temperature.

Sea Level Rise

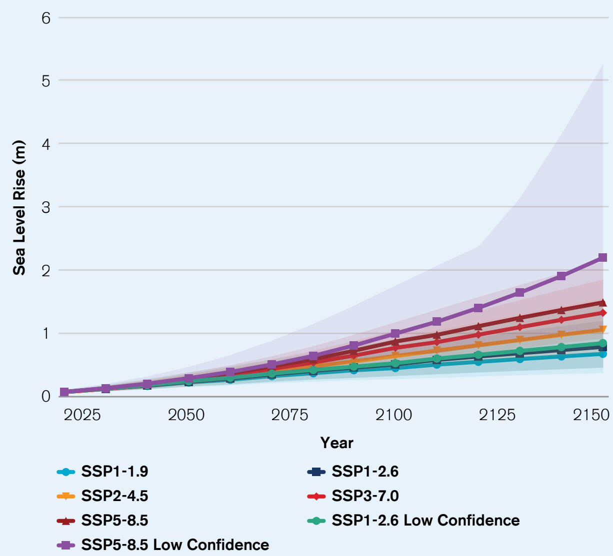
According to altimetry (satellite) data, sea level rose 13 centimeters total from 1993 to present along Togo's coastline[13]. Under the SSP3-7.0 scenario, sea level is expected to rise 19.5 centimeters from 2020 to 2050,

[12] IPCC AR6 WGI Interactive Atlas https://interactive-atlas.ipcc.ch/.
[13] NASA https://earth.gov/sealevel/sea-level-explorer/

with a likely range from 14 to 26 centimeters, and 70 centimeters from 2020 to 2100, with a likely range from 52 to 95 centimeters. This means that sea level rise is projected to increase by 0.26 meters by 2050 and 0.77 meters by 2100 under the SSP3-7.0 scenario, relative to the reference period 1995–2014 (**Fig. 9**).

Over the next two decades, sea level rise is expected to occur at a similar rate regardless of emissions, scenarios, or warming levels. However, beyond this period, high-emission scenarios project significantly greater increases in sea level. Despite uncertainties, it is certain that sea levels will continue to rise across all scenarios for centuries, underscoring the need for long-term planning. Sea level rise could reach 0.3 m above historical conditions starting around 2050 or earlier in all scenarios, and 0.5 m during the second half of the 21st century with respect to the 1995–2014 baseline. "Under the SSP3-7.0 scenario, there is a 92% chance of exceeding half meter of global sea level rise 9% chance of exceeding 1 meter of global sea level rise by 2100" (NASA Sea Level page).

FIGURE 9. Projected Total Sea Level Change Under Different SSP Scenarios Relative to the Historical Baseline (1995–2014). The Shaded Ranges Show Uncertainties at 17th-83rd Percentile Ranges. Data from NASA.



Natural Hazards

Climate change is now recognized to have a significant impact on disaster management efforts and poses a significant threat to the efforts to meet the growing needs of the most vulnerable populations. According to EM-DAT[14], 39 disaster events were recorded between 1980 and 2024. Floods were the most frequent natural hazard, with 15 events (7 classified as general floods and 8 as riverine floods), followed by epidemics (10 bacterial and 2 viral disease outbreaks), droughts (2 events), and one water-related disaster. Bacterial diseases in Togo are primarily water-borne, exacerbated by existing issues with water sanitation. The growing unpredictability of climate change is expected to hinder efforts to address these diseases. Additionally, rising temperatures will alter the timing and distribution of vector-borne diseases, further complicating public health efforts. Floods will be intensified by extreme precipitation.

Think Hazard[15] identifies river floods, water scarcity, extreme heat, and wildfires as the highest natural risks, followed by urban flood, coastal flood, earthquake and landslide as medium risks, and tsunamis as low risk.

[14] The International Disaster Database https://www.emdat.be/
[15] Think Hazard, GFDRR, https://thinkhazard.org/en/report/243-togo

Agriculture and Blue Economy

Agriculture in Togo is predominantly rainfed and subsistence-based, which makes it particularly vulnerable to climate variability. The agricultural sector is characterized by a reliance on smallholder farms with limited access to mechanization, fertilizers, and irrigation. Most farming is done on a small scale, and productivity is closely tied to rainfall patterns.

