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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Socio-hydrologic perspectives of the co-evolution of humans and water in the Tarim River Basin, Western China: the Taiji–Tire Model" *by* Y. Liu et al.

Anonymous Referee #4

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This is an interesting paper that is suitable for publication in the special issue of HESS. The authors made genuine efforts to understand the sociohydrology of the Tarim River basin in China. It is particularly intriguing how different combinations of natural forces and social processes affect the rise and fall of settlements in the TRB, and in turn the human-water interactions. The manuscript shows a rare bold attempt to unravel complex interactions between human and water using various sources of historical records. The manuscript can be improved by considering the following points.

General comments 1. The manuscript can be better organized. I suggest that the authors shorten the description of historical background of the study area and focus

more on the connection to the sociohydrology of the basin. The conceptual Taiji-Tire framework can be placed earlier since most western readers are more familiar with deductive reasoning. Some repeated paragraphs can be better synchronized into one place. 2. The Taiji-Tire model can be improved. Since both internal and external factors can interact with each other and shape the sociohydrology system, it might be better to use a dashed line for the inner circle and a solid line for the outer circle. The authors also consider placing some arrows to show the linkages between the inner and outer domains. This revised diagram also closely mimics the actual shape of a tire. It is unclear why the Taiji symbol is included in the center. The authors need to explain how the original Taiji symbol is linked back to their Taiji-Tire model. The Taiji symbol implies that the human system can drive the water system or vice versa. Is this what the authors attempt to explain? 3. The authors might consider including a table or a diagram illustrating internal and external drivers of change. It might be worthwhile to distinguish external forces (war between Tang and Arab States, global scale climate change, new technology) from internal forces (internal social organization, regional climate change). In other words, how did the global scale change affect the regional dynamics of sociohydrology of the basin? 4. The authors can discuss any legacy effects (time lag between changes in the social system and changes in hydrology) such as political upheaval or economic reforms on human-water interactions. How did the transition from traditional agrarian economy to communist economy to a mixed market-driven economy affect the human interactions with water in the study area and the exchange with outside of the study area? How has the relative influence of internal and external social and biophysical factors changed over time? How did the rate of human-water interactions change as a result of changes in political economy in the nation? 5. The authors place the importance of their research better in the context of other related research in socio-hydrology. If the intent of this article is to provide insights for comparative socio-hydrologic studies around the world as stated in the introduction, the authors can compare and contrast their findings to other studies. It appears that their study is nicely connected to other case studies (e.g., disappearing lakes) in Australia,

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India, and Aral Sea regions, albeit short-term time scale. 6. Some statistics can be reported for better understanding how the internal and external drivers of human and water interactions are similar or different. What are possible connections between the rapid development in the east coast of China and changes in human-water interactions in the TRB? Any teleconnections? Since the changes in the sociohydrology of the TRB can be affected by changes in other places, it might be worthwhile to include such information. For example, figure 6 shows growths in population and irrigated areas in the study area. Can the authors compare these growths with those at the whole China? What is the major driving force of increasing irrigation in the study area? Has there been any decline in irrigation areas in some parts of China as a result of rapid industrial growth (conversion of ag land to urban and industrial land)? Does the TRB export grains to other parts of China? The authors might consider including information on regional crop growth and compared those to population growth in China. Any statistics on fertilizer usages in the study area? How about changes in water quality? 7. Some concepts are not well-explained and need to be elaborated. See my comments below. 8. While generally well-written and easy to follow, grammars could be tightened. See my detailed comments below.

Other detailed comments Page 12755. “sustainable human development”? Change to sustainable development of human society Page 12756. What do you mean by “social productive forces”? Page 12758, line 1. Insert “the” before the river names. Page 12760, last paragraph. Move this paragraph to later Page 12762, line 26. Outmigration? Page 12763, line 12. Change :week” to “weak” Page 12763, line 19. Insert comma after “Road” Page 12764, lines 1-2 It is unclear why the authors state “the city-states in TRB became more vulnerable to social and environmental stresses”. If they were more mobile than traditional agrarian societies, weren’t they less vulnerable to internal and external stresses? Page 12764, lines 4-6, I don’t agree that all social factors are internal drivers and hydroclimatic factors are external drivers. Page 12765, line 14. What do you mean by “a deterioration of system sophistication”? Page 12765, line 22. Insert comma before “and” Page 12765, line 23. Change “In” to “With” Page

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12765, line 24. Change “Is” to “was” Page 12765, line 25. Change “are” to “were” Page 12766. Can the authors demonstrate how “SHS evolved into a new equilibrium state”? This could be an important concept to be discussed in a conceptual framework. Page 12766. The second paragraph is repeated from the previous section. I suggest that the authors consider condensing information. Page 12767, lines 2-3. Can the authors show the different patterns of human settlement development in the study area over time? Page 12767, lines 15-16. I wonder if the extensive irrigation development and the resultant high water consumption could also lead to changes in the next phase of sociohydrologic system. It seems that according to the Taiji symbol, both positive and negative components coexist in one system. Page 12770, 2nd paragraph. This seems a nice place to illustrate how small fragmented local societies were connected to larger worlds through human-water interactions at different stages. Page 12771, lines 15-18. Can the authors show declines in water quality in the study area as a result of fertilizer usage? Page 12771, before section 5. This might be a nice place citing other references for comparative socio-hydrologic studies in Australia, India, and the Aral Sea.

Page 12772, line 18. Remove “the” before lake names Page 12772, line 19. Insert “the” before TRB. Page 12772, line 20. Insert “the” before Kaidu-Kongqi River Page 12772, line 22. What do you mean by “during the natural period”? Page 12773, last paragraph. It seems that SHS did not evolve into a new equilibrium state. Figure 6. Better to show population density rather than raw population for comparing two regions with different sizes.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 12753, 2013.