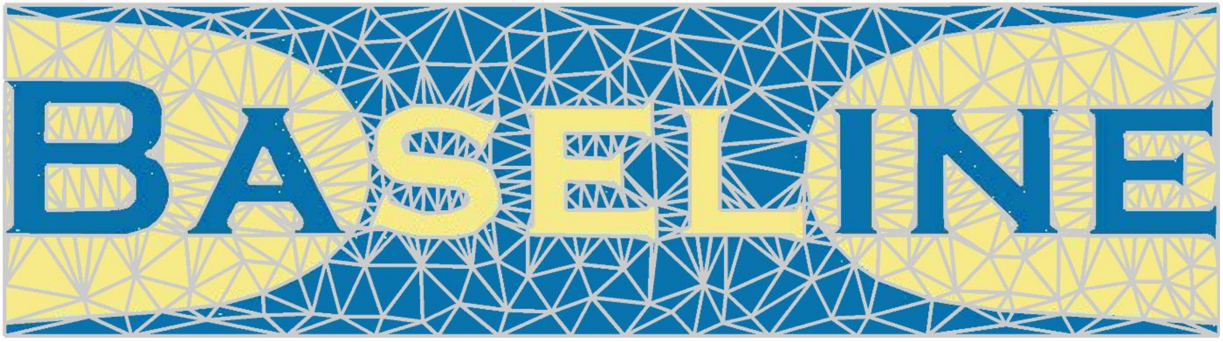
Rijkswaterstaat
Ministry of Infrastructure
and Water Management



User Manual Baseline 6.3

Date	February 2023
Status	Final
Valid for	Baseline 6.3.2 or higher versions

Deltares maintains and supports Baseline according the de Service Level Agreements (SLA) with the Ministry of Infrastructure & Water Management (I&W).

Deltares
Enabling Delta Life

User Manual Baseline 6.3

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Contents

1 Introduction

Baseline 6 is a combination of an ArcGIS extension and a geographical database. The database is meant for storage, editing, consulting and presenting of data of hydrodynamic systems used in calculations. In addition Baseline can be used to convert data to suitable files for use in D-HYDRO Suite and SWAN. The ArcGIS extension and database are suitable for use with ArcGIS Desktop 10.3.1 or higher (hereafter ArcGIS) with an ArcGIS-Advanced license and 3D-analyst extension. For the conversion of an gridcell-averaged elevation to D-HYDRO and SWAN a Spatial Analist extension is required.

The geographical database and extension are developed on behalf of Deltares and Rijkswaterstaat. However Baseline can be used whenever a structured storage of river data and/or a link of flow models with a GIS environment is desired.

Baseline is designed by WSP. The predecessor of Baseline 6 is Baseline 5. Baseline 5 was developed by Geodan IT and LievenseCSO (before CSO). Both Baseline 5 and Baseline 6 are based on ArcObjects and extensions of ArcGIS.

Although Baseline has been developed as an ArcGis extension, the application is primarily aimed at users of hydrodynamic models. Basic knowledge of ArcGIS is required.

The purpose of this document is to guide the user in using Baseline 6. This manual explains the structure and usage of the database and describes the functionality. Subsequently, the operation of the individual functions of Baseline 6 is described.

The datamodel and workflow is completely revised compared to Baseline 5. Data that was stored twice (in Baseline 5) is now stored in one place only.

2 Background Baseline, D-HYDRO Suite and SWAN

2.1 Introduction

Baseline can be used to generate files which can be used for D-HYDRO Suite (Delft3D-Flexible Mesh Suite) and SWAN. This chapter explains the functionalities of Baseline and how it can be used to generate the necessary files for hydrodynamic models. In addition a brief description is given of D-HYDRO Suite.

2.2 Baseline and hydrodynamic models

2.2.1 *Baseline*

General

Baseline 6 is a combination of an extension of ArcGIS and a geographical database. This database is meant for storing, editing, consulting and presenting of data of hydrodynamic systems used in hydrodynamic simulations. In Baseline spatial data is stored in such a way that an adequate geographical description of an area is obtained. This geographical description is converted to input for a hydrodynamic model.

Since 2017 Baseline 6 is developed. The most important changes with respect to Baseline 5 are described in this manual. In addition to this document a Baseline 6 protocol is created. A detailed description of Baseline 6 (the purpose and use) is given in Chapter 4. Baseline 6 is the successor of Baseline 5 which was developed from 2009 till 2017.

Baseline is a GIS tool used for hydrodynamic models. All functionalities in Baseline are controlled via menus. With these menus it is possible to change and maintain the geographical data stored in the database and convert these data to hydrodynamic models. In Figure 1 the menus of Baseline are presented.

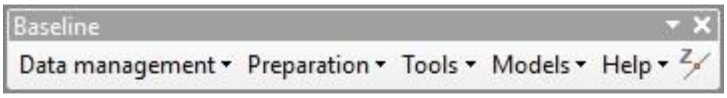


Figure 1: Menus Baseline 6

All functions are designed to make spatial data unambiguously available for conversion to hydrodynamic model files. By formalizing procedures and documenting the data model, a high degree of reproducibility of schematizations is obtained.

The function “Data management” offers the possibility to create an empty template for new areas, variants and schematizations. Also an active variant of measure can be loaded.

The menu “Preparation” contains the input module for building measures.
The application enables the user to make a cut of the model (clip) or to erase a part of the model (erase). This can be done with the menu “Tools”. This menu also is used to start mixing measures or go into batch-mode. Finally this menu offers a check on protocol and content for variants and measures and some advanced tools.

The menu “Models” can be used for converting the geographical database to files usable for hydrodynamic models. Hydrodynamic models which are supported are SWAN and D-HYDRO Suite, module D-Flow Flexible Mesh (D-Flow FM).

2.3 Hydrodynamic models

2.3.1 *D-HYDRO Suite*

The D-HYDRO Suite or Delft3D Flexible Mesh (Delft3D FM) Suite is the successor of (structured) SIMONA/WAQUA or Delft3D 4 Suite. Like Delft3D 4, the Delft3D FM Suite can simulate storm surges, hurricanes, tsunamis, detailed flows and water levels, waves, sediment transport and morphology, water quality and ecology, and is capable of handling the interactions between these processes. The suite is designed for use by domain experts and non-experts alike, which may range from consultants and engineers or contractors, to regulators and government officials, all of whom are active in one or more of the stages of the design, implementation and management cycle.

The key component of D-HYDRO Suite is the D-Flow Flexible Mesh (D-Flow FM) engine for hydrodynamical simulations on unstructured grids in 1D-2D-3D.

All FeatureClasses of the Baseline database can be converted to inputfiles for D-Flow Flexible Mesh.

2.3.2 *SWAN*

SWAN is a numerical model for the simulation of waves in deep, moderate and shallow water. SWAN uses a rectilinear, curvilinear or unstructured (flexible) mesh, like D-Flow Flexible Mesh.

A SWAN model can be used for the following processes:

- Wave reproduction in time and space, shoaling, refraction due to flow and depth, frequency shift due to flow and non-stationary depth;
- Wave formation through wind;
- Non-linear interaction between waves (both quadruplets and triads);
- Blocking of waves by flow.

More information on: www.swan.tudelft.nl

The conversion of the Baseline data is limited to the elevation model, weirs and thin dams (included in the weirs file). These are the elevation and the wave reducing obstacles used in SWAN.

3 Database en Files Baseline

3.1 Introduction

The Baseline database is designed to save and process files on a reproducible manner. This chapter discusses the Baseline database and files. To enable a relative easy and structured method the Dataprotocol Baseline 6.3 (WSP 2022) is developed. In the dataprotocol the entire database and several files are explained more thoroughly.

3.2 Baseline database

The Baseline database is a structured collection of folders with Baseline-files. When starting with Baseline the first step is to build a database with the Baseline structure. This structure is showed below:

<Name can vary> , File name, [Directory-Name]

```
<area>
    <variant>
        [Data]
            [Source] (Location of source files)
            [Import] (Actually non-functional, )
            [Export] (Export location for example to. ASCII)
            [Layers] (Users defined layer-files for deviation of standard layers)
        [Metainfo]
            [lists] (batch-lists, measurelists and erase- and appendlists.
            [Logs] (Location of log files)
            Metadata.doc
            Other .doc-bestanden
        [Models]
            [SWAN]
                [<Schematization_name>]
                    <rooster>.swn
                    (<rooster>.rgf)
                    (<rooster>.grd)
                    rooster.gdb
                    [Geometry]
                        [Output_locations]
            [DflowFM]
                [<schematization_name>]
                    [boundary_conditions]
                    [computations]
                    [general]
                    [geometry]
                        [cross_sections]
                        [output_locations]
                        [sources_sinks]
                        [structures]
                    [initial_conditions
                    [metainfo]
                    [rtc]
        [Baseline.gdb]
```

A more thorough description is available in the Dataprotocol Baseline 6.3 (WSP 2022).

3.3 Visualizing the Baseline database

When installing Baseline there are also some default layers installed. These layers are used to visualize a Baseline database when using the Baseline toolbar (see chapter4.2.1). There are layers for a (sea)variant and one for a (sea)measure.

However as presented in the previous paragraph there is the opportunity for the user to use custum layers to visualize a database. To do so the custum layer had to be placed in the data>Layers directory. When using the Baseline toolbar to add the Baseline database to the map firstly a check is carried out if a custum layer is available. If this is the case this layer is used, if not the default layers are used.

4 Baseline Functions

4.1 Introduction

The Baseline extension is a toolbar in ArcMap. This toolbar contains all Baseline functions. This chapter discusses all available menus and functions. Every menu of the toolbar is discussed in a separate section. Per menu all submenus and/or functions are discussed. The purpose of each function is described.

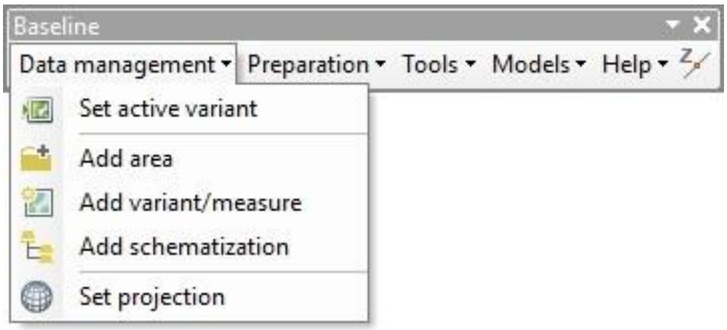


Figure 2: Menu and functions.

As can be seen above the following menus are available:

- Data management
- Preparation
- Tools
- Models
- Help

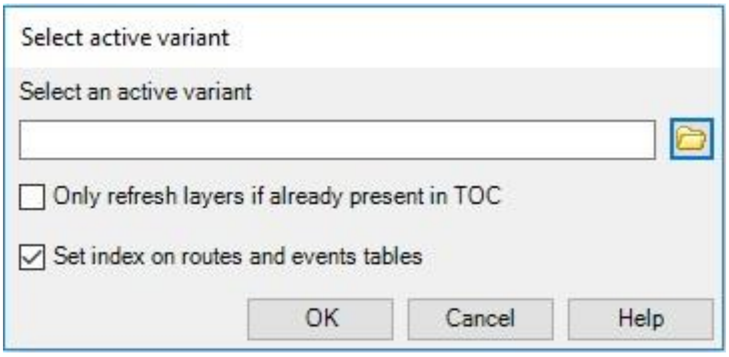
4.2 Data management

This paragraph describes the following functions:

1. Set active variant
2. Add area
3. Add variant/measure
4. Add schematization
5. Set projection

4.2.1 *Set Active variant*

Purpose:
With this function an active variant is set. The active variant is the database in which changes are made with the Baseline functions.


Select active variant

Select an active variant

□ Only refresh layers if already present in TOC

☑ Set index on routes and events tables

Figure 3: Select active variant

Explanation:
The active variant is selected using a "Windows Explorer structure" where the user navigates to the variant or measure. A variant is always located in an area, which is always located in the directory Baseline: "Baseline/<area>/<variant>. A measure must be located in the directory Baseline: "Baseline/<area> or within a subfolder of this directory. Subfolders up to 3 levels deep are allowed. When a chosen directory is not a variant or measure, an error will appear. After selecting an active variant this variant/measure will be loaded in ArcMap, using the default legend. There is a legend for a variant and one for a measure. Differences between those two are the presence of an elevation model and erasefiles for instance. For Baseline data on sea, outside the domain of the Rijksdriehoelsstelsel there are sea variants and measures in WGS1984 projection available.

Note: Baseline recognizes a measure by the presence of an erase_list.txt and an append_list.txt.

If a user uses the option "Only refresh layers if already present in TOC" a previous loaded variant will be refreshed. When this option is ignored a previous loaded variant will be duplicated in the TOC. When closing Baseline the last active variant set is remembered.

If a user uses the option "Set index on routes and events tables" (default checked) an index is set on all routes and events for the field NUMBER. When this option is checked but an index is present no action will be carried out. As a result of this index the performance is significantly increased. However, when no index is present yet this action will take some extra time.

4.2.2 *Add area*

Purpose:
The user can add a directory for a new area.

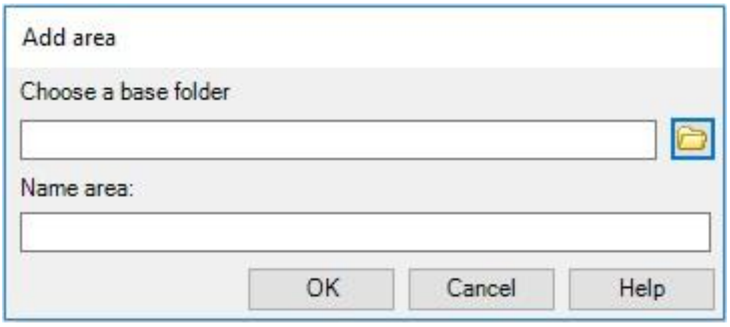
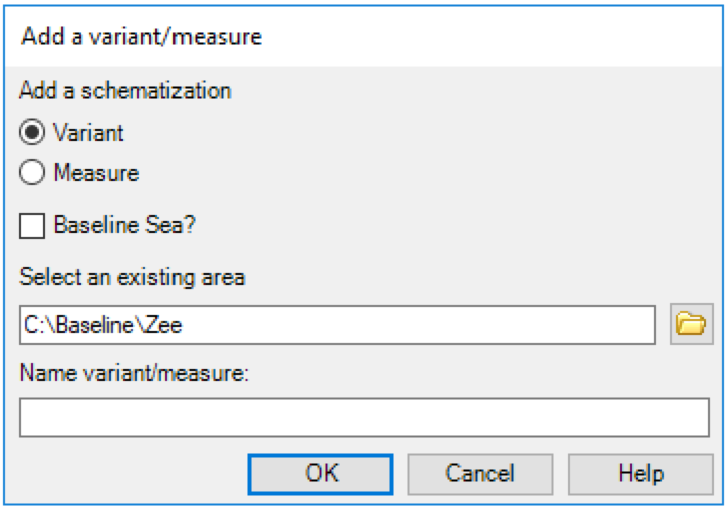


Figure 4: Add area

Explanation:
When creating a Baseline database, the user must first add an <area>. The user determines the name and location of the area. This can also be done outside Baseline using "Create folder" in the windows explorer.

4.2.3 *Add variant*

Purpose:
The user can add a variant or measure directory. According to the name conventions a measure name should start 2 characters representing the waterbody, followed by an underscore, then maximum 20 characters/numbers for the actual name (no spaces and special tokens allowed), another underscore, ending with one characters and one number. For example *wl_dynrivbeheergeldprt_a1* refers to waterbody Waal, dynamisch rivierbeheer Gelderse poort, version a1.



Add a variant/measure

Add a schematization

● Variant

○ Measure

□ Baseline Sea?

Select an existing area

C:\Baseline\Zee

Name variant/measure:

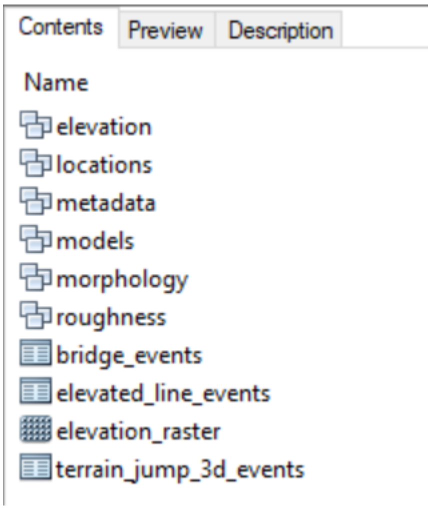
Figure 5: Add variant/measure

Explanation:
After adding an area, the user adds a variant directory. This will be located directly in Baseline/<area>. The user can choose if it is a “land” or “sea” database. There are some small differences between the two types. These are documented in the dataprotocol.
The user determines the name of the variant. This variant directory has the following structure:

```
[Data]
        [Source]
        [Import]
        [Export]
        [Layers]

[Metainfo]
        [Lists]
        [Logs]
[Models]
        [dflowfm]
        [swan]
baseline.gdb
```

The File Geodatabase baseline.gdb contains the following Feature Datasets:



Name
- elevation
- locations
- metadata
- models
- morphology
- roughness
- bridge_events
- elevated_line_events
- elevation_raster
- terrain_jump_3d_events

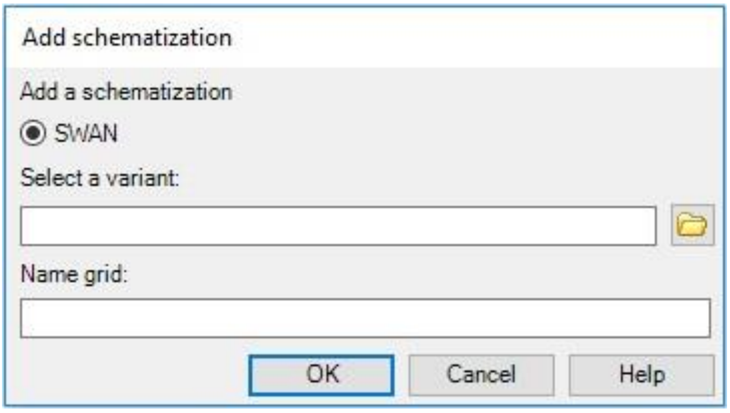
Figure 6: Feature Datasets (elevation_raster is only present in a sea measure or variant and elevation_mosaic only in a sea variant)

Within these Feature Datasets the Feature Classes will be created.

When instead of a variant a measure is added a similar process is executed. However in that case the Feature Dataset "erase_polygons" is created with the corresponding Feature Classes. Also instead of variant.lyr the layerfile measure.lyr is loaded.

4.2.4 *Add schematization*

Purpose:
This function adds a SWAN directory with the name of the grid. In this directory the input files for hydrodynamic models are created with the function "Conversion to SWAN.


Add schematization

Add a schematization

● SWAN

Select a variant:

Name grid:

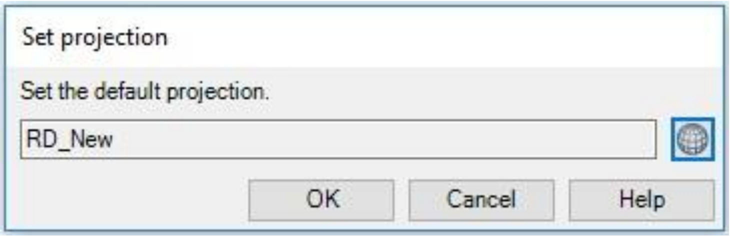
Figure 7: Add schematization

Explanation:
The grid directory is created in the model directory. The name of this directory is determined by the user. In this directory a default structure is created. After creating this grid directory the <>.swn file and eventually <>.grd file should be placed in this directory.

The default structure:
SWAN: /Baseline<area>/<variant>/models/swan/<model name>

4.2.5 *Set projection*

Purpose:
This function allows the user to choose a projection which is used. This projection is used for the template geodatabases of variants and measures. When a projection is selected by the user, these templates are copied to the user template directory of Baseline. This function needs to be used to work with a projection different than RD_NEW (Rijksdriehoeksstelsel). This function does not need to be used if RD_NEW is used unless another projection is used previously.



Set projection

Set the default projection.

RD_New

Figure 8: Set projection

Explanation:
Default template databases have an RD_NEW projection by default. When a user would like to work with another projection it is necessary to convert these default database to the desired projection. These are located in the user template directory \Users\<username>\AppData\Local\Baseline\Template. Hereafter Baseline continues working with the chosen projection until another projection is set. If the user selects a variant with a projection other than the selected projection a message is displayed.

Note: Baseline is only able to save a chosen projection if it is a default ArcGIS projection (provided with a ESPG-code; http://spatialreference.org). Moreover only **projected** coordinate systems can be used. This is a restriction due to the presence of terrains in the Baseline database. Terrains can not be made using non-projected data.

For this reason a second set of templates is introduced to cope with non-projected data. These templates are "variant_sea" and "measure_sea", both have a WGS1984 projection. These templates are used in order to work with Baseline in the North Sea and the Atlantic Ocean outside the spatial domain of the Rijksdriehoeksstelsel. It is not necessary to change the projection using 'set projection' to set sea variants or measures as active variant. More information on sea databases is given in paragraph 4.4.4 and in the dataprotocol.

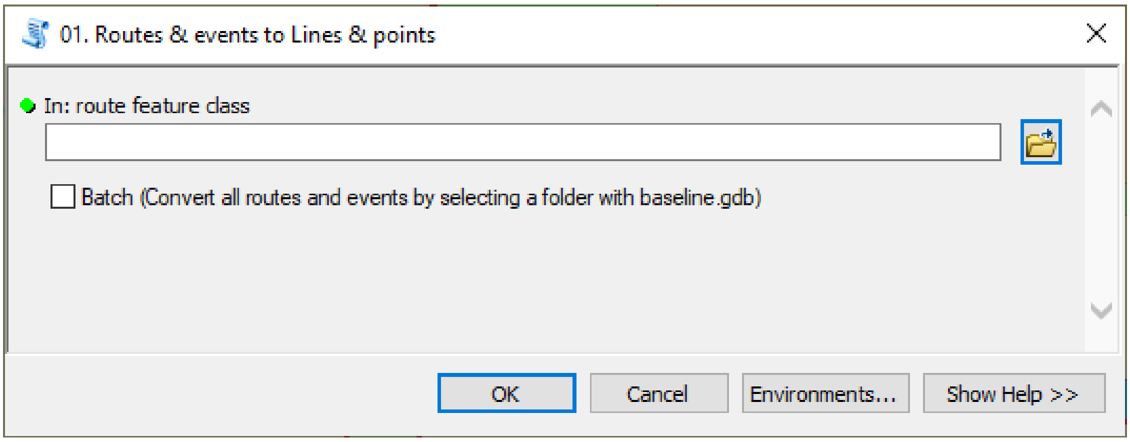
4.3 Preparation

The Preparation menu contains tools to assist the Baseline 6 user when creating and updating Baseline 6 measures, without the need of converting to other GIS-dataformats (shapefiles etc). The use of these tools is not mandatory, although strongly recommended.

