XBeach Course

1 November 2016
Delft, The Netherlands

1 GETTING STARTED

The course materials contain the XBeach executable, model examples and Deltares software (Quickplot, XBeach and Delft Dashboard) that will help us to analyze and modify model (results).

2 HANDS-ON EXERCISE: Lovas 2000, flume (2 hours)

Løvås [2000] and Løvås and Tørum [2001] studied the effect of kelp vegetation on wave propagation, run-up and dune erosion using flume experiments with waves propagating over artificial kelp (L. hyperborea) vegetation. The experiments were carried out in a 40-m-long wave flume at SINTEF, Norway. A sandy cross-shore profile was applied with a surf zone slope of 1/30, and several runs were carried out with and without vegetation (Figure 1).

The fully submerged model vegetation had an effective height of about 0.09 m and was placed at about 0.3 to 0.5 m water depth. The number of plants per unit area was N_v = 1200 units/m2. The test program included random wave simulations with two peak wave periods (2.5 and 3.5 s) and two wave heights.
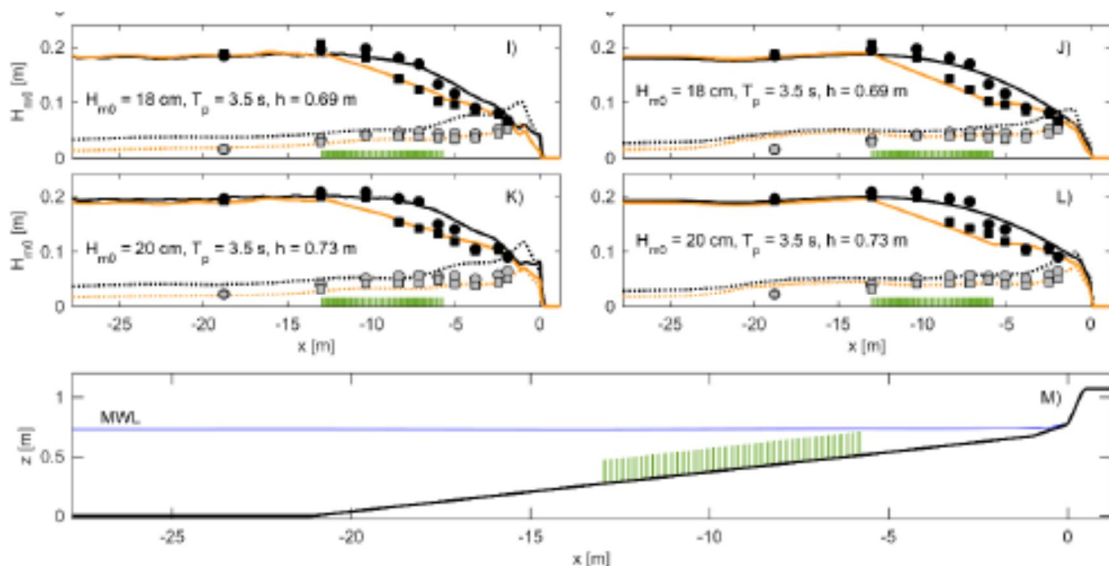

Figure 1. Setup of the flume of Lovas (2000) and some results.
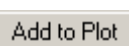
2.1 First, you are going to look at simulation setup files:
1. Go to the folder: \vegetation_day\hands-on\lovas_2000\clean\surfbeat\
2. Open *params.txt* in which you specify model input files and settings for XBeach. Check the number of grid-points in x-direction (nx) and initial/boundary conditions (i.e. still water level and waves).
   How is the flume schematized?
   Is there already vegetation implemented in this XBeach model?

3. Open *jonswap.txt* in which you specify wave boundary conditions.
   What waves are specified here?
4. Open *bed.dep* and *x.grd*.
   What is the grid cell size and what is the depth of the flume? Does this match the setup in Figure 1?
5. Open kelpbed.txt and kelp025.txt.
   Where do we find vegetation, and what does it look like?
   How would you implement other vegetation types (e.g. mangroves) and spatial variation in vegetation types?

2.2 Secondly, you are going to run this setup using the surfbeat and nonh versions, with and without vegetation:

All simulations that you will run have been pre-run already to save you from waiting. You will find the results in …\vegetation_day\hands-on\lovas_2000\run\.
1. Copy the folder ..\lovas_2000\clean\surfbeat\ to e.g. ..\lovas_2000\simulations\surfbeat
2. Add _run_King_XB_model.bat to this folder (from folder ..\software\XBeach\)
3. Run XBeach by starting this batch file.
4. Repeat steps 1-3 for the ..\lovas_2000\clean\nonh\ folder
5. Inspect the 'surfbeat' results using Quickplot: Plot bed level, water level and wave height in one plot see Chapter 3 on how to use Quickplot). For the mean wave height over the simulation period, select 'Hrms wave height based on instantaneous wave energy – meantime: rms'. *What do you see?*
6. Add the velocities and dissipation to your plot and save the plot as a figure so you can use it to compare to other results.
7. Remove the vegetation from the model by setting vegetation=0 in params.txt before you start the model. Repeat steps 1-2 for the surfbeat version and do the same for the nonh version.
8. While the simulations without vegetation are running, start plotting the results of the nonh simulation with vegetation (step 5 and 6).
   What do you see? What are the differences compared to the surfbeat mode?
9. To better understand the differences, make a movie of both the surfbeat and nonh[1] results (steps 4 and 5 in Chapter 3).
10. By now, your simulations without vegetation have been finished too. Make plots and movies.
    What are the key differences in water level and wave height between nonh and surfbeat and with/without vegetation?

2.3 Thirdly, you are going to make some changes to the model input for a joint sensitivity study:

Group A: Vary vegetation properties
Group B: Vary still water level and wave conditions
Group C: Vary the bed level.
The exact settings will be discussed with the full group and results will be evaluated jointly.

If you want to see where you have which type of vegetation, add 'vegtype' to the list of variables to be stored in params.txt. Do not forget to change nvar accordingly.

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[1] For a nonh simulation you cannot simply plot the wave height. To obtain the wave height from a nonh simulation you should do a Fourier analysis, however a proxy of the Hrms is 8 times abs(zs_var).

3 How to use Quickplot for graphs and movies

1. You can start quickplot via the Delft3D menu, (Utilities → Quickplot)

2. Click ![icon] to open a file.

3. Choose Files Type 'NetCDF and GRIB Files' and open 'xboutput.nc'. Select 'Hrms wave height based on instantaneous energy' as the data-field to plot. Select the proper location (M corresponds to cross-shore locations and N to longshore locations) or station you want to investigate and press Quick View . If you want to make plots together and compare, you can choose a different colour by Colour ![blue], and then click Add to Plot . Use ⊕ ⊖ icons to zoom in/out. Drag ![slider] or click ![icon] on the toolbar to view different time steps.

4. To make animations of multiple variables instantaneously, variables need to be linked in time (space is another option). You can do this by pressing ![v] and then select:
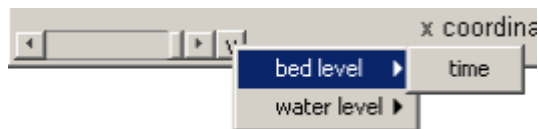
5. In the Quickplot figure click ![icon] to make animations. Select 'avi' files in the output window to generate your own avi files.