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African coastlines face unprecedented sea level surge crisis

A groundbreaking study led by researchers at the University of Cape Town's (UCT) [Department of Oceanography](#) has revealed that Africa's coastlines are facing a rapidly accelerating crisis. It found that the 2023-2024 El Niño event triggered the most significant sea level surge ever recorded in the region, exceeding even the historically powerful 1997-1998 event and highlighting a dangerous new reality for the continent's coastal nations.

The study, published in [Communications Earth & Environment](#), analysed over three decades of satellite data spanning from 1993 to 2024 across the Atlantic Ocean, Indian Ocean, Mediterranean Sea, Red Sea and adjacent waters surrounding Africa. Regional sea levels have risen by 11.26 centimeters since 1993, outpacing the global average and accelerating at a rate of 0.14 millimeters per year squared, faster than previously documented.

A record-breaking climate event

When the long-term trend of rising seas is removed to isolate the effect of natural climate cycles, the 2023-2024 El Niño produced a sea level anomaly of 27 millimeters, the largest on record. This dwarfs the 1997-1998 El Niño, considered one of the most powerful climate events of the 20th century, which produced a smaller anomaly of roughly 19 millimeters.

What made this event extraordinary was not the El Niño alone. Multiple climate patterns aligned simultaneously beforehand. The Indian Ocean Dipole, the Atlantic Niño and the Tropical North Atlantic index all reached record-positive levels, preconditioning the ocean to respond with unusual intensity. This rare convergence amplified the El Niño's impact far beyond what its strength alone would predict.

"We are witnessing a fundamental shift in how the ocean responds to climate variability. The 2023-2024 event interacted with an ocean already preconditioned by multiple climate forces and excessive heat, creating a compound effect that pushed sea levels to heights we have never seen in the satellite record," said Dr Franck Ghomsi, the study's lead researcher and a postdoctoral fellow at the [Nansen-Tutu Centre for Marine Environmental Research](#) in the Department of Oceanography at UCT.

Trapped heat, rising seas

Thermal expansion, the physical swelling of water as it heats up, accounted for over 70% of the total rise during the event. In simple terms, the ocean was experiencing a fever.

Typical wind patterns that usually bring cold, nutrient-rich water up from the deep ocean along Africa's coasts effectively shut down. This meant hot surface water piled up along the coastline. Simultaneously, the ocean became highly stratified or layered. This stratification acted like a lid, trapping heat near the surface and preventing it from mixing into deeper, cooler waters. The result was a quadrupling of ocean heat content compared to previous events, creating a feedback loop that locked ever more warmth near the surface and drove sea levels higher.

A continent at a crossroads

The study identified a critical turning point around 2009, when sea level rise accelerated by 73%. Before 2009, levels rose at 2.72 millimeters per year. Afterward, that rate surged to 4.70 millimeters per year. The 2023-2024 period alone contributed 2.34 centimeters, roughly one-fifth of all rise recorded since 1993.

This acceleration poses severe risks to Africa's 38 coastal nations. Over 15 million people in coastal cities now face heightened flood risk. Major urban centres, including Lagos (Nigeria), Douala (Cameroon), Accra (Ghana) and Dar es Salaam (Tanzania), are increasingly vulnerable to rising waters, land subsidence and extreme weather. For Small Island Developing States such as the Seychelles and Comoros, every millimeter of rise threatens infrastructure, fresh water supplies and habitability.

The crisis extends beneath the waves. The suppression of cold, nutrient-rich water that drives sea levels higher also devastates marine life. Fisheries providing food and income for millions of Africans are under immense stress, threatening biodiversity and food security across West Africa and island communities.

A call for urgent action

The researchers stressed that Africa's coastlines now serve as early warning indicators of compound climate hazards, where long-term warming intersects with sudden extreme events to produce risks far greater than either factor alone. They call for expanded ocean monitoring networks, improved early warning systems integrating scientific and indigenous knowledge and coordinated regional adaptation strategies.

"This research closes a critical knowledge gap regarding African sea levels," said Dr Ghomsi. "But knowing the data is only the first step. We must use this information to drive policy, build resilient infrastructure and protect the vulnerable ecosystems and communities that define our continent's coastline."

The study supports initiatives endorsed at international climate summits, including urgent emissions reductions, enhanced coastal protection and investment in Africa's climate observation infrastructure.

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