Preliminary results of the ice cover drift studies performed in the 2013-2017 winter surveys in the Russian Arctic seas

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ABSTRACT

The drift of ice floes is what defines the ice loads on hydrotechnical structures, mode of their operation, choice of supply vessels, ice management systems, etc. In comprehensive winter surveys performed on behalf of Rosneft Oil Company over 2013-2017 on the shelf of the Kara, Laptev, and East Siberian Seas, radio buoys allowing for detection of coordinates and signal transmission were used to monitor the drift of ice floes. The paper considers the experimental setup and equipment used, presents the main results of the studies. The obtained data were analyzed to explain the patterns of the drift of large fields of compact ice, the drift velocities of ice formations, their variability (i.e., parameters specified in the documents regulating activities on the Arctic shelf) and dependency on seasonal extrema of the ice thickness.

KEY WORDS: ARGOS system radio buoys, ice floes, drift and trajectories.

INTRODUCTION

The ice cover drift parameters are crucial for designing various types of offshore structures and safe operation of hydrocarbon deposits in the Russian Arctic. The ice cover drift determines the loads on the structure, its operational regimen, the choice of supply vessels, and ice management systems. For many regions of the Russian Arctic, the data on the ice drift are unavailable or scarce. Between 2012 and 2017, supported by the Rosneft Oil Company and the Arctic Research Center, AARI completed 12 interdisciplinary expeditions in the Barents, Kara, Laptev, and East Siberian Seas. Four of them were performed under conditions of maximum ice extent (2013–2015 and 2017) and eight in the open water season (2012–2016) (Fig.1). The winter expedition of 2015 became the largest Arctic expedition in the world over the past 20 years in terms of the scope of work (https://www.rosneft.com/press/news/item/174511/). One of the objectives of these expeditions was to investigate the drift of icebergs and ice floes in the Kara, Laptev, and East Siberian 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. The data sets collected are unique in many respects. The analysis of these data allows one to plot a trajectory of a specific ice formation over the buoy lifetime and calculate its drift parameters. An overview of the winter drift of ice formations surveyed in 2013–2015 is given in (Buzin et al., 2016). In (Buzin et al., 2019) provisional characteristics of iceberg drift in the Russian Arctic Seas were obtained. This paper focuses on ice cover drift patterns.

Fig. 1. Regions of winter surveys performed for Rosneft Oil Company in 2013–2017 and fieldwork locations


The use of radio buoys to determine coordinates and transmit the information is a conventional practice in studying the dynamics of ice formations, both for scientific and practical purposes. 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. In addition to being actively used for scientific purposes (see, for example, the International Arctic Buoy Program, SEDNA - Lei et al., 2016; Hutchings et al., 2010), radio buoys have been approved as a tool for collecting data for hydrotechnical structure...