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Large global-scale vegetation sensitivity to daily rainfall variability

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Abstract

Rainfall events are globally becoming less frequent but more intense under a changing climate, thereby shifting climatic conditions for terrestrial vegetation independent of annual rainfall totals^{1,2,3}. However, it remains uncertain how changes in daily rainfall variability are affecting global vegetation photosynthesis and growth^{3,4,5,6,7,8,9,10,11,12,13,14,15,16,17}. Here we use several satellite-based vegetation indices and field observations indicative of photosynthesis and growth, and find that global annual-scale vegetation indices are sensitive to the daily frequency and intensity of rainfall, independent of the total amount of rainfall per year. Specifically, we find that satellite-based vegetation indices are sensitive to daily rainfall variability across 42 per cent of the vegetated land surfaces. On average, the sensitivity of vegetation to daily rainfall variability is almost as large (95 per cent) as the sensitivity of vegetation to annual rainfall totals. Moreover, we find that wet-day frequency and intensity are projected to change with similar magnitudes and spatial extents as annual rainfall changes. Overall, our findings suggest that daily rainfall variability and its trends are affecting global vegetation photosynthesis, with potential implications for the carbon cycle and food security.