Hydrolight-Ecolight Technical Report

Sergi Pons Freixes
Contact: spons@utm.csic.es
Author information: http://www.cub3.net

Marine Technology Unit (UTM-CSIC)

April 8, 2010

Contents

1 Install

Hydrolight-Ecolight (refered as HE from now) can work without authenticating any license, but the compiler it uses (Lahey/Fujitsu Fortran 95) doesn't. The compiler must be activated via Internet connection. If the compiler has not been activated, it will work in trial mode for 30 days. If a new license is needed, it can be asked by e-mail at http://www.lahey.com, justifying the cause (the old installation has been lost due to hard disk format, hardware changes, etc.).

After installing, it is recommended to apply the last updates, which can be found on the HE mailing list (see page 5). The updates are not incremental, so only the last one needs to be applied. At the moment of redaction of this document, the last version was 5.1, which can be installed as follows:

- Download file Upgrades.piz and place in your HE5 directory. Rename to Upgrades.zip and unzip. This will create a directory HE5\Updates.
- Run HE5\Updates\installVer510.bat to install the upgrade.

- Files HE5\Updates\Readme.txt and HE5\Updates\Rev510\Rev510_readme.txt have further information about this upgrade.

1.1 Windows 7

Comment of Curtis Mobley on the mailing list regarding Windows 7:

> If you have too old a version of the Lahey compiler, it will not install on W7 (I know that Lahey v 5.6 will NOT work on W7, but I do not know where the cutoff is). If your copy of Lahey does not install on W7, you will need to upgrade to the current LF95 Express version 7.2, which does work OK. Note also that recent versions of Lahey can be installed only twice. If you're upgrading to a new computer, you may need to have Lahey approve another installation on the new computer. Contact www.lahey.com for questions and upgrades.
>
> Once you have a version of Lahey running on W7, HE5 seems to install and run OK. Running

2 Linux Port

2.1 HE 5.X

Both the compiler and HE (including GUI and the main code (runEL.exe and runHL.exe)) can be installed and run using wine with no problem.

2.2 HL 4.2

Extracted from the mailing list:

> Are you sure you don't want to run HL through wine in Linux and avoid compiling? It's very easy. First install wine.
>
> Then using the GUI, in windows, create your HL run (let's name it `ac9_013`).
>
> Then, in Linux, open a shell prompt and type:
> `cd /h42/maincode wine maincode.exe < ../run/batch/Iac9_013.txt`
>
> If you don't have the new Linux drivers that allow read/write to a windows NTFS partition, you might have to install HL on a FAT32 partition so that Linux can write to it.
>
> If you really want to compile the code, here is how I did...
>
> As I told you, I used Intel Fortran compiler under Linux, which is a commercial software. You might want to try out other compilers. I'd be interested in knowing the results.
>
> In IOshorten.f90, comment out all the windows module declarations and calls to the function `GetShortPathName`
>
> In IOshorten.f90 (near line 47), modify the open statement
> `IF(lreturn.gt.0) then open(iounit, file=shortfn, status='old', ACTION='read')`

to read
`IF(1) then open(iounit, file=longfn, status='old', ACTION='read')`

Rename the file Dimens.inc to DIMENS.INC

Remove the last lines of SLAcom.f BLAS.f

Modify Initial.f line 693 for
```
write(10,fmt="(//' ERROR:',/' depths are not monotonically
increasing, or are too close together (deltazK =',f6.4,')',)")
deltazK
```
to read
```
write(10,fmt="(//' ERROR:',/' depths are not monotonically
increasing, or are too close together (deltazK =',f6.4,')')")
deltazK
```

Modify irradat.f line 13 for
`INCLUDE 'dimens.inc'`
to read
`INCLUDE 'DIMENS.INC'`

Modify setdflts.f around lines 64-68 comment lines 64-65 to read
```
c sl='\ '
c sysl=sl(1:1)
```
and comment-out lines 67-68 to read
```
bsl='/ '
sysl=bsl(1:1)
```

In gcirrad.f, main.f and setdflts.f: replace all occurrences of
`character*24 gcifile`
to
`character*30 gcifile`

Run the GUI to create a specific HL run (for example, let's name this run ac9_St_013). The GUI will create the file batch/ac9_St_013.for

To compile hydrolight:
`cd maincode ifort -c *.f` (this will create all the object files)
`ifort batch/ac9_St_013.for *.o -I. -o hdrl_exec_ac9` (this will compile the hdrl_exec_ac9.for file that was created by the GUI for your specific HL run and link it into the executable file called hdrl_exec_ac9).

