**Beyond the Headlines: A Data-Driven Analysis of the Meteorological Triggers Behind the Marra Mountain Landslide**

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## Introduction

The tragic landslide on August 31, 2025, which devastated the village of Tarasin in North Darfur State and reportedly claimed over 1,000 lives, was a profound shock to our nation. In the immediate aftermath, questions of cause and preventability rightly come to the forefront. To move beyond speculation, this report details a comprehensive analysis of over four decades of satellite rainfall data. The investigation reveals that the disaster was not a random act of nature, but the result of a predictable "perfect storm": a historically unprecedented and highly localized rainfall event striking a landscape already dangerously saturated from one of the wettest rainy seasons on record.

This analysis provides a clear, data-driven explanation for the tragedy and serves as an urgent call to action for establishing targeted, multi-agency early warning systems in Sudan's vulnerable highland regions.

### Data and Methodology

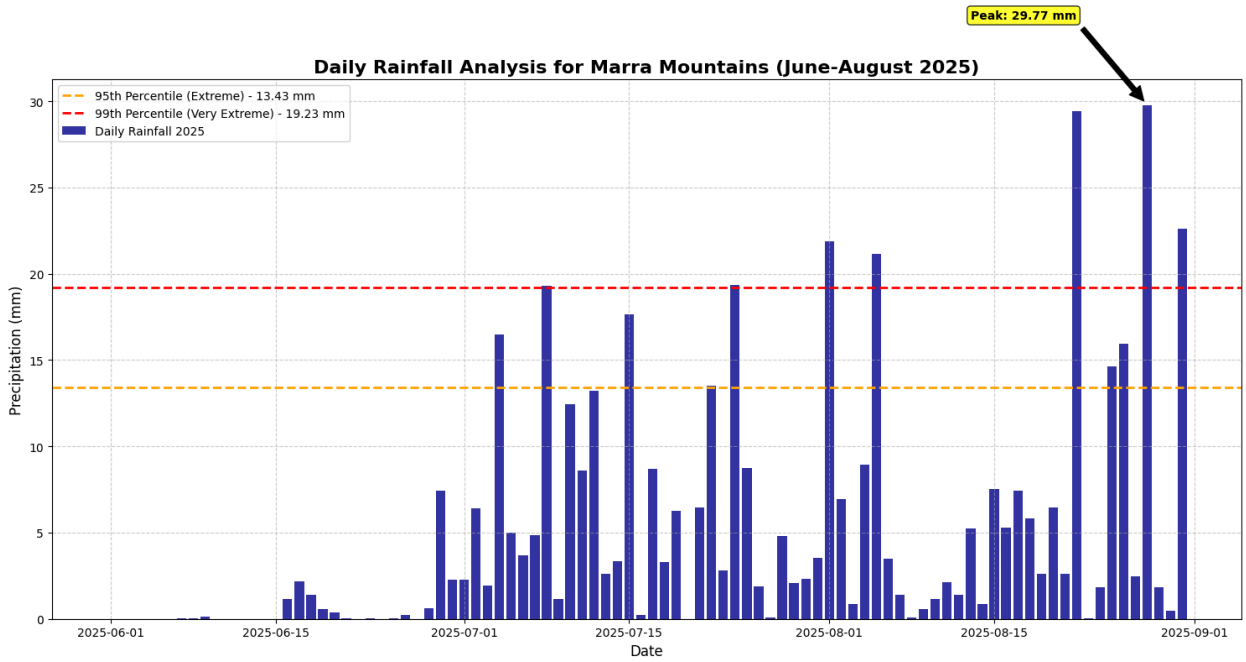
This analysis is based on two high-resolution, satellite-derived precipitation datasets, which are essential for remote regions where ground-based weather stations are unavailable. The historical baseline (1983-2023) was established using the **PERSIANN-CDR (Climate Data Record)** dataset. The specific