Using the preparation tools the user can automate a number of (time-consuming or complex) processes. Also, a larger degree of uniformity can be achieved, which enhances the overall quality of Baseline 6 measures.

For the tools which manipulate elevation data, 3D Analyst is required.
The menu contains various tools focussing on specific editing operations in ArcMap of mainly the elevation lines in Baseline measures. The Baseline 6 dataprotocol does use (3D)routes and events and 3D-lines. This is similar to Baseline 5.
However, ArcMap does not contain straightforward edit tools for (3D) routes and events and 3D-lines. In order to cope with this problem the (3D) routes and events or 3D-lines must be converted in lines and points before editing. These lines and points can be edited with standard ArcGis tools or specific Baseline preparation tools, after which they can be converted again to routes and events. During this conversion it is checked whether the points are positioned on the lines.

4.3.1 *3D-Lines,(3D)Routes & Events to Lines & Points*



01. Routes & events to Lines & points

● In: route feature class

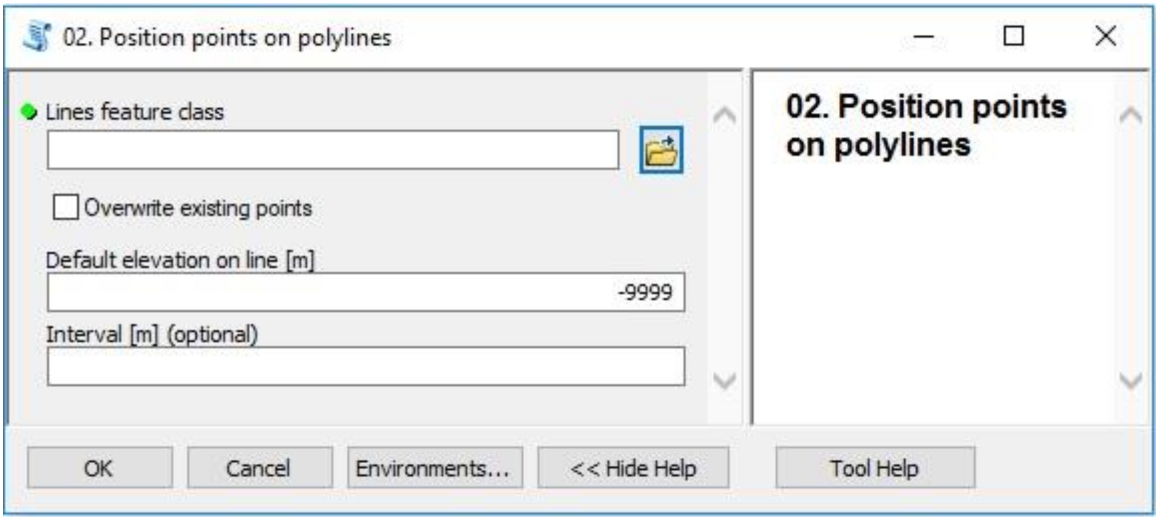
□ Batch (Convert all routes and events by selecting a folder with baseline.gdb)

Figure 9: 3D-lines, routes & events to lines & points

This tool converts (3D)routes and events or 3D-lines to lines and points. Both attributes of feature class and table are preserved. The selected (3D)routes/3D-lines might be an empty feature class or a feature class containing actual (3D)routes or 3D-lines. In the feature dataset *elevation* a line- and point feature class are made (_lines and _points). In case of the conversion of bridges routes and events these lines and points will be placed in the feature dataset *locations.* After this conversion the original (3D)route feature class and corresponding event table or 3D-line feature class are deleted. In this way the user is forced, after editing the lines and points, to do the backward conversion to (3D)routes and events or 3D-lines in order to prevent version issues.
If only a single route feature class must be converted this feature class should be entered; when batch is checked a Baseline database folder should be selected and all present route feature classes will be converted to lines and points.

4.3.2 *Position Points on Polylines*

The tool 'Position Points on Polylines' adds points on the (selected) lines of the line feature class. If in ArcMap a selection of lines is active only points are added on these lines, if no lines are selected, points are added to all lines. If points are already situated on a line, the tool adds a vertex to the line if not already present. This is conform Baseline protocol.



02. Position points on polylines

● Lines feature class

□ Overwrite existing points

Default elevation on line [m]: -9999

Interval [m] (optional)

02. Position points on polylines

Figure 10:Position points on polylines

- When ‘Overwrite existing points’ is NOT checked lines already having points are skipped and these existing points (having the same NUMBER as the line) will be preserved. If the number of vertices of the line is smaller than the number of points on the line, extra vertices are added. If the line contains more vertices than points, extra points will be added, having the default ‘standard crest elevation’. For these points, realistic elevation values must be defined with tool 3 (see paragraph 4.3.3).

  If checked, existing points are deleted and a complete rebuild is made.

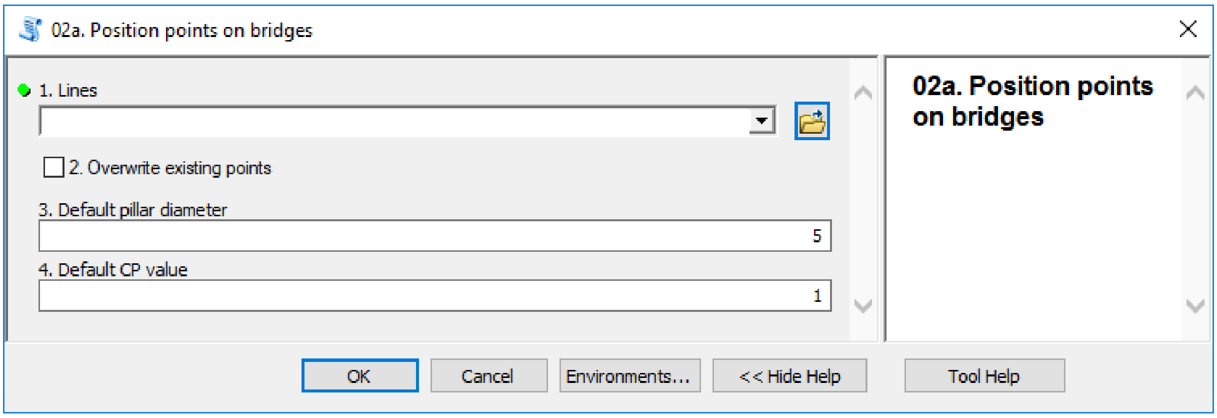
- ‘Default elevation on line’ is the default crest elevation which is filled in the field ELEVATION_CREST. Default is -9999. So it can be easily detected if ELEVATION_CREST is already determined.

- The ‘interval’ determines on what distance extra points are added on the lines in between the existing vertices. No interval results in points only on existing vertices of the lines.

The default spatial tolerance in ArcGIS and Baseline is 0.001 m (1 mm). The default precision of the field MEASURE of events is 4 decimals. The location of an event along a route can vary from 0.000% to 100.0000%. Combining the 1 mm tolerance and the measure precision the maximum route length is 1000 meters. Longer routes might result in the coincidence of 2 events along the route. When longer routes are used it is recommended that the events on the routes have an interval of at least 1 cm in case of a 10 kilometre route and 10 cm in case of a 100 kilometre route.

4.3.3 *Position points on bridges*

The tool ‘Position points on bridges’ adds points on the (selected) lines of the line feature class of bridges. If in ArcMap a selection of lines is active only points are added on these lines, if no lines are selected, points are added to all lines. If points are already situated on a line, the tool adds a vertex to the line if not already present. This is conform Baseline protocol.



02a. Position points on bridges

1. Lines

□ 2. Overwrite existing points

3. Default pillar diameter: 5

4. Default CP value: 1

Figure 11: Position points on bridges

- When ‘Overwrite existing points’ is NOT checked lines already having points are skipped and these existing points (having the same NUMBER as the line) will be preserved. If the number of vertices of the line is smaller than the number of points on the line, extra vertices are added. If the line contains more vertices than points, extra points will be added, having the default values for pilar diameter and CP value.

  If checked existing points are deleted and a complete rebuild is made.

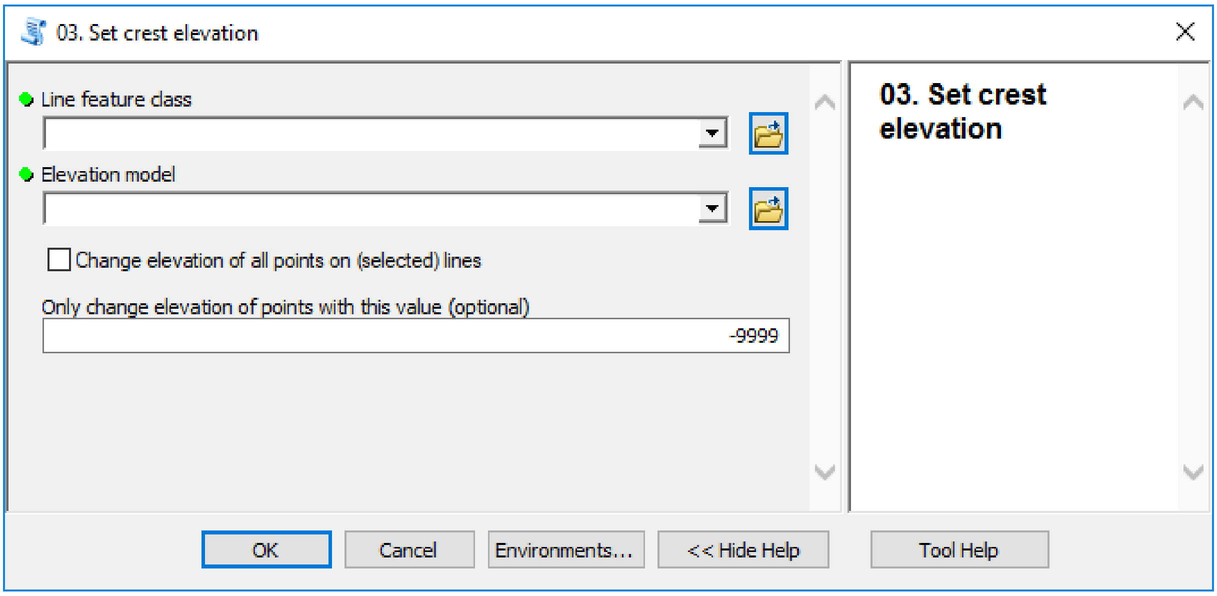
- ‘Default pillar diameter’ is the default diameter which is filled in. Default is 5. The default CP value is 1.

- When extra vertices are needed to decribe the start- and end-location of the bridge_route or when the bridge_route contains bends then these vertices are also converted to bridge_events. When there is no pillar at these locations the diameter should be -999. D-Hysro recognizes these locations as dummy pillars.

4.3.4 *Set crest elevation*

This tool fills in the (crest) elevation in the field ELEVATION_CREST for all points on the selected lines. The elevation is determined using an elevation model. Valid elevation models are TIN, Terrain or Raster (Esri grid, Erdas Imagine img, …). For this tool 3D Analyst is needed.
Lines might contain: a feature class, or a selected set of lines in ArcMap. If in ArcMap a selection of lines is active the crest elevation of points are added on these lines only. If no lines are selected, the crest elevation is added to all points.

Change elevation of all (selected) points is unchecked by default. When unchecked 'Elevation to change' is activated. When a value is entered, only points with this elevation are updated (e.g.update of -9999 values, while keeping other elevation data).


03. Set crest elevation

● Line feature class

● Elevation model

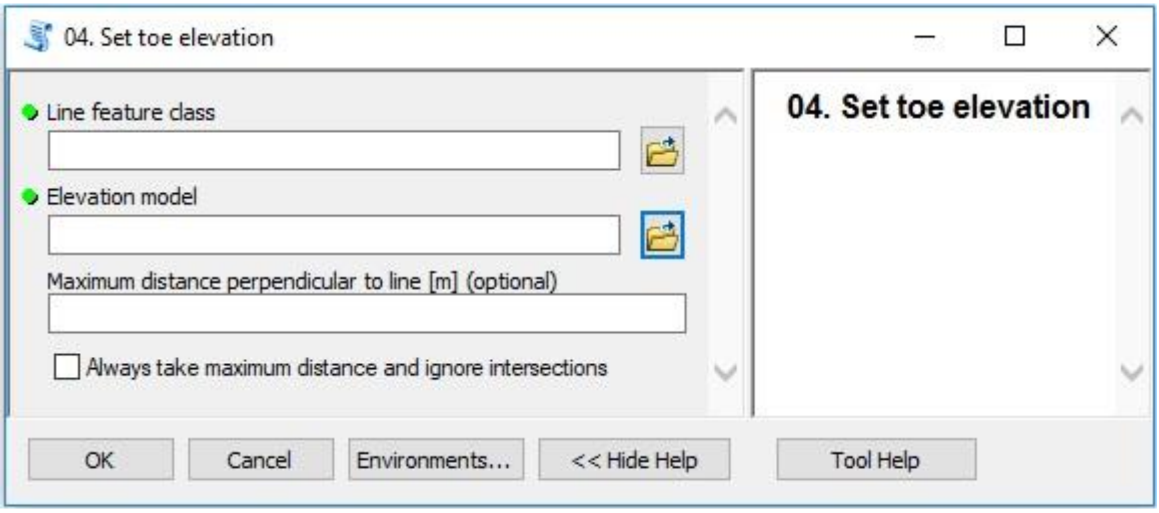
□ Change elevation of all points on (selected) lines

Only change elevation of points with this value (optional): -9999

03. Set crest elevation

Figure 12: Set crest elevation

4.3.5 *Set toe elevation*


04. Set toe elevation

● Line feature class

● Elevation model

Maximum distance perpendicular to line [m] (optional)

□ Always take maximum distance and ignore intersections

04. Set toe elevation

Figure 13: Set toe elevation

This tool fills in the (toe) elevations in the fields ELEVATION_LEFT and ELEVATION_RIGHT for all points on the (selected) lines. The elevations are determined using an elevation model. Valid elevation models are TIN, Terrain or Raster (Esri grid, Erdas Imagine img, …). For this tool 3D Analyst is needed.
Lines might contain: a feature class, or a selected set of lines in ArcMap. If in ArcMap a selection of lines is active the toe elevations of points are added on these lines only. If no lines are selected, the toe elevations are added to all points.

The determination of toe elevation is done in several steps:

- For each point on a line left and right of this line perpendicular lines are constructed using the maximum distance parameter, default 10 meters (see Figure 14). When a line changes direction both neighbouring line segment directions are taken into account in the construction of the perpendicular line.
- When the input elevation model is a TIN or Terrain, breaklines of this model are selected and intersected with the perpendicular lines. The intersection closest to the original line is interpreted as the toe location and the corresponding elevation is added to the point. If no breakline is found within the maximum distance the toe elevation is determined at the end of the perpendicular line.
- When the input elevation model is a Raster, the toe elevation is determined at the end of the perpendicular line (defined by the maximum distance).
- If the line featureclass is a *terrain_jump_lines*, toe elevations on both sides of the line are compared with the crest elevation, at the side with the lowest sill the toe elevation gets the same height as the crest elevation.

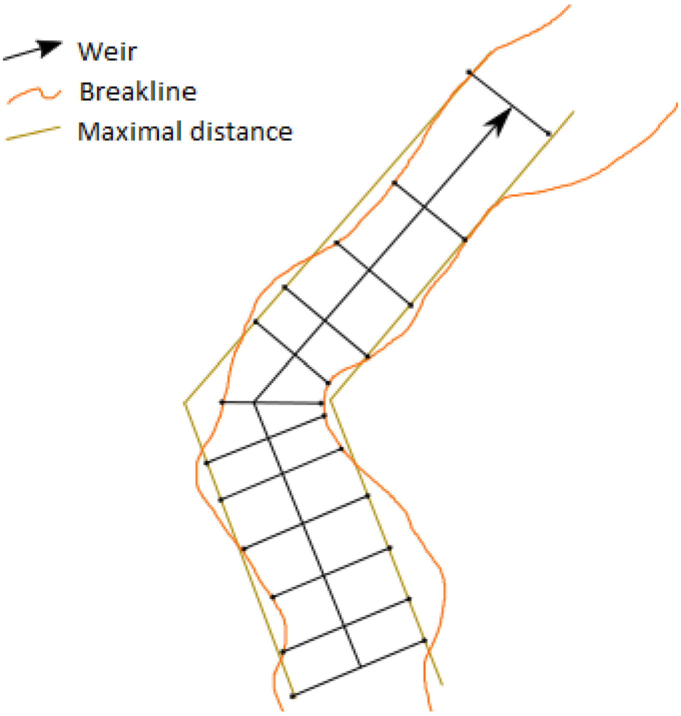


Figure 14. Determination of toe elevations

4.3.6 *Renumber routes and events*

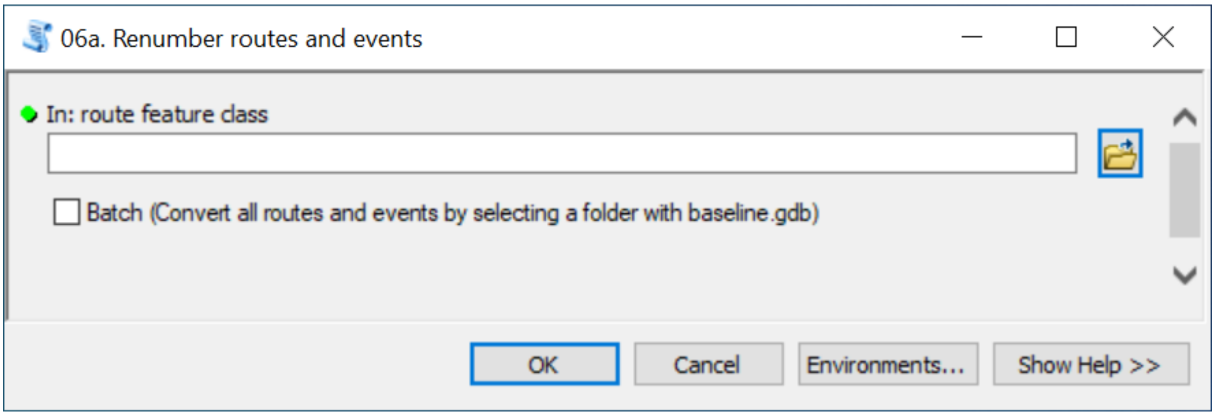
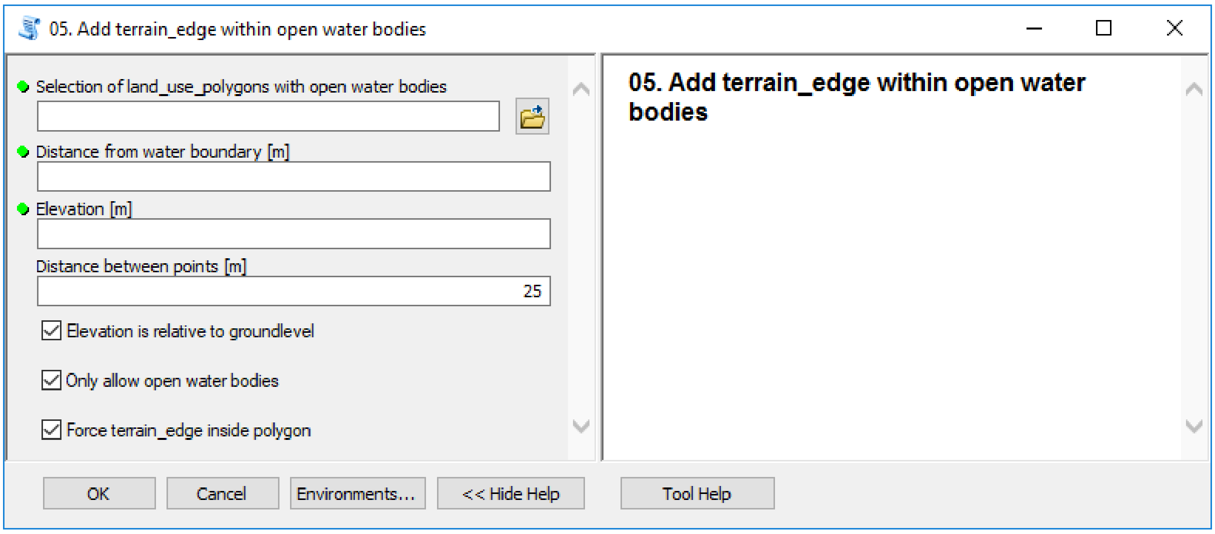

06a. Renumber routes and events
In: route feature class
☐ Batch (Convert all routes and events by selecting a folder with baseline.gdb)
OK
Cancel
Environments...
Show Help >>

Figure 15: Renumber routes and events

This tool alters the content of the NUMBER field in elevated_line_routes, terrain_jump_3d_routes and terrain_edge_3d_lines. Records (both routes and events) are renumbered from 1 to the number of records in the route featureclass.
If only a single route feature class must be renumbered this feature class should be entered; when batch is checked a folder containing a Baseline database should be selected and all present route feature classes (elevated_line_routes, terrain_jump_3d_routes) and terrain_edge_3d_lines will be renumbered.

Note: this fuction only works with measures, NOT with variants.

4.3.7 *Add terrain_edge within open water bodies*


05. Add terrain_edge within open water bodies
Selection of land_use_polygons with open water bodies
Distance from water boundary [m]
Elevation [m]
Distance between points [m]
☑ Elevation is relative to groundlevel
☑ Only allow open water bodies
☑ Force terrain_edge inside polygon
05. Add terrain_edge within open water bodies
OK
Cancel
Environments...
<< Hide Help
Tool Help

Distance between points [m]: 25

Figure 16: Add terrain edge within open water bodies

This tool constructs (bottom) terrain_edge_3d_lines in open water, usually this is done in open water where no bathymetry is available.

This tool only works when there is a selection made in land_use_polygons using ArcMap.

