Scaled marine plankton disruption through early Paleogene transient global warming events

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The Paleocene-Eocene Thermal Maximum (PETM, ~56 Ma) is global warming event associated with the injection of carbon into the ocean-atmosphere system, with analogies to current anthropogenic climate change. However, the PETM was not a singular event, but rather the most extreme of a series of inferred transient warming events in the Paleogene known as 'hyperthermals'. These events provide enormous potential for testing for biotic response across a range of carbon cycle perturbations that are relatively closely spaced in time. We present and apply a novel metric to quantify the marine biotic disruption associated with the PETM and several smaller hyperthermal events including Eocene Thermal Maximum 2 (ETM2), H2, I1 and I2. Summed standard deviation analysis of calcareous nannoplankton records show a linear relationship between assemblage variability and magnitude of the carbon isotopic excursions (CIEs) that mark the hyperthermals. CIEs smaller than the PETM, ETM2 and I1 show no significant biotic variance implying an environmental threshold equivalent to approximately 2°C warming for this particular biotic response in the Eocene. Our analysis also provides comparable results from the foraminifera and dinoflagellate data, demonstrating the enormous potential this approach has for enabling fully integrated biotic comparisons, even between biologically unrelated groups.