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Quantitative analysis of contested water uses and management in conflict-torn transboundary river basins

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Sharing waters in a transboundary river basin is challenging, especially when there is no tradition of cooperation between riparian countries in other, non water-related, issues such as trade. Moreover, as water resources are being developed and climate change is a new source of risk, the lack of shared information on hydrological flows or human/institutional decisions on resources management implies that it is increasingly difficult to distinguish between natural and anthropogenic factors affecting a flow regime. We propose a modeling framework that combines remote sensing, multi-agent simulation, and scenario analysis to independently understand and quantify the causes of hydrological changes in non-cooperatively managed, institutionally complex, over-built, river basins. Taking the conflict-torn Yarmouk River basin as a case-study, we first model agricultural policies and reservoirs management in Syria, Jordan and Israel since 1983. The simulated flow matches well downstream measurements (KGE' = 0.90). The consequences of contested political narratives developed by riparians and other complementary theories are then quantitatively assessed using the multi-agent simulation model to understand the drivers behind the changes in Yarmouk River discharges over the last 30 years. The impact of these scenarios on the sharing of the flow between downstream Jordan and Israel is finally evaluated by modelling institutional interactions between these two countries.