

Exercise: estimating infiltration and runoff with the SCS-CN method

By applying the SCS – CN method it is required to compute the cumulative runoff depth induced by two subsequent rainfall events. The first event, which was observed on February 15 of a given year, occurred after a dry period of 13 days and produced a total rainfall depth of 108.2 mm. During the second event, which occurred on February 18, a rainfall depth of 141.6 mm was observed.

The watershed is characterised by a CN value equal to 61.

Please note that the given CN value corresponds to a AMC = 2, while the AMC for the remaining classes can be computed through the relationships:

$$CN(I) = \frac{CN(II)}{2.3 - 0.013 \cdot CN(II)} = \frac{61}{2.3 - 0.013 \cdot 61} = 40 ,$$

$$CN(III) = \frac{CN(II)}{0.43 - 0.0057 \cdot CN(II)} = \frac{61}{0.43 + 0.0057 \cdot 61} = 78 .$$

AMC is identified through the following guidelines:

- 1) AMC (antecedent moisture condition) is equal to I, if rainfall during the preceding 5 days is lower than 12.7 mm in the dormant season and 35.6 mm in the growing season;
 - 2) AMC is equal to II if rainfall is comprised between 12.7 mm e 27.9 mm in the dormant season or between 35.6 mm and 53.3 mm in the growing season;
 - 3) AMC is equal to III for rainfall greater than 27.9 mm or 53.3 mm in the dormant and growing seasons, respectively.
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Solution

If one indicates with the symbol T the time of occurrence of the first event, one obtains:

$$S = 254 \left(\frac{100}{40} - 1 \right) = 381 \text{ mm};$$

$$q_{\text{cum}}(T) = \frac{(108.2 - 0.2 \cdot 381)^2}{108.2 + 0.8 \cdot 381} = 2.5 \text{ mm}.$$

The runoff coefficient of the event is equal to::

$$\phi = \frac{2.5}{108.2} = 0.023 .$$

If one indicates with T' the time in which occurred the second event, one obtains:

$$S = 254 \left(\frac{100}{78} - 1 \right) = 72 \text{ mm};$$

$$q_{\text{cum}}(T') = \frac{(141.6 - 0.2 \cdot 72)^2}{141.6 + 0.8 \cdot 72} = 81.2 \text{ mm}.$$

The runoff coefficient of the second event is equal to:

$$\phi = \frac{81.2}{141.6} = 0.57 .$$

One can note the variability of the runoff coefficient.