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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Accounting for environmental flow requirements in global water assessments" *by* A. V. Pastor et al.

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General comments

The manuscript deals with the certainly difficult problem to take into account environmental flow requirements (EFR) in global water assessments. It quantitatively compares five hydrological EFR approaches (based solely on river discharge). The innovations described in the manuscript are 1) establishment of two new EFR approaches and 2) comparison of the thus computed EFR values with the EFR values derived by other approaches in 11 local case studies. In addition, all EFR methods were implemented in the global vegetation and hydrology model LPJml, such that five variants of global-scale EFR were determined. While the research design presented is reasonable, the presentation is very poor. This includes the structure of the text, the description of methods and data, the analysis of the data and the use of the English language. In

addition, the framing of the research is insufficient; the lack of actual information of the effect of river discharge alterations on freshwater-dependent biota, as well as the fact that EFRs are societal decisions, is not reflected.

Specific comments

Abstract

It is not correct to say (or at least not meaningful) that the "VFM method mimics for the first time" natural flow regimes . . .". The Tessmanm method also seems to do this (even though the explanation of the method in section 3.3. and Table 2 is not clear), and so does the "presumptive standard for environmental flow protection" of Richter et al. (2012) which would allocate 80% of mean monthly flows to the environment . It was cited in the literature review in 2.2.1 but not further discussed later.

1 Introduction

The introduction is too broad and does not guide the reader well to work presented later. For example, the first paragraph is, in my opinion, superfluous. On the other hand, important information on the poor degree of scientific knowledge about the effect of flow alterations on freshwater ecosystems is not presented (e.g. Poff, N. L. and Zimmerman, J. K. H.: Ecological responses to altered flow regimes: a literature review to inform the science and management of environmental flows, Freshwater Biol., 55, 194– 205, 2010). This would be required for the reader to understand how extremely uncertain any quantification of EFRs to achieve a "fair" or "good" status of the ecosystem is.

2 and 2.2 have the same title. The Xenopoulos et al. (2005) study does not deal with EFRs but quantifies the effect of mean river discharge on fish species number.

2.1 There is no "legislation of environmental flow methods"; what is described here relates to legislation regarding environmental flows. The scope of the European WFD is incorrect or at least misleading, as good ecological status does not (directly) relate

to EFRs. The section should be deleted (or rewritten and moved to the introduction.

3.1: It is not well explained which flow data were used to compute the five EFR values for each case study. In particular, how well are “natural” conditions represented in each case study=

3.3 and Table 2. A clearer description of the five EFR methods is required, and a description of the rationale of each methods. E.g. in Table 2, the explanations in superscripts are not well formulate or are even wrong (b).

4.2 Not meaningful to correlate EFR of case studies to computed EFRs in absolute numbers, as you did in Figure 2, better to do it, as in Table 4, normalized. Absolute numbers of EFR vary by a factor of 1000, which is a much higher number than the ratio of mean annual flow to EFR! In addition, it seems inconsistent that in three out of the five methods (b,c,e), one case study EFR is related to many computed values. E.g. in the Smakhtin method, only eleven points altogether should be shown. Is this maybe the reason for the lower R2 of these three approaches?

Table 3: Not clear how the number of high/intermediate/low flow months are defined (Tessmann of FVM), and why intermediate months and in Table 4 only low and high flow requirements mentioned?

5.1. Hoekstra and Mekonnen (2011) (HOEKSTRA, A.Y. & MEKONNEN, M.M. (2011): Global water scarcity: monthly blue water footprint compared to blue water availability for the world’s major river basins, Value of Water Research Report Series No. 53, UNESCO-IHE, Delft, Netherlands) already considered interannual variability of EFR in their global-scale water scarcity study.

5.3. It is incorrect to say that Tennant, Smakhtin and Q90_Q50 method allocate too large amounts of water during low-flow seasons etc. At least Smakhtin et al. only deal with total annual EFR such that also the representation in Figure 1 is incorrect, and the discussion at the end of 5.3 is not meaningful.

5.4. (Sentence on p. 15009, l. 18). Given the underestimation of EFR in xeric basins and the low fit in polar ones (Table 4) of the VFM, it is not correct to write this sentence.

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