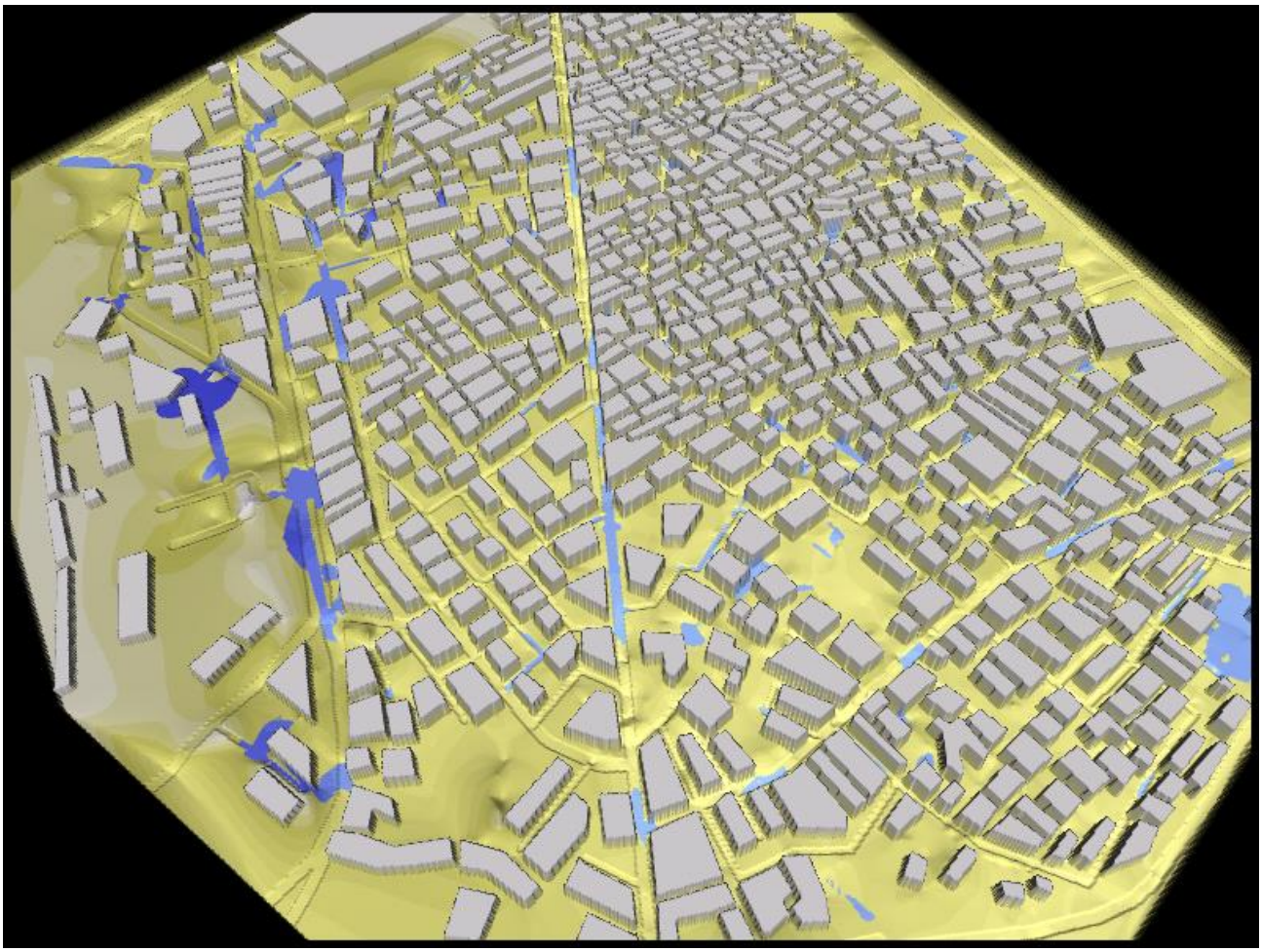

MIKE FLOOD

Modelling of Urban Flooding

Step-by-step training guide

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1 Introduction

This Step-by-step training guide focuses on urban flooding in the city of Bangkok, Thailand. A typical picture of flooding in the city after a minor heavy rain event in Bangkok can be seen in Figure 1.1.

Figure 1.1 The Nontaburi area in Bangkok after a 'minor' heavy rain event on 27 April 2002

1.1 Background

Bangkok has a very high level of economical activities and the most important national offices are situated in Bangkok. When heavy rainfall occurs in Bangkok, some of the consequences are: heavy traffic jams, water logging, blackouts, and big economical losses due to property damage. Improved understanding and analysis of the flooding conditions in the city centre of Bangkok will help the city administration manage and mitigate flooding and associated damage.

A MIKE FLOOD model (consisting of MIKE+ and MIKE 21) has been setup for Sukhumvit, the most important commercial area in Bangkok. The model covers an area of approximately 25 km^2. This model simulates simultaneously the flow in the sewer, the drainage system and the surface flow. Hence, during flooding it simulates the flow in the sewers, the streets and the flow around the houses.

The urban inundation maps produced by the model are ideal for visualizing and understanding historical flood events. Subsequently MIKE FLOOD may be applied to identify the most efficient and cost effective ways for reducing the stress from flooding.

