

## ***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 file to Editor

First we would like to thank the Editor and both Referees for their evaluation and comments on the manuscript, which definitely improve its quality. We incorporated all comments in the revised manuscript (major revision) and give an overview of changes in this document. We also like to refer to our replies in HESSD to the comments of both reviewers, as we already answered here to different questions in detail.

### **GENERAL COMMENTS**

Both Referees think that the Title should be re-thought.

**Answer:** We changed the title to: "Seasonality in alpine water resources management

- a regional assessment". The text in the final revised manuscript is adapted accordingly. We do not use the term water logistic system any more, we only refer to water resources management. In Eq. (3) (in the new version Eq. (4))  $T_{log}$  is changed to  $T_{wbal}$  (wbal referring to water balance), as this expresses the goal of the paper.

Both Referees and the Editor state that the presentation – aims – goal – conclusion – of the paper are not clear enough. Referee 1 asks to give more focus on a general outlook, including the aspect of climate change. Referee 2 asks to remove the chapters 1.2 to 1.4, and to better discuss the 3 equations, also questioning the presentation of the Figures 2 and 3 (in the current version Figures 3 and 4). Both Referees 1 and 2 ask to be clear on the time step.

**Answer:** We adapted in detail the Abstract, Chapter 1.1 and the Conclusions in order to describe the focus, implications and practical use of the presented methodology. We extended the general outlook in the Conclusions.

We did not remove the chapters 1.2 to 1.4 as suggested by Referee 2, as we see them as essential to this paper. A more detailed justification on our behalf was given in our answer to Referee 2 in HESSD. However, we did adapt chapter 1.3 significantly to express the information in a more concise way. We did not see much possibility to reduce on the information given in the chapters 1.2 and 1.4.

We did adapt the chapter Methodology (Chapter 3) and the Figures as asked by Referee 2. First we divided Chapter 3 into 3 subchapters in order to achieve a more structured and clear formulation. We chose to describe the Equations 1 to 3 in more detail by means of visualising them in the adapted Figures 2, 3 and 6 (in the current version Figures 3, 4 and 7). The different factors in the Equations are presented here.

The time step in the analysis is a daily one. For clarity we deleted all descriptions about half-monthly time intervals. We only present the interpolated snow cover start and end date rasters in half-monthly intervals in Figure 4 as in the original manuscript. This8211; as described in the Results (Chapter 4) - in order to show the much shorter

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temporal and spatial variation of the snow cover start date raster (SCOV6190 \_S) (2.5 months) in comparison to its counterpart end date (SCOV6190 \_E) (4 months).

We included a new Figure 2, representing the average monthly number of tourist overnight stays (in Mio.) recorded for the years 2000 to 2006 in the Kitzbueheler region. We also included the public base water demand as a factor influencing the definition of both seasons, as this water demand stake holder is influenced by the seasonal behaviour of the water resources that serve its supply systems (Equation (3)) with accompanying description. Eq. (3) in the original manuscript has become Eq. (4). This is a large improvement with regards to the original manuscript, as now the variance between different municipalities in terms of population is included. In the Kitzbueheler region this water demand stakeholder does not have a lot of effect on the seasonality. This was the reason why it was first not included. However, to be able to implement this method in alpine regions with different characteristics, this water demand stakeholder is essential. In the manuscript (Conclusions, last paragraph) the examples of Soelden and Innsbruck are given. With respect to this change we included a new Table 4, and adapted Table 5 (Table 4 in the old manuscript).

We included a new Table 1 representing land use in the study area (with accompanied description in Chapter 2 - Study Area) as requested by Referee 1.

We adapted Figure 1 by indicating the elevations of the different stations - an issue requested by Referee 1).

## SPECIFIC COMMENTS AND TECHNICAL CORRECTIONS

**Referee 1 comment:** *Snow data and interpolation: The altitude bias in snow measurement should be discussed, for the higher altitudes are underrepresented (as in almost any gauging network in mountains*

**Answer:** We included this matter in Chapter 3.1 (Snow cover start and end date) for the map of Schoener and Mohnl (2003). We included this matter in Chapter 4 (Results)

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for the study area (first paragraph).

