Modelling of long-term permafrost evolution in the discontinuous permafrost zone of North-West Siberia

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The rate of climate warming in North-West Siberia is among the highest in the world and this trend is especially pronounced in summer [1]. Analysis of permafrost thermal conditions in this area provides plausible scenarios of permafrost degradation also elsewhere. An increase in the summer mean temperature together with the prolongation of the warm season results in the increase of the thawing degree-days enhancing thawing of permafrost. Here we present the results of decadal temperature observations from three boreholes near Nadym, North-West Siberia. We further use the results and the observed cryolithological structure of soils in two boreholes to model the long-term evolution of the deep permafrost under two climate scenarios, RCP2.6 (climate action, fast reduction of CO2 emissions) and RCP8.5 (‘business as usual’). Both borehole sites have a topmost high-porosity, high-ice content layer of peat which helps prolonging the degradation. The main difference between the boreholes is snow cover resulting from the difference of borehole positions (one is located on the top of the hill). Our results suggest that under RCP8.5 scenario permafrost will degrade in both boreholes. On the contrary, under RCP2.6 scenario permafrost will degrade in one borehole with the deeper snow cover, where it already shows the signs of degradation. For the other borehole, the model predicts that permafrost will not degrade within the next 300 years, although the permafrost temperatures are eventually above -1°C.