



Pre- & Postprocessing in QGIS

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BASEMENT Anwendertreffen

30. Januar 2020



Content

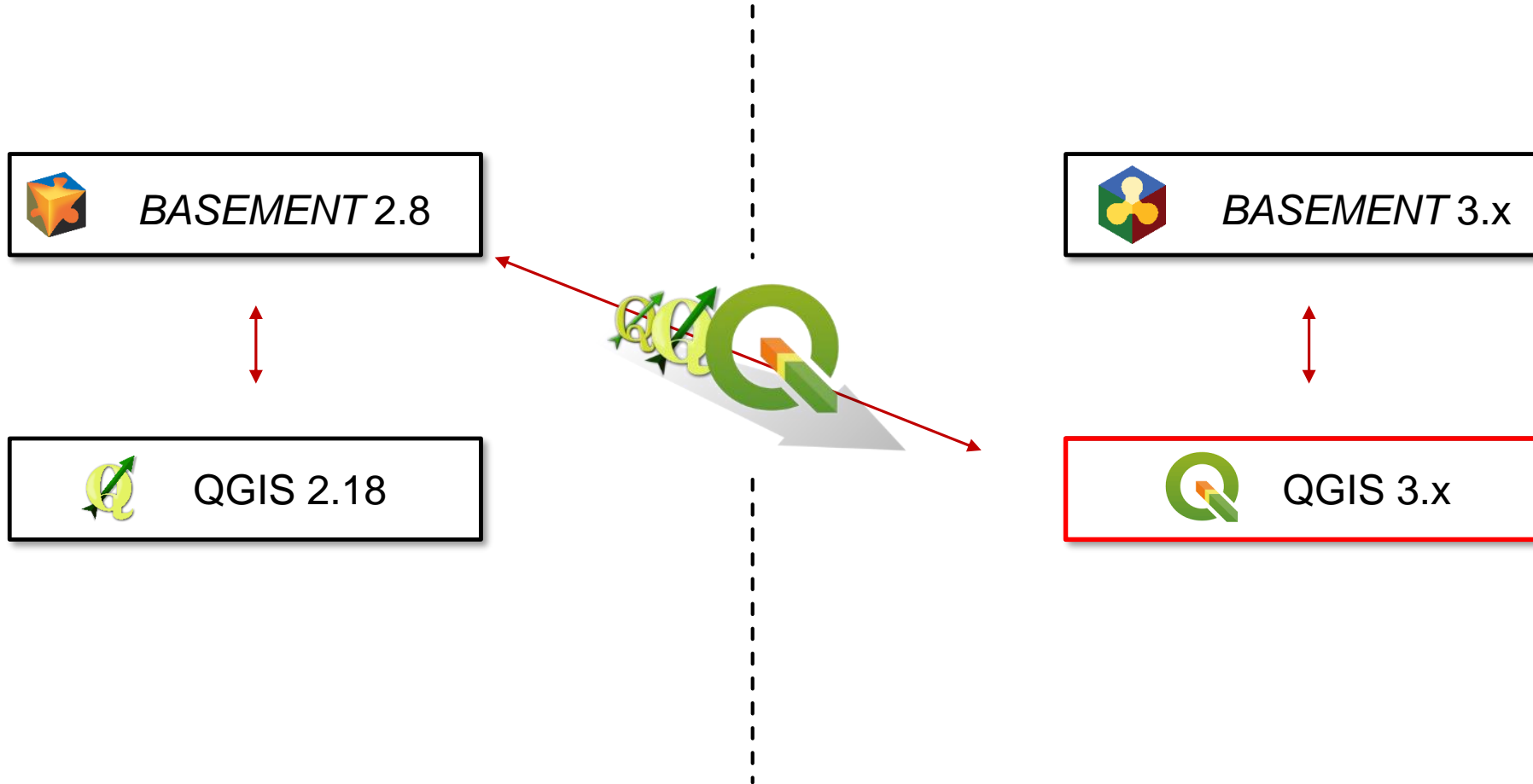
- Update on recent developments (Stephan)
 - QGIS 2.x vs. QGIS 3.x
 - Postprocessing in QGIS
- Preprocessing (Leonhard)
 - *BASEmesh* for QGIS 3.x
 - Outlook *BASEmesh* 2.0





