Analysis of the satellite data of the sea ice extent dynamics related to incoming solar radiation

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According to astronomical ephemerides, we calculated the values of coming to the top of the Earth`s atmosphere solar radiation from 3000 BC to 2999 AD. The database of the incoming solar radiation was created for 5 degree latitude zones with a time step of 1/12 of the tropical year. The change of the solar activity was not taken into account. The obtained values of incoming solar radiation were compared with satellite observations data of the sea ice extent in the Northern Hemisphere from 1979 to 2013. Two indicators of the sea ice cover were analyzed. This is the maximum and the minimum sea ice extent.

We have shown that the reduction of the sea ice extent is highly correlated with spatial and temporal variations of the incoming solar radiation. The higher correlation between the incoming solar radiation and sea ice extent marked while taking into account the accumulation of solar radiation. This is evidence of the heat accumulation in the ocean and atmosphere due to the incoming solar radiation. Thus, the reduction of the sea ice cover is associated with the enhanced greenhouse effect. We have identified close relationship between long-term variability of the sea ice extent and difference of the solar radiation coming to the Equatorial and polar region of the Northern hemisphere. This proves participation of the intensification of the inter-latitude heat transfer in the reduction of the sea ice cover. The inter-latitude heat transfer is enhanced by significant decreasing incoming solar radiation to Polar Regions and some increasing incoming solar radiation to the equatorial region. This effect is determined by the secular changes of the tilting of the Earth's rotation axis. Thus, on the basis of satellite and solar radiation data we have identified two factors which determine secular trends of the sea ice extent. The first is inter-latitude heat transfer. The second is the greenhouse effect probably associated with increasing water vapor in the atmosphere and its condensation. The consequence of the intensification of these factors is the trend to reduction of the sea ice cover in the Northern Hemisphere.

Biography:

Pavel Grebennikov Graduated from the Department of Landscape science of the Geographical faculty of the Lomonosov Moscow State University in 1998. Specialty – landscape science. He is presently working as a scientific researcher of the Snow avalanches and Debris flows Research Laboratory, Geographical faculty, University from 1999. Research Moscow State interests are the sea ice and its role in the interaction of the ocean and atmosphere.

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Valery Fedorov is a Senior Researcher, Faculty of Geography, Lomonosov Moscow State University, and the PhD of geographical sciences. He is Author of more than 100 scientific papers (including 5 monographs) in geophysics and geography. Research interests: the study of spatial and temporal variations of the incoming solar radiation and global climate change. (http://www.solar-climate.com/en/indexen.htm).
http://www.geogr.msu.ru/structure/labs/geos/personal/fedorov.php