Large Historical Growth in Global Terrestrial Gross Primary Production

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Growth in terrestrial gross primary production (GPP) may provide a negative feedback for climate change. It remains uncertain, however, to what extent biogeochemical processes can suppress global GPP growth\(^3\). In consequence, model estimates of terrestrial carbon storage and carbon cycle–climate feedbacks remain poorly constrained\(^4\). Here we present a global, measurement-based estimate of GPP growth during the twentieth century based on long-term atmospheric carbonyl sulphide (COS) records derived from ice core, firn, and ambient air samples\(^5\). We interpret these records using a model that simulates changes in COS concentration due to changes in its sources and sinks, including a large sink that is related to GPP. We find that the COS record is most consistent with climate-carbon cycle model simulations that assume large GPP growth during the twentieth century (31\% ± 5\%; mean ± 95\% confidence interval). While this COS analysis does not directly constrain future GPP growth it provides a global-scale benchmark for historical carbon cycle simulations.