Prediction of summer Arctic sea-ice distribution with a statistical method

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Arctic Sea Ice Information Center predicts the arctic sea ice distribution from July 1 to September 20 and publishes it on the website in May, June, and July each year. A base of the sea ice forecast method is following Kimura et al (2013). The method assumes that there is a correlation between the sea ice divergence/convergence (SID) from winter to spring and the detrended sea ice concentration (DSIC) in summer. This is because when SID is high, sea ice thickness gets thick and sea ice becomes hard to melt away.

This year, new parameters; sea-ice age (SIA), mean divergence of ice motion (MDI), and an accumulated absolute divergence/convergence of ice motion (AADI) were introduced to that method. These parameters are obtained by backward tracking of sea ice for 4 years (SIA and MDI) or 3 months (AADI). When the particle reaches open ocean area, we assume it to be ice production. In this way, we can determine the SIA. Also, MDI and ADDI are calculated by sea ice divergence and convergence during the life of sea ice. SIA, MDI, and AADI represent the resistance to melting of sea ice related to the ice age or thickness. Ice predictions in the first, second, and third reports are performed by the multiple regression analysis of DSIC, SID, SIA, and MDI, of DSIC, SID, and AADI, and of DSIC, SID, and SIE, respectively.

The predicted ice cover of the September 10 in the first, second, and third reports are shown in Fig 1. There is no significant difference between them on the Russian side, while sea ice distribution on the Beaufort Sea and the Kara Sea is different. The effect of the old ice tongue in the Beaufort Sea is greatest in the third report. The accuracy of these predictions is verified by comparing them with observation, and studies are underway to develop more accurate forecasting methods.

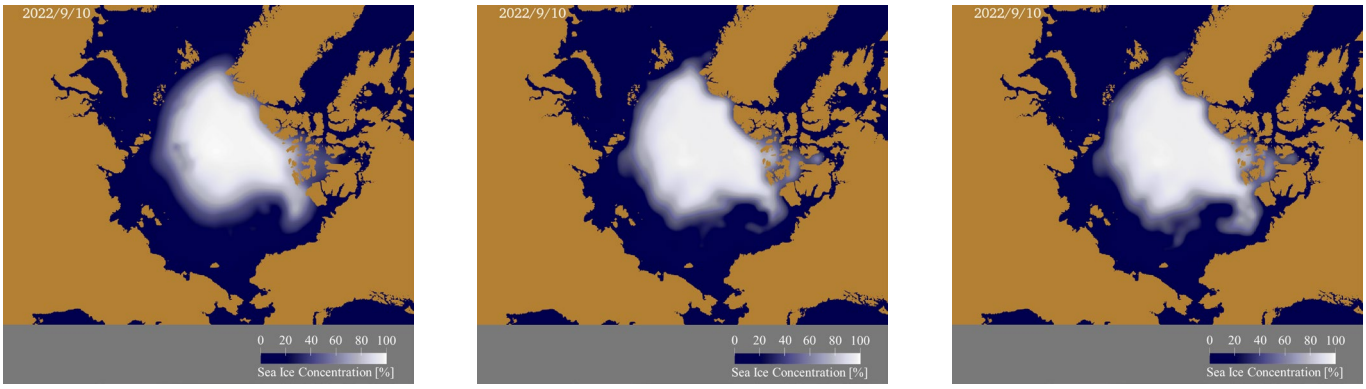

Fig 1: The results of the September 10, 2022 prediction conducted in the first (Left), second (Middle), and third (Right) reports.

References

N. Kimura, A. Nishimura, Y. Tanaka and H. Yamaguchi, Influence of winter sea ice motion on summer ice cover in the Arctic, Polar Research, 32, 20193, 2013.