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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Indicators of Necessary Storages for Flood and Drought Management: Towards Global Maps" *by* Kuniyoshi Takeuchi and Muhammad Masood

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RESPONSE TO THE REVIEWER #4'S COMMENTS

We are grateful to Reviewer #4 for the helpful and insightful comments. The provided comments have contributed substantially to improving the manuscript. Accordingly, we have made significant efforts to revise the manuscript with the details being explained as follows.

Point #1

COMMENT: The writing/grammar and arrangement of the paper is poor. Several spelling/grammar issues and "awkward" sentences that have to be read a few times

to try and understand what the authors are trying to say. Most of the issues are minor but there is too many to list and I suspect this is detracting from the main points the paper is trying to make.

RESPONSE: Thanks for the comments. Accordingly, for better understanding, we thoroughly revise our manuscript with correcting all spelling or grammatical mistakes and reformulating the awkward sentences as much as possible.

Point #2

COMMENT: The concept being introduced is interesting. The FDC-DDC method proposed has some advantages over the mass curve method. It is a simple approach but is also flawed in that stationary hydroclimatic conditions are assumed. Also, a major strength of the FDC-DDC method is its simplicity and transferability (e.g. the authors say it could be used to create global maps of necessary storage and the state of water resources) but then I wonder why if the method is so simple and transferable is it only demonstrated for one basin?

RESPONSE: Thanks for the comments. One of the aim of this manuscript is methodological demonstration of the extended application of FDC-DDC to show spatial distribution of necessary storages. And for that purpose, we took three distinct basins; the Ganges, the Brahmaputra and the Meghna as a case study. The global application is another step. But within the GBM basin, we have subdivided the three basins into several sub-basins with distinct characteristics to analyze hydrological heterogeneity. With such analyses, we consider it enough for demonstrating the theoretical framework.

Point #3

COMMENT: The other major problem I have with this paper is the way the impact of climate change is simulated. Only 3 lines worth of explanation (sect 3.2.1) are given to explain this and it is not clear at all how the GCM outputs were used as inputs to the hydrological modelling? Which variables were used? At what time step? I assume

daily (or maybe monthly) and if so there are known to be significant issues associated with daily GCM data and bias correction is usually required? Precipitation data from GCMs is particularly problematic, especially in the Asian monsoon region where this study is focussed. How were the biases associated with GCM outputs addressed?

RESPONSE: Thanks for the comments. We fully agree with the Reviewer's comment. In order to avoid the complexity and keep the focus of this paper clear, the climate change components including 3.2.1 will be removed from the entire manuscript. But as an example to show applicability to climate change analyses, Fig.9 is left remain and this explanation was put into its caption with citing references for detail. Regarding your question, daily time series of two variables, precipitation and temperature have been used as inputs to the hydrological modeling to obtain discharge time series for present and future time period. The bias of precipitation dataset has been corrected by multiplying using monthly correction coefficient (ratio between basin averaged long term monthly mean precipitation from WFD and that from the GCM) for each basin.

Point #4

COMMENT: Sect 3.2.2.1, lines 15-21 is also a bit confusing: : :..here you say CRU data was used for PET: : :.but then in the next sentence you also say that Zhou et al (2006) method was used to compute PET? Why do you need to compute PET if you already have it from CRU. Similarly, you say APHRODITE precip data is used but the previous section and the next section indicate that MRI-AGCM model data is used for the hydro modelling? Maybe you used APHRODITE for the bias correction or maybe APHRODITE was used as the baseline data and the perturbed based on climate change factors from the MRI-AGCM??? Either way some more detailed explanation is required as to what you actually used to run the hydro model (under both the current and future climate simulations).

RESPONSE: Thanks for the comments. We apologies for the confusion with this paragraph. We have removed it. It was mistakenly left from the original draft (which men-

tioned about the other application of the BTOPMC model).

Point #5

COMMENT: Other problem is you have just used one GCM and just one emissions scenario (and it is an out of date emission scenario also, IPCC has moved from SRES to RCP several years ago now). I realise at start of Sect 3 you explain you just use one GCM projection as proof of concept. This I guess is ok in a paper like this where you are just demonstrating a method but given one of your main claims is that this FDC-DDC method is easy to apply it should be the case that running multiple GCM/emission scenarios through the method and comparing the differences should be ok. This would make your argument for the acceptance of this method more convincing (as would inclusion of a few other case study locationsâĂŤas per comment #2). Assuming one GCM is enough to demonstrate your concept I guess is possibly ok: : :: : :but what is definitely not ok is to then make concluding statements that suggest that what the findings/results from your one GCM example are somehow indicative of what will happen (they might be but there is a lot of uncertainty associated with future projections and you need to convey that). For example, concluding point #7 you say "CC impacts on floods increases": : :: : :: : :.based on your single model study maybe this might be true but that is just one plausible scenario: : :: : :there are many other equally plausible scenarios and, as per latest IPCC findings and many other papers focussing on this region and elsewhere around the world, there is no consensus either way on whether floods will increase or decrease: : :: : :: : :..same issue when you say "impact decreases the necessary storage for drought management,: : :..": : :..this is just based on the single GCM you assessed: : :: : :based on just a single GCM run using just one emission scenario you should not be making such a definite conclusion such as this (which could have quite serious and expensive practical implications if decision-makers accepted and acted on this conclusion).

RESPONSE: Thanks for your comments. Yes, it is true that without analyzing multiple projections, nothing can be concluded. As mentioned above, we decided to remove

the part of climate change analyses from this paper but just mention that the necessary storage indicator would be a valuable tool to analyse the impact of climate change, too.

Point #6

COMMENT: Your concluding point #9: : :..this is a good recommendation to use this FDC-DDC method in as many places as possible to create global maps of the necessary storage and water resources situation: : :: : :: : :.but as per previous comment, to cover the climate change impact bit you need to put something in about repeating this using multiple different future scenarios (i.e. different GCMs, different emission scenarios etc): : :: : :: : :.then you might get towards some sort of consensus. Your method could be applied at major basins around the world using, for example, the GCM info available at the CMIP websites and some appropriate downscaling and bias correction methods (also GCM selection methods if required): : :.this would be a useful exercise but it is pointless doing it based on the outputs from just a single GCM as that doesn't really tell us anything much about what is possible in the future. Refer to some of the work done by CSIRO for the Murray-Darling Basin in Australia and also some of the work done by Mekong River Commission for examples of how to comprehensively assess potential impacts of climate change on water resources (i.e. using climate change projections from multiple GCMs and multiple emission scenarios).

RESPONSE: Thanks for your comments. Once again we agree with you and remove the climate change impact assessment from this manuscript.

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