

Interactive comment on “Quantitative analysis on the ecological impact of large-scale water transfer project on water resource area in a changing environment” by D. H. Yan et al.

Anonymous Referee #2

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The manuscript presents the application of a set of methodologies and coupled numerical models to assess the quantitative impact of a large scale water transfer project (including reservoirs) on the ecosystem functioning of a water resource area for the western route of the China’s South-North Water Transfer Project. After a selection of key environmental factors and their corresponding evaluation indexes, numerical models of coupled climate, hydrology and ecological components were used to assess the impact of the project construction (with and without reservoir scenarios). A novel approach involved the use of analysis at spatial scales ranging from regional (south-east Asia) to a stream river reach. The authors have made an effort on putting together in-

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formation for such a complex topic but the manuscript presents some issues in relation to lack of focus, failure to proper communication of the results, and provision of results to support the conclusion arrived. To this reviewer this manuscript should be split into two parts: one containing the quantitative impact expressed by the four specific aims of the work, and the second on the impact on environment and ecology. In the current form of the manuscript, the title does not reflect neither the core nor its specific aims, the later related to impact on hydrological, hydraulic, and water quality issues. “Ecological impacts” are inferred or suggested based on climate, hydrological and hydraulic impacts of the project, particularly for aquatic ecosystems. The framework for the hydrological-ecological model is limited to terrestrial ecosystems (e.g. vegetation and coupled soil carbon cycle) but lack of an ecological model for aquatic ecosystems, yet the most impacted component of the project. Ecological impacts on downstream stream environments seem to be based on the use of a simple transport model for BOD and nutrients, point source discharge for towns (with and without pollution control) as a result of the decreasing streamflow discharge after the project. The authors seem to be aware and have the information on ecological impacts of the seasonal hydrological behavior of the systems (e.g. Fish life cycles, etc.) but fail to present them in the manuscript. The Introduction presented properly the issue and relevant literature, particularly in ecological aspects. The manuscript aimed for four specific objectives related to quantification of impact on climate, hydrological condition of river reaches and typical wetlands, and water environments below the dam after project completion. Results and proper discussion for the above aims get lost in the manuscript due to the introduction of environmental-ecological impact and aspects of the project, but they are a more general aim for the manuscript as state by the authors (e.g. “Contributing to show how, and to what extent the project will impact on ecology and environment. . .”). The Material and Methods section presents some problems that make difficult the flow of the manuscript. Detailed description of geographical location and mismatches in location names, occupies more of the valuable space of the section. The readers do not have basic information on area of the catchments, reservoirs, basic climatic data (mean

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temperature, annual rainfall) and why the area is an ecologically fragile region. A map showing approximately locations of towns and river reaches relevant to the fourth specific aims is widely desirable. Sections from 2.2 to 2.5 are too wordy and unnecessary repetition of phrases take place (e.g. “the present article”). Explanation of the evaluation covering the five aspects is just a repetition of the specifics objectives of the work. Along these sections, the authors presented several tables with results (e.g. Table 1 and Table 3) and model performance should be the first part of the Result section. On the other hand, Table 2 seems to contain similar information as Figure 4. Then, the Result section begins with the presentation of the climate model results on hydrology and water circulation but not data or evidences are presented. For example, could the authors show a diagram with model results on increases/decreases in rainfall figures at seasonal scale? This information is important for what follows on the discussion and conclusion sections. Later, the results on the impact of water circulation for the river reaches below the dam are presented. Figures on the percentage of reduction in monthly water flow volumes are presented for a series of reservoirs (location not presented in the map) with interesting differences in the seasonal impact on the hydrology. Again, this is an important result that needs to be presented in a figure as they are used later on for the water quality analysis and the conclusions. The authors fail to present some of the most interesting results from the numerical modeling in relation to impact on wetlands and natural reserves. In this regards, the reader has learned that there is a significative impact on river reaches located below the dam after the water transfer but it is uncertain for those upstream locations, and then referred to look into Tables 4 and 5. These tables contain important results and findings that need to be brought up and discussed. After all they are two of the specific objectives of the manuscript. Finally, results on water quality impact due to decreasing flow conditions after the water transfer completion are presented for river reaches with and without point source pollution contributions from towns. Lack of definition (or concentration values) on established water quality standards (e.g. Standard I, II, III) and first time presented scenarios about town discharges with and without pollution control have introduced confusion to

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the results. Again, the authors refer the reader to Table 7 for a closed look of the results. Certainly, those issues need to be addressed. The impact on environmental and ecological aspects of the project are summarized in a single paragraph, one Table, and two Figures. Again, this section contains important results that need to be properly presented. As a result of the above, the conclusion section seems to be a summary of the manuscript, where some of the conclusions are not supported by the information provided in the manuscript by the authors. This reviewer believe that there is an important contribution in the work but the authors fail to communicate it due to lack of focus, proper results presentation and discussion, excessive use of tables with information, and some writing styles issues. Focus can be achieved by strictly addressing the four specific objectives stated in the manuscript which after adequate presentation, and discussion can be them used to explore the environmental impacts. The authors should exercise caution when using the term ecological impacts (e.g. in the title) as the model and tools presented in the manuscript deal with vegetation, carbon cycle in terrestrial ecosystems and a limited water quality models for aquatic ecosystems. The manuscript requires to address these issues and the specific comments that follow.

