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SPATIOTEMPORAL CHANGES OF SNOW COVER IN THE MONGOLIAN PLATEAU DURING 2001–2012

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This paper describes the nearly 12 years of Mongolian plateau snow cover area of change make use of MODIS snow products and Analyzed the different altitude snow cover area of spatial and temporal variation characteristics of Mongolian plateau. And compare the maximum of 12 years every year the difference between snow cover area. In 12 years between 2001–2012 in the Mongolian Plateau the annual maximum snow cover area are distributed between December and January, there may be a relationship with rainfall . In time, maximum snow cover in the area in each year, the least extent is on December 2001 which is 1,373,500 km². In space, snow-covered areas are mainly distributed in the western foot of the northern Greater Hinggan mountains and southern, northeastern, northern Yinshan Mountains, western Ordos Plateau, southern Mongolia Mongolian Altai and northern IKH NUURUUDIIN KHUNDII, Hovsgol mountains, to the Khangai Mountains branch of mountains, hills and mountains Kent Sukhbaatar province Eastern Province. Snow December 26, 2004 to cover the largest area of 1,866,500 km². Space, mainly in the snow-covered area is mainly distributed in Inner Mongolia Erdos Plateau, Wulanchabu grasslands, Hohhot, Baotou, Western Mountains, north of the intersection of Yinshan Mountains, Mountains northwest and southwest and northern Alashan. Mongolia's Altai Mountains (MONGOL ALTAYN NURUU), IKH NUURUUDIIN KHUNDII, Hovsgol mountains and mountains branch hangay Mountains, Kent mountains branch Mountains, the central provinces, the former hangay province, the Gobi Province, South Gobi province, East Gobi province Kent Province, Eastern Province and Sukhbaatar Province.

1. Introduction

Snow is an important part of the earth surface cover, large scale category, a wide range of snow image surface radiation and energy exchange, climate change and resource utilization etc...

Mongolia plateau is a relatively closed inland plateau, Mongolia plateau ecosystem changes on China and northeast Asia regional environment has important image, so master the Mongolian plateau snow coverage and dynamic change characteristics, can further improve the Mongolian plateau snow disaster remote sense monitoring and pastoral area assessment to provide scientific basis.

2. Data and method

2.1 Data

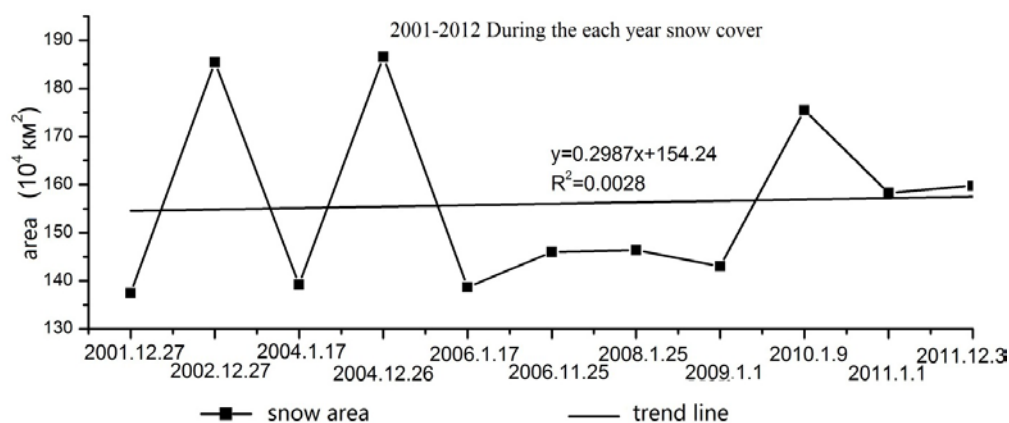
In this paper we use MOD10A2 image of MODIS/ Terra satellite data of eight days of snow cover from NASA LAADS WEB which is collected from October to May each year during 2001–2012 and the grid resolution is 500 m. We use DEM90m (Digital Elevation Model) as the base map.

