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Hydrology and Earth System Sciences Discussions

Interactive comment on "A framework for evaluating regional hydrologic sensitivity to climate change using archetypal watershed modeling" *by* S. R. Lopez et al.

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Thank you for providing clear comments and suggestions regarding our manuscript. We feel the guidance provided by Reviewer #1 have helped us to better focus our goals and improve the general framework of our paper.

We specifically address each of the reviewer's concerns below:

1) The goals of the project while generally stated are not clearly enunciated at the end of the introduction. This lack of clarity prevents myself as the reader from clearly understanding how to organize the remainder of the paper in my head and as a result

offer a clear judgment on the value of the work that was done in this paper. To me the goals seem to be - a) develop framework for climate change sensitivity studies that relies on generic catchment classification system. b) assess climate sensitivity of region using the regional archetypes c) define potential changes in risk of specific hazards occurring in the specific southern California region of study. We appreciate the guidance on framing our research goals. Using the reviewer comments as a guideline, we are adding the following statements to page 5, Lines 3-6:

The goal of the current work is to (a) develop a user-friendly and efficient framework to perform regional hydrologic analysis, (b) assess hydrologic and sediment behavior sensitivity to climate variability within each archetypal watershed, and (c) analyze how varying levels of urbanization affect the potential changes flooding and sediment transport in southern California.

2) – The entire approach proposed for looking at sensitivity to climate change rests on the current model used (HSPF) has a robust representation of all processes important to climatic response. This flaw is true of all synthetic analyses of climate sensitivity. The authors need to explain how their approach and analyses deals with this conceptual problem. As it currently stands the manuscript skates around this problem instead of tackling it head on. This paper also goes a step beyond typical model structural representation challenges by developing catchment archetypes. This approach would seem to almost make the model application fictional further calling the relevance of the results into question.

We agree with the reviewer and agree there are limitations in using any hydrologic model, whether they be physically-based or conceptual, when analyzing climate impacts. No current model can claim to have a robust or accurate representation of all necessary processes to account for dynamic changes in land use (i.e. urbanization growth, shifts in vegetation type), climatic feedback, etc. We advocate that we don't skate around this issue, but instead present an alternative method to handle potential land cover change or uncertainty in future climate for the study region without rely-

ing on a “deterministic” approach, utilizing a range of parameters/condition across the region. We also purposely use a common operational model (EPA’s HSPF) that is utilized by numerous regional planners and consultants so the developed framework can be readily applied.

Our land cover types also represent dynamic conditions in the region. Region I has minimal urban development, but has plans to expand. Region III has more development and their local climate already accounts for this change in feedback. We can use Region III as a “model” for what could potentially happen in Region I. Each of these archetypes has physically realistic parameters and ultimately, by varying the climate, we feel we are able to assess how various future scenarios may potentially affect each region. The results show each archetype does well in capturing the regional hydrologic behavior. Using archetypal watersheds was less computationally expensive and required minimal input data than using real systems or a physically-based model. This model is also built with the goal of application by operational resource managers in the area; hence a parsimonious and efficient framework was necessary in order to development something useful for developers in this region and other urban areas undergoing a range of develop scenarios.

Minor comments: We have rearranged the introduction and added some descriptions to advocate the usefulness of our approach.

page 13734 (My page 6) line 4 were should be wasâĂŤ Changed

page 13745 (My page 17) form line 19 on some of this material would be better covered in the methods section of the paper.

Section 2.4 (Development of Climate Scenarios) was reorganized to describe the 21 scenarios upfront and how the hydrologic and sediment changes were evaluated. In addition, the description of how the 10, 25, 50, 90% probability peak flows were only evaluated for coupled temperature increase and precipitation variability. This statement was added to highlight that in section 2.4.3 Only for scenarios involving precipitation

variability were the 10, 25, 50, 75 and 90% probability peak flow values identified, and evaluated for the 2, 35 and 50 year recurrence intervals.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 13729, 2012.