

## ***Interactive comment on “Groundwater contribution to river flows – using hydrograph separation, hydrological and hydrogeological models in a southern Quebec aquifer” by M. Larocque et al.***

### **Anonymous Referee #2**

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This paper is devoted to the estimation of base flow by using three different methods (a conceptual hydrological model, a groundwater flow model and hydrograph separation). The paper is well written and well organized.

The paper needs some revisions and additional discussions for the following reasons:  
- Concerning the conceptual model, the estimated bias for the validation period is -2.5 m<sup>3</sup>/s and the RMSE is 23.8 m<sup>3</sup>/s, whereas the estimated base flow fluctuates between 5 m<sup>3</sup>/s (summer period) and about 28 m<sup>3</sup>/s (april). What is the reliability of the esti-

mated base flow? - The groundwater flow model is calibrated by trial and error using average heads only. Why is the model run in steady state? What about the leakage coefficients used to estimate the exchange between rivers and groundwater? Could the recharge rates estimated by the conceptual model be used for the groundwater simulation? - The match between measured and simulated heads shows some significant differences (44% in the range of +/- 5m, 71 % in the range of +/- 10m). Since the water exchange between groundwater and rivers is proportional to the head differences, these differences will impact the computed flow rate in the rivers. This should be quantified. - The groundwater model is run in steady state with annual varying recharge. This means that there are no storage effects in the domain within one year. This assumption should be verified. - There are many possible parameter sets which will be able to reproduce the piezometric heads and the estimated flow rates will strongly depend on these parameters. These uncertainties cannot be handled by trial and error calibration. Therefore, I would strongly recommend calibrating the groundwater model in transient and with an automatic procedure (MODFLOWP for example). This will lead to a better estimate of the base flow rates with an estimate of the associated uncertainties.

I encourage the authors to provide some additional results concerning the uncertainties of the base flow estimation for the conceptual and the groundwater model.

Minor comments P. 7819, line 16: ... tends to overestimate... P. 7819, line 18: ... higher air temperatures at the end ... P. 7823, line 2-3: ... It is improbable that water .. Fig. 4 is difficult to read.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 7809, 2010.

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