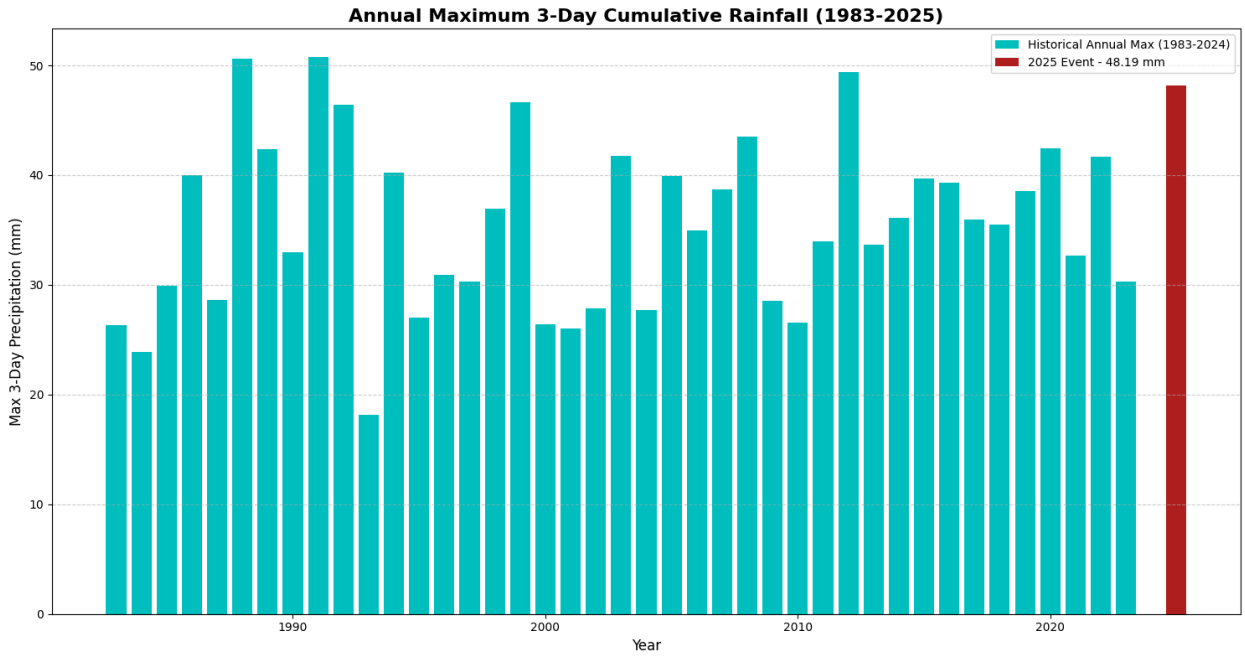
2025 event was analyzed using the real-time **PERSIANN-CCS (Cloud Classification System)**, providing a comprehensive view of the region's climate and the anomalous nature of this specific storm.

### Key Findings: Anatomy of a Compound Disaster

#### 1. The Final Trigger: An Unprecedented Downpour

The immediate cause of the landslide was a single, exceptionally intense day of rain. On **August 28, 2025**, an average of **29.77 mm** of rain fell across the Marra Mountains. According to the 42-year historical record, this figure is more than 50% greater than the threshold for a "very extreme" event (19.23 mm), placing it among the most severe daily downpours ever recorded in the region. This was the final blow that the unstable ground could not withstand.



