IOCMSE 2025 Conference
The 1st International Online Conference on Marine Science and Engineering
24–26 November 2025 | Online
MDPI

Assessment of the sea age composition in the Laptev Sea

Anna B. Timofeeva[1], Ruslan I. May[2], Andrey V. Rubchenia[3]

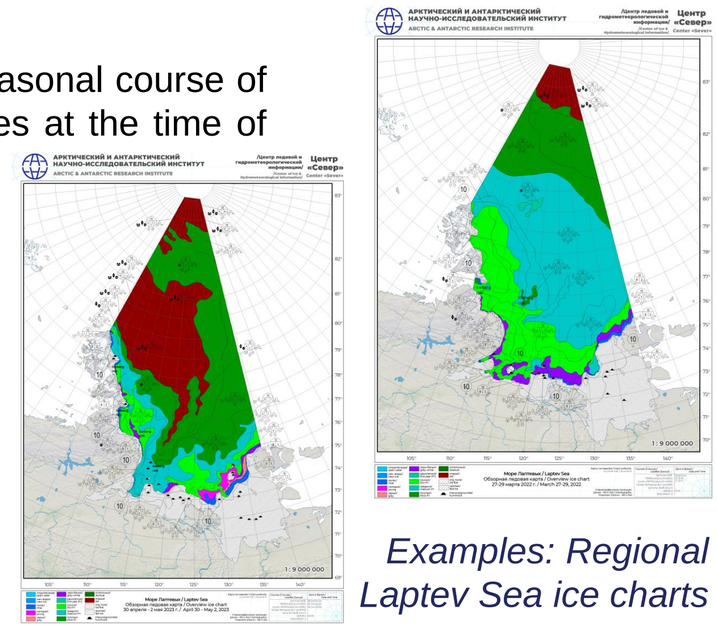
[1] Arctic and Antarctic Research Institute (AARI), St. Petersburg, Russia
[2] Krylov State Research Center, St. Petersburg, Russia
[3] State Oceanographic Institute, St. Petersburg Branch (SPBSOI), St. Petersburg, Russia

INTRODUCTION

The age composition of the Laptev Sea ice cover is considered in the autumn-winter period. The seasonal course of the ice development was estimated from October to May in 1997-2024, as well as interannual changes at the time of maximum increase (April-May).

DATA & METHOD

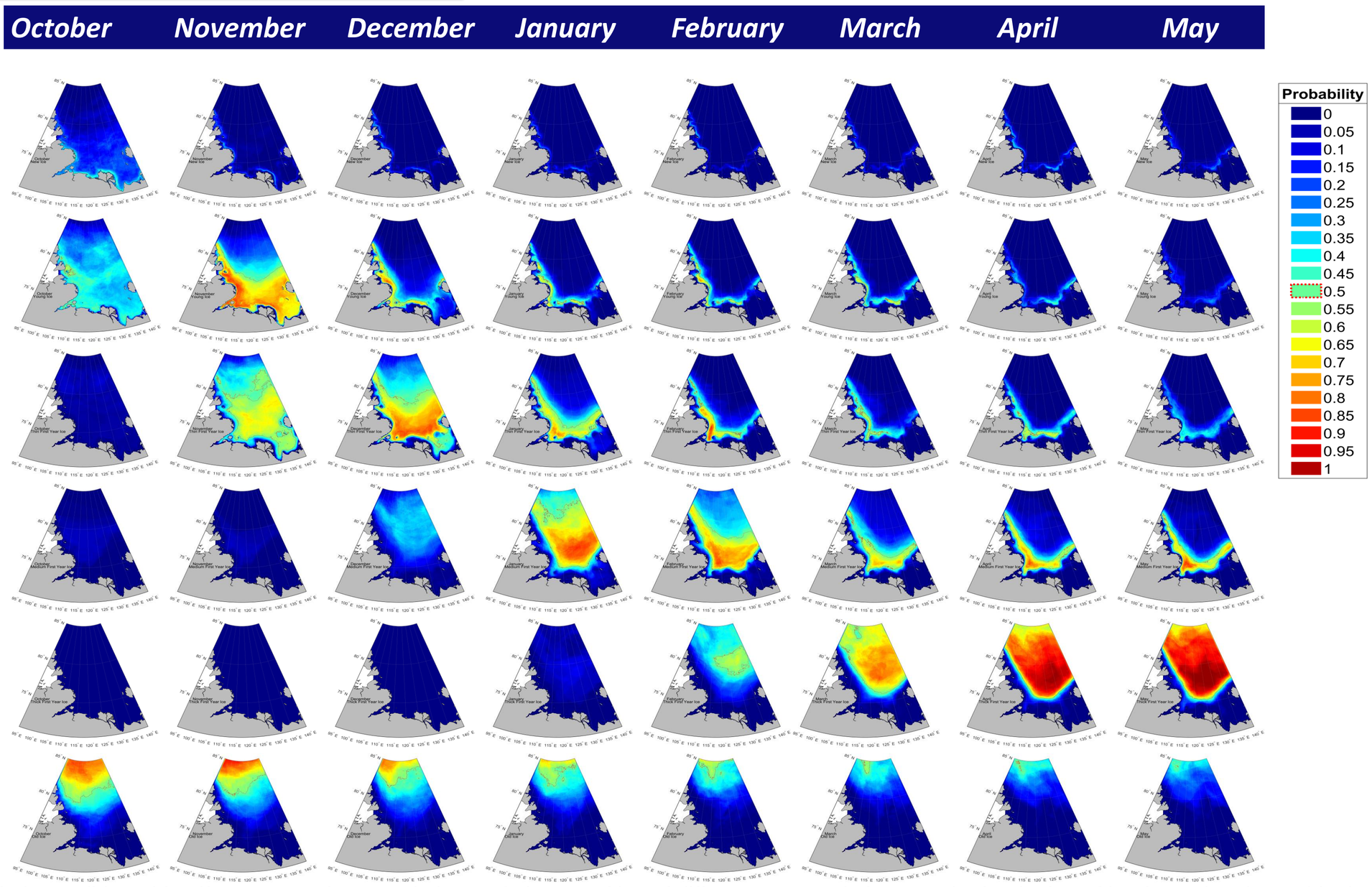
Regional Laptev Sea charts of the ice conditions, compiled by the AARI (available in the electronic catalog of the World Sea Ice Data Center), were used as the data source. Regional charts are the result of analyzing satellite information in 2-3 days made as SIGRID-3 format. The spatial and temporal variability of sea ice with different stages of development (new ice, nilas, gray and gray-white ice, one-year thin, medium, thick and old ice) was analyzed using the method of probability calculated by polygon intersections.



