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Decadal changes of the snow in the western Tian- shan derived from in-situ snow depth measurements

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Winter snow accumulation is important for summer water supply in Central Asia, and contributes more than 50 % to the annual runoff. The region's water availability is highly dominated by snow reserves in the mountain, which will be affected by climate change. Volumetric snow data play a vital role for hydrologic forecast in mountainous river basins, where snow is considered as a dominating hydrological component. This study quantifies decadal snow depth changes in the Western Tian-Shan in the Chirchik River Basin in Uzbekistan. The snow depth measurements from Uzhydromet have been used in this research. The historical changes in snow depth has been statistically analyzed for the 1963-2020 hydrological years. Correspondingly, the impact of climatic factors (temperature and precipitation) on snow dynamics were assessed as well. The results of hydrometeorological parameters such as snow depth, air temperature at 2 meters and precipitation were plotted as the trend line on monthly, seasonal, and annual scales. To verify statistical significance of the trend dynamics, the slope method and the Mann-Kendall trend test were applied. Our results show that snow cover (duration) days were significantly decreased by 4 days per decade or 21 days for 57 years from 1963 to 2020. Particularly, the initial occurrence of a permanent snow onset day was significantly delayed by 3 days per decade or 16 days for 57 years. Likewise, annual peak snow depth day was significantly shifted earlier by 4 days per decade or 20 days for 57 years. Interestingly, the maximum snow depth did not change statistically significant, but we observe a decline of 3.33 cm per decade or 19 cm for 57 years. Overall, we conclude that the duration of snow cover (snow reserve) has significantly decreased in the Chirchik basin due to climate warming in the last 57 years.