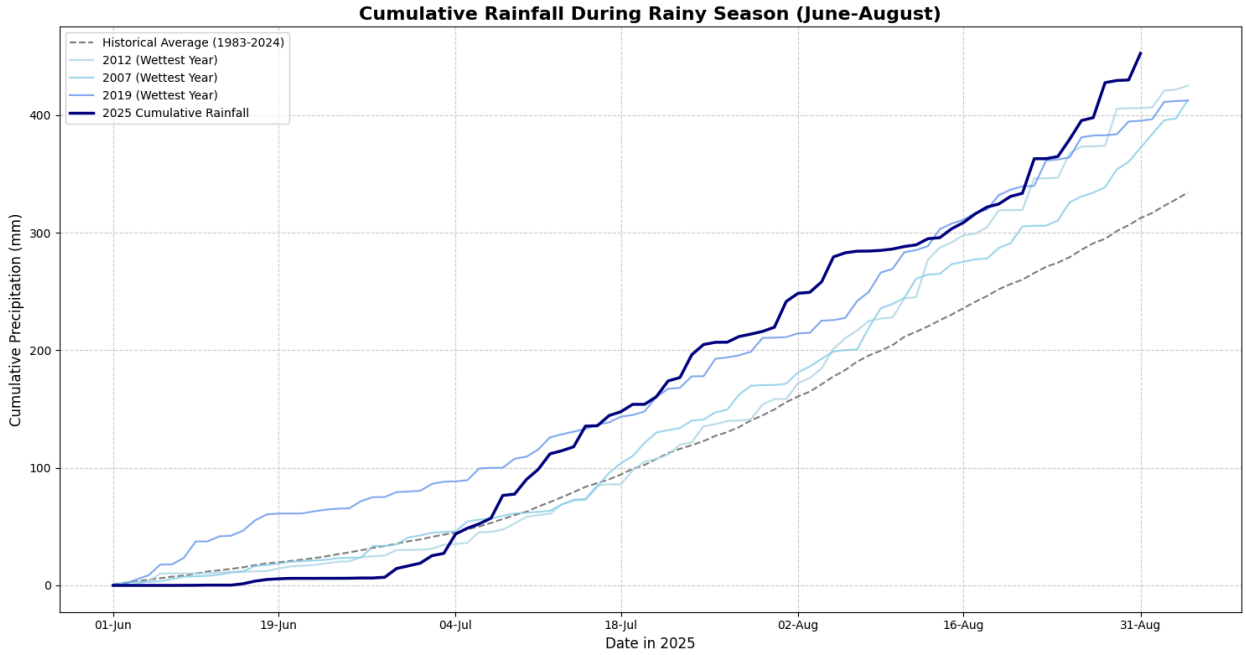



**2. A Season of Saturation: The Ground Was Already Primed**

Crucially, this record-breaking storm did not fall on dry earth. The analysis shows that the ground was already primed for disaster from weeks of sustained rainfall.

