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Advances in Water Resources 25 (2002) 701–702

Advances in Water Resources

www.elsevier.com/locate/advwaters

Letters to the Editors

Comment on "The hydrology and hydrometeorology of extreme floods in the Great Plains of Eastern Nebraska" by Y. Zhang, J.A. Smith and M.L. Baeck

The authors have compared the flood response of two adjacent watersheds in Nebraska to extreme precipitation. They concluded that "the striking contrast in flood response between Maple Creek and Pebble Creek are related to contrasts in drainage network structure, infiltration properties and flood wave attenuation". While I agree with most parts of this conclusion, I would like to point out that probably there is no contrasting difference in infiltration properties and consequently in the runoff ratios of the two watersheds.

The United States Geological Survey-published [3,5] contributing drainage areas of the two catchments, Pebble Creek and Maple Creek, are 528 and 956 km^2, respectively, above the gaging stations near Scribner (USGS ID# 06799385) and Nickerson (USGS ID# 06800000). The latter value is 18% smaller than is published (i.e. 1165 km^2) by the authors. As a consequence, the Maple Creek runoff ratios (%) for the selected five flood events change from 15, 27, 20, 16, 38 to 18, 33, 24, 20, 46, respectively. When these are compared to the runoff ratios (22, 34, 51, 33, 50) of Pebble Creek, only the third and fourth events differ significantly. However, using daily precipitation [1] at Clarkson (Fig. 1) and daily mean discharge data [4] near Nickerson, aggregated from 15-min measurements, the runoff ratios (%) for Maple Creek become 55 and 24, respectively, for the third and fourth events, close to what were observed at Pebble Creek. Of course, one may argue which measurement technique results in better areal precipitation estimates, a point measurement of actual precipitation located within the catchment, or measuring radar signal reflectivity, which does not directly measure precipitation intensities but covers the entire watershed.

Our main point however is that it is unlikely that there would be any "systematic differences in runoff ratio between the two catchments" either for flood events or during dry periods as the authors claim. The long-term runoff ratios (1978 October 1–1993 September 30, i.e. the temporal coverage of the USGS-published [5] daily mean discharge data for Pebble Creek) for the two catchments are 12.38% (Maple) and 14.81% (Pebble). The same values for the warm seasons only (May–September), to exclude any delaying effects of possible snow-cover, are 11.05% and 13.84%, respectively.

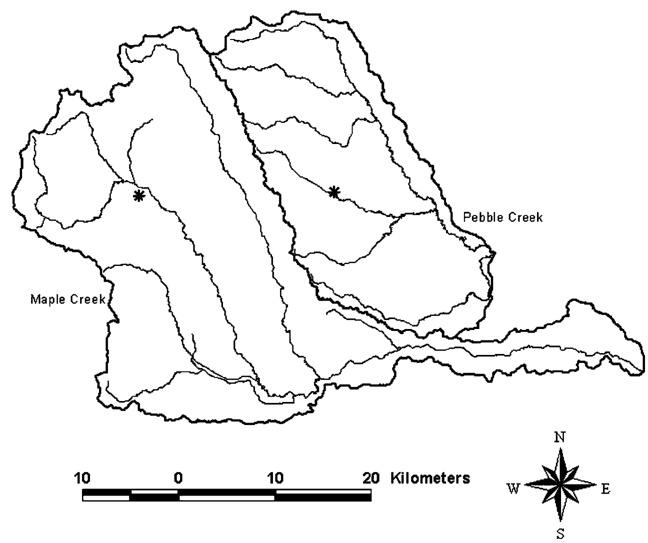

Fig. 1. Locations of the precipitation stations at Clarkson (Maple Creek) and at Dodge (Pebble Creek), Nebraska.

Table 1
Selected drainage basin characteristics for Maple Creek and Pebble Creek, Nebraska

	Maple Creek	Pebble Creek
Total drainage area above gaging station (km^2) [3,5]	956	528
Contributing drainage area (km^2) [3]	956	528
Long-term mean annual precipitation (mm) at Clarkson and Dodge [1]	719	723
Available water capacity of soil (–) [3]	0.20	0.19
Permeability of the least permeable soil layer (mm h^{-1}) [3]	12	10
Permeability of the upper 1.5-m soil profile (mm h^{-1}) [3]	30	30
Mean slope (degree) and its standard deviation of the 30-m [4]	2.93	2.54
Digital Elevation Model	2.08	1.72
Portion of watershed covered by dry cropland (%) [2]	75	82

Similarities, rather than contrasts in runoff ratio and, as a consequence, in infiltration properties are indeed expected due to very similar soil, land-use, topographic and climatic conditions of the two adjacent watersheds. See Table 1 for a comparison of those characteristics.

This is not to say that there are no systematic differences in the runoff response between the two catchments.

The differences, however, stem overwhelmingly from the very differing geometric properties [3] (i.e. compactness ratio, shape factor) of the two catchments, and especially the stream networks (i.e. drainage pattern, main channel slope), as the authors point out correctly.

Our findings may give some solace to practicing hydrologists in regard to lending further evidence that the widely available geographically referenced land-use, soil, elevation, stream-network data are useful tools in predicting hydrologic response of the watershed such as infiltration and the runoff ratio in our case.

References

[1] National Climatic Data Center. Summary of the Day. EarthInfo, Boulder, Colorado, 1998.

[2] Nebraska Department of Natural Resources. Digitized Landuse by County. Lincoln, Nebraska, 1983.

[3] Soenksen PJ, Miller LD, Sharpe JB, Watton JR. Peak-flow frequency relations and evaluation of the peak-flow gaging network in Nebraska. Water Resources Investigations Report 99-4032. US Department of the Interior, US Geological Survey, 1999.

[4] United States Geological Survey. Nebraska Elevation by County. Conservation and Survey Division, University of Nebraska, Lincoln, Nebraska, 2001.

[5] United States Geological Survey's web-site 2002. Available from: http://water.usgs.gov/nwis/sw.

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PII: S0309-1708(02)00039-8

Response to comment on "The hydrology and hydrometeorology of extreme floods in the Great Plains of Eastern Nebraska"

The authors appreciate Professor Szilagyi's comments concerning water balance computations for Pebble Creek and Maple Creek. The contrasting results from the two analyses are due to a revision in the drainage area of Maple Creek. At the time that we obtained discharge data for Maple Creek, the drainage area was listed as 450 mi^2. The drainage area was subsequently revised to 369 mi^2 [P.J. Soensken, USGS; personal communication] based on recent studies by the USGS and the State of Nebraska. The revised drainage area has the attractive feature, as noted by Professor Szilagyi, of significantly reducing the contrasts in runoff ratio between Pebble Creek and Maple Creek. Our conclusion 4 should be revised to remove references to infiltration contrasts leaving: "Pronounced contrasts in flood response between Maple Creek and Pebble Creek are related to: (a) contrasts in timing of flood response linked to drainage network structure, (b) contrasting fractional coverage of rainfall follows from basin size and structure and (c) differential attenuation of flood waves, especially for valley-bottom full floods".

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PII: S0309-1708(02)00040-4