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The objective of the present study is to evaluate the feasibility of using machine and deep learning methods to improve dependencies associated with forecasting the dates of occurrence of initial persistent ice phenomena. The study focuses on the rivers of the Kola Peninsula with varying ice formation conditions. A spatiotemporal analysis of the dates of initial ice phenomena and long-term variability of negative air temperature totals in the study area was performed. A database of hydrological and meteorological information for characteristic dates was compiled, and a predictive model was assembled. The paper presents a forecast of autumn ice phenomena using two approaches: regression and classification. The regression approach utilizes decision trees (XGBoost), while the classification approach relies on a hybrid neural network model (XGBoost – CNN-GRU). The forecast obtained by the hybrid approach does not exceed permissible errors and can be recommended for use.

*Keywords:* ice regime, Kola Peninsula, ice phenomena forecast, neural networks, machine learning, deep learning, XGBoost, LSTM

Tab. 3. Fig. 3. Ref. 28.