RVR MEANDER - USER'S MANUAL
STAND-ALONE VERSION

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Abstract

This document illustrates how to use the stand-alone version of RVR Meander. An ArcGIS-ArcMap version of RVR Meander and its User's Manual are also available.

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1. OVERVIEW

The RVR Meander platform merges the functionalities of the first version of RVR Meander (Garcia et al., 1994; Abad and Garcia, 2006) and CONCEPTS (Langendoen and Alonso, 2008; Langendoen and Simon, 2008; Langendoen et al., 2009). It is written in C++ language and is composed of different libraries for preprocessing, hydrodynamics, bank erosion, migration, filtering, plotting, and I/O. It runs as stand-alone application on Windows and Linux operating systems and needs 4 input text files, specifying general parameters for simulation, channel centerline, valley centerline, and initial bank properties (geometry and erodibility). Several output

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files are produced, which describe the migrated centerlines, the two-dimensional (2D) hydrodynamics or bed morphodynamics field, and the evolution of bank geometry. Such files can be visualized in Tecplot or imported in Excel.

RVR Meander also has an ArcGIS-ArcMap interface, written in C Sharp language and developed for ArcGIS versions 9.3/9.3.1 and 10. It consists of a toolbar that can be added to ArcMap, containing four buttons. One of them calls a userform where data can be entered by the user for running simulations. In particular, the tab "Layer Definition" defines channel and valley centerlines, now input as shapefile polylines (therefore they can be created and edited in the GIS environment). The other tabs "Channel Properties", "Preprocessing", "Hydrodynamics", "Bank Erosion", "Migration", "Smoothing", and "Output Files" specify other general parameters for simulation. A menu allows importing input data into the userform, exporting input data to text file, adding the initial bank properties as text file, and running the simulation. The other three buttons in the toolbar are for converting a text file to shapefile polyline or viceversa (feature useful for channel and valley centerlines) and importing the simulation results in the GIS environment, in terms of migrated centerlines (shapefile polyline) or 2D representation of hydrodynamics or bed morphodynamics (shapefile points).

In terms of units, the stand-alone version works exclusively with SI (International) Units, while the ArcGIS-ArcMap interface can either work with SI or English Units.

2. THE STAND-ALONE VERSION

2.1. Running a simulation

The steps to run a simulation are the following:

1. Copy in the same folder the dynamic-link library files
    - "inih.dll",
    - "libconfig++.dll",
    - "librprep.dll",
    - "librmhydrodynamics.dll",
    - "librmbankerosion.dll",
    - "librmigration.dll",
    - "librmfilter.dll",
    - "librplotting.dll", and
    - "librmio.dll"

    and the executable file
    - "rm-meander.exe"

    and the simulation input files (described in the next section).
2. In Windows, Start → Run.
3. Type "cmd".
4. In the MS-DOS prompt, if the folder is in a volume different from "C", for instance "E", type "E:" to go to that volume.
5. Type "cd [path of the folder where all files were copied]".
6. To run RVR Meander:
    - type "rm-meander prototype.cfg": RVR Meander runs with no output on screen or in log text file;
    - type "rm-meander prototype.cfg log.txt": RVR Meander runs with output in log text file;
    - type "rm-meander prototype.cfg -stdout": RVR Meander runs with output on screen.

If the simulation does not run, copy the folders

- "Microsoft.VC80.CRT" and
- "Microsoft.VC80.DebugCRT"

in the simulation folder.

2.2. Input files

The input text files are:

- “testdata.txt”: initial channel centerline;
- “valley.txt”: valley centerline (can be optionally used for computations);
- “prototype.cfg”: general parameters for simulation;
- “InitialSectionProperties.dat”: initial configuration of channel banks (shape and properties), only for physically-based approach for meander migration.

The structure of these files are explained in the following sections.

