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# Comparison of Snowball Events Across the Proterozoic: Climate Stability & Clouds in a GCM

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Proterozoic climate was punctuated by severe low-latitude glaciations where ice likely reached the equator, representing "Snowball Earth" events. Using the global climate model ExoCAM, we elucidate the stable climate states of the Paleoproterozoic, Neoproterozoic, and modern Earth by quantifying glaciation and deglaciation thresholds under a brightening Sun and varying greenhouse gas concentrations. Our results show Earth as a tri-stable system with ice free, water-belt and snowball states. A higher solar constant broadens the CO2 range over which these states persist and permits regional polar glaciation during the Neoproterozoic and modern eras. We attribute this enhanced stability against CO2 perturbations to an increase in shortwave cloud forcing, which masks the ice-albedo feedback. Furthermore, we identify a reversal in the net cloud radiative effect during the transition from an ice-free to a snowball state, as cloud forcing shifts from greenhouse-dominated to albedo-dominated.