



Snow Cover Assessment over Nepal using Satellite Data

Objective

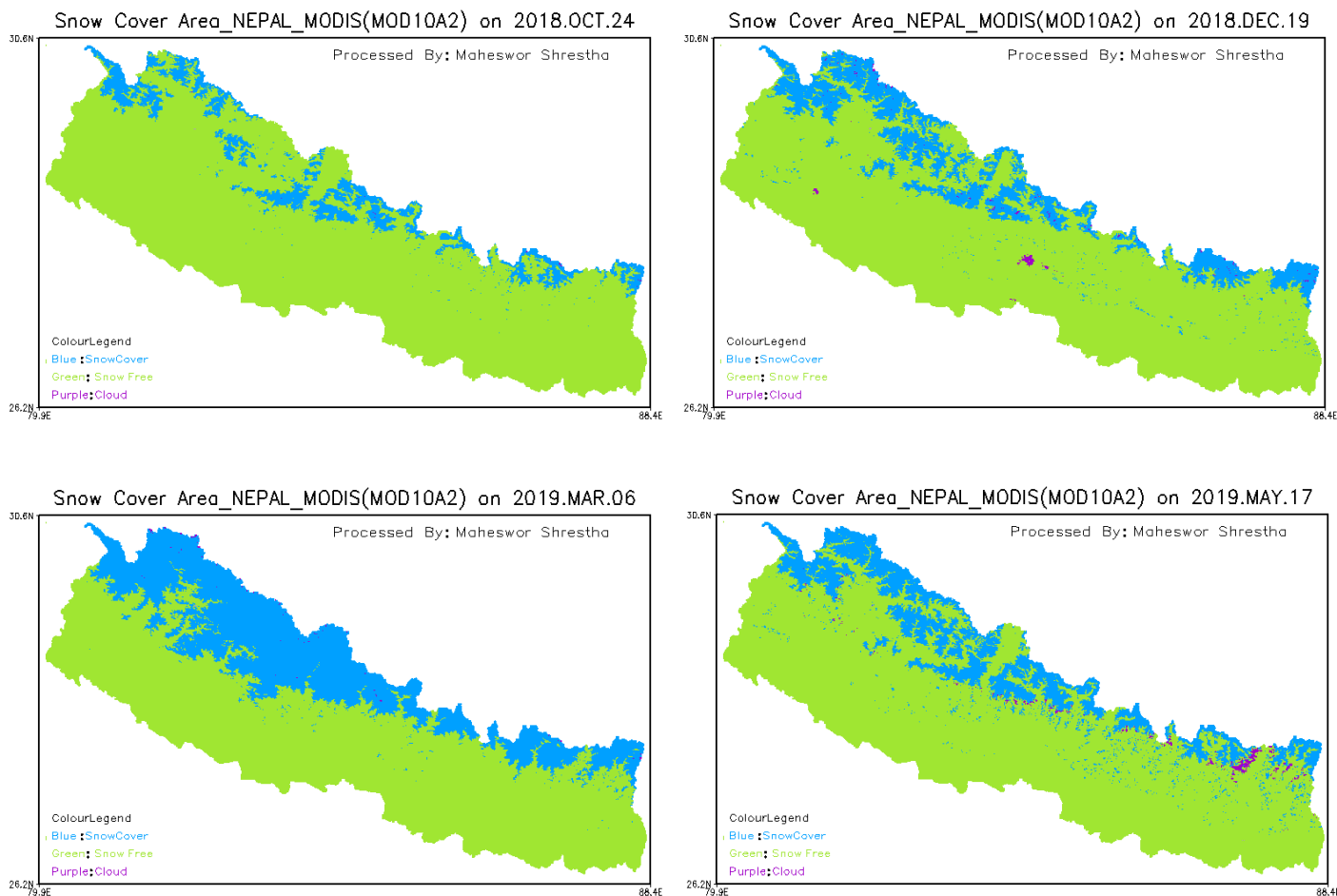
To assess the snow cover over Nepal using remote sensing data from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard the Terra satellite. The nationwide assessment of snow cover adds value to the water resources management in understanding the water and energy balance of the river basins.

