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Modifications of Atlantic inflow along the Fram Strait Branch to the Arctic Ocean and its variability north of Svalbard from ship-borne and moored observations in the last two decades.

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Understanding variable properties and dynamics of the Atlantic water (AW) inflow into the Arctic Ocean, and their impacts on ocean heat content, ocean-atmosphere-sea ice exchanges, changing sea ice cover and propagation of anomalies are key prerequisites to elucidate drivers and mechanisms behind the new, warmer regime of the Arctic Ocean. As the AW progress northwards, its properties are modified by ocean-atmosphere interactions, mixing and lateral exchanges. Warm anomalies reaching the Arctic Ocean can result from smaller heat loss during the AW northward passage through Fram Strait, and/or from an increased oceanic advection. Vertical structure of the Atlantic water layer implies the depth of winter convection and access to oceanic heat carried northward by the inflow.

During the last two decades warming of the Atlantic inflow has been reported to progress into the Arctic Ocean, however with strong interannual variations and quasi-periodic pulses of water with extraordinary high temperature. Here we present results from 20 years of annual hydrographic surveys, covering the Atlantic water inflow in the eastern Norwegian and Greenland seas, Fram Strait up to the southern Nansen Basin. Interannual changes in the AW properties and transport are analyzed with a focus on the en route modifications of AW inflow in the Fram Strait Branch and changes in the integrated ocean heat content.

After leaving Fram Strait, the part of AW continues eastward and enters the Arctic Ocean boundary current along different pathways north of Svalbard. The strongest ocean-atmosphere-sea ice interactions and lateral oceanic exchanges in this region lead to substantial local modification of the Atlantic inflow before it continues farther eastward around the rim of the Arctic Ocean. Observations from year-round moorings deployed since 2013 north of Svalbard are used to describe changes in the Atlantic water properties, vertical structure, and dynamics on monthly to seasonal and interannual time scales and their links to the upstream conditions and local and regional atmospheric forcing. Vertical heat fluxes from the Atlantic layer are derived to evaluate the ocean-air and ocean-sea ice exchanges in the only region of the Arctic Ocean where Atlantic-origin water has still contact with sea ice cover.