Specific comments Page 10466 Line 2. Use spatio-temporal instead of spatiotemporal Line 5. Remove “And”... Line 14. Replace “to imitate the laws of...” by “ to mimic ecological and environmental responses of the.” Line 18. Rephrase “overall influence evaluation”..... Page 10467 Line 2. Replace spatiotemporal by spatio-temporal Line 12. Please rephrase “ecological influence evaluation” throughout the manuscript. Page 10468 Line 3. Replace “What’s more” by What is more. Line 11. Remove “And” to begin the sentence. Line 17. In which way is the area sensitive to Climate change??? Please explain. Lines 27-29. Unnecessary repetition of “evaluate the influence of water transfer”. Please rephrase. Page 10469 Line 8. Remove the phrase “with geographic coordinate of...”. Please put the two coordinates of the box in brackets. Lines 10-15. Too much information and names which are not indicated in the map. Also, please refer the reader to Figure 1 here. Lines 22-23. Where is the Yangtze River in the map? Is it the same that Yangzi?? Please clarify. Also what is so important about the ecology

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of the area??? Provide the reader with the information. Page 10470 Line 7. Please clarify and specify what does “all ecological factors” refer to. Lines 12-18. Too long sentence. Please rewrite. What do the authors refer to as eco-environmental laws? Please specify. Page 10471 Line 1. Remove “the present article”. Line 5. Please include a reference for the method. What is a ladder model? Page 10472 Line 10. Remove “the present article”. Line 12. The authors refer to Figure 3 without introducing first Figure 2. Please check figure numbers. Page 10473 Lines 10-18. The model on climate-hydrology and ecology (vegetation –carbon cycle) seems to be confined to terrestrial ecosystems. The authors need to state from the beginning that “ecological aspects” will only account for vegetation and soil carbon biogeochemical processes. Is this right? Please clarify. Lines 19-22. This paragraph contains information on results and should be moved accordingly. Page 10474 Line 1. Use the term “scenarios” instead of “experiments”. Lines 4-5. Information relevant for the scale of the domain is needed. What is the area of the computational domain? What is the area of the reservoir?? This is important to illustrate the reader about the scale of the problem. What follows is simple information on model results but they are not presented. The authors did not provide general information on the climate of the area in the site description section, thus it is difficult to assess the effect on the reservoir construction on the local climate. For example, what is the mean annual rainfall for the area???? Is it 22mm a significant increase in rainfall??? Without information on annual rainfall it is not possible to assess the increase/decrease in the seasonal rainfall predicted by the model. Please clarify. Page 10475 Line 11. Please indicate the time frame for the extraction of the 8B m3.??? Lines 15-25. Results are presented for several reservoirs but no indication on the maps of where are they located. A figure showing the effect of the monthly discharge distribution (with and without the reservoirs) at the selected locations will be more useful here. Please consider this figure. Also, are these reductions associated to a particular climate scenario? Page 10476 Line 8. Are the hydraulic indexes the same as previously defined as water indexes? Lines 9-10. No a proper presentation of the results observed in Figure 5. Line 11. What do the authors refer to by “the increase