2.2.1. Input file "testdata.txt"

The file "testdata.txt" specifies the (x^*,y^*) coordinates of the initial channel centerline in dimensions (meters). Table 1 shows its structure. "350" is the number of channel centerline nodes, each described by "2" (x^*,y^*) coordinates. The list of the (x^*,y^*) coordinates of the nodes, from upstream to downstream, follows.

Table 1: Structure of the file "testdata.txt", with example values and notes. Just few of the centerline-node coordinates are shown for brevity.

Example value	**Example value**	**Example value**	**Note**	**Note**	**Note**
RMTEXT	350	2		Number of centerline nodes	Number of node coordinates
0.000000	0.000000		x^* coordinate of the 1^{st} node [m]	y^* coordinate of the 1^{st} node [m]	
-2.484339	11.148516		x^* coordinate of the 2^{nd} node [m]	y^* coordinate of the 2^{nd} node [m]	
-4.951767	22.300793		x^* coordinate of the 3^{rd} node [m]	y^* coordinate of the 3^{rd} node [m]	
...	...				

2.2.2. Input file "valley.txt"

This file specifies the (x^*,y^*) coordinates of the valley "centerline", which is not necessarily a straight line, in dimensions (meters).

Table 2 shows its structure. "5" is the number of valley centerline nodes, each described by "2" (x^*,y^*) coordinates. The list of the (x^*,y^*) coordinates of the nodes, from upstream to downstream, follows.

Table 2: Structure of the file "valley.txt", with example values and notes. In this case the valley centerline is described by two nodes.

Example value	**Example value**	**Example value**	**Note**	**Note**	**Note**
RMTEXT	2	2		Number of centerline nodes	Number of node coordinates
0.000000	0.000000		x^* coordinate of the 1^{st} node [m]	y^* coordinate of the 1^{st} node [m]	
-2798.649000	992.568000		x^* coordinate of the 2^{nd} node [m]	y^* coordinate of the 2^{nd} node [m]	

2.2.3. Input file "prototype.cfg"

This file specifies the main parameters and switches characterizing the simulation. They are illustrated with comments in the file itself and divided in the following categories:

- Channel (Table 3)

Table 3: "channel" parameters in the file "prototype.cfg", with example values and notes.

Parameter	**Example value**	**Note**
flow	46.2	Flow discharge (constant in space and time) [m^3/s].
width	38.0	(Initial) channel width [m].
sediment_size	0.060	Sediment size (for computation of the friction coefficient, it has to be thought as a measure of the bed roughness) [m].
centerline	"testdata.txt"	This is the absolute path of the channel-centerline file.
valley_centerline	"valley.txt"	This is the absolute path of the valley-centerline file.
use_valley_centerline	true	If true, the file valley_centerline is used to compute the channel slope. If false, valley centerline is equal to the straight channel connecting the upstream and downstream ends of the channel at all times.
water_density	1000.0	Density of water [kg/m^3].
valley_slope	0.000900	Slope of the valley (constant in time) [m/m].
upstream_bed_elevation	0.0	Upstream bed elevation at the centerline [m a.s.l.].
num_transverse_nodes	51	Number of transverse nodes (for 2D mesh representation).
mesh_generation_method	1	Method for determining the normal to channel centerline at each centerline node. If equal to "1", the normal to the segment connecting the node and that downstream of it is used. If equal to "2", the direction that bisects the angle formed by the normal to the segment connecting the node and that downstream of it and the normal to the segment connecting the node and that upstream of it is used.
threshold_regridding	0.9	Threshold for regridding of centerline nodes (in half widths). If nodes are spaced more than that, additional nodes are added.
manning_coefficient	0.030	Manning's coefficient (it is only used for computing the the first-guess depth of the recursive computation of uniform-flow depth at each time step).

- Preprocessing (Table 4)

Table 4: "preprocessing" parameters in the file "prototype.cfg", with example values and notes.