QGIS 2.x vs. QGIS 3.x





2D Pre- and Postprocessing using QGIS





QGIS 2.x vs. QGIS 3.x

2D Visualization using QGIS

	QGIS 2.18.23 (or older)  (Crayfish 2.7.2)	QGIS 3.6.x  (MDAL/Crayfish)
<i>BASEMENT</i> 2.8 	<ul style="list-style-type: none"> • 2dm (nds) ✓ • nds/els (*.sol) ✓ 	<ul style="list-style-type: none"> • 2dm (nds) ✓ • nds/els (*.sol) ✓
<i>BASEMENT</i> 3.x 	(X)	<ul style="list-style-type: none"> • 2dm (els) • els (*.xdmf)











nds: node centred
els: element centred

QGIS v3.6 (July 2019)



QGIS 2.x vs. QGIS 3.x

2D Visualization using QGIS

	QGIS 2.18.23 (or older)  (Crayfish 2.7.2)	QGIS 3.10.x  (MDAL/Crayfish)
<i>BASEMENT</i> 2.8 	<ul style="list-style-type: none"> • 2dm (nds) • nds/els (*.sol)  	<ul style="list-style-type: none"> • 2dm (nds)  • nds/els (*.sol) 
<i>BASEMENT</i> 3.x 		<ul style="list-style-type: none"> • 2dm (els)  • els (*.xdmf) 

nds: node centred
els: element centred

→ Download von Grayfish Plugin bei **Neuinstallation QGIS 2.18** nicht länger möglich!

Postprocessing in QGIS

QGIS 2.18  & *BASEMENT* 2.8  **workaround**



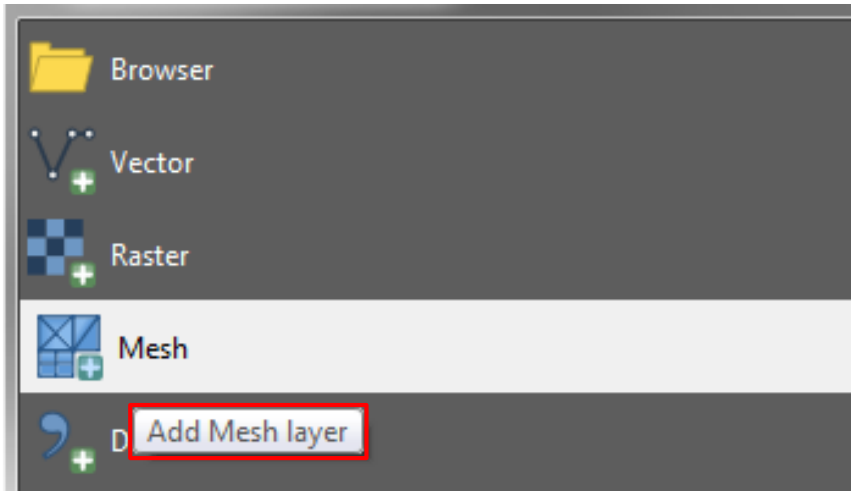
- Verwendung von QGIS 2.18 mit Crayfish Plugin bei bestehender Installation weiterhin möglich
- Bei Neuinstallation backup von Crayfish Ordner erstellen

➤ **C:\Users\username\.qgis2\python\plugins**



Postprocessing in QGIS

QGIS 3.x BASEMENT 2.8 & BASEMENT 3.x





QGIS Enhancement: Unstructured Mesh Layer

- 2dm files
- simulation results

- QGIS 3.x & Crayfish 3.x, C++ library replaced by [MDAL*](#)
- Crayfish simple python plugin (no platform specific libraries)
- Make use of QGIS [Unstructured Mesh Layer](#)

QGIS 3.x

- 2dm (Bed elevation)
- els/nds results
 - *.xdmf 
 - *.sol 
- mesh calculator
- (3D view)

