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Hydrology and Earth System Sciences Discussions

Interactive comment on "It takes a community to raise a hydrologist: the Modular Curriculum for Hydrologic Advancement (MOCHA)" *by* T. Wagener et al.

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The authors have identified the need for hydrologists to learn field and lab observation techniques, quantitative analytical methods to process data, and computational modeling methods to examine concepts and hypothesis. They note the call for this training has been made before (for ecample, Eagleson et al., in the 1991 National Academy Press), yet no single textbook or set of lecture notes has delivered the material to adequately train hydrology students. As such, many hydrology professors are spending significant time assembling instructional material to complement or supplement existing books and are not spending enough time developing appropriate pedagogical approaches to excite and achieve student learning.

They recognize the field of hydrology has learned from other fields (sanitation) and had benefited from open source and shared data approaches (COMET, LINUX). They propose to use Modular Curriculum for Hydrologic Advancement (MOCHA) to harness these collaborative approaches and remedy the need for better instructional material.

These authors are a wonderful example of how to form a community – they are all at the top of their fields and prioritize finding time to work together and bring along the rest of the hydrology community. Their leadership in field work, quantitative analysis, and computational modeling lends itself to developing fun exercises. My biggest need as a hydrology professor is not lecture notes but in-class, in-lab, and take-home exercises that tap into the real world applications these hydrology heroes and authors have tackled.

The issue of audience is possible unresolved. I was unclear whether the MOCHA based hydrology class was intended for engineering and non-engineering students – should both groups enroll in the same lecture. I ask because the authors stated engineering students would have had fluid mechanics as a pre-requisite, and that non-engineering students would not, but that a control volume approach would satisfy both sets of students. I am hopeful a singular course would work for both, but the non-engineering group could be broad, and include geologists, foresters, environmental chemists, etc. It is possible having the first (and often only) class in hydrology be the same for both populations of students may result in each population underserved. Would they be at a disadvantage compared to their disciplinary peers when applying to graduate school or performing research? It seems for engineers, after they complete fluid mechanics the engineering hydrology course should pick up on more complex pipe network problems and more complex open channel flow problems, to name a few topics. I see on lines 14-16 on page 2339 you are suggesting MOCHA slides have more material than needed so different amounts can be selected for different audiences. This seems appealing, but the implementation of this may be difficult (e.g, finding equivalent time to teach each audience, ensuring equivalent homework in each audience, the instructor having the training to handle questions for each audience). It would be great if you had a curriculum expert assess whether the audiences had equivalent learning when different in-depth versions of these MOCHA slides are used.

Regardless of the targeted academic discipline for the MOCHA class there is a variety of learners and aptitudes. For example, if we teach engineering students only with the Brutsaert book, some will wither in the mathematics and not pursue let alone capture the excitement of field work, while others will revel and celebrate in the mathematics elegantly describing the system. Note to authors - a very good book balancing a systems perspectives and computational analysis not mentioned by the authors is by Wurbs and James, entitled Water Resources Engineering; there are similarly titled books by Chin and Maidment.

The MOCHA scale feature in the PPT slides seems like a helpful addition for students who are not able to see the forest for the trees. The problem may be the artificial boundaries of point, plot, and watershed. For a Global Circulation Model, it treats a $\frac{1}{4}$ degree unit of the earth as a point, like other lumped watershed models. As scale increases, do vertical balances change, or do lateral connectivity emerge?

The authors need to clarify what MOCHA lessons are available – from the website it seems you have 2 lessons. In Line 23, page 2337 you say, "All MOCHA modules include…"; perhaps you can say the 2 modules? This is rewarding to have 2, but until you have a full course ready it seems the students / faculty using this approach may experience the confusion of discontinuity (e.g., disorientation of moving between different format slides and textbooks and problems, having different terms presented for common phenomena, etc). I realize in Lines 5-10 on page 2339 you argue differently.

The development and use of the infiltration module is commendable. I realize the authors are concerned some hydrology concepts that are taught and in textbooks are

HESSD

9, C1739–C1742, 2012

Interactive Comment

out-dated, however engineers training to be a practitioners need to know the simple Curve Number model to pass the FE / PE exams and comply with local ordinances. While we need students to know a Green Ampt or Richards Eqn solution to deal with initial abstractions for intense and short duration rainfall events, the Curve Number approach is robust for the applications it undertakes.

Some errors: Line 11 on page 2336 “to students are more restricted” seems to miss “who”? Line 12 on page 2336 “is not need”, perhaps use “no”

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