Anthropogenic and climatic controls on surface water loss across USA

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Surface water resources are severely affected by human activities and climate variability, and their rapid depletion is one of the main challenges for sustainable development. This situation is expected to worsen because of climate change, world population growth and the associated conversion of rural lands into urban areas. Since about 70% of global population is projected to be living in cities by 2050, it is necessary to shed light on the influence of climate and human dynamics on water occurrence variation to better understand their driving role.

Remote sensing is a key tool for monitoring the process of environmental change because it provides the advantages of global spatial coverage, high temporal resolution, and fast updating. Satellite data enable to record changes in climatic conditions, land use, and spatial allocation of human settlement and activities, which are major factors in altering water dynamics. However, the potential of such data has not been fully exploited.

Here, the interrelation between spatial and temporal distribution of water depletion, changes in precipitation, and human dynamics across the USA watersheds is investigated using remote sensing data. In particular, the contribution of urbanization and precipitation variation to surface water decrease in the last 35 years (from 1984 to 2018) is evaluated at the basin scale. Preliminary results highlight the presence of a positive correlation between surface water loss and urban area growth. On the other hand, a counterintuitive increasing trend of surface water decrease with growing annual precipitation is found. A multiple linear regression among surface water loss, urbanization, and annual precipitation change is calculated, showing that most of the surface water loss can be attributed to the urbanization process. A spatial and temporal clustering analysis is then performed to better understand the influence of anthropogenic factors on surface water losses. Results clearly show a high level of urbanization close to surface water loss hotspots.