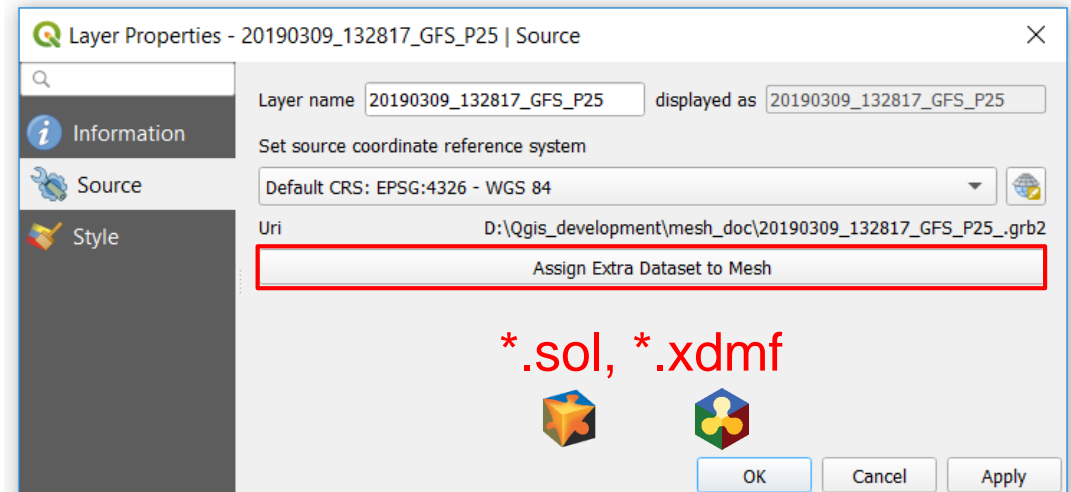
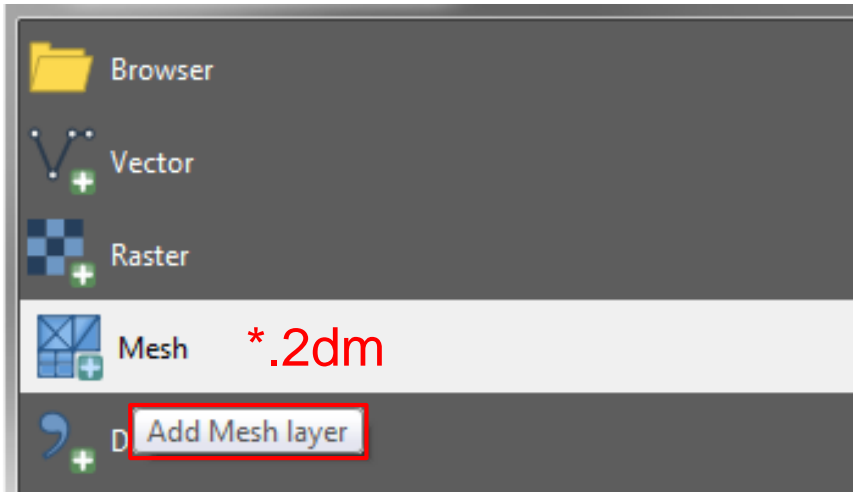
Crayfish 3.x

- plot/animation
- export mesh (vector)
- rasterize

*Mesh Data Abstraction Library

Postprocessing in QGIS

QGIS 3.x  BASEMENT 2.8 & BASEMENT 3.x



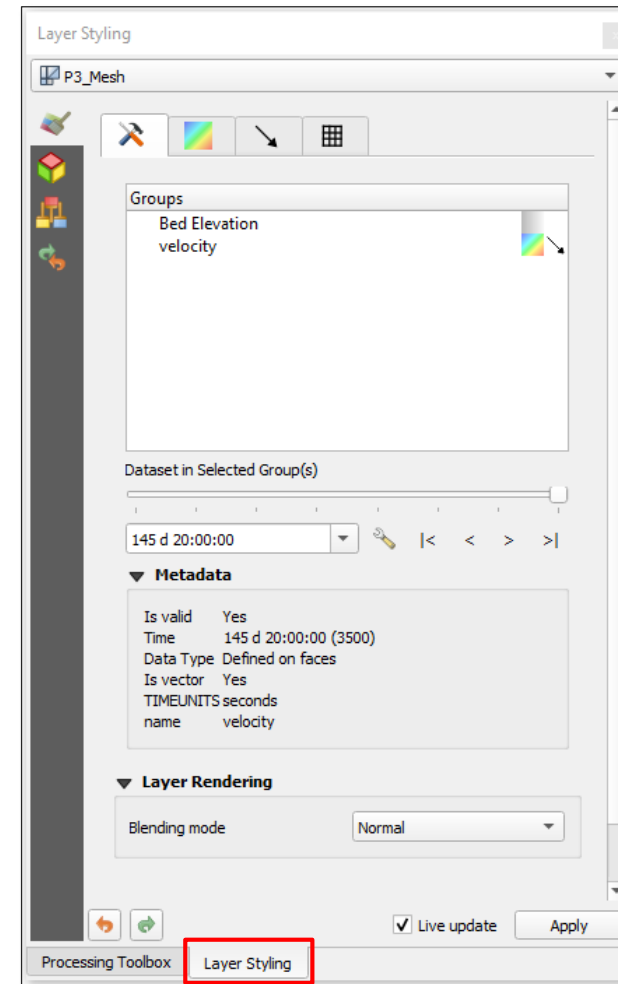
Postprocessing in QGIS

QGIS 3.x BASEMENT 2.8 & BASEMENT 3.x



- Some documentation available in [QGIS 3.x User Guide](#)