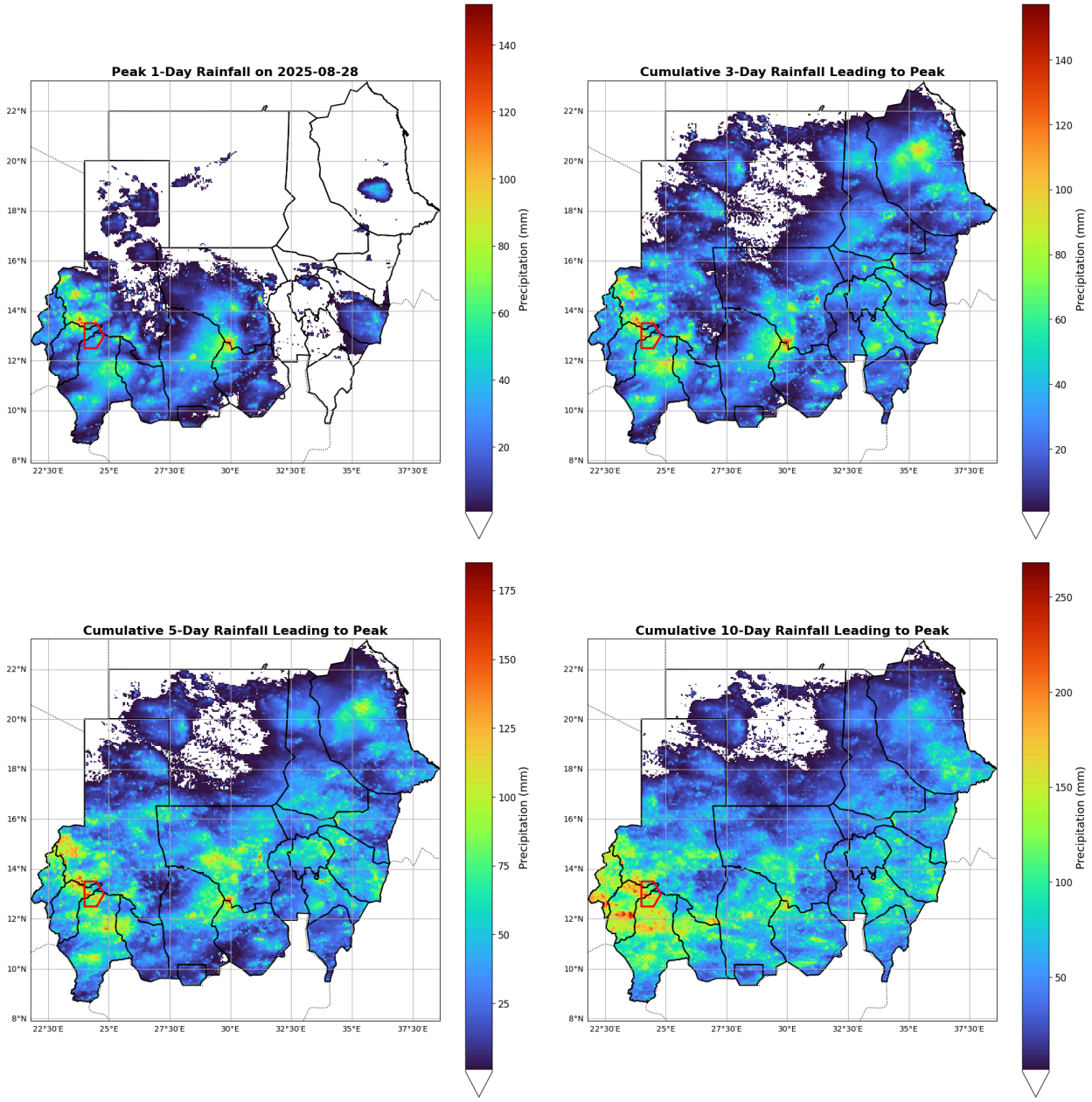
The cumulative rainfall for the 3-day period leading up to the event reached **48.19 mm**—a true historical anomaly that significantly surpasses the maximum 3-day rainfall total for any other year in the past four decades.

Furthermore, the entire 2025 rainy season was exceptionally wet. By mid-August, weeks before the landslide, the total rainfall had already exceeded that of the three previously wettest years on record (2007, 2012, and 2019). This meant the soil was already waterlogged and heavy, with a minimal capacity to absorb any more water. The final storm, therefore, almost immediately became runoff and infiltration, triggering the landslide.




**3. A Localized Threat, Not a National Storm**

Spatial analysis reveals that this was not a widespread weather system but a highly concentrated event. The maps of 1, 3, 5, and 10-day rainfall accumulations all show an intense hotspot focused directly over the Marra Mountains, **highlighted in red**. While other parts of Sudan received rain, the extreme, record-breaking accumulations were overwhelmingly localized to this specific region. This finding vividly illustrates why a national-average approach to disaster risk is insufficient. The event underscores that specific, high-risk topographies like the Marra, Nuba, and Red Sea mountains require tailored monitoring and planning.




**From Data to Action: A Call for a New Warning System**

The evidence is unequivocal: the Marra Mountains landslide was a compound disaster, caused by a record-breaking storm hitting an already vulnerable, saturated landscape. This data-driven analysis invalidates any previous assumption that landslides are "rare" events that do not pose a significant threat in Sudan, especially in an era of accelerating climate change.

The findings provide a clear justification for immediate action on three fronts:

1. **Establish** a Multi-Agency Early Warning **System:** An effective system must integrate the meteorological forecasting of the Sudan Meteorological Authority (SMA) with the on-the-ground expertise of a geological survey and the communication and response capabilities of the National Council for Civil Defense.
2. **Invest in National Hazard Mapping:** A national program to create detailed landslide hazard maps for the Marra, Nuba, and Red Sea mountains is urgently needed to identify and protect the most at-risk communities and guide future land-use policies.
3. **Reverse the "No-Warning" Policy:** The premise that such events are too rare to warrant a warning is now tragically proven to be false. A