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Mid to late Holocene strengthening of the East Greenland Current paralleled by increased Atlantic Intermediate Water outflow from the Arctic Ocean

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The relatively fresh and cold East Greenland Current (EGC) connects the Arctic with the subpolar North Atlantic. Its strength and influence on the freshwater balance in the North Atlantic impacts Subpolar gyre (SPG) dynamics and deep convection in the Labrador Sea. Enhanced freshwater and sea ice expansion in the subpolar North Atlantic is suggested to modify the northward heat transport in the North Atlantic Current (NAC). High-resolution palaeoceanographic reconstructions, based on planktonic and benthic foraminifera assemblage data, from the central East Greenland shelf (Foster Bugt) reveal distinct centennial to millennial-scale oceanographic variability that relate to climatic changes during the mid to late Holocene (last c. 6.3 ka BP). Our data highlight intervals of cooling and freshening of the polar surface EGC waters that accompanies warming in the underlying subsurface Atlantic waters, which receives contribution of return Atlantic Intermediate Water (AIW) and of the Return Atlantic Current (RAC). Mid Holocene thermal optimum-like conditions prevailed until c. 4.5 ka BP. A relatively warm surface PW and strong contribution of subsurface RAC waters, alongside low drift/sea ice occurrence, suggest a relatively weak EGC during this period. Subsequently, from 4.5 to 1.4 ka BP, the surface PW layer freshened and cooled, and the water column became well stratified, indicating a strong EGC. This EGC strengthening is accompanied by increasing subsurface AIW contribution from the Arctic Ocean after c. 4.5 ka BP, which culminated in the time from 2.3 to 1.4 ka BP. Simultaneously to this maximum AIW contribution, distinct warming is also recognized in the NAC, the Irminger Current and the West Greenland Current. We relate this enhanced Arctic Ocean AIW contribution to the 'Roman Warm Period'; a warm phase whose origin is still a matter of debate. We suggest that the observed warming offshore East Greenland, centred at c. 2.0 ka BP, results from the interaction of i) a weakened SPG; ii) increased northward advection of the NAC, and iii) a predominant positive North Atlantic and Arctic Oscillation mode, prevailing during this time.