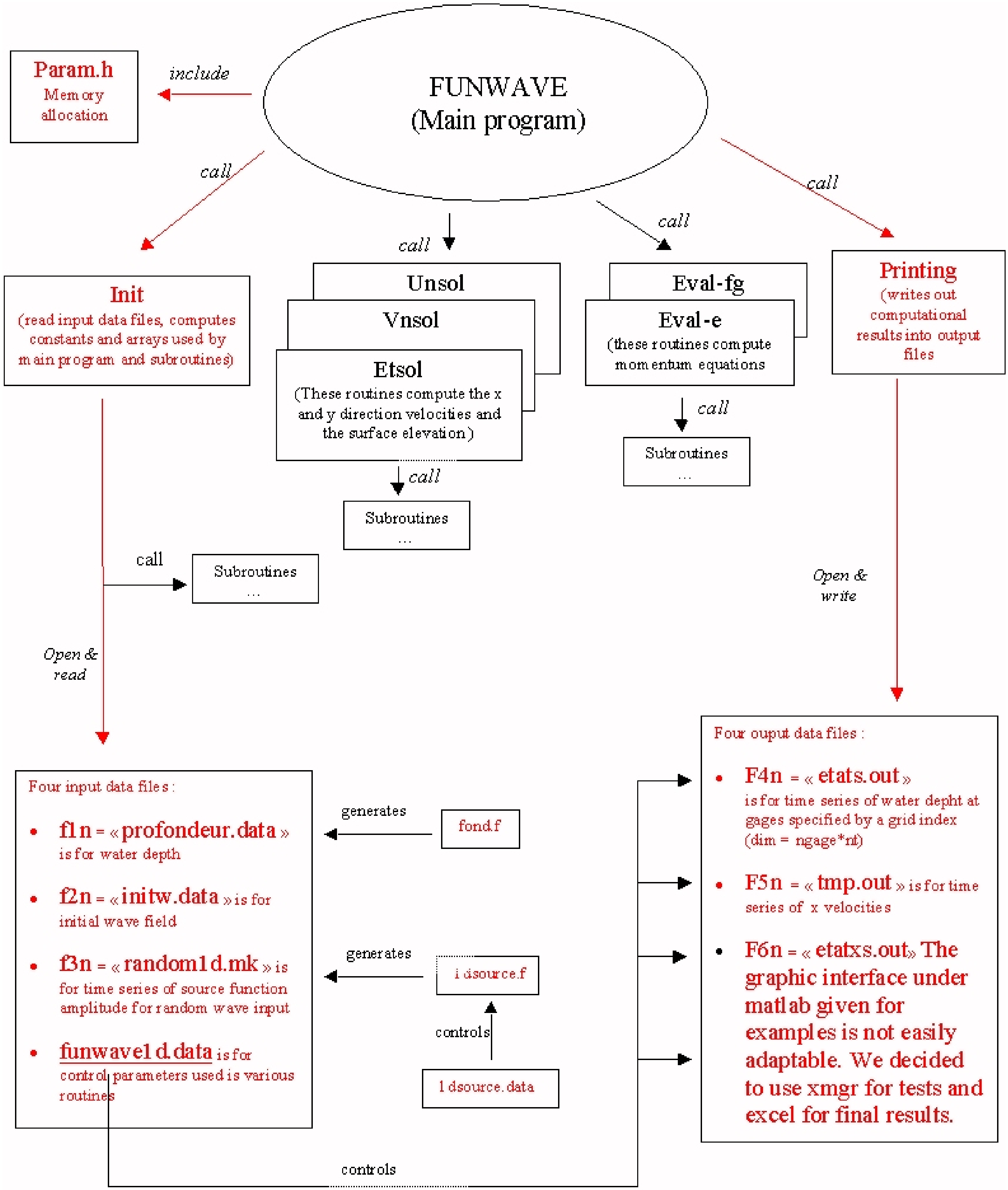
Running simulations with Funwave
(a step by step method)

Here is presented a procedure to run FUNWAVE with your own input datas. Each step is completed by a concrete case chosen by our binom (see example).

