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Threshold in North Atlantic-Arctic circulation controlled by the Oligocene-Miocene subsidence of the Greenland-Scotland Ridge.

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Changes in high latitude ocean gateways are thought to be main drivers of Cenozoic climate evolution. However, the link between global climate changes and the early ocean gateway formation between the North Atlantic and the Arctic Ocean (incl. the Greenland and Norwegian Seas) controlled by the subsidence of the Greenland-Scotland Ridge is poorly understood. Here, we use a coupled ocean–atmosphere general circulation model for Oligocene-Miocene boundary conditions to address a threshold behaviour for the ventilation of the Arctic Ocean controlled by the subsidence of the Greenland-Scotland Ridge. Our model simulations reveal that a deepening of the ridge from approx. 100 to 200 metres below sea-level forces major reorganizations in the North Atlantic-Arctic circulation associated with extreme salinity and temperature changes in the Arctic Ocean. These changes are induced by an abrupt regime shift from restricted estuarine conditions to a bi-directional flow regime similar to today. Taking uncertainties in timing into account this suggests that tectonic processes, which started at the late Eocene to Oligocene controlled the climate and circulation regime of the Arctic Ocean.