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2019-2020 mechanisms of fresh water release from the Beaufort Gyre region of the Arctic Ocean

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From September 2019 to September 2020, the sea-level atmospheric pressure over the Beaufort Gyre region (BGR) was reduced relative to climatology and a well pronounced cyclonic circulation forcing of sea ice and ocean lasted more than eight months. This resulted in the following: increased sea ice area in 2020 relative to 2019; periodic reversals of sea ice drift from anticyclonic to cyclonic; the formation of an unusual donut-shaped sea ice cover pattern (in August-September 2020); upwelling in the central BGR with a reduction of freshwater content by ~1000 km³; downwelling along the periphery of the BGR; changes in the intensity and trajectories of freshwater fluxes from the Mackenzie river and Bering Strait and fresh water contributions to the BGR freshwater content; unusual warming of the Pacific water layer in the northern BGR; and biogeochemical changes driven by ocean circulation and water mass redistribution. Numerical modeling is used to better understand the causes and consequences of the observed changes. Sea-level atmospheric pressure from NCAR/NCEP reanalysis, sea ice concentration and ice motion from NSIDC, altimetry based sea surface heights from Technical University of Denmark, and hydrographic data from the Beaufort Gyre project and USCGC Healy expeditions are used in the study.