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.

$$\Delta v = v_{i+1} - v_i$$

$$\Delta h = h_{i+1} - h_i$$

$$a_{i+1} = \Delta v/\Delta h$$

$$hh_{i+1} = h_i + 0.5 * \Delta H$$

$$i=1 \ldots (NVAL-1)$$

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 hh_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.

$$HRE \quad = HR + HE$$

$$H'_2 \quad = H_1 + HRE$$

$$A'_2 \quad = a(H'_2)$$

$$A_1 \quad = a(H_1)$$

$$AA \quad = 0.5 * (A_1 + A'_2)$$

$$QRE' = AA * HRE$$

where HR   is the period rainfall depth
      HE   is the period evaporation depth
      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.

$$QI1' = \quad QI1 + QRE'$$
$$QI2' = \quad QI2 + QRE'$$
$$QIM' = \quad QIM + QRE'$$

$$V_2 \quad = \quad V_1 + (QIM - QOM) * \triangle t$$
$$H_2 \quad = \quad h(V_2)$$
$$A_2 \quad = \quad a(H_2)$$
$$AA \quad = \quad 0.5 * (A_1 + A_2)$$
$$QRE \quad = \quad AA * HRE$$
$$ERR \quad = \quad (QRE - QRE')/QRE$$

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.