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Two simple concepts to assess the role of climate and land-use changes on streamflow

M. Renner and C. Bernhofer

TU Dresden, Institute of Hydrology und Meteorology, Meteorology, Tharandt, Germany
(maik.renner@mailbox.tu-dresden.de)

Extracting meaningful signals of hydro-climate data is of crucial importance to understand past changes in the hydrological cycle of river basins. The task is further complicated by climate and land-use changes occurring in parallel. Thus, there is the need to distinguish between both impacts.

Recent literature presented two simple analytical frameworks to address this problem. One approach, Wang and Hejazi (2011), is based on Budyko functions, which determine a trace of how the evaporation ratio (ET/P) changes with aridity (PET/P). This is compared with an ecohydrological approach (Tomer and Schilling (2009), Renner et al. (2011)) which employs a non-dimensional relation of the long-term water balance and the energy balance. The ecohydrological framework makes assumptions on how the partitioning of water and energy fluxes is changing under changes in climate (i.e. the aridity) or under changes in basin characteristics.

Here, we compare both approaches using a large hydro-climate dataset covering more than 400 basins in the continental US. We evaluate the differences in long-term average precipitation (P), potential evapotranspiration (PET) and streamflow (Q) of two periods in the second part of the 20th century (1948-1970 and 1971-2003). The results show that both methods yield comparable results on the magnitude of probable impacts on streamflow. Further, the ecohydrological framework provides an immediate measure on the relative importance of climate and land-use change. The mapping of this measure reveals large scale hydro-climate changes mainly driven by increasing humidity, but strongly transformed by human made changes in basin characteristics.

References

[1] Renner, M., Seppelt, R., and Bernhofer, C.: A simple water-energy balance framework to predict the sensitivity of streamflow to climate change, Hydrology and Earth System Sciences Discussions, 8, 8793–8830, doi:10.5194/hessd-8-8793-2011, URL http://www.hydrol-earth-syst-sci-discuss.net/8/8793/2011/, 2011.

[2] Tomer, M. and Schilling, K.: A simple approach to distinguish land-use and climate-change effects on watershed hydrology, Journal of Hydrology, 376, 24–33, doi:10.1016/j.jhydrol.2009.07.029, 2009.

[3] Wang, D. and Hejazi, M.: Quantifying the relative contribution of the climate and direct human impacts on mean annual streamflow in the contiguous United States, Water Resources Research, 47, W00J12, doi:10.1029/2010WR010283, 2011.