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September 17, 2014

Dr. Dieter Gerten
Potsdam Institute for Climate Impact Research
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Dear Dr. Dieter Gerten:

Please find attached the revised manuscript titled "Socio-hydrologic Modeling to Understand and Mediate the Competition for Water between Agricultural Development and Environmental Health: Murrumbidgee River Basin, Australia".

In our revision we followed the recommendations and annotations made by the reviewers. Based on our replies to the referees, we constructed a list of changes that were applied to the manuscript. For every comment it has been indicated by which referee it was addressed. In the revised manuscript, all changes have been indicated with a yellow highlight. We hope that this provides a clear insight in the changes that have been made.

We would like to thank the anonymous referees for the constructive comments that have contributed to significant improvement of our manuscript.

Please do not hesitate to contact me if you have any questions regarding the manuscript.

Sincerely,

Tim van Emmerik, M.Sc.
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REVISIONS

1. **Emphasize that focus of this paper is showing how socio-hydrologic modelling can best studying and explaining observed co-evolutionary dynamics, rather that the model itself. (Referee 1, 2, 3)**
   Done, see Abstract (p. 2, lines 60-62), Introduction (p. 5-6, lines 155-169), Results & Discussion (p. 29, lines 865-869) and Conclusions (p. 29-30, lines 873-885). We have rewritten the manuscript in to make it clearer what the aim of this paper is. Although we have written our manuscript around the developed socio-hydrologic model in the Murrumbidgee River Basin, we aim to emphasize that socio-hydrologic modelling can be used as a tool to study and explain observed dynamics in human-water coupled systems.

2. **Explanation of the overall long-term goal with regard to model development and socio-hydrology. (Referee 2)**
   Done, see Introduction (p. 5-6, lines 155-169), Results & Discussion (p. 27, lines 796-804) and Conclusion (p. 33, lines 981-996).

3. **Reinforce the assumptions and literature support for the governing equations and constitutive relations. (Referee 2)**
   Done, see Methods (p. 6-7, lines 173-201; p. 12, lines 340-354).

4. **Comparison to other socio-hydrologic models. (Referee 2)**
   Done, see Methods (p. 6-7, lines 173-201).

5. **Elaborate on calibration of constitutive relationships. (Referee 3)**
   Done, see Methods (p. 9, lines 266-274).

6. **Add more justification of the people dynamics. (Referee 2)**
   Done, see Methods (p. 12, lines 340-354).

7. **Correct equation 6. (Referee 2)**
   Done, Equation 6 has been corrected (p. 15, line 443).

8. **Include reference to Hafi et al. (2005) to support that over 50% of water is allocated for rice production. (Referee 1)**
   Done, see Methods (p. 20, lines 581-584).

9. **Include references for the data in Fig. 6 (Kandasamy *et al.*, 2014; NSW State Water Corporation; ABS, 2013a,b; DWR, 1989) (Referee 1)**
   Done, see Methods (p. 21, lines 606-610).

10. **Sensitivity study of selected parameters on the model outcome and the derived conclusions (Referee 1, 2, 3)**
    A sensitivity analysis had been performed and added to the manuscript, see Methods (p. 21-22, lines 612-648), Results and Discussion (p. 27-28, lines 806-869) and Conclusions (p. 31-32, lines 923-948).

11. **Describe correlation between model results and historical events more clearly. (Referee 2)**
    Done, see Results & Discussion (p. 22-27, lines 659-804).

12. **Highlight potential issues regarding chaotic behaviour of complex systems. (Referee 2)**
    Done, see Conclusions (p. 32, lines 956-965).

13. **Stability of ODE system, effect of initial conditions (Referee 1, 2, 3)**
    We have chosen to perform a thorough first order sensitivity analysis. Given the scope of our research, studying the stability of socio-hydrologic models is left to future research (p. 32, lines 939-948).

14. **Take-home message (to current generation hydrologists). (Referee 2, 3)**
    Done, take-home message has been refined, see Introduction (p.5-6, lines 155-169) and Conclusions (p. 33, lines 981-996).

15. **Analyse case of the Republican River basin to find analogies (Referee 2)**
    We believe it would be very interesting to investigate different socio-hydrologic case studies, either with a literature review or a modelling exercise. However, it has been decided that this lies beyond the scope of our investigation. We would like to emphasize that this would be an interested case study for a next socio-hydrologic modelling exercise.

16. **Other revisions**

- Table 4 has been added.
- Figures 13-15 have been added.
- The constitutive relationship describing the external migration as function of attractiveness has been added to Table 3.
- Several references have been updated (Elshafei et al, 2014; Kandasamy et al., 2014; Pande and Ertsen, 2014; Lui et al, 2014; Sivapalan et al., 2014).