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Millennial-scale variations in atmospheric N₂O during the past 2000 years

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Improved knowledge of greenhouse gas-climate feedbacks is required to understand past and future climate changes. Atmospheric nitrous oxide (N₂O) is of concern for its potential role in global warming and future stratospheric ozone destruction. Existing ice core N₂O records for the Holocene have not been sufficiently consistent to allow an examination of small changes on sub-millennial time scales. Here, we present new high-resolution and high-precision N₂O records obtained from the Greenland NEEM (North Greenland Eemian Ice Drilling) and Antarctic Styx Glacier ice cores. Our reconstruction shows, for the first time, a centennial-scale variability of ~10 ppb during the last 2000 years. Comparisons with proxy records suggest that centennial- to millennial-scale variations in N₂O are driven, to a large extent, by changes in tropical and subtropical land hydrology and marine productivity.