

## Limited Applicability of Rational Formula in the Presence of Storage Effect

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### ABSTRACT

This study evaluates the applicability of Rational Formula (RF) or Modified Rational Formula (MRF) in the presence of storage effect. For this purpose, a storage-effect-considered MRF (MRFS) is derived, and its peak time and peak flow are compared with those of MRF. Additionally, these models are compared with the Clark Model, where both the uniformly-distributed and temporally-distributed rainfall based on the Huff method are considered (i.e., Clark-Uniform and Clark-Huff). All of these models are then applied to artificial basins as well as to real basins. Results show that MRF estimates the largest peak flow among the models, but is similar to that of Clark-Huff. The peak flow of MRF is much higher than those of MRFS and Clark-Uniform. Both MRFS and Clark-Uniform are similar to each other in their peak times and peak flows. The difference between MRF and MRFS increases as the storage effect increases, which becomes higher than 10% in case the Russell coefficient is 0.32 or higher. Their difference is also maximized when the concentration time equals the rainfall duration, which then decreases as the rainfall duration increases. Overall, it is verified that MRFS can be an alternative to the existing Clark model if the temporal variability of rainfall is small. Also, if the rainfall duration is sufficiently long, MRF can produce a reasonable design peak flow similar to that based on the Clark model.

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