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Who follows whom: Reservoirs and population dynamics in the USA

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Dams and reservoirs have enabled economic growth in main countries around the world. They have been used to cope with the spatial and temporal variability of floods and droughts, or support agriculture and energy production. On the one hand, the spatial distribution of human population influences the spatial distribution of reservoirs: they are built mainly were more water is needed. On the other hand, the spatial distribution of reservoirs also influences the spatial distribution of human population: reservoirs enable agricultural, industrial and urban expansions. This reciprocal effect of reservoirs on human population is not fully understood. Some studies explored how dams and reservoirs lead to population displacement in flood areas (according to the World Commission on Dams large dams have forced about 40-80 million people from their lands in the past six decades). However, only a few studies investigated the role of reservoirs as attractors of new population. As such, we explore the reciprocal effects between expansions of reservoirs and population shifts over the last 200 years in the United States (US) at the decadal time scale. In particular, we exploit two datasets: 1) the 1-km decadal population maps for the conterminous US from 1790 to 2010 (Fang and Jawitz, Scientific Data, 2018); and 2) the Global Reservoir and Dam database (GRanD). These datasets are used to calculate the center of mass of both US population and reservoir storage capacity and assess their spatio-temporal inter-relationships within the USA. A statistical causal analysis is implemented to better understand (lag)correlations and co-integration between changes in the spatial distribution of human population and reservoirs. The preliminary results of this study show, as expected, that both people and dams have moved from East to West. More specifically, we investigate how, and to what extent, reservoirs act as attractors of new population. This study can be considered as the first step to better understand socio-hydrological dynamics between human population and water infrastructure.