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Climate change or irrigated agriculture – what drives the water level decline of Lake Urmia?

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Lake Urmia is one of the largest hypersaline lakes on earth with a unique biodiversity. Over the past two decades the lake water level declined dramatically, threatening the functionality of the lake's ecosystems. There is a controversial debate about the reasons for this decline, with either mismanagement of the water resources, or climatic changes assumed to be the main cause.

During this study we gathered an extensive hydro-meteorological data set, information about the reservoirs and the lake bathymetry. This data served for a quantification of the water budget components of Lake Urmia over the last five decades. Interestingly, a comparison of the temporal patterns of the principal natural boundary conditions of streamflow (precipitation and evaporation) with the inflow to the lake revealed that the variability of the inflow can be well explained its natural drivers. With this we can show that variations of Lake Urmia's water level during the analyzed period were mainly triggered by climatic changes.

However, under the current climatic conditions agricultural water extraction volumes are significant and often exceed the remaining surface water inflow volumes. This rather simple observation shows that something deeper needs to be dug here. Therefore, we performed a parsimonious hindcast experiment and run a set of development scenarios based on the previously developed water balance. This helped us to better quantify the human impact on the development of the water volume of Lake Urmia. We could show that changes in agricultural water withdrawal would have a significant impact on the lake volume and could either stabilize the lake, or lead to its complete collapse (Schulz et al., 2020).

References

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