Examples: Regional Laptev Sea ice charts

RESULTS

Seasonal course



New ice (*frazil ice, grease ice, slush, shuga , nilas up to 10cm thick)*

Young ice (*Grey, 10-15 cm and Grey-white, 25-30cm thick*)

Thin first-year ice (*30-70 cm thick*)

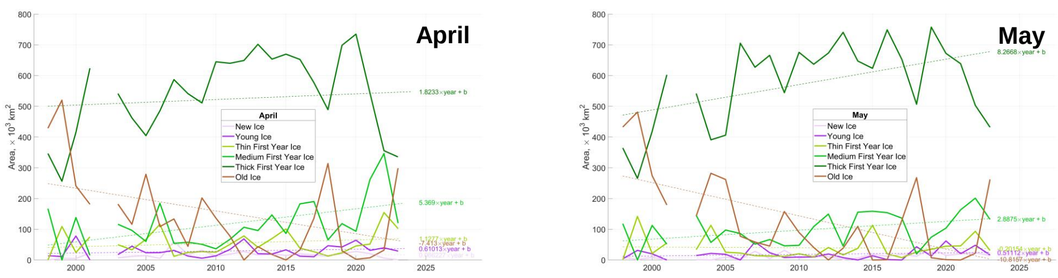
Medium first-year ice (*70-120 cm thick*)

Thick first-year ice (*over 120 cm thick*)

Old ice (*has survived at least one summer's melt*)

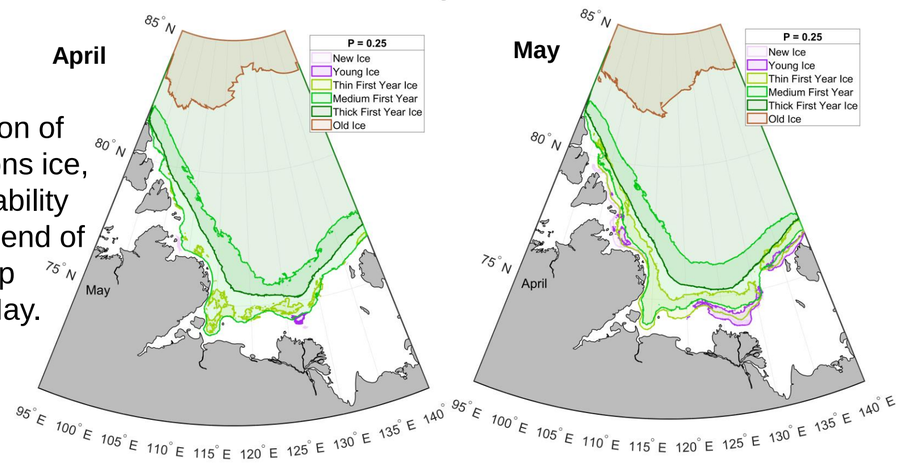
The analysis of the seasonal course made it possible to identify patterns of accumulation and change of ice of different age gradations. At the beginning of ice formation the residual ice stays on water area with high recurrence, there is Taimyr ice massif that did not melt during the summer season. Until the first decade of November, young (gray and gray-white) ice prevails, accounting for more than 60%. The transition to the gradation of first-year thin ice begins in mid-October at the north of the sea among the residual ice. The predominance of first-year thin ice in the sea area with a high recurrence occurs in December. With a r recurrence of about 30%, the transition of ice to the gradation of the medium first-year ice in the north of the sea among the residual is already observed. In general medium first-year ice become predominant from the second decade of January and remain so until mid-March. Since mid-January, in the process of increasing the thickness of some of these ice gradually passes into the gradation of first-year thick ice, which has prevailed since the third decade of March, their number varies slightly in the following months. The old ice is gradually being pushed out from the sea area during the winter season.

Interannual variability of different sea ice age gradations area



In April - May, at the time of the maximum development of the ice cover, first-year thick ice prevails in the sea. Their amount has been trending positively since 1998 due to a decrease in the amount of old ice (correlation coefficients -0.76 and -0.89, respectively, for April and May). In recent years, there has been a significant increase in the amount of medium first-year ice, which indicates a slower transition to the thick ice.

The spatial distribution of various age gradations ice, averaged from probability fields, formed at the end of the ice cover build-up period in April and May.



CONCLUSION

Polygons of the probability of the presence of various ages gradations ice of in the Laptev Sea have been obtained. The patterns of accumulation and change of various ages gradations ice are revealed. An average ice distribution is obtained based on the probability polygons at the time of maximum ice cover build-up. Assessment of interannual fluctuations demonstrate a tendency to shift the timing of the transition to the next age gradation to later ones, as well as a tendency to reduce the number of old and increase first-year thick ice.