



Time-varying imagery of ice features dynamic scattering in presence climate change: polytypical lakes Ladoga and Peipus as example

V. Melentyev (1,2), K. Melentyev (3), L. Pettersson (4), and M. Mushkudiany (2)

(1) Scientific Foundation “Nansen International Environmental and Remote Sensing Center”, St. Petersburg, Russia, (vladimir.melentyev@niersc.spb.ru), (2) State University of Aerospace Instrumentation (GUAP), St. Petersburg, Russia, (3) St. Petersburg Branch of the State Academy of Custom, St. Petersburg, Russia, (4) Nansen Environmental and Remote Sensing Center (NERSC), Bergen, Norway

The Problem of dynamical instability of ice conditions and modification of ice regime of polytypical lakes owing to global warming was investigated using time-varying satellite imagery. Deep-water Lake Ladoga and shallow-water Lake Peipus both situated at the north-western part of Russian Federation in moderate climatic zone but possessed different heat capacity were used for comparative studies. The comprehensive analysis of ERS/RADARSAT/Envisat SAR images was provided using the results of long-term studies of thermal structures of these inland water bodies and peculiarities of their variability during open water season as well calculations of heat supply in different weather conditions.

1993-2008 NERSC/NIERSC SAR archive as well materials sub-satellite experiments on board research vessel and research aircraft since 1960-s is used. Shipborne observations were used for validation satellite information. Thematic interpretation of satellite data shows that SAR signature of ice could be applied as tracer of various natural processes and phenomena, including climatically and ecologically important ones. As result dependence of hydrological features and the time of freeze-up and ice destruction in both selected lakes in consequence of climate change and softening of winter severity in nowadays was assessed.

Wind regime patterns (speed and direction) were analyzed using algorithm CMOD 4 and in the upshot the increase of seasonal and regional variability of windy weather in studied regions was fixed. In frame of these studies wind cadastre appurtenant to the NW part of RF was composed on the basis of satellite SAR survey. In particular the modification of “wind climate” was disclosed. And what is more: it was revealed that intensification of windy weather resulted in intensification of dynamic range of water and ice exchange between the central part of both studied polytypical lakes and their gulfs. These natural processes took place due to widening duration of the open water period and growth of heat capacity of well-warmed now inland water bodies.

Thematic interpretation series of consecutive satellite survey allows providing classification SAR signatures of different types of ice. It allows revealing domination now of new, nilas and young types of ice that is thinning of ice with growth number fractures, polynyas and other openings following intensification of rafting and hummocking of ice. It allows also fix formation of vortex and rotten ice zones. Study this dangerous phenomenon allows authorizes eddies and rotten ice with seiche phenomenon and connects its appearance with intensification cyclonic circulation due to mild fall-winter seasons in nowadays.