

We thank Dr. Perry for his thorough review, positive comments, and constructive criticism on this manuscript. We believe that, by addressing the concerns in this review, the manuscript has improved. Our reply to the numbered General and Specific Comments are given below:

General Comments:

This paper and its companion are important and novel contributions. A clear and well-documented framework is presented as a basis to improve our understanding of water resources use and management; the approach makes extensive use of satellite information sources, which are generally in the public domain and often freely available, which allows significant elements of the analysis to be undertaken independently of access to “ground” information, which in contentious cases is often kept secret. The potential thus exists to facilitate (or force) more open debate about water sharing between countries, regions and sectors.

We are glad that experts with international panel experience finds our paper to be an innovative and important contribution towards better understanding water resources use and management.

Specific Comments:

1. In the opening section, reference is made to Molden’s substantial contributions (1997, 1999, 2007), and also to Perry (2007), which was the result of consultations within ICID. The paper suggests that neither provided the basis for intersectoral, basin-scale analysis. I do not believe that is a fair comment. The abstract of the last paper states “Based on the work of various previous writers, an analytical framework and associated terms are proposed to better serve the needs of technical specialists from all water-using sectors, policymakers and planners in achieving more productive use of water...”. It would certainly be fair to say that nobody has tried as hard as the authors of this paper to achieve that goal, but the discussion could better be focused on what this paper (WA+) adds to the earlier contributions in terms of defining different land classes and types of use.

Response: Done. We revised the manuscript to address the issue.

2. I believe the paper erroneously criticises the UN-SEEAW approach. The issue is that the example presented in SEEAW pays inadequate attention to irrigation, and NO attention to rainfed agriculture, forestry and other water consuming economic activities. That is a flaw in the example, NOT a flaw in the SEEAW accounting process, which I believe is sound on “flow” accounting, but demonstrably inadequate on “stock” accounting. The authors might look at Chapter 10 of the recent Inclusive Wealth Report (http://www.unep.org/pdf/IWR_2012.pdf) for an expansion on these points. In my opinion, the approach presented in WA+ could substantially strengthen the SEEAW approach, and the SEEAW approach similarly provides a well-documented way of presenting links to non-agricultural elements of the economy. Since SEEAW is “official”, joining it might be better than fighting it.

Response: The comment was well taken. The paragraph describing SEEAW was revised to better reflect on its merits.

3. My main criticism of the paper relates to terminology, and I would strongly urge the authors to reconsider, conclude (either following the suggestions below, or not), and then EDIT the report for consistency and the minimal use of alternative terms. Terminological inconsistency and vagueness has plagued water resources discussion for decades. One problem is the confusion of “use” with “consumption”; another is the assumption that an increase in efficiency “saves” water. All this is well documented in the references mentioned in para 1, above. In this paper, the terms “consumption”, “utilisation” and “depletion” are used interchangeably. “Net withdrawal” is also used. Furthermore, “utilisation” is applied both to water and to land.

I recommend:

(i) to use CONSUMPTION as the only term that implies conversion of water into water vapour (E, or T); The point is best made using a quote from the second paper: ““Landscape ET” (depletion directly from rainfall) was 344 km³ (69 % of total consumption). “Blue water” depletion (“utilized flow”) was 158 km³ (31 %).” What is gained by calling the same “transaction” in the accounts (liquid water converted to water vapour) by four different terms (ET, depletion, consumption, utilisation)? The reader assumes there must be distinctions, but there are none.

Response: Indeed being consistent in using terminology is very important, especially in a formulation paper. We accurately revised the manuscript to make sure consistent terminology is used throughout both papers.

The reviewer suggests using consumption throughout the paper, while we have a preference for depletion as the main terminology. Both terms could be doable, but after internal debates we prefer depletion. One argument is that the original WA framework is also based on depletion, and this WA+ is a continuation of that. Furthermore, we believe that consumption taking equivalent to ET, has some critical problems. The word is already commonly used related to water, more in the sense of withdrawal or use. For domestic use, consumption is related to the withdrawal of water, not ET. That is a fact. People consume water by flushing toilets and filling their glasses and drinking water. Getting people to change to consumption as ET from domestic use will be an impossible task. Similarly consumption is used interchangeably for withdrawal in agriculture, and consumption for industrial use most often means withdrawal. People consume water, but only a fraction is depleted by that use.

(i) use DEPLETION to refer to reductions in storage (aquifer or reservoir). I believe most people would distinguish between “consumption” as something funded either by their income, or “depletion” of their savings. The following definitions of depletion are available from Wikipedia (<http://en.wikipedia.org/wiki/Depletion>) Depletion may refer to: Depletion (accounting), an accounting concept Depletion region, a concept of semiconductor physics Depletion width, a concept of semiconductor physics Grain boundary depletion, a mechanism of corrosion Oil depletion, the declining of oil supply Overdrafting, extracting

groundwater beyond the equilibrium yield of an aquifer Ozone depletion, a decline in the total amount of ozone in Earth's stratosphere]] Resource depletion, the exhaustion of raw materials within a region NONE relates to consumption, so why try to use it that way here?

Response: "Depletion" has been used in many studies in the past to denote evaporation, transpiration, and incorporation into a product and/or rendering water unusable for the next user downstream. As stated in the paper "WA+ is a new framework that uses the IWMI WA principles... ". Therefore it adopts the same definition for water depletion as the IWMI WA. We use depletion in this sense, clearly and unambiguously different than withdrawal, and broader than ET. We used the opportunity to revise the manuscript on this aspect to provide readers with more background information on this issue, such as reference to the FAO and ICID terminologies.

(iii) Consider carefully whether the distinction between blue water and green water helps or confuses the debate. Hydrologists, in my experience, do not like the term. Here, what does it add? Is water that evaporates in-situ from a landscape blue or green? Is water that went to a fossil aquifer a thousand years ago blue or green? DOES IT MATTER? Basically in hydrology we have in situ ET (landscape ET as called here); runoff, and infiltration to aquifers. These are clear concepts, and the blue/green distinction adds nothing to them.

Response: We acknowledge the reviewer's point of view, and have never been in favor of adding colors. While we have systematically avoided green water in the original manuscript, we agree with the reviewer that we better remove blue water also. To avoid the drawback of undefined water colors, we replaced "blue water" with "exploitable water". The use of term "exploitable water" is inspired by FAO terminology (FAO, 2012). The manuscript was revised accordingly throughout the texts, graphs and tables.

(iv) Utilisable flow is a tricky concept. It varies as you construct infrastructure, and some "utilisable flow" – floods in the Ganges/Brahmaputra, for example – are certainly not "utilisable" in any realistic perspective.

Response: While we agree that "Utilizable outflow" is hard to estimate and distinguish from "non-utilizable outflow" when it comes to storm water issues, we believe it does help us to know better the existing capacity to use excessive outflow (outflow in excess to reserved flows) . Floods are indeed non-utilizable outflows unless the existing infrastructure in the basin allows utilizing them. We revised the resource base sheet to better reflect on these points.

While I believe these represent significant presentational issues (and recommended revisions), they do not reflect on the underlying science, and I strongly recommend publication.

Technical comments:

I have “marked up” the pdf with many small comments and suggestions. This has been forwarded to the authors and I will upload it here if possible.

We found comments and suggestion in the “marked up” pdf, very helpful in improving the manuscript, and we are very thankful to Dr. Perry for his detailed and insightful review. Most of them are reflected in the updated version of the paper

References:

FAO: Coping with water scarcity; an action framework for agriculture and food security, FAO water reports 38, FAO, Rome, 2012.