1.2 Objective

The objective of this step-by-step training guide is to make the user familiar with the MIKE FLOOD user interface. I.e. after going through this guide the user should be able to configure and run MIKE FLOOD simulations.

It is a prerequisite that the user is already familiar with the basic operation of MIKE+ and MIKE 21. Thus this guide does not deal with specific MIKE+ and MIKE 21 matters – if the user requires knowledge on the basics of these software packages - then the user must refer to the respective manuals. Hence, the starting point of this guide is that the user has already setup a model of the urban drainage system in MIKE+ and that the user has already prepared topography (bathymetry) for the MIKE 21 surface flow model inside the city area.

The files used in this step-by-step training guide can be found in your MIKE Zero Examples installation folder.

Hence, you do not need to generate all the MIKE FLOOD input parameters yourself. All the MIKE FLOOD input parameter files needed to start a simulation are included.

2 Starting MIKE FLOOD

In order to start MIKE FLOOD select MIKE Zero from the Start menu.

Your first screen will look like in Figure 2.1 below:

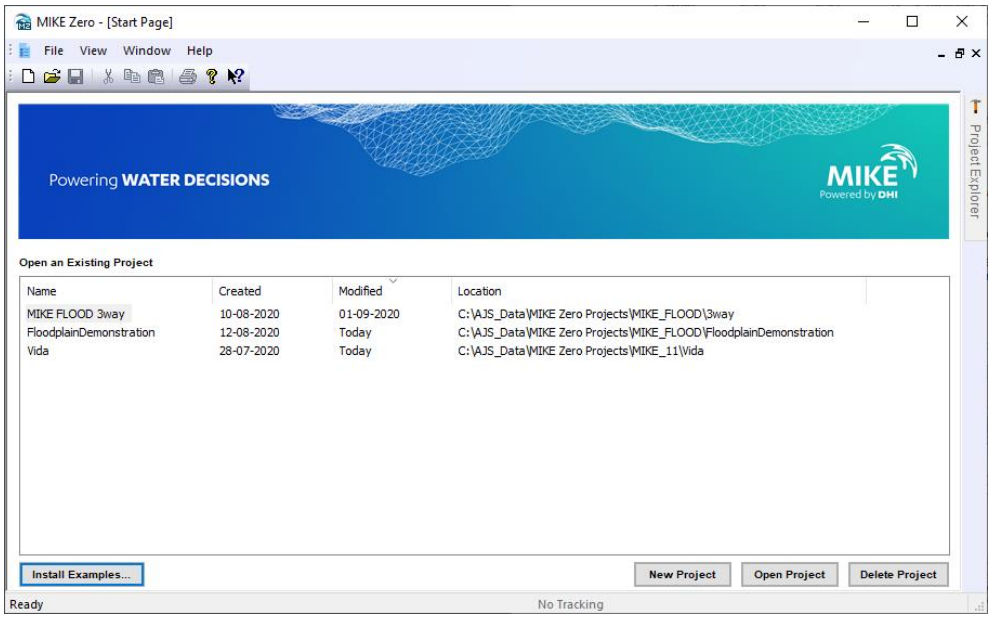


Figure 2.1 The first menu - when you open MIKE Zero

Press the *Install Examples…* and select to install the MIKE FLOOD examples. Choose a location for storing the examples.

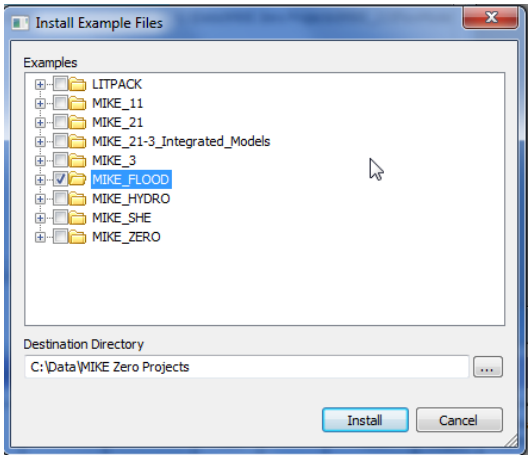


Figure 2.2 Selecting the MIKE FLOOD examples to install

Select ‘File | Open | File’ and open the predefined MIKE FLOOD model setup located in the folder you chose above.

…\MIKE_FLOOD\urban\mflood\MIKEFLOOD.couple

This file contains a MIKE FLOOD model setup, which covers a small part of Bangkok, Thailand. After opening the MIKE FLOOD coupling file the menu changes to the MIKE FLOOD main menu. See Figure 2.3.

