

# 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: TILLINGHAM, UK

**Inundation at Tillingham, UK (1D XBeach and 2D LISFLOOD):** This case concerns overtopping of a dike and inundation of the hinterland at Tillingham during a (fictive) extreme event. You can work on the following assignments.

### 2.1 First, you are going to look at simulation setup files and results created on forehand:

1. Go to the folder: `\vegetation_day\hands-on\tillingham\clean\xbeach_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 boundary conditions (i.e. tide and waves). Do this for all the transect models. Is there already vegetation implemented in these XBeach models?
3. Go to the folder: `\vegetation_day\hands-on\tillingham\clean\LISFLOOD\`
4. Open *tillingham\_par.txt* in which you specify model input files and settings for LISFLOOD. What Manning coefficient is used in this simulation? Is there infiltration in de model and what is the effect do you think?
5. Open de DTM (Digital Terrain Model; *DTM\_Tillingham\_10x10m.asc*) with Quickplot. How high is the dike that protects Tillingham from the sea?
6. Go to the folder: `vegetation_day\hands-on\tillingham\run\SSL_40_veggie_NO\XBeach`. Inspect the model results of transect 1 and make an animation of the short wave height and the water levels.
7. Go to the folder: `vegetation_day\hands-on\tillingham\run\SSL_40_veggie_YES\XBeach`. Make a similar figures / animation as previous step. In which simulations were the waves and water levels higher? Will this result in more or less overtopping? Check this by plotting the mean discharge over the dike for both simulations.
8. Go to the folder: `vegetation_day\hands-on\tillingham\run\SSL_40_veggie_YES\LISFLOOD`. Open `\results\res.max` with Quickplot. Where does the most inundation occur? Make a similar plot for the LISFLOOD simulation without vegetation.
9. The `res.mass` provides an overview of how much water flows in the LISFLOOD model. What is the decrease in area inundated compared for a simulation with and without vegetation?

### 2.2 Secondly, you are now going to create the vegetation files for XBeach and nest XBeach in LISFLOOD yourself with the help of Delft Dashboard (DDB):

1. Copy the files from `vegetation_day\hands-on\tillingham\clean\` to a new directory called `d:\simulations\vegetation\setup_v001\`.
2. Open Matlab, go to the folder with the OpenEarthTools, and load these tools by typing in `oetsettings.mat`. Once the OpenEarthTools are loaded, type in `'ddb'`. This will launch the start-up screen of Delft Dashboard.
3. Click on 'Coordinate System' and select WGS84 - UTM 31N

4. Click on 'Model' and select XBeach
5. Click on 'File' and select 'open transects'. Browse to the folder where you have your XBeach model setup saved (step1). Note: When you select transect\_001 DDB will automatically find the other transect models.
6. Click on 'View' and select 'Aerial' to see Tillingham using Bing Maps
7. Click on 'Toolbox', select 'XBeach Vegetation Toolbox'.
8. Click on 'Draw Polygon', name your vegetation 'marshes' and draw a polygon where you think based on the aerial view where vegetation is located. Give the vegetation a value of  $ah = 0.4$ ,  $Cd = 0.15$ ;  $bv = 0.004$  and  $N = 1000$ .
9. Click on 'Create' to generate the necessary XBeach vegetation files in the directories of your model setup.
10. For nesting your XBeach setup with LISFLOOD we are going to use the 'Advanced Nesting Toolbox' in DDB. This toolbox needs a XML-file describing the structure of the nesting procedure. Minimize DDB and go to your newly created directory with all the files (e.g. `d:\simulations\vegetation\setup_v001\`) and open `models.xml` with notepad. Change the path of the XBeach and LISFLOOD model with the new path (e.g for XBeach: `d:\simulations\vegetation\setup_v001\XBeach`)
11. Maximize DDB, click on 'Toolbox', and select 'Advanced Nesting Toolbox'.
12. Click on Step 1: load XML, and load `models.xml`.
13. Click on Step 2: Visualize models and inspect the XBeach transect models and LISFLOOD (In older matlab versions the default renderer might give strange figures. Solve this by typing `'set(gcf, 'renderer', 'zbuffer')` in the Matlab command window.)
14. Click on Options in the Tree Structure tab, define the location of LISFLOOD (e.g. `d:\software\LISFLOOD\lisflood.exe`) and change the time step of nesting (e.g. 600 seconds).
15. Click on Step 3: make observations to set the requested output for XBeach in the `params.txt` of the individual models.
16. Click on Step 4 to run the batch script which includes running XBeach, nesting the result in LISFLOOD and running LISFLOOD. A window will pop up to ask you for a location of your model simulation: create a new folder where you want your simulation and results to be stored, e.g. `..\vegetation\run_v001`.
17. Use Quickplot to visualise the results (select 'All files' to see all extensions).

### 2.3 Thirdly, you are going to use a LAI map as input for the vegetation in XBeach. This can be done via DDB too:

1. Click on 'Toolbox', select 'XBeach Vegetation Toolbox' and click on LAI
2. First define the map by clicking on 'Define map' by going to: `...\vegetation_day\hands-on\tillingham\data\LAI\UKT_20151229_SSMarsh_LAI_UTM31N.tif`.
3. To see the map, click on 'Preview Map'. Where is the most vegetation in Tillingham?
4. To apply the map first click on 'Use Map'. This will calculate an average LAI per XBeach grid cell. Secondly click on 'Create Map' to create the input files for XBeach. Use the same vegetation height (0.4 m) as before.




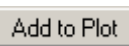





*What are the differences in comparison to the yes/no vegetation map?*

You now know how to carry out the basic steps to assess nature-based flood defences. Fourthly you can start analysing the impact of vegetation in more detail. You can do the following things:


- A. Boundary conditions: as a result of SLR water levels are increasing. What is the impact of rising water levels on the (% decrease in) overtopping volume for simulations with and without vegetation?

- B. Vegetation height: an advance of vegetation is that it can grow with SLR. What is the impact of different vegetation heights on the (% decrease in) overtopping volume for simulations with and without vegetation?
- C. Vegetation location: the marsh at Tillingham is eroding. What is the impact if part of the marsh erodes on the (% decrease in) overtopping volume for simulations with and without vegetation?
- D. Marsh seasonality: In the same folder as the LAI map you already used, there is also a LAI map for summer conditions. What is the difference between seasons?

## 3 How to use Quickplot for graphs and movies

1. You can start quickplot via the Delft3D menu, (Utilities → Quickplot)
2. Click  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 . If you want to make plots together and compare, you can choose a different colour by , and then click . Use   icons to zoom in/out. Drag  or click  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  and then select:



5. In the Quickplot figure click  to make animations. Select 'avi' files in the output window to generate your own avi files.

