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Hydrology and Earth System Sciences Discussions

Interactive comment on "HYDROGEIOS: A semi-distributed GIS-based hydrological model fordisturbed river basins" *by* A. Efstratiadis et al.

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The paper by Efstratiadis et al. presents a hydrologic model of a river basin that is endowed with the capacity for water resources management integrated in its structure. This particular feature makes HYDROGEIOS a very useful tool in water resources engineering that can be applied to study actual or hypothetical (planned) states of a basin and, as the authors also point out, can serve the objectives of the European Union's Water Framework Directive (WFD) 2000/60/CEC as well. The discusser wishes to commend the authors for their work, and also to raise a few issues for which further clarifications are requested of the authors.

The first (minor) point concerns the term "disturbed", which is used in the title and also in the body of the paper to indicate river basins or hydrosystems modified by

human intervention. In keeping with the terminology of the WFD for the water bodies, the authors may want to consider adopting the term "modified", instead of "disturbed", since the latter connotes a state of departure from normality that is often associated with a malfunction.

Regarding modelling, there appears to be an inconsistency between the understandably terse description of the groundwater flow component of the model in the paper (section 3.3.2) and the one given in the cited work of Rozos and Koutsoyiannis (2005). It is stated in the paper, immediately after eqs. 3 and 4, that the model leads to a system of linear equations, which implies that the interfacial areas between the polygonal cells are constant. In a classical porous medium, such a linear flow model corresponds exactly to confined aquifers and also approximately to unconfined aquifers, after linearisation of the relevant equations. However, the groundwater flow model of Rozos and Koutsoyiannis (2005) is a conceptual one that was designed to represent a karst system by a number of cells (storage elements) interconnected via conduits; that model is non-linear in the case of free-surface flow in the conduits (and it is, of course, linear in the case of pressure, or pipe flow). The authors are requested to clarify the groundwater flow model employed in HYDROGEIOS.

With respect to the parameter estimation/optimisation method used by the authors, which employs multiple criteria that also include soft information, it is worth pointing out that a similar approach was also successfully applied by Mazi et al. (2004a, b). The comparison is relevant, and can be useful, as in both cases it was important to obtain an overall good modelling efficiency, while also simulating extreme conditions in a reasonable manner: in Efstratiadis et al. (2007), periods of no-flow, in Mazi et al. (2004a, b), the opposite, avoiding the running dry of a "linear reservoir aquifer" (conceptual lumped model). In both applications, the goal was achieved by judicious (non-optimal, in a global sense) specification of certain relevant parameters, in an overall near-optimal parameter set.

Regarding the case study, the discusser agrees that the model performance, or effi-

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ciency, is generally good, especially given the complexity of the modelled hydrosystem. However, one notices also that, with the exception of the discharge hydrograph at the basin's outlet, which is simulated with high efficiency, the modelled hydrographs are smoother than the corresponding observed ones and, typically, more notably so during the model validation period, October 1990 - September 1994, than during the calibration period, October 1984 - September 1990. The discusser wonders whether this behaviour indicates that, while the discretisation of the entire basin is sufficient for predicting the total basin response at the basin outlet, it is not adequate at the level of the sub-basins, hence the somewhat diffuse responses. [Of course, a more detailed breakdown of the basin would increase the number of parameters and thus the computational effort, especially during optimisation, but this is an additional matter to ponder and to decide, to some extent, independently, also considering the overall purpose of the model application]. The authors are kindly invited to comment on this observation.

It is also noted, as a side remark, that, given the (proper for water management simulations) monthly time step, the use of the term "flood" (section 5.3 Calibration strategy) should be avoided, because floods in the Boeoticos Kephisos basin last, at the most, a few days and, therefore, cannot be resolved at the monthly scale. The authors may want to consider as, probably, more appropriate the term "period of high flow".

Finally, the presentation of this generally well written paper would benefit from a careful editing of the text. A version of this useful paper, edited by the discusser during its review, is at the disposal of the authors for their consideration in composing the final copy.

References

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