



The Mass Balance of Glacier No. 1 at the Headwaters of the Urumqi River in Relation to Northern Hemisphere Teleconnection Patterns

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Most small glaciers in the world have significantly decreased their volume during the last century, which has caused water shortage problems. Glacier No. 1, at the headwaters of the Urumqi River, Tianshan, China, has been monitored since 1959 and similarly has experienced significant mass and volume losses over the last few decades. Thus, we examined the trend and potential abrupt changes of the mass balance of Glacier No. 1. Principal component analysis and singular value decomposition were used to find significant relations between the mass balance of Glacier No. 1 and Northern Hemisphere teleconnection patterns using climate indices. It was found that the mass balance of Glacier No. 1 had a significantly decreasing trend corresponding to -14.5 mm/year from 1959 to 2010. A change point was detected in 1997 with 99% confidence level. Two time periods with different mass balances were identified as 1959-1996 and 1997-2010. The mass balance for the first period was -136.4 mm/year and up to -663.9 mm/year for the second period. The mass balance of Glacier No. 1 is positively related to the Scandinavian Pattern (SCA), and negatively related to the East Atlantic Pattern (EA). These relationships are useful in better understanding the interaction between glacier mass balance and climate variability.