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How variable is the Holocene?

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Determining the magnitude of natural climate variability is necessary for predicting the plausible range of future climates. While the instrumental record is too short to determine slow climate variations, climate archives of the Holocene can provide information about the variability on decadal to millenial timescales in interglacial boundary conditions.

We present a global comparison of marine temperature variability derived from instrumental data, corals and sediment cores and a range of general circulation model (GCM) simulations. The results indicate that current models systematically underestimate the variance in regional ocean temperature variability during the mid-late Holocene, with the discrepancy increasing from decadal to millennial timescales to more than an order of magnitude. The possibility that the greater variability results from noise in temperature proxies is rejected after analysis of the covariability between instrumental temperature records and coral, alkenone, and Mg/Ca proxies of temperature. The balance of evidence indicates that internal climate variability is much larger than simulated by GCMs on decadal and longer timescales, though the sensitivity of the climate system and magnitude of external forcing could also be greater at multi-decadal and longer timescales than presently accounted for in GCMs. In either case, these results suggest that model simulations are biased toward showing a too stable climate.