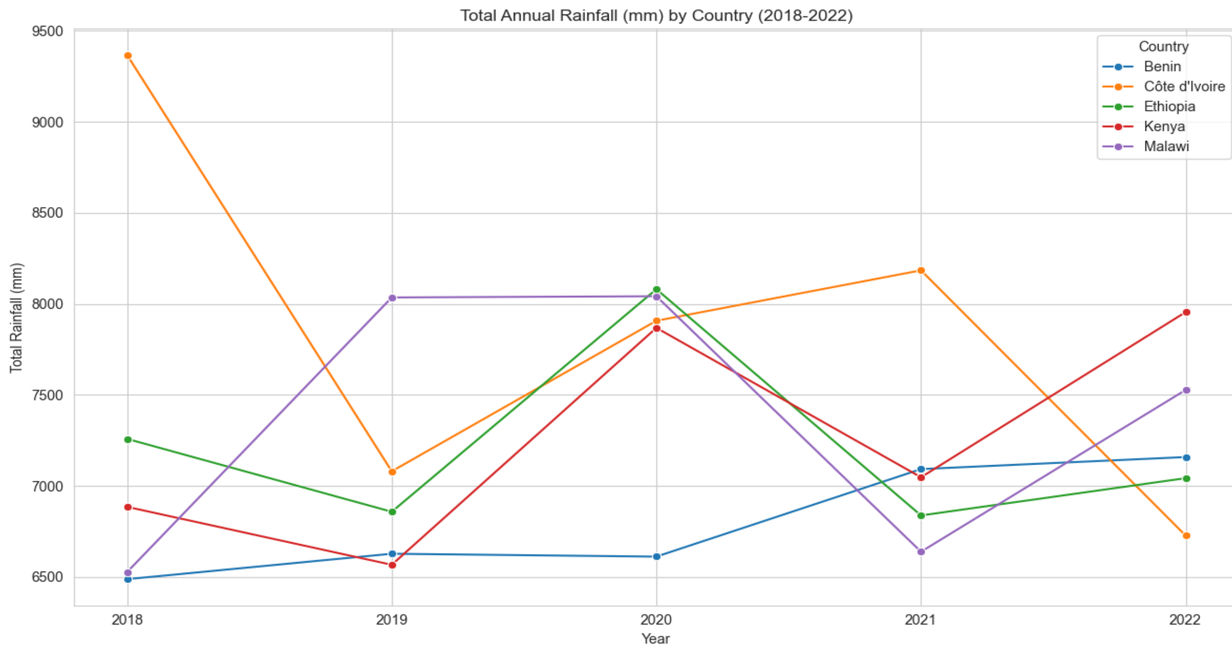
<u>**Rainfall Variability Analysis for Agrifood and Climate Resilience in East and West Africa, 2018-2022**</u>

This analysis highlights monthly rainfall (mm) patterns from 2018 to 2022 across regions in five eligible African countries (Kenya, Ethiopia, Malawi, Benin, Côte d'Ivoire) using Digital Earth Africa CHIRPS data. It aims to identify key trends, patterns, and/or anomalies, explore their influence on agriculture, and propose additional datasets to enhance climate decision-making.

<u>**Noticeable Trends, Patterns, or Anomalies in Rainfall (2018-2022):**</u>

Fig 1. Total Annual Rainfall (mm) by Country



1. **Annual Rainfall Trends (2018-2022)**:

Rainfall patterns across the studied regions exhibit significant variability. Annually, there is no consistent increasing or decreasing trend across all countries; however, year-to-year fluctuations are prominent, highlighting regional climatic influences. Distinct seasonal patterns are evident; East African countries (Kenya, Ethiopia, Malawi) typically display a **bimodal rainfall pattern**, with two main rainy seasons: the "Long Rains" (March-May) and the "Short Rains" (October-December). West African countries (Benin, Côte d'Ivoire) generally exhibit a **unimodal pattern**, with a single, extended "Main Rainy Season" usually peaking between July and September. These seasonal patterns are crucial for agricultural planning.
Anomalies, defined as months with rainfall exceeding 350 mm (very high) or falling below 30 mm (very low), were identified. A total of 125 entries recorded very high rainfall events, such as Addis Ababa, Ethiopia in April 2022 (399.89 mm) and Abidjan, Côte d'Ivoire in November 2020 (399.18 mm). Conversely, 55 months experienced very low rainfall, with instances like Mzuzu, Malawi in June 2021 (6.83 mm) and Korhogo, Côte d'Ivoire in May 2020 (7.52 mm). These extreme events represent significant variations from typical conditions.

2. **Influence of Rainfall Variability on Crop Yields and Farming Practices:**

The observed rainfall variability directly impacts agricultural productivity and necessitates adaptive farming practices.

- **Impact on Crop Yields:** Both insufficient rainfall (leading to droughts, delayed planting) and excessive rainfall (causing waterlogging, flooding, and nutrient leaching) during critical crop growth stages can severely reduce yields or lead to complete crop failure, particularly for rain-fed agriculture.

- **Influence on Farming Practices:** Farmers are increasingly forced to adapt by selecting drought-resistant or flood-tolerant crop varieties, diversifying their crops to spread risk, and investing in advanced water management techniques such as irrigation or drainage systems.

3. **Proposed Additional Dataset for Enhanced Agricultural/Climate Decision-Making:**

Proposed Additional Dataset: Soil Moisture Data.

Why Soil Moisture Data?

- **Direct Water Availability:** While rainfall measures precipitation input, soil moisture directly quantifies the water content available to plants in the root zone. This is a more immediate and accurate indicator of drought stress or waterlogging than rainfall figures alone.
- **Optimized Water Management:** Real-time soil moisture data allows for precise irrigation scheduling, preventing both over-irrigation (saving water, energy, and reducing nutrient runoff) and under-irrigation (mitigating crop stress).
- **Improved Crop Modeling and Yield Prediction:** Soil moisture is a critical parameter for crop growth models, leading to more accurate predictions of crop development, biomass accumulation, and eventual yields when combined with rainfall data.
- **Enhanced Drought Monitoring and Early Warning:** Changes in soil moisture over time, combined with rainfall deficits, provide an earlier and more nuanced warning of developing drought conditions, enabling timely interventions and disaster preparedness.