Geophysical Research Abstracts,
Vol. 11, EGU2009-14098, 2009
EGU General Assembly 2009

Characteristics of forming mutiyear sea ice in modern climatic conditions

P.V. Bogorodsky and A.V. Pnyushkov
Arctic & Antarctic Research Institute, St.Petersburg, Russia

The goal of the work was to study the thermodynamic evolution of sea ice in modern climate conditions. The model describes repetitive changing the processes of winter ice growth, snow summer melting and dissolution of ice upper layer and its autumn re-crystallization. Ice block uses classical (frontal) variant of Stefan problem and takes into consideration the processes of melt water pool forming and freezing which are often absent in the analogous models. The essential values of ice cover surface which is not identified with air temperature are calculated from heat balance. As atmospheric forcing the repetitive data of atmospheric NCEP/NCAR reanalysis for 2006-2007 years are used.
According to calculations for the North Hole point the forming of modern multi-year ice cover is slower than in the former years. For 10 years its maximal thickness slightly exceeded 4 m and did not reach thermodynamically equilibrium value. The important parameter affecting ice thickness evolution is the rate of melt water drainage during period of melt pool forming. The difference of ice thicknesses for 10 years at average drainage rate between 0 and 1 cm/day was close to 2 m that is equivalent to constant heat flow from the ocean equal to 3 W/m2. The result most close to characteristic melt water pool average depths (0.2 m) correspond to drainage rate of 1 cm/day. With the beginning of cooling the compensation of heat flux to the atmosphere occurs in consequence of melt water layer crystallization. Therefore, sea ice thickness does not increase as long as the liquid thickness reaches some critical value determined by its initial salinity and depth. Taking into consideration the significant area occupying by the melt ponds as well as their depths it is obvious that the over ice water layer is a qualitative element of ice cover those forming and re-crystallization considerably determines evolution of sea ice depth.

The work was supported by Russian Foundation for Basic Research (projects ## 07-05-00393 and 08-05-00129).