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Global climate response to Greenland melting in a coupled climate model

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We investigate the transient ocean-atmosphere response to a realistic freshwater anomaly around Greenland. A 50-year long simulation by a coupled atmosphere-ocean general circulation model (CGCM) is compared with another of the same length in which Greenland melting is prescribed. The focus is on the pathways by which such perturbation is communicated globally. During the first decade of simulation, sea surface temperature (SST) anomalies in the North Atlantic generate a local baroclinic response in the atmosphere, which later extends in space and amplifies in magnitude through an atmospheric bridge between the North Atlantic and the North Pacific Oceans. This fast teleconnection triggers local ocean-atmosphere interaction, which amplify the signal in the Pacific. In the second decade, the Atlantic Overturning Circulation weakens. This result in decreased heat transport in the North Atlantic, thereby this part of the ocean cools while the South Atlantic slightly warms. The associated anomalous winds shift the Atlantic ITCZ south of the equator. In the southern hemisphere there is a strong atmospheric response in the sea level pressure and geopotential height anomalies that is concurrent to the initial North Atlantic-Pacific interaction. Due to these atmospheric anomalies the strength of the volume transport across Drakes passage increases in the, which then later redistributes the heat anomalies in the ACC regime.