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Modelling snowpack formation processes and meltwater runoff using the LSM SWAP under permafrost and highland conditions

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Abstract An ability of a physically-based land surface model SWAP, which describes heat and water exchange processes in a soil–vegetation–(snow cover)–atmosphere system, to reproduce snow formation processes and meltwater runoff at small watersheds under permafrost and highland conditions is investigated. Model simulations were performed for a 10-year period (1969–1978) using observations from the Kolyma Water Balance Station (KWBS), located within the permafrost zone of the Kontaktovyi Creek basin (the upper course of the Kolyma River, Russia). The model was validated against available observations of snow depth; soil thawing/freezing depth; soil and snow surface temperatures; snow evaporation; runoff from different river basins located within the KWBS. The validation results demonstrated the ability of the SWAP model to reproduce heat and water exchange processes under permafrost and highland conditions quite reasonable.

Key words land surface model SWAP; snow formation; meltwater runoff; parameter optimization; Russia