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Snowball termination and life evolution

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The Snowball Earth hypothesis explains the development of glaciation at low latitudes in the Neoproterozoic, as well as the associated iron formations and cap carbonates, in terms of a runaway ice-albedo feedback leading to a global glaciation followed by an extreme greenhouse of climate. The initiation and meltdown of a snowball glaciation is linked to solar forcing and CO_2 concentration, as implied in earlier studies. A simple linear regression is used to assess the relative importance of solar and CO_2 concentration. The results show that the relative importance ratio of solar and CO_2 is about 6/153 without the consideration of other factors. In order to simulate a snowball earth in Neoproterozoic, we have conducted simulations using an Earth system model of intermediate complexity—MPM-2, CO_2 concentration of 400ppm (about present level) and a varied solar constant. Our results show that above a critical value of approximately 14% reduction in solar forcing, global freezing occur with 400-ppmv of atmospheric CO_2. In order to terminate this snowball, a accumulating CO_2 concentration of 60000ppm (about 150times of the present level) is needed, which is tested with some data. In addition, this paper further explores the relationship between snowball termination and life evolution.