To run HL, type in the shell prompt:
`hdrl_exec_ac9 < ../run/batch/Iac9_St_013.txt`

3 How to run a batch of several simulations at once

There are several ways to do this:

- The easiest but most time-consuming way is to pass through the UI (which you can do just by hitting return to go quickly from one form to the other) and just change whatever is needed from one run to the next, and "stack up" multiple input files, which are then made as one run.

- After defining and making the first run, you can use the `Change Input File` button on the last UI form to view the input for the run. You can then change the input there, save the change, and make another run, and repeat that process. Doing that does require that you understand the *exact* format of the various inputs, which are described in the Tech Doc Appendix A (and which have small but important changes for v 5.1 vs. 5.0).

- You can use the python library HydroLighTER to "mass produce" input files (the Iroot.txt files) with the values you want, and then place those in the HE5\run\batch directory, with the file names listed in the HE5\run\runlist.txt file, and the do the run "manually" from a DOS window (see the Tech Doc section 9.3). As in the previous method, you need to understand the format of the Iroot.txt input files.

- You can reprogram the source code main program to, for example, add a do loop that reads a data file of your concentrations and loop over multiple solutions of the RTE, but using a difference concentration for each solution. That is probably the hardest way, since it requires you to figure out the HE5 internal code.

4 Parallelizing HE

Extracted from the mailing list, about parallelizing HE:

> I had run the previous version of Hydrolight on a serial computer with about 800 processors. We had the challenge of performing thousands of short simulations (each taking about a minute to execute). There was no parralelization, though.
>
> We simply compiled the HL code to run it under Linux. We did not modify the code. Every simulation was being separately assigned to a different processor. There was a homemade batch queuing software that was taking care of an optimal assignment of executions to different processors.

5 Troubleshooting

Problem: No output files are generated, or only one file is generated.

Cause: The third line of the iroot files, defined as record 3 on the Technical Documentation, is used as the filename of the output files. Therefore, if all the iroot files of a batch have the same content in this line, HE will overwrite the output for each simulation.

Solution: Modify record 3 for each file. HydroLighTER has a function which replaces this line which the own filename, automatizing the task.

Problem: Simulation is not run, it complains about the number of wavelengths or depths being too high.

Cause: A hard-coded limitation

Solution: Modify dimens.inc file. Variable `wvmax` must be >= to the number of wavelengths, and variable `zmax` must be >= to twice the number of depths.

Problem: Error raised, output files partially empty, and the output filenames are not complete.

Cause: A hard-coded limitation.

Solution: Modify a variable which limits the length of filenames. In HE5/Code/common/initial.f, line 32, reads:
`character rootname*32, sl*2, bsl*2`
Change the 32 for the desired value. Be careful and do not put a extremely large number, as other variables depend on this value and can lead to unexpected behaviour. [1]

Problem: In the output, some very small values are incorrect: instead of `X.XXXXE-100` they read `X.XXXX-100`. In addition to that there are some strange outliers (spikes).

Cause: It is a numerical artifact of there simply being no light left (your simulation is too turbid). You are well beyond the numerical accuracy requirements of the ODE solver. Also, small errors in the nearly zero Ed will be amplified when you look at it's slope (Kd). Long before you've reached a depth with 1E-100 of light, you have passed beyond what is biologically or physically meaningful.

Solution: It depends on what are you trying to simulate. For example, round all the small values to 0 for Ed, and recalculate Kd using HydroLighTER.

6 References

- Homepage: `http://www.sequoiasci.com/products/Hydrolight.aspx`
- Mailing List: `http://tech.groups.yahoo.com/group/HydroLightUsers/`
- User's Guide: `http://www.sequoiasci.com/downloads/HE5UsersGuide.pdf`
- Technical Documentation: `http://www.sequoiasci.com/downloads/HE5TechDoc.pdf`

[1] The source code files (*.f, *.for) can be overwritten by updates, so you may need to apply the patches described again.