I. A look on the software organisation : focus on files that have to be modified for running your simulations

Funwave does not have any graphical interface for input datas. The user has to find the useful files to enter his datas but also to visualize his results. These files are quite the only to be modified. In the following scheme, they are colored in red.



Scheme.1 : a basic software organigram

II. How to run your own simulations :

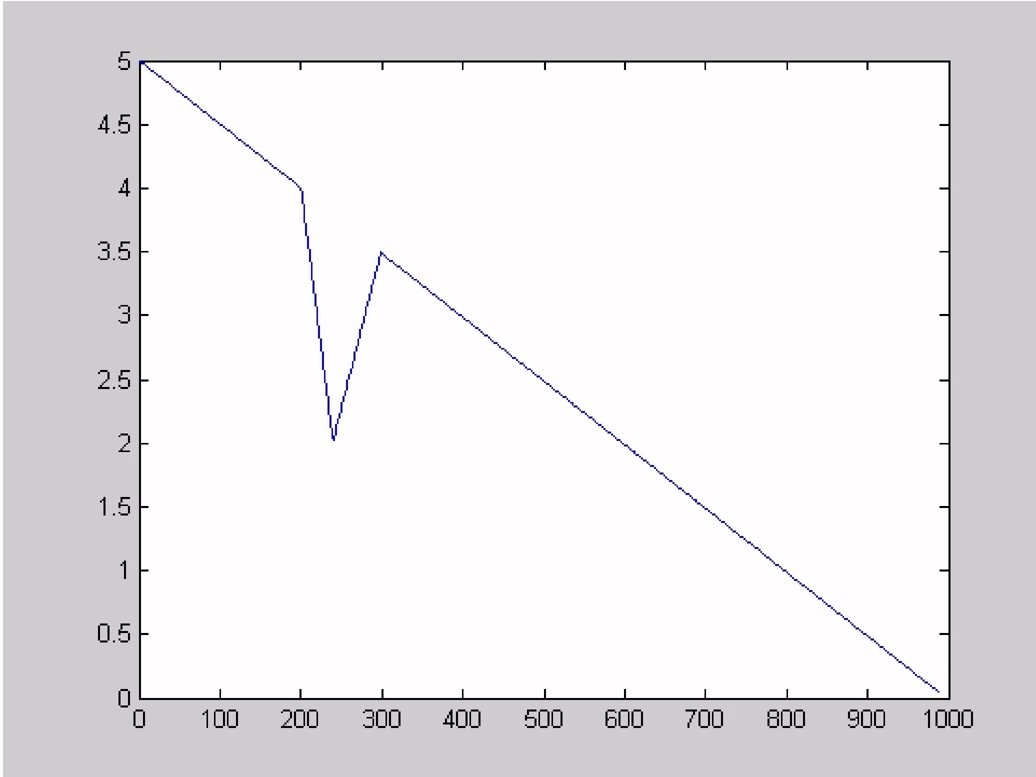
Advice : In order to get clear with your own data, copy the already existing EXAMPLE4.1 as a new directory. You can then keep the all useful files and entering your own parameters.

1) Fill your input files step by step

- **Create and enter your bathymetry** : as shown in scheme.1, ***Init*** opens and reads the water depth file ***profondeur.data (f1n)***.Originally, a Fortran program reads the some of the control parameter file ***funwave1d.data***. It then generates one of the four examples depth grid. However you can create your own profile with a Fortran or Matlab program. After writing it, make sure that it is writed in ***profondeur.data (f1n)***

  ! *Caution* : Make sure that the memory allocation is then enough. For this, go to ***param.h*** and check that *iq* is greater than the number of points (mx) you generated with your program. Moreover, be careful that *mx* in ***funwave1d.data***is now really equal to the number of points generated.

  Example : writing a simple Matlab program ***fond.m****, an artificial reef was generated (see graph.1). This profile created a 990 points grid. It was then necessary to increase the iq value (70 000) in* ***param.h*** *and precise mx (990) in* ***funwave1d.data****.*



Graph.1 : depth profile genrated by ***fond.m***. *As expected by the program, the water depth is positive defined*

- **Enter the initial water depth and velocity components values :** these input datas are contained in ***initw.data (f2n)***. The Fortran program ***initw.f*** allows to generate these values. By default they are all equal to zero.

