

Dear editor and reviewers,

We are pleased to submit a revised version of the paper entitled “Daily gridded datasets of snow depth and snow water equivalent for the Iberian Peninsula from 1980 to 2014” by Alonso-González et al. First of all we want to thank the positive and constructive comments provided by the two reviewers. We have followed their suggestions and they resulted to us very useful to improve our manuscript. Below, you can find a point by point answer to all the comments by reviewers.

Looking forward for your kind reply,

Esteban Alonso-González and coauthors.

REFeree COMMENTS 1

Specific comments:

RC1: *The workflow used in this paper, from reanalysis to modelling, is really meritorious. Several hypothesis and parameterizations had to be used to obtain some inputs required for the snow modelling (lapse rates, cloud cover, fraction of solid precipitation...). They make a nice chain of hypothesis but, at the same time, add a lot of uncertainty to the input data derived from them. The authors themselves recognize, rightly, these limitations (section 3.2 and line 338 and following) and have clearly stated that the dataset may be useful only at regional scale studies. Besides, the resolution of the simulation, despite the usage of bands for the solid fraction of precipitation, is in the order of magnitude of the size or width of the mountain ranges we are dealing with in Spain, with the exception of the Pyrenees. I think that in most of these areas this is an important drawback to use this dataset, not only for avalanches or wind-driven phenomena, but also for hydrological or environmental applications (Line 373-374), which are here very dependent on local constrictions. I guess that the use of a more detailed model is feasible and a good next step. This is not a question in itself, but rather a comment to generate some discussion on this topic.*

Authors: We recognise the uncertainties and the limitations of the database due to the resolution and parametrizations. The main objective of the database was to develop long term regional scale studies, allowing the users to deal with the generalised lack of snow and high mountain meteorological data. It is obvious that the local effects may be not properly captured, but the main features related with interannual variability of snowpack depth and duration are properly reflected (although resolution is 10km the calculation of SD and SWE at 100 m elevation bands increases the representativeness of simulated snowpack even for small size mountain areas of central Spain or Sierra Nevada. In the Validation section, the database is consistent with MODIS data (in all the considered mountain systems) and with telenivometers signal. It proves that the database can deal with the inter-annual variability of the snowpack. The use of different thresholds in the telenivometers validation, proves also the consistency of the database with the intra-annual variability of the snow. For this reasons we considered that the generated products are a good description of the general behaviour of the snowpack for Iberia. The discussion of the revised manuscript specifically makes reference to existing uncertainties and potential limitations in its use, since obviously it must be used for regional scales and mid scales but is not reliable to deal with small scale snowpack variability.

Your suggestion of using more detailed models in the future is an interesting input. It is a possible path to follow in which we are thinking on it. Either way, higher resolutions means new computational and methodological challenges but we agree with the comment that can be a good next step.

RC1: *Did you carry out any kind of calibration of the snow model FSM? What criteria have been used to decide the configuration and the value of the parameters of the model?*

Authors: There is not enough observational data to calibrate properly the FSM model. We did a first approach with MODIS trying to select the best configuration but not consistent spatial patterns were found. Trying to avoid overfitting we choose the configuration with more physical sense (described in lines:144-148).

RC1: *Even though English is not my mother tongue, I think there are many poorly constructed sentences in what seems like a bad translation from Spanish passive tense. The paper would require a thorough grammatical revision. Examples: (some examples)*

Authors: Thanks for all your suggestions that have been incorporated to the manuscript. The grammar has been revised by a professional editor and we have carefully checked again before submission.

Technical corrections:

RC1: *Line 40: extra comma between 'economy' and 'of'*

Authors: Fixed

RC1: *Line 181 'de' by 'the'*

Authors: Fixed

RC1: *Line 194. 'parametrization proposed by Walcek'...Do you mean parametrization of Cc or SW?*

Authors: We mean Cc. We have rephrase the text as: "Thus, in this work, it was used the parametrization proposed by Walcek (1994) for c_c estimation..."

RC1: *Line 229-230. The sentence seems incomplete.*

Authors: We have rephrased the text as: "Similarly, we used data from telenivometers, which were available in the Pyrenees from October 2009 to June 2014."