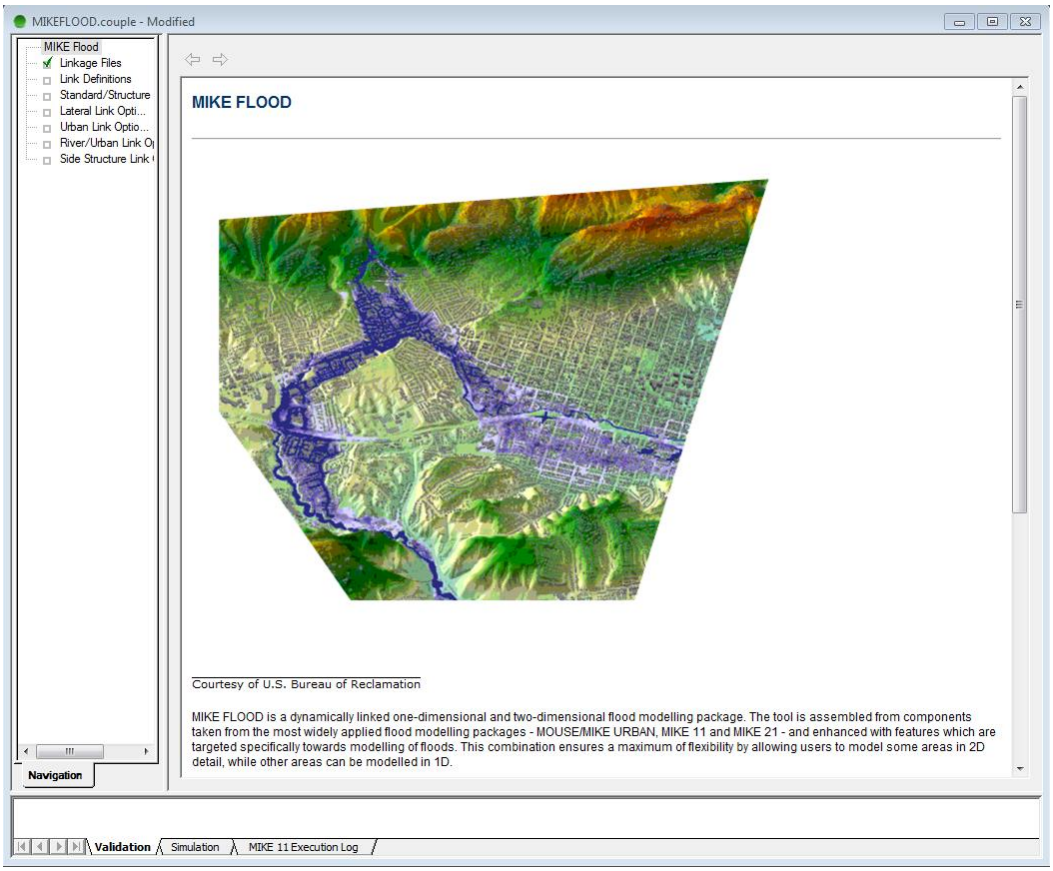


Figure 2.3 The MIKE FLOOD main menu

From the MIKE FLOOD main menu you have access to a number of sub- menus. For the urban simulation you will work with the menus ‘Linkage Files’, ‘Link Definitions’ and ‘Urban Link Options’. These menus are explained below.

2.1 Loading MIKE 21 and MIKE+ Data

First open the ‘Definition menu’ to specify the MIKE 21 and the MIKE+ data files. The menu can be seen in Figure 2.4.

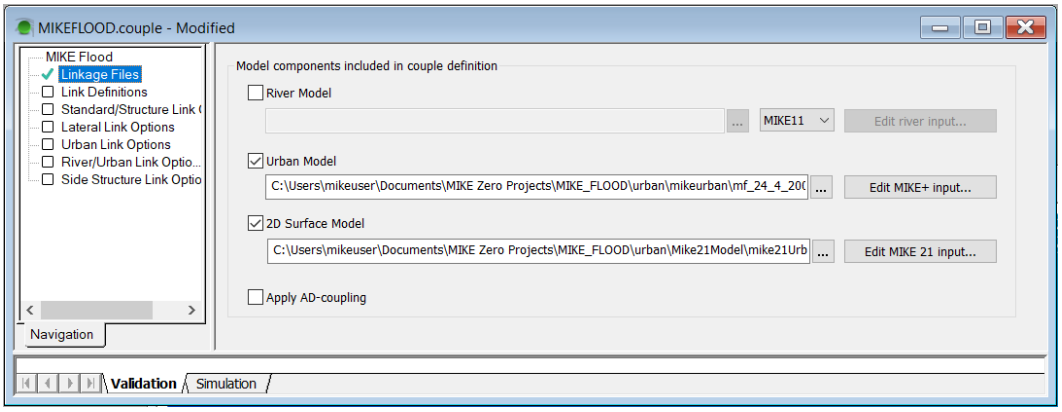


Figure 2.4 The MIKE FLOOD Linkage Files menu

The lower menu field – next to 'Edit MIKE 21 input', specifies the MIKE 21 data used for the overland flow simulation. In order to edit/inspect the MIKE 21 data – simply click 'Edit MIKE 21 input…'.

Add a tick mark in the 'Urban Model' field and it is possible to add the data for MIKE+. Note, that a MIKE+ data file can only be added if you have MIKE+ installed on your computer. Also, note that all the software: MIKE FLOOD, MIKE 21 and MIKE+ – *must be from the same DHI software release!*

After adding the MIKE 21 and the MIKE+ data – the layout of the data will be displayed in the horizontal plot on the menu.

