Hydrol. Earth Syst. Sci. Discuss., 8, C5010–C5013, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C5010/2011/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Prioritization of water management under climate change and urbanization using multi-criteria decision making methods" *by* J.-S. Yang et al.

S. Stoll (Referee)

stoll@ifu.baug.ethz.ch

Received and published: 18 November 2011

General comments

In this paper, multi-criteria decision making techniques are used to evaluate five different alternative management strategies concerning their effectiveness to guarantee environmental flow under climate change and urbanization conditions. Although I find the topic interesting, in the current form, the paper is hard to follow. A clear formulation of the problem is missing and the work is based on number of (hydrological) methods which are not explained in the paper. The authors also did not account for the

uncertainty related to climate change projections and the hydrological modeling.

Specific comments

I found some parts of the manuscript hard to follow. For example, I miss a clear formulation of the management problem. What is the specific problem in the catchment and how would the suggested measures contribute to a solution. Related to that, I would suggest to put the catchment description in front of the methodology section.

You work is based on the modeling results presented in Chung et al. 2011. To enable the reader following your study without thoroughly reading the complete Chung et al. paper, I would suggest including a short description of the hydrological model and the downscaling method in your methodology section. Related to that I would also strongly recommend to clearly separate between the results you produced yourself and results you got from Chung et al. 2011. You shouldn't present the results of Chung et al. 2011 in your result section.

Being a natural science-oriented hydrologist and quite a novice concerning the multi-criteria decision making problem, I would find it very convenient to have a bit more comprehensive introduction into the multi-criteria decision making topic. For example by introducing terms like the payoff matrix shortly.

Section 4.1 What is the rationale behind the proposed alternative watershed management strategies? Why did you choose them and what is the benefit regarding the management problem. I would rather put them into the methodology section, as they are not a result of an analysis you presented in the manuscript. It would be also interesting to know, what you mean by using groundwater which is collected in the subway (how is it collected, where is it stored and pumped etc.; are the cost for pumping included in the cost estimates presented in Table 6).

I have some serious reservations how climate change is handled. The climate change scenarios presented, are based on the downscaled outputs of just one global climate

model. It is widely known that especially the precipitation outputs of global climate models are highly uncertain. Different climate models usually produce different precipitation trends. While one model expects decreasing precipitation other models may project increasing precipitation amounts. There is also the uncertainty connected to the intra-annual distribution of precipitation which can be quite different among several climate models. Additionally, recent studies have shown that also the downscaling method can contribute significantly to the uncertainty envelope. Related to the latter, I'm also missing a description of the downscaling method (not the name of the software, but the approach used in the software). I would recommend analyzing the results of other climate models. At least, a discussion about the uncertainties should be included in the manuscript. Stating clearly, that this is just one among several possible future climate change projections.

Usually Rainfall-Runoff models are subject to large parameter uncertainty. As the performance of the model is not reported in the manuscript, I had a look in the Chung et al. paper. Although the model efficiency was reasonable, I had the impression that especially during the recessions, significant deviations are present. As you focus on discharge during dry periods, this might be of importance. Therefore, it would be interesting to know not only the standard Nash-Sutcliffe efficiency but also the logarithmic one, which gives more emphasis on the low flows.

P9903, l.19-25 and Table 7 It would be interesting to know, which random values were assigned. I find it very surprising that although random numbers were chosen, no change (compared to the other scenarios) can be recognized concerning the prioritization. Can you comment on this? How to do explain, that you get quite serious different results for AVF and Electre II (e.g. for alternative 4)? Which method would you trust more?

Figure 3 I did not fully understand why you introduced driving force and pressure as evaluation criteria. While I understand that it would be beneficial to reduce P2 (groundwater withdrawal), I do not see how you can judge the others. For example how do you

score things like the slope? What is meant by ratio of covered length?

Technical corrections

In your conclusions you state, that Alt 5 is found to be the most preferred one, which would be the construction of a small treatment plant in DR. However, in the abstract you state that the use of groundwater collected by the subway would be the preferred alternative.

P9903, l.6: insert "selected" after "Fourteen criteria are. . ."

P9904, l.22: correct to 0.6

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 9889, 2011.