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Response of Tropical Forests to Intense Climate Variability and Rainfall Anomaly over the Last Decade

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During the last decade, strong precipitation anomalies resulted from increased sea surface temperature in the tropical Atlantic, have caused extensive drying trends in rainforests of western Amazonia, exerting water stress, tree mortality, biomass loss, and large-scale fire disturbance. In contrast, there have been no reports on large-scale disturbance in rainforests of west and central Africa, though being exposed to similar intensity of climate variability. Using data from Tropical Rainfall Mapping Mission (TRMM) (1999-2010), and time series of rainfall observations from meteorological stations (1971-2000), we show that both Amazonian and African rainforest experienced strong precipitation anomalies from 2005-2010. We monitored the response of forest to the climate variability by analyzing the canopy water content observed by SeaWinds Ku-band Scatterometer (QSCAT) (1999-2009) and found that more than 70 million ha of forests in western Amazonia experienced a strong water deficit during the dry season of 2005 and a closely corresponding decline in canopy backscatter that persisted until the next major drought in 2010. This decline in backscatter has been attributed to loss of canopy water content and large-scale tree mortality corroborated by ground and airborne observations. However, no strong impacts was observed on tropical forests of Africa, suggesting that the African rainforest may have more resilience to droughts. We tested this hypothesis by examining the seasonal rainfall patterns, maximum water deficit, and the surface temperature variations. Results show that there is a complex pattern of low annual rainfall, moderate seasonality, and lower surface temperature in Central Africa compared to Amazonia, indicating potentially a lower evapotranspiration circumventing strong water deficits