Parameter	Example value	Note
method	1	Method to calculate the curvature. If equal to "1", the parametric method (Johannesson and Parker, 1985) is used. If equal to "2", the method based on fitting local circle through three points is used.
upstream_method	2	Method to calculate the curvature at the upstream node. If equal to "1", the value init_curvature (see "migration" parameters) is used at the first iteration, then curvature is calculated with extrapolation from the curvature at the following two nodes. If equal to "2", the value init_curvature is used along the whole simulation. If equal to "3", the curvature is constant and equal to zero.
downstream_method	1	Method to calculate the curvature at the downstream node. If equal to "1", curvature is extrapolated. If equal to "2", curvature is constant and equal to zero. If equal to "3", zero longitudinal curvature gradient is assumed.

- Hydrodynamics (Table 5)

Table 5: "hydrodynamics" parameters in the file "prototype.cfg", with example values and notes.

Parameter	**Example value**	**Note**
last_node_method	1	Method for the computation of the hydrodynamics at the downstream node. If equal to "1", dimensionless perturbations of velocity, depth, and bed elevation are extrapolated. If equal to "2", dimensionless perturbations of velocity, depth, and bed elevation are computed using curvature and curvature gradient at the downstream node. If equal to "3", zero longitudinal curvature gradient is assumed for dimensionless perturbations of velocity, depth, and bed elevation.
method	"Ikeda Et. Al. 1981"	Currently, only the Ikeda et al. (1981)'s model is available.
init_perturbation_velocity	0.0	Dimensionless perturbation velocity at the upstream end [-].
scour_factor	5.0	Scour factor [-].

- Bank erosion (Tables 6 and 7)

Table 6: "bank_erosion" parameters (part 1 of 2) in the file "prototype.cfg", with example values and notes.

Parameter	**Example value**	**Note**
method	"Physically-based"	Method for modeling the bank evolution. It can be equal to "Migration coefficient" or "Physically-based".
floodplain_heterogeneity	false	Switch for use of floodplain file to define resistance-to-erosion properties. If "true", the path of the floodplain file needs to be specified (see parameter "floodplain_file").
erosion_coeff	0.00000030	Migration coefficient [-]. It needs to be specified if the parameter "method" is equal to "Migration coefficient". All following parameters need to be be specified if the parameter "method" is equal to "Physically-based".
pb_method	2	Type of physically-based migration. If equal to "1", the purely erosional approach is used. If equal to "2", the physically-based migration coefficient approach is used.
bank_shear_stress_method	3	Method to evaluate the shear stress on bank. If equal to "1", the shear stress is computed from stage. If equal to "2", the shear stress is constant on the bank, and equal to the one on the bed at the bank. If equal to "3", the shear stress is "distributed" on the different layers of the bank, based on the one on the bed at the bank.
node_to_monitor	40	Node to monitor for bank evolution. It may change as centerline nodes are regridded during the simulation. Note that in this file nodes (i.e., cross sections) are numbered from zero, while in the file "InitialSectionProperties.dat" they are numbered from one.
update_width_method	4	Method to update the width (used if the parameter "pb_method" is equal to "1"). If equal to "1", intersects water stage-banks and considered, and the mean value among all sections is considered. If equal to "2", intersects water stage-banks and considered, and the minimum value among all sections is considered. If equal to "3", bank toes and considered, and the mean value among all sections is considered. If equal to "4", bank toes and considered, and the minimum value among all sections is considered.
erosion_distance_method	2	Method to compute the bank erosion distance. If equal to "1", the displacement of the intersects between water stage and banks is considered. If equal to "2", the displacement of the bank toes is considered.
gap_elongation	0.1	Tolerance for bank elongation [m]. By increasing it, the number of added bank nodes can be reduced. If not positive, no additional node is added (use this option only in presence of vertical banks).
regrid_centerline_nodes	true	Switch for regridding the centerline nodes. Note that regridding is always active in case of "Migration coefficient" approach.
interpolate_after_splines	false	Switch for bank interpolation after splines application.
interpolate_frequency	10	Iterations interval for interpolation after splines application.
bank_interpolation_tolerance	0.02	Tolerance for interpolation of bank nodes [m]. If not positive, the interpolated bank is set equal to the downstream bank.