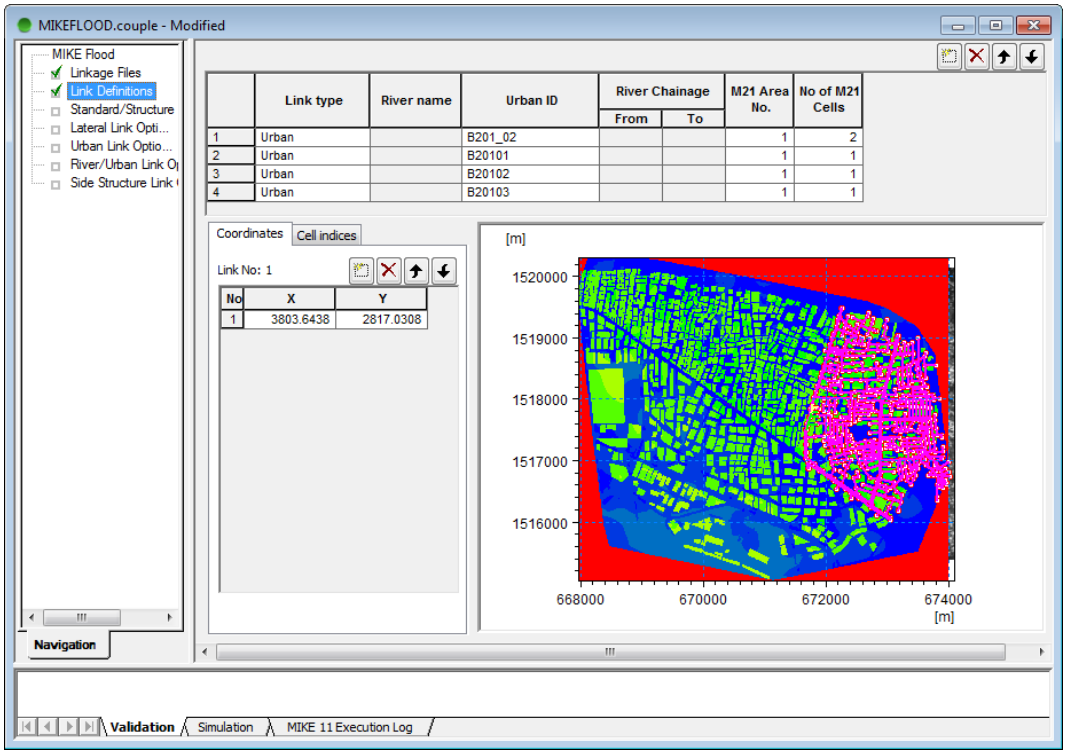


Figure 2.5 Adding files to the project and the horizontal plot of the MIKE 21 and the pipe network from MIKE+

2.2 Properties for the Horizontal Plot

The horizontal plot on the ‘Definition menu’ provides access to a number of options like:

- zooming
- formatting of the horizontal plot
- linking of the pipe flow model and the surface model

Formatting of the horizontal plot can be carried out by using the options: ‘Add/remove layers’; ‘Layer Properties’ and ‘Add/remove images’. These functions are described in detail in the MIKE FLOOD User Guide. The adding of a background image is outlined below – just to illustrate one of these functionalities.

2.2.1 Adding a background image

Open the menu with the option for the horizontal plot by ‘right clicking’ on the plot. Select ‘Add/Remove Images’ and specify the file type and load the file by clicking on the selection next to the file type, see Figure 2.6. Set the size of the image by selecting ‘Edit’ next to the field with the filename. Specify the coordinates for the lower left corner together with the pixel length and height – the total size of the image will then be computed automatically – see Figure 2.7.