The user has to fill in 5 parameters:

- The distance (m) from the terrain edge to the shoreline,
- The elevation of the terrain edge.
  When "Elevation is relative to groundlevel" is checked: this elevation is relative to the groundlevel of the waterbody. A positive value results in a value lower than the

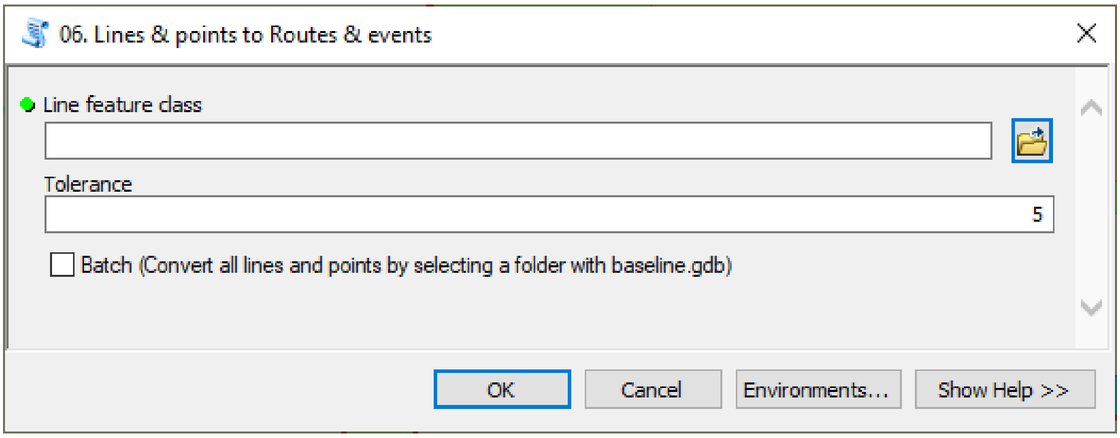
groundlevel. When unchecked: this elevation is a fixed elevation relative to datum (NAP in the Netherlands).

- Only allow open water bodies.
  When this is checked all selected polygons must have ROUGHNESS_CODE 102, 103, 104, 105, 106, 201, 302, 303, 304 or 305. The tool performs a check and will not execute if other polygons are selected. When unchecked: the tool will not validate the ROUGHNESS_CODE. All ROUGHNESS_CODEs are allowed.
- Force terrain edge polygon.
  When checked: the terrain edges are always located inside the selected polygon. When unchecked: the location of the terrain edges depend on the sign of the distance. A negative sign means a terrain edge inside the polygon, a positive sign means a terrain edge outside the polygon.

NB. If terrain edges are already present in the Featureclass *terrain edges* the new constructed terrainedges are added to this Featureclass .

4.3.8 *Lines and Points to Routes & Events*

After finishing all edits in the elevation or bridges, lines and points must be converted back to routes and events in order to be consistent with the Baseline data protocol.



06. Lines & points to Routes & events

Line feature class

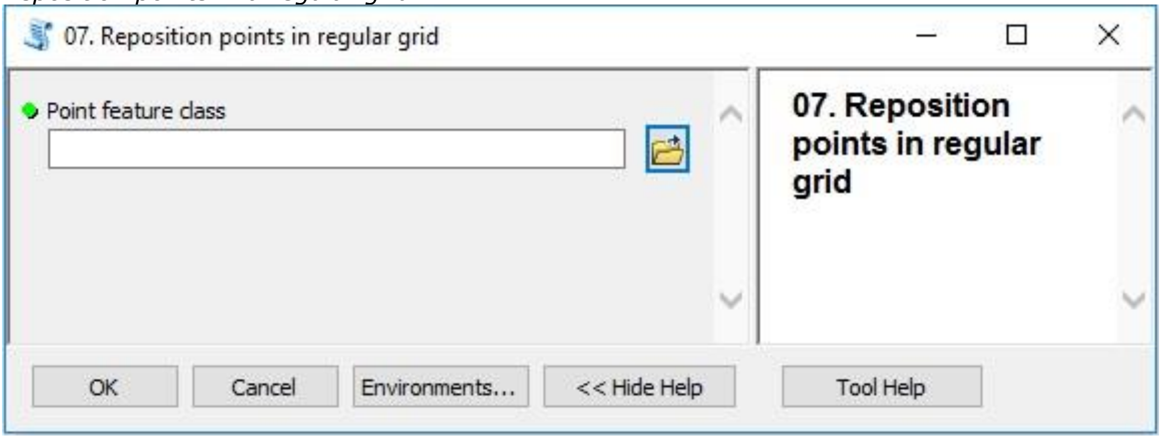
Tolerance: 5

□ Batch (Convert all lines and points by selecting a folder with baseline.gdb)

Figure 17: Lines and points to routes and events

The tolerance is the distance that a point may be located from the line with the same NUMBER to be incorporated as event on the route. Points with the same NUMBER as the line but outside this tolerance distance will be not be added to the event table. These points are preserved in the _points Feature class. After a succesfull conversion the line and point feature classes are deleted. If only a single line feature class must be converted this feature class should be entered; when batch is checked a Baseline database folder should be selected and all present line and point feature classes will be converted to routes and events

4.3.9 *Reposition points in a regular grid*



07. Reposition points in regular grid

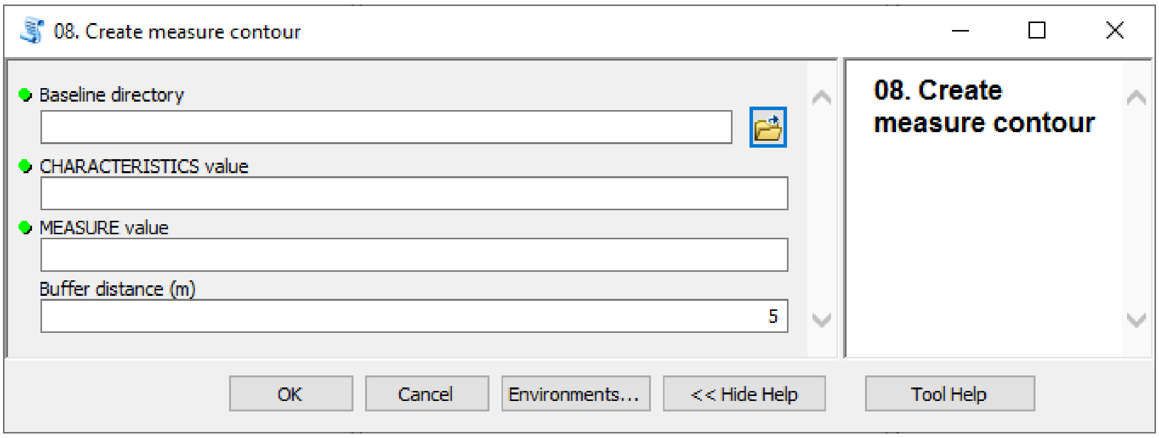
● Point feature class

07. Reposition points in regular grid

Figure 18: Reposition points in a regular grid

This tool replaces the former functionality of ‘Bascon’ and must be used to process elevation points derived from an ArcGIS grid or raster. These points have the property to have coordinates on a regular mesh. Using such points in a TIN or Terrain, ArcGIS/Baseline is not able to produce a single solution triangulation which results in non reproducable results. This tool shifts all points with a maximal shift of 1 milimeter in a random direction. As a result Baseline is able to make a single solution Terrain. NB. This tool should be used just once per point featureclass. Never use this tool on points in a variant database because then thew reference data are altered.

4.3.10 *Create measure contour*



08. Create measure contour

● Baseline directory

● CHARACTERISTICS value

● MEASURE value

Buffer distance (m)
5

08. Create measure contour

Figure 19: Create measure contour

This tool constructs a hull polygon of all objects in the Baseline measure; both erase- and add-polygon-, polyline-, route- and point-Feature Classes are used. All polygons, polylines, routes and points are buffered with a variable distance (default 5 meter) and the resulting (generalised) polygons are added to *measure_contour_polygons.*
Four parameters must be entered:

- The Baseline measure (directory),
- The string to be filled in in the field CHARACTERISTICS (usually the name of the measure),
- The string to be filled in in the field MEASURE (this is the name of the measure),
- Buffer distance (m) to create around all measure objects representing lines and points (default 5m).

-

4.3.11 *Update all CHARACTERISTICS values in measure*

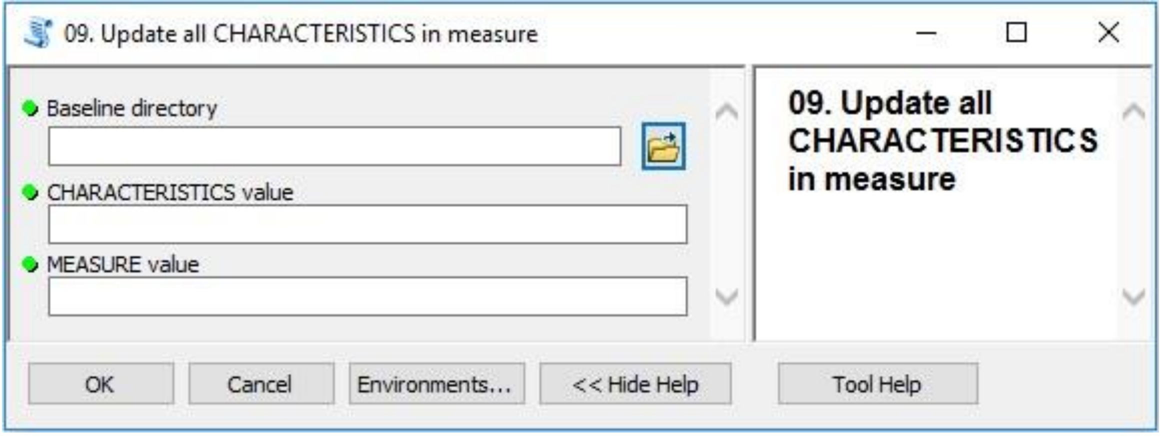


Figure 20: Update all CHARACTERISTICS values in measure

This tool fills the field CHARACTERISTICS in a Baseline measure for all objects.
Three parameters must be entered:

- The Baseline measure (directory),
- The string to be filled in in the field CHARACTERISTICS (usually the name of the measure),
- De string to be filled in in the field MEASURE (usually the name of the measure).

4.3.12 *Clean Baseline Database*

This tool removes all empty Featureclasses within a Baseline database.

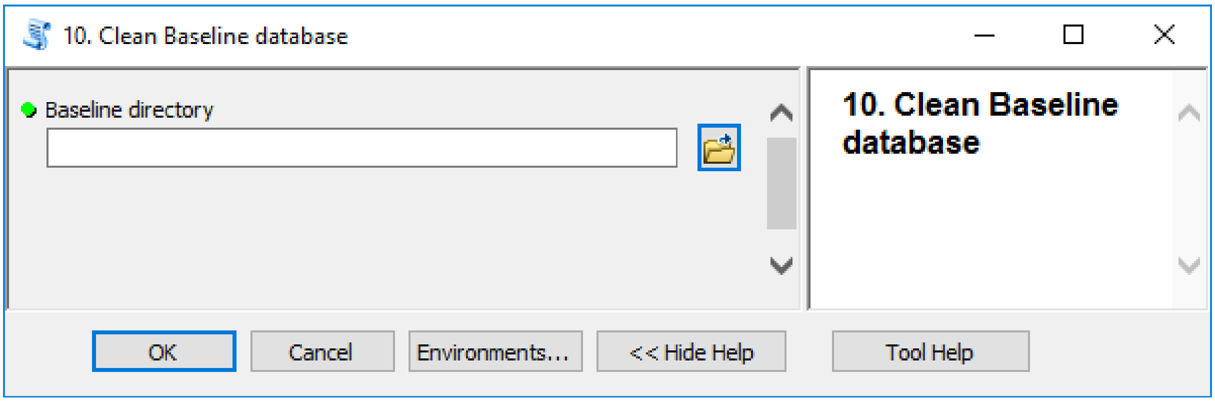


Figure 21: Clean Baseline Database

Be aware that this tool does not delete files that not comply with protocol. This is not checked. Only empty files are deleted. When a file that not comply with protocol is filled, it will not be deleted

4.3.13 *Create erase- and appendlist*

This tool creates the files erase_list.txt and append_list.txt in the selected Baseline measure database. Only feature classes that are present and contain data are included in the list. Empty feature classes are ignored. Feature Classes that are present but which don't comply with protocol are also included in the lists. There is no check carried out if all items in the list comply with protocol. This is a user responsibility.

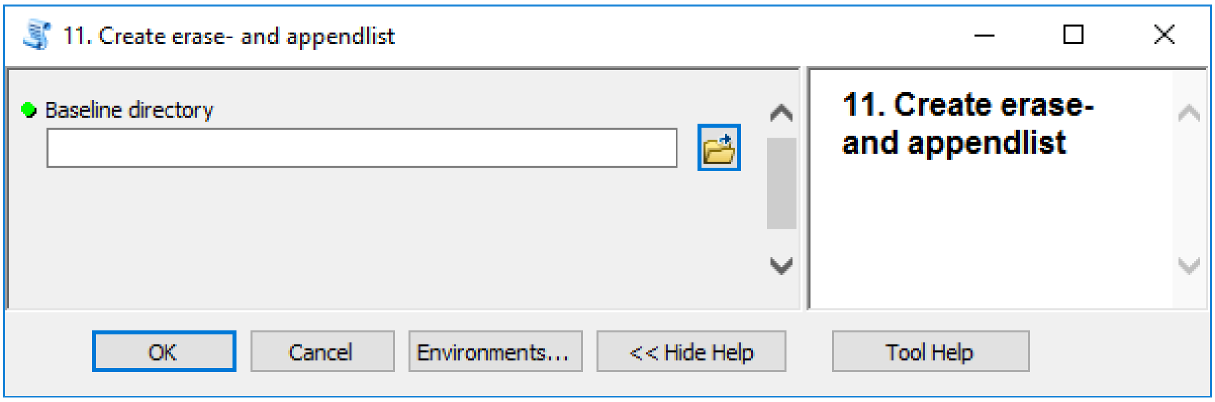

11. Create erase- and appendlist
Baseline directory
11. Create erase- and appendlist
OK
Cancel
Environments...
<< Hide Help
Tool Help

Figure 22: Create erase- and appendlist

4.3.14 *Create land_use_polygons*

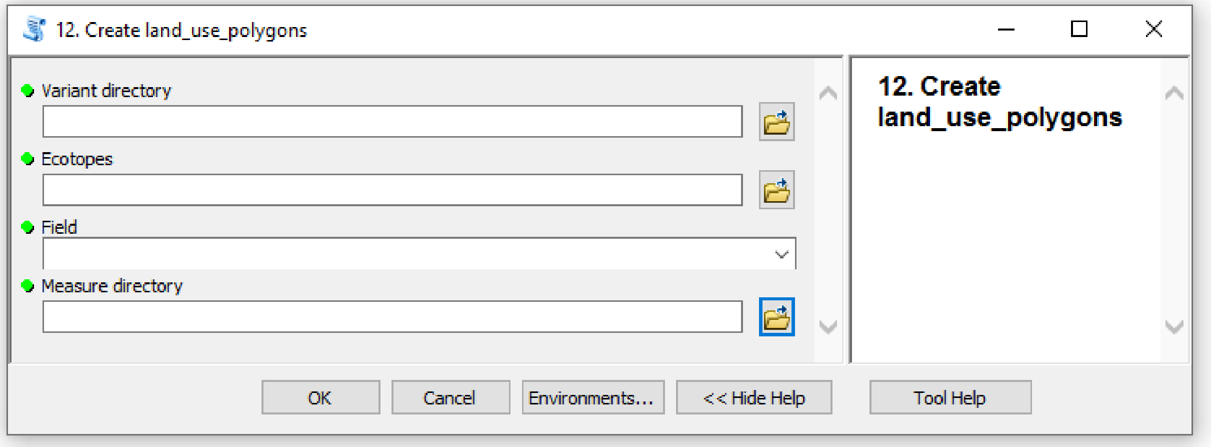


Figure 23: Create land_use_polygons

This tools creates *land_use_polygons* in an empty measure based on new ecotopes combined with the corresponding Baseline variant. This is the Baseline 6 duplicate of the Baseline 5 tool "Clustering ecopen". However since Baseline 6 only contains one *land_use_polygons* file (instead of multiple types as was the case in Baseline 5) some information of the variant is needed to maintain data with a higher precision (like waterbodies). Also calibrations polygons should be maintained.

Therefore this tool selects all features from *land_use_polygons* (of the variant) with ROUGHNESS_CODE equal to 1 (buildings) or 102-106, 201, 302-305 (waterbodies). In addition all features present in *calibration_section_input_polygons* are selected in *land_use_polygons*. All selected features are used to erase the ecotopes. The remaining ecotopes are transferred to the allocated measure with the corresponding ROUGHNESS_CODE.

The translation form ecotope code to ROUGHNESS_CODE is done using *landuse_key.csv* in the install folder (eg. C:\Program Files (x86)\Deltares\Baseline6\Scripts\BaselineInputModule). It is recommended to check and eventually update this file when new ecotope codes are introduced.

Four parameters must be entered:

- The Baseline variant (directory),
- The new ecotopes (shapefile/ feature class),
- Field in the new ecotopes files containing the ecotope codes,
- The target (empty) Baseline measure (directory).

-

4.4 Tools

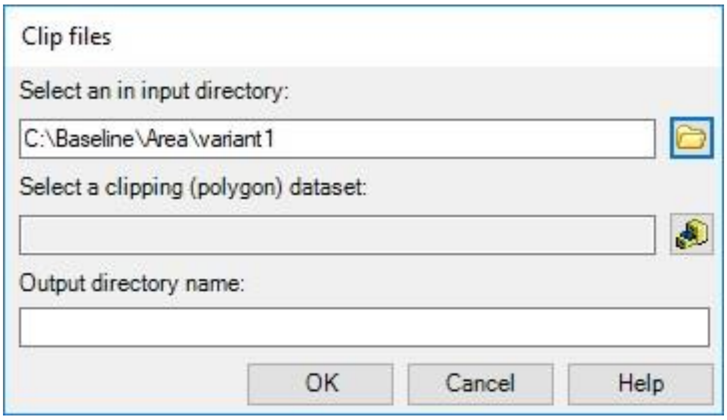
In this paragraph the following functions are described:

1. Clip
2. Erase
3. Assimilation of measure
4. Merge Land and Sea
5. Check variant/measure
6. Batch

4.4.1 *Clip*

Purpose:
This function clips all Feature Classes within the selected Baseline database. This function copies these cutouts to a new Baseline database. The Clip dataset can only be a polygon feature class inside a File Geodatabase.

The clip dataset might contain more then one clip polygons. If so, the dataset also must contain a field NAME in which the name of the output directory name (target Baseline directory) is defined.



Clip files

Select an in input directory: C:\Baseline\Area\variant1

Select a clipping (polygon) dataset:

Output directory name:

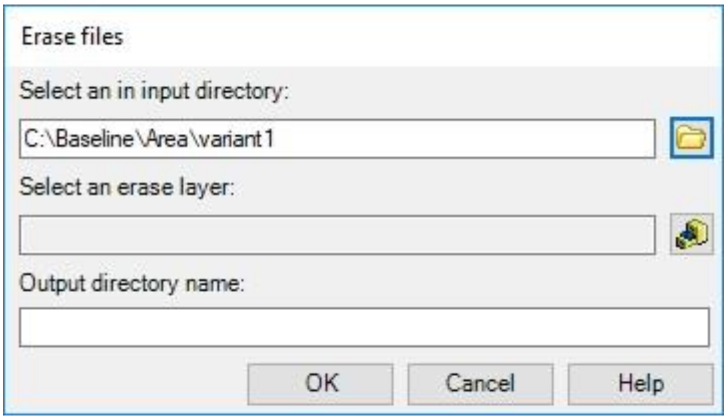
Figure 24: Clip tool

Explanation:
To use this function an input folder should be selected. This should be a Baseline variant or measure. Next a polygon featureclass in a File geodatabase should be selected. This featureclass contains one or more polygons defining the extent of the desired clip(s).
At last the name of the clipped variant/measure is given. This name cannot be the same as the input folder. If a multiple clip is performed a dummy name should be given for the output directory name.

The output(s) of this function is/are saved in the same folder as the input. In case of multiple clip polygons, for each clip polygon a Baseline directory is created with the name as defined in the field NAME.

4.4.2 *Erase*

Purpose:
With this function all features within a given polygon are erased from the input Baseline database.



Erase files

Select an in input directory:

C:\Baseline\Area\variant1

Select an erase layer:

Output directory name:

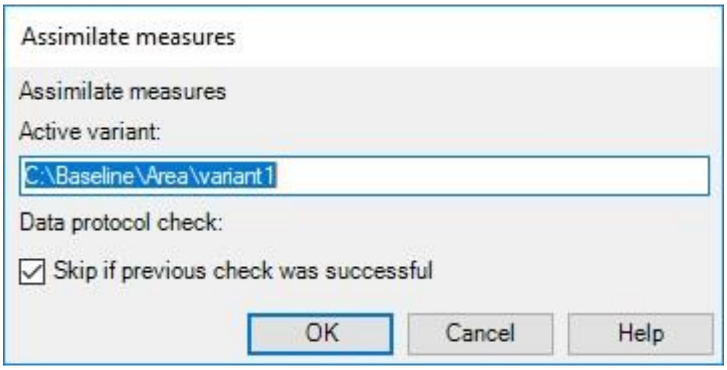
Figure 25: Erase tool

Explanation:
For use of this function an input folder should be selected. This should be a Baseline variant or measure. Next a polygon file should be selected. This file contains the extent of the desired erase. At last the name of the clipped variant/measure is given. This name cannot be the same as the input folder.

The output of this function is saved in the same folder as the input.

4.4.3 *Assimilate measures*

Purpose:
When performing "Assimilate measures" Baseline measures will be included in the active variant. These measures are defined in measure_list.txt in the folder metainfo/lists of the active variant.



Assimilate measures

Assimilate measures

Active variant:

C:\Baseline\Area\variant1

Data protocol check:

☑ Skip if previous check was successful

Figure 26: Assimilate measures tool

The measure_list.txt defines the location of the Baseline measures which should be included in the active variant. Each measure contains a folder metainfo\lists. This folder contains two files: append_list and erase_list. The erase_list.txt contains a list of polygons, indicating which areas should be erased from the active variant. Such a polygon is always called erase_<Feature Class>, where < Feature Class> is a Feature Class in the Baseline database in accordance with the Baseline protocol. Append_list.txt contains Feature Classes which should be included in the active variant after completing the erase_list.txt.

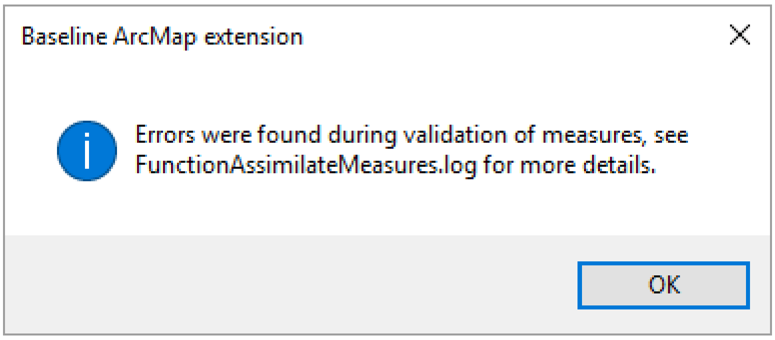
An exact description of all lists and Feature Classes is included in the Dataprotocol Baseline 6 .