Key food crops include maize, millet, sorghum, yams, cassava, and rice. In addition to these staples, cash crops such as cotton, coffee, and cocoa are cultivated primarily for export markets. Livestock farming is also important, particularly in the north, where cattle, goats, sheep, and poultry are commonly raised.

Togo's marine ecosystems, although limited in extent due to the country's relatively short coastline of approximately 50 kilometers, are ecologically significant. The main coastal ecosystems include mangroves, coastal lagoons and estuaries, and sandy beaches.

By the period 2090–2099 and under the high-emissions scenario RCP8.5 (+4.4°C), marine animal biomass along Togo's coast is expected to decline around 20% (Tittensor et al., 2021[16]), relative to levels observed during 1990–1999.

The historical maximum sustainable yield from 2012 to 2021 is 11.45 metric tons for Togolese 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 decrease t by almost 91% compared to historical levels (Free et al., 2020[17]).

Trisos et al. (2020)[18] 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 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.

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[16] 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

[17] 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

[18] 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

ANNEX – TABLES: HISTORICAL AND PROJECTED CHANGES ACROSS REGIONS

Historical Climate Across Regions

Table A1 and A2 show the variations in historical temperature and precipitation across Togo's districts.

TABLE A1. Historical a) Air Surface Temperature Averages (1991–2020), CRU, and b) Trends per Decade (1971–2020), ERA5, for Average, Minimum and Maximum Temperatures (in deg C), All Columns Colored According to Intensity. The Regions are Organized from North to South. Significant Trends are Noted in Bold.

Regions	Historical Air Surface Temperature Averages (1991–2020) (degrees C), CRU					Trend per Decade (1971–2020) (degrees C/decade), ERA5		
	Temp	Min Temp (night temp)	Max temp (day temp)	Min temp (August)	Max Temp (March)	Temp	Min Temp (night temp)	Max temp (day temp)
Togo	27.36	21.94	32.82	21.39	36.23	**0.26**	**0.28**	**0.19**
Savanes	28.74	22.72	34.82	22.37	39.32	**0.23**	**0.29**	**0.13**
Kara	27.72	21.84	33.65	21.56	37.51	**0.25**	**0.29**	**0.14**
Centrale	26.89	21.24	32.58	20.87	36.05	**0.25**	**0.27**	**0.18**
Plateaux	26.85	21.84	31.91	21.02	34.83	**0.27**	**0.27**	**0.22**
Maritime	27.18	22.87	31.53	21.87	33.8	**0.28**	**0.29**	**0.28**

TABLE A2. Historical Precipitation, Maximum Number of Consecutive Dry Days per Year, and Maximum Number of Consecutive Wet Days per Year (1991–2020) (in mm), and Linear Trends from 1971 to 2020, All Columns Colored According to Intensity. CRU and ERA5 Datasets as Indicated. Significant Trends are Noted in Bold.

Regions	Historical Precipitation (1991–2020) (mm), CRU and ERA5, and Decadal Trends, ERA5, 1971 to 2020					Maximum Number of Consecutive Dry Days per Year - CDD - ERA5		Maximum Number of Consecutive Wet Days per Year - CWD - ERA5	
	Pr max (around August)	Total Yearly PR (CRU)	Total Yearly PR (ERA5)	PR Decadal Trend	% Decadal Trend	Historical (1991–2020)	Decadal Trend (1971–2020)	Historical (1991–2020)	Decadal Trend (1971–2020)
Togo	210	1217	1309	**–37.8**	**–2.9**	49	**1.24**	37	–1.38
Savanes	255	1054	805	–3.6	**–0.4**	74	1.16	21	–0.42
Kara	260	1291	1215	**–29.6**	**–2.4**	60	0.61	36	–1.41
Centrale	226	1265	1567	**–46.4**	**–3.0**	52	1.37	46	–1.08
Plateaux	187	1238	1441	**–46.7**	**–3.2**	38	**1.91**	40	–1.09
Maritime	188	1153	1279	**–51.8**	**–4.0**	20	**1.51**	33	**–2.83**

Projected Climate Across Regions

Tables A3 to A6 shows the variations in CMIP6 historical and projected temperature and precipitation related variables across Togo's districts.

