Changes of the West Spitsbergen Current properties and their climatic implications

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Significant variability of the properties of the Atlantic Water, carried by the West Spitsbergen Current has been observed by Institute of Oceanology PAS during the last eighteen summers. Changes in the Atlantic Water temperature, heat content and northward transport have a strong influence on the Arctic climate and ecosystem. This study was conducted during the AREX project. Since 2000 the regular grid of approx. 200 CTD/ADCP stations has been repeated, and continuous measurements of currents were performed between the stations by the vessel-mounted ADCP.

AREX cruises
Analyses is based on the data collected by Institute of Oceanology PAS since 1996. Every summer, Institute vessel R/V ‘Oceania’ conducts research in the region between the northern Norway and Fram Strait under the AREX project. Since 2000 the regular grid of approx. 200 CTD/ADCP stations has been repeated, and continuous measurements of currents were performed between the stations by the vessel-mounted ADCP.

Horizontal distributions of temperature and geostrophic currents at 100 dbar in summers 2000-2015

Time series of the mean Atlantic Water properties

Black line – mean for the whole study area
Red line – southern part (south of the 74°N)
Blue line – northern part (north of the 74°N)
Atlantic Water parameterized as: T°C. C · S ≥ 34.25

Temperature (°C)

Salinity

AW layer heat content (10^{24} J)

AW layer thickness (m)

AW layer volume (10^{24} m³)

References


Long-term variability at section N°

The section ‘N° along 76°30’N is the longest IDUPS time series. The pronounced changes of AW temperature and salinity with a period of 5 years have been found. There is strong positive correlation between AW temperature and salinity, except for the period 2010-2012.

Diversity and longitude and the climate sea area between the Norwegian Sea and North Pole, and ice free area (ratio) north of Svalbard.

The correlation between AW temperature and ice conditions (area free of ice) north of Svalbard

The oceanic heat transported with AW by the northward boundary and currents across the 73°30’ parallel divergers:
- 75% of heat flows in the Arctic Ocean through Fram Strait;
- 54% goes eastward to the western Greenland Sea (recirculation);
- 25% of heat is transferred to the atmosphere.

It results in 90 W m⁻² of yearly mean heat flux between ocean and atmosphere

NCEP/NCAR for the northern WSC:
- Test: 107 W m⁻²
- Real: 187 W m⁻²

The inflow of Atlantic origin waters into the Nordic Seas, as well as their cooling, freshening, recirculation, and conversion, on their way towards Fram Strait, has high importance to the global thermohaline circulation. In addition, AW is the main source of heat and salt for the Arctic Ocean.