Explanation:
User checks on the shown display if the correct active variant is set before clicking on "OK". After that the following validations are performed:

1. Presence of measure_list.txt in the active variant

2. Presence of the measure called in measure_list.txt
3. Presence of append- and eraselist.txt in metainfo/lists
4. Presence of all Feature Classes in measure and variant called in erase- and appendlist.txt.
5. Are the variant and measure listed in accordance with the protocol.

If any of the above points is not valid, an error message will appear:



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Errors were found during validation of measures, see FunctionAssimilateMeasures.log for more details.

Figure 27: Error during validation Assimilate measures

A direct reference to a log-file is given. The file is named FunctionAssimilateMeasures.log and is located in metainfo\Logs of the active variant.

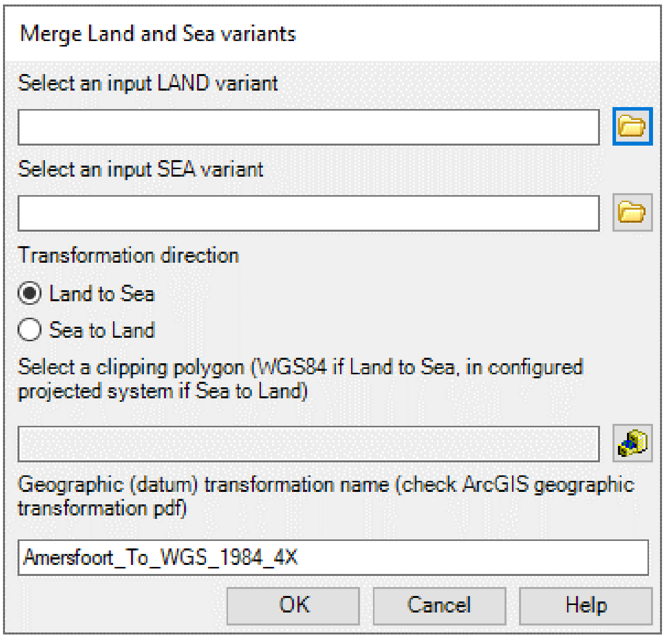
When all points are valid the assimilation of measures can be executed or aborted. When there is an error during the assimilation an error message is shown, which is also included in the log-file.

When the assimilation of measures is completed the message: Assimilate Measures completed is shown.

Action 5 includes checking the active variant and all included measures whether they meet all protocol requirements. This can take some time. To prevent this the user can check the variant and all measures before this function is performed. When this validation is completed successfully a log file is placed in metainfo\logs of the variant and measures with the last line containing “ProtocolCheck succeeded”. By checking checkbox “Skip when previous check was successful” these checks are skipped when a ProtocolCheck.log ends with “ProtocolCheck succeeded”. When this is not the case or no ProtocolCheck.log is present the database is checked.

4.4.4 *Merge Land and Sea*

Purpose:
This function is used to merge a “land” database and a “sea” database.



Merge Land and Sea variants

Select an input LAND variant

Select an input SEA variant

Transformation direction

● Land to Sea

○ Sea to Land

Select a clipping polygon (WGS84 if Land to Sea, in configured projected system if Sea to Land)

Geographic (datum) transformation name (check ArcGIS geographic transformation pdf)

Amersfoort_To_WGS_1984_4X

Figure 28: Merge land and sea variants

Explanation:
This function is used to merge a “land” database and a “sea” database. For instance the Rijn-Maasmonding model with the Northsea. When this is done it can be treated as a regular model.

- First a “land” and “sea” database must be selected. These databases are available at Deltares. There is a slight overlap (approximately 150 meters) between these databases in order to prevent nodata in the elevation_raster at the connection of both databases.
- Then a choice should be made which type of dataset the results should be. In other words: should the “land” dataset be converted to “sea” or the other way around.
- Moreover a clipshape should be selected defining the area of the target database which is partly overlapping with Baseline-Land and partly with Baseline-Sea. When the result is a “sea” database this shape must contain WGS84 coordinates.
- The last choice is a transformation (the default is ‘Amersfoort_To_WGS_1984_4X’). The geographic_transformations.pdf can be found in the Baseline install folder.

The vertical reference for Baseline-Land is NAP and for Baseline-Sea MSL (Mean sea Level). In Baseline the assumption is done that NAP is equal to MSL, therefore **no vertical transformation** is done when merging Land and Sea databases. Data from Rijkswaterstaat CIV show that in the coastal zone, where Baseline data are transferred from land to sea or vice versa, MSL and NAP differ only slightly (eg. less then 5 cm).

The function generates the following results:

1. Clipped land variant database, within the contours of the (projected) clipshape named <source land variant>_CLIPPED_sl (when the target database is a land database) or <source land variant>_CLIPPED_ls (when the target database is a sea database)
2. Clipped sea variant database, within the contours of the (projected) clipshape named <source sea variant>_CLIPPED_sl (when the target database is a land database) or <source sea variant>_CLIPPED_ls (when the target database is a sea database)
3. Projected version of Clipped land or sea variant database named <source sea variant>_CLIPPED_sl_PROJ (when the target database is a land database) or <source land variant>_CLIPPED_ls_PROJ (when the target database is a sea database)
4. Measure database of Projected version of Clipped land or sea variant database (result 3 converted to measure) named <source sea variant>_MEASURE (when the target database is a land database) or <source land variant>_MEASURE (when the target database is a sea database)

5. Merged land or sea variant database (result 4 assimilated in result 1 or 2) named <source land variant>_CLIPPED_sl (when the target database is a land database) or <source land variant>_CLIPPED_ls (when the target database is a sea database)

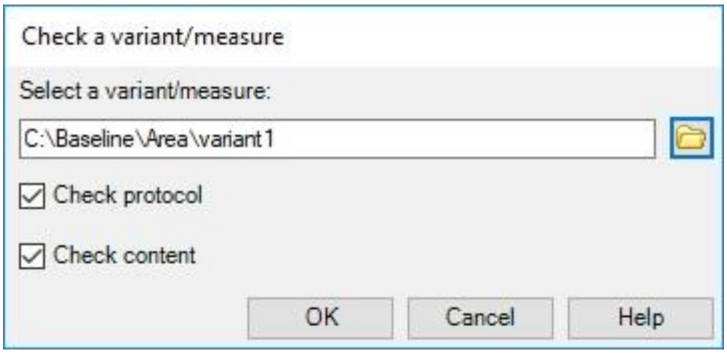
When a land database is converted to a sea variant the elevation_model_terrain is converted to 5x5m elevation_raster. In the resulting merged sea variant this raster is named elevation_raster_land and this raster is added to the mosaic dataset named elevation_mosaic.

When a sea database is converted to a land variant the elevation_raster is converted to points. In the resulting merged land variant these points are added to the elevation_model_terrain.

4.4.5 *Check a variant/measure:*

Purpose:
This function is used to perform two validations of a variant or measure:

1. Validation if a variant/measure complies with the protocol;
2. Validation of the content of the variant/measure.



Check a variant/measure

Select a variant/measure: C:\Baseline\Area\variant1

☑ Check protocol

☑ Check content

Figure 29: Check a variant/measure tool

Explanation:
With this function it is possible to perform two checks on variants and measures.

Check Protocol
The selected variant or measure is compared with the templates of Baseline. The result of this validation is saved in ProtocolCheck.log. When this validation is succesfull the log is ended with "ProtocolCheck succeeded". Attachement B presents the performed tests.

Check Content
The selected variant or measure is checked on content. All fields in the Baseline Database are revised where wrong or strange values are reported. The result of this validation is saved in ContentCheck.log in metainfo\logs. Attachement B presents the performed tests.

Note: These validations can take a very long time, especially checking if there are double points with deviating heights in the various Feature Classes.

4.4.6 *Batch*

Purpose:
The purpose of the batch function is to perform tasks in Baseline without the intervention of a person. This involves all functions available in Baseline. This allows a user to create inputfiles for hydrodynamic models from the beginning Baseline database through a number of tasks without the user needs to run the individual functions. These functions are performed automatically.

Explanation:
When starting the Batch function the following display will appear:

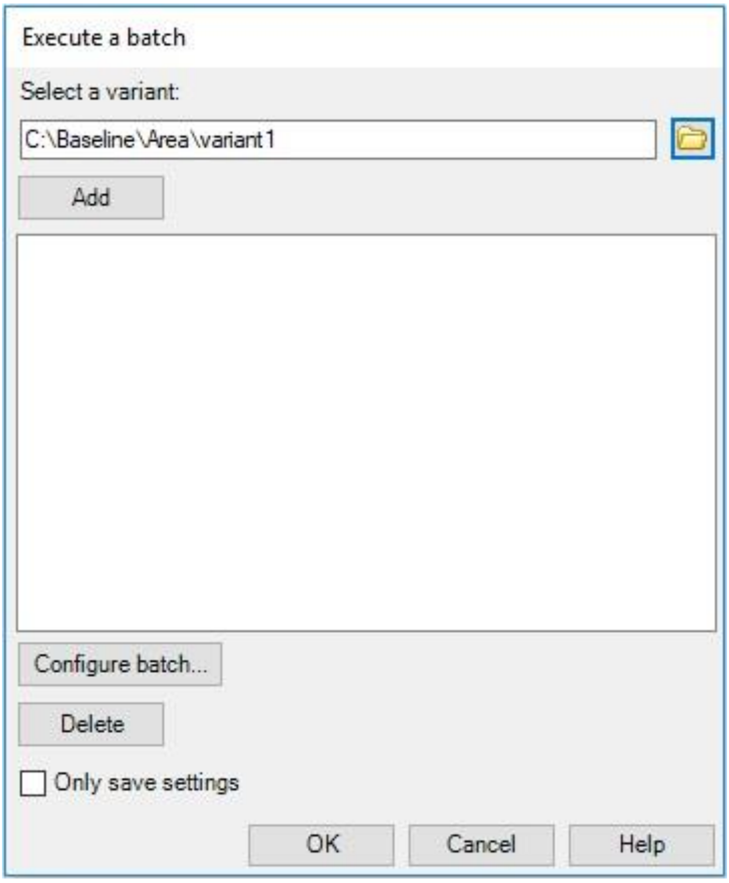
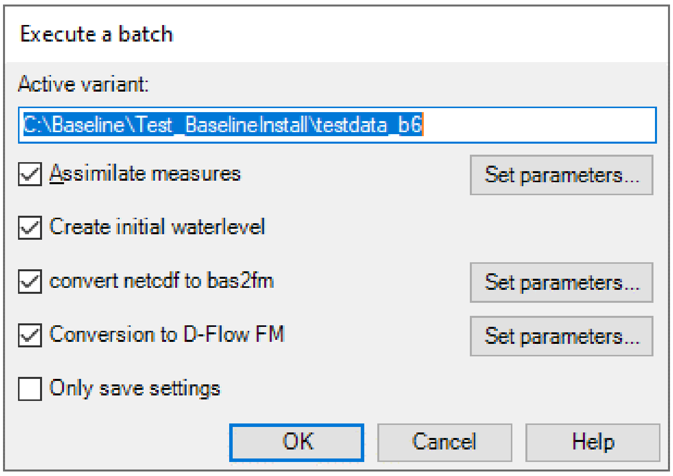


Figure 30: Batch tool

It is possible to add multiple variants with the “Add” button. When selecting a variant the properties of the batch can be set with “Configure Batch”.

Before it is possible to run the batch a number of lists should be created (as described in the Dataprotocol). The creation of these lists can be made manually but also automatically with use of the batch function. Exceptions are Assimilate measure which requires a measure_list.txt. This list should be made manually. Besides that the function Assimilate measures requires a list “assim_measures_params.txt” which indicated whether all measures should be checked again (False) or not (True) when these measures are checked earlier.

From the display “Configure Batch” can be clicked on “Set Parameters” this button will show the same display compared to when this function is performed manually.



Execute a batch

Active variant: C:\Baseline\Test_BaselineInstall\testdata_b6

☑ Assimilate measures

☑ Create initial waterlevel

☑ convert netcdf to bas2fm

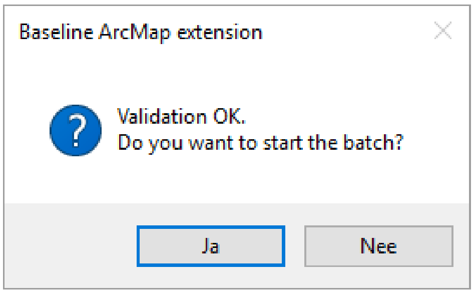
☑ Conversion to D-Flow FM

☐ Only save settings

Figure 31: Batch tasks

Note: When a variant does not contain lists these should be made via the button “Set Parameters” before a batch can be performed.

After setting parameters the message “Resulting Feature Class < Name> already exists. Do you want to overwrite?” can be shown, if applicable. The user indicates whether this is desired. After all functions are set all properties are validated and when this check is successful the batch can be started.



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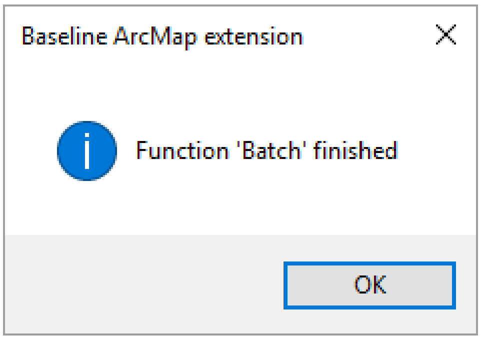
Validation OK.
Do you want to start the batch?

Figure 32: Batch validation OK

When only “Only save settings” is checked all lists are created and validated but the batch will not be started. This checkbox can be checked out by default by changing <add key="SaveBatchSettingsDefault" value="true" /> to <add key="SaveBatchSettingsDefault" value="false" /> in C:\Documents and Settings\<user>\Local Settings\Application Data\Baseline\Baseline.user.config’.

Whenn errors are detected during validation a message is displayed. When this is the case it is possible for the user to retrieve the error in the following log files: C:\Documents and Settings\<user>\Local Settings\Application Data\Baseline\Baseline.<user>.log’, FunctionBatch.log in directory metainfo\logs or in the log file of the regarding function.

When the validation succeeds and the Batch is completed, the following message is displayed:



Baseline ArcMap extension

Function 'Batch' finished

Figure 33: Function Batch finished

4.5 Advanced Tools

4.5.1 *Create Initial Waterlevel terrain*

Introduction

The Baseline 6 *Create Initial Waterlevel terrain* is a tool to create the Initial Waterlevel Conditions for a simulation with D-Flow Flexible Mesh (D-Flow FM). The tool has the same objective as the previously used function 'waqini'. However, this tool does not require a hydrodynamic model calculation. The (initial) water level is completely derived using the land/water boundary as stored in the Baseline database. The function does not work with sea-variants.

General method

The *initial_waterlevel_terrain* is derived from the *elevation_model_terrain* and information from *sections* en *landuse_polygons*.

From *sections* both section 1 and 2 polygons (river and banks) are selected together with the 'wet' *landuse_polygons* (roughness codes[1] 104, 105, 106, 201, 302, 303, 304). These polygons are merged and dissolved and the result is converted to a polyline, the 'water boundary'. The elevation of all vertices from this water boundary is determined using the *elevation_model_terrain*. This elevation represents the 'year average waterlevel' of the river and lakes in the floodplain (or more accurate the water boundary at the time the source data of these Featureclasses were collected). The resulting polylineZ is not a flat line so some smoothing/averaging is done:

- The elevation of the water boundary of the river (section 1 and 2) is smoothed using a smoothing routine which use a window average pointlist of 500 vertices. Before this smoothing is applied all vertices of the waterboundary within waterbodies are deleted. In this way no waterlevel is determined within connected waterbodies.
- The next step is to determine the elevation of the waterboundary of waterbodies which are not part of section 1 and 2. Therefore three separate routines are processed.
  - First a selection is made of isolated waterbodies, waterbodies with a single connection to the river or waterbodies with multiple connections to the river.
  - When waterbodies with multiple connections to the river are found these boundaries are used to update the waterboundary of section 1 and 2. With this routines multiple connected waterbodies are embedded into the smoothing routine of de waterlevel in the river.
  - When a waterbody is just connected to the river at one location the waterlevel of the start and end vertices of the waterboundary is retrieved at the connection. The highest value of these waterlevels is used for the waterlevel in the waterbody.
  - When a waterbody is not connected to the river the elevation of all vertices of isolated water bodies in the floodplain is averaged (median) to retrieve a single waterlevel.
- After the waterlevel within the model area is determined the waterlevel at the open water boundaries are determined. At these locations no water boundary is available so at these locations no accurate waterlevel can be derived form the *elevation_model_terrain.* To make the best possible assumption a boundary is determined. For this boundary a subdivision is

[1] Roughness code 102 is not taken into account as requested by Rijkswaterstaat

made for boundaries in a river or at sea. This is done based on the length of the boundary. Assumed is that when a boundary is less than 1000 meter it is a boundary in a river if longer it is a boundary at sea. A boundary at sea is given a value of 0 meter. For a boundary in a river the waterlevel is determined based on the elevation on the start en end of the boundary.

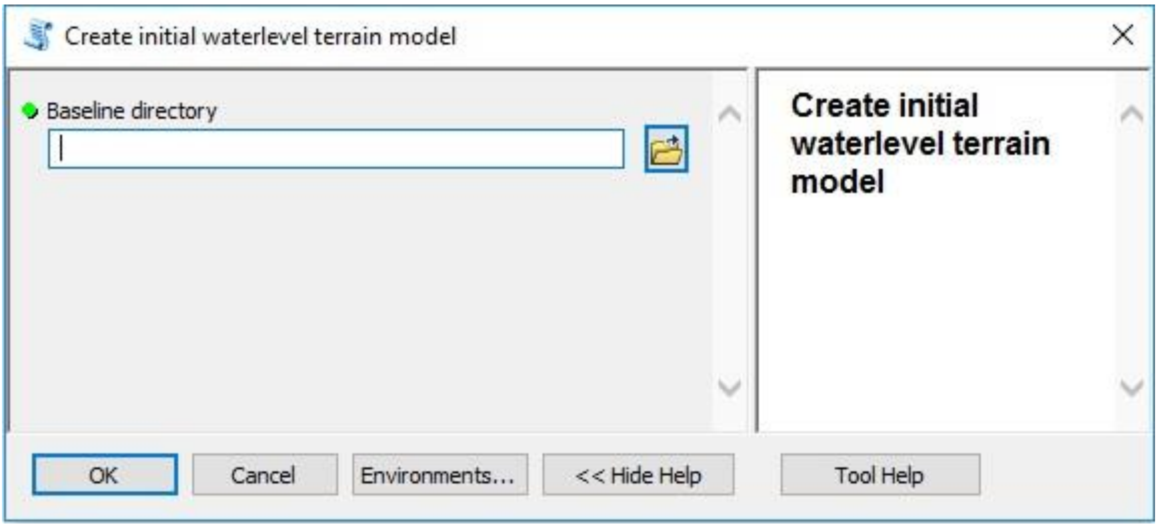
Using this ingredients the *water_level_terrain* is built. The terrain is still not a smooth water level, so after conversion to D-Flow FM a simulation should be run in order to derive a stable initial water level field. Because the *water_level_terrain* is based on the model geometry rather than on a simulation there is no direct relation between this water level terrain and a specific discharge. Also because of this shortcomings in the model geometry can result in an incorrect water_level_terrain.

Considering these knowledge still the *water_level_terrain* is a good starting point to derive a real initial state for a D-Flow FM model.

Comparison with waqini
Unlike waqini there is no real boundary condition associated with this water level terrain model, it serves as a starting point for simulations and approaches a bankfull situation. The accuracy of this waterlevel terrain model depends on the accuracy of the position of the land/water boundary in relation to the terrain elevation model, both stored in the Baseline database. As a result of inconsistencies between these two data sources the water level terrain model has no flat or slightly declining surface; it contains pits and spikes of water. A simulation is needed to level out these inconsistencies but the simulation needs less time to become stable because all water bodies are filled up already.

Environment
The tool is part of the Baseline 6 software package and cannot be used without Baseline 6 being installed. The tool runs on systems with ArcGIS 10.3.1 and higher.

Input
The tool uses a Baseline variant as input, additionally a suffix should be given for the name of the waterlevel terain model.



Create initial waterlevel terrain model

● Baseline directory

Create initial waterlevel terrain model

Figure 34: Input Initial Waterlevel tool

In the Baseline variant the following data should be present:

- Sections_polygons
- Roughness_polygons
- Elevation_model_terrain

Output

The tool generates the following data in de Feature dataset Models:

- Initial_water_level_terrain, the actual waterlevel terrain model
- Initial_water_level_input1, the elevation of the boundaryline of connected waterbodies
- Initial_water_level_input2, the elevation of the boundaryline section1/2 –section 3
- Initial_water_level_input3, the elevation of the open waterboundaries
- Initial_water_level_input4, the outer boundary of the waterlevel terrain model

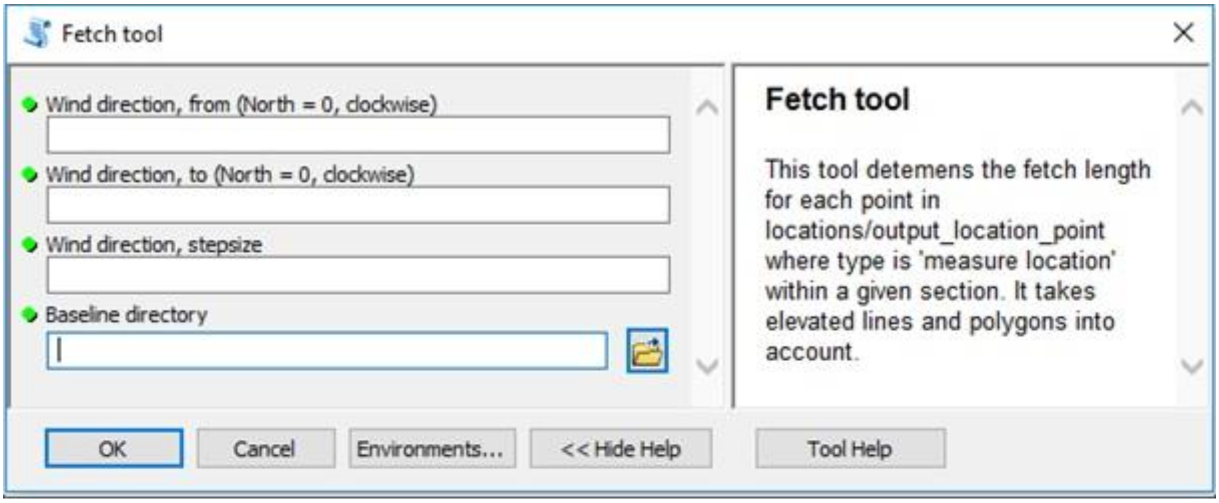
Points of attention

The operation of the tool is based on the elevation in the Elevation_model_terrain at the boundary of waterbodies; the boundary wet/dry. This boundary is present in Baseline databases describing the river domain of the Netherlands, eg. Rhine and Meuse. In models describing both river and sea domain (like the Rhine-Meuse estuary and the Southwestern Delta) in the sea part of the domain the boundary wet/dry is not present at the western borders of the domain. As a result no waterlevel can be determined from the Baseline data in this part of the domain. The waterlevel at the sea is therefore set on 0 meter.

