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Simulation of snow cover in two non-monitored Andean catchments using VIC hydrological model with remote sensing validation

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Snow plays a key role in the hydrologic cycle over mountainous areas of Central Chile. Its principal function is to store a large amount of water during winter season and release it in spring creating a time gap between precipitation and streamflow.
Surface observations of snow like snow pillows or snow depths measurements are unable to capture fully the spatial and temporal variability of snow. Moreover, in this area is easy to find volcanoes and mountains over 6000 masl, but registers are found generally under 3000 masl. Nevertheless, additional information about snow can be obtained from hydrological models that are forced with surface meteorological variables (precipitation, air temperature, wind, etc.) and represent the effects of topography, soil and vegetation on snow processes, but these forcing registers are equally poor across this area. In this work, a combined in situ measurement and MODIS land surface temperature images were related to create daily maximum and minimum air temperature maps for two catchments of Central Chile located in Los Andes mountains, Colorado antes Junta Olivares and Olivares antes Junta Colorado, without any meteorological records available. To overcome the lack of this information we used the results of WRF (Weather Research and Forecasting) for wind and a vicinity gauge for precipitation.
The aim of this work was to validate the dynamics of snow cover comparing MODIS snow cover images with hydrological model results once streamflow calibration was performed. In this case, a gridded or "checkerboard type" model was required to compare both results. The chosen model was the Variable Infiltration Capacity (VIC) because it grids spatially the results and recently was released the "Data Set Global VIC Input Parameters at 0.5-Degree Resolution" reducing calibration effort time. However, VIC model has been used to assess water availability on continental and global scales using mainly 0.125 to 2 degree resolutions, a very low resolution for Chilean Andes, so we reduced the scale to 0.03 degree to observe snow cover elevation gradient effects. In this manner, is possible to observe the dynamics of snow cover since year 2000 until today (availability of MODIS images). Results for streamflow calibration using Nash Sutcliffe efficiency were 0.64 and 0.70 during 2002/2012 period. Respect to snow cover, we obtained 84% and 82% of similitude between images and model's results in both basins, Colorado and Olivares respectively.