

Climate Profiles of Countries in Southern Africa: Zambia

Dr Meghan Bailey, Senior Technical Advisor, Red Cross Red Crescent Climate Centre
Dorothy Heinrich, Technical Advisor, Red Cross Red Crescent Climate Centre
Andrew Kruczkiewicz, Technical Advisor, Red Cross Red Crescent Climate Centre

The following climate factsheet⁹ provides an overview of the climate of Zambia, one of ten countries of interest for the Finnish Red Cross Food Security Study, 'Interventions to improve food security in a changing climate in Southern Africa'. Each of the factsheets were written as a compilation of information from peer-reviewed academic papers, government publications, and INGO documentation, and are also available in one compiled document.

1. What is the general climate of Zambia, and what are its climate zones?

Zambia's climate is generally categorised as subtropical, being mostly humid subtropical or tropical wet/dry all year ([Government of the Republic of Zambia 2020](#)). There are also small semi-arid regions in the southwest of the country in the Zambezi river ([Government of the Republic of Zambia 2020](#)). The climate is heavily influenced by high altitudes which makes some locations in Zambia cooler (and wetter) than surrounding countries in southern Africa (Hobson [et al. 2020](#)). Average annual precipitation varies across the country, from 800-1400mm. Temperature is also highly variable and moderated by elevation – the highest average daily maximums are found in the Luangwa valley in the central-eastern part of the country as well as in the southwest (Hobson [et al. 2020](#)). The coolest area is the Nyika plateau which lies over 2,000m in elevation in the northeast of the country. Finally, the wind regime is generally easterly/southeasterly but in the rainy seasons winds also blow from the north/northwest (Hobson [et al. 2020](#)).

The country is divided into three agroclimatic zones (Greenberg et al. 2015, [Government of the Republic of Zambia 2020](#)). In the south, AER I is the driest zone, receiving less than 800 mm of precipitation annually, and a growing season between 80 and 120 days. In the centre and east, AER II receives between 800 mm and 1,000 mm of rainfall annually, and has a growing season between 100 and 140 days. Finally, in the north and west, AER III accounts for the largest land area (46%) of Zambia. It is the wettest region, receiving between 1,000 mm and 1,500 mm of precipitation annually and also has the longest growing season, between 130 and 160 days. ([Government of the Republic of Zambia 2020](#)).

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1.1 How does precipitation vary throughout the year?

May to mid-October are the dry winter months, when little precipitation occurs. The rainy season begins in November and ends around April/May. In October, periodic thunderstorms lead to heavy rainfall and potential flash flooding (Hobson [et al. 2020](#), [Government of the Republic of Zambia 2020](#)). The rains generally start in the north around the first week of November, and propagates towards the capital of Lusaka (central Zambia) over a timescales of weeks (Hobson [et al. 2020](#)). The wettest period is December and January. In April, rainfall declines rapidly, leading into the dry winter months.

1.2 How do temperatures vary throughout the year?

Temperatures are lowest in the dry winter, between May and August with maximum daily temperatures ranging from the mid 10°Cs to the mid 20°Cs throughout the country. June and July are the coolest months of the year when even frost can occur in valleys and in the higher elevations. Temperatures rise rapidly from mid-August to mid-October, which is the country's hot dry season, when maximum temperatures range between mid 20°Cs and mid 30°Cs throughout the country ([Government of the Republic of Zambia 2020](#), Hobson [et al. 2020](#)). By mid-October, however, cooler temperatures occur concurrent with the first rains, until the hot dry winter starts again in August (Hobson [et al. 2020](#))

