Geophysical Research Abstracts
Vol. 12, EGU2010-10135, 2010
EGU General Assembly 2010

Past and future changes in the discharges of the Euphrates and Tigris Rivers

Omer Lutfi Sen, Alper Unal, Tayfun Kindap, Deniz Bozkurt, Hasan Nuzhet Dalfes, and Mehmet Karaca
Istanbul Technical University, Eurasia Institute of Earth Sciences, Istanbul, Turkey (senomer@itu.edu.tr)

Temperature has been traditionally used as the primary parameter in detecting the climate change signal at scales from local to global. As being point measurements, however, temperature data come with important shortcomings such as the lack of the representivity of large areas and contamination by urban heat island effect as most stations are located in cities. The snowfed river discharge data, on the other hand, provide an opportunity to detect the climate change signal over large areas that are relatively free of human interference. One of the best quantitative indicators for this purpose is the shift in the median of the cumulative flow, which is commonly referred as center time approach. The present study deploys this approach to investigate the past climate change signals in the Euphrates and Tigris, two important rivers in the Middle East. Streamflow observations on their unregulated tributaries in the eastern Anatolia indicate that the fractions of the discharge between March and June amount to 58-79%, which is a good indication of the fact that these rivers are primarily fed by snowmelt runoff. The statistical analysis reveals that there are no significant trends in the annual streamflow data (i.e., covering 35 years from 1972 to 2006). Differences in the center times of the two consecutive 17-year periods are found to be statistically significant, both with parametric and non-parametric statistical tests, at six out of eight stations at a significance level of 0.1. Among significant stations, the average shift to earlier times is 5.2 days, indicating earlier spring melting of snow due to increased temperatures. The climate change projections based on SRES A2 scenarios indicate up to 6oC warming by the end of 21st century for these basins. This warming implies a decline in the winter snowpack of the region as a result of two processes: increased snowmelt and increased fraction of the precipitation falling in the form of rain. These result in increased runoff in winter and reduced runoff in spring, which also implies that the center time of the river discharges of the basins shifts even earlier in the future. These findings are critical to understand possible impacts of climate change on snowfed water systems: i) management of several dams and hydroelectric power plants on the Euphrates and Tigris rivers; and ii) temporal distribution of water available for domestic use and irrigation to south eastern Anatolia and to down-stream countries such as Iraq and Syria.