

State of Oregon
Department of Environmental Quality

Memorandum

To: File **Date:** April 22, 2008

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Subject: What's new in Heat Source Version 8

The purpose of this memo is to briefly document the updates in Heat Source version 8 from the previous version. The major difference is that the model code is now written in Python 2.5 and C rather than Visual Basic. This change was made for two reasons: 1) to dramatically decrease model run times and 2) prepare for the potential integration of Heat Source and GIS applications. For now the user interface still remains in Excel. The model mathematics for heat and mass transfer are the same as in Heat Source model version 7 with a few minor exceptions. Those exceptions plus general updates to the model are noted below. Users may still refer to the Heat Source version 7 user manual as a reference for the model methodology. Model setup and operation have somewhat changed from the previous version and an update to those portions of the manual will occur as time allows.

Changes:

1. Model code was ported from VBA to python2.5 and C.
2. General updates to the user interface.
3. Model output is now stored in text files rather than in Excel worksheets. This requires the user to designate an output path on the model setup worksheet.
4. The model run period can differ from the period for which data is entered.
5. There is no restriction on the number of days that can be modeled.
6. Model has been updated for use in any global time zone. Time zone is defined by an offset from UTC rather than a specific time zone. User needs to be aware of daylight savings. Model does NOT make any adjustments for daylight savings.
7. Bottom width is required rather than bankfull width. Users may crosswalk bankfull width to bottom width using a separate macro that utilizes the methodology from version 7 (i.e. width to depth ratio and channel angle z).
8. Parameters governing the exchange of heat between the water and sediment are now

specified by the user and can vary longitudinally. This includes sediment thermal conductivity, sediment thermal diffusivity, sediment thickness and percent hyporheic exchange. The previous methodology is outlined in the version 7 manual and relied on horizontal bed conductivity, bed particle size and embeddedness to calculate these parameters. As a reference, typical values in Heat source 7 were 13.0 W/m/°C for sediment thermal conductivity, 0.0327 cm²/sec for the sediment thermal diffusivity, 26.9% for porosity, and 0.2 – 0.75 m for the sediment thickness. Hyporheic flow was variable and reported in hydraulic output sheet.

9. Cloudiness can now vary spatially.
10. Each model reach now is assigned the meteorology data for the closest continuous node location (by river km) rather than to the upstream one as in version 7.
11. Boundary conditions, meteorology, and input tributary data are linearly interpolated between times steps. For this to work properly an additional hour of data is required at the end of the last time step on the last model day.
12. Version 8 requires the installation of python 2.5.2 or greater, python Win32com, and the Heat Source executable. These executables are bundled with the Heat Source version 8 download and must be installed before running the model. Python pysco 1.63 (which is also included in the download) is an optional installation and is not required to run Heat Source version 8. We recommend that python pysco be installed because it optimizes the code and improves model run times. All of these executables may be downloaded (for free) from the internet from their respective websites.

<http://www.python.org>

<https://sourceforge.net/projects/pywin32/>

<http://psyco.sourceforge.net/>

Installation instructions:

1. Open the folder “install_executables”.
2. Double click on “python-2.5.2.msi” and follow installation instructions.
3. Double click on “pywin32-210.win32-py2.5.exe” and follow installation instructions.
4. Optional: Double click on “psyco-1.6.win32-py25.exe “ and follow installation instructions.
5. Double click on “heatsource-8.0.0-RC1.win32.exe” and follow installation instructions.
6. Run the model and input data from within the excel spreadsheet. We have provided an example model for reference.