2.10 Tutorial 8. Sand trap with experimental data (SSIIM 2)

This tutorial is based on the data from the laboratory experiment by Olsen and Skoglund (1994). The study modelled a laboratory sand trap where water velocities and sediment concentrations were measured. The geometry and measured data are taken from the web page: http://folk.ntnu.no/nilsol/cases/doris. (Doris is the name of the flume)

Step 1: Grid

To save download time, the *unstruc* file is not given on the web page. Instead, a *koosurf* file is given. The *unstruc* file is generated in the first step using the *koosurf* file. This can be done from the *GridEditor*, or it can be done automatically by modifying the *control* file. The *F 2* data set in the *control* file must then be: *F 2 YH test*. The *Y* letter invoke functions that read the *koosurf* file first, and then make the 3D grid. The *H* letter will invoke a function writing the *unstruc* file. Or the *control.g2* file from the web site can be used and renamed *control* without extension. After the *unstruc* file is made, *SSIIM 2* must be terminated before next step. Note that a *SSIIM 2* version made after June 2015 must be used for this step.

S**tep 2: Water velocities**

The next step is to compute the water velocities. Before this is done, the discharges need to be specified. This can be done in the DischargeEditor, or alternatively, by using the *F 314* and *F 237* data sets, as given in the control file from the web site. Edit the *control* file and replace the *YH* on the *F 2* data set with *UW*. Or use the *control.u2* file from the web site, renamed without extension. Then restart the program and wait until it converges. The measured water velocities are given in the *verify.u* file. This file was used in *SSIIM 1* to compare measured and computed values directly in the *SSIIM 1* graphics. It is actually better to use a spreadsheet for this comparision - the graphics will be better, with scales, legends etc. The *verify* file gives the velocities at profiles specified with (x,y) coordinates. This is the same coordinate system as used for making the grid. Comparing the computed and measured results, it is necessary to produce profiles of computed velocities at the same location as the measurements. This is done with the *interpol* file. A file called *interpol.u* is given on the web page. This can be downloaded and put in the working directory. It also has to be renamed *interpol*, without an extension. Then, the *control* file has to contain the data set *F 48 2*. When this data set and the *interpol* file is used and *SSIIM 2* writes the results, *SSIIM 2* will also produce a file called *interres*. This contains the computed velocity profiles at the locations from the *interpol* file. Which is the same as the measured profiles. The data from the *interres* file and the *verify.u* file can then be taken into a spreadsheet and compared.

Step 3: Sediment concentrations

The third step is to compute the sediment concentrations. To do this, the *control* file has to be modified, or the *control.s2* file used. Add *F 37 2*, *F 33 10.0 10* and *F 68 2*. The *F 68 2* data set will invoke a computation where the water velocities are not recomputed for each time step, only the sediment concentrations. This will save comptuational time and not deteriorate the results as the bed elevation changes were very small. Also, replace *UW* on the *F 2* data set with *F 2 URSM*. The *M* invokes a function writing a new *interres* file. Also, change the *F 48* data set to *F 48 6* instead of *2*, which will produce concentrations instead of velocities. This time, we will use the *intepol.c* file, which can be downloaded and renamed *interpol*. Also, add an *F 1 D*

data set in the *control* file. This will write the sediment fluxes to the *boogie* file, enabling computation of the trap efficiency for the sand trap. The first parameter on the *K 1* data set can be reduced to 100, to save computational time. This means only 100 time steps are used. A transient computation of the sediment concentration is done here, but over a long time so that a steady state is produced at the end of the computation. Also, the *timei* file from the web site has to be used.

Using the data for other CFD programs

If you want to compute the water flow and sediment concentration using another CFD program, it is possible to use the data from the current case. Most CFD programs will use a rectangular grid block which is modified using an STL file. The STL file of the current geometry can be written from *SSIIM 2* and imported into the other CFD program.