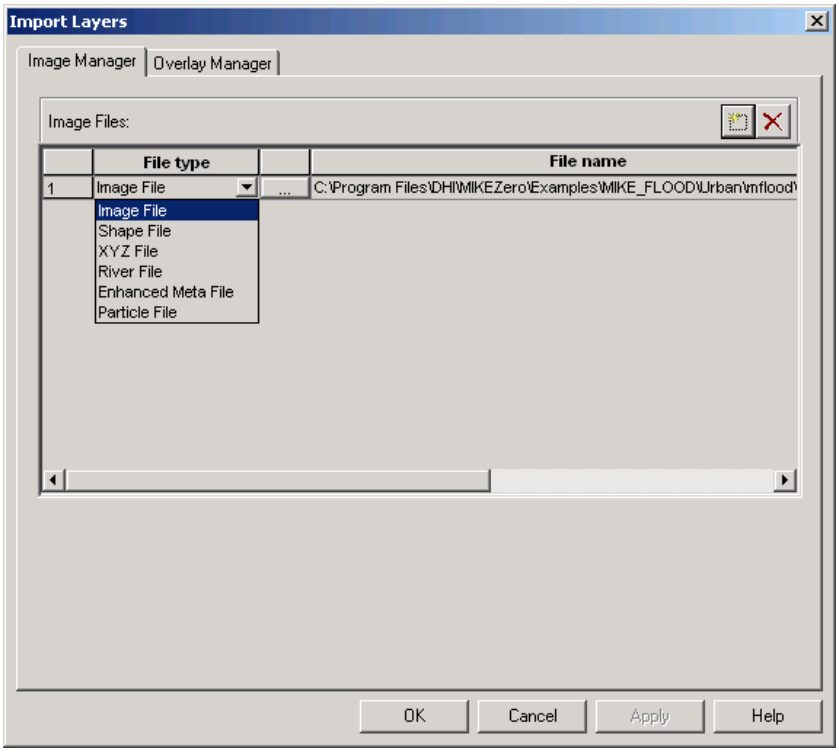


Figure 2.6 Import of background images

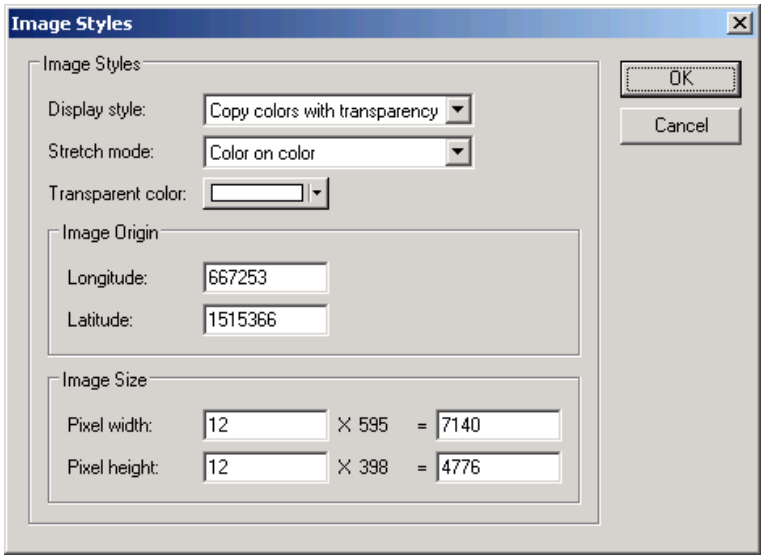


Figure 2.7 Import of background images

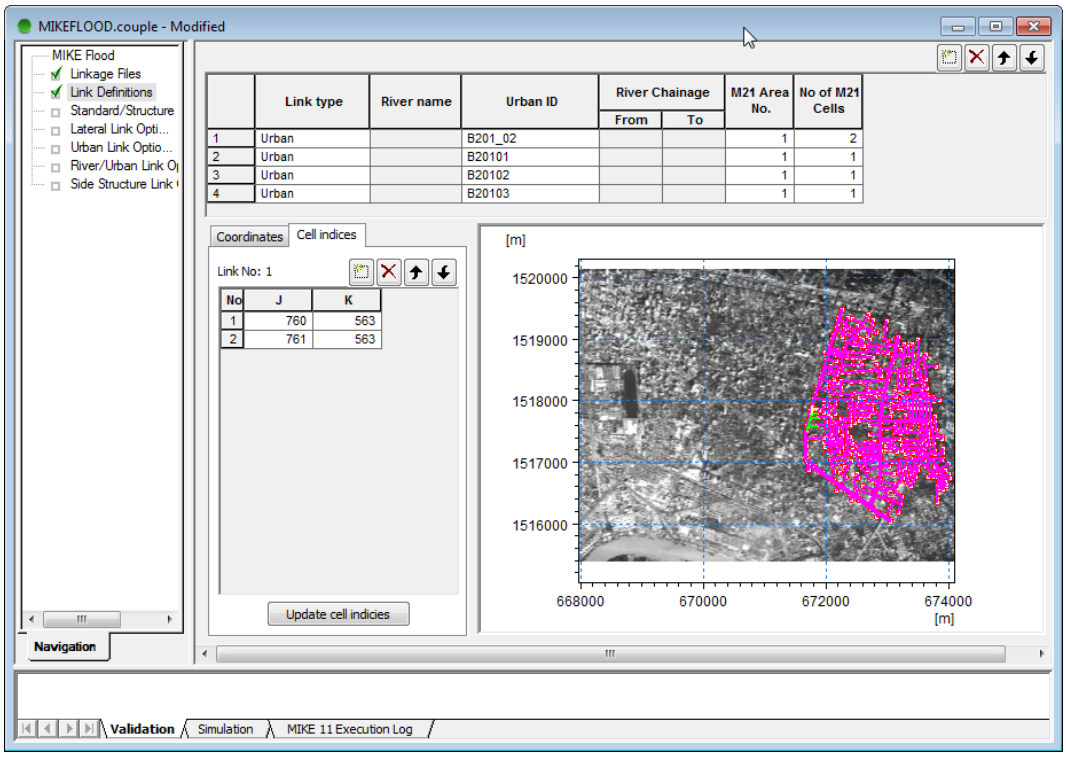


Figure 2.8 The MIKE FLOOD model with a background image from down town Bangkok

2.3 Linking MIKE 21 with the MIKE+ Model

In order to generate the links between the MIKE 21 and the MIKE+ models – right click on the horizontal plot and select 'Link urban node to MIKE 21' – see Figure 2.10.

