

Spatial variation in surface reflectance and dust on glaciers in Tianshan Mountains, XinJian, China derived from Landsat

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Surface dust on glaciers can significantly affect albedo on the glacial surface, and thus accelerate melting of snow and ice. The eastern TienShan, western China, are located in an arid and semi-arid region of central Asia, the source region of Asian dust. And also Dust storms are an important phenomenon in this region.

Although the low amount of precipitation and extremely dry climate, mountains in this arid area hold one of the greatest concentrations of glacial ice in the mid-latitudes, and they constitute a vital source of water for more than 100 million people living in this region.

Monitoring studies show that many mountain glaciers worldwide area decreasing in mass. An important component of the process of ice mass loss is the effect of dust on albedo and its effect on glaciers mass balance. (Takeuchi.N, 2008).In generally, glacial shrinkage is considered to result from climate change such as global warming, but also possibly from the variations in surface dust. In particular, significant amounts of wind-blown desert dust are deposited on glaciers in western China because the glaciers are surrounded by arid areas encompassing vast deserts such as the Taklimakan, Junggar, and Gobi (e.g. Wake et al., 1994).

The spatial variation in surface dust on glacier ablation area were analyzed to identify their response to Wind-blown dust using Landsat TM 1992/08/15, SRTM DEM 2000 Image at The Kalik mountains in the eastern Tianshan mountains in the western China.

The result shows that the mean surface reflectance for visible band in glacier ablation area varied from 0.25 to 0.37. The area below mean surface reflectance ($R=-0.31$) was 37% of all glacier ablation area. Depending on glaciers surface reflectance level glaciers were classified into 3 types, such as A type high reflectance glaciers (clear glaciers), B-type mid reflectance glaciers (dusty glaciers), and C type low reflectance glaciers (very dusty glaciers). SRTM DEM data showed that there is no correlation ($r=-0.31$) between reflectance and elevation of the glacier surface. This suggests that the variation in surface reflectance is not due to elevation, but due to direction of glacier slope. The mean reflectance of each glacier in this mountain range was compared with the glacier area changes from 1992 to 2001. We found a significant negative correlation between area change and surface reflectance ($r=-0.71$, $p<0.05$). This correlation suggest that the surface reflectance affect glacier area change. The spatial variation in surface reflectance of glaciers in the Kalik mountains may be due to amounts of Wind blown dust from Taklimakan desert, and Junggar desrt and Gobi desert.

Keywords: glacier, Tianshan Mountains, Albedo, Dust, Satellite image