



Impact of war, precipitation, and water management on quantity of water resources in the Tigris/Euphrates area

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The fast-paced conflicts in the Middle East have the potential to disrupt management and supply of water resources in the region. In this research, we use the normalized difference water index (NDWI) in order to monitor changes in the extent of various water bodies over the time span of the Landsat 4, 5, 7, and 8 satellites (1984-present). We focused on Mosul and Haditha dam lakes, located on the Tigris and Euphrates Rivers, respectively, each of which has experienced changes in sovereignty over the last few years of conflict. We established two areas, one land and one water, on each image, plotted the distributions of all NDWI values for each area, and used the number of standard deviations between the two distributions in order to set a dynamic NDWI threshold for each image. Using this threshold, we determined water pixels and lake surface area, and computed daily percent change in lake extent between images. Furthermore, we took account of explanatory water resource variables, such as upstream dam management (via surface extent of upstream Turkish dams), precipitation (via globally-compiled databases), evaporation (based on surface area decreases during non-rainy months), and irrigation withdrawals (based on MODIS Enhanced Vegetation Indices). We used these explanatory variables in order to build a general model of expected dam lake surface extent, and we looked to see if anomalies from expected surface area corresponded with periods of conflict. We found that the recent years of conflict do not appear to have had as much impact on the Mosul and Haditha dam lakes as did the conflicts related to the earlier Gulf Wars. The dam lakes have recorded an overall decrease in surface area simultaneous to increases of upstream dams. A strong seasonal signal driven by springtime Turkish snowmelt and summer evaporation is also evident.