Also, when there is a discrepancy in the geometry of *sections* and the *elevation_model_terrain* (eg. a *terrain_edge_3d_line* representing a shoreline in *elevation_model_terrain* is not situated at the boundary between section 1 or 2 and 3) the resulting *initial_water_level_terrain* will not show a smooth surface.

This tool does not work on Baseline sea variants.

4.5.2 *Fetch tool*



Fetch tool

This tool detemens the fetch length for each point in locations/output_location_point where type is 'measure location' within a given section. It takes elevated lines and polygons into account.

Figure 35: Fetch tool

The Baseline 6 Fetch tool is a tool that enables the user to calculate the so-called *fetch* at a location.

The fetch is the distance over which the wind can blow to a certain location. This distance is a parameter for the calculation of wave height. The fetch is restricted by dykes and flood free areas.

The fetch is calculated by the following method (Technische Adviescommissie voor de Waterkeringen, 1985).

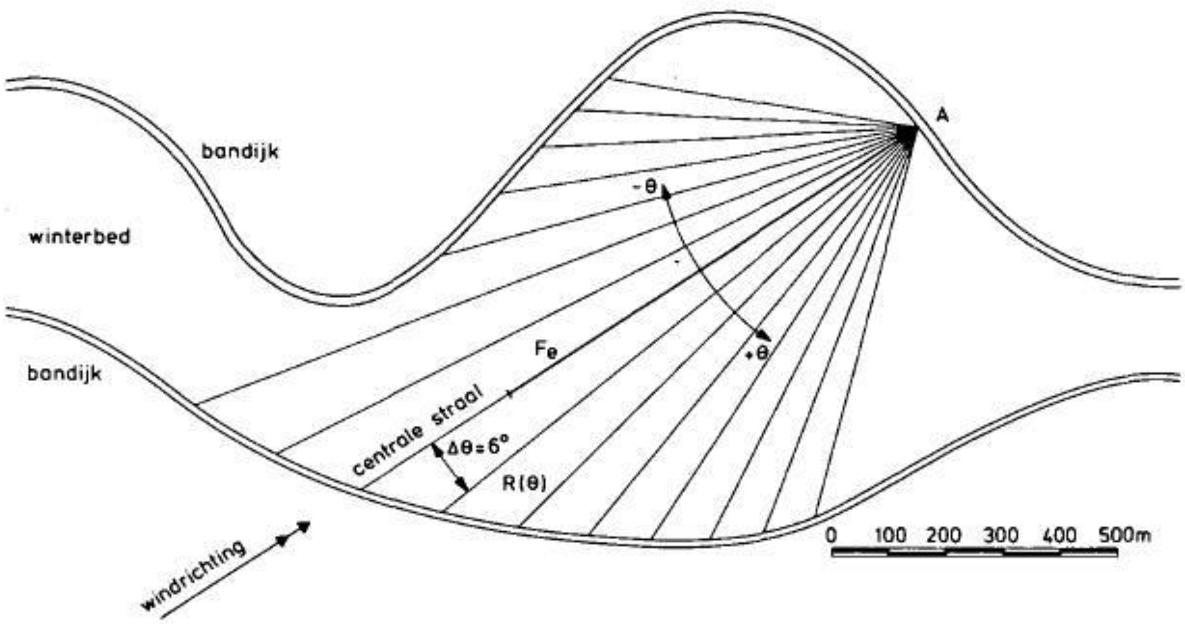


Figure 36: Fetch calculation in tool

For every wind direction an array of fetch transects is created in steps of 6° from the wind and a maximum angle of 42° on both sides. This gives a total of 15 fetch transects: one in the wind direction and seven on either side.

Using the angle and length of the transects, the effective fetch is calculated with the following formula:

$$F_e = \frac{\sum R(\theta)\cos^2(\theta)}{\sum \cos\theta}$$

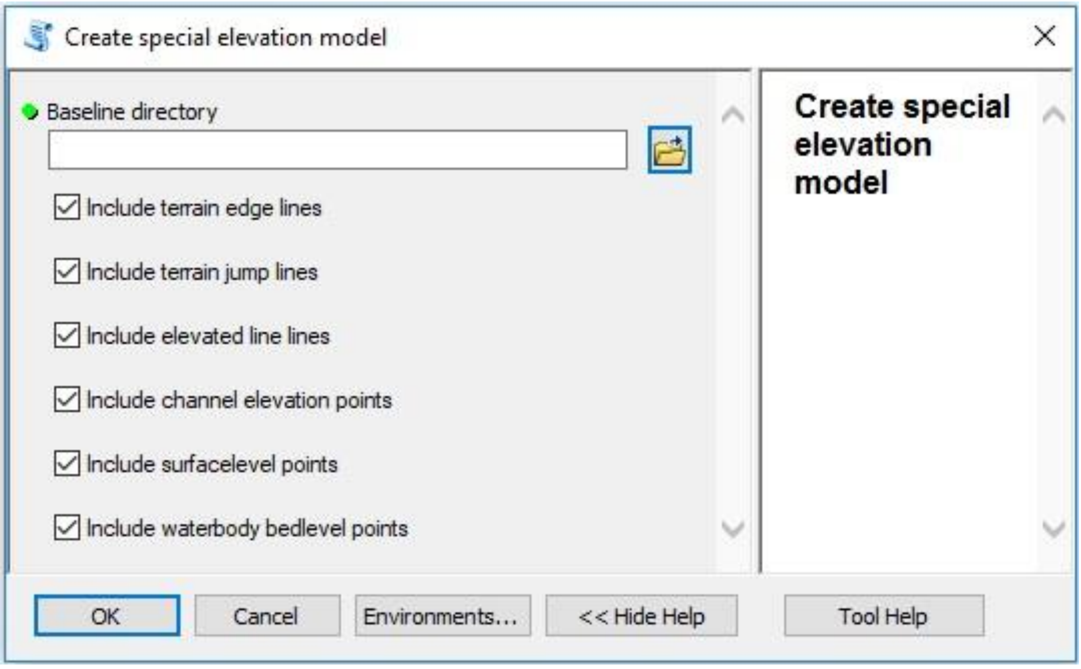
Where F_e is the effective fetch, R is the length of the transect and θ is the angle to the wind direction.

An example is showed in the following table (taken from (Technische Adviescommissie voor de Waterkeringen, 1985)).

θ [graden]	$\cos(\theta)$	$\cos^2(\theta)$	$R(\theta)$ [m]	$R(\theta)\cos^2(\theta)$	
-42	0.743	0.552	520	287	De effectieve strijklengte, Fe volgt uit: $F_e = \frac{\sum R(\theta)\cos^2(\theta)}{\sum \cos(\theta)}$ $F_e = \frac{11220}{13.512} = 830 \text{ m}$
-36	0.809	0.654	570	373	
-30	0.866	0.750	640	480	
-24	0.914	0.835	720	601	
-18	0.951	0.904	830	750	
-12	0.978	0.956	1340	1281	
-6	0.995	0.990	1240	1228	
0	1.000	1.000	1140	1140	
6	0.995	0.990	1050	1040	
12	0.978	0.956	980	937	
18	0.951	0.904	920	832	
24	0.914	0.835	880	735	
30	0.866	0.750	830	623	
36	0.809	0.654	780	510	
42	0.743	0.552	730	403	
$\sum\cos(\theta) = 13.512$		$\sum R(\theta)\cos^2(\theta) = 11220$			

4.5.3 *Create Special Elevation model*

Introduction
The Special elevation model tool is built to provide functionality for Baseline users to build custom elevation models with different elevation data as input, including the ones that are not available in the standard Baseline application (weirs and groynes).



Create special elevation model

Baseline directory

☑ Include terrain edge lines

☑ Include terrain jump lines

☑ Include elevated line lines

☑ Include channel elevation points

☑ Include surfacelevel points

☑ Include waterbody bedlevel points

Create special elevation model

Figure 37: Create special elevation model tool

Environment
The tool is part of the Baseline 6 software package and cannot be used without Baseline 6 being installed. Therefore, the same systems requirements as for Baseline 6 have to be met.

Input
The tool uses a Baseline variant as input, the function does not work with sea-variants. The user chooses which elevation data to include in the resulting model.

Output
The tool generates a file geodatabase in the /data/source folder, named special_elevationmodel_<<datum>>_<<time>>.gdb. In this database, a feature dataset hoogtemodel is stored with 3D-lines, an area file (dissolved secties) and the elevation model.

It is decided not to include these datasets in the general baseline.gdb database, as these files do not comply with the Baseline dataprotocol.

Note that there can be some, local differences between the Baseline elevation model and the model generated with this tool. Effort has been put into optimizing the method to resemble the standard Baseline method as close as possible. Further optimizations are planned.

For conversion to hydrodynamic models, the original Baseline data and models have to be used. The elevation model resulting from running this tool is only to be used for visual inspection.

This tool does not work on Baseline sea variants.

4.5.4 *Baseline 5 to Baseline 6 converter*

The Converter translates Baseline 5 references, variants and measures to Baseline 6. References and variants can be converted on their own while a measure is converted with respect to underlying measures and the underlying reference. In the last section of this paragraph, more details are given on the converter.

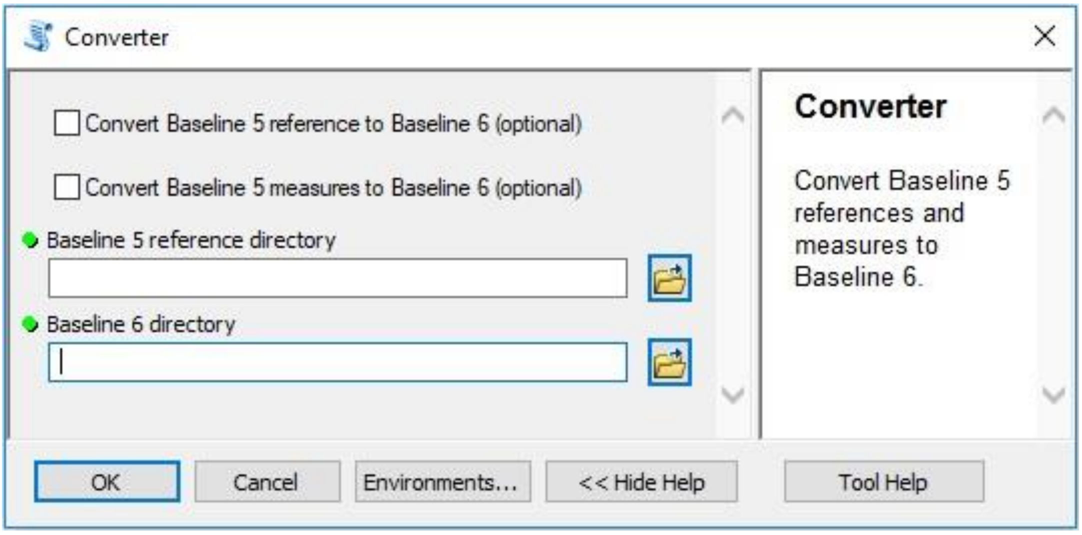
Step 1: Prepare your Baseline 5 data
There are some important things to consider before using the converter

- Make sure all Baseline 5 data is correct and valid. Data which does not comply with the Baseline 5 data protocol can give unexpected results when converting to Baseline 6.
- Make sure there is enough disc space available to store the Baseline 6 data. The Baseline 6 data will use about the same amount of disc space as Baseline 5.
- It is advised to make a backup of all Baseline 5 data, before using the converter.

Step 2: Run the converter

1. Open the 'Baseline 6' ArcToolbox. The dialogue box (Figure 38) of the converter opens

Note: It is strongly recommended to run the converter in ArcCatalog while no variants or measures are loaded in ArcMap at the same time. Otherwise, problems with file-locking are expected to occur.


Converter
□ Convert Baseline 5 reference to Baseline 6 (optional)
□ Convert Baseline 5 measures to Baseline 6 (optional)
Baseline 5 reference directory
Baseline 6 directory
OK
Cancel
Environments...
<< Hide Help
Tool Help

Converter

Convert Baseline 5 references and measures to Baseline 6.

Figure 38: Interface of the Converter tool.

2. The first checkbox 'Convert Baseline 5 reference to Baseline 6 (optional)' is used when a Baseline reference or variant has to be converted.

3. The second checkbox 'Convert Baseline 5 measures to Baseline 6 (optional)' is used when Baseline has to convert one ore more measures.

4. In the field 'Baseline 5 reference directory', browse to an input folder which holds the Baseline 5 reference. The measure-list in this reference will be used to locate the Baseline 5 measures which needs to be converted. **NOTE: the convertor only performs well when relative pathnames are used in this measure-list.**

5. In the field 'Baseline 6 directory', browse to a folder in which your Baseline 6 data will be stored. When a reference is converted, the converter will place the Baseline 6 reference in this directory. The converter will create a directory called 'measures_baseline6' in this folder. All converted measures will be stored in the 'measures_baseline6' directory in the same tree-structure as before in Baseline 5.

6. Click OK. The conversion starts.

The duration of the conversion depends strongly on the size of the reference and measures. A reference plus a set of 200 measures can take up to 12 hours to complete. During conversion, a log will be written to the directory indicated at the 'Baseline 6 directory'-field of the converter interface

Step 3: Validate the results
When the converter has finished, two more steps are required. At first, it is recommended to check the results of the converter manually by checking the log-file. Secondly, one might be required to make manual changes to the converted data. This paragraph explains these steps.

Reading the log-file
The log-file is located in the directory provided in the 'Baseline 6 directory'-field of the converter interface. Each time the converter is used, a new log-file is created.

Check the following lines in the log-file:

- When the converter has finished, the last line of the log-file should read 'INFO: Finished in XX hours, XX minutes and XX seconds.
- No lines with the label 'ERROR' should appear in the log. When they do appear, a description of the error is given in the log.
- Pay attention to lines labeled 'WARNING', in some cases they point to changes that have to be made manually. See the next paragraph for more information.

Manual changes to the converted data
In two cases, the Baseline 6 Feature Classes contains more detailed information about features than Baseline 5. In those cases, the converter will transfer the features from Baseline 5 to Baseline 6, and use default values for certain fields. The log-file indicates which fields in which feature classes have to be enriched manually after the converter has finished.

The following feature classes/fields need to be enriched manually after conversion:

- In Feature Class 'locations/output_locations_points', the field 'SORTING' has to be filled manually. The default value is NULL.
- In Feature Class bridge_points, the fields 'NAME', 'NUMBER' and 'CP' have to be filled manually. The default value for CP is -999, the others have NULL as the default value. These fields are only used in export to D-HYDRO, see the manuals of D-HYDRO for more information about these fields.

Inner workings of the converter
The main reason for the introduction of Baseline 6 is the development of a next generation of models, based on D-HYDRO Suite. This requires new export formats for the data, managed by Baseline. Furthermore, there is the need to store more detailed information in Baseline, for example bridge pillars and - in the future - river morphology of the river bed.

The introduction of Baseline 6 is also used to improve the existing data model using experience and knowledge gained over the past years. The biggest change in the existing data is the removal of derivative files for roughness's, weirs and elevation. Finally, the new data model of Baseline 6 uses English terminology instead of Dutch.

The aim of the converter is to convert Baseline 5 data to Baseline 6 automatically, without manual changes. Due to the big difference in the data model, especially those regarding roughness, the converter performs a complex operation to ensure a smooth transition from Baseline 5 to Baseline 6. This chapter explains the main difference between Baseline 5 and 6 and discusses the inner workings of the converter.

Main differences between Baseline 5 and Baseline 6
Besides the transition from Dutch terminology to English, there are 6 important differences between Baseline 5 and Baseline 6. These are briefly described below.

1. Removal of weirs as derivative file and the introduction of weirs as basic-file. In Baseline 5 there were 2 basic files containing weirs: *kades* and *kribben*. After assimilation of measures, both files were combined into one derivative file called *overlaten*. In Baseline 6, both types of weirs are stored in the same weirs file, which removes the need of a derivative file.
2. Adding bandijken to both terrain_edges_lines (teenhoogte) and elevated_lines/weirs (kruinhoogte)
3. Removing *lanen* and put those trees as individual trees in roughness_points, together with trees (bomen).
4. Combining ecotopen_ruwheid, plassen and hoogwatervrij_vlakken with roughness code (ruwheidscode) 1 to roughness_poly. This removes the need for a derivative file for roughnesses.
5. Moving hoogwatervrij_vlakken with roughness code (ruwheidscode) 2 to flowblocking_polygons.
6. Moving hoogwatervrij_vlakken with roughness code (ruwheidscode) 3 to bridges_points
7. Removing hoogtemodel as derivative file and introducing elevationmodel_terrain which is automatically created after assimilation of measures.
8. A straightforward combination of similar data types into one file. Each of the following Baseline 6 files has a field called 'type' indicating the Baseline 5 source file.
    a. Combining *oeverhoogtes* and *winterbedhoogtes* into landelevation_points.
    b. Combining *meetpunten*, *uitvoerlocaties*, and *rivierkilometer_punten* into output_location_points.

The conversion process
For most files (feature classes) and erase covers the converter simply moves the data from Baseline 5 to Baseline 6. Table 1 gives an overview of the conversion on file (feature class) level. In the six cases mentioned above, the converter performs a more complex operation, which all happen automatically and without user intervention.

Table 1: Conversion of Baseline 5 to Baseline 6 on file (Feature Class) level.

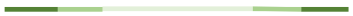
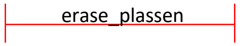
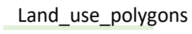
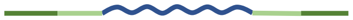
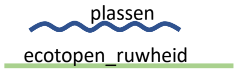
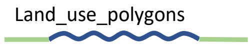
Baseline 6	Baseline 5
FDS Elevation	
terrain_edge_3d_lines	breuklijnen_routes /bandijken_routes (toe)
elevation_model_terrain	hoogtemodel (not transferred but newly build during conversion)
bedlevel_points	zomerbedhoogtes
surfacelevel_points	winterbedhoogtes, oeverhoogtes
waterbody_bedlevel_points	plashoogtes
terrain_jump_3d_routes	hoogteverschillijnen_routes
elevated_line_routes	kades, kribben, bandijken_routes (crest)
model_area_polygon	Dissolve(models/sections_poly)
FDS Locations	
cross_section_lines	rivierkilometer_lijnen
source_sink_points	bronnen_putten
output_location_points	meetpunten, uitvoerlocaties, rivierkilometer_punten
structure_lines	kunstwerken

bridge_routes bridge_points	*New, no data is transferred to this Feature Class* hoogwatervrij_vlakken (ruwheidscode 3)
FDS Roughness	
land_use_lines	heggen
land_use_points	bomen, lanen
land_use_polygons	hoogwatervrij_vlakken (huwheidscode 1), ecotopen_ruwheid, plassen
FDS Metadata	
measure_contour_polygons	omtrek_maatregel
FDS Models	
branch_1d_lines	rivierassen
calibration_section_input_polygons	zomerbed
calibration_section_polygons	*New, no data is transferred to this Feature Class*
cross_section_1d_polygons	*New, no data is transferred to this Feature Class*
flow_blocking_polygons	hoogwatervrij_vlakken (ruwheidscode 2)
flow_blocking_lines	hoogwatervrij_lijnen
initial_water_level_terrain	*New, no data is transferred to this Feature Class*
section_polygons	secties
FDS Morphology	
D50_points	*New, no data is transferred to this Feature Class*
dredging_polygons	*New, no data is transferred to this Feature Class*
suppletion_polygons	*New, no data is transferred to this Feature Class*
bed_characteristics_input_polygons	*New, no data is transferred to this Feature Class*
bed_characteristics_polygons	*New, no data is transferred to this Feature Class*

Conversion to land_use_polygons
The conversion of ecotopen_ruwheid, plassen and hoogwatervrij_vlakken with ruwheidscode 1 to land_use_polygons is a complex operation which dictates the overall working of the converter. In Baseline 5, removing an open water body (plas) requires an erase_plassen. However, in Baseline 6 it requires the definition of a new (ecotopen) roughness. When assimilating such a measure in Baseline 5, the Baseline 5 application would remove the open water body and put back the ecotopen_ruwheid as defined by one of the previous measures of reference in the area of the former open water body. To convert such a measure, the converter needs to mimic this Baseline 5 assimilation process in order to create the new ecotopen_ruwheid for the measure. This process is further explained in Table 2. The described method or conversion dictates that a measure can only be converted in context of the underlying/previous measures and reference.

Conversion of erase covers
Erase covers are translated to Baseline 6 as well. Regarding the combination of erase covers for combined files (e.g. the erase cover for terrainjumps, which is a combination of the erase covers for hoogteverschillijnen and bandijken), the converter creates one new Baseline 6 erase cover that only removes the features as intended in Baseline 5. This results in an erase cover with very small polygons around the features that need to be removed, leaving other features untouched.

Table 2: Schematization of conversion to roughness_poly in Baseline 6

		In the field	**Baseline 5**	**Baseline 6**	**Converter**
		This column describes the changes in the field which are schematized in Baseline.	This column describes the way in which Baseline 5 is handling the changes in schematization.	This column describes the way in which Baseline 6 is handling the changes in schematization.	This column describes the actions carried out by the converter to convert measures from Baseline 5 to Baseline 6.
← time	Measure 2	The open water body is muted. Vegetation around the open water body remains untouched. 	An erase_plassen indicated which open water bodies (plassen) needs to be erased.  	A new vegetation is defined on the location of the former open water body.  	The converter is placing the most recent vegetation from previous measures and reference back in land_use_polygons at the extent of erase_plassen. In this particular case this will be the vegetation of measure 1 for the surrounding of the open water body. For the open water body itself the vegetation of the reference is taken.
	Measure 1	An open water body is being dug and the vegetation around the open water body is changed. 	An open water body is schematiszed in plassen, new vegetation is schematized in ecotopen_ruwheid.  	Open water body and new vegetation is schematized using land_use_polygons.  	The converter merges plassen and ecotopen_ruwheid to land_use_polygons.
	Reference		A vegetation is present in ecotopen_ruwheid. 	A land_use_polygons with vegetation is present. 	The converter copies all data from ecotopen_ruwheid to land_use_polygons.

4.5.5 *Convert a 6.1 gdb to 6.3 gdb*

This tool is not present in the Baseline toolbar but can be run from the Arctoolbox BaselineTools\Advanced Toolset\ Convert a 6.1 gdb to 6.3 gdb.
The tool must be used to update the datamodel of older Baseline 6 databases. In Baseline 6.3 some new features are added to the datamodel and this tool adds these features in Baseline databases.

