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Constraining polar amplification with a global compilation of planktonic foraminiferal $\delta^{18}O$

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Polar amplification – the phenomenon in which changes to the earth's climate tend to produce a larger change in temperature near the poles than the planetary average – is a primary concern in climate dynamics and in forecasting the effects of climate change. This amplification is observed in the geologic record as a decrease in the temperature difference between high and low latitudes under warmer climate states. However, the magnitude of equilibrium polar amplification predicted by climate models remains up to ~10°C lower than those derived from empirical compilations, and many of the existing proxy data remain temporally sparse or difficult to interpret. Here, we present a new global compilation of planktonic foraminifera $\delta^{18}O$ values and use it to produce resolved estimates of polar and equatorial sea surface temperatures for the last 95 million years, accounting for diagenetic concerns. We find a strong and consistent pattern of polar amplification across all climate states over the past 95 Ma, with a polar amplification factor (PAR) of ~1.6. This equilibrium amplification is greater than that predicted by the current generation of global climate models (PAR ≈ 1.3), but less extreme than that predicted by some prior proxy-based work (e.g., PAR ≈ 2). Our results provide robust constraints for testing the efficacy of global climate models in predicting out-of-state climate systems of the future.