«Working with Mesh Data»

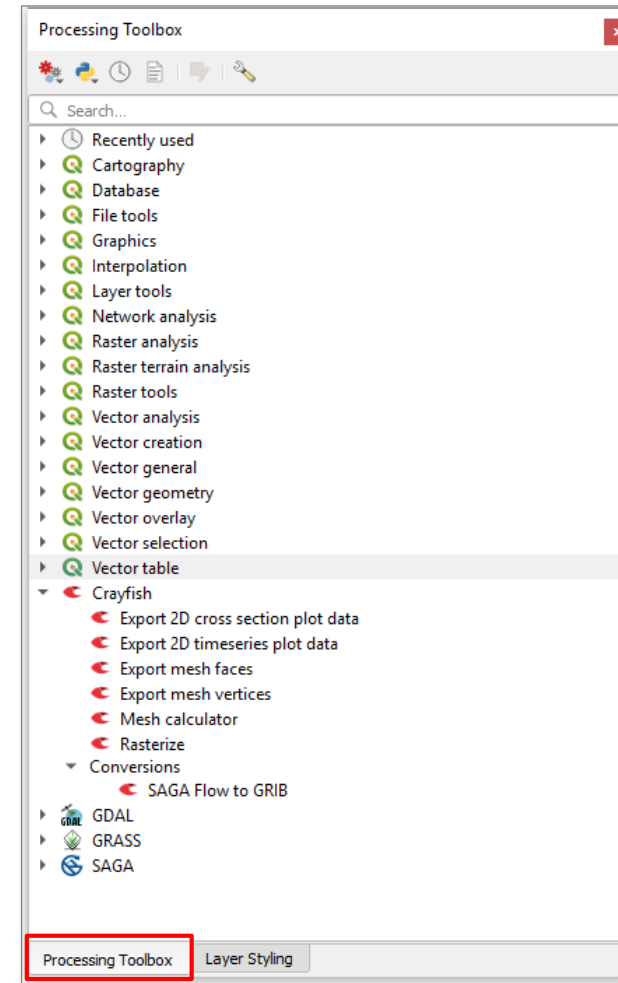
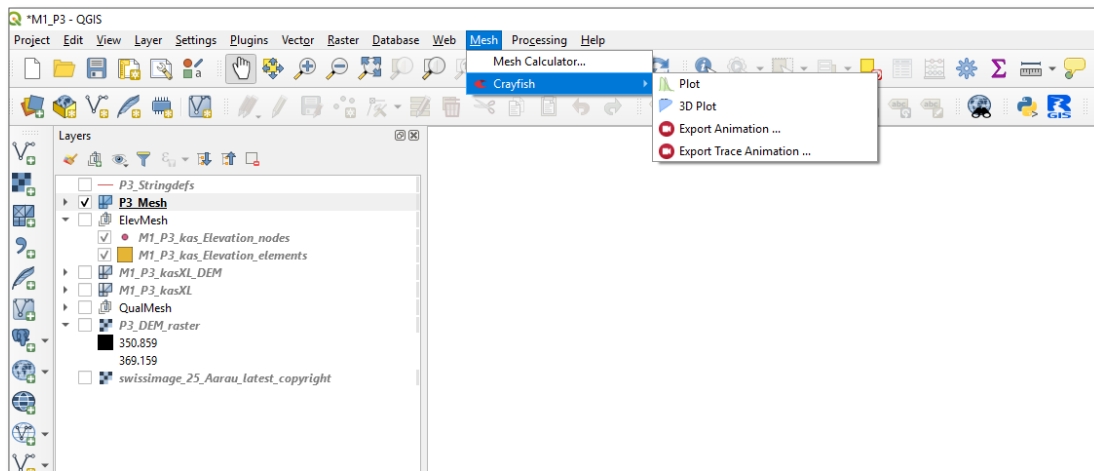




Postprocessing in QGIS

QGIS 3.x BASEMENT 2.8 & BASEMENT 3.x

- Some documentation available in [QGIS 3.x User Guide](#)
- Access Crayfish functions via:
 - Processing Toolbox
 - Menu Toolbar → Mesh





