

HESS Opinions: Drought impacts as failed prospects

Both Referees agree that the paper was improved through revision, but provide constructive comments that should be addressed. In addition to the technical comments of Referee #2, I agree with the point made by Referee #1. Indeed, the paper would be enriched by adding a concluding section turning "the technical language of prospect theory into an opinion/conclusion in simple language that an average reader (hydrologist) can easily understand". Moreover, it is important to stress that prospect theory is not a solution looking for a problem, but the other way around. Prospect theory as an elegant hypothesis for explaining for what has been observed in Brazil. The abstract should also be revised accordingly.

*We would like to thank the editor and reviewers for the review process and for recognizing the relevance of our study. We present below the changes made in response to the reviewers' suggestions.*

***Abstract.** Human actions induce and modify droughts. Yet, there remain scientific gaps regarding how hydrological processes, anthropogenic dynamics, and individuals' perception of impacts are intrinsically entangled in drought occurrence and evolution. This adds complexity to drought assessment studies, that cannot be addressed by the natural and environmental sciences alone. Furthermore, it poses the challenge of developing ways to evaluate human behavior and its pattern of co-evolution with the hydrological cycle - mainly related to water use and landscape modifications. During field work in Brazil, we observed how drought impacts are experienced by the people that were exposed to a multi-year drought. Evaluating our data, it appeared that Prospect theory, a behavioral economic theory that is usually applied to explain decision-making processes under uncertainty, has explanatory power for what we observed in the field. Therefore, we propose an interdisciplinary approach to improve the understanding of drought impacts emergence by using this theory. When employing Prospect theory in this context, drought impacts are considered failed welfare expectations ("prospects") due to water shortage.. A shifting baseline after prolonged exposure to drought can therefore mitigate experienced drought impacts. We demonstrate that this theory can also contribute to explaining socio-hydrological phenomena such as reservoir effects. This new approach can contribute to bridging natural and social sciences perspectives for more integrated drought management that takes into account the local context."*

## **“6 Conclusion**

*We demonstrated the application of the concept of drought impact as a failed prospect. We argue that the collective perception of individuals regarding the emergence of drought impacts plays a crucial role in both the magnitude and the occurrence of this kind of disaster. We argue that Prospect theory, which originates from behavioral economics, can provide a new angle to analyze the human dimensions of drought by including the individual's perception on the center of analysis. We presented the idea that drought impacts arise when individuals perceive they haven't achieved their desired welfare level due to water shortage. This observation emerged from the multi-year drought event that occurred in the Semi-Arid region of Brazil from 2012-2018 as a case study. Applying Prospect theory and its concepts, such as the "Reference point" helped us understand that individuals' perception of drought impacts emergence varies over time. In simpler terms, prolonged water shortage periods can be seen as a new "normal" situation. Consequently, individuals may no longer experience impacts, since their welfare expectations would be aligned with the new water availability condition. Other concepts, such as the "loss aversion effect" and "framing effect" helped us understand the individual's tendency to change their water consumption pattern only when this resource is lacking, as well as their tendency to adapt to drought events.*

*This understanding offers the opportunity to bridge the knowledge gaps related to the human influences on drought events by acknowledging the individual human dimensions. We showed the potential of Prospect theory in addressing interdisciplinary methodological and conceptual gaps between natural and social sciences. The hypothesis presented here can contribute to the identification of new socio-hydrological phenomena and improve the understanding of phenomena already described in the literature. Furthermore, our insights contribute to the demand for a change of perspective on how studies related to disasters of hydro-meteorological extremes, especially drought events, should be conducted, bringing new ideas about the importance of representing the human component. We also support the idea of bringing more balance between the "socio" and "hydro" component in studies related to drought assessment, in which more interdisciplinarity should be sought, as hydrology and meteorology alone simply do not provide the means to understand human dynamics within the (socio-)hydrological cycle.”*