Table 7: "bank_erosion" parameters (part 2 of 2) in the file "prototype.cfg", with example values and notes.

Parameter	Example value	Note
use_hydraulic_erosion	true	Switch for fluvial erosion .
type_law_hydraulic_erosion	1	Type of law for fluvial erosion. If equal to "1", the original expression is used. If equal to "2", the expression characterized by continuous derivative is used.
xs_division;	2	Method for the calculation of the shear stress on the banks when water stage-based method is used. If equal to "1", the vertical depth method is used. If equal to "2", the area method is used.
gr_threshold	0.016	Grain roughness threshold for correction of the friction slope. Used if "bank_shear_stress_method" is equal to "1".
wp_threshold	0.025	Wetted perimeter threshold [m] for shear stress calculation. Used if "bank_shear_stress_method" is equal to "1".
max_erosion_dist	10.0	Maximum erosion distance [m] for each numerical time step. It can avoid extremely high erosion distances due to very high local curvature.
min_distance	0.05	Minimum distance to add a new node [m]. By increasing it, the number of added bank nodes can be reduced.
use_cantilever_failure	true	Switch for cantilever failure .
undercut_threshold	0.1	Undercut threshold [m].
use_planar_failure	false	Switch for planar failure .
num_intersects	3	Number of intersects between the slip surface and bank that are evaluated.
z_threshold	0.1	Minimum distance from failing block toe node to an existing bank node [m].
tension_crack_opt	0.5	Tension crack depth. If negative, the depth is internally calculated in the code.
slice_multip	5	Number of failing block slices per layer.
positive_pore	true	Switch for bank failure analysis: positive. If "true", positive pore-water pressure is calculated.
negative_pore	true	Switch for bank failure analysis If "true", negative pore-water pressure is calculated.
hydrost_force	true	Switch for bank failure analysis. If "true", hydrostatic force acting on the failure block is calculated.
accuracy	0.005	Accuracy in recursive research of the minimum factor of safety.
max_iter	8	Maximum number of iterations in recursive research of the minimum factor of safety.
analysis_method	3	Analysis method for the computation of the factor of safety. If equal to "1", ordinary method is used. If equal to "2", Janbu simple method is used. If equal to "3", Morgenstern-Price methodis used.
lambda	0.4	Parameter λ (for the calculation of intershear forces in the Morgenstern-Price method).
initial_section_prop_file	"InitialSectionProperties.dat"	Path of the file that specifies the initial properties of the banks.
floodplain_file	"Grid.txt"	Path of the file that describes the floodplain. It is used if the parameter "floodplain_heterogeneity" is "true".

- Migration (Table 8)

Table 8: "migration" parameters in the file "prototype.cfg", with example values and notes.

Parameter	Example value	Note
init_curvature	0.0	Curvature at upstream end [-].
duration	37.0	Duration of the simulation [years].
num_iterations	185	Number of iterations.
filter_iterations	10	Iterations interval for filtering.
splines_initially	false	Switch for application of splines on initial centerline.
plot_iterations	10	Iterations interval for plotting.
migrate_upstream_node	true	Switch for migration of upstream node.
migrate_downstream_node	true	Switch for migration of downstream node.
threshold_for_cutoff	1.0	Threshold for cutoff (in half widths). If negative, cutoff is switched off.

- Smoothing (Table 9)

Table 9: "smoothing" parameters in the file "prototype.cfg", with example values and notes.

