

Evaluation of MODIS snow cover and cloud mask and its application in Northern Xinjiang, China

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Abstract

Using five-year (2001–2005) ground-observed snow depth and cloud cover data at 20 climatic stations in Northern Xinjiang, China, this study:

- 1) evaluates the accuracy of the 8-day snow cover product (MOD10A2) from the Moderate Resolution Imaging Spectroradiometer (MODIS)/Terra satellite,
- 2) generates a new snow cover time series by separating the MODIS cloud masked pixels as snow and land, and
- 3) examines the temporal variability of snow area extent (SAE) and correlations of air temperature and elevation with SAE.

Results show that, under clear sky conditions, the MOD10A2 has high accuracies when mapping snow (94%) and land (99%) at snow depth ≥ 4 cm, but a very low accuracy (63%) for patchy snow or thin snow depth (< 4 cm). Most of the patchy snow is misclassified as land. The mean accuracy of the cloud mask used in MOD10A2 for December, January and February is very low (19%). Based on the ratio of snow to land of ground observations in each month, the new snow cover time series generated in this study provides a better representation of actual snow cover for the study area. The SAE (%) time series exhibits similar patterns during six hydrologic years (2001–2006), even though the accumulation and melt periods do not exactly coincide. The variation of SAE is negatively associated with air temperature over the range of -10 °C to 5 °C. An increase in elevation generally results in longer periods of snow cover, but the influence of elevation on SAE decreases as elevation exceeds 4 km in the Ili River Watershed (IRW). The number of days with snow cover shows either a decreasing trend or no trend in the IRW and the entire study area in the study period. This result is inconsistent with a reported increasing trend based on limited in situ observations. Long-term continuance of the MODIS snow cover product is critical to resolve this dilemma because the in situ observations appear to undersample the region.

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