



Interrelation of polynyas of Siberian shelf seas and thermohaline characteristics in Fram strait

A.Rubchenia

(1) St-Petersburg State University, Department of Oceanology (pp6077@mail.ru)

Influence of Arctic on a global climate is realized through ocean, in particular - through its most active surface layer and sea ice. The surface layer of Arctic ocean with sea ice makes the significant role in formation of the Arctic's influence on a global climate. Return influence of anomalies of a climate of polar areas on a global climate is connected to change of amount of sea ice on a surface of polar oceans and maintenances of fresh water in their upper layer, whence they act in adjoining areas of world ocean and influence intensity of mixing, heat exchange with an atmosphere and oceanic mass transfer and heat transfer to high latitudes.

Well-known, that the basic source of new ice for the Arctic basin are shelf arctic seas. As has shown in papers (Zaharov, 1996) up to 70 % of volume of new ice of the seas of the Siberian shelf are produced in flaw polynyas of the appropriate seas. Conclusions of Zakharov concern to 1960-70th to years of 20th century. According to investigations of A.Popov (Popov, 2000), these years repeatability and the areas polynyas in the seas of the Siberian shelf were minimal. From 1970th to 1990th there was a significant increase as areas, and repeatability of episodes of existence polynyas. Sizes of repeatability have increased from 30-60 % up to 80-100 %, i.e. many polynyas went from the category incidental went in a class of constant polynyas. Thus the area of many polynyas has increased in 2-5 times. Calculations of new ice production were executed by various techniques the calculations (Sabinin, 1960; Martin, Cavalieri, 1989; Cavalieri, Martin, 1994). We found, that ice production of polynyas, at their significant development can exceed in 2-3 times ice production of all sea surface (excluding flaw lead polynyas), calculated without taking into account carrying out of ice.

Further the most part of new ice is involved in system of superficial currents of Arctic Ocean and taken out in the Arctic basin. In process of promotion in the Arctic basin new ice pass numerous seasonal cycles of increase and thawing. Nevertheless, receipt of the big volume of new ice from Siberian shelf area, should create significant indignations in climatic system. And the climatic signal caused by formation of the big volume of new ice in polynyas is shown twice. First, it occurs at the period of direct formation of ice, owing to an intensification energy and mass exchange between ocean and an atmosphere. In the second, here arise, so-called distant connections in climatic system. Formation of ice in polynyas is accompanied by genesis of new water weights. Ice and the formed water are involved in system of currents of Arctic Ocean. After numerous seasonal cycles of increase and thawing, through the certain time named "reaching time", this ice will arrive through Fram Strait in the Euro-Arctic seas. Big volume of the ice which has arrived from places of origin and in Fram Strait will be significant enough. Thus, ice transfers a climatic signal to area of the origin in the Euro-Arctic seas and further to Northern Atlantic. Carrying out of significant volumes of ice to Greenland Sea and Northern Atlantic stimulates occurrence here significant anomalies thermohaline characteristics. That in turn influences a mode of convective processes, results in an aggravation polar and sub-polar hydrofronts and as consequence results in an intensification of system of currents Gulf Stream - North Atlantic - Norwegian. Alongside with it, there is an aggravation of atmospheric fronts. Apparently, the similar script of development of events can be used for an explanation of a phenomenon of substantial growth of temperature of the Atlantic waters, marked in 1990th years of 20th century and the beginning of 21th century.

In view of the aforesaid, was executed correlation analysis of interrelation of long-term changes ice production of seas of the Siberian shelf and thermohaline structure of waters of Fram Strait and Greenland Sea. For the analysis time series of total volumes of the ice formed both in separate polynyas, and in the seas as a whole during all period of ice formation (November - May) in 1978-2004 years were used.

There is statistically significant connection of characteristics of polynyas and thermohaline conditions in Fram strait. Correlation coefficients change in limits from 0.46 up to 0.8, all factors are positive. Time shift changes from -2 years till +6 years. As it was marked above, new ice for a way from areas of formation up to Greenland Sea pass a number of cycles of seasonal transformations, therefore the initial climatic signal is a little shaded. The least influence the ice formed in polynyas of the Kara and Laptev Seas render on formation of thermohaline structure of waters in the central area of Fram Strait. Factors of correlation change from 0.53 till, and time shifts change from -7 up to +3 years. In all other cases the increase of production of ice in polynyas outstrips increase of salinity and temperatures of waters of the given area.

Influence of long-term changes in ice production in polynyas on formation thermohaline structure of waters in other areas of Greenland Sea is considerably more expressed. So connection of time series of integrated anomalies of ice production in polynyas of Kara Sea and temperature of West Spitsbergen current waters is described by very high positive factors of correlation, they change in limits from 0.83. Time shift changes from +1 years till -6 years (+2..+3 years mainly). The greatest factors of correlation (0.9) are received for connection of numbers of ice production in polynyas located at east coast of Novaja Zemlya and changes of temperature on horizon of 1000 meters, at time shift in 2-3 years. The increase of ice production outstrips increase of temperature at 2-3 years. Influence of polynyas of Laptev Sea is a little bit less, but also is rather significant. 2-3 years is traveling time of new ice, produced in these seas, to Fram strait. There is no pronounced interconnection of ice production of East-Siberian Sea and Chukchi Sea, probably due to remoteness of these seas from Fram strait.

It seems that there is pronounced interconnection of ice production in polynyas of Kara and Laptev Seas and thermohaline characteristics in Fram strait, in particular, increase of ice production in flaw lead polynyas outstrips increase of temperature in West Spitsbergen current at about 3 years.

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