

DOCTORAL THESIS

The spatio-temporal pattern of snow cover and its relations to climate change in western aridzone of China

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Abstract

Global climatic change as well as its consequences such as extreme weather events and sea-level rising has become a focusing issue in the contemporary world. Alpine snow cover is increasingly regarded as a good and sensitive indicator of climatic change due to the less direct interference by human. In western aridzone of China, majority of mountainous areas are covered by snow in winter seasons. This region is one of the most important seasonal snow cover regions in China and also a typical alpine snow cover region in the mid-high latitudes of the Northern Hemisphere. Being less affected by economic development and human activities in the history, the change of permanent and seasonal snow cover in this region echoes the global climatic and environmental change. In addition, snow melt water, which provides the major water supply in the region, is vital for living beings in the arid and harsh environment. It is therefore necessary to understand the snow cover change during the past decades.

This study aims to investigate the spatio-temporal pattern of snow cover in the western aridzone of China in the past 30 years by using remote sensing technology and to analyze the relationship between the change of snow cover and global climate. The reliability of remote sensing-derived global snow data is firstly examined. Data consistency

and accuracy are assessed against the ground measurements. In order to undertake a down-scale snow depth analysis with other high-resolution environmental data, a method that fuses the low-resolution passive microwave and high-resolution optical snow cover images is proposed. A linear mixture model is adopted in spectral unmixing for modifying snow depth estimates. Time series analysis method is utilized to describe the long-term trend and periodic features. The analysis is applied not only to the whole region but also to the local scale represented by a pixel so that the spatial pattern of the change can be illustrated. Using the result and climatic data, the relationship between snow cover and global/regional climatic change is established.

The results make contribute to the understanding of the impacts of climatic change, at regional level, on the spatio-temporal pattern of snow cover in the western aridzone of China.

Keywords: Snow and ice, alpine snow cover, remote sensing, spatio-temporal pattern, long-term trend, climatic change, western aridzone of China

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