ABSTRACT

The article deals with the modeling of the impact in the ice basin on offshore oil and gas structures (MOGS) from the torus, the field data of which were studied during Arctic expeditions in the Khatanga Bay, the Laptev Sea. The ice pool is located in the ice laboratory, on the basis of the Far Eastern Federal University (FEFU). The room is equipped with a modernized freezer, which allows you to maintain a given temperature regime, quickly and in a wide range to control the mode of freezing ice. The pool bowl allows you to model hummocks in an acceptable scale. As a model of the structure a rectangular steel indenter was used. Models of hummocks were made according to a specially developed technology. The methodology for conducting model tests in the ice basin included: the manufacture of models of torus with a given speed, registration of the required parameters of the experiment (contact force, speed of movement of the indenter, geometric dimensions of the torus model, physical and mechanical properties of the ice formation model), photo and video fixation of the process of interaction of the indenter with the model hummock above and below water. A total of 8 experiments were conducted. The study was carried out in compliance with the similarity criteria: geometric, kinematic, dynamic, to recalculate the results from model tests to full-scale values. The results obtained can be used in the analysis of the processes of formation of ice loads at the MOGS on the shelf of freezing seas.

KEY WORDS: ice ridge, ice load, ice basin/

INTRODUCTION

The Arctic is becoming an important region for solving the most complex scientific and technical problems for the development of continental shelves resources and the development of the Northern Sea Route. This is due, first, to the presence of a heavy ice regime, harsh climatic conditions. Drifting ice sheet is a major problem for oil and gas and other offshore structures, as ice loads create a high degree of uncertainty for these unique objects (Korzhavin, 1971; Tsinker, 1995; Løset et al, 2010). Ice formations, including hummocky ice, are constantly moving under the influence of wind and current, interfere with navigation and exert significant loads on marine and hydraulic structures (Sanderson, 1988), which must be taken into account when designing.

In regulatory documents, the load created by the hummock is determined from each part separately (SP 38.13330.2018, 2019; ISO/FDIS 19906, 2019). Existing methods for calculating loads from the impact of ice on structures are mainly analytical, empirical, and semi-empirical formulas. Calculation formulas are limited in use, they mainly determine the loads from the torso keel on a vertical structure. In Russian regulatory documents (SP 38.13330.2018, 2019), formulas for calculating the load from hummocks on structures allow you to determine the load with a large margin.

The aim of the work is to study in laboratory conditions the processes of formation of ice loads from hummocks at the MOGS.

To achieve this goal, the following tasks are solved in the work:

- process and analyze the data obtained during studies of hummock formation at the Science Station Hastyr (SS Hastyr).
- develop a test methodology.
- perform a series of experiments on the effect of model hummocks on the model of the MOGS support in the FEFU ice basin.
- perform the analyze of experiments results on physical modeling of the effects of hummocks in an ice basin.