IMPROVED ALGORITHM FOR MODELLING OF HEAT DYNAMICS IN FROZEN SOILS

Olga Semenova[1,2], Yury Vinogradov[1,2,3], Lyudmila Lebedeva[4,2,3]
[1] *Gidrotehproekt Ltd*
[2] *Hydrograph Model Research Group*
[3] *State Hydrological Institute*
[4] *Nansen Centre*
omakarieva@gmail.com

The details of the method to simulate the processes of ground thaw-freeze accounting for phase transformations in soils will be presented. It is based on several approaches which simplify the differential equation of heat transfer in soil profile and allow deriving its analytical solution. Additional information is given on the techniques of estimation heat transfer and conductivity characteristics of soil and snow in different states. The methods are integrated into calculating algorithms of the hydrological model Hydrograph. Physical properties of soil horizons used as the model parameters allow for robust assessment of their values according to landscape characteristics.
Verification of proposed approaches was conducted with the use of observational data of thaw/freeze depth in different landscapes of the Kolyma water-balance station (continuous permafrost zone, North-East of Russia). Study sites included slope and plateau with thaw depths varying from 0.5 to 1.8 m across landscapes characterized distinctly as rocky talus, mountain tundra with dwarf tree brush, moss-lichen sparse growth forest or larch forest. Soil-vegetation profile schematization and corresponding model parameters were developed for each landscape. The model was run for continuous period of 1960-1990 with daily step interval and simulated values have shown good agreement with observed ones at all studied sites.