**Changes from v3.8 are highlighted.**

**1. Main input file 'hi\_wb.in' contains the following:**

no. of simulations desired

no. of years desired for each simulation

start year

land-cover period code (1-12, see polygon input file)

number of sugarcane land-cover codes (0 if no sugarcane)

land-cover codes for sugarcane (up to 3 codes separated by spaces, use 0 if no sugarcane)

land-cover code for corn (0 if no corn)

land-cover code for water bodies (0 if no water bodies)

land-cover code for reservoirs (0 if no reservoirs)

land-cover code for near-coastal or estuarine water bodies (zero recharge) (0 if none)

land-cover code for taro (0 if no taro)

fraction of taro land cover in production (0-1)

seed value (integer) for random number generator

initial soil-moisture storage (in fraction of capacity, 0-1)

"root depth" to use for unvegetated or fallow areas

storm-drain code (0-storm drains inactive, 1-storm drains active)

paved surface interception capacity (in.)

constant water-body recharge rate (not including reservoirs)(in/yr)

constant reservoir recharge rate (in/yr)

constant taro recharge rate (in/yr)

water-main leakage rate (in/day)

disposal-well discharge rate (Mgal/d)

canopy-interception method (1-3)(see note)

canopy-interception constant A or C (based on canopy-interception method)

canopy-interception constant B or D (based on canopy-interception method)

rainfall data type code (0-monthly time-series grids, 1-polygon-based normals)

number of rainfall grid files\*\*

total number of months represented in the rainfall grid files\*\*

start year of rainfall grids\*\*

monthly rainfall weighting factor code (0-no weighting, 1-weighting)

runoff data type code (0-temporally variable RO:RF ratios, 1-constant RO:RF ratios)\*\*\*

print-out interval for output file hi\_wb4.out (no. polygons)

print-out code for yearly FAO recharge (0-don’t print yearly recharge, 1-print yearly recharge) (maximum 30 years)

name of polygon input file

name of land-cover input file

name of available-water-capacity values by soil code

name of rainfall fragment file

name of monthly:annual pan evaporation ratio file

name of monthly fog:rainfall ratio file

name of irrigation file

**if rainfall data type code is 0, then:**

name of file containing the names of monthly rainfall grid files

**if rainfall data type code is 1, then:**

name of normal monthly rainfall file

name of monthly rainfall coefficient file

**if runoff data type code is 0, then:**

name of file containing the names of variable monthly RO:RF files

**if runoff data type code is 1, then:**

name of constant monthly runoff-to-rainfall ratio file

**if sugarcane is present (number of sugarcane land-cover codes is greater than 0) then:**

name of sugarcane file

**if canopy interception method is 2, then:**

name of modified Gash interception model file

**Note:** canopy-interception methods are as follows:

method 1: linear relation between monthly fog interception (F) and the ratio of net precipitation (NP) and rainfall of the form: NP/RF = A\*F+B, where A and B are constants

method 2: modified Gash model

method 3: event-based relation between rainfall plus fog and ratio of net precipitation to rainfall plus fog of the form: NP/(RF+F) =C\*exp(D/(RF+F)), where C and D are constants

\*\*-Values are not used by program if rainfall data type code is 1

\*\*\*-If temporally variable monthly runoff is selected (0), then the monthly time-series rainfall data type option must also be selected (0), and the variable monthly runoff file structure must match the monthly time-series file structure (same number of files, same number of months per file).