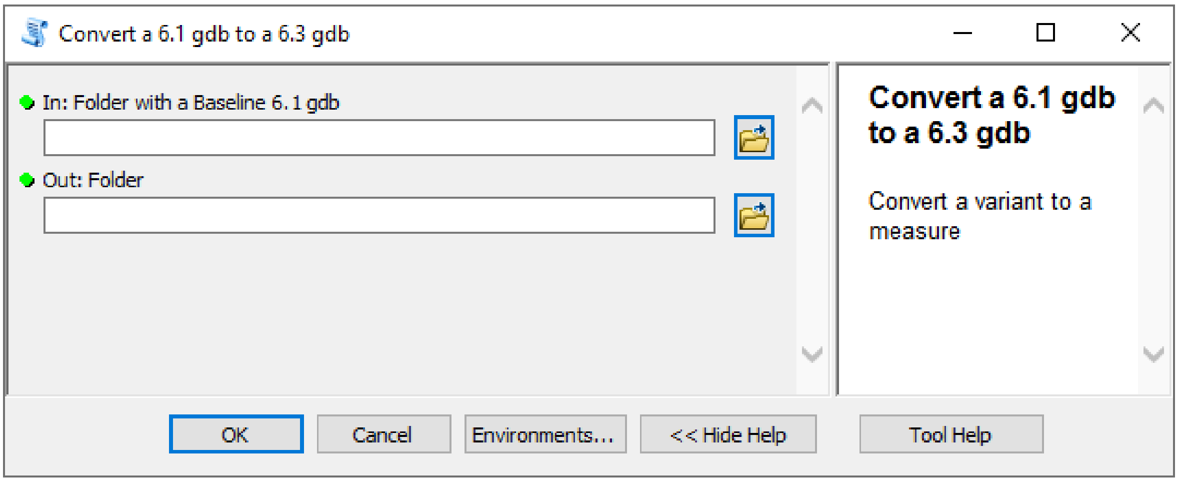

Convert a 6.1 gdb to a 6.3 gdb
In: Folder with a Baseline 6.1 gdb
Out: Folder
Convert a 6.1 gdb to a 6.3 gdb
Convert a variant to a measure
OK
Cancel
Environments...
<< Hide Help
Tool Help

Figure 39: Convert a 6.1 gdb to 6.3 gdb

Parameters:

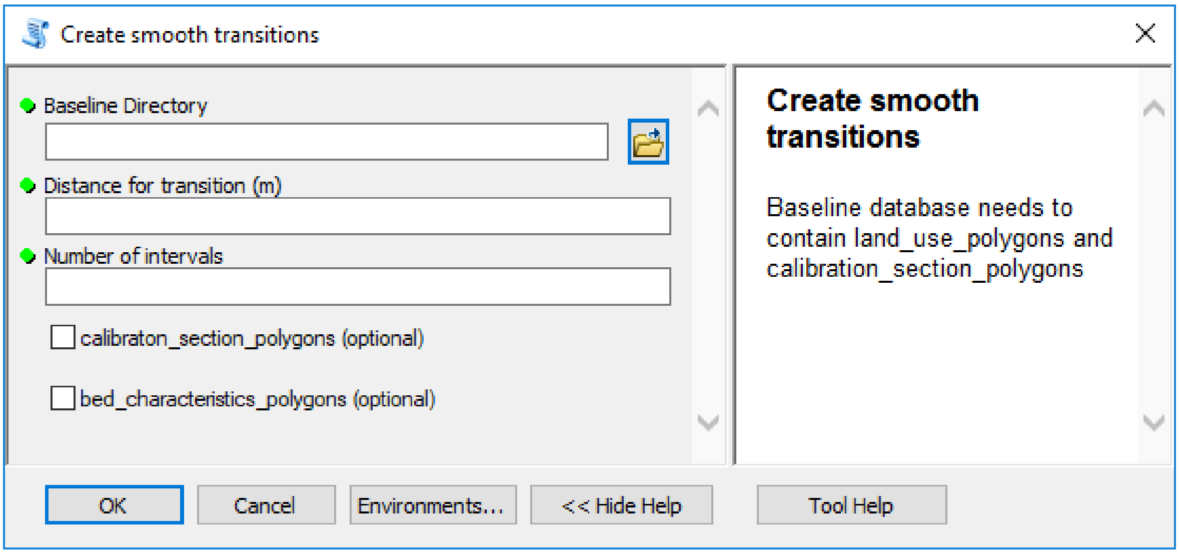
- In: Folder with a Baseline 6.1 gdb;
- Out: Folder where an updated copy of the input measure or variant is placed.

Remark:
After conversion new/altered attribute fields are available in the updated database. However these fields are not filled in, that should be done by the user.
Exception is the field SORTING in various locations_layers; If a field SORTING2 already is present in the Featureclasses the conte nt of this field is copied into the altered field SORTING.

4.5.6 *Create Smooth Transitions*

Purpose of the tool:
Both *calibration_section_input_polygons* and *bed_characteristic_input_polygons* contain information on hydraulic roughness in longitudal direction of the main channel of the river. The polygons in these Featureclasses result, after conversion to D-Hydro input files, in discrete (abrupt) transitions in the hydraulic roughness of the main channel. Especially morphological models are sensitive to abrupt transitions. In order to prevent this the tool generates smaller stepwise transitions between two adjacent polygons. As a result the D-Hydro input files contain smoother transitions in main channel roughness.

This tool creates *calibration_section_polygons* or *bed_characteristic_polygons* with smooth transitions using the feature class *calibration_section_input_polygons* or *bed_characteristic_input_polygons* and the field *Transition*. If *bed_characteristic_input_polygons* is not present in the Baseline database this Featureclass is derived from *land_use_polygons* selecting all polygons with Roughness_code > 1999.


Create smooth transitions

● Baseline Directory

● Distance for transition (m)

● Number of intervals

□ calibraton_section_polygons (optional)

□ bed_characteristics_polygons (optional)

Create smooth transitions

Baseline database needs to contain land_use_polygons and calibration_section_polygons

Figure 40: Create Calibration Section Polygons

When *Calibration_section_input_polygons* is input the tool will create the featureclass *models\calibration_section_polygons* with two calibration codes and two calibration fractions for each polygon to make the transition. The interval must be an odd number (integer). Bas2fm converts *calibration_section_polygons* to <model name>*_calibration_sections.cll*.

When *Bed_characteristic_input_polygons* is input the tool will create the featureclass *morphology\bed_characteristic_polygons* with two roughness codes and two roughness fractions for each polygon to make the transition. The interval must be an odd number (integer).

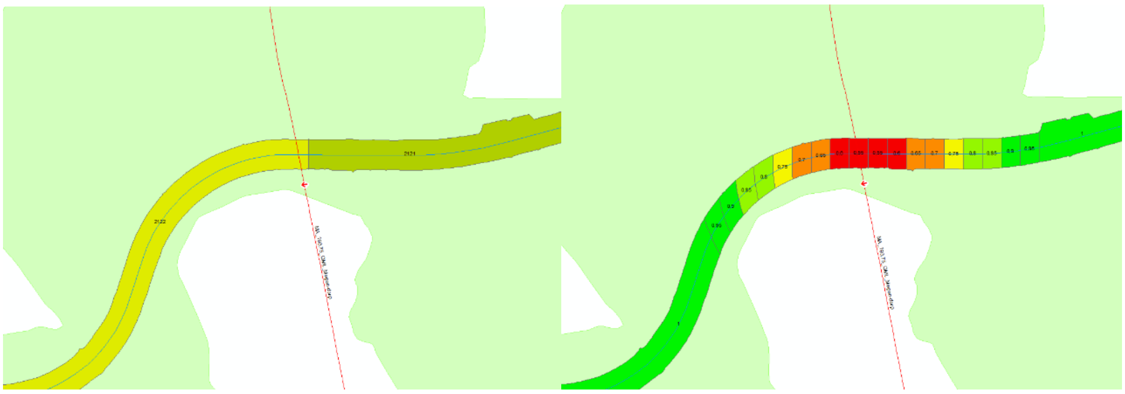
When *Bed_characteristic_input_polygons* is not present *bed_characteristic_input_polygons* is derived from *land_use_polygons* selecting all polygons with Roughness_code > 1999. The resulting featureclass *morphology\bed_characteristic_polygons* with two roughness codes and two roughness fractions for each polygon to make the transition. The interval must be an odd number (integer).

Bas2fm converts *bed_characteristic_polygons* to *<model name>_trachitopes.arl* by updating *land_use_polygons* within the main channel.

Both the *Calibration_section_input_polygons* and *Bed_characteristic_input_polygons* featureclass should not contain fixed layers and boundaries between polygons must lay between maximum two adjacent polygons. At bifurcations the polygon boundaries must be positioned downstream of the bifurcation at a distance of at least half the distance for the transition.

The tool will not give valid results when complex geometries are used.

The picture below gives an impression of the result (left calibration_section_input_polygons, right calibration_section_polygons).



The CALIBRATION_FRACTION1 is plotted from 0.5 (red) to 1 (green). The calibration code will flip in the middle of the transition.
The tool will give a warning when a smooth transition is given where a calibration section input polygon does not span the whole width of a channel but will create this transition anyway.

4.6 Models

This paragraph describes the following functions:

1. Convert NetCDF to BAS2FM input
2. Conversion to D-Flow Flexible Mesh
3. Conversion to SWAN

It is mandatory to perform tool 1 before tool 2 can be executed. This is only the case when tool 1 is never used to convert the NetCDF that is to be used for the conversion tot D-Flow Flexible Mesh.

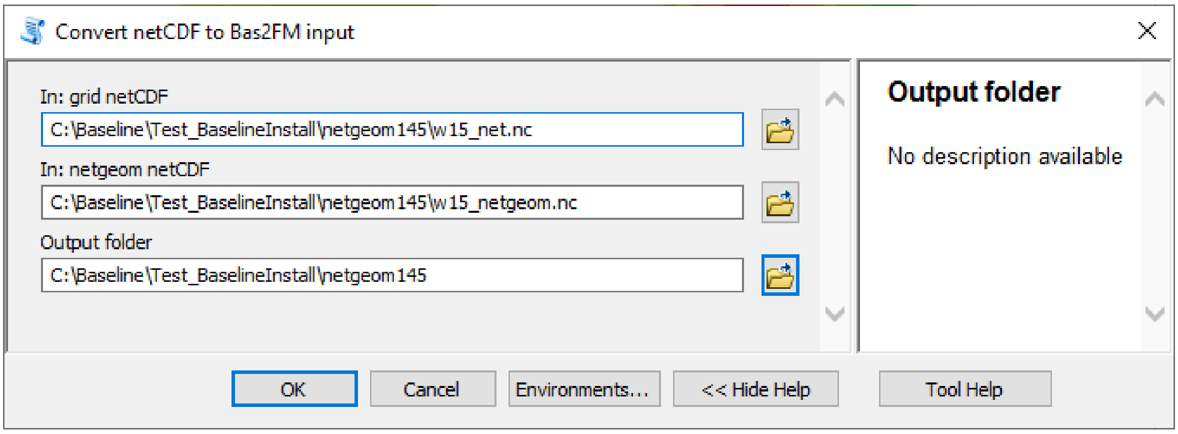
4.6.1 *Convert NetCDF to BAS2FM input*

Before the Conversion to D-Flow Flexible Mesh can be run, as described in next paragraph, the relevant netCDF’s (<>.net and <>.netgeom) should be translated to GIS Featureclasses in order to project some of the geometrical data in the Baseline database on the netCDF.

The resulting Featureclasses are stored in a file geodatabase with the same name as the netCDF.

Warning: The following characters are not allowed in file- and folder names (see also https://docs.microsoft.com/en-us/windows/win32/fileio/naming-a-file).
Use any character in the current code page for a name, including Unicode characters and characters in the extended character set (128–255), except for the following:
< (less than)
> (greater than)
: (colon)
" (double quote)
/ (forward slash)
\ (backslash)
| (vertical bar or pipe)
? (question mark)
* (asterisk)
Integer value zero, sometimes referred to as the ASCII NUL character.

Each time a conversion is run using the same netCDF’s (<>.net and <>.netgeom) this file geodatabase also can be used. In this is the case it is not needed to perform this tool every time a conversion to D-Flow FM is carried out.



Convert netCDF to Bas2FM input

In: grid netCDF
C:\Baseline\Test_BaselineInstall\netgeom145\w15_net.nc

In: netgeom netCDF
C:\Baseline\Test_BaselineInstall\netgeom145\w15_netgeom.nc

Output folder
C:\Baseline\Test_BaselineInstall\netgeom145

Output folder

No description available

Figure 41: 4.6.1 Convert NetCDF to BAS2FM input

Parameters:

- In: Grid netCDF ➔ the netCDF (created by D-HYDRO / rgfgrid) storing the grid. A copy of this file will be placed in the output directory. Therefore output directory and the location of the grid-file cannot be the same;
- In: netgeom netCDF ➔ (created in D-HYDRO, see below for procedure). This file will not be altered by Bas2FM; it is only used as input to create the trachytope files;
- Output folder; folder where the resulting file geodatabase is stored. This can be the same folder where the netCDF and netgeom netCDF are located.

Five Featureclasses are created:

- depth_fm;
- face_depth_fm;
- faces_fm;
- flownet_fm;
- ZonalFC.

ZonalFC is a featureclass containing the representative zones surrounding the nodes in featureclass depth_fm and are derived using Thiessen polygons around the nodes.

If one or more Feature classes are missing the conversion to D-flow Flexible Mesh cannot be done. If this is the case than the Convert NetCDF to BAS2FM input tool has to be executed again.

During the conversion of the NetCDF it is possible that a warning is presented about the absence of a coordinate system in het NetCDf. This an result in a incorrect conversion because for instance some intersections cannot be made. When no coordinate system is present RD_NEW is assumed.

To fix this it is needed to execute the following steps:

1. Open D-HYDRO Suite (version 2021.01 or higher);
2. Create a new Flow Flexible Mesh Model (*Project1 > New Model*);
3. Add an coordinatesytem to the Flow Flexible Mesh Model (General>Coordinate System);
4. Load a Grid (Right Mouse Button on *Grid* > Import and browse to grid-file);
5. Double click on “Grid”, RGFGRID is opened;
6. Export the new grid via File>Export>UGrid;
7. Close the D-HYDRO Suite.

4.6.2 *Conversion to D-Flow Flexible Mesh*

Bas2FM is a module for Baseline 6 that enables the user to convert Baseline 6 data to input for D-HYDRO Suite / D-Flow FM.

It uses the Baseline 6 database in conjunction with FM grids (netCDF-files) to create required D-Flow FM model input files. The tool does not create a fully functional D-Flow FM model model.

Warning: when large grids are used the computational time is extensive due to some elaborate GIS operations. For example the conversion of the RhineMeuse model (RMM) takes about 36 hours.

Before Bas2FM can be used it should be installed according to the Baseline 6 Installation Manual (WSP, 2022).

Baseline database to D-Flow FM model input files

The main tool (figure 42) to be used for conversion from Baseline 6 to D-Flow FM model input data is incorporated in the Baseline 6 toolbar. Other functions are available in the separate ArcToolbox. How these tools can be activated is also described in the Baseline 6 installation manual.

In figure 42 the main tool is presented. This tool is used for conversion from Baseline 6 to D-Flow FM model input data. The tool consist of multiple parameters of which some are **mandatory**:

Parameters:

- **In: Baseline directory ➔ A Baseline variant tree (e.g. C:\Baseline\maas\j15_5-v1)**
- **In: Model name ➔ extension of all model files. (e.g *maas15*);**
- **In: NETCDF GDB ➔ the GDB (created by Convert NetCDF to BAS2FM input) storing the GIS Featureclasses of the netcdf and netgeom relevant for the bas2fm conversion;**
- **In: Grid netCDF ➔ the netCDF (created by D-HYDRO / rgfgrid) storing the grid. A copy of this file will be placed in the output directory. Therefore output directory and the location of the grid-file cannot be the same;**
- **In: netgeom netCDF ➔ (created in D-HYDRO, see below for procedure). This file will not be altered by Bas2FM; it is only used as input to create the trachytope files;**
- In: model boundary (optional) ➔ polygon feature class. If one is entered, only Baseline data intersecting these polygons will be converted (no clipping will occur);
- Use cdf enclosure if present ➔ if the netCDF contains an enclosure container, this can be used as a clip-boundary. If both model bounds and cdf enclosure are selected, the combined polygon will be used. If neither one is selected, all Baseline data will be converted.
- Convert checkboxes ➔ depending on presence of required feature classes in the selected Baseline database, the available conversion options are shown;

Output:

- Output dir containing FM input files:
  <baseline dir>/models/dflowfm/<<model name>>

- boundary_conditions
- computatons
- general
- geometry
    - sources_sinks
        - <model name>_sources_sinks.pli
        - <model name>_<name1>.pli
        - <model name>_<name2>.pli
        - Etc…
    - structures
        - <model name>_structures.pli
        - <model name>_<name1>.pli
        - <model name>_<name2>.pli
        - Etc…
    - output_locations
        - <model name>_0_all_obs.xyn
        - <model name>_1_kilometer_obs.xyn
        - <model name>_2_output_obs.xyn
        - <model name>_3_measurement_obs.xyn
        - <model name>_4_boi_obs.xyn
        - <model name>_5_100m_obs.xyn
        - <model name>_6_20m_obs.xyn
        - <model name>_7_obs.xyn
        - <model name>_8_obs.xyn
        - <model name>_9_obs.xyn
        - <model name>_10_obs.xyn
        - <model name>_11_obs.xyn
        - <model name>_12_obs.xyn
        - <model name>_13_obs.xyn
        - <model name>_14_obs.xyn
        - <model name>_15_obs.xyn
        - <model name>_16_obs.xyn
        - <model name>_17_obs.xyn
        - <model name>_18_obs.xyn
        - <model name>_19_obs.xyn
        - <model name>_20_obs.xyn
    - cross_sections
        - <model name>_0_all_crs.pli
        - <model name>_1_kilometer_crs.pli
        - <model name>_2_output_crs.pli
        - <model name>_3_measurement_crs.pli
        - <model name>_4_calibration_crs.pli
        - <model name>_5_crs.pli
        - <model name>_6_crs.pli
        - <model name>_7_crs.pli
        - <model name>_8_crs.pli
        - <model name>_9_crs.pli
        - <model name>_10_crs.pli
    - <model name>_fxw.pliz
    - <model name>_thd.pli
    - <model name>_dry.pol
    - <model name>_enc.pol
    - <model name>_net.nc
    - <model name>_trachytopes.arl
    - <model name>_calibration.cll
    - <model name>_bridges.pliz
    - <model name>_initial_water_level.xyz
    - <model name>.gdb

            - *Gdb files*
        - {Other files which are not created with Bas2FM}
    - initial_conditions
    - metainfo
    - rtc
- <baseline_dir>\metainfo\logs\bas2fm.log. The log-file with Bas2FM-conversion history. New log-information is appended to the file. Subsequent runs are separated by the following line:

  ```
  =============================================================
  ==
  ```

The used methods to create this output are described in Appendix C.

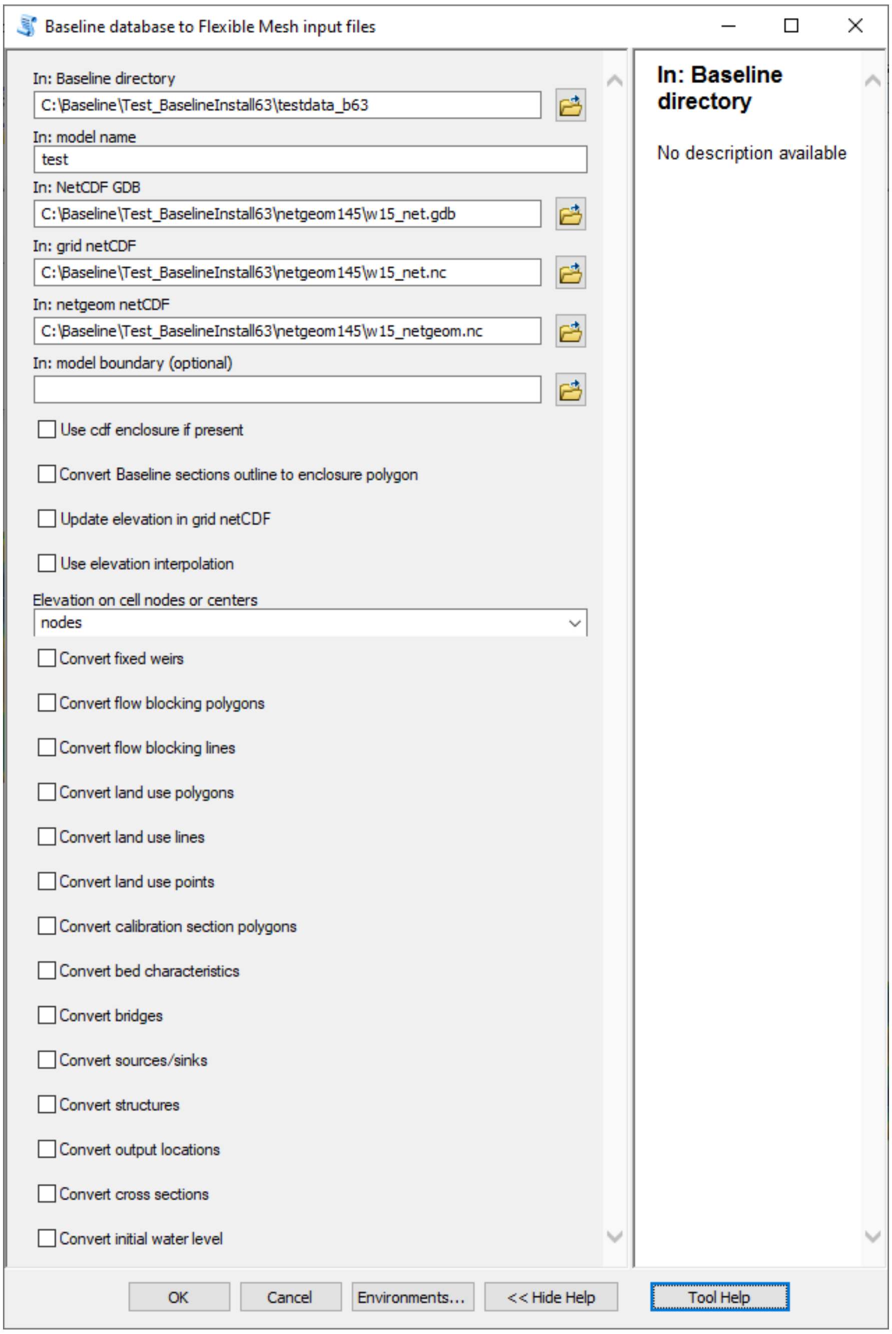
Partial conversion

Sometimes it is not necessary to convert an entire Baseline database to D-Flow FM. For example if in a variant only elevated_lines are modified compared to the reference then a conversion of only fixed weirs has to be done, all other FM input files remain the same. Bas2fm facilitates partial conversion and this reduces the conversion time considerably.