Parameter	**Example value**	**Note**
method	"Savitzky-Golay"	Type of filter on centerline. Only Savitzky-Golay (Savitzky and Golay, 1964) is available.
smoothing_order	3	Smoothing tools applied. If equal to "0": no splines, no filter on centerline. If equal to "1": filter on centerline, no splines. If equal to "2": splines, no filter on centerline. If equal to "3": filter on centerline then splines. If equal to "4": splines then Filter on centerline.
curvature_filter	true	Switch for curvature filtering.
iterations	1	Parameter for Savitzky-Golay filter: number of times of application of the filter.
polynomial_order	2	Parameter for Savitzky-Golay filter: order of the polynomial (2^{nd} or 4^{th} order).
window_nodes	5	Parameter for Savitzky-Golay filter: number of nodes included in the filter window (5, 7, 9, 11, or 13).

- Plotting (Table 10)

Table 10: "plotting" parameters in the file "prototype.cfg", with example values and notes.

Parameter	**Example value**	**Note**
output_1D	"TecPlot1D.DAT"	Path of the file containing centerline migration.
output_uv2D	"TecPlotuv2D.DAT"	Path of the file containing dimensionless perturbations of velocity in streamwise and transverse direction, dimensionless curvature, and angle between centerline and x^* axis.
output_hde2D	"TecPlothde2D.DAT"	Path of the file containing dimensionless perturbations of water stage, depth, and bed elevation.
output_U1V12D	"TecPlotU1V12D.DAT"	Path of the file containing dimensioned perturbations of velocity in streamwise and transverse direction.
output_H1D1E12D	"TecPlotH1D1E12D.DAT"	Path of the file containing dimensioned perturbations of water stage, depth and bed elevation.
output_UUVV2D	"TecPlotUUVV2D.DAT"	Path of the file containing dimensioned values of velocity in streamwise and transverse direction.
output_HHDDEE2D	"TecPlotHHDDEE2D.DAT"	Path of the file containing dimensioned values of water stage, depth, and bed elevation
output_VELandTAU2D	"TecPlotVELandTAU2D.DAT"	Path of the file containing velocities and shear stress.
output_Sections2D	"TecPlotSections2D.DAT"	Path of the file containing 2D visualization (station-elevation) of bank geometry at a user-selected cross section, only for physically-based bank evolution.
output_Hydro3D	"TecPlotHydro3D.DAT"	Path of the file containing water stage in 3D, only for physically-based bank evolution.
output_BedBanks3D	"TecPlotBedBanks3D.DAT"	Path of the file containing bed and banks in 3D, only for physically-based bank evolution.
output_Floodplain	"TecPlotGrid.DAT"	Path of the file containing floodplain characterization.

2.2.4. Input file "InitialSectionProperties.dat"

Figure 1 shows a typical configuration (bank node and layer numbering) of any cross section. A node has to be entered at each layer boundary elevation. Layer boundaries are assumed horizontal. In Figure 1, point 1 in the left bank and point 6 in the right bank ("floodplain nodes") have to be set far enough to ensure the simulation of possible high erosion distances. Moreover, the water stage cannot be higher than the minimum of their elevation. Notice that the layers' parameters are defined from the highest to the lowest layer, for both the right and the left bank.

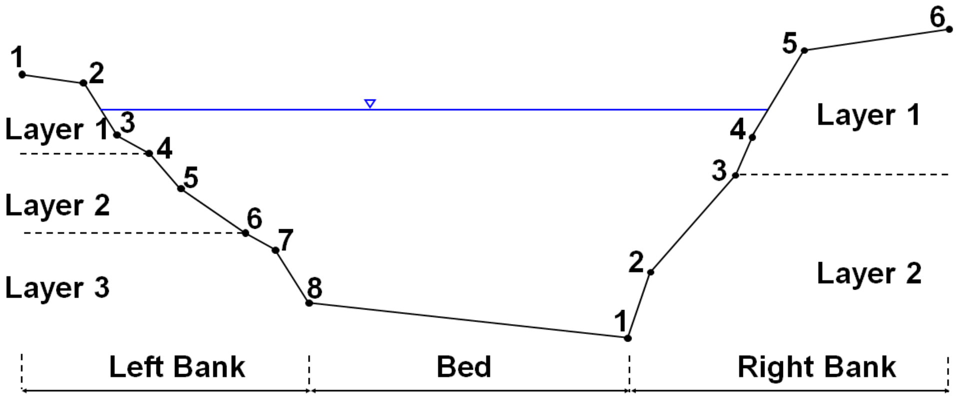

Figure 1: Cross section description in the model.