2.2 Method

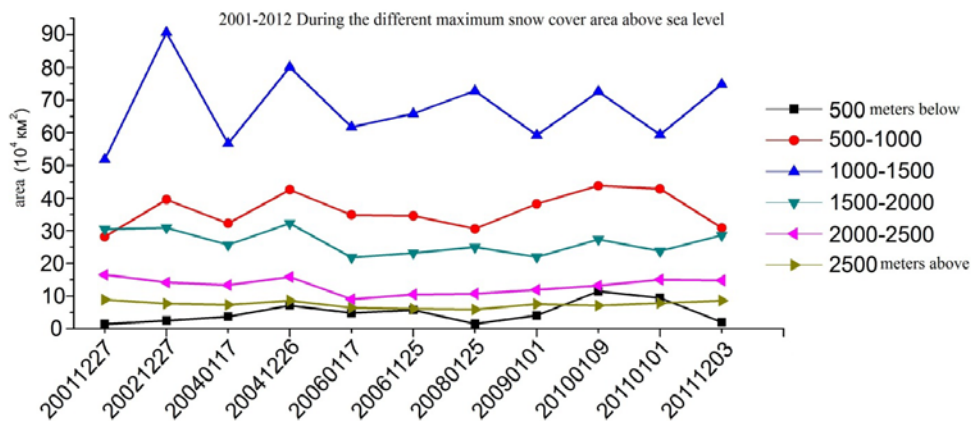
We use ENVI4.8 to project each phase of 12 MOD10A2 product separately as ALBERS projection, ellipsoid to WGS84. Use ENVI4.8 basic tools \ Statistics menu to calculate the number of pixels using 200 which represents snow cover extent. We composite $(B1 * 500 * 500) / 1000000\text{km}^2$ (B1 represents the number of pixels) of snow maps and DEM (digital elevation model) to get the come snow elevation map, then use ENVI4.8 Classification \ DecisionTree to classify elevation snow .

3. Results

3.1 Temporal changes in snow cover in the Mongolian Plateau

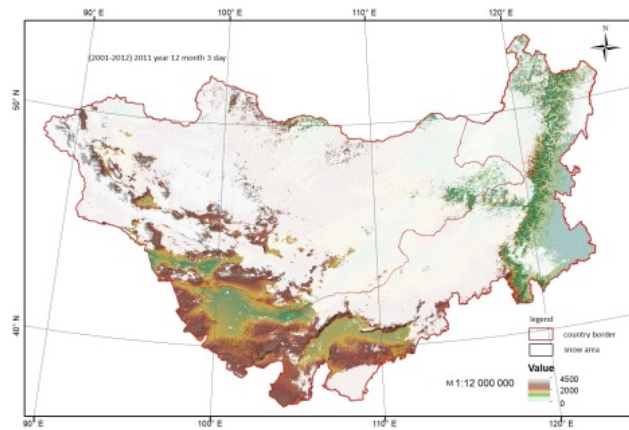
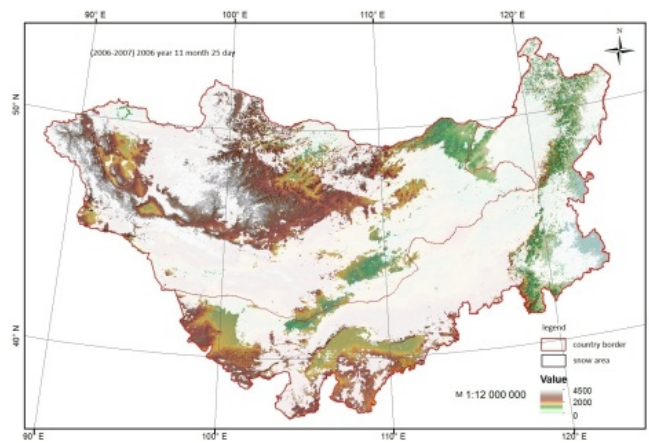
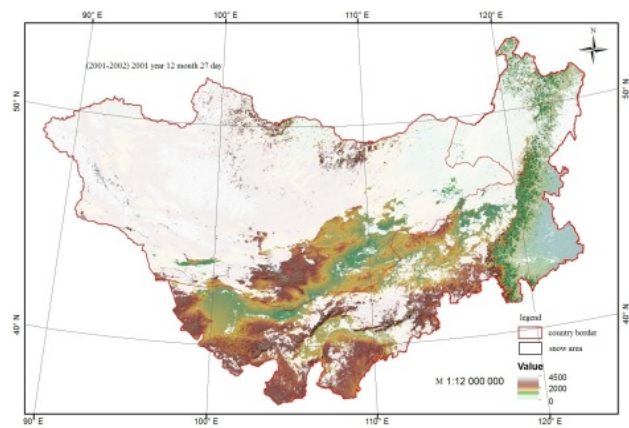


Annual maximum snow cover of Mongolia plateau during 2001–2012 is showing an increasing trend. Three peaks were 2002.12.27, 2001.12.26 and 2010.1.9. Trough is 2001.12.27, 2004.1.17 and 2006.1.17. the extent of low altitude of 4,000 metres or below is the least, above 2,500 m is covered with external snow. In addition to an altitude of between 1500–200 m variability of snow showed an increasing trend. Snow covered area is relatively high at an altitude of 500–1000 meters, the largest snow covered area is between 2000–2005 in elevation. 2,500 meters above sea level is relatively low between 1000–1500 meters in elevation.