However, because some Featureclasses are combined in the FM input files it is necessary to check these combinations when a partial conversion is done. The following combinations should be used:

1. *trachytopes.arl > land_use_polygons, land_use_lines, land_use_points* and *bed_characteristics_polygons*[2]
2. *dry areas.pol > section_polygons* and *flow_blocking_polygons*

[2] bed_characteristics_polygons only must be used when smooth transitions in the main channel are required



Baseline database to Flexible Mesh input files

In: Baseline directory
C:\Baseline\Test_BaselineInstall63\testdata_b63

In: model name
test

In: NetCDF GDB
C:\Baseline\Test_BaselineInstall63\netgeom145\w15_net.gdb

In: grid netCDF
C:\Baseline\Test_BaselineInstall63\netgeom145\w15_net.nc

In: netgeom netCDF
C:\Baseline\Test_BaselineInstall63\netgeom145\w15_netgeom.nc

In: model boundary (optional)

□ Use cdf enclosure if present

□ Convert Baseline sections outline to enclosure polygon

□ Update elevation in grid netCDF

□ Use elevation interpolation

Elevation on cell nodes or centers
nodes

□ Convert fixed weirs

□ Convert flow blocking polygons

□ Convert flow blocking lines

□ Convert land use polygons

□ Convert land use lines

□ Convert land use points

□ Convert calibration section polygons

□ Convert bed characteristics

□ Convert bridges

□ Convert sources/sinks

□ Convert structures

□ Convert output locations

□ Convert cross sections

□ Convert initial water level

In: Baseline directory

No description available

Figure 42: Baseline database to D-Flow FM model input files

How to create a netgeom file

8. Open D-HYDRO Suite (version 2021.01 or higher)
9. Create a new Flow Flexible Mesh Model (*Project1* > *New Model*)
10. Load a Grid (Right Mouse Button on *Grid* > Import and browse to grid-file)

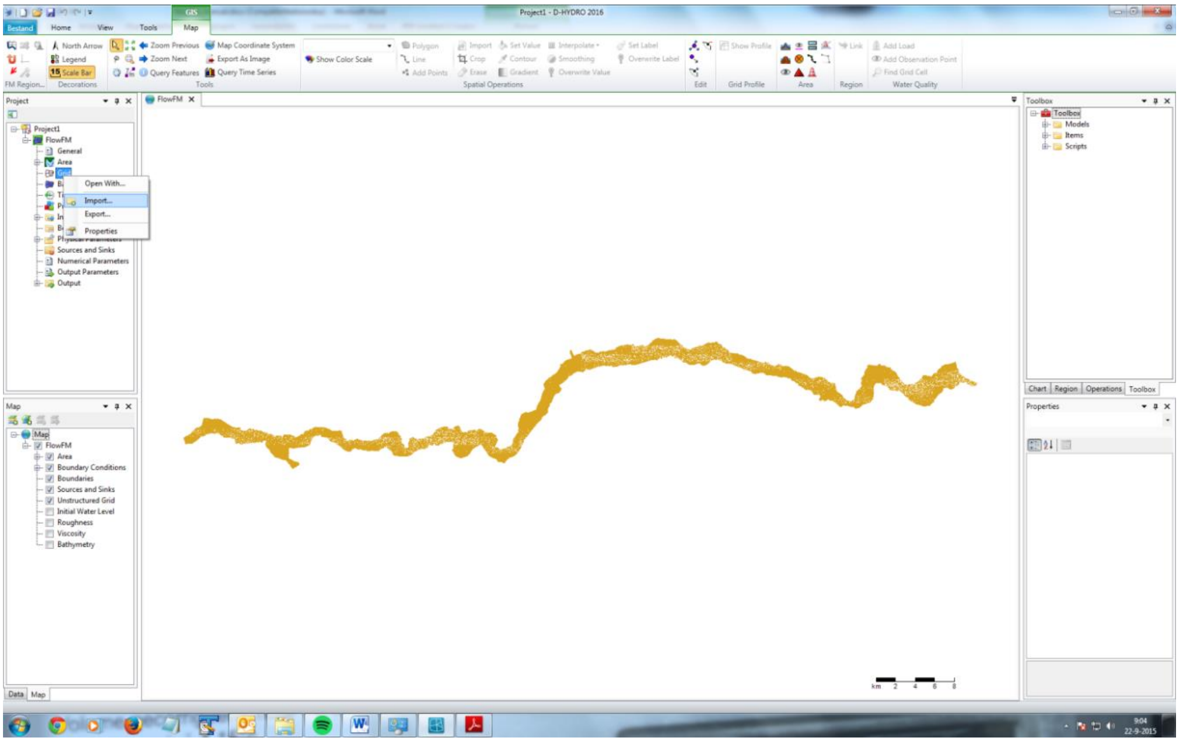


Figure 43: Import grid file

11. Right Mouse Button on imported grid > select *Export*

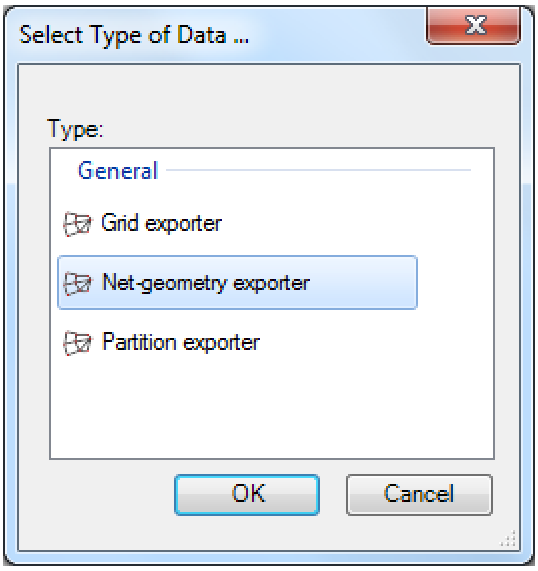


Figure 44: Grid exporter. Select Net-geometry exporter.

12. Store ZIP-file
13. Extract ZIP-file to desired location: the netgeometry file has the same name as the input grid, added with *_netgeom.*

D-HYDRO Suite can be closed now.

Convert polyline or polygon to landboundaries-file

Tool to create .ldb files which can be used as landboundaries-file in D-HYDRO suite. This tool can be added as ArcToolbox, see installation manual.

4.6.3 *Conversion to SWAN*

Goal:
The function "Conversion to SWAN" converts data from the Baseline database to inputfiles for SWAN.

Explanation:
The function "conversion to SWAN" uses the active variant. This should be set by the user. There are several possibilities for SWAN input, three of these are mandatory:

1. The Model name is the identification which is used as prefix for SWAN input files.
2. At "Select SWAN inputfile" the user selects a <>.swn inputfile. This file should be located in a SWAN schematization directory. This directory should be made with the Baseline application. This directory is used for writing the SWAN inputfiles.

After this some properties of the grid are shown.

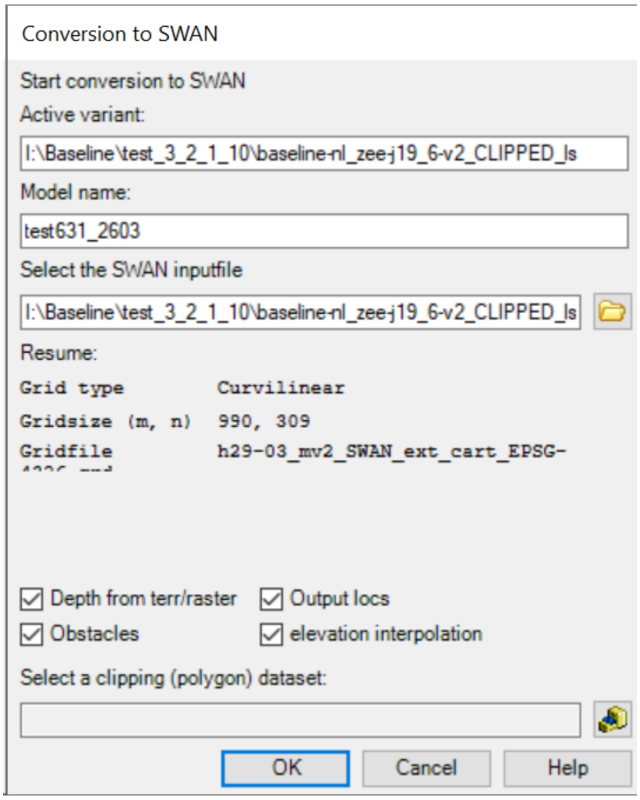
Next to these properties the user can define which inputfiles should be generated. The available check-boxes are automatically checked if the necessary files are present in the Baseline database of the active variant. This selection can be undone. Only selected features will be converted.

3. Depth form terrain/raster: Is a representation of the elevation at the elevationpoints. These are the elevationpoints of the SWAN grid. These are written to *<model name>\geometry\<model name>.bot*.
4. Obstacels: Obstacles/fixed weirs consists of lines/routes and points/events. When this checkbox is selected *<model name>.fxw* is created. This file represents weirs as line elements with relative height on the pointlocations. Different types of line elements are incorporated:
    a. Elevated_line_routes (containing primary dikes, summer dikes and groynes)
    b. Terrain_jump_3d_routes (containing terrain_jumps)
    c. Flow_blocking_polygons, these will become non floodable elements (elevation 999m)
    d. Flow_blocking_lines, these will also become non floodable elements (elevation 999m)
5. Output_locs: output_locations, these are written to *<model name>\geometry\output_locations\<model name>_<location type>_obs.pnt*.
6. Elevation interpolation: instead of the default method of determining the elevation (using "LINEAR" interpolation for land-databases and "BILINEAR" interpolation for sea-databases) at the locations of rooster_bp_punten in rooster.gdb gridcell averaging (zonal statistics MEAN) is used within the polygons of rooster_bp_vlakken in rooster.gdb. This might give a better representation of for example the bathymetry of smaller tidal channels. For this option the Spatial Analist extension is required.

Finally a featureclass containing a modelboundary clip polygon can be defined to "clip" the swan input files using a model boundary (output_locations are not clipped).

The result of the conversion to SWAN is written to the folder geometry in the folder *<model name>*. However the inputfiles are written in several directories, see the data protocol.

The converted files are placed on location on the SWAN model name (gridcells and crossings of links) and can now be used as input for SWAN models.



Conversion to SWAN

Start conversion to SWAN

Active variant:

I:\Baseline\test_3_2_1_10\baseline-nl_zee-j19_6-v2_CLIPPED_ls

Model name:

test631_2603

Select the SWAN inputfile

I:\Baseline\test_3_2_1_10\baseline-nl_zee-j19_6-v2_CLIPPED_ls

Resume:

```
Grid type          Curvilinear
Gridsize (m, n)    990, 309
Gridfile           h29-03_mv2_SWAN_ext_cart_EPSG-
```

☑ Depth from terr/raster ☑ Output locs

☑ Obstacles ☑ elevation interpolation

Select a clipping (polygon) dataset:

Figure 45: Conversion to SWAN model

A part of the converted files is also converted back to a Feature Class. The purpose of this is that the user can do a visual check in ArcGIs whether the conversion from Baseline to SWAN is done properly. Alle files converted to a Feature Class are being saved in the database *Invoer.gdb*. This database can be found in the directory input in *models/SWAN/<model name>/geometry*. After conversion these files are automatically added to the Table Of Contents (TOC) using default layers.

4.7 Help

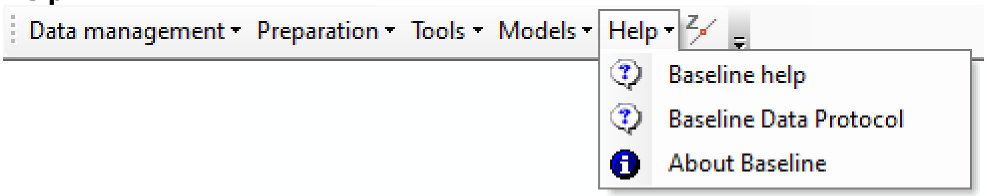


Figure 46: Help in Baseline

In this paragraph the following function are discussed:

1. Baseline Help
2. Baseline Data Protocol
3. About Baseline

4.7.1 *Baseline help*

Goal:
With this function this document is opened in a PDF-reader (if it is installed). Otherwise the pdf can be opened via the explorer in an internet browser.

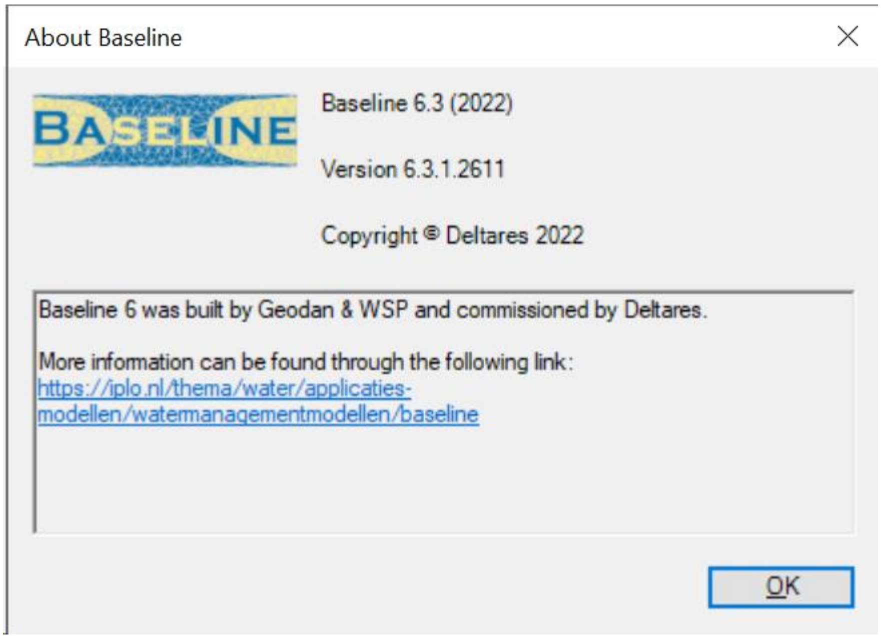
Note: This document is also opened with the help-buttons of other Baseline functions.

4.7.2 *Baseline Data Protocol*

Goal:
With this function this document is opened in a PDF-reader (if it is installed). Otherwise the pdf can be opened via the explorer in an internet browser.

4.7.3 *About Baseline*

Goal:
This function shows the versionnumber of the application.



Baseline 6.3 (2022)

Version 6.3.1.2611

Copyright © Deltares 2022

Baseline 6 was built by Geodan & WSP and commissioned by Deltares.

More information can be found through the following link:
https://iplo.nl/thema/water/applicaties-modellen/watermanagementmodellen/baseline

Example: The version number of Baseline, in this case: 6.3.0.2512.

4.8 Identify 3D line vertices

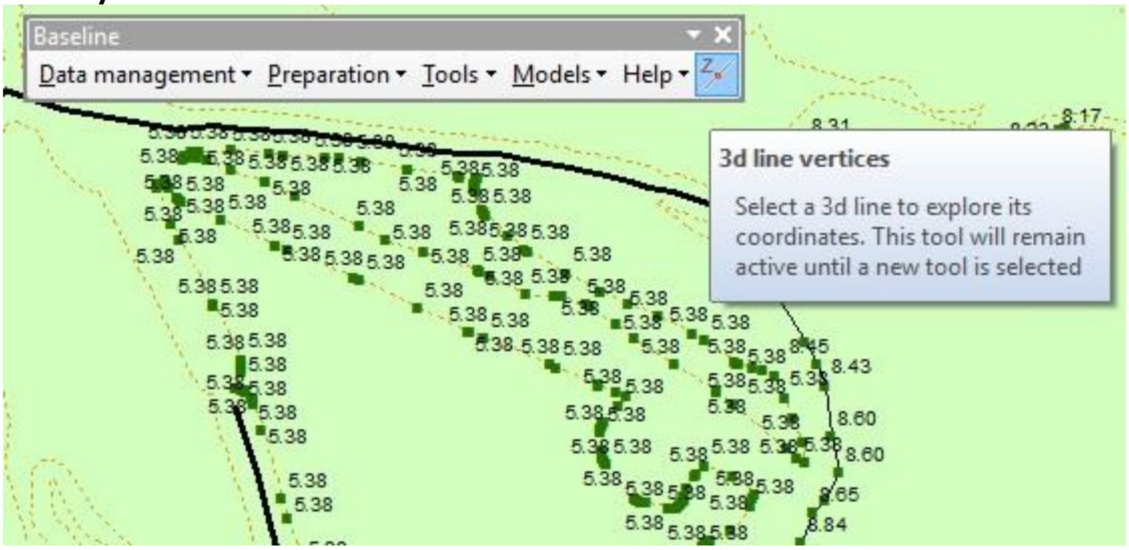

Baseline
Data management
Preparation
Tools
Models
Help
3d line vertices
Select a 3d line to explore its coordinates. This tool will remain active until a new tool is selected

Figure 47: Help in Baseline

Goal:
With this function 3D lines in a Baseline database can be examined on their Z-value.

The function “Identify 3D line vertices” uses the active variant and only works for terrain_edge_3d_lines and terrain_jump_3d_routes. After activating the button a new temporary layer “vertexCoordinates” is added to the TOC and the cursor changes into a cross. Using this cross a box can be drawn, this will reveal the vertices of all visible 3D lines overlapping this box and show the Z-coordinate. More boxes can be drawn subsequently by activating the button.
Do not remove this temporary layer “vertexCoordinates”, after removal this function will no longer work.

5 References

- Dataprotocol Baseline 6.3. WSP, 2023.
- Installation Manual Baseline 6.3 WSP, 2023.

Appendices

Appendix A: Baseline database and files

Location in database	Feature Class/file
	elevation_mosaic (sea_variant)
	elevation_raster (sea variant/measure)
	elevation_raster_land (merge sea variant)
	bridge_events
	elevated_line_events
	terrain_jump_3d_events
Baseline.gdb/Elevation	terrain_edge_3d_lines
	elevation_model_terrain
	bedlevel_points
	surfacelevel_points
	waterbody_bedlevel_points
	terrain_jumps_3d_routes
	Elevated_line_routes (not included in elevation_model_terrain)
	model_area_polygon
Baseline.gdb/Locations	Bridge_routes/events
	cross_section_lines
	Source_sink_points
	output_location_points
	structure_lines
Baseline.gdb/Roughness	land_use_lines
	land_use_points
	land_use_polygons
Baseline.gdb/Metadata	measure_contour_polygons
Baseline.gdb/Models	branch_1d_lines
	calibration_section_input_polygons
	calibration_section_polygons
	Cross_section_1d_polygons
	flowblocking_lines
	flowblocking_polygons
	Initial_water_level_terrain
	section_polygons
Baseline.gdb/Morphology	D50_points
	dredging_polygons
	suppletion_polygons
	bed_characteristics_input_polygons

Location in database	Feature Class/file
	bed_characteristics_polygons
Models/dflowfm/<model name>/geometry/	<model name>_landboundaries.ldb
	<model name>_net.nc
	<model name>_fxw.pliz
	<model name>_dry.pol
	<model name>_thd.pli
	<model name>_trachitopes.arl
	<model name>_calibration.cll
	<model name>_bridges.pliz
	<model name>_initial_water_level.xyz
Models/dflowfm/<model name>/geometry/ sources_sinks/	<model name>_sources_sinks.pli <model name>_<name1>.pli <model name>_<name2>.pli Etc…
Models/dflowfm/<model name>/geometry/ structures/	<model name>_structures.pli <model name>_<name1>.pli <model name>_<name2>.pli Etc…
Models/dflowfm/<model name>/geometry/ output_locations/	<model name>_0_all_obs.xyn <model name>_1_kilometer_obs.xyn <model name>_2_output_obs.xyn <model name>_3_measurement_obs.xyn <model name>_4_boi_obs.xyn <model name>_5_100m_obs.xyn <model name>_6_20m_obs.xyn <model name>_7_obs.xyn <model name>_8_obs.xyn <model name>_9_obs.xyn <model name>_10_obs.xyn <model name>_11_obs.xyn <model name>_12_obs.xyn <model name>_13_obs.xyn <model name>_14_obs.xyn <model name>_15_obs.xyn <model name>_16_obs.xyn <model name>_17_obs.xyn <model name>_18_obs.xyn <model name>_19_obs.xyn <model name>_20_obs.xyn
Models/dflowfm/<model name>/geometry/ cross_sections/	<model name>_0_all_crs.pli <model name>_1_kilometer_crs.pli <model name>_2_output_crs.pli <model name>_3_measurement_crs.pli <model name>_4_calibration_crs.pli <model name>_5_crs.pli <model name>_6_crs.pli <model name>_7_crs.pli

Location in database	**Feature Class/file**
	<model name>_8_crs.pli <model name>_9_crs.pli <model name>_10_crs.pli
Models/dflowfm/<model name>/geometry/ <model name>.gdb	Depth_fm
	Flownet_fm
	Flownet_fm_roughpoly
	Flownet_fmroughnessline
	Flownet_fmruwpoint
	Enclosure_fm
	Initial_waterlevel_fm
Models/swan/<model name>	<grid>.swn <grid>.grd <grid>.rgf
Models/swan/<model name>/geometry/	<model name>.bot
	<model name>.fxw
Models/swan/<model name>/geometry/output_locations	<model name>_0_all_obs.xyn <model name>_1_kilometer_obs.xyn <model name>_2_output_obs.xyn <model name>_3_measurement_obs.xyn <model name>_4_boi_obs.xyn <model name>_5_100m_obs.xyn <model name>_6_20m_obs.xyn <model name>_7_obs.xyn <model name>_8_obs.xyn <model name>_9_obs.xyn <model name>_10_obs.xyn <model name>_11_obs.xyn <model name>_12_obs.xyn <model name>_13_obs.xyn <model name>_14_obs.xyn <model name>_15_obs.xyn <model name>_16_obs.xyn <model name>_17_obs.xyn <model name>_18_obs.xyn <model name>_19_obs.xyn <model name>_20_obs.xyn

Appendix B: Overview of all checks in function “Check variant/measure”