The structure of the input file "InitialSectionProperties.dat" is described in the Tables from 11 to 16 for the case only one material layer characterizes both left and right banks, and in the Tables from 17 to 22 for the general case characterized by the presence of several material layers in the banks.

Notice that only one reach has to be specified (in Table 11 or 17 in the general case) and all nodes (i.e., all cross sections) have to be in that reach. The reach (grid) structure was kept in the RVR Meander code since it is present in the original CONCEPTS code. Observe also that Tables from 12 to 16 (or Tables from 18 to 22 in the general case) have to be repeated as many times as the number of cross sections (in other words, centerline nodes).

An Excel file "Initial Section Properties Generator.xls" is available for automatically generating the file "InitialSectionProperties.dat". The first upstream section is specified, then all properties are copied for the next section except Section ID, elevations of the cross section nodes and groundwater levels, which are calculated once specified Δs^* (streamwise distance between consecutive centerline nodes), L_0^* (length measured along the valley centerline), L_{ch}^* (length measured along the channel), S_0 (valley slope), and depth of the groundwater table at the upstream end (m).

Note also that, as mentioned earlier, monitor nodes in the file “prototype.cfg” are numbered from zero, while in the file “InitialSectionProperties.dat” are numbered from one.

- Case of only one material layer in both left and right bank (Tables 11 to 16)

Table 11: Structure of the file "InitialSectionProperties.dat", with example values and notes. Case of only one material layer in both left and right bank (table 1 of 6).

Example value	**Note**
1	Number of reaches
350	Number of nodes (i.e., cross sections) in the i-th reach

Table 12: Structure of the file "InitialSectionProperties.dat", with example values and notes. Case of only one material layer in both left and right bank (table 2 of 6).

Example value	1	3	3	0.016
Note	Section ID	Number of nodes of left bank	Number of nodes of right bank	Section effective friction factor (used if "bank_shear_stress_method" = "1")

Table 13: Structure of the file "InitialSectionProperties.dat", with example values and notes. Case of only one material layer in both left and right bank (table 3 of 6).

Example value	**Example value**	**Note**	**Note**
-300.0	3.0	Left bank, station [m]	Left bank, elevation [m]
-19.0	3.0	Left bank, station [m]	Left bank, elevation [m]
-19.0	0.0	Left bank, station [m]	Left bank, elevation [m]
19.0	0.0	Right bank, station [m]	Right bank, elevation [m]
19.0	3.0	Right bank, station [m]	Right bank, elevation [m]
300.0	3.0	Right bank, station [m]	Right bank, elevation [m]

Table 14: Structure of the file "InitialSectionProperties.dat", with example values and notes. Case of only one material layer in both left and right bank (table 4 of 6).

Example value	1	1	2.0	2.0
Note	Number of layers (left bank)	Number of layers (right bank)	Groundwater table (left bank) [m]	Groundwater table (right bank) [m]

Table 15: Structure of the file "InitialSectionProperties.dat", with example values and notes. Case of only one material layer in both left and right bank (table 5 of 6).

Example value	0	2	3.0	18000.0	0.0000012	9.0	5000.0	25.0	15.0
Note	Left bank (layer 1): bottom index	Left bank (layer 1): top index	Left bank (layer 1): top elevation [m]	Left bank (layer 1): unit weight [N/m^3]	Left bank (layer 1): erosion-rate coefficient [m/s]	Left bank (layer 1): critical shear stress [Pa]	Left bank (layer 1): cohesion [Pa]	Left bank (layer 1): angle of repose [°]	Left bank (layer 1): angle ϕ_b [°]

Table 16: Structure of the file "InitialSectionProperties.dat", with example values and notes. Case of one material layer in both left and right bank (table 6 of 6).

