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The Application of GPS in Glacier Flow Velocity: A Case Study of Qiyi Glacier

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The Application of GPS in Glacier Flow Velocity: A Case Study of Qiyi Glacier

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Key words: GPS; Qiyi Glacier; Surface flow velocity

Abstract. Surface flow velocity is a key parameter of glacier kinetic theories study. With the help of GPS, glacier surface flow velocity research improved convenient and accurate. Therefore, this paper is committed to acquire the condition of surface flow velocity of Qiyi Glacier during 2009 to 2010 based on GPS data, optical remote sensing images and topographic maps. And it is concluded that during this time, the average surface flow velocity of Qiyi Glacier is decreasing while distributed relatively fast on central and slowly on both sides, and area retreated about 0.06km² compared with that of 1965, whose value is consistent with motion mode of mountain glacier and the tendency of changes in Qiyi Glacier according to ELA data and Mass balance.

Introduction

Glacier is the most sensitive sensor of climate change under the background of global change. Meanwhile, glacier surface flow velocity indicates the condition of glacier changes. Thus, researchers faced a problem that how to get the accurate data of glacier flow velocity immediately and continuously.

The application of GPS system covers a great area of geography research, which could be also applied to the study of glacier surface flow velocity. These years, Chinese researchers have surveyed and studied many mountains' surface flow velocity including Tianshan, Aertaishan, Qilian, Himalaya, and Hengduanshan [1]. Jing et al. surveyed that of Puruogangri Ice Field and concluded that flow velocity of that area appeared max in ELA (equilibrium-line altitude) and decreased gradually to the sides [2]. Liu et al. surveyed surface flow velocity of Laohugou No.12 glacier, and calculated that from June 2008 to June 2009, the east branch's max velocity reached 32.4m/a, and max value appears at the altitude of 4750m-4800m, and decreased from 4800m to the top, and stayed 23-26m/a. Meanwhile the west branch's max velocity is about 32.6m/a, and decreased 29m/a every 10m [3].

Principal methods

RTK (Real Time Kinematic) is an effective method to measure points, especially on the mountain or valley glaciers because of the scale and terrain. This study utilized Trimble 5700 GPS system including one reference station and two mobile stations to survey the position of all typical points on the surface of glacier. The author selected 8 of these points as indicators compared with that in two different times based on the topography of 2005 to get the data of glacier surface flow velocity.

Brief introduction of study area and this research

Qiyi Glacier, which is located in northwest of Gansu province, is the nearest glacier belonging to Qilian Mountains to urban area (Fig.1), the area is 2.698 km², 3.66 km long, according to ground stereo photogrammetric results in 2005[4].

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