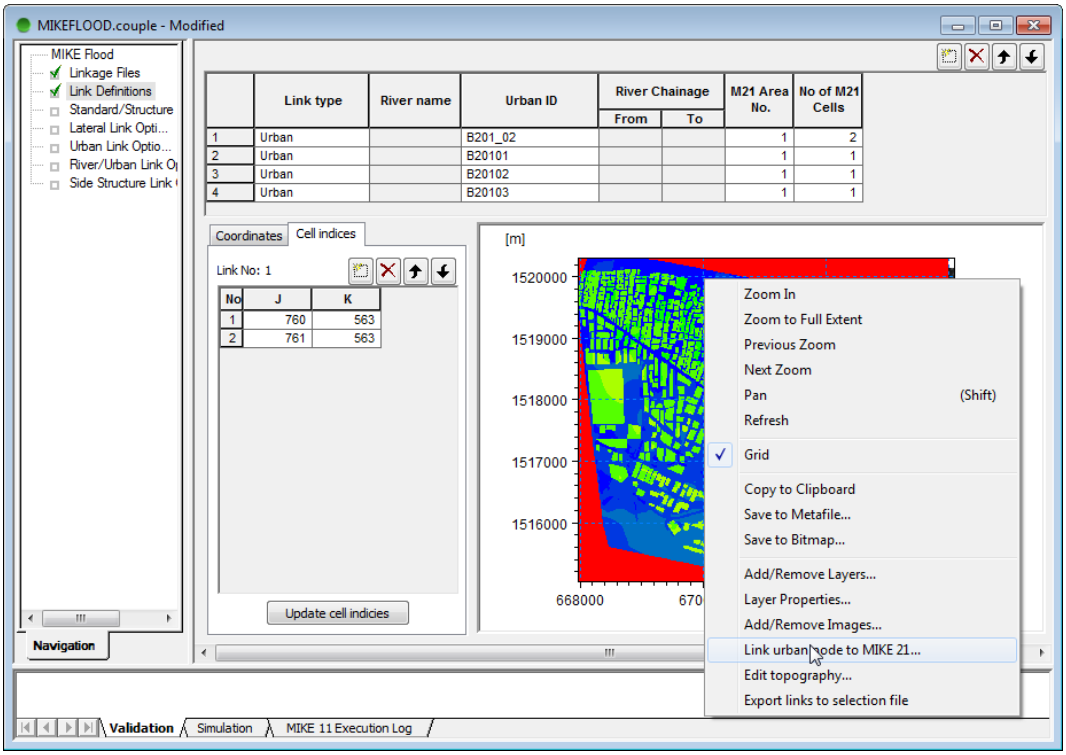


Figure 2.9 Options for the horizontal plot

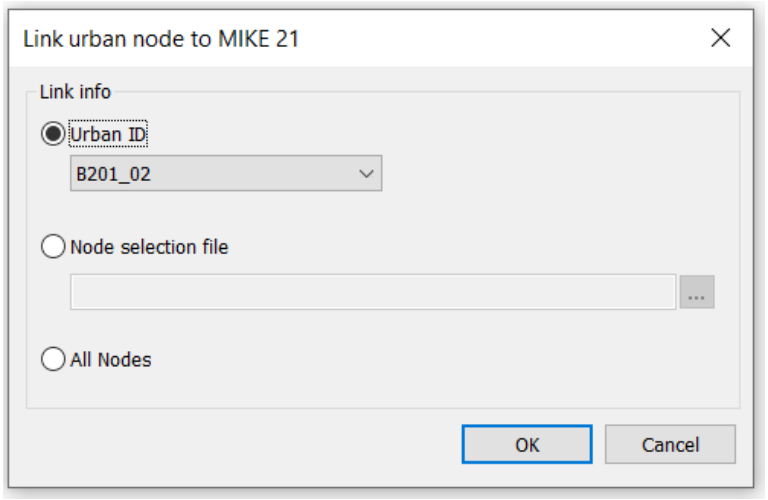


Figure 2.10 Linking of urban nodes to MIKE 21

The nodes can now be linked between the two models in the following ways:

1. On an individual basis through the 'Urban ID'

2. By use of a ‘Node Selection File’. (From MIKE URBAN/MIKE+: *.MUS – From MOUSE: *.NSE)

3. All nodes from the MIKE+ model will be connected to the MIKE 21 model.

Please note: at present the automatically link only works for nodes e.g. link types ‘M21 to inlet’ and ‘M21 to outlet’.

2.3.1 Coupling of the MIKE+ model with more than one grid in MIKE 21

The node in MIKE+ can be coupled to more than one grid in MIKE 21. This may make the computation more stable and make the computation run with a larger time step. The coupling of the MIKE+ node with more grid cells in MIKE 21 is carried out from the ‘Definition Menu’. Click on the specific connection between the models and the connected cells in MIKE 21 are displayed in the column ‘M21 Cord 1’. In the case in Figure 2.12 the MIKE URBAN node is connected to two cells in MIKE 21, i.e. cells:

J	K
760	563
761	563

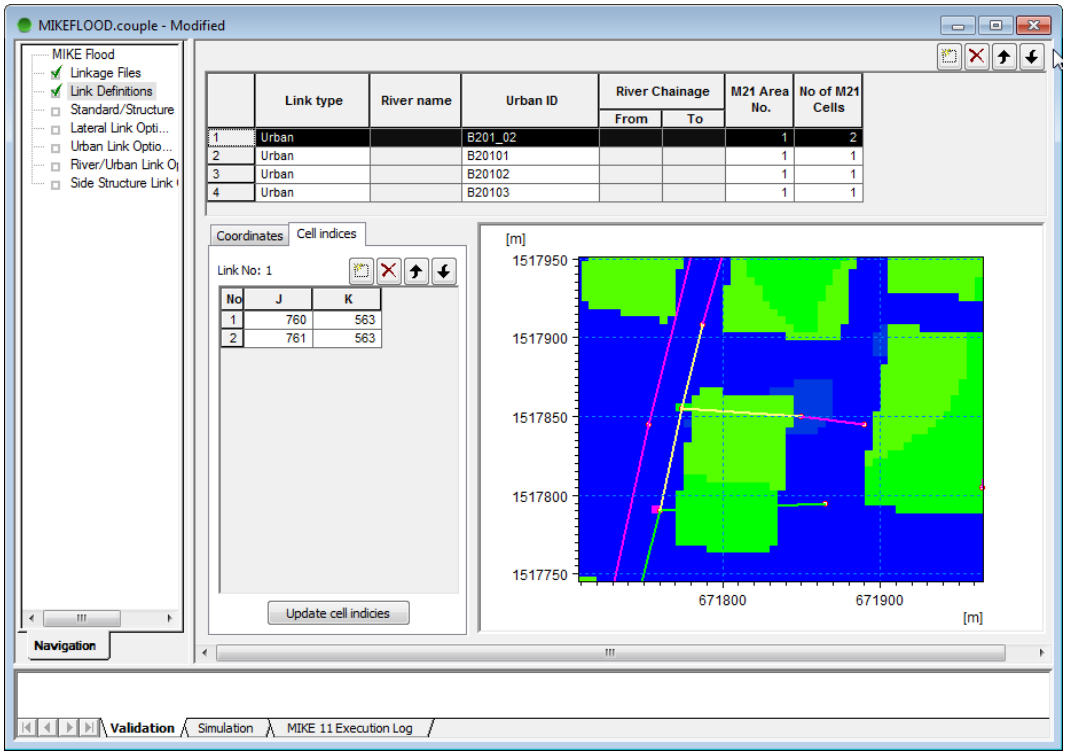


Figure 2.11 Linking of a node to multiple grids in MIKE 21 – i.e. the two red cells

2.4 Defining the Link Types between MIKE 21 and MIKE+

In the menu ‘Urban Link Options’ the connection type and parameters are set for each connection between the MIKE+ and the MIKE 21 models.

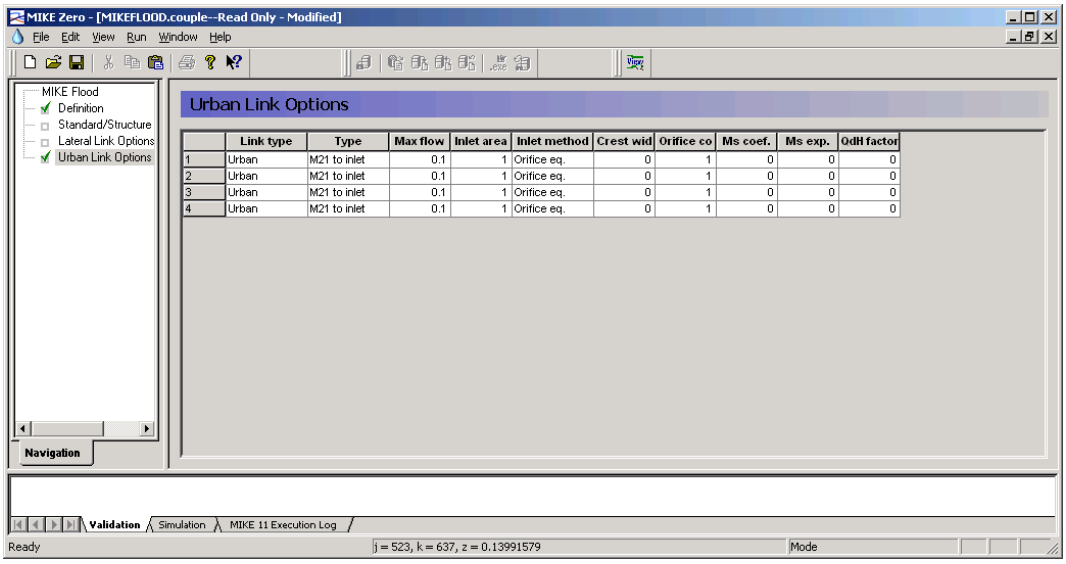


Figure 2.12 The Menu with the ‘Urban Link Options’

Each line specifies one connection point between the models. The number in the list corresponds to the number on the ‘Definition menu’.

An explanation of the parameters in this menu can be found in the Help system and in the MIKE FLOOD User Guide.

2.5 Definition of Result Files

Two result files are generated from a simulation: one 2D file (MIKE 21) containing the hydrodynamics for the entire area and on 1D file containing the results from the MIKE+ simulation. The result file for the MIKE+ simulation is the result file specified from inside MIKE+ and the results from the MIKE 21 simulation are stored in the result file specified in MIKE 21, see Figure 2.13.

