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Mapping Glacial Lake Changes in Mountain Areas of Central Asia with Landsat Imagery during 1990-2010

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Central Asia is one of the world most vulnerable areas responding to global change. Glacier lakes in alpine regions remain sensitive to climatic change and fluctuate with temperature and precipitation variations. Study shows that glaciers in Central Asia have retreated dramatically, leading to the expansion of the existing glacial lakes and the emergence of many new glacial lakes. The existence of these lakes increases the possibility of outburst flood during the ice melting season, which can bring a disaster to the downstream area. Mapping glacial lakes and monitoring their changes would improve our understanding of regional climate change and glacier related hazards. Glacial lakes in Central Asia are mainly located at the Tianshan Mountains, the Altai Mountains and Kunlun Mountains with average elevation more than 1500 meters. Most of these lakes are supplied with the glaciers and snowmelt water during the summer seasons. Satellite remote sensing provides an efficient and objective tool to analyse the status and variations of glacial lakes. The increased availability of remote sensing sensors with appropriate spatial and temporal resolutions, broad coverage makes lake investigations more feasible and cost-effective. The paper intends to map glacier lake changes in the Tianshan Mountains, the Altai Mountains and Kunlun Mountains with Landsat imagery. About 400 scenes of Landsat images in circa 1990, circa 2000 and 2010 are used to map the glacial lakes over the Central Asia, and the temporal processes and spatial patterns of these lake changes are also analysed, so as to find the relations between lake changes and region climate change. Over 12 000 glacial lakes were mapped in circa 2010, and the most of them are located the Altai Mountains and the Tianshan Mountains. The result shows that the numbers and areas of the glacial lakes in the Altai Mountain remain stable. The Tianshan Mountain have experienced changes in the last two decades, and about a half number of lake areas are increased by 10 percent since the circa 1990. The number of glacial lakes in the Kunlun Mountain is relative small in the circa 1990, but has increased to 2800 lakes in the central part of the mountains. The reasons to these lake changes need to be further studied.