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The Preliminary Results of Iceberg Drift Studies in the Russian Arctic Throughout 2012–2017

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Icebergs greatly influence the operational regime of hydrotechnical structures in the Arctic offshore waters. In this paper we focus on the preliminary results obtained for the iceberg drift in the Kara and Laptev Seas. Initial data were collected with the help of radio buoys during the 2012–2017 field surveys. Key drift parameters, such as velocity and its variability in summer and winter, are discussed. The differences between the iceberg drift patterns in these seas can be explained by the difference in mass and size of icebergs from the Novaya Zemlya and Severnaya Zemlya archipelagos. Due to this fact, ice cover and water drag influence these groups of icebergs in a different way.

INTRODUCTION

Icebergs cause high risks for navigation; their drift is among the factors influencing the safety of hydrotechnical objects in the Arctic Offshore (ISO, 2016a). Despite the significant progress of technical means since the infamous iceberg-caused tragedies of the 20th century, with enormous human and ship losses ("Titanic" in 1912, "Hans Hedtoft" in 1959), minor incidents (the oil tanker "Overseas Ohio" in 1994) and near-emergency events ("Sea Rose" FPSO in 2017) (Tangborn et al., 1998; Hill, 2000; C-NLOPB, 2018) are still observed.

Understanding the patterns of iceberg drift and the respective morphometric parameters is essential for designing hydrotechnical structures and ensuring safe exploration of hydrocarbon deposits in the seas of the Russian Arctic. Drifting and entering the waters near the prospective deposit icebergs significantly influences the operational regime of hydrotechnical structures, choice of supply vessels, and ice management systems, etc. For many regions of the Russian Arctic, the data on the iceberg drift are unavailable or scarce.

Therefore, supported by the Rosneft Oil Company and the Arctic Research Center, AARI completed 12 interdisciplinary expeditions in the Barents, Kara, Laptev, East Siberian, and the Chukchee Seas. Four of them were performed under conditions of maximum ice extent (2013–2015 and 2017) and eight in the open water season (2012–2017). Moreover, a winter expedition of 2015 became the largest in the world over the last 20 years in terms of scope of work (Rosneft, 2015). One of the objectives of these expeditions was investigating the drift of icebergs and ice floes in the Kara and the Laptev Seas; the task involved using radio buoys allowing for detection of coordinates and signal transmission. In some water areas, it was the first time buoys were used for such purposes. Thus, the large sets of data collected are unique; their analysis allows one to plot a trajectory of a specific ice formation over the buoy lifetime and calculate its drift parameters. This experience was partially summed up in Neftyanoe Khozyaystvo (2015). An overview of the winter drift of icebergs and ice floes surveyed in 2013–2015 is given by Buzin et al. (2016).

In the present work, we analyzed the drift of icebergs based on data gathered throughout 2012–2017. Below, we provide descriptive characteristics of their drift in the southwestern Kara Sea and the Laptev Sea. We analyzed the ice cover period, the period when ice cover decays and water gets free of ice, and the period when ice formation begins. In addition, we described icebergs drifting in the Vilkitsky Strait and those moving off the eastern coast of Novaya Zemlya, as these regions are essential for navigation and not well-studied in terms of ice management systems.

THE USE OF RADIO BUOYS IN ICE DRIFT SURVEYS AND RESULTS OBTAINED OVER 2012–2017

The use of radio buoys allowing for detection of coordinates and signal transmission (i.e., GPS buoys) is a conventional practice in both scientific and applied studies of the dynamics of ice formations. A radio buoy locates an ice formation and transmits its geographic coordinates together with a set of associated parameters to a consumer via satellite communication systems. Such devices are actively used for scientific purposes (IABP, 2019; Hutchings, 2007; Hutchings et al., 2010; Lei et al., 2016). Moreover, radio buoys have been approved as a tool for collecting data for hydrotechnical structure design and as a component of technological arsenal aimed to ensure proper functioning of ice management systems (ISO, 2016a, 2016b). In the Atlantic sector

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KEY WORDS: Radio buoys, icebergs, drift parameters, southwestern Kara Sea, Laptev Sea, ice hazards, iceberg database.