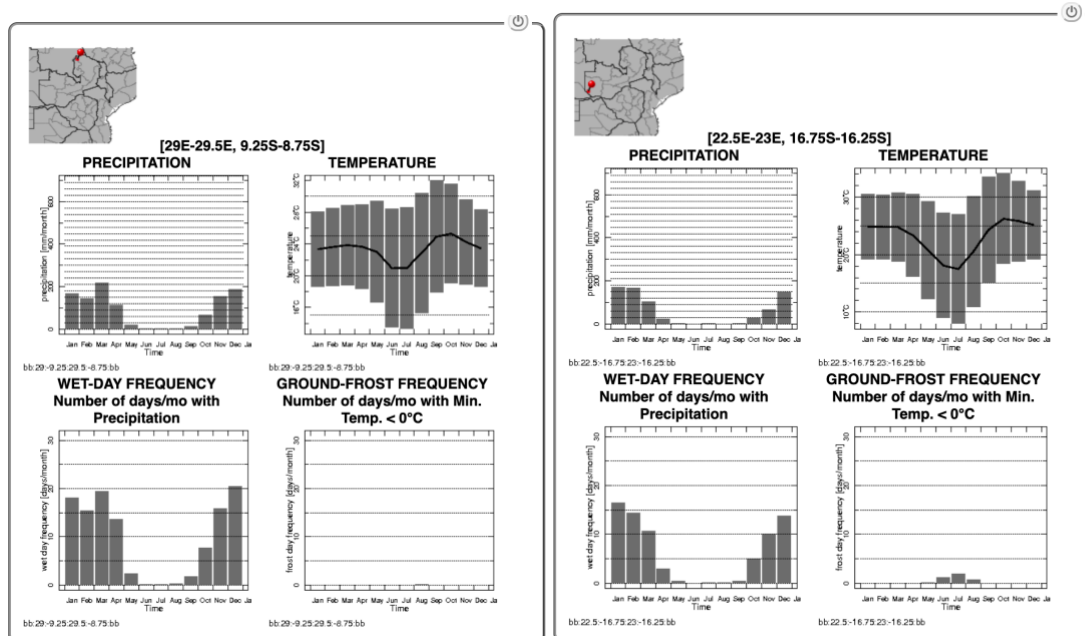


Figure 1. Climate Statistics for northern (1a) and southeastern (1b) Zambia

2. What types of extreme weather and climate does Zambia experience?

Floods and droughts occur regularly, with 36 emergency operations since 1983, mainly for these two hazards (IFRC).

- Floods occur in the rainy season, particularly in December and January where high intensity precipitation events are most common. Both flash floods and riverine floods are of concern. Flash floods and water logging created by heavy precipitation events affected a recorded 238,258 people in 2009-2010 ([Government of the Republic of Zambia 2020](#)). In October 2020, the Early Action Protocol for floods was approved by the IFRC, planning for the release of funds on the order of 200,000 CHF per activation ([IFRC 2020](#)).
- Droughts and dry spells occur even more frequently than floods ([Thurlow et al. 2012](#)) and notably, AER1 is the country's most drought-prone region ([Government of the Republic of Zambia 2020](#)). These can span multiple years and have intense effects on livelihoods and food security. Between 1976 and 2007, the worst drought occurred in 1991-1992 and its impact was widespread throughout the country. Smaller scale droughts also occurred in 1986-2018, 1994-1995, 2004-2005, and 2017-2018. ([Thurlow et al. 2012](#)). In 2019 and 2020, the national government and humanitarian agencies warned that Zambia was experiencing of its worst droughts on record ([Lusaka Times 2020](#)) building off prolonged droughts in 2017-2018 in the south and western regions of the country; in December 2019, UN OCHA warned that more than 2.3 million people are projected to be food insecure by March 2020 ([OCHA 2019](#)). Severe floods have occurred on top of these droughts, leaving the country reeling from the compounded impact (see, for example, [IFRC 2020](#)).
- Zambia is impacted by ENSO ([Stern and Cooper 2011](#), [Hachigonta and Reason 2006](#)) with La Nina leading to increased chance of below average dry spell frequencies while El Nino years leads to increased chance of above average rainfall ([Hachigonta and Reason 2006](#)).

3. What are likely current and projected impacts of climate change in Zambia?

3.1 Observed Changes

- Increases in temperatures are visible in the climate record, as are differences between daily maximum and minimum temperatures ([Government of the Republic of Zambia 2020](#)). Mean annual temperatures have increased on average by 0.29°C since the 1960s, or a total of 1.6°C. Additionally, temperature extremes are increasing as well - annual daily maximums have been increasing since 1950 as has the diurnal temperature range (DTR) and the number of sunny days with maximum temperatures of 25°C, 30°C, and 35°C. In addition, the warmest daily maximum temperature has increased throughout most of the country. The lowest rates of change are visible in the northwestern part of the country

while the most important changes have occurred in the east, in Lundazi and Mount Makulu ([Government of the Republic of Zambia 2020](#)).

- Between 1971 and 2005, annual rainfall declined by 6% (or 58mm) compared to the prior 30-year baseline period. Shorter rainy seasons have particularly been visible in the southwest of Zambia, and, in the last twenty years, the AER I region is experiencing particularly low, unpredictable and heterogeneously distributed rainfall. It is important to note, however, that many of these trends are not statistically significant, and therefore it becomes difficult to draw robust conclusions about them. For instead, Zambia experienced below average rainfall between 1886 and 1925, and above average rainfall between 1926 and 2010 - with these changes, baselines to examine current climates are complex to establish ([Government of the Republic of Zambia 2020](#)).

3.2. Projected Changes

- Temperature trends highlighted in section 3.1 are expected to continue into the later part of the century, in RCP 4.5 and 8.5 scenarios. Notably, annual changes in minimums and maximums are projected to increase in the next 30 years, respectively by 0.56-1.32°C and 1.45-2.08°C. Additionally, average seasonal temperatures are also projected to increase ([Government of the Republic of Zambia 2020](#)).
- Changes in precipitation trends are also expected, with highly seasonal variation. For instance, in the Third Communication, projections show that seasonal median rainfall increases in January-March by approximately 2.53 mm but decreases in October-December (by 5.59) under RCP 4.5; the opposite pattern would occur under RCP 8.5 with similar numbers. There is spatial variation to this as well. AER I is projected to receive more precipitation in January to March and October to December by 2050. AER II will experience minimal decreases of precipitation in these periods and AER III is projected likely to receive less rainfall ([Government of the Republic of Zambia 2020](#)).

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