

Snow cover dynamics in Andean watersheds of Chile (32.0-39.5°S) during the years 2000-2013

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This study analyses the snow cover area (SCA) and snow cover dynamics (SCD) for Chile using MODIS 8-day snow cover data. The authors first conduct evaluation of MODIS 8-day data using in-situ data and then analyze trends in the last years (since 2000). Moreover, they look the correlation of SCA with precipitation data. In, general I agree with the authors that snow information is highly valuable for such mountain regions where snow is stored in winter months and contributes to discharge in warm season when water resources is important for agricultural and energy production purposes. MODIS snow cover product can therefore be highly valuable in such remote areas where observation is rare. Therefore, I support the idea to use RS snow cover data to better understand the hydrological behavior in alpine regions.

However, in my opinion the study lacks on scientific quality. The outcomes that are based on scientific results may therefore not be robust and valid. The presented figures also have less quality. Moreover, some sentences are contradictory to results and needs justification. The outcomes (e.g. evaluation of MODIS data, trend analysis, correlations, etc.) that should bring scientific novelty are not based on robust methods which makes them questionable at the end. Therefore, I would not suggest this study for publication in HESS. My conclusion is based mainly on following general comments:

1. The authors evaluate MODIS 8-day snow cover data using in-situ data. MODIS 8-day snow cover data is the composite (maximum extent) of daily MODIS snow cover data (MOD10A1). If the authors compare average in-situ snow depth data for these 8 days with maximum snow cover extent in the same 8 days period, then the comparison is inappropriate as only one day of maximum snow cover extent can have high impact on 8-day snow cover data whereas this is not the case with in-situ data. Moreover, the authors state that they did not achieve good results for evaluation of daily snow cover data against in-situ, but the 8-day snow cover data is the product of daily snow cover data. Therefore, in my opinion the evaluation is not comprehensive. It would be more interesting to use daily snow cover data for evaluation to understand the impact of local climate (e.g. due to close distance to ocean, steep slopes) on snow cover behavior and why this can be challenging for snow observation using remote sensing.
2. The authors use only 13 (16) years of data for trend analysis. In my opinion, this is too less time series to carry out trend analysis and to make meaningful and significant conclusions on snow cover variability in this region. Moreover, it is not clear which time frame is used at the end for trend analysis as there are phrases with data usage on 2000-2013 vs. 2000-2016 (in the abstract section).
3. The presented quality of research is poor. The correlation analysis between SCA and precipitation also does not add any additional value to the research. It is known that precipitation should to some extent control the snow cover and therefore some correlation is expected (in most cases positive correlation). The relationship between SCA and precipitation as illustrated in Fig. 5 (for Biobio and Tolten watersheds) should not lead to conclusions that there is a negative or no correlation as the points are scattered over all region with no clear dependency.
4. The authors state in the text that they used also temperature data for the analysis (page 3, lines 33-34) but this was not the case.

5. Snowline definition is based on different sources for different watersheds and these studies are also from 1990s. High variation between snowlines (2100 m vs. 750 m) for different watersheds are questionable. It is difficult for international community to follow on which data are the values for snowline are based since the references are also in other language (Spanish).

Specific comments:

1. Figure 2 is too detailed and confusing. There is much more information than needed. For instance differentiation of each snow routines or observations is not necessary. Also, the duplication of figures as in Fig. 2b and 2d is not necessary.
2. Figure 3 shows some questionable results. There are several “jumps” in SCA after 2012/2013 where snow cover almost disappears for several days (or only one observation period – 8 day) and reaches its previous value only after few days. Such evidence is not visible in the time series before 2012/2013. The authors should check whether this is not due to systematic errors.
3. Figure 4 does not add any additional scientific value to this research.

Due to my general comments that leads to rejection, I did not add any further specific comments although there are some more where presentation art does not fit the standards of HESS.