Spatial and Temporal Variability of Snow Cover in the Andes Mountains

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Abstract. The Andes is the world's highest mountain range outside of Asia and has a wide variety of climates across more than 7,000 km. Most of the snow cover in these mountains is in the southern portion of the Andes, but the spatial and temporal patterns of snow cover have not been studied in detail in this region due to sparse and unevenly distributed climate data. Remote sensing offers the opportunity to document snow cover patterns throughout the region, including areas that have no ground-based snow measurements. The Moderate Resolution Imaging Spectroradiometer (MODIS) satellite sensors provide imagery two times per day using two satellite missions launched in 2000 (Terra) and 2002 (Aqua). This study uses the 500m, 8-day maximum snow cover extent product from MODIS to document the seasonal patterns of snow throughout the Andes region. To do this, we calculated a snow cover index (SCI) that represents the fraction of years with snow cover for each 8-day period across the year. A snow persistence (SP) map was developed for the 2000-2014 time period to identify distinct snow zones across the region. The results showed that snow cover lasts more than half of the year only in the highest elevations at the Peru-Chile border (18º Lat South). In the Atacama Desert area (18º Lat South to 30 º Lat South) little to no seasonal snow cover was detected. South of the Atacama Desert, the mountains had more persistent snow cover, with the extent of the winter snow covered area dropping with elevation further south. The MODIS-based product developed is an initial template for defining snow patterns and identifying areas that may be most sensitive to changing climate in the Andes Mountains. However, cloud cover in the southern Andes made challenging to map snow cover in this area.