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Hydroclimatologic variations in the eastern tropical Pacific during Heinrich Stadial 1

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Atmospheric water vapor transport from the Atlantic to the Pacific across central America plays an important role in maintaining high Atlantic sea-surface salinities and hence may exert a strong control on the strength and stability of the Atlantic thermohaline circulation. Whether variations in the Atlantic-to-Pacific vapor transport acted as a positive or negative feedback on thermohaline circulation changes during Heinrich Stadial 1, however, is unclear as previous results from paleosalinity reconstructions and model experiments lead to contrasting conclusions. We conducted a freshwater hosing simulation using the Community Climate System Model (version 3.0) with high resolution (T85/gx1v3) under Last Glacial Maximum (LGM) boundary conditions, introducing an anomalous freshwater flux of 0.2 Sv into the northern North Atlantic as surrogate for Heinrich Stadial 1. Atmospheric vapor fluxes, based on daily model output, indicates a reduced cross-isthmus moisture transport (from 4°N to 14°N) for the unperturbed LGM run of 0.26 Sv compared to 0.31 Sv of the pre-industrial control run. In the glacial freshwater-hosing simulation no significant change of the cross-isthmus vapor transport compared to the unperturbed LGM run is found. Induced by the slowdown of the Atlantic thermohaline circulation, strengethened trade winds favor enhanced cross-isthmus moisture transport from the Atlantic to the Pacific. However, in absolute terms, this enhanced flux is compensated by lower atmospheric moisture content of the cooler air. A precipitation minus evaporation pattern in the eastern tropical Pacific region is simulated in the hosing run with wetter conditions in western Colombia and dryer conditions over the Gulf of Panama and west of Costa Rica. This dipole pattern during Heinrich Stadial 1 is consistent with published sea-surface paleosalinity reconstructions of the last termination. We conclude that the cross-isthmus vapor flux feedback on thermohaline circulation variations was negligible during Heinrich Stadial 1.