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Influence of Flaw Polynyas on Formation of Ice Cover Anomalies of the Arctic Seas

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The reasons of formation of the abnormally small areas of a sea ice cover in the seas of the Siberian shelf are considered in this report. These extremes of ice cover were noted in August-September 1990, 1995 and 2005-2007. An assumption of possible development of an ice cover the nearest years is given in this report too. It is known, that for all period of observations since 1940, there are six extreme minima of the area of sea ices - in 1945, 1990, 1995 and in 2005-2007.

On the basis of the intermutual analysis of time series of values of the areas of a sea ice cover in the separate seas and the Siberian Arctic waters as a whole, the relative contribution of each of the seas to formation of total ice cover is shown. In conformity with the author's concept about defining influence of flaw polynyas on formation of ice cover conditions during the summer period, a retro-forecast of ice cover for the specified years was executed. We got that deviation between real data and predicted values was no more than 10%. It is obtained, that if influencing flaw polynya in February-May exceeds norm in 1.5 - 14.5 times, the area of sea ices cover in the corresponding sea in August-September will be less than the normal value in 1.2 - 17 times. The return is true too: if during the winter and spring period in this or that sea of a flaw polynyas are developed poorly, or are closed in general, during the summer period in the given sea will be observed abnormally high ice cover.

Unique explanation of high values of factors of correlation of communication of time numbers of the areas of flaw polynyas and ice in Siberian shelf seas can be influence of winter ice cover conditions on features of reorganization of atmospheric circulation. In connection with rather short period of thawing of sea ice in Arctic regions, occur-

rence of large anomalies of ice cover is defined by creation of significant anomaly of absorbed solar radiation. Anomalies of absorbed solar radiation arise under influence of changes of such factors as albedo and ice concentration. The greatest anomalies of albedo and ice concentration appear during the spring period with the development of significant flaw polynyas. Atmosphere pressure situations which have provided extreme development of each flaw polynyas and rendered significant influence on formation it is abnormal the small areas of an ice in the corresponding sea were considered.

Thus, extremely small (or extremely great) areas of a sea ice cover observed last twenty years in the seas of the Russian Arctic regions, are connected with extreme changes of general dynamics of an atmosphere and ocean, during the winter and spring period previous to noted extremes of ice cover. The considered mechanism defines influence of flaw polynyas limited by one concrete season. However, in works of the author it is shown, that by means of generation of long-distance connections in climatic system, flaw polynyas are capable to influence on thus, extremely small (or extremely great) areas of sea ice observed last twenty years in the seas of the Russian Arctic, are connected to extreme changes of general changes of an atmosphere and ocean interaction, in the winter and spring period previous to marked ice cover extremes. The considered mechanism determines influence of flaw polynyas limited to one concrete season. However, in works of the author it is shown, that by means of generation of long-distance connections in climatic system, flaw polynyas are capable to influence on ice cover and hydrometeorological conditions of the seas of the Siberian shelf through rather long time intervals.

In 1996 famous climatologist J.F.Zakharov has shown, that “Ěthe most important reason of fluctuation of the area of sea ice in Arctic regions during a cold season are changes of vertical structure in the top layer of ocean” (Zakharov, 1996) and, as consequence, increase of the area of sea ice in the North-European basin. It is known, that the greatest influence on formation of this or that water weight is rendered with those factors which result in change of volume of the most water weight.

Numerous researches both Russian, and foreign scientists, allow to approve, that changes of the area of sea ice cover in Greenland sea substantially determined by variability of conditions of cyclone genesis in Northern Atlantic and influence what tracks will distribute these new cyclones. At displacement of an edge of ice in Greenland Sea to the north, cyclones are distributed on high-altitude tracks. More southern arrangement of an edge promotes that cyclones from area of origin follow on middle-latitude tracks. To the greatest degree these properties of sea ice of Greenland Sea are shown at their extremely big (or extremely small) development.

On the basis of the theory of Arctic halocline, developed J.F.Zaharov (Zakharov,

1996), and as a results of investigations executed by the author, we could put forward a hypothesis that increasing or reducing, concerning norm of an flaw polynya the increasing or reducing volumes of young ice produceâ in polynyas. The fresh water contains in these ice is included in fresh-water balance of Arctic Ocean and starts to influence on formation of vertical structure of a surface layer of an ocean. Through time named “reaching time” fresh-water anomaly reaches Northern Atlantic and further through ice in Greenland Sea influences on changes of atmospheric circulation in the winter period. More northern tracks of cyclones provide significant development of flaw polynyas in the winter period and accordingly smaller ice cover in the summer. And on the contrary, movement of cyclones on southern tracks lead to oppression of flaw polynyas and increasing of ice production in Siberian shelf seas. Being based on the mentioned above hypothesis, we have assumed, to all anomalies of the areas of flaw polynyas there corresponds anomaly of ice cover in Siberian shelf seas noticed through “reaching time”. Comparison of such qualitative super long-term forecast with the fact sheet has revealed concurrence at 88-94% cases, for the different seas. In a case when the climatic signal from the several seas simultaneously reaches Greenland Sea there is a significant anomaly of sweetening and ice cover, capable to result in sharp change of a climatic situation. The similar situation has arisen in 1963-1964 years when on open spaces of Atlantic has left, so-called “Great Salinity Anomaly”. Changes of atmospheric circulation appeared are so significant, that ice cover in Arctic regions has rather sharply increased and the temperature of air has gone down. In our opinion similar conditions have appeared in the present time, when after several years of extreme development of flaw polynyas extreme sweetened anomaly which reaching of Greenland sea is possible to expect in 2008. In conformity with this hypothesis it is possible to expect reduction of the areas of flaw polynyas next years, and in the following summer period - toughening of ice cover conditions in Arctic regions in the winter. And, as shows our super long-term forecast, increasing of ice cover will be observed during a comparatively long period - at least, till 2012. Thus, we stand on a threshold of the period of a cooling of the Arctic.

1.Zakharov V. Marine ice in global Climate system (monograph) // St-Petersburg, Russia, 1996.