Description

Utility RAINEVAP is used to account for direct meteorological effects on the reservoir lake surface area.

The areas needed to compute incremental rainfall/evaporation volumes are interpolated from an elevation versus area curve. This curve is derived from the elevation versus storage curve input to the model. The areas are assigned to the midpoint between two consecutive elevations on the elevation versus storage curve and are computed as the difference between the volumes at the two consecutive elevations divided by the difference in the elevations. The first area, \( a_1 \) (lowest elevation, \( h_1 \)) is assumed to be zero.

\[
\Delta v = v_{i+1} - v_i \\
\Delta h = h_{i+1} - h_i \\
a_{i+1} = \frac{\Delta v}{\Delta h} \\
h_{h_{i+1}} = h_i + 0.5 \times \Delta h
\]

\[i=1 \ldots (NVAL-1)\]

where \( NVAL \) is the total number of data points on the storage-elevation curve.

\( v_i \) is the reservoir storage volume corresponding to elevation \( h_i \) on the storage-elevation curve.

\( a_i \) is the reservoir surface area corresponding to elevation \( h_{h_i} \) on the area-elevation curve.

Rainfall data (PCPN) are specified always through a time-series. Evaporation effects can be specified by either a monthly curve (EVAP) or a time series (EVAP). The values used to define the monthly curve represent the daily evaporation value for the 16th day of each month. Intervening daily values are interpolated linearly between two adjacent mid-month values. The daily evaporation is further distributed throughout the day by a user-specified distribution curve (DIST). Uniform distribution is used if a distribution curve is not specified.

If evaporation effects are specified by a monthly curve, the interaction of effects between rainfall and evaporation is controlled by an evaporation reduction function that is based on the precipitation amount for the time interval. The potential evaporation for the time interval is reduced linearly between 0 percent for precipitation of 0.0 inches up to the maximum 100 percent reduction at a 0.25-inch precipitation amount. (The 0.25-inch value is for a 6-hour time interval and is adjusted for different time intervals.) Above the 0.25-inch amount, all evaporation effects are ignored.

The rainfall/evaporation effects are manifested in a modification to
the inflow volume to the reservoir. The modified inflow volume is computed by distributing the rainfall/evaporation amount for the time period over the entire reservoir surface area. The area used to determine the additional inflow volume is the average of the area at the beginning of the time period and the area at the end of the time period. An initial estimate of the period ending surface area is made by equating it to the area at the start of the time period.

\[
\begin{align*}
\text{HRE} & = \text{HR} + \text{HE} \\
H'_2 & = H_1 + \text{HRE} \\
A'_2 & = a(H'_2) \\
A_1 & = a(H_1) \\
\text{AA} & = 0.5 \times (A_1 + A'_2) \\
\text{QRE}' & = \text{AA} \times \text{HRE}
\end{align*}
\]

where \( \text{HR} \) is the period rainfall depth
\( \text{HE} \) is the period evaporation depth
\( \text{QRE} \) is the inflow due to direct rainfall/evaporation

The resulting inflow is added to or subtracted from the stream inflow. This estimated total inflow is then used to compute the reservoir release for the current time period. The pool elevation at the end of the time period (after all schemes have been executed) is used to calculate the resultant surface area. A new inflow due to direct rainfall/evaporation can then be computed.

\[
\begin{align*}
\text{QI1}' & = \text{QI1} + \text{QRE}' \\
\text{QI2}' & = \text{QI2} + \text{QRE}' \\
\text{QIM}' & = \text{QIM} + \text{QRE}' \\
V_2 & = V_1 + (\text{QIM} - \text{QOM}) \times \Delta t \\
H_2 & = h(V_2) \\
A_1 & = a(H_1) \\
\text{AA} & = 0.5 \times (A_1 + A_2) \\
\text{QRE} & = \text{AA} \times \text{HRE} \\
\text{ERR} & = (\text{QRE} - \text{QRE}')/\text{QRE}
\end{align*}
\]

If the error of this newly determined value, ERR, differs from the initial estimate by more than a specified percentage, the second value is used to re-compute the average area and inflow modification. The model then recycles through the same time period using the modified inflow value to re-compute the model outputs. At the end of this second pass no tolerance checks are made against the newly calculated and initially computed period ending elevations.