Materials and Methods

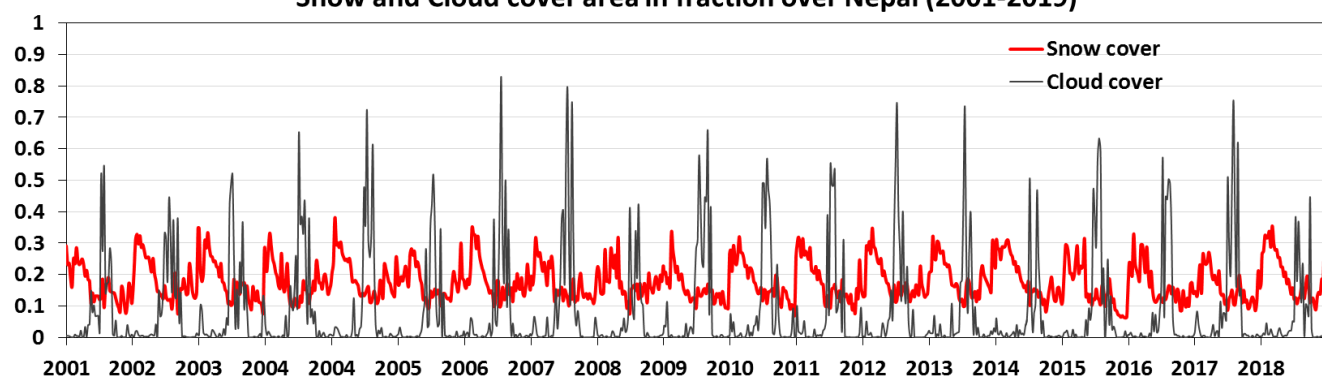
MODIS Eight-days snow cover data (MOD10A2) at 500 m resolution in HDF-EOS format (Hall and Riggs, 2016) are available for download at <https://urs.earthdata.nasa.gov>. MOD10A2 represents the maximum extent of snow cover over 8 days. A pixel is classified as cloud only when it is continuously cloud covered during all 8 days and the pixel is classified as snow covered if snow cover is observed on any of the 8 days. The study area comprises five tiles (h24v05, h24v06, h25v05, h25v06 and h26v06). The shell script is coded to mosaic, resample, re-project and subset to the boundary of Nepal from these tiles within the framework of MODIS Reprojection Tool for the period of 2001-2019. The Grid Analysis and Display System (GrADS) tool is used to display the gridded binary data. This method of snow cover assessment has been applied at Dudhkoshi river basin of Nepal Himalaya by Shrestha et al. (2012).

Results

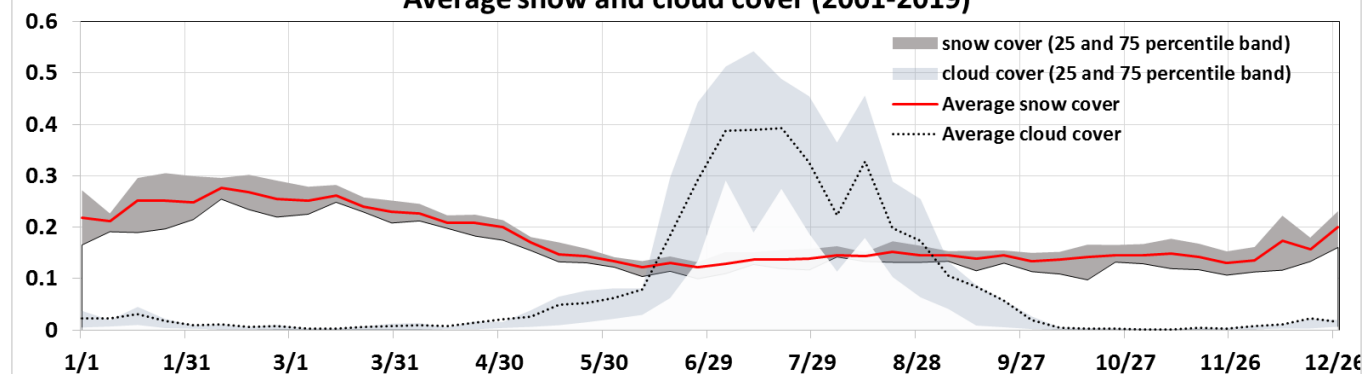
The following are the figures showing snow cover area over Nepal on 24 Oct 2018, 19 Dec. 2018, 6 Mar. 2019 and 17 May 2019.



Snow and Cloud cover area in fraction over Nepal (2001-2019)



Average snow and cloud cover (2001-2019)



Remarks

Average snow cover is about 23%, 26% and 24% (of total area of Nepal) in January, February and March respectively. Snow cover area begins to decline in April due to a rise in temperature and a fall in solid precipitation. Cloud cover is found remarkably less in the MODIS data until the end of April. Cloud cover increases gradually from May and becomes high in July and August, preferably due to active monsoon.

Way Forward

Basin-wide snow cover assessment and its impact on water resource projects in basin-scale would be the future tasks to be conducted. MODIS snow cover data could be utilized to validate the snow cover area generated by different hydrologic models. However, noises of snow cover in low elevation region and errors (overestimation and underestimation) due to cloud pixels need to be well addressed. The use of other optical or microwave remote sensing data could be the area of research to remove noises and minimize errors in MODIS data due to cloud cover.

Reference

Hall, D.K. and Riggs, G.A., 2016. MODIS/Terra Snow Cover 8-Day L3 Global 500 m Grid, Version 6, Boulder, Colorado USA, NASA National Snow and Ice Data Center Distributed Active Archive Center. doi:10.5067/MODIS/MOD10A2.006. [Date Accessed - 2020/09/27]

Shrestha, M., Wang, L., Koike, T., Xue, Y. and Hirabayashi, Y., 2012. Modeling the spatial distribution of snow cover in the Dudhkoshi region of the Nepal Himalayas. *Journal of Hydrometeorology*, 13(1), pp.204-222. doi:10.1175/JHM-D-10-05027.1.

FOR FURTHER INFORMATION:

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