**2. Polygon input file contains the following on each line:**

polygon id no., area (sq. m), rainfall grid cell number, 12 land-cover codes (sequential) for 12 different land-cover scenarios (use zeroes to pad if less than 12 scenarios), runoff zone no. (sequential), soil code no. (sequential), annual pan evaporation (in.), pan-evaporation zone no. (sequential), fog zone no. (sequential), fog elevation zone no. (sequential), rainfall-fragment zone no. (sequential), water-main code (0 or 1), disposal-well code (0 or 1), sewer/cesspool/septic system code (0-sewer,1-cesspool,2-septic system), septic or cesspool leakage rate (in/day), aquifer-system code, plantation code (0-non-sugarcane,1 or higher sequential integer for sugarcane),field no.(0-non-sugarcane, 1 or higher sequential integer for each plantation for sugarcane), fraction of pervious area (0-1),storm-drain code (0-no storm drains,1-storm drains),

**The following 3 parameters should be assigned 0 if canopy-interception method is not 2 (see main input file) or land cover is not forest or shrubland:**

fraction of canopy cover (0-1), fraction of rainfall that passes through canopy and is intercepted by trunk (0-1), ratio of mean rate of canopy evaporation to mean rate of rainfall

**3. Land-cover input file contains the following on each line:**

land-cover code (sequential), root depth (in.), fog-catch efficiency (0-1), irrigation code (0-unirrigated, 1 or higher-irrigated), storm-drain code (0-no drains, 1-drains), canopy-interception capacity (inches)(0, if canopy-interception method is not 2 or land cover is not tree or shrub), trunk-interception capacity (inches)(0, if canopy-interception method is not 2 or land cover is not tree or shrub), depletion fraction for 5 mm/d PE (see FAO 56, table 22), 12 monthly (Jan-Dec) pan coefficients (use zeroes for sugarcane),

pan coefficient 1 for initial growth stage (use 0 for non-sugarcane),

pan coefficient 2 for middle growth stage (use 0 for non-sugarcane),

pan coefficient 3 for ending growth stage (use 0 for non-sugarcane),

pan coefficient 4 for fallow stage (use 0 for non-sugarcane),

no. days in initial growth stage (use 0 for non-sugarcane),

no. days in developmental growth stage (use 0 for non-sugarcane),

no. days in middle growth stage (use 0 for non-sugarcane),

no. days in ending growth stage(use 0 for non-sugarcane),

no. fallow days (use 0 for non-sugarcane)

**Note:** pan coefficients for sugarcane are computed as follows:

stage 1: initial growth, constant pan coeff 1

stage 2: developmental, linearly interpolate pan coeff 1 to 2

stage 3: middle, constant pan coeff 2

stage 4: late growth, linearly interpolate pan coeff 2 to 3

stage 5: fallow, constant pan coeff 4

**Caution:** if table 12 from FAO 56 is used for pan coefficients,

1. make sure to adjust pan coefficients to reflect the possibility

that pan does not equal ETo

2. adjust Kc,ini to reflect wetting frequency (p. 114-121)

3. adjust Kc,mid to local climate conditions (p. 121-124) and

wetting frequency (p. 124)

4. adjust Kc,end to local climate conditions (p. 125-127)

**4. Available-water-capacity file contains the following on each line:**

soil id no. (sequential), component no., fraction of area represented by component (0-1), horizon no., depth for top of horizon (in.), depth for bottom of horizon (in.), available water capacity value, hydrologic soil group (1-4, with A=1,B=2,C=3,D=4)

**5. Daily rainfall fragment file contains the following on each line:**

month (1-12), rainfall zone no., sequential no. of rainfall zone fragment set, 31 daily fragments (pad with dummy ‘9999’ values if less than 31 days in month)

**6. Monthly-to-annual pan evaporation ratio file contains the following on each line:**

pan evaporation zone no. (sequential), 12-monthly (Jan-Dec) monthly-to-annual pan evaporation ratios (0-1)

**7. Monthly fog parameter file contains the following on each line:**

fog zone no. (sequential), fog elevation zone no. (sequential), 12 monthly (Jan-Dec) ratios of fog drip to rainfall

**8. Irrigation file contains the following on each line**

irrigation code no, (sequential), irrigation-estimation type (1-demand,2-supply), monthly irrigation rate (in.) (0-if demand estimation), irrigation-estimation multiplier, irrigation method efficiency (0-1), 31 irrigation application codes for each day of the month (0-no irrigation applied,1-irrigation applied)

