

Interactive comment on “Seasonality in the alpine water logistic system on a regional basis” by D. Vanham et al.

D. Vanham et al.

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Authors' response to the comments of Referee 2

We would like to thank Referee 2 for his/her evaluation and comments on the manuscript. In this response we answer to the fundamental critics and questions of the Referee.

GENERAL COMMENTS

In this section Referee 2 raises a number of critical issues and points, which we will discuss in more detail below.

Referee 2 concludes that the paper is not acceptable in its current form for publication in HESS, based on the assessment that the paper has no clear focus on *what information*

should be given and how the information should be organised. We do not think that this assessment gives the paper the credit it deserves and disagree with this harsh statement. We do agree that the equations presented can be more discussed -as asked by the referee- and that the Figures 2 and 3 can be presented in more detail with accompanying text. We also agree that the goal and implications of the paper should be more discussed, as stated below in more detail.

Referee comment: *First, it is not really clear, why we need a paper on this specific topic of how to calculate the start and end date of the winter period. Why it is so important to have two separate seasons? Please discuss implications and use of your results.*

Answer: A more detailed discussion of aims and implications was also asked by Referee 1. We agree to this aspect and stated on the 2nd of October in the discussion phase that we will focus on this matter in the final revised manuscript. We also stated in this answer an important issue in relevance to this analysis being climate change-as asked by Referee 1. To summarize our response: The main conclusion/goal of the paper is the definition of a winter and summer period in order to analyse a water balance (water resources - water demand) for these two defined periods. Especially the winter period is crucial as being the period with high water demand due to alpine tourism and low water availability. If the water balance in this period is not met (or no longer met due to higher water demand e.g. from technical snow making or lower resources e.g. due to climate change impacts) technical storage schemes have to be build. As we pointed out already in the discussion this issue will be made clearer in the final paper and we thank the referees for this comment.

Referee comment: *First, it is not really clear, why we need a paper on this specific topic of how to calculate the start and end date of the winter period. Why it is so important to have two separate seasons?*

Most of the text is rather general information of alpine water resources in the Kitzbuehel

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region, which may be interesting for the reader, but not needed to understand the methodology adopted or the results presented. For example chapter 1.2 to 1.4 are, of course, related to the topic but not really necessary. Due to the plethora of such general information, it is not possible to follow the central theme.

Chapter 1.2 to 1.4: Not really needed to understand the methodology adopted or the results presented. Please remove.

Answer: We strongly disagree with the reviewer to remove the chapters 1.2 to 1.4. These chapters are essential to this paper, and give an answer or fundament to the first question of the reviewer *Why is it so important to have two separate seasons*. In these chapters the whole interaction between water resources and water demand and its typical seasonal behaviour in an alpine environment are discussed. Therefore we do not see these chapters as mere *rather general information of alpine water resources in the Kitzbuehel region*. As a matter of fact, we see them as crucial information to understand the methodology and results - a question raised by the reviewer. The term *plethora* seems quite inappropriate in this context. The information in these chapters is a fundament for the equations 1 to 3.

Referee comment: *The Referee asks for a more detailed description of the equations 1 to 3 including the clarification of specific terms.*

Answer: In the final version of the paper, we will include a more detailed description of the equations 1 to 3.

SPECIFIC COMMENTS

Referee comment: *Title: What does the title mean? Please do not use terms (water logistic system), which are not clear and have to be defined in the abstract.*

Answer: We agree with the reviewer. This question was already raised by reviewer 1, and answered by the authors on the 2nd of October. An alternative title could be: "Seasonality in alpine water resources management - a regional assessment".

