

Glacier regression in past decades and future trend in China

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Abstract

From comparison of aerial photographs and field investigations as well as satellite image interpretation, glaciers in China have been in shrinkage generally in past several decades, although the regression rate is different in various mountains and even at different glaciers in a same region. The regression rate in central and north part of the Tibetan Plateau is less than that in the surrounding mountains such as Himalayas, Karakoram and Tianshan, and is larger in the monsoon maritime region than in the continental climate region. For example, Dongkemadi Glacier in Tanggula Mountains (in the central of the plateau) and Malan Glacier in south slope of Kunlun Mountains (in north part of the plateau) was in stable or advance before 1990 and have been retreating at a rate of about 2 ma^{-1} thenceforth, while the average retreat rate is higher than $10\text{-}20 \text{ ma}^{-1}$ in past decades in southeastern Tibetan Plateau, where it is in monsoon maritime climate, and in Karakoram and Himalayas. The regression rate is medium in Qilian Mountains (northeast of the plateau) and eastern Tianshan, mostly less than 10 ma^{-1} .

The observation data from ten and more glaciers indicates that since 1990s, the regression seems to be speeding up in most regions, especially in the last decade. For instance, on north slope of the central Himalayas, regression rate of the Rongbuk Glacier terminus in Mt. Everest is less than 10 ma^{-1} between 1970 and 1990, but increased by about or larger than 10 ma^{-1} in recent years. The Glacier No.1 in Urumqi River, eastern Tianshan, has been in regression with a rate of 4.5 ma^{-1} since beginning observation in 1959. During this period, the rate is less than 4 ma^{-1} in 1970s and 1980s and increased to about 6 ma^{-1} after 1994.

According to IPCC report, climate warming will continue in coming decades both on global and regional scales. Therefore, a dynamic model is applied to make projection of the Glacier No.1 in Urumqi River, Tianshan and the nearby region under the future climate scenarios, in view of long term monitoring in this glacier. The result shows that both area and volume of this glacier will decrease by a half and more, and about 80% of glaciers in the Urumqi River basin, less than 1 km^2 in area of each, will melt away by 2050. For other regions, it is estimated that most of small glaciers, such as those with area of less than 2 km^2 , may disappear by the middle of this century in southeastern part of the Tibetan Plateau, the Karakoram and western Tianshan. In central and northern Tibetan Plateau, decrease in area of glaciers will be relatively small compared with other regions, less than 10-20%. Doubtless the glacier shrinkage is not only a dominant trend but will be accelerated in all mountains in future decades if climate keeps warming like recent years, even precipitation increase has been observed in northwest China.

Key words: glacier regression, China, Tibetan Plateau

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