  Caution, example variables were set zero. However it was necesary to adapt initw.data to the new number of points generated in ***profondeur.data*** *(990). In order to get at least mx points quickly, following commands were done with Unix:*

  - nota: initw.data cointained initially W lines of zeros, instead of the X required. Let's modified its size:

  - cat initw.data > new.data create a new file similar to initw.data

  - cat new.data >> new.data doubles the size of new data (command repeated to get 2084 points >> mx = 990)

  - kill initw.data and "recall" new.data initw.data

  A suficient size file was then created for our initial values.

- **Generate and enter the time series of source function amplitude:** here you can choose to enter a spectrum (imeth=1) or to enter an time series of measured water depth (imeth=2). In both case these input datas are contained in ***random1d.mk (f3n)***. The Fortran program ***1dsource.f*** allows to generate these values. Moreover a separate input data file ***1dsource .data*** is required to run ***1dsource.f***.

  Example : in ***1dsource .data****, we specify*

  in $data0

  imeth = 1 to select the generate the source function time series by entering an input spectrum of the water depth

  in $data1

f1 = 5 and f2n = 5 are respectively our lowest and higest freqsuency components to be used in the spectrum

nf = 1 is the number of frequency components between f1 and f2n

e.g. we choose to generate monochromatic wave in order to simplify our study

Nota : 1dsource.data is shown as it can be found in the software. If imeth = 2 would have been chosen, an input time series of measured water deepth would have been required. In this case, control parameters which have to be specified in $data2 are explained.

- **Fill the other general parameters :** ***funwave1d.data*** contains control parameters which are used through the program. Some of them are used by the input files mentioned above and have to be carefully filled, see the following example. Other will be used for the output files (see paragrph 2)) and lasts would be required for a more advanced used of the software.

  Example : control parameters that have to be modified in ***funwave1d.data*** according to our input files :

  a0 = 1.5 is the input wave amplitudes in metre

  h0 = 5 is the constant water depth in meters over the wave generation

  tpd = 9 is the wave period for chronomatic waves

  dx = 0.00001 is the space discretization in meters for the x direction (ours is obviously very small but necessary according to the problems coped encountered)

  mx = 990 number of grid point in the x direction

  nt = 40 000 number of time step to the program to run

  f1n, f2n, f3n check that these input files are corectly refered (***profondeur.data, initw.data, r2d470.dat)***

  cbrk = 1.2 is a typical value for wave breaking inequations

  cb_bt = 0 bottom friction

2) Control the different kinds of result storages thanks with the input file funwave1d.data

Indeed, some paramaters located in ***funwave1d.data*** allow the user to control the **time steps for the spatial profiles**, or the **gage location for the time series**. There are finally four output files which can be controlled.

- **What king of datas can I register? In which files are they located? How can I can control them?**

Type of datas	File names	Parameters in ***funwave1d.data*** allowing to control this file
time series of the water depth elevation for specified gages	f4n = **etats.out**	in $data2 : **ngage** specifies the gage number and **ixg** their locations
time series of x direction velocity	f5n = **temp.out**	
spatial profile of the water depth at 6 time steps specified	f6n = **etaxs.out**	in $data2 : **itg** (6 values) specifies the time steps where spatial profiles are stored
spatial profile for a specified interval time	f7n = **etaxt.out**	in $data1 : **itbgn**, **itend**, **itdel** specify the beginning, ending and interval numbers of time step

Example : all the paramaters mentionned above were modified. funwave1d.data allows to have a look on this input file as it can be found in the software. Notice that parameters mentionned in the paragraph 1) have been filled. Resting parameters were set at their first values.

3) Run the program

*Before running the program, being located in FUNWAVE1D, **compile** all the Fortan files. You have to be sured that FUNWAVE will use your new directory datas : **enter into the directory you created** and run the program by using the command*
../initw
../1dsource
../funwave

4) How to visualize the results

The matlab output interface proposed in funwave was not so easy to use. We chose the **xmgr** plotting software to view the output files. Final results are presented with Excel.