Dear Editor,

I am pleased to submit our original research article entitled “Climate and human impacts on hydrological processes and flood risk in southern Louisiana” to be considered for publication in *Water Resources Research*. Current scientific literature defines sea level rise as a major factor in increasing global coastal flood risk in recent and future decades (Oppenheimer et al., 2019; Taherkhani et al., 2020). As previously highlighted in other high impact journals (Blum & Roberts, 2009; Jankowski et al., 2017; Syvitski et al., 2009; Taherkhani et al., 2020), coastal flood risk, particularly over southern Louisiana, is exacerbated by natural and human-induced subsidence, as well as local processes such as wave effects, storm surges, tides, erosion, sedimentation and compaction. However, the impacts of climate-induced hydrological change (CHC) on flooding and synergy with SLR over that region are often overlooked. In this study, we quantify how CHC affect southern Louisiana’s water dynamics and its synergy with SLR and water management that results in observed land loss and increase in terrestrial water storage over the decades. We look to answer the following science questions: how much of observed changes are due to CHC and SLR; what are their individual contributions to increasing flood risk; and to what extent is water management contributing to flood resilience in coastal Louisiana?

Our main findings are that CHC is an important factor contributing to flooding and likely poses a large risk to life and property, and that water management is key to reducing flood risk over the domain, particularly protecting its cropland and major cities, including as Baton Rouge and New Orleans. For example, currently (i.e., 2016-2020 period), CHC-induced flooding puts an additional 73km2 of cropland under flood risk at least half of the time (median flood event) and 65km2 once a year (annual flood event), when compared to a past period (1993-1997). That is a ten- to twenty-fold increase relative to SLR-induced flooding. CHC also increases population vulnerability to flooding; additional 9900 residents currently live under flood risk at least half of the time, and that number increases to 27,400 for annual flood events. The number of residents vulnerable to SLR-induced flooding is lower (6000 and 3300 residents, respectively). These findings have implications over the world’s densely populated and managed coastal areas. It is estimated that 630 million people are vulnerable to projected SLR-induced coastal floods alone (Kulp & Strauss, 2019). The scientific community has been gathering and refining information on sea level rise impacts on these regions, but CHC impacts and its synergy with other climate and human factors are poorly documented. Hence, similar analyses of individual and synergistic impacts of climate and human factors, including but not limited to those considered in this study, should be performed globally.

On behalf of the authors, thank you for your consideration.

Sincerely,s

References

Blum, M. D., & Roberts, H. H. (2009). Drowning of the Mississippi Delta due to insufficient sediment supply and global sea-level rise. *Nature Geoscience*, *2*(7), 488–491. https://doi.org/10.1038/ngeo553

Jankowski, K. L., Törnqvist, T. E., & Fernandes, A. M. (2017). Vulnerability of Louisiana’s coastal wetlands to present-day rates of relative sea-level rise. *Nature Communications*, *8*(1), 14792. https://doi.org/10.1038/ncomms14792

Kulp, S. A., & Strauss, B. H. (2019). New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding. *Nature Communications*, *10*(1), 4844. https://doi.org/10.1038/s41467-019-12808-z

Oppenheimer, M., Glavovic, B. C., Hinkel, J., Wal, R. van de, Magnan, A. K., Abd-Elgawad, A., et al. (2019). Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. In H.-O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, et al. (Eds.), *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*.

Syvitski, J. P. M., Kettner, A. J., Overeem, I., Hutton, E. W. H., Hannon, M. T., Brakenridge, G. R., et al. (2009). Sinking deltas due to human activities. *Nature Geoscience*, *2*(10), 681–686. https://doi.org/10.1038/ngeo629

Taherkhani, M., Vitousek, S., Barnard, P. L., Frazer, N., Anderson, T. R., & Fletcher, C. H. (2020). Sea-level rise exponentially increases coastal flood frequency. *Scientific Reports*, *10*(1), 6466. https://doi.org/10.1038/s41598-020-62188-4