TABLE A3. CMIP6 Simulated Historical Averages (1994–2015), Mid-Century SSP3-7.0 Projections (2040–2059), End-of-Century Projections (2080–2099), and Decadal Trends (2000–2050 and 2050–2100 depending on variable) for a) Average Surface Air Temperature, b) Number of Hot Days per Year with Tmax > 35°C

Regions	Average Surface Air Temperature (degrees C)					Annual Number of Hot Days with Tmax > 35°C (days)				
	Temp Hist (1995–2014)	Temp Trend 2000–2050	Tmin Decadal Trend 2000–2050	Tmax Decadal Trend 2000–2050	Temp Decadal Trend 2050–2100	Hist (1995–2014)	2040–2059	2080–2099	Decadal Trend 2000–2050	Decadal Trend 2050–2100
Togo	27.23	0.28	0.31	0.26	0.45	57.45	104.82	173.5	10.38	17.22
Savanes	28.72	0.31	0.33	0.28	0.5	151.31	200.8	251.77	12.06	12.32
Kara	27.27	0.29	0.32	0.25	0.49	78.99	135.79	201.29	12.34	16.5
Centrale	26.74	0.28	0.32	0.25	0.46	46.67	104.54	179.28	12.38	18.82
Plateaux	26.82	0.28	0.29	0.26	0.42	23.94	66.66	143.23	9.04	18.94
Maritime	27.23	0.26	0.26	0.27	0.38	1.72	19.11	83.76	3.84	17.26

TABLE A4. CMIP6 Simulated Historical Averages (1994–2015), Mid-Century SSP3-7.0 Projections (2040–2059), End-of-Century Projections (2080–2099), and Decadal Trends (2000–2050 or 2050–2100 depending on variable) for a) Number of Hot Nights per Year with Tmin > 23°C, b) Number of Hot Nights per Year with Tmin > 26°C, and c) Number of Hot Humid Days per Year with Heat Index > 35°C

Regions	Number of Tropical Nights per Year with Tmin > 23°C (days)				Number of Tropical Nights per Year with Tmin > 26°C (days)				Number of Days with Heat Index > 35°C (days)				
	Hist 1994–2015	2040–2059	2080–2099	Trend 2000–2050	1994–2015	2040–2059	2080–2099	Trend 2050–2100	Hist 1994–2015	2040–2059	2080–2099	Trend 2000–2050	Trend 2050–2100
Togo	140	268	346	27	14	51	153	30	13	72	191	10	29
Savanes	217	302	351	18	60	116	233	32	43	112	222	13	24
Kara	121	241	331	25	14	52	143	28	15	64	174	9	27
Centrale	72	212	336	30	0.8	18	96	26	3	37	151	4	29
Plateaux	118	279	354	33	0.6	25	127	30	5	64	193	9	32
Maritime	273	356	364	19	18	102	248	38	9	124	263	22	33

TABLE A5. CMIP6 Simulated Historical Averages (1994–2015), Mid-Century SSP3-7.0 Projections (2040–2059), End-of-Century Projections (2080–2099), and Anomalies (with respect to historical period) for Annual Total Averaged Precipitation

Regions	Annual Average Precipitation (mm)				
	1994–2015	PR Anomaly 2040–2059	PR Anomaly 2080–2099	% Anomaly Change to 2040–2059	% Anomaly Change to 2080–2099
Togo	1365	36	51	2.6	3.8
Savanes	835	61	95	7.3	11.4
Kara	1277	43	76	3.3	6.0
Centrale	1626	39	76	2.4	4.7
Plateaux	1491	18	4	1.2	0.2
Maritime	1367	32	24	2.3	1.7

