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Surface runoff responses to climate change and LUCC in the Asian arid zone

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Abstract

The ongoing global warming is of serious concerns for the arid Asian zone because it is one of the most sensitive areas to the global climate change. The rates of warming during the past 60-100 years in most parts of the zone are higher than the global average (0.14°C/10a). For example, the rate is 0.29°C/10a in Uzbekistan (1950–2005); 0.26°C/10a in Kazakhstan (1936–2005); 0.18°C/10a in Turkmenistan (1961–1995); and 0.39°C/10a in northwestern China (1950–2010). In despite of the fact that precipitation has been increasing in many parts of the zone, the surface runoff has responded to the increasing precipitation differently in different settings. For example, in high-elevation watersheds the runoff has been increasing as a result of increased ice melting resulted from temperature rising and the precipitation increasing also contributed a small portion of the increase. But, in low-elevation watersheds the runoff has been declining in despite of precipitation increasing. Two water-related issues are crying for attentions: (1) global warming and (2) socio-economic expansion. First, water storage in glaciers will be sooner or later exhausted under warming climates. For example, in arid northwestern China about 85% of the water resources are formed in high elevations and the glacier-melting contribution to runoff has been doubled since 1980's. The concern is that approximation to the turning point of glacier-melting supplies to runoff (i.e., transition from increasing runoff to decreasing runoff) will pose great threats to ecological and socio-economic systems. Second, socio-economic expansion will also pose great threats. For example, the surface runoff in Tarim mainstream has been decreasing since 1960s and the decreasing was due to the increasingly intensified human impacts. Chinese government statistics indicate that the actual irrigation area in mainstream exceeds the allowed area (i.e., 123×10^4 hm^2) by as much as 40×10^4 hm^2 in 2008, meaning that about 50×10^8 m^3 water is consumed for the excessive expansion of irrigated area (i.e., 40×10^4 hm^2).

Biography

Zhaodong Feng obtained his Ph.D. from University of Kansas (1992), M.S. from University of Washington (1987) and M.A. from Lanzhou University (1982). He did two-year postdoctoral study at Columbia University (1992-1994) and was a professor at Montclair State University (1996-2008). He was a Yangtze-Scholar Professor at Lanzhou University (2000-2010) and Tianshan-Scholar Professor at Xinjiang University (2011-2013). Changchun Xu got her M.A. from Xinjiang University (2000) and her Ph.D. from Chinese Academy of Science (2005). She is currently an associate professor at Xinjiang University.