AOGS 2006

A Piece-Linear Reservoir Operation with a Minimum Variance for the Main Reservoir in Northwest México

ISIDRO CRUZ

Instituto Tecnológico de Sonora

In populated arid and semiarid regions where water is scarce, reservoir administrators look for a reservoir management rule that permits to use the maximum annual average volume. It can be shown that this rule is equivalent with the reservoir operation that minimizes water spills for surpassing the reservoir capacity. From the equation of continuity it can be seen that the maximum annual average released volume from the reservoir can not be greater that the annual runoff average and therefore this runoff average is the goal for any optimal discharge policy in arid and semiarid regions. On the other hand, the marginal analysis theory of Massé provides the rigorous proof that a release policy is not optimal unless it guarantees the constancy of the marginal benefit in time, besides, if the marginal benefit depends on time solely by its dependence on the release at time t and not through the argument time, then the constancy of the marginal benefit is equivalent to the constancy of the release. Unfortunately, an annual constant release increases the probability of water spills (β) and the probability to empty the system (α) below the specified minimum capacity. Therefore, to achieve the maximum annual average goal volume it will be necessary to increase water releases when the reservoir in near to its total capacity and to decrease water releases when the reservoir is near to the specified minimum capacity. A compromise reservoir operation is proposed minimizing the variance of water releases. This compromise can be obtained fixing the probabilities α and β, for example to 0.025 and to 0.05 respectively (in arid and semiarid regions it seems worst to dry the system). An optimal release piece-linear policy with three components is obtained from these considerations for a reservoir system in northwest México.

Notes:

After water spills (Beta)

After empty the system (Alpha)