TABLE A6. CMIP6 Simulated Historical Averages (1994–2015), Mid-Century SSP3-7.0 Projections (2040–2059), End-of-Century Projections (2080–2099) , and Anomalies with Respect to Historical Period (1995–2014) for CDD (annual maximum number of consecutive dry days, with daily precip < 1 mm) and for CWD (annual maximum number of consecutive wet days, with daily precip > 1 mm)

Regions	Maximum Number of Consecutive Dry Days per Year - CDD					Maximum Number of Consecutive Wet Days per Year - CWD				
	Hist 1994–2015	2040–2059	2080–2099	Anomaly to 2040–2059	Anomaly to 2080–2099	Hist 1994–2015	2040–2059	2080–2099	Anomaly to 2040–2059	Anomaly to 2080–2099
Togo	43	41	40	−0.6	−1.8	71	64	53	−8.5	−16.8
Savanes	70	69	68	−0.2	−1.4	41	37	30	−1.3	−6.6
Kara	55	54	53	−0.7	−2.0	70	62	52	−6.6	−15.7
Centrale	44	42	41	−1.2	−2.9	89	80	65	−12.8	−23.1
Plateaux	30	28	28	−0.5	−1.6	77	68	55	−11.4	−20.7
Maritime	14	14	15	0.5	−0.2	63	61	56	−4.9	−9.3

Population Exposure Across Regions

Tables A7 and A8 shows the variations in CMIP6 historical and projected population exposure to temperature and precipitation related variables across Togo's districts[19].

TABLE A7. For Each Admin1 District, Percent of the Population at High Health Risk for Three Periods: Retrospective (1975–2024, centered on 2000), Future (2010–2059, centered on 2035), and Distant Future (2050–2099, centered on 2075), Under SSP3-7.0. High-Risk Areas are Defined as Locations where the 50-Year Return Level Indicates, that, on Average Once Every 50 Years, a Year Occurs with a) More Than 30 Days with Tmax > 35°C, b) More Than 20 Days with Tmax > 40°C, c) More Than 20 Days Characterized by Heat Index Surpassing 35°C.

Regions	Number of Days with Tmax > 35degC - hd35			Number of Days with Tmax > 40degC - hd40			Number of Days with Heat Index > 35degC - hi35	
	hd35 - 2000	hd35 - 2035	hd35 - 2075	hd40 - 2000	hd40 - 2035	hd40 - 2075	hi35 - 2000	hi35 - 2035
Togo	49	68	83	6	14	36	68	97
Savanes	100	100	100	49	100	100	100	100
Kara	100	100	100	0	10	99	48	100
Centrale	89	100	100	0	0	51	13	100
Plateaux	49	79	100	0	0	7	43	90
Maritime	0	24	49	0	0	0	100	100

[19] 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 to the time series. 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 (1).

TABLE A8. For Each Admin1 District, Percent of the Population at High Health Risk for Three Periods: Retrospective (1975–2024, centered on 2000), Future (2010–2059, centered on 2035), and Distant Future (2050–2099, centered on 2075), Under SSP3-7.0. High-Risk Areas are Defined as Locations where the 50-Year Return Level Indicates, that, on Average Once Every 50 Years, a Year Occurs with a) More Than 30 Nights Characterized by Night Temperatures Surpassing 26°C, b) More Than 20 Nights with Night Temperatures Surpassing 29°C, and c) Where the 25-Year Return Level of the Annual Largest 5-Day Cumulative Precipitation Exceeds 130 mm.

	Number of Days with Tmin > 26degC - tr26		Number of Days with Tmin > 29degC - tr29			Annual Largest 5-Day Cumulative Precipitation - rx5		
Regions	**tr26 - 2000**	**tr26 - 2050**	**tr29 - 2000**	**tr29 - 2050**	**tr29 - 2075**	**rx5 - 2000**	**rx5 - 2035**	**rx5 - 2075**
Togo	45	73	0.5	13	55	35	51	56
Savanes	100	100	3.9	98	100	43	90	100
Kara	27	79	0	2.6	75	74	98	100
Centrale	0	27	0	0	12	85	93	93
Plateaux	0	43	0	0	13	36	50	55
Maritime	78	100	0	0	75	0	5	8

CLIMATE RISK COUNTRY PROFILE

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