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Discussions

Interactive comment on "A dynamic water accounting framework based on marginal resource opportunity cost" *by* A. Tilmant et al.

Anonymous Referee #1

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Summary: The paper proposes a new method for water accounting. It is a dynamic method that is based on an economic concept of marginal value (in particular marginal opportunity cost). Water flows and stocks in a water system are tracked and their marginal values ascertained based on the assumption that all agents in the basin co-operate to maximize system wide total value of water intensive agricultural activities. The accounting framework is illustrated with the Eastern Nile river basin in Africa.

Comments: This is a very interesting paper. It extends the existing state of the art of water accounting by proposing a dynamic framework that not just ensures balances of physical quantities of water but also makes sure that (economic) value of water in various functions that it performs (such as agricultural production, ecological services, hydropower production etc) balances out. In my opinion, an accounting system is only

complete if both physical quantity and economic value balances out in the system. This is often not the case in the current state-of-the-art of water accounting systems. In addition, it is a dynamic framework that can be used at any temporal scale. Thus, I find this paper of great value to water accounting literature and to water resources literature in general. Below are some comments that the authors may want to consider.

1) The authors may want to further highlight the niche of their proposed methodology, especially in terms of exhaustion of value (that value of flows and stocks balance out at system scale in some sense) since it is based on hydro-economic principles (or KKT conditions in particular). They may also want to highlight, when comparing with other water accounting methods, where the proposed method is similar and where it advances the state-of-the-art.

2) The authors may want to highlight the assumptions of their accounting scheme such as basin scale efficient solution and others at one place for tractability. A format of Assumption 1, Assumption 2... before the mathematical program is introduced would be helpful.

3) Equation 5: q_t is not defined. Further, it is not clear what the authors mean by uncontrolled flows.

4) Equation 6: A more formal treatment of Lagrange multipliers is desirable for the mathematical program defined in (1)-(4). We know that there is a law of motion for the lambdas (similar to mass balance for water at system nodes).

5) Comparison between equations (7)-(8): the water, r_t(1), is sold by agents 1 at a (virtual) price that is different from the (virtual) price at which agent 2 buys. Where does the surplus go?

6) Equations (7) and (8): It appears that the accounting scheme has a big role for the RBA in buying and selling of uncontrolled flows I_t(1). Please explain what these uncontrolled flows physically mean and why should RBA mediate in its transaction.

7) The choice variables (x) both in sections 2.2. and 2.3. is not clear. In a standard mathematical program, all except the parameters of the program and exogenous variables are treated as choice variables. Please clarify.

8) Section 2.3: Please describe the mentioned 30 hydrological scenarios.

9) Section 3: A brief description of SDDP techniques is desirable here even though it has been extensively covered elsewhere, for completeness sake. I would be more interested in knowing how operation rules are incorporated within this dynamic programming technique.

10) Page 11749, lines 5-15: It would be helpful if these are explained in terms of equations 7-8 (with direct reference to various components of these equations).

11) Why are irrigation withdrawls seen as benefits forgone? – they are input to crop production and hence generate value and income.

12) Page 11749, lines 20-25: It is not clear what is meant by the value of blue water, please highlight this in equations (7)-(8). A more physical/economic interpretation would be helpful. It appears it dominates the valuation of the Eastern Nile water system (table 2). Why should this be the case?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 11735, 2014.