**Referee 1 comment:** *Methodology: Commercial water use is also derived from number of inhabitants. Is commuting relevant?*

**Answer:** Answered in our reply to Referee 1 in HESSD

**Referee 1 comment:** *Methodology: The formulas for  $T_{\text{snow}}$  and  $T_{\text{tour}}$  are introduced also on a half month time interval, grids "SCOV6190\_S" / "SCOV6190\_E" on a daily basis (p2724 l14). Be clear on the time-steps used.*

**Answer:** See GENERAL COMMENTS

**Referee 1 comment:** *References: the extensive data in the Hydrological Atlas of Switzerland could be referred to as a comparison, eg. the respective plates for low flow, snow cover and discharge regime, but also the significance of the Alps for water resources questions.*

**Answer:** Answered in our reply to Referee 1 in HESSD

**Referee 1 comment:** *p2714 l1 rather "a" instead of "the" water logistic system? .*

**Answer:** Not applicable any more as we removed the term water logistic system. See GENERAL COMMENTS.

**Referee 1 comment:** *p2714 l4"both temporal and spatial seasonal fluctuations": no clear. difference between temporal and seasonal fluctuation? inter- or intra-annual?*

**Answer:** Temporal refers to time, in this case intra-annual. Spatial refers to the elevation factor in mountainous areas.

**Referees comment:** *Both Referees question the sentence - The goal of this study is to determine an optimal winter and summer season, for which the water balance variability within the water logistic system is reduced to a minimum - on p2715 l8-10.*

**Answer:** We deleted this sentence as it is not an appropriate formulation. Actually we

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rewrote the whole chapter 1.1 to describe the goal - focus of this paper.

**Referee 1 comment:** *p2714 l24 "...being very dependent on seasonal variation, the water demand ..." relation between sub-sentences not clear. is it a causal relation?*

**Answer:** This sentence was deleted, as the Chapter 1.1 was rewritten. This also applies to the following technical correction comment of Referee 1.

**Referee 1 comment:** *p2714 l14 "datasets **\*\*of\*\*** mean..."? p2715 l5 why is "system" in brackets? p2716 l5 "mind **\*\*that\*\*** in the Austrian..."*

**Answer:** Adapted

**Referee 1 comments:** *p2714 p2716 paragraph 1.3 make clear why low flows are considered. p2716 l21 [mm/a] is **\*\*runoff\*\***, not specific discharge (latter would be l / (s km<sup>710</sup>;2))*

**Answer:** Adapted as Chapter 1.1 was rewritten.

**Referee 1 comments:** *p2718 l19 land use statistics would be helpful (percentage of forests, rock, ...)*

**Answer:** See GENERAL COMMENTS

**Referee 1 comments:** *p2719 l21 "winter cover" is not explained sufficiently*

**Answer:** Adapted to a more detailed description

**Referee 1 comments:** *p2719 l21 "p2720 l29 why must the study only take into account seasonal water demand? Is this compulsive, a decision of the authors or following from the analysis?"*

**Answer:** This is a decision of the authors. In Chapter 1.1 this is discussed in more detail

**Referee 1 comment:** *p2722 l22 rather **\*\*\*Because\*\*** the..." instead of "While the...". p2723 l10 is 20*

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**Answer:** All 3 comments are addressed to in the revised version

**Referee 1 comment:** p2725 l5 what does "winter season of 0.88 to 1" mean? explain.

**Answer:** This was only applicable for the half-monthly time interval. We deleted this time interval as described in GENERAL COMMENTS

**Referee 1 comment:** p2726 l26 Kan, not Kann. p2731 make clear that first two items refer to water sources1 and third item to water sources2. p2737 "relationship" in legend is somewhat misleading. this is rather an example from a (representative) year

**Answer:** All 3 comments are adapted in the revised version

**Referee 1 comment:** p2733 indication of station altitudes would be helpful (cf. discussion of station altitude bias)

**Answer:** See GENERAL COMMENTS.

**Referee 2 comments:**

**Answer:** The general comments of Referee 2 are addressed to in the above section the Author8217;s answer in HESSD of 22 October 2007. To all specific and technical comments a reply was given in the Author8217;s answer in HESSD. Regarding p2719 l5-l14: I think this is not needed to understand the methodology. Please remove we removed p2719 l5-l10.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 2713, 2007.

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