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Abstract

One of the factors of soil stability on slopes during the construction of avalanche-protecting geotechnical constructures in mountainous areas is the freezing of the underlying soil, since in mountainous areas the soil can be in a frozen state for eight or more months. However, the recent changes in air temperature and precipitation (primarily in the form of snow) lead to a change in the depth and duration of freezing of the soil and, as a consequence, a decrease in its stability. In this work, based on the developed calculation scheme, the depth of soil freezing is estimated for the last few winter seasons based on data on the thickness of the snow cover and air temperature for the Anzob pass (Tajikistan). Aznob Pass (Tajikistan) is located at latitude 39.07 and longitude 68.88 with an altitude of 3373 m above sea level. The average annual temperature there is -2.7 °C, but due to heavy snow accumulation, there is no long-term freezing and only seasonal is observed. Computational modeling showed the presence of seasonal frozen rocks on the slope of the northern exposure at a depth of up to 1.5 m. Thus, in the winter of 2018, the depth of seasonal soil freezing on the slopes of the northern exposure was 1.5 meters. In the winter of 2020, on the slopes of the northern exposure, the depth of seasonal soil freezing was 1.2 meters at an average annual soil temperature of 2.42 °C. Calculations of changes in the depth of soil freezing were carried out according to the proposed calculation scheme based on data on the thickness of snow cover and air temperature based on a three-layer model of the medium (thawed soil, frozen soil, snow) and assuming a linear change in temperature in the media and heat flow according to Fourier's law. Calculations of the effect of the thickness of the snow cover and air temperature on the depth of freezing of the soil were carried out according to the proposed calculation scheme. The work was performed in the frame of state topic “Danger and risk of natural processes and phenomena” (121051300175-4) and “Evolution of the cryosphere under climate change and anthropogenic impact” (121051100164-0).