

# Numerical simulation of permafrost-related methane hydrate reservoir of the Laptev Sea shelf

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The Laptev Sea shelf with a thick sedimentary cover is expected to have cryogenic hydrate reservoirs associated with relict permafrost. The fate of these reservoirs, with their potential to significantly increase conventional hydrocarbon resources is still poorly understood. The aim of this study is to forecast the scale and distribution character of GHSZ under simulated physical, and paleogeographic conditions for two characteristic sites in the Laptev Sea (Lena delta and Ust-Lena rift). In our study time dependent 1D thermal conductivity problem with constant heat flow at the base ( $60 \text{ mW/m}^2$ ) and piecewise constant temperature function at top of the modeling domain (with constant temperatures during transgression-regression periods and instantaneous temperature shift in between) was solved. Simulation setup inter alia included specific heats of gas hydrate formation and ice melting. For the boundary conditions, two permafrost evolution scenarios according to Hubberten (2001) and Soloviev et al. (1987) were considered. It is allowed to compare two paleoreconstructions distinguishing by freezing time span and corresponding temperature shifts. Comparison of our modeling results with permafrost indications on seismic records (Rekant et al, 2015) allowed to groundtruthing our simulation results. The results obtained obtain a justified forecast of GHSZ distribution and evolution and estimate methane hydrate reservoir.