



The role of ocean gateways on cooling climate on long time scales

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We examine ocean changes in response to changes in paleogeography from the Cretaceous to present in an intermediate complexity model and in the fully coupled CCSM3 model. Greenhouse gas concentrations are kept constant to allow a focus on effects arising from changing continental configurations. We find consistent and significant geography-related Cenozoic cooling arising from the opening of Southern Ocean (SO) gateways. Both models exhibit consistent behaviour, with a 6° C deep ocean cooling arising from tectonic evolution alone. Simulations employing continental configurations associated with greenhouse climates, namely the Turonian and the Eocene simulations, systematically exhibit warm deep ocean temperatures at elevated pCO₂ close to 10 ° C. In contrast, continental configurations associated with (later) icehouse climates are associated with cooler deep ocean temperatures at identical pCO₂, arising from a progressive maturation of the ACC. This suggests that a component of the Cenozoic benthic cooling trend recorded in oxygen isotopes could arise directly from changes in continental configuration, and so be decoupled to a degree from the Cenozoic greenhouse gas history.