Referee comment: *p2719: It seems that the authors use the approach of Schoener and Mohn (2003) to produce their snow cover duration map. But as Schoener and Mohn (2003) already cover the Kitzbuehel area, why it is necessary to produce a new map. Better resolution, more station data?*

Answer: Schoener and Mohn (2003) published a snow cover duration map in the Hydrological Atlas of Austria. This map only indicates the duration (length) of the snow cover, not the start and end dates. However, as described in the paper, a snow cover mean start date and end date raster are used in the analysis. These had to be generated. An interpolation module as described on p2720 l3-7 was used. The resolution 250m*250 m (p2720 l6-7) is the same as in the analysis of Schoener and Mohn (2003) (p2719 l12). We do not know how many station data were used by Schoener and Mohn (2003) in our study area. The snow cover duration map of Schoener and Mohn (2003) was also used as a verification for the methodology used in this paper, as described on p2724 l10-13.

Referee comment: *p2719 l5-l14: I think this is not needed to understand the methodology. Please remove.*

Answer: In this part it is stated that Schoener and Mohn (2003) generated a snow cover map (250m*250 m) for the entire Austrian area, based upon a spatial interpolation of daily snow depth measurements at 835 climatological stations for the World Meteorological Organization's climate normal period from 1961 to 1990. Further in the text it is referred to this passage. The reviewer also relates to this topic in his/her previous question, hereby making this paragraph relevant himself/herself. It is the opinion of the authors that this part has relevance to the paper.

Referee comment: *p2721 l16-28: Is this really the right place for the chapter (inbetween snow making)?*

Answer: Will be changed in the final version.

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Referee comment: *p2721 I16: What does GIS-multicriteria approach mean? Please stress out what are the different alternatives and criteria in your study.*

Answer: An answer to this question is given in the paragraph p2721 I16-27.

Referee comment: *p2723 I1 SCOV5190_s and SCOV5190_e are not intuitive terms for start and end date maps.*

Answer: Intuitivism is a subjective matter. We used abbreviations that in our opinion comprise all information these geodatasets represent (SCOV= snow cover; 6190= mean values for the period 1961-1990; s and e= start and end date of the snow cover duration respectively)

Referee comment: *P2723 I14: Which procedure is visualised? A map of water supply is given.*

Answer: A map representing the seasonal behaviour (by means of the mean snow cover start date) of the water resources providing the water supply systems to which hotels and guesthouses are connected is given

Referee comment: *P2723 p2724 What is the time step used in the procedure? SCOV5190_s and SCOV5190_e are on a daily basis, Eq.3 is calculated on half-month intervals.*

Answer: The question of time step was already raised by Referee 1. We understand that our text led to some ambiguity. As stated in our response to the comments of Referee 1 on the 2nd of October in the discussion phase, the time step is a daily one. In the actual analysis a daily time step is used. The grids "SCOV6190_S" / "SCOV6190_E" comprise daily information. The half month time intervals are stated as a generalisation.

Referee comment: *p2726, I3: Why are start and end date calculated only from Eq. 1, or should it be Eq. 3.*

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Answer: p2725, l3. No, it is Eq. 1, which takes snowmaking into account. They are not only calculated from this equation.

Referee comment: p2726, l5: " results in a weighted start of the winter seasons of 0.88 to 1.." What does it mean? p2732 Table 3 What are "seasonality results"? Please explain what single numbers mean.

Answer: The first question was also stated by Referee 1. Basically this refers again to the question which time step has been used in the analysis. This is a daily one. The mean snow cover start (SCOV6190_S) and end date raster (SCOV6190_E) have been interpolated on a daily basis (i.e. every grid cell defines a specific day of the year). In the presentation of the results we used half-monthly intervals. However, we understand that our description regarding this matter leads to some ambiguity. We will adapt this in the final version of the paper.

Referee comment: p2734 Fig. 2 Where can i see the ski regions used in Eq.2?

Answer: The seasonality of snowmaking is analysed in Eq. 1, not Eq. 2. The ski slopes presented in Fig. 2 represent only a part of all ski slopes in the study area. We can add names and location in the final version of the paper.

Referee comment: p2734 - p2735: It is not clear why Fig.2 and Fig.3 are necessary. They are just two maps of ski slopes and water infrastructure. If there is something special, please explain.

Answer: See before. We will describe these figures better in the final version of the paper.

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