

DOCTORAL THESIS

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

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Date of Award:
2014

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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

Acknowledgements

I would like to express my sincere appreciation to Prof. Qiming Zhou, my principal supervisor, for his patient guidance and support during my five-year study in Hong Kong Baptist University (HKBU). He is a mentor not only in my academic career but also in life.

Great thanks go to my co-supervisor Prof. Donggen Wang who led me to the world of statistics. His valuable suggestions inspired me a lot.

I am very grateful to Prof. Xi Chen and Prof. Anming Bao at Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences (CAS) for their assistance in the field investigation and data collection.

I am most indebted to my classmates at Department of Geography, HKBU (Eve, Bingxia, Helen, Polly, Ray, Winnie, Bobo, Serey, Fenglong, Tao, Richard) and colleagues at Shenzhen Institutes of Advanced Technology, CAS (Ms. Ping Liu, Mr. Shuhong Peng), for their help and continuing friendship. Special thanks to my senior classmate and friend Dr. Jing Qian, for her constant encouragement and assistance.

I appreciate greatly the time, strength and motivational talks from Miss. Yi Liu and Miss. Xue Ao who kept me company almost every day via Internet although they were in hundreds of thousands of miles away. They kept talking to me when I was despaired during the thesis pending period. I will never forget those lucky days.

I would also like to acknowledge the people offering comments and advices throughout the research effort. They are Prof. Jiabing Sun and Prof. Yumin Chen at Wuhan University, Mr. Xuefei Li at Department of Physics and Mr. Xuehu Zhu at Department of Mathematics, HKBU, and the editors and two anonymous reviewers of the journal of *Remote Sensing Letters*.

Extraordinary thanks to many other individuals with whom I have shared such a beautiful life including all my friends in Hong Kong, mainland cities and overseas.

Most importantly, I devote my deepest gratitude to my parents and the whole big family. It is the endless love they gave that braced me up during the most struggling time. Without their support, this work could not have been possible.

Table of Contents

Declaration.....	ii
Abstract.....	iii
Acknowledgements	v
Table of Contents.....	vii
List of Tables	x
List of Figures.....	xii
List of Abbreviations	xv
Chapter 1 Introduction	1
1.1 Background.....	2
1.2 Statement of research questions	6
1.3 Objectives and significance of this research	7
1.4 Organization of the thesis.....	8
Chapter 2 Theoretical Framework	11
2.1 Remotely sensed snow cover observation.....	11
2.2 Mixed pixel problem in snow cover observation	17
2.3 Long-term change detection and time series analysis	19
2.4 The relation between snow cover and climatic changes	22
2.5 Summary of this chapter.....	22
Chapter 3 Study Area, Data and Methodology.....	25
3.1 Introduction to the study area	26
3.2 Review of previous studies.....	29

3.3	Data used in the study	39
3.4	Research design and methodology.....	41
3.5	Summary of this chapter	43
Chapter 4	Evaluation of Remotely Sensed Snow Cover Observation .	45
4.1	Introduction.....	46
4.2	Two long-term snow depth products	48
4.3	Evaluation methods.....	50
4.4	Accuracy assessment result.....	56
4.5	Analysis and discussion	61
4.6	Summary of this chapter	64
Chapter 5	Fusion of Snow Cover Extent and Depth Data.....	67
5.1	Introduction.....	67
5.2	Problem formulation	70
5.3	Fusion scheme.....	72
5.4	Experiment of data fusion	74
5.5	Analysis and discussion	80
5.6	Summary of this chapter	82
Chapter 6	Spatio-temporal Pattern of Snow Cover	85
6.1	Introduction.....	86
6.2	Time series analysis of snow cover data.....	88
6.3	Regional-level analysis of snow cover change	91
6.4	Spatio-temporal analysis of snow cover change.....	95
6.5	Analysis and discussion	100
6.6	Summary of this chapter	101
Chapter 7	The Relation between Snow Cover and Climatic Changes	103

7.1	Introduction	103
7.2	Factors of Xinjiang's climate	104
7.3	Data and analytical methods.....	106
7.4	The relation to regional climatic factors.....	109
7.5	The relation to continental climatic factors	111
7.6	Analysis and discussion.....	112
7.7	Summary of this chapter.....	113
Chapter 8	Discussion	115
8.1	Major findings and comparison with other studies	115
8.2	Scale issues	119
8.3	Uncertainties.....	121
8.4	Summary of this chapter.....	122
Chapter 9	Conclusion and Outlook.....	125
9.1	Conclusions	125
9.2	Further perspectives.....	129
References.....		133
Appendix I – List of ground weather stations in Xinjiang and data availability periods		151
Appendix II – Program codes of sampling and data processing		154
Appendix III – Program codes of time series analysis		159
Curriculum Vitae		160
Primary Publications.....		161