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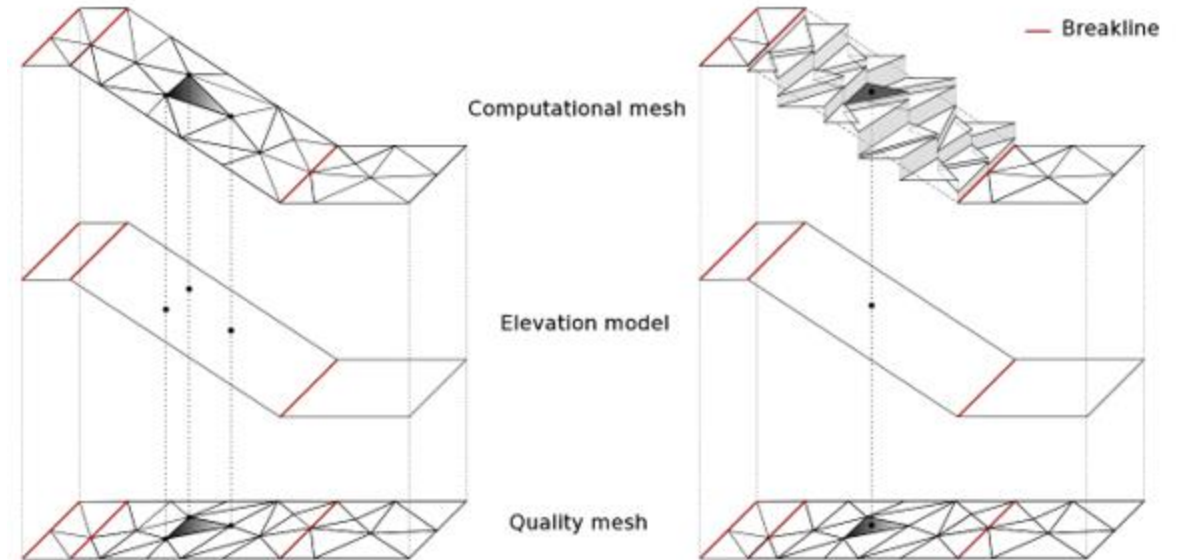
Current Status

New Requirements for BASEMENT 3

- New mesh element representation
 - Elevation via centroids
 - More convenient cell geometry
 - Accurate representation of break lines requires higher element density

→ Necessity for larger meshes

- Performance in BASEmesh was suboptimal before
- Current solution scales poorly





Current Status

BASEmesh v1.4.4

- Released 01-07-2019
- Large Mesh Tool introduced
 - All-in-one workflow
 - No intermediate files
 - Output for BASEMENT 3
- Temporary solution
 - Still scales poorly
 - Black box

BASEmesh - Generate large meshes

INPUT

Compulsory layers
Model boundary

Optional layers

Breaklines
 dividing constraint

Regions
 maximum area
 material index
 holes

Vertices

TRIANGLE parameters

-V (verbose): detailed statistics during mesh generation
 -D: Conforming Delaunay - insertion of Steiner points
 -q: Quality mesh generation using minimum triangle angle
 Minimum triangle angle [degrees]

-Y: Prohibits insertion of Steiner points on mesh boundary
 Expert options
 Relative snapping tolerance

String Definition

Breaklines
 Stringdef field
 Relative snapping tolerance

Elevation layers (for interpolation)

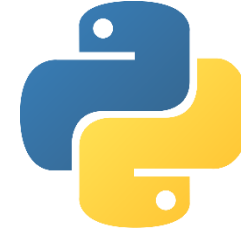
Elevation mesh
 Nodes vector layer
 Elements vector layer

Digital elevation map
 Raster layer
 Band

Current Status

New Requirements for QGIS 3

- Python 3.7
- User interface uses Qt 5
- Crayfish plugin functionality is gradually integrated into QGIS
- New mesh layer type through MDAL
- 3D-Visualisation



Current Status

BASEmesh v1.4.5

- QGIS 3 port of v1.4.4
- First performance improvements
- «Update of the temporary fix»
 - Performance still underwhelming
 - New QGIS 3.X features are hardly utilised



z.B. Flood protection Alpine Rhine

350'000 elements

QGIS 2.18: **11m 51s**

QGIS 3.10: **5m 36s**



Future Development

Problems with the current solution

- Code grew over years
 - No easy fixes for core performance issues
- Current architecture is hard to adapt for new features

→ Major Restructuring of the Codebase required

→ Focus on modularity and adaptability for new QGIS features



Future Development

BASEmesh v2.0

- Mesh data type for intermediate steps