Example value	0	2	3.0	18000.0	0.0000012	9.0	5000.0	25.0	15.0
Note	Right bank (layer 1): bottom index	Right bank (layer 1): top index	Right bank (layer 1): top elevation [m]	Right bank (layer 1): unit weight [N/m^3]	Right bank (layer 1): erosion-rate coefficient [m/s]	Right bank (layer 1): critical shear stress [Pa]	Right bank (layer 1): cohesion [Pa]	Right bank (layer 1): angle of repose [°]	Right bank (layer 1): angle ϕ_b [°]

- General case with more than one material layer in left and right bank (Tables 17 to 22)

Table 17: Structure of the file "InitialSectionProperties.dat", with example values and notes. General case with more than one material layer in left and right bank (table 1 of 6).

Example value	**Note**
1	Number of reaches
421	Number of nodes (i.e., cross sections) in the i-th reach

Table 18: Structure of the file "InitialSectionProperties.dat", with example values and notes. General case with more than one material layer in left and right bank (table 2 of 6).

Example value	1	6	6	0.016
Note	Section ID	Number of nodes of left bank	Number of nodes of right bank	Section effective friction factor (used if "bank_shear_stress_method" = "1")

Table 19: Structure of the file "InitialSectionProperties.dat", with example values and notes. General case with more than one material layer in left and right bank (table 3 of 6).

Example value	**Example value**	**Note**	**Note**
-500.0	2.0	Left bank, station [m]	Left bank, elevation [m]
-17.0	2.0	Left bank, station [m]	Left bank, elevation [m]
-15.5	0.5	Left bank, station [m]	Left bank, elevation [m]
-15.0	0.0	Left bank, station [m]	Left bank, elevation [m]
-15.0	-1.0	Left bank, station [m]	Left bank, elevation [m]
-15.0	-4.0	Left bank, station [m]	Left bank, elevation [m]
15.0	-4.0	Right bank, station [m]	Right bank, elevation [m]
15.0	-1.0	Right bank, station [m]	Right bank, elevation [m]
15.0	0.0	Right bank, station [m]	Right bank, elevation [m]
15.5	0.5	Right bank, station [m]	Right bank, elevation [m]
17.0	2.0	Right bank, station [m]	Right bank, elevation [m]
500.0	2.0	Right bank, station [m]	Right bank, elevation [m]

Table 20: Structure of the file "InitialSectionProperties.dat", with example values and notes. General case with more than one material layer in left and right bank (table 4 of 6).

Example value	3	3	1.0	1.0
Note	Number of layers (left bank)	Number of layers (right bank)	Groundwater table (left bank) [m]	Groundwater table (right bank) [m]

Table 21: Structure of the file "InitialSectionProperties.dat", with example values and notes. General case with more than one material layer in left and right bank (table 5 of 6).

Example value	2	0	2.0	18000.0	0.0000005	5.0	5000.0	25.0	15.0
Example value	4	2	0.5	18000.0	0.0000005	5.0	5000.0	25.0	15.0
Example value	5	4	-1.0	18000.0	0.0000005	5.0	5000.0	25.0	15.0
Note	Left bank (layer 1): bottom index	Left bank (layer 1): top index	Left bank (layer 1): top elevation [m]	Left bank (layer 1): unit weight [N/m^3]	Left bank (layer 1): erosion-rate coefficient [m/s]	Left bank (layer 1): critical shear stress [Pa]	Left bank (layer 1): cohesion [Pa]	Left bank (layer 1): angle of repose [°]	Left bank (layer 1): angle ϕ_b [°]
Note	Left bank (layer 2): bottom index	Left bank (layer 2): top index	Left bank (layer 2): top elevation [m]	Left bank (layer 2): unit weight [N/m^3]	Left bank (layer 2): erosion-rate coefficient [m/s]	Left bank (layer 2): critical shear stress [Pa]	Left bank (layer 2): cohesion [Pa]	Left bank (layer 2): angle of repose [°]	Left bank (layer 2): angle ϕ_b [°]
Note	Left bank (layer 3): bottom index	Left bank (layer 3): top index	Left bank (layer 3): top elevation [m]	Left bank (layer 3): unit weight [N/m^3]	Left bank (layer 3): erosion-rate coefficient [m/s]	Left bank (layer 3): critical shear stress [Pa]	Left bank (layer 3): cohesion [Pa]	Left bank (layer 3): angle of repose [°]	Left bank (layer 3): angle ϕ_b [°]

