

Reviewer's report

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Title: Socio-hydrology: A new science of people and water
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Reviewer: Demetris Koutsoyiannis
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Reviewer's assertion: It is my opinion that a shift from anonymous to eponymous (signed) reviewing would help the scientific community to be more cooperative, democratic, equitable, ethical, productive and responsible. Therefore, it is my choice (and my aesthetic attitude) to sign my reviews.

1. I recommend this Invited Commentary for publication and I anticipate that it will become popular and citation-rich. The authors are renowned and well respected. The title promises a new science. The text contains popular terms and fashionable phraseology, such as (to copy some phrases): "*co-evolution and self-organisation of vegetation in the landscape*", "*tipping points*", "*have to accommodate the time arrow*", "*Black Swan events, which therefore makes predictions a real challenge*" [reviewer's note: my impression was that Black Swan events challenge our ability to predict]. And it concludes prescribing three "*avenues*" with several directions which "*point to both challenging and exciting times for the future of hydrologic science*". What perhaps may not make enthusiastic some potential followers is the authors' opinion that "*socio-hydrology must remain a quantitative science*".
2. I must clarify though, that I do not regard myself a follower; rather I follow more traditional paths and ideas that originated 50 years ago or more. The authors exclaim "*Welcome to socio-hydrology, the science of people and water*". In my opinion they could also say "*Welcome to hydrology*" as the definition of hydrology (called "*classical hydrology*" in the paper) includes the relationships of hydrological processes with human activities. This has been clarified a long time ago (by UNESCO, 1964, unesdoc.unesco.org/images/0015/001539/153976eb.pdf): "*Hydrology is the science which deals with the waters of the earth, their occurrence, circulation and distribution on the planet, their physical and chemical properties and their interactions with the physical and biological environment, including their responses to human activity*". Despite not being a follower, I provide below some remarks and suggestions. The authors may feel free to judge whether their text needs modifications or not.
3. Perhaps the authors regard "classical" hydrology as an academic or even scholastic field. This is my impression formed after reading several points in the paper, e.g., "*Should such predictions [related to the impact of the societal changes] even be the business of hydrologists?*" and "*natural scientists have for too long ignored the human*

- factor. Hydrologists are not exceptions to this*". However, being a hydrological engineer, I have never felt that the impact of human/societal changes is not part of hydrology. How can hydrologists ignore the human factor when they deal, for example, with a water supply system, a flood protection/warning system (particularly in an urban area), or a hydropower plan?
4. In the same tune, I do not see the reason why the authors downgrade "*the science of integrated water resources management (IWRM)*" stating that it "*often uses the 'scenario-based' approach as the common means to explore these interactions*" and that "*this approach is severely limiting and unrealistic*". Numerous sophisticated approaches, including systems analysis, stochastic simulation and optimization etc., which are far beyond scenario based approaches, have been developed and published in hydrological journals and books.
 5. I wonder if one can introduce "**a new science**" in a paper, stating it in its title—which, by the way, does not look too modest. I am familiar with expressions like "proposed new technique", "proposed new method" or "proposed new methodology", "proposed new hypothesis", "proposed new framework", and I can even understand "proposed new theory". However, it seems to me strange to read the expression "*the **proposed new science of socio-hydrology***". I also found interesting the contrast the authors make of socio-hydrology with eco-hydrology. The latter they regard a sub-field, when they say "*There is considerable similarity between the **proposed new science of socio-hydrology** and the now established **sub-field of eco-hydrology***". I also find that "*proposed science*" contrasts with the syntax of the article, which is in present tense, e.g. "*Socio-hydrology addresses this strongly felt need*" or "*Socio-hydrology is therefore concerned with ...*".
 6. On the other hand I agree with the authors' statement: "*At a time when hydrology textbooks continue to dwell on the complexities of processes occurring in undisturbed places or under idealized conditions, which are the exception rather than the rule in the real world, and almost all water bodies are affected by people in one way or another, there is an urgent need for **hydrology itself to adapt and evolve** to cope with the emergent scientific and practical challenges*". I think, though, that this contradicts the main part of the article. Yes, hydrology needs to adapt and evolve, perhaps revisiting older ideas, when it did not dwell in details of processes under idealized conditions, but this does not provide a reason to promise a new science.
 7. The "human factor" on hydrology seems to have been underrated when the authors say: "*For example, water flows downhill except when it is pumped uphill. The pumping is the social component and demonstrates that social factors can be a powerful force.*" Human constructions usually exploit gravity and it is quite rare to use pumps. For example in dams not only do we avoid pumping but we usually *produce* energy and then divert water to follow paths that would not follow naturally. Furthermore, it is misleading to say that "*water flows downhill*". It is more accurate to say that it flows following the maximum gradient of potential energy. This provides us with the opportunity to divert the flow, in order to cover our needs, without pumping but again

using gravity with lower gradients. This formulation also covers the cases of pressurized flows (which may direct water locally flow “upstream”—cf. siphons etc.), which again do not use pumps.

8. The example given in the Introduction about the Murrumbidgee system in Southeast Australia is very interesting. However, the projection given and depicted in Fig. 1, according to which the irrigation will spectacularly “move” downstream seems not very plausible to me. Currently Australia is not densely populated and perhaps an increased population in the future could lead to increase of irrigated land. Perhaps it would be better to avoid projections and present facts.
9. I think that the literature coverage in the text is insufficient. I would recommend that the authors take a look at the recent Special Issue of *Hydrological Sciences Journal* entitled “*Water Crisis: From Conflict to Cooperation*” (vol. 56, issue 4; <http://www.tandfonline.com/toc/thshj20/56/4>), where they can find related articles (including a Foreword by Sandra Postel, an overview by Sivakumar, my own paper, and many more), as well as a rich collection of references to existing literature; they will even find a closely related article by Sivakumar entitled “*Hydropsychology: the human side of water research*”.
10. Since the authors are interested about “*Historical socio-hydrology*” and mention water management in ancient Athens, I wish to let them know about two related papers of mine:
 - Angelakis, A. N., D. Koutsoyiannis, and G. Tchobanoglous, Urban wastewater and stormwater technologies in ancient Greece, *Water Research*, 39 (1), 210–220, 2005.
 - Koutsoyiannis, D., N. Zarkadoulas, A. N. Angelakis, and G. Tchobanoglous, Urban water management in Ancient Greece: Legacies and lessons, *Journal of Water Resources Planning and Management - ASCE*, 134 (1), 45–54, 2008.

In particular, I wish to urge them to see the motto of the first paper taken from Gray (1940).