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What happens with Atlantic Water entering the Arctic Ocean through the Fram Strait?

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We present some results of recent long-term mooring-based observations, carried out in the Nansen Basin of the Arctic Ocean between Svalbard and Franz Josef Land. This region is remarkable since it is the one where inflowing Atlantic Water transforms from a surface current into an intermediate depth flow, and a large amount of ocean sensible heat is released to the atmosphere. The mechanism behind this transformation is rather speculated than known. According to one concept, upon entering the Nansen Basin, Atlantic Water descents (literally “dives”) below the surface Arctic water, which moves in the opposite direction. Another version considers gradual cooling and freshening of the upper part of Atlantic Water on its way forward without substantial sinking. Occasional hydrographic surveys, carried out in the past, do not allow discriminating between these hypotheses. Our measurements provided detailed information on the water properties, currents and their temporal variability within a two-year long span. Novel findings of these observations are the following. Regular seasonal signal in temperature and salinity records dominates over the other variability modes down to 215 m depth and is still distinguished at 470 m. Amplitude of temperature variation decreases from 7ºC at 60 m to 1 ºC at 470 m. Time lag between annual temperature/salinity minima at the closest to the ocean surface measured depth (60 m) and at 215 m is about 1 month. Minimal temperature is observed in May-June. Temperature/salinity maxima at both depths are observed synchronously in November. Ocean currents in the upper part of the water column (between 60 and 215 m) are highly correlated. Mean current direction is north-east with maximum speed (18 cm/s) at 215 m. Basing on these results, we conclude that starting from 60 m depth (at least)

the motion of Atlantic Water is unidirectional and no persistent counter-flow occurs. Strong seasonal variation of water properties points out that cooled and freshened Atlantic Water might be the major contributor in formation of the upper mixed layer in this part of the Arctic Ocean.