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A mechanism for brief glacial episodes in the Mesozoic greenhouse

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The Mesozoic, perhaps representing the longest period of warmth during the Phanerozoic Earth history, has been repeatedly affected by short-lived cold interludes on the million year time scale. Distinct lines of evidence for these cooling events include glendonite abundance, stable oxygen isotope records and faunal migration. While plausible mechanisms have been proposed for the two largest ice age events of the Phanerozoic, convincing explanations for these Mesozoic cold snaps are still lacking. Thought, these events are puzzling because they occur in a greenhouse world and because of their relative short duration. Here, we investigate the climate-carbon cycle behavior during these events with a particular focus on the Middle Late Jurassic Transition using a general circulation model with coupled components for atmosphere, ocean, cryosphere and biogeochemical cycles of C, O and P. We force our climate-carbon model with geological evidences of the evolution of carbonate production in the mid and low latitudes. We show that the general drawdown of carbonate platforms is a powerful mechanism capable of generating a fast atmospheric CO_2 decrease and a moderate sea level drop associated with ice-sheet buildup. Temporary nature of the carbonate drawdown explains the relative short time of these cold events but makes it possible to account for ice sheet inception and death.