

Revised runoff curve number for runoff prediction in the Loess Plateau of China

Wenhai Shi¹ and NI Wang¹

¹Chang'an University

November 10, 2020

Abstract

The Soil Conservation Service Curve Number (SCS-CN), one of the most commonly used methods for surface runoff prediction, was developed by the United States Department of Agriculture (USDA). For many years, the direct application of the CN look-up table derived from USDA in regions elsewhere with different characteristics was questionable, because it could lead to a large error in runoff prediction. To eliminate this error, some studies suggested that CN entries should be revised based on measured data, whereas others indicated that major factors affecting runoff should be considered for application in specified regions. In this study, the above-mentioned CN revision approaches were compared to adjust CN values using a large amount of rainfall-runoff observation data for 43 study sites across the Loess Plateau region. The results showed that the average CN values of each watershed obtained from the measured rainfall-runoff data are quite different from the tabulated CN2 values. However, the calculated average CN values produce little improvement in runoff estimation with the SCS-CN method, due to large CN value variation. Therefore, three factors—soil moisture, rainfall depth, and intensity—were identified as influencing the CN values under field conditions in the Loess Plateau, and a new CN value with a CN2 value in the conventional SCS-CN method was developed. The reliability of the proposed method was tested with data from three watersheds on the Loess Plateau. High Nash–Sutcliffe efficiency ($NSE = 74.70\%$) and low root mean square error ($RMSE = 3.08$ mm) indicated that the proposed method could accurately estimate runoff and was more reliable than the standard SCS-CN method ($NSE = 19.26\%$; $RMSE = 5.51$ mm). Moreover, the factors incorporated in the proposed method seem to more effectively reflect the large CN value variations than the revised CN2 value based on measured dataset in the Loess Plateau region.

Hosted file

Manuscript-2020-11-5.pdf available at <https://authorea.com/users/287013/articles/492051-revised-runoff-curve-number-for-runoff-prediction-in-the-loess-plateau-of-china>