Installing MoRPHED

MoRPHED may be installed by building the code (see notes below) from source or using the provided installer. The source code and installer for any MoRPHED version can be downloaded on GitHub from the MoRPHED repository (https://github.com/morphed/MoRPHED). To use the installer, simply launch the EXE and follow the instructions. Once MoRPHED is installed, note that:

a. the Delft3D flow model must also be installed.

b. the paths to two Delft3D executables must be added to your PATH variable: deltares_hydro.exe, d3d_qp.exe. The executables should be available at this location: Delft3dInstallationFolder/w32.

Running a Simulation with the MoRPHED GUI

1. Start the GUI

Open the MoRPHED_GUI.exe that will be located at the specified installation path (if using the installer).

2. Start or Open a Project

From the file menu, either start a new project or open an existing project. To start a new project, simply select or create a directory (folder) where the model will create its files. To open a project, navigate to the directory of an existing project and select the *.morph file. Once a project is created or opened, actions in the GUI will be enabled.

3. Load Inputs

Click the Inputs button; this will open a new dialog.

Select a Digital Elevation Model (DEM) representing the initial conditions you wish to model. We suggest using the GeoTiff (.tif) file format, though the model will accept most formats. The upstream and downstream boundaries of the reach to be modeled must occur on the North or South edges of the DEM. Therefore, it may be necessary to rotate and clip certain DEMs in order to ensure the boundaries fall on the north and south edges of the topographic surface.

Select an input text file. This is a space delimited file that specifies the date, discharge, downstream water surface elevation (DSWSE), and imported sediment volume for each event. Dates **must** be in the format 'MM/dd/yyyy,hh:mm'. Specify discharge in cubic meters per second. Specify DSWSE in meters below the maximum elevation of the input DEM; this will always be a negative number. For example, if the DSWSE is 30 m and the highest point on the input DEM is 35 m, the value of the DSWSE will be -5 m. This value simply provides a starting point for a 1D conveyance calculation performed in MoRPHED to determine an exact DSWSE for each simulation and therefore does not need to be exact. Imported sediment can be represented as an exact volume (m^3) or as a proportion the sediment exported from the reach during an event (0-1). The appropriate option must be then be selected in the inputs dialog.

4. Set the MoRPHED Parameters

Click on the MoRPHED Parameters button, which contain user-specified parameters that may be adjusted for modeling a particular field setting.

Set the parameters for the path-length distributions that will be used to determine transport and deposition locations for entrained and imported sediment.

The parameters *Slope Threshold*, *Shear Stress Threshold*, and *Area Threshold* relate to bank erosion. Slope Threshold describes the minimum slope (in degrees) of a bank in order to undergo bank erosion. Area Threshold describes the minimum area a group of cells must contain in order to undergo bank erosion, and Shear Stress Threshold is the minimum shear stress in adjacent wetted cells necessary to compute bank erosion at a cell.

The Bed Erosion Scaling Factor describes the proportion of sediment that is eroded at a given location as a fraction of the total computed scour depth at a cell. Grain Size is the median (D_{50}) grain size of the reach to be modeled and is used to determine the critical shear stress for bed erosion.

5. Set the Delft3D Parameters

Click on the Delft3D Parameters button.

Select the directory where Delft3D is installed. The correct directory will contain a subdirectory called 'w32'. Select the location of the upstream and downstream boundaries. For the other parameters, consult the Delft3D documentation provided at:
http://oss.deltares.nl/documents/183920/185723/Delft3D-FLOW_User_Manual.pdf

6. Run

Click Run and the MoRPHED model will begin. While the model is running, the GUI will be unresponsive and the status will read "Not Responding". Once the model has finished the GUI will once again become responsive. You may check the progress of the simulation by navigating to the working directory for the simulation and viewing the outputs for each completed event.

Notes

1. MoRPHED has been successfully built on Windows 7 and 8. The software is written in C++ using Qt libraries, so cross-platform building on Linux should be possible.

2. We build MoRPHED using Qt with the MinGW compiler (g++; Qt 5.3.0, MinGW, 32 bit).

3. MoRPHED leverages Geospatial Data Abstraction Libraries (GDAL) for geoprocessing routines. GDAL must be built from source; for directions see http://trac.osgeo.org/gdal/wiki/BuildingOnWindows and/or http://trac.osgeo.org/gdal/wiki/BuildHints.

4. To build MoRPHED, select 'Release' mode and build "MORPHED_GUI". Once built, put a copy of libgdal-1.dll (obtained in Step 3) in MORPHED_GUTS/release.

5. MoRPHED integrates with the freely-available Delft3D hydaulic model, which must be built by following the instructions at http://oss.deltares.nl/web/delft3d. When prompted in MoRPHED, provide the top-level directory of Delft (e.g. C:/delft3d).

Building from source

1. Clone the repository https://github.com/morphed/MoRPHED.

2. Update the .pro files for the MORPHED_LIB and MORPHED_GUI projects to point to the location of the GDAL DLL and header files.

3. Make sure the MORPHED_GUI .pro is linked to the MORPHED_LIB project.