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## ***Interactive comment on “A new permanent multi-parameter monitoring network in Central Asian high mountains – from measurements to data bases” by T. Schöne et al.***

### **Anonymous Referee #3**

Received and published: 22 September 2012

#### 1. Synopsis

The manuscript describes the development and adaptation of a hydro-meteorological sensor network for remote, high altitude environments in Central Asia. Central Asia's arid lowlands heavily rely on water resources originating from the high mountain ranges of this region. Thus, shared open-access hydro-meteorological data are of high societal relevance in this region – in particular, as collecting observations of environmental parameters has been declining since the former Soviet Republics became independent. The introduced sensor data-base is designed for open access to hydro-meteorological observation data with the option (and declared goal) of integrating future environmental

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sensor networks. However, to achieve the latter task further information is needed in terms of (i) system integration specifications and (ii) a full description of the underlying (meta)data model. Obviously, this can't be documented in a scientific paper – however supplementary material or a technical report covering these issues would be highly appreciated (I fully agree with the other referees).

## 2. General Statement

The structure of the paper is clear, the language is concise. The figures and tables are supportive, but some figures could be joined or should be reworked (details see below). A rather weak point of the paper is the discussion. Discussion and conclusion should be separated. Right now, it's a conclusion with very little discussion. In the discussion, the design of the installed sensor network should be compared and discussed with similar wireless sensor networks (WSN) operated in alpine environments (Scientific WSN: e.g. Beutel et al. 2009, Simoni et al. 2011, Zhang et al. 2012; Governmental WSN: e.g. Egli et al. 2008; Commercial WSN: e.g. Campbell, Decagon, Ott, Seba etc.). The topic of the paper - multi-parameter (wireless) sensor networks - is not a novelty itself. However, the significance of this paper lies in the task specific adaptation of an expandable WSN at a multi-national scale in a region where environmental observations are heavily needed by society and science. Finally, making data freely available is a great approach, which should be better acknowledged by the science community.

## 3. Detailed Suggestions

### 3.1 Title

Monitoring is not limited to sensors – it implies both, sensing and sampling of the environment. However, the manuscript focuses on sensor networks. As sampling is in the scope of this paper, I suggest to replaced the term "monitoring" by "sensing".

### 3.2 Text

p302/l2 please define "flow formation zone" or give a reference

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p302/I16-20 are (or will be) these rehabilitated stations be included into your WSN?

p302/I24-27 The chosen WSN design should be discussed and be put in context with WSN's operated in Alpine/High Mountain regions (see references in general statement)

p302/I28 Why are real-time data transmissions to data users are needed? Please illustrate that (example, application, reference). This part could/should be discussed (-> new section discussion), as this has a significant impact on power consumption (and thus of the design) of your WSN!

p304/I1-2 The data management structure and the underling data model should be discussed (-> new section discussion), described or referenced at least. The hardware is nicely described in section 2.1, the sensors in section 2.2, but neither section 2.3 nor 3 does explain the data model -> this could be illustrated in an addition figure (e.g. simplified data model).

p306/I3ff You nicely describe the sensors in detail. Is would be interesting to know more about your sensor selection criteria (e.g. power consumption vs accuracy/precision vs robustness), which have to be balanced/optimized. - > This could be done either in the text or possibly in Tab. 1

p306/I17 Typo: headwater?

p311/I15ff Beyond a description of the central IT-platform, it would be very useful to have an illustration of the applied data model, e.g. a Figure XY (more see under Figures). This would help external users interested in make use of your open data base, as it would clarify the query options (and might be more illustrative than Tab.3).

p314/I5ff Section 4.1 Could you please specify, which hydro-meteorological parameters are observed? (same for section 4.2).

p314/I10 What is "the standard hydro-meteorological equipment"? Which parameters, sensors types & specs? Alternatively, reference to Tab.2 and/or 5.

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p315/113 "...snow and its properties". Please specify these snow properties: snow-water-equivalent, snow temperature gradient,...? Or cross-reference to the according table.

### 3.3 Figures

Fig.1 Could Fig.1 be merged with Fig.8? A legend illustrating elevation would be helpful (or contour lines at 1000m, 2000m, 3000m, 4000m). Locations and labeling of large glaciers (Fedschenko etc.) and large reservoirs could be supportive. Possibly better use 'Tien Shan' (Russian name) instead of 'Tian Shan' (Chinese name).

Fig.2 Is this picture really needed? The sensors are hard to see, the picture is taken from an non-illustrative position (back side) - I assume you have better pictures - otherwise I suggest to skip this picture.

Fig.8 This figures has to be reworked. Scale, N-arrow and/or coordinates are missing. Major rivers (Amu Darya, Syr Darya) and 3000m, 4000m, 5000m contour lines would help to understand the site selection of your stations. → Why are there no stations planned in the Central and Eastern Pamir regions? Kyrgyzstan is much better covered than Tajikistan (or N-Afganistan, Wakhan Valley). What about the Fedchenko-Glacier station (Aizen et al., 1997)? Will this station be included into your data base? Fig.XY → Additional Fig.: Simplified (meta)data model, illustration the query options of the data base.

### 3.4 Tables

Tab.1 Please add columns describing precision & accuracy of the instrument/sensor.

Tab.4 Please add a column sensor/instrument.

Tab.6 Please add columns altitude and coordinates of station. → I assume that snow sensors and stream sensors are spatially separated - what's the difference in altitude and horizontal distance?

#### 4. References

Aizen et al. 1997. Climatic and Hydrologic Changes in Tien Shan, Central Asia. *Journal of Climate*, VOL.10, pp. 1393-1404.

Beutel et al. 2009. Operating a Sensor Network at 3500 m Above Sea Level. *Proc. 8th ACM/IEEE Intl Conf. on Information Processing in Sensor Networks (IPSN/SPOTS 2009)*, pp. 405-406.

Egli, L. 2008. Spatial variability of new snow amounts derived from a dense network of alpine automatic stations. *Annals of Glaciology*, VOL.49(1), pp. 51-55(5).

Simoni et al. 2011, Hydrologic response of an alpine watershed: Application of a meteorological wireless sensor network to understand streamflow generation. *WATER RESOURCES RESEARCH*, VOL.47, W10524, 16 PP., doi:10.1029/2011WR010730

Zhang et al. 2012. An Eco-Hydrology Wireless Sensor Demonstration Network in High-Altitude and Alpine Environment in the Heihe River Basin of China. *Wireless Sensor Network*, VOL.4, pp. 138-146 doi:10.4236/wsn.2012.45020

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