RC1: *Line 232. 'Same workflow to each...' by 'Same workflow for each...'*

Authors: Corrected

RC1: *Lines 517 and 520. The author enumeration is duplicated (Liston and Elder).*

Authors: Corrected

RC1: *Lines 556-557 The same as above. And something similar in other references, like Line402-403, Line 425, Line 429 (...)*

Authors: Corrected

RC1: *Line 448. '?' in place of a missing character*

Authors: Corrected

REFeree COMMENTS 2 (RC2)

Specific comments:

RC2: *The reanalysis and modelling of Snow Depth (SD) and Snow Water Equivalent (SWE) for the Iberian Peninsula mountains presented in this paper is of great interest as mentioned before. However, and as the authors have rightly pointed, there are some limitations related with the applicability of the dataset. From my point of view and experience in snow variability in Sierra Nevada, the coarse resolution of the results (10km) would make difficult to use the data set for hydrological or risk management studies, as this topic require a much more detailed approach. However, the utility of the data set generated and presented in this paper in not dubious or doubtful, but it should be considered for larger scale analysis and not for local studies.*

In this regard, would you consider in the future to use a combination of MODIS images (good temporal resolution) with Landsat or Sentinel imagery (better spatial resolution) (lines 227-229)?

Authors: As we respond to RC1, we recognise the uncertainties and limitations of the database. The spatial resolution of the products limits its usage for local studies, but we consider that in the no-data actual context can be useful for many regional applications. Specially in those which long term daily data could be necessary, as land management, ecology or regional scale water management. We are currently using this database for relating snowpack with synoptic climatology, evolution of river flows and forest growth (from tree ring analyses) and the results are very satisfactory. Either way, resolution limitation is a key discussion point which should be considered for each application. We really hope that this is clearly stated in the discussion section of the revised manuscript (3.2. Gridded snow dataset: applications and limitations).

Answering your question, for this work we need observational products with great temporal resolution and long term series (MODIS cover ~1/3 of the dataset period) to validate. We had focus on this temporal resolution because of the main objectives of the database is the development of long term studies, so MODIS was the better option. But mix our products with different remote sensing data sources trough assimilation techniques is and interesting input that we will consider in the near future.

RC2: *Concerning the snow energy and mass model balance model, is not clear to me if parameters like emissivity are estimated daily (line 176-179) or hourly (as explained in line 164)? This should be clarified.*

Authors: Thanks for your comment. WRF outputs have a time resolution of 3h time step (line:117). We generate all the FSM inputs at the same spatiotemporal resolution than WRF outputs but the outputs are aggregated daily inside the FSM model in order to reduce the computing requirements for the users. A new sentence has been added to the revised manuscript in: 2. *Data and methods* paragraph: "FSM outputs where aggregated at daily time step in order to increase the manageability of the data". Thanks.

RC2: *For Sierra Nevada there are available DEM at a better spatial resolution. This is just a suggestion that could help you to improve the quality of the results.*

Authors: Thank you for the information. At the resolution we are working in this dataset we think is not necessary to use more detailed DEMs, but it may result of interest for future simulations.

RC2: *Regarding the grammatical revision and technical corrections, I would suggest the revision of the same aspects already pointed by other referee. So in this regard I would only add two corrections/suggestions:*

- *Line 244: The authors duplicate de Ns parameter. I guess the second one should be only N refereeing to the total number of days of the period.*
- *On the figure1 (page 20), I would probably add a small table with some details about the telenivometers and the SD sensors (mountain range, location, altitude, orientation...). Also on figure 3(page 21) there are 10 different locations with Telenivometers but on figure 1 we can identify only 8-9 Telenivometers. Maybe the Telenivometers location is so close to each other (in some cases) that the symbols are overlapped in map (Fig.1)?*

Authors: Thanks for the comment, same as answered to RC1, the grammar has been revised by a professional and a new revision made by the coauthors has been made to improve the revised manuscript. We have corrected the mistake in line 244. All the information about the telenivometers is online freely available (maps, coordinates, description of the area, photographs of each position...) instead of a table we will add the online reference that we consider that gives much more information. (line 255: A complete description of the telenivometers and its ubications can be found at www.saihhebro.com.) There was an error on figure 1. We had added the other telenivometers.