

Learning about past catastrophes from the present perturbation

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The present perturbation of the climate system is dominated by injection of CO₂ into the atmosphere, raising its concentration from about 270ppm in 1800 to 400 ppm today. The rate of increase is about 300 times that which occurred during the last glacial termination. Predictions of the changes in response to this perturbation have been wrong. In 1982 it was proposed that the Arctic might become ice-free in summer in 2200. It is more likely to occur by 2020. The heating of the Earth's surface has paused from time to time, due to albedo changes induced by atmospheric pollutants and by heat storage in the ocean interior. Over the last decades, sea ice formation around Antarctica had expanded rather than contracted, counterintuitively due to warming of the Southern Ocean. In 2016-2017 the climate system may have experienced a jump to a new state, with winter growth of Arctic sea-ice inhibited and summer melting of circum-Antarctic sea ice greatly enhanced.

Analysis of reconstructions of the Ronov (1993, Pliocene through Early Cambrian) and Hay (1994, Quaternary) databases on sedimentary rocks to estimate the amounts originally present suggest that the Holocene and Anthropocene may be unique episodes in geologic history. The Anthropocene climate was originally stabilized by human activity, then massively destabilized in recent centuries. However, Earth was already in a uniquely unstable state, more prone to rapid climate change than at any other time during the Phanerozoic.

As the perturbation proceeds we will learn much about climate change from catastrophic events.