

Possible futures for urban East Africa under a changing climate

Three possibilities for what the climate might be like in 2050 and the resulting impacts felt by urban areas of East Africa are described here. Three climate futures have been selected to demonstrate a range of plausible futures but they do not cover every possible outcome projected by climate models. Some of the impacts which may be experienced by urban areas in East Africa are also included, but these may vary for individual cities due to local adaptations. For a more comprehensive picture of projected climate changes, please see the technical appendix available on the project website: <http://www.futureclimateafrica.org/project/hycrystal/>

Future 1: Much wetter, large increase in heavy rainfall and hotter

In Future 1 in 2050, it is much wetter than it used to be a few decades ago. The total amount of rainfall in the Long Rains has increased by around 25% and the Short Rains are about 20% wetter on average.

However, some areas of the region have seen larger increases than this and some have seen smaller. When it rains, it is usually much more intense and severe storms occur around five times more frequently.

Change in rainfall and temperature since 1980-2010

● % change in rainfall ● Change in temperature (deg C)



The Short Rains now last longer by about a week and the Long Rains start several days earlier too. Dry spells still occur within the rainy seasons as they used to at the start of the century.

Future 2: Increase in extreme rainfall and hotter

In 2050 in Future 2, it is a bit wetter during the Long Rains than it used to be in previous decades, with seasonal totals having returned to the levels seen in the 1970s and 1980s. The Short Rains are much the same as they were at the start of the century. However, when it rains it is often much heavier than it used to be and extreme storms occur about two or three times more frequently.

Change in rainfall and temperature since 1980-2010

● % change in rainfall ● Change in temperature (deg C)



Overall, the timings of the rainy seasons have not changed much, with their onset and cessation occurring at roughly the same time as they used to. Dry spells are now about 50% longer than they used to be compared with the start of the century.

Future 3: Much hotter and drier with more erratic rainy seasons

Temperatures have risen substantially by 2050 in Future 3. These are on average about 3°C hotter across the region. Maximum temperatures have also increased so the hottest days of the year are now unbearably hot, especially in urban areas.

The Long Rains have continued to decline and seasonal totals are about 5% less than they used to be compared with the start of the century. The Short Rains are around 7% drier than in previous decades.

Change in rainfall and temperature since 1980-2010

● % change in rainfall ● Change in temperature (deg C)



The Long Rains are about 10-15 days shorter than at the start of the century and the Short Rains have seen a reduction of at least 5 days. Dry spells are common within the rainy season and often last twice as long as they used to a few decades ago.

Future 1: Much wetter, large increase in extreme rainfall and hotter

Lake Victoria levels have the potential to rise by at least a metre to those seen in the 1960s, depending on hydropower use. River levels have also markedly increased.

It is hotter in 2050, with average annual temperatures about 2°C higher than at the start of the century. Maximum temperatures have also risen, making the hottest days feel much hotter, particularly in cities.

Urban areas of East Africa now experience substantial increase in the frequency, duration, extent and depth of floods. Catastrophic loss of life and property occurs during the more frequent flash floods. Sanitation and drainage systems are often overwhelmed and cases of malaria, cholera and diarrhoea are widespread and severe. Costs of drainage maintenance and water treatment have risen substantially due to the turbid floodwaters.

The floods also damage critical bridges and road links. Unpaved roads are often impassable. This has an extensive impact on the economy through effects on business and educational activities. Many areas close to water bodies have become untenable, forcing large-scale movements of settlements and businesses. Added to the increased rural-urban migration, infrastructure and services are under extreme pressure.

Hydropower production has increased substantially, leading to cheaper and more reliable energy with surpluses available for export.

Future 2: Increase in extreme rainfall and hotter

Lake Victoria has the potential to rise by about half a metre, depending on how much water is used for hydropower. River levels are also higher.

The temperature has notably risen over the past few decades. Average annual temperatures have increased by 2-3°C and even higher temperature rises are felt in urban areas. Maximum temperatures have also increased by a similar amount and hot days are now extremely hot.

The frequency, extent and depth of floods has increased in urban East Africa. Flash flooding is now more common and severe and can result in catastrophic loss of life, particularly after long dry periods. Drainage systems in urban areas are periodically overwhelmed leading to increased malaria and water-borne infections and the hot climate further increases prevalence of some diseases including malaria, dengue and filariasis.

Critical infrastructure is frequently badly damaged by the floods with subsequent interruptions to business and educational activities. The increased intensity of the storms leads to more turbid flood waters, and increased costs of water treatment and drainage maintenance.

Pressures in rural communities from the extreme weather has led to a substantial increase in rural-urban migration, exacerbating issues in the cities.

Hydropower production has increased slightly, with cheaper and more reliable energy becoming more available to local residents and businesses.

Future 3: Much hotter and drier with more erratic rainy seasons

Lake Victoria levels have dropped by a metre. River levels in the region have also fallen. When it does rain, showers are sometimes much heavier than they used to be.

Water shortages are an issue in urban areas and this is compounded by increased demand from a rising urban population. As temperatures rise, water harvesting and other approaches to mitigate water shortages and flooding have become harder to manage. Often potable water supply does not meet demand.

Water shortages, coupled with temperature increases, have led to a decline in personal hygiene practices due to reduced and more expensive water supplies. Drainage systems are often silted and filled with solid waste and are hard to maintain. Water-based sanitation systems are increasingly dysfunctional.

Larger numbers of people suffer from heat stress in the hot weather. Respiratory diseases and allergies are also on the rise in the increasingly dusty environment.

Despite being drier overall, flooding from the occasional intense rainfall causes frequent and severe flash floods. Disease is spread through flooding of drainage systems and damage to roads and other infrastructure has consequences for economic activity.

Hydropower production has decreased with reductions to internal supplies and external revenue.

