

## ***Interactive comment on “Teaching groundwater dynamics: connecting classroom to practical and field classes” by V. Hakoun et al.***

**V. Hakoun et al.**

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Received and published: 7 March 2013

### **Answer to Reviewer comments (T. Gleeson)**

Please find below a point by point answer to the Reviewer. The Reviewer remarks and questions are in bold text.

**Hakoun et al provide an interesting and very useful example of an integrated hydrogeology class. Personally, it was very gratifying to see many of the theoretical ideas we suggested in our review paper (Gleeson et al 2012) actually used and used effectively, to the benefit of the students. Two major strengths**

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**of the paper are: 1) how the authors are very clear and thoughtful about what they want the students to learn - this type of reflection and planning is critical but relatively uncommon. The common terms for this the authors should add is 'teaching/learning goal/objective'. 2) the detailed appendices of student activities will be useful for many hydrogeologists. The text is relatively clear although some of the authors' English vocabulary is confusing - I would be happy to help with this over a quick skype call or they could hire a English editor.**

→ Thank you for the constructive Skype discussion and for both your positive comments and useful suggestions that helped clarify the manuscript.

**The common terms for this the authors should add is 'teaching/learning goal/objective'.**

→ We added to the revised manuscript the list (see below) of the teaching goals for the course example presented in section 3 'An adapted teaching loop for a course on groundwater flow processes'. These teaching goals are:

- overall knowledge of aquifers types and properties,
- fundamental laws and equations to describe groundwater flow processes,
- analytical and numerical models as a tool to solve groundwater flow problems and assess hydrodynamic parameters,
- quantitative analysis of groundwater problems,
- numerical modeling of groundwater flow and transport.

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**1)Is there any data on student success, engagement and enjoyment (such as before and after surveys) since all the information of student responses in the paper is anecdotal. Or data on ability of students to acquire jobs after this integrated training? This would really strengthen the paper and is basically essential for geoscience education journal but maybe not for this HESS special edition.**

→ We agree about the fact that such data are essential for geoscience education papers. Indeed without such data the course's impact on the students' learning process is hard to defend. Unfortunately, no survey on students success and engagement was conducted before 2004. Statistics on the overall students professional insertion are available but it is difficult to evaluate the specific impact of this course. Indeed, job access also depends on the job-market demand so that the influence of the training characteristics on the job acquirement is not straightforward.

**2)Another tool that could be mentioned is using videos of aquifer experiments in class - I do this and it is a quick and easy way of bringing some lab experiments into the class. Some example videos are on my webpage.**

→ We also show such videos to the students in other courses, we do agree that this is an easy way to bring lab experiments into the class. We have now added this information into the improvement paragraph in the 'Discussion' section of the revised manuscript.

**3)Pictures of the apparatuses in Figure 3 could really be useful - a picture is worth a thousand words. Also a scale would be useful in these schematics. Finally, the use of the row of piezometers in each of these is unclear to me -try**

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**to explain this.**

→ We modified Fig. 3 in the revised manuscript. We added to the figure a photograph of each apparatus and modified the captions and labels. We also added a scale to the schematics. In the previous version of Fig. 3 the row of piezometers was represented having in mind to describe precisely the couple of apparatuses. The newly added photographs are more explicit and the previous piezometer representation is not essential anymore. We removed it.

**4)'Groundwater dynamics' is not defined anywhere. I am not sure exactly what the authors mean by this. May groundwater flow or groundwater flow processes might be more clear? Not sure. Atleast Groundwater dynamics should be defined very early in the manuscript.**

→ This points out a wrong French to English translation. The terms 'Groundwater flow processes' that we define as 'the motion of water in an aquifer' expresses best what was referred to as 'groundwater dynamics' in the manuscript. Each occurrence of 'groundwater dynamics' has been replaced by 'groundwater flow processes' and we also added a short definition of 'groundwater flow processes' at the end of the 'Introduction' section in the revised manuscript.

**5)Define what '5 ETSC' are more clearly - how many hours per week of instruction? Overall percentage of degree etc? imagine somebody from Canada or Ghana trying to see how much effort students are expected to do.**

→ The European Credit Transfer and accumulation System (ECTS) is a grading system defined by the European Commission. 5 ETSC correspond to a course of 50

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hours during one semester. 5 ECTS represents about 16 percent of the total number of ECTS a student must obtain in one semester. We added these precisions into the subsection 'Overall teaching approach' in the revised manuscript.

**Minor English suggestions: replace all eg. With such as -pg.1073 line 1 (and else- where): change efficient to effective -pg.1073 last line: delete 'like' -pg. 1075 second line: change 'remind' to 'review' -pg. 1077 third line: not sure 'sustainable' is the right word. -pg. 1077 line 23: what do you mean by 'ground'? -pg. 1078 first line: change 'global' to 'overall'.**

→ We thank the reviewer for highlighting these English problems and suggestions. We took all the suggestions into account in the revised manuscript. The sentence which contained 'sustainable' was changed into: 'The topics of groundwater scarcity and quality issues are stressed in the pedagogical activities by the teacher in different manners.' By 'ground' we referred to this description: 'the classroom is where we teach the students basis of groundwater flow processes'. We replaced the previous sentence by this one in the revised manuscript.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 1071, 2013.