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Can inter-ocean gateways explain long-term cooling since the early Pliocene?

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Some 5-4 million years ago, in the early Pliocene, the Earth experienced a warm, temperate climate. The gradual cooling that followed led to the establishment of cooler modern temperature patterns. Three critical conditions define the early Pliocene climate in comparison to the present: no difference in maximum sea surface temperatures, a substantially weaker meridional temperature gradient, and reduced zonal ocean temperature contrasts. Here, we investigate the role that changes in inter-ocean gateways played in development of the modern sea surface temperature pattern using a coupled climate model. None of the currently proposed gateway changes can account for all three conditions, even in combination with reducing CO_2 levels. We briefly discuss additional dynamical mechanisms, such as variations in ocean mixing, that might be necessary to reproduce these conditions.