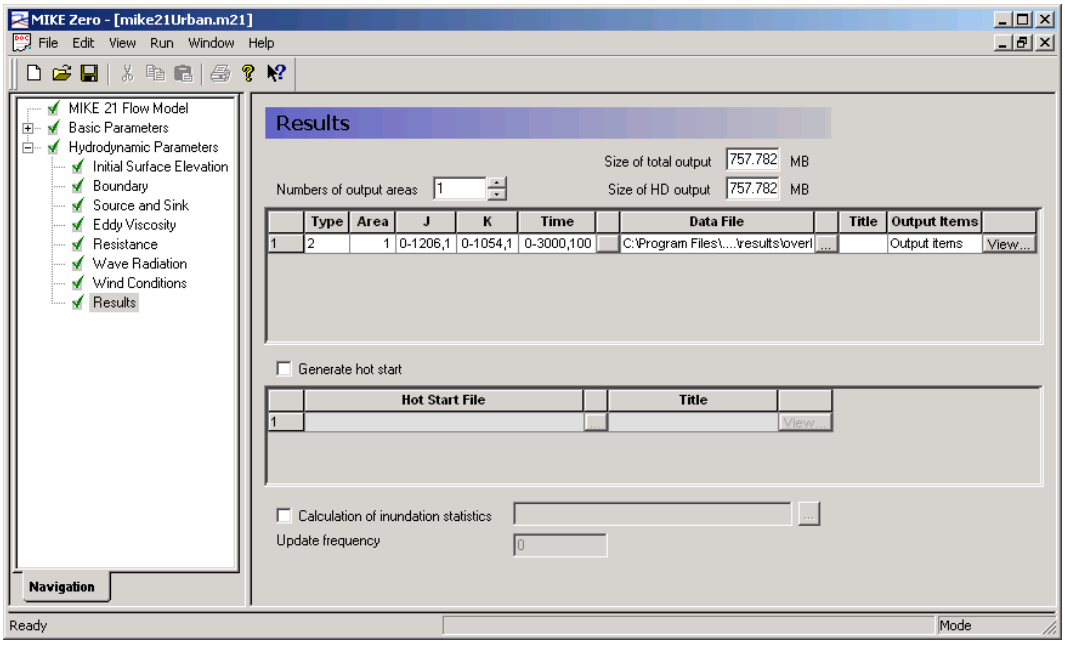
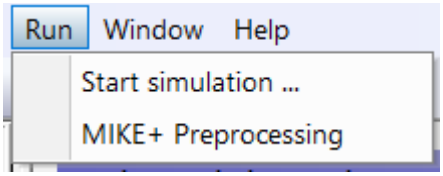


Figure 2.13 Defining the MIKE 21 result file

In order to view flooding areas please check the ‘Calculation of inundation statistics’ and specify a result file.

3 Running the Model

The computation is started from the MIKE FLOOD interface. Before launching the simulation the MIKE+ set-up must be pre-processed. This is done by selecting the appropriate menu item under the run menu in the main MIKE ZERO menu bar:



Once the MIKE+ set-up has been pre-processed the simulation may be launched by clicking ‘Run’ – ‘Start simulation’ on the main menu bar, see Figure 3.1.

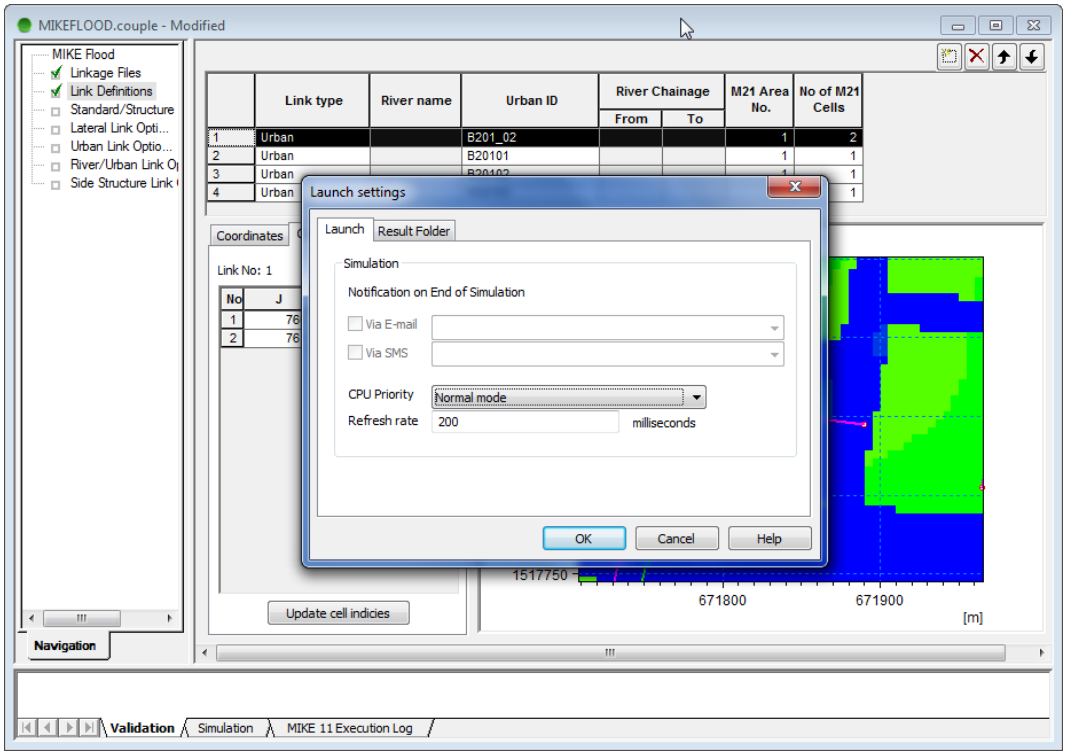


Figure 3.1 Starting a simulation

It is recommended to set the ‘CPU Priority Level’ to ‘Normal’.
When the simulation is finished, summaries of the simulations can be found in the files: reducedBase_Summary.html and MIKEFLOOD.log in the respective MIKE+ and MIKE FLOOD directories.

4 Result Presentation

The results from the simulations can be presented in MIKE View or inside the MIKE Zero results presentation. For the results presentation of the MIKE 21 overland flow results in the DFS2 file format - pls. refer to the MIKE VIEW and MIKE Zero manuals for details.