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Interaction of surface and subsurface waters in the system ”water- rock-atmosphere – carbon” (an example of the Khibiny mountains massif).

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Purpose of the study – to assess the influence of the Khibiny massif on the formation of the chemical composition of surface and subsurface waters, generated within its boundaries using physical-chemical modeling (“Selector” software package).
Objects of monitoring – rivers with sources in the upper reaches of the Khibiny massif (surface waters), and boreholes, located in these rivers’ valleys (subsurface waters) have been chosen as objects of monitoring.
Processes of formation of surface and subsurface waters, generated within the boundaries of the Khibiny massif, have been considered within the framework of a unified system “water-rock-atmosphere-carbon”. The initial data of the model: chemical compositions of the Khibiny massif rocks and chemical analyses of atmospheric and surface waters. Besides, there have been considered Clarke concentrations S, Cl, F, C, their influence on the formation of chemical composition of water solutions; geochemical mobility of chemical elements. The previously developed model has been improved with the purpose of assessment of the influence of organic substance, either liquid or solid, on the formation of the chemical composition of water.
The record of the base model of the multisystem includes 24 independent components (Al-B-Br-Ar-He-Ne-C-Ca-Cl-F-K-Mg-Mn-N-Na-P-S-Si-Sr-Cu-Zn-H-O-e), 872 dependent components, including, in a water solution – 295, in a gas phase – 76, liquid hydrocarbons - 111, solid phases, organic and mineral substances – 390. The record of solid phases of multisystem is made with consideration of the mineral composition of the Khibiny massif.
Using the created model, the physical-chemical modeling of surface and subsurface water generation has been carried out:
1. The system “water-rock-atmosphere” has been studied, depending on the interaction degree (ksi) of rock with water. A model like this allowed investigating the interactions of surface waters (rivers and lakes) with rocks that form the Khibiny massif.
2. The evolution of subsurface waters has been studied using reservoir dynamics. It was assumed that the generated surface waters react with rock, when getting down at a certain depth, which allows tracing the process of formation and change of waters in the underground space.
A computer model of surface waters was compared with the results of clean water monitoring (2001), while the computer calculation of subsurface waters was compared to the data of monitoring of Vudjavrjok, Kunijok and Oleny Ruchey rivers deposits.