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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Large-scale impacts of hydropower development on the Mompós Depression wetlands, Colombia" *by* Héctor Angarita et al.

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The manuscript under discussion presents an interesting case study of impacts of hydrological alterations from potential hydropower development in the Magdalena River. The authors investigated and presented on how a large array of potential scenarios derived from random combinations of development projects plans could affect river connectivity, degree of regulation, sediment trapping, migratory fish habitat, and wetland hydrodynamics. Overall, the most significance contributions that this study provide are: (1) The configuration and analysis of the large array of modeling scenarios and (2) one of the first (to my knowledge) comprehensive scientific studies of hydropower

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development in one of South America's most important rivers. The only major caveat I encountered was the vague description of the ReservoirSimulator model used, which has only been presented in conference proceedings and a thesis before. Other than that, I thought that in general the manuscript was well written, including excellent presentation of figures.

I do have, however, a number of specific comments that I suggest the authors consider in their revision:

Abstract

1. Page 1, line 14: please add the actual area (in km2) of the Mompos Depression wetland under study.

2. Page 1, line 27: episodic inundation of the floodplain during dry periods? I presume this refers to dry years rather than dry season, please clarify

Introduction

3. Page 2, line 7: first reference should be Dynesius and Nilsson, not Nilsso.

4. Page 3, line 3: when referring to the different hydrological characteristics of rivers that exhibit non-linear cumulative behavior, what does temporality refers to? Is it the same as timing?

5. Page 3, line 17: Please provide the hydropower capacity (in GW) associated with that 43% of the electricity generation in Colombia.

6. Page 3, line 29: When mentioning "large-scale" impacts (here and throughout the text), I suggest that the authors are more specific as the audience of this journal can have different interpretations of what large-scale is (continental or global?). I think "basin-scale" is the most appropriate term.

7. Page 4, line 5: Mosaic is a more appropriate ecological term than patchwork, in my opinion.

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Data and Methods

8. Page 6, lines 1-4: what is the source of this information?

9. Page 6, lines 1-12: Here a general description of the ReservoirSimulator is provided, but given that such model has not been published in the international scientific peer-reviewed literature before, I wonder if this is a good opportunity to present in more depth some of the algorithms used. This could become part of the Supplementary data.

10. Page 8, line 4: What is the temporal resolution at which the Dendy's formula is used? Also, please make sure that all terms in the equation relate to the written description (capacity/inflow ratio, in particular).

11. Page 11, line 16: please make sure that the use of the terms "ecodeficit" and "ecosurplus" is correct and consistent throughout the text and figures.

Results

12. Page 13, lines 23-25: Here the authors state that they found a high inverse correlation between migratory connectivity and sediment trapping. Do you have a figure to support this? Perhaps a separate frame in Fig 9. Highlighting this finding could be important as it might be very relevant to other large tropical rivers undergoing similar tradeoffs.

13. Page 13, line 33: please add the number of scenarios (5): "It should be noted that all 5 scenarios are plausible. . ."

14. Page 14, line 18: here authors say the acceptance value for NSE is 0.65, but figure 11 has NSE> 0.75 shaded. Please fix.

Discussion

15. Page 16, lines 25-33: in addition to this interesting discussion on sediment trapping, could you also comment on how that could affect the operation and longevity of

hydropower dams in the Magdalena? Would there be any risks that the high rates of deforestation could make sediment accumulation much higher? Are there any measures or incentives from the hydropower sector to abate this potential issue?

16. Page 17, line 5: I believe that this is the first time the term "reference period" is mentioned, although it is presented in figure 10. A quick explanation in the methods of what the authors mean by reference versus baseline periods would be helpful.

17. Page 17, line 31: please add the word “with” to “Hydrologic alteration in combination with over-fishing. . .”

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