3.2 Spatial changes in snow cover in the Mongolian Plateau

On 2001 12,27, snow-covered areas are mainly distributed in the western foot of the northern and southern Greater Hinggan mountains., northeastern, northern Yinshan Mountains, western Ordos Plateau, Southern Mongolia Mongolian Altai Mountain and northern IKH NUURUUDIIN KHUNDII, Hovsgol mountains, to the Khangai Mountains branch of mountains, hills and mountains Kent Sukhbaatar Province, Eastern Province. 2006–2007 Winter November 25 Inner snow covered mainly in the western and eastern Greater Hinggan mountains, Xilin Gol Grassland, Ulanchap grasslands, Ordos Plateau, northwestern Alxa. Mongolia's Altai Mountains in southern Mongolia, IKH NUURUUDIIN KHUNDII, west branch of Khangai Mountains, Hovsgol mountain, ORHON SELENGA RIVER basin, Kent Mountains and South Gobi province, in the Gobi province, East Gobi Province Sukhbaatar province.



2001–2002 The winter snow cover area biggest figure 2001.12.27, 2006–2007
The winter snow cover area biggest figure 2006.11.25, 2011–2012 The winter snow
cover area biggest figure 2012.12.03

According to Figure 3, on December 3, 2011, the extent of snow cover mainly in Inner Mongolia Erdos Plateau, Western Mountains, north of the intersection of Yinshan Mountains, northwestern and southwestern Greater Hinggan mountains. Mongolia's Altai Mountains (MONGOL ALTAYN NURUU), IKH NUURUUDIIN KHUNDII, Hovsgol mountains and mountains branch hangay Mountains, Kent mountains branch Mountains, the central provinces, the former hangay province, the Gobi Province, South Gobi province, East Gobi province Kent Province, Eastern Province and Sukhbaatar Province.

4. Conclusion

In 12 years between 2001–2012 in the Mongolian Plateau the annual maximum snow cover area are distributed between December and January, there may be a relationship with rainfall. In time, maximum snow cover in the area in each year, the least extent is on December 2001 which is 1,373,500 km². In space, snow-covered areas are mainly distributed in the western foot of the northern Greater Hinggan mountains and southern, northeastern, northern Yinshan Mountains, western Ordos Plateau, southern Mongolia Mongolian Altai and northern IKH NUURUUDIIN KHUNDII, Hovsgol mountains, to the Khangai Mountains branch of mountains, hills and mountains Kent Sukhbaatar province Eastern Province. Snow December 26, 2004 to cover the largest area of 1,866,500 km². Space, mainly in the snow-covered area is mainly distributed in Inner Mongolia Erdos Plateau, Wulanchabu grasslands, Hohhot, Baotou, Western Mountains, north of the intersection of Yinshan Mountains, Mountains northwest and southwest and northern Alashan. Mongolia's Altai Mountains (MONGOL ALTAYN NURUU), IKH NUURUUDIIN KHUNDII, Hovsgol mountains and mountains branch hangay Mountains, Kent mountains branch Mountains, the central provinces, the former hangay province, the Gobi Province, South Gobi province, East Gobi province Kent Province, Eastern Province and Sukhbaatar Province.

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ПРОСТРАНСТВЕННО-ВРЕМЕННЫЕ ИЗМЕНЕНИЯ СНЕЖНОГО ПОКРОВА МОНГОЛЬСКОГО ПЛАТО В 2001-2012 гг.

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В статье описывается почти 12-летнее наблюдение изменений площади
снежного покрова монгольского плато с помощью дистанционного зонда

MODIS и проводится анализ пространственно-временных характеристик высоты покрова, сравниваются максимальные площади снежного покрова за 12 лет. В период между 2001 и 2012 г. ежегодная максимальная площадь снежного покрова монгольского плато приходится на декабрь и январь, что может быть связано с выпадением осадков. За этот период наименьшие показатели максимального снежного покрова наблюдались в декабре 2001 г. — 1373 500 км². Заснеженные территории в основном распространены у западных подножий северных гор Большого Хингана и на южных, северо-восточных, северных горах Иньшань, на западном плато Ордос, на южном Монгольском Алтае и в северном ущелье Нурудудин Хундии, Говсгольских горах, в цепи гор и холмов Хангай и горах Кент Сухбаатар Восточной провинции. 26 декабря 2004 г. снегом была покрыта наибольшая площадь — 1 866 500 км². Заснеженные области Внутренней Монголии главным образом распространены на плато Эрдос, лугах Уланчабу, в Хух-Хото, Баотоу, Западных горах, к северу от пересечения гор Иньшань, гор северо-западного, юго-западного и северного Алашаня, горах Монгольского Алтая, ущелье Нурудудин Хундии, Говсгольских горах, горной цепи Хангай, Кентских горах, Центральной провинции, бывшей провинции Гоби, провинции Восточной Гоби и провинции Сухбаатар.

Ключевые слова: снежный покров; Монгольское плато; пространственно-временные изменения.