Table 22: Structure of the file "InitialSectionProperties.dat", with example values and notes. General case with more than one material layer in left and right bank (table 6 of 6).

Example value	3	5	2.0	18000.0	0.0000005	5.0	5000.0	25.0	15.0
Example value	1	3	0.5	18000.0	0.0000005	5.0	5000.0	25.0	15.0
Example value	0	1	-1.0	18000.0	0.0000005	5.0	5000.0	25.0	15.0
Note	Right bank (layer 1): bottom index	Right bank (layer 1): top index	Right bank (layer 1): top elevation [m]	Right bank (layer 1): unit weight [N/m^3]	Right bank (layer 1): erosion-rate coefficient [m/s]	Right bank (layer 1): critical shear stress [Pa]	Right bank (layer 1): cohesion [Pa]	Right bank (layer 1): angle of repose [°]	Right bank (layer 1): angle ϕ_b [°]
Note	Right bank (layer 2): bottom index	Right bank (layer 2): top index	Right bank (layer 2): top elevation [m]	Right bank (layer 2): unit weight [N/m^3]	Right bank (layer 2): erosion-rate coefficient [m/s]	Right bank (layer 2): critical shear stress [Pa]	Right bank (layer 2): cohesion [Pa]	Right bank (layer 2): angle of repose [°]	Right bank (layer 2): angle ϕ_b [°]
Note	Right bank (layer 3): bottom index	Right bank (layer 3): top index	Right bank (layer 3): top elevation [m]	Right bank (layer 3): unit weight [N/m^3]	Right bank (layer 3): erosion-rate coefficient [m/s]	Right bank (layer 3): critical shear stress [Pa]	Right bank (layer 3): cohesion [Pa]	Right bank (layer 3): angle of repose [°]	Right bank (layer 3): angle ϕ_b [°]

2.3. Additional input file for floodplain heterogeneity

In case the user wants to set the spatial distribution of the soil erodibility and, in general, of the parameters governing bank retreat ("floodplain_heterogeneity" is set to "true" in the file "prototype.cfg"), an additional input file needs to be provided (its path is "floodplain_file" in the file "prototype.cfg"). Tables 23 and 24 illustrate the structure of this file in case only one material layer characterizes both left and right banks.

Table 23: Structure of the floodplain file in case only one material layer characterizes both left and right banks (table 1 of 2).

Parameter	x^* value of the origin of the floodplain grid [m]	y^* value of the origin of the floodplain grid [m]	Grid size Δx^* [m]	Grid size Δy^* [m]	Number of columns	Number of rows
Example value	-4.0	-145.6	60.0	60.0	30	7

Table 24: Structure of the floodplain file in case only one material layer characterizes both left and right banks (table 2 of 2).

Parameter	x^* value of the floodplain-grid node [m]	y^* value of the floodplain-grid node [m]	Migration coefficient [-]	Erosion-rate coefficient [m/s]	Critical shear stress [Pa]	Unit weight [N/m^3]
Example value	-4.0	-145.6	3.0e-007	5.17e-007	6.68	18000.0
Example value	...	...	...	...	...	...

Parameter	Cohesion [Pa]	Angle of repose [°]	Angle ϕ_b [°]
Example value	5000.0	26.0	13.0
Example value	...	...	...

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