**9.** *If rainfall data type code is 0, then include the following file:*

**File with monthly rainfall grid filenames**

filenames of the month-year rainfall grid files, one filename per line (filenames are absolute reference and cannot contain spaces nor be longer than 100 characters)

**10.** *If rainfall data type code is 0, then include the following files:*

**Monthly rainfall data in files that each contain the following on each line (location of the files is specified in #10 above):**

*If all data is included in one file:*

rainfall grid cell no., rainfall for month 1 (in.), rainfall for month 2, ..., rainfall for final month

*If data is in more than one file:*

**For the first monthly rainfall file:**

rainfall grid cell no., rainfall for month 1 (in.), rainfall for month 2, ..., rainfall for month 36

**The second monthly rainfall file continues:**

rainfall grid cell no., rainfall for month 37, rainfall for month 38, ..., rainfall for month 72

**This pattern continues for monthly rainfall files 3 through the final file (specified in the main input file). The final file will have 36 or fewer monthly rainfall values.**

**12.** *If rainfall data type code is 1, then include the following file:*

**Monthly normal rainfall file includes the following on each line:**

polygon id no. (sequential), 12 monthly (Jan-Dec) normal rainfall values (in.)

**13. Monthly rainfall coefficient file contains the following on each line:**

*if rainfall data type code is 0:*

rainfall grid cell no., coefficient for January, coefficient for February,...., coefficient for December

*if rainfall data type code is 1:*

rainfall zone no., year, 12 monthly observed-to-normal ratios (Jan. to Dec.)

**14.** *If runoff data type code is 0, then include the following file:*

**File with variable monthly RO:RF filenames**

filenames of the variable monthly RO:RF files, one filename per line (filenames are absolute reference and cannot contain spaces nor be longer than 100 characters)

**15.** *If runoff data type code is 0, then include the following files:*

**Variable monthly RO:RF ratios in files that each contain the following on each line (location of the files is specified in #10 above):**

*If all data is included in one file:*

rainfall grid cell no., rainfall for month 1 (in.), rainfall for month 2, ..., rainfall for final month

*If data is in more than one file:*

**For the first variable monthly RO:RF file:**

runoff zone no., RO:RF for month 1 , RO:RF for month 2, ..., RO:RF for month 36

The second monthly RO:RF file continues:

runoff zone no., RO:RF for month 37, RO:RF for month 38, ..., RO:RF for month 72

**This pattern continues for monthly RO:RF** **files 3 through the final file. The final file will have 36 or fewer monthly rainfall values. These files must be set up the same as the month-year rainfall files. They must have the same start month, same end month, and same number of files.**

**16.** *If runoff data type code is 1, then include the following file:*

**Constant monthly runoff-rainfall ratio file contains the following on each line:**

runoff zone no. (sequential), 12 monthly (Jan-Dec) runoff-rainfall ratios

**17. Sugarcane file contains the following on each line for each sugarcane land-cover code in the order listed in the main input file (only needed if sugarcane is present)**

length of sugarcane irrigation period (days), length of sugarcane non-irrigation period (days), length of sugarcane fallow period (days), initial day of sugarcane planting for field group 1, initial day of sugarcane planting for field group 2, initial tolerance (allowable error) for selecting 50% of sugarcane-field area

**18. Modifed Gash interception model file contains the following on the top line (only needed if the modified Gash interception model is selected in the main input file)**

method code no. for determining ratio of daily canopy evaporation to interception (1-3), ‘a’ for method 1 and 2, ‘b’ for method 2, ‘c’ for method 2 (in.), ‘d’ for method 2, ‘e’ for method 2 (in.), ‘g’ for method 3 (should be a negative value), daily interception multiplier

**Note:** The ratio of daily canopy evaporation to interception (f) for the modified Gash interception model are computed in the following manner:

method 1: f = a (constant)

method 2: f = a, unless…

for daily rainfall + fog >= b (inches), f = c

for daily rainfall + fog >= d (inches), f = e

method 3: f = exp(g\*(daily rainfall + fog))