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Dansgaard–Oeschger events as coupled climate-carbon cycle oscillations

Content

Abrupt climate change events during the last glacial period represent a fascinating and mysterious set of interactions and instability within the Earth's climate system, that appear to depend on the climate's mean state. Here we investigate these events from an idealized energy balance and transport perspective, with the aim of identifying a minimum complexity of interactions between different components of the Earth's climate system that can lead to self-sustaining, mean-state dependent oscillations with an abrupt phase. We step through a hierarchy of idealized models building up interactions between sea ice, continental topography, atmospheric and ocean heat transport, and finally atmospheric greenhouse gases that can explain many features of these events. This conceptual model calls back to an original (though flawed) notion about Dansgaard–Oeschger events and the potential role of the carbon cycle, now reexamined from a new perspective. Finally we show that ice core records show evidence for this set of interactions and can help distinguish between this and other potential conceptual models of the dynamics of Dansgaard–Oeschger events.

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