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in catchment area below the dams??? Please clarify. Line 23. The authors stated no influence on wetland below the dam areas. Lack of information on river characteristic does not allow this reviewer to assess the claim. It is expected that the reservoir may regulate floods affecting wetland on the river floodplains. Is this the case? Do these rivers have floodplains?? Please clarify. Page 10477 Lines 15 - 20. The quantitative data presented here refer only to the increase in inundated area by the reservoir and submergence of vegetation. What follows are expected conditions based on expected outcomes (qualitative but no quantitative). Table 6 does not present a comprehensive evaluation to the results. The authors should explain how the biodiversity aspect was quantified. Page 10478 Line 1. The authors refer to “water environment” when in reality they are assessing water quality in relation to BOD, COD, and nutrients. Lines 5-20. Most of the water quality assessment is conducted in for particular reaches of the Ake River which has not been properly presented/indicated in the map. Also, water quality standards(I, II, etc.) need to be identified by the concentration limits for each category. Please clarify. Page 10479 Line 4. It is not clear in the header what the authors refer to with “Capacity influence analysis”... Please clarify and/or rewrite. Also, since the results are presented for specific cross sections (county town) it is expected that these locations should be approximately located in the map (Figure 1?). Line 7. Please clarify what CODMn and NH3-N stand for accordingly. Does the Environmental capacity mean “natural reaeration replenishment of oxygen”??? To this reviewer this is just a simple model of oxygen depletion (point source) rather than an ecological model. Please clarify. Line 14. This line confirms that the stream flow model is for point source pollution. Page 10480 Lines 4-11. The impact of the expected reduction of flow speed, river width, water depth of the river corridors on the ECOLOGY of downstream environments (stream reach, wetlands, reserves) has not been addressed at all in the present work. Page 10481 Line 5. There are no evidences/results been presented that support the conclusion in relation to Water Ecology. Line 10. “There is generally no impact on wetlands of overland flow recharging below the dam..” Is it too obvious?? Why would be overland flow local wetland by affect by the reservoir??? The authors need to present

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results (e.g. Figure) and show how the area of wetland above the dam sites increases after the construction of the dam. This reviewer is confused on whether the authors are mistaken “inundation” of land created by the reservoir itself with a truly wetland area, as both are clearly different on physical and ecological functioning. Lines 15-20. Similar as above the Inundation with wetland creation issue. Also, no results have been presented to support the conclusion arrived that not “severe enough to cause any serious damage” as only a water quality for point source discharge has been presented. Lines 22- 27. The authors introduce a new issue of “with and without pollution control” on water quality at the lower reaches. This has not been properly introduced or discussed in the manuscript. Page 10482 Lines 7-12. No evidences to support the conclusion are presented. So far, all the impacts presented are on hydrology, hydraulic, and water quality of the low reaches below the dams. Nothing has been presented on ecological impact of those factors. Table and Figures Page 10486. Table 1 caption. Replace “Environmentally and ecologically” by “Environmental and ecological”. Page 10487. Table 2. Please inform the reader about CWRP, RegCM3, WEP, CLM, etc. . . . Also, it is clear from the table the Ecological processes are only limited to vegetation and carbon cycle in terrestrial ecosystem. The aquatic component is a simple transport model for water quality but not for ecology of aquatic ecosystems. This issue has to be addressed in the manuscript accordingly. Page 10488. Table 3. Full names for NPP, COD, NH3-N have to be introduced in the manuscript. A reader no familiar with the topic needs the information. Page 10489. Table 4. This is an interesting result but the authors fail to conduct a proper presentation and discussion of the results in the manuscript. This reviewer suggests to include and cover these results in more detail in the manuscript. Page 10491. Table 6. This Table needs to be removed as the information provided is limited and can be presented in the text. Page 10492. Table 7. This table contains information on water quality parameters in relation to “pollution control” under the water transfer scenarios. It is expected that it also contains different climate scenarios. Again the result section corresponding to the table has not been presented properly. Please include in the text of the manuscript. In the current form, the reader is forced to

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interpret results from a series of tables that contains the information, thus jeopardizing the readability of the manuscript. Page 10493. Table 8. The table contains information on ecological aspect of the streams that are relevant but not stated in the manuscript. For example, the effect of streamflow conditions in April-May when fish lay eggs. Why is it here and no in the result section???? Certainly, water level drop by 20-30% would have an impact of light penetration, primary production, sediments biogeochemical cycles, etc. . . . Can the author introduce a short paragraph in the discussion section in the manuscripts? How was the eutrophication assessed for the water environments below the dam??? Page 10494. Figure 1. The map needs to be improved and the river reaches located (symbols-box) where the water quality assessment was conducted. Check for consistence on the names between those in the manuscript and the correspondings in the map. Page 10495. Figure 2. This reviewer suggests removing this figure as the information is provided in the text. Page 10496. Figure 3. Good figure! This is necessary to inform the reader about the spatial scales used for the present work. Well done. Page 10497. Figure 4. This figure is too complex. The authors need to clarify in the manuscript that ecological model component is only for terrestrial ecosystem and account for vegetation dynamic and carbon cycling in the soil. It is clear here that no component or ecological model for aquatic ecosystems is presented. Page 10498. Figure 5. This is the kind of plots that needs to be presented for other results in the manuscript to visualize the impact. This reviewer suggests including similar plots, e.g. for climate and wetland area increments for scenarios with and without reservoirs. Page 10499. Figure 6. The reader needs information on how to interpret this figure. Are the color sectors related to a scale of impact? Page 10500. Figure 7. Similar as above.

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