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Unprecedented decline of sea ice thickness in Fram Strait in 2017-2018

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Fram Strait is the major gateway connecting the Arctic Ocean and the northern North Atlantic Ocean where about 80 to 90% of sea ice outflow from the Arctic Ocean takes place. Long-term observations from the Fram Strait Arctic Outflow Observatory maintained by the Norwegian Polar Institute captured an unprecedented decline of sea ice thickness in 2017 – 2018 since comprehensive observations started in the early 1990s. Four Ice Profiling Sonars moored in the East Greenland Current in Fram Strait simultaneously recorded 50 – 70 cm decline of annual mean ice thickness in comparison with preceding years. A backward trajectory analysis revealed that the decline was attributed to an anomalous sea level pressure pattern from 2017 autumn to 2018 summer. Southerly wind associated with a dipole pressure anomaly between Greenland and the Barents Sea prevented southward motion of ice floes north of Fram Strait. Hence ice pack was exposed to warm Atlantic Water in the north of Fram Strait 2 – 3 times longer than the average year, allowing more melt to happen. At the same time, the dipole anomaly was responsible for the slowest observed annual mean ice drift speed in Fram Strait in the last two decades. As a consequence of the record minimum of ice thickness and the slowest drift speed, the sea ice volume transport through the Fram Strait dropped by more than 50% in comparison with the 2010 – 2017 average.