Stream and Lake Gaging (Monitoring) Station File (GAGE)

This document combines the input instructions for stream and lake gaging stations, which were previously described by Prudic and others (2004, p. 52 and 53), Niswonger and Prudic (2005, p. 30 and 31), Merritt and Konikow (2000, p. 57), and online at http://water.usgs.gov/nrp/gwsoftware/modflow2000/MFDOC/guide.html.

A particular stream reach or lake can be designated for a gaging or monitoring station. At each designated stream reach or lake, the time, stream or lake stage, streamflow out of the reach or lake volume, and (if solute transport is being simulated) the concentration of a solute after each time step (and each transport time increment) will be written to a separate output file to facilitate model output evaluation and graphical post processing of the calculated data. Several options are available to also print additional information about a stream reach or lake.

The input file for specifying gaging station locations is read if the file type (Ftype) "GAGE" is included in the MODFLOW name file. The output file will contain two header lines that provide relevant information (the text will be contained within quotes).

FOR EACH SIMULATION, IF GAGE PACKAGE IS USED:

1. Data: NUMGAGE

NUMGAGE Total number of stream and lake gaging stations

FOR EACH GAGING STATION:

Data sets 2a and 2b are used to specify information for stream or lake gaging stations, respectively. The total number of lines (records) specified for data sets 2a and 2b must equal NUMGAGE. Records in data sets 2a and 2b can be entered in any arbitrary order, and it is permissible to interleaf records for stream gaging stations with those for lake gaging stations if NUMGAGE > 1.

FOR EACH STREAM GAGING STATION:

2a. Data: GAGESEG GAGERCH UNIT OUTTYPE

GAGESEG An integer value that is the stream segment number where gage is located.

GAGERCH An integer value that is the stream reach number where gage is located.

UNIT An integer value that is the unit number of output file for this gage. A unique unit number must be specified for each gage and the unit numbers must be matched to DATA file types and file names in the MODFLOW name file (see Harbaugh and others, 2000, p. 42-44).

OUTTYPE An integer value that is a flag for type of expanded listing desired in output file:

- 0 Use standard default listing of time, stream stage, outflow, and solute concentration.
- 1 Default values plus depth, width, flow at midpoint, precipitation, evapotranspiration, and runoff. Computed runoff from the UZF Package is added when the UZF Package is active.
- 2 Default values plus streambed conductance for the reach, head difference across streambed, and hydraulic gradient across streambed.
- 3 Default values plus solute load in stream (if GWT is active).
- 4 All of the above.
- 5 Use for diversions to provide a listing of time, stage, flow diverted, maximum assigned diversion rate, flow at end of upstream segment prior to diversion, solute concentration, and solute load.
- 6 Use for unsaturated flow routing to provide a listing of time, stream stage, ground-water head beneath stream, streambed seepage, change in unsaturated zone storage, and recharge to ground water.
- 7 Use for unsaturated flow routing to provide a listing of time and the unsaturated water content profile beneath the stream. Two profiles are printed. The first is the volume averaged water content of all unsaturated zone cells (multiple unsaturated zone cells are allowed) beneath a stream reach. The second profile is the volume averaged water content beneath the low flow channel only. The two profiles are identical when only one unsaturated zone cell is assigned beneath a stream reach.

Notes:

Solute load (OUTTYPE options 3, 4, or 5 for a stream gaging station) represents the total mass of solute passing the stream gaging station during a model time unit. Units for solute load depend on the units used for solute concentration, time, and length in the model.

FOR EACH LAKE GAGING STATION:

2b. Data: LAKE UNIT {OUTTYPE}

LAKE A negative integer value that is the lake number where the gage is located.

UNIT An integer value that is the unit number of output file for this gage. A unique unit number must be specified for each gage and the unit numbers

must be matched to DATA file types and file names in the MODFLOW name file (see Harbaugh and others, 2000, p. 42-44). A negative value allows the reading of OUTTYPE.

OUTTYPE An integer value that is a flag for type of expanded listing desired in output file. It is read only when UNIT is a negative value:

0 Standard default listing of time, lake stage, lake volume, and solute concentration.

1 Default values plus all inflows to and outflows from lake (as volumes during time increment), and total lake conductance. Computed runoff from the UZF Package is added whenever the UZF Package is active.

2 Default values plus changes in lake stage, lake volume, and solute concentrations.

3 All of the above.

Notes:

Total lake conductance (OUTTYPE options 1 and 3 for a lake gaging station) is the sum of the conductances of each seepage interface for each lake. Changes in lake stage, volume, and solute concentrations (OUTTYPE options 2 or 3) are listed as incremental changes from previous time increment and as cumulative change since start of simulation.

REFERENCES

Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G., 2000, MODFLOW-2000, The U.S. Geological Survey modular ground-water model—User guide to modularization concepts and the ground-water flow process: U.S. Geological Survey Open-File Report 00-92, 121 p.

Niswonger, R.G., and Prudic, D.E., 2005, Documentation of the Streamflow-Routing (SFR2) Package to include unsaturated flow beneath streams—a modification to SFR1: U.S. Geological Survey Techniques and Methods Book 6, Chap. A13, 57 p.

Merritt, M.L., and Konikow, L.F., 2000, Documentation of a computer program to simulate lake-aquifer interaction using the MODFLOW ground-water flow model and the MOC3D solute-transport model: U.S. Geological Survey Water-Resources Investigations Report 00-4167, 146 p.

Prudic, D.E., Konikow, L.F., and Banta, E.R., 2004, A new Streamflow-Routing (SFR1) Package to simulate stream-aquifer interaction with MODFLOW-2000: U.S. Geological Survey Open-File Report 2004-1042, 95 p.