	Baseline validation module Baseline 6				
	Note: OK, no errors.				
	Warning: Be carefull but no error				
	Error: Validation not succescol				
	When the validation is succesfull this is displayed with a note.				
	Tool	**Scriptversion**	**Error**	**Note/Error/Warning**	**Remark**
1	ProtocolCheck.py	26	Directory metainfo not present	Note.	If not present, it will be created
2	ProtocolCheck.py	26	Baseline 6 not installed (check registry)	Error.	If Baseline 6 is not installed the validation will stop
3	ProtocolCheck.py	26	ArcGIS 10.3.1 / ArcGis 10.4 or ArcGis 10.5 is not installed	Error.	
4	ProtocolCheck.py	26	template not present in Baseline 6installdir	Error.	Template is neccesary for further validation
5	ProtocolCheck.py	26	Name measure/variant contains space	Error.	spaces are forbidden according to protocol
6	ProtocolCheck.py	26	Name measure/variant contains more than 26 characters	Error.	More than 26 characters are forbidden according to protocol
7	ProtocolCheck.py	26	Baseline.gdb not present in measure/variant	Error.	Baseline.gdb needs to be present

8	ProtocolCheck.py	26	structure of directories not according protocol (including TEMP)	Error.	Mandatory directories are: models, data, metainfo, baseline.gdb and optional temp
9	ProtocolCheck.py	26	structure of directory DATA not according protocol	Error.	Mandatory directories in DATA are: export, import, layers, source
10	ProtocolCheck.py	26	structure of directory Models not according protocol	Error.	Mandatory directories in Models are: FM
11	ProtocolCheck.py	26	structure of directory Metainfo not according protocol	Error.	Mandatory directories in Metainfo are: Lists and Logs
12	ProtocolCheck.py	26	Other directories than listed at 8 in measure-rootdir	Error.	No other directories are allowed
13	ProtocolCheck.py	26	Feature Dataset in Baseline.gdb is missing	Error.	All FD's need to be present in a variant/measure
14	ProtocolCheck.py	26	Unnecessary Feature Dataset are present in Baseline.gdb	Error.	FD's which are not present in the templates are not allowed in baseline.gdb
15	ProtocolCheck.py	26	Unnecessary FeatureClas are present in Baseline.gdb	Warning.	FC's which are not present in the templates are not allowed in baseline.gdb. However this is the responsibility of the user
		26			This also means that Elevation does not contain **_lines, **_points or **_locate_errors.
16	ProtocolCheck.py	26	Fields in FC's not according protocol	Error.	Fields in FC's not according protocol
17	ProtocolCheck.py	26	Unnecessary Tabellen in Baseline.gdb	Error.	Only event-tables are allowed in the database
18	ProtocolCheck.py	26	Table field not according protocol	Error.	Check if Fields are according protocol/template
19	ProtocolCheck.py	26	erase_list and append_list is missing or not complete	Error.	Check if erase_list and append_list are present
		26		Error.	Check if item in list is present in Baseline.gdb
		26		Warning.	Check if FC in baseline.gdb is present in lists.
20	ProtocolCheck.py	26	check on singlepart 1 polygon dissolved sections	Error.	If Als er meer dan 1 omhullende is dan crasht baswaq.
21	ContentCheck.py	38	Directory metainfo not present	Note.	If not present, it will be created
22	ContentCheck.py	38	ArcGIS 10.3.1 / ArcGis 10.4 or ArcGis 10.5 is not installed	Error.	
23	ContentCheck.py	38	FC measure_contours is missing	Error.	FC measure_contours is needed to check if all FC's are inside this polygon

24	ContentCheck.py	38	List of all Characteristics in an FC or Event Table is made	Note.	List of all Characteristics in an FC or Event Table is listed in logfile
25	ContentCheck.py	38	Characteristics not filled	Warning.	Characteristics should be filled
26	ContentCheck.py	38	Lijst met items in LOCATIE	Note.	In het logbestand wordt per FC weggeschreven welke LOCATIEs zijn opgegeven.
27	ContentCheck.py	38	LOCATIE is verkeerd	Warning.	Locatie mag alleen LINKEROEVER of RECHTEROEVER zijn
28	ContentCheck.py	38	KENMERK niet hwatvrij bij poly's met opp > 2500m2	Warning.	Een oppervlak van 2500m2 of groter moeteigenlijk hwatvrij zijn.
29	ContentCheck.py	38	In measure_contours, item MEASURE not equal to measure name	Error.	In measure_contours each polygon should contain the measure name in the MEASURE field.
30	ContentCheck.py	38	Land_use_polygon: connected is connected or not connected	Error.	Connected should be connected or not connected where ROUGHNESS_CODE is 104,105,106 or 201
31	ContentCheck.py	38	Features in a measure are outside measure_contours	Error.	All features are inside measure_contours (buffer of 10cm)
32	ContentCheck.py	38	Overlapping polygons in a polygon-FC	Error.	No overlapping polygons are allowed, exception is measure_contours.
33	ContentCheck.py	38	Elevation lines with a Number which is not present in the corresponding event table.	Error.	Elevation lines with a Number which is not present in the corresponding event table.
34	ContentCheck.py	38	Elevation points with value = -9999	Error.	-9999 is an incorrect value'
35	ContentCheck.py	38	Elevation points with value = 0	Warning.	Check if value is correct
36	ContentCheck.py	38	Elevation points with values < -30 or > +70	Warning.	Check if value is correct
37	ContentCheck.py	38	CRESTHEIGHT < LEFT, RIGHT	Error.	Is not permitted
38	ContentCheck.py	38	Elevated_line: ELEVATION_LEFT and _RIGHT both non-equal to ELEVATION_CREST.	Error.	Check if value is correct
39	ContentCheck.py	38	Multiple elevation points on the same locations with different elevations (rounded to centimeters)	Error.	Different Elevation values on the same locations are not permitted

40	ContentCheck.py	38	bedlevel_points, surfacelevel_points or waterbody_bedlevel_points are placed in a regular grid	Warning.	This is not permitted but hard to check
41	ContentCheck.py	38	A measure containing waterbody_bedlevelpoints which are outside a waterbody in the same measure.	Warning.	Not logical to append waterbody_bedlevel_points outside waterbodies
42	ContentCheck.py	38	Land_use_points or land_use_lines with HEIGTH, DIAMETER of DENSITY = -9999	Error.	-9999 is an incorrect value'
43	ContentCheck.py	38	Land_use_points or land_use_lines with HEIGTH, DIAMETER of DENSITY <0	Error.	Value should be positive
44	ContentCheck.py	38	Land_use_points or Land_use_lines : HEIGHT > 15	Warning.	Check if value is correct
45	ContentCheck.py	38	Land_use_lines: DENSITY is incorrect	Error.	DENSITY is open, very open or dense
46	ContentCheck.py	38	Al fc's with ROUGHNESS_CODE: List of alle used codes	Note.	
47	ContentCheck.py	38	Routes with number = 0	Error.	Numbers should be greater than zero for baswaq to run
48	ContentCheck.py	38	Multipart polygons	Error.	No multipart features are allowed
49	ContentCheck.py	38	Check if polyline feature classes have overlapping records	Error.	Polylines should not overlap
50	ContentCheck.py	38	GROUNDLEVEL waterbody = -9999	Error.	-9999 is an incorrect value'

Appendix C: Bas2FM Methods and technical details

Overview

As described in chapter 0, Bas2FM generates the following input data for the D-HYDRO Suite. See chapter 0 for directory structure.

Window: **Baseline to Flexible Mesh**		
	Baseline – used as input	**Generated D-HYDRO input**
Convert boundaries	Section_polygons	<model name>_enc.pol <model name>_dry.pol[3]
Convert elevation in grid NetCDF	Elevation_model_terrain[4] Elevation_ raster Elevation_raster_land	<model name>_net.nc
Convert weirs	Elevated_line (routes and events) Terrainjump_line (routes and events)	<model name>_fxw.pliz
Convert areas outside flood zone	Flow_blocking_polygons	<model name>_dry.pol <model name>_thd.pli
Convert flow blocking lines	Flow_blocking_lines	<model name>_thd.pli
Convert roughness polygons	Land_use_polygons	<model name>_trachytopes.arl
Convert roughness lines	Land_use_lines[5]	
Convert roughness points	Land_use_points[5]	
Convert bed characteristics	Bed_characteristics_polygons	
Convert calibration sections	Calibration_section_polygons	<model name>_calibration.cll
Convert bridges/pillars	Bridges_routes/events	<model name>_bridges.pliz
Convert crosssections	Cross_section_lines	<model name>_<nr>_<type>_crs.pli
Convert lateral sources/sinks	Source_sink_points	<model name>_sources_sinks.pli *Plus files with individual sources/sinks*
Convert barriers	Structure_lines	<model name>_structures.pli *Plus files with individual structures*
Convert Waterlevel in water bodies	initial_water_level_terrain	_<model name>initial_water_level.xyz
Convert output locations	output_location_points	<model name>_0_all_obs.xyn *Plus files with individual feature class data.*

Method for elevation on cellnodes

For all gridpoints the default method in which the elevation is determined is by the standard ArcGIS- function to interpolate in a Terrain ("Add Surface Information"), the method used is "LINEAR" for land-databases and "BILINEAR" for sea-databases. This is compliant with previous

[3] In case of inner rings in sections

[4] Elevation _model_terrain in case of a land-variant, elevation_raster in case of a sea-variant, elevation_raster and elevation_raster_land in case of a merged sea-variant

[5] When a sea varaint is converted no roughness lines or points are taken in to account due to a negligible area

Baseline releases. Tests have shown that the resulting elevation model for curvilinear (Waqua)grids is almost similar: only at some limited areas there are differences.

Alternative elevation interpolation

Besides this default method the elevation can be determined using a cell-averaging method[6]. In the Bas2FM menu "use elevation interpolation" should be checked. For this method the Spatial Analist ArcGis extension is required. The following steps are conducted:

- When a land variant is input the elevation_model_terrain is converted to a 5x5m raster named elevation_raster_land.
- Using the function "zonalstatistics" mean values are calculated within the polygons of ZonalFC (in <modelname>_net.gdb) from:
    - elevation_raster in case of a sea variant
    - elevation_raster and elevation_raster_land in case of a merged sea variant
    - elevation_raster_land in case of a land variant

Technical details:

- Input:
    - Elevation_model_terrain/ Elevation_raster/ Elevation_raster_land
- Output – intended for use in D-HYDRO Suite:
    - <model name>_net.nc
    - See D-HYDRO Suite documentation for file-format and definitions
- Bas2FM reads and uses the z_positive = 'up/down' from the <model name>_net.nc-file
- Bas2FM reads the "fill-value" from the <model name>_net.nc-file, for example '-999'. Bas2FM writes the fill-value where ArcGIS cannot determine the elevation. So, on all grid-points elevation is written!

Method for elevation on cell centers

The determination of elevation is similar to the ones described before. Only the location where elevation is derived from is different; cell centers instead of cell nodes.

This method is only possible for netCDF files with UGRID format=1.0 or higher.

If the cell-center elevation attribute is not present in the netCDF-file, Bas2FM will add it to the file prior to defining data on these locations.

Method for elevation near grid enclosure

If one or more of the neighbouring nodes of a cell-center do not have a valid elevation D-Flow FM uses the value "bedleveluni" (if this value is -999 there will be a depression in the model). In an earlier version of bas2fm only nodes within or on the edge of the enclosure (Featureclass section_terrain) received a z-value which resulted in cell-centers having no z-values.
In order to avoid this, bas2fm extrapolates existing z-values over a distance of **250 meters** outside the enclosure (the z-value is taken form the closest vertex on the edge of the Baseline elevation_model_terrain, so the extrapolation is always horizontal). This value of **250 meters** might be insufficient when Baseline is used in areas where the grid resolution is coarser then 250 meters, eg. in North Sea models.

Method for vegetation (Trachytopes / roughness areas, lines and points)

[6] This option will not work in combination with elevation on cell centers.

Bas2FM intersect for all flow/net-links the so-called Perot-areas / polygones with all the Roughness polygones. D-HYDRO, specifically the module D-HYDRO Suite writes the Perot-areas / polygons to the <model name>_net-geom.nc file. This file has to be provided to Bas2FM together with the grid (<model name>_net.nc). In paragraph 0 is described how.

Definitions:

- In D-HYDRO flow/net-links are defined as the lines connecting grid-points. Water "flows" from one grid-cell to the other, passing the flow/net-link.
- A Perot-area is the rectangle given by 2 lines perpendicular to the flow-link, through the grid-points on both sides of the flow-link and 2 lines parallel to the flow-link, through the opposing cell-centres.

Technical details:

- Input:
  - Land_use_polygons
  - Land_use_lines
  - Land_use_points
  - Bed_characteristics_polygons (only when present in the variant)
- Output – intended for use in D-HYDRO Suite:
  - <model name>_trachytopes.arl
  - See D-HYDRO Suite documentation for file-format and definitions
- Mark that flow/net-geom polygons can overlap. In those cases the roughness is counted double. Still, the Perot-area can be seen as the area that "influences" the flow over a flow-link. Mark also that in case of curvilinear grids this method is identical to the method used in previous Baseline releases, in casu Baswaq / WAQUA.
- Mark that flow/net-geom cells are limited to the grid. This is a minor improvement to the method used in Baswaq.
- Roughness points:
  - are transposed into surface-areas derived from the diameter of the tree. The sum of all tree-surface-areas is also written to the trachytopes -file.
  - (roughnesspercentage for a tree) = (∑(diameter of the tree) / (tree-surface-area))
- Roughness lines
  - are one by one projected on flow/net-links. The totalprojected length is written in the trachytopes -file with the roughness code of the 'heg'.
  - Bas2FM writes NO information as Thin dams. This is equivalent to the former Baswaq, that did not write any information in the schotarea-u/v.
- Bed_characteristics_polygons
  - When this featureclass is checked it is used to overwrite the underlying information from land_use_polygons.
- Mark that total area-percentage per cell as stored in the trachytope-file exceeds 1.0 (100%) when roughness lines or points are located within this cell. This is identical to the Baswaq / WAQUA method.

Method for calibration sections

Calibration sections are converted in the same manner as land_use_polygons.

Method for modelling Enclosure, Areas outside flood zone and Flow blocking lines

Areas outside flood zone (flow_blocking_polygons) are ('flood free') areas/buildings where no water will flow (no flow, no precipitation, no source/sink). These areas are modelled as Dry areas and/or Thin dams and as trachytopes.

Flow blocking lines (flow_blocking_lines) block the flow of water, modelled in D-HYDRO Suite as Thin dams.

Technical details:

- Input:
  - flow_blocking_polygons
  - flow_blocking_lines
  - section_polygons (polygons that will be dissolved during Bas2FM conversion process)
- Output – intended for use in D-HYDRO Suite:
  - <model name>_thd.pli
  - <model name>_dry.pol
  - <model name>_enc.pol
  - See D-HYDRO Suite documentation for file-format and definitions
- For enclosure polygons (sections_polygons)
  - Only the outside polygon(s) are modelled as individual enclosures.
  - Inner rings (e.g. islands that will not be part of the model area) are modelled as Dry area
- For areas outside flood zone (flow_blocking_polygons):
  - Gridcells which are completely covered by a flow_blocking_polygon or building are modelled as Dry area.
  - The remaining parts of these former flow_blocking_polygons and buildings are written as Thin dams and processed by D-HYDRO Suite: the part of a flow_blocking_polygon overlapping a gridcell is projected on the flow/net-link.
  - D-HYDRO Suite treats a flow/net-link like a Thin dam (no flow of water) if it intersects a flow_blocking_polygon or flow_blocking_line.
- For Flow_blocking_lines:
  - Flow_blocking_lines are modelled as Thin dams, In Baseline they are stored as (poly)lines and cannot be written as Dry areas.
  - D-HYDRO Suite treats a flow/net-link like a Thin dam (no flow of water) if it intersects a flow_blocking_polygon or flow_blocking_line.

Modelinformation on lines

Modelinformation on lines must be projected on flow/net-links. This done by D-HYDRO Suite. Bas2FM passes the information "as is" in the format of D-HYDRO Suite (*.pli).

Weirs

Elevated lines and terrain_jumps are modelled in D-HYDRO Suite as Fixed weirs.

Technical details:

- Input:

  - Elevated lines (routes and events)
  - Terrain_jumps (routes and events)
- Output – intended for use in D-HYDRO Suite:
  - <model name>_fxw.pliz
- Mark that D-HYDRO Suite requires the following definitions:
  - Crest level (m, NAP)
  - Sill height (left and right) (m, relative to the Crest level, positive down)
  - Slope-left and right (e.g. 4.0, which means 1 metre down on every 4.0 metres)
  - See D-HYDRO Suite documentation for file-format and definitions

Structures (Lines)

Barriers are modelled in D-HYDRO Suite as Structures.

Technical details:

- Input:
  - Structure_lines
- Output – intended for use in D-HYDRO Suite:
  - <model name>_structures.pli
  - See D-HYDRO Suite documentation for file-format and definitions

Bridges

Bridges are modelled in D-HYDRO Suite as bridge (pillars).

Technical details:

- Input:
  - bridges (routes and events)
- Output – intended for use in D-HYDRO Suite:
  - <model name>_bridges.pliz
- See D-HYDRO Suite documentation for file-format and definitions

Cross_sections (Lines)

Cross_sections are modelled in D-HYDRO Suite as Cross_sections.

Technical details:

- Input:
  - Cross_section_lines
- Output – intended for use in D-HYDRO Suite:
  - <model name>_<nr>_<type>_crs.pli
  - See D-HYDRO Suite documentation for file-format and definitions

Modelinformation on points

Again, like modelinformation on lines, Bas2FM passes the information on points “as is” in the format of D-HYDRO Suite (*.xyn).

Lateral sources/sinks (points)

The location of lateral sources/sinks (‘bronnen/putten’) is written.

Technical details:

- Input:
  - Source_sinks_points
- Output – intended for use in D-HYDRO Suite:
  - <model name>_sources_sinks.xyn
  - See D-HYDRO Suite documentation for file-format and definitions

Output locations

Output_locations ('Uitvoerlocaties') are modelled as output location points

Technical details:

- Input:
  - Output_location_points
- Output – intended for use in D-HYDRO Suite:
  - <model name>_<nr>_<type>_obs.xyn
  - See D-HYDRO Suite documentation for file-format and definitions

Measuring stations

Measuring stations are modelled as output location points
Technical details:

- Input:
  - Output_location_points
- Output – intended for use in D-HYDRO Suite:
  - <model name>_<nr>_<type>_obs.xyn
  - See D-HYDRO Suite documentation for file-format and definitions

Kilometer locations

Kilometer locations (points) are modelled as output location points.
(Kilometer locations ('Rivierkilometerraaien', lines) will be converted to (D-Flow FM) Cross sections.)

Technical details:

- Input:
  - Output_location_points
  - cross_sections_lines
- Output – intended for use in D-HYDRO Suite:
  - <model name>_<nr>_<type>_obs.xyn
  - <model name>_<nr>_<type>_crs.pli
  - See D-HYDRO Suite / D-Flow FM documentation for file-format and definitions

Using a modelboundary

When a modelboundary is defined in the bas2fm conversion the geometric data of a Baseline database can be partially converted to D-Flow FM.

Some remarks on the use of this modelboundary:

1. All input point data are clipped using this modelboundary, so only fm-output is written of data within the clip polygon.
2. All input polylines which are within the modelboundary or intersect the modelboundary are written to fm-output.
3. All nodes or cell-centers that are within the modelboundary are written to fm-output.
    a. At locations where the modelboundary is smaller then the Baseline database, elevation at nodes or cell-centers is also written to the <model name>_net.nc-file in a zone up to 250m from the modelboundary.
    b. At locations where the modelboundary is exeeds the Baseline database, elevation at nodes or cell-centers is also written to the <model name>_net.nc-file in a zone up to 250m from the boundary of the Baseline database.
4. All roughness information in the flow faces which are within the modelboundary or intersect the modelboundary is written to fm-output.

Appendix D: Bas2Swan Methods and technical details

Overview
As described in chapter 4.6.3, Bas2Swan (baswaq.exe) generates the following input data for the SWAN model. See chapter 4.6.3 for directory structure.

Window: **Baseline to SWAN**		
	Baseline – used as input	**Generated SWAN input**
Convert boundaries	Section_polygons	<model name>_dry.pol <model name>_dry.thd[7]
Convert elevation in grid NetCDF	Elevation_model_terrain[8] Elevation_ raster Elevation_raster_land	<model name>.bot
Convert weirs	Elevated_line (routes and events) Terrainjump_line (routes and events)	<model name>.fxw
Convert areas outside flood zone	Flow_blocking_polygons[9]	<model name>.fxw
Convert flow blocking lines	Flow_blocking_lines[10]	<model name>.fxw
Convert output locations	Output_location_points	<model name>_0_all_obs.pnt *Plus files with individual feature class data.*

Method for elevation on cellnodes
For all gridpoints the elevation is determined by the standard ArcGIS- function to interpolate in a Terrain ("Add Surface Information"), the method used is "LINEAR" for land-databases and "BILINEAR" for sea-databases. This is compliant with previous Baseline releases. Tests have shown that the resulting elevation model for curvilinear (Waqua-)grids is almost similar: only at some limited areas there are differences.

Technical details:

- Input:
  - Elevation_model_terrain/ Elevation_raster/ Elevation_raster_land
- Output – intended for use in SWAN models:
  - <model name>.bot
- Bas2Swan reads and uses the z_positive = 'up/down' from the <model name>_net.nc-file

Modelinformation on lines
Modelinformation on lines must be projected on grid cell boundaries.

Weirs/obstacles

[7] These files are generated by baswaq, they are not used in SWAN models

[8] Elevation _model_terrain in case of a land-variant, elevation_raster in case of a sea-variant, elevation_raster and elevation_raster_land in case of a merged sea-variant

[9] Flow_blocking_polygons are converted to polylines and added as fixed weirs with an elevation of 999 m

[10] Flow_blocking_lines are added as fixed weirs with an elevation of 999 m

Elevated lines, terrain_jumps, flow_blocking_polygons and , flow_blocking_lines are modelled in SWAN as Fixed weirs/obstacles.

Technical details:

- Input:
  - Elevated lines (routes and events)
  - Terrain_jumps (routes and events)
  - Flow_blocking_lines (vertices get elevation 999)
  - Flow_blocking_polygons (are first converted to polylines, then vertices get elevation 999)
- Output – intended for use in SWAN:
  - <model name>.fxw
- Mark that SWAN requires the following definitions:
  - Crest level (m, NAP)
  - Sill height (left and right) (m, relative to the Crest level, positive down)

Output locations

Output_locations (‘Uitvoerlocaties’) are modelled as output location points

Technical details:

- Input:
  - Output_location_points
- Output – intended for use in SWAN:
  - <model name>_<nr>_<type>_obs.pnt

Using a modelboundary

When a modelboundary is defined in the bas2swan conversion the geometric data of a Baseline database can be partially converted to SWAN.

Some remarks on the use of this modelboundary:

1. All input polylines which are within the modelboundary are written to fm-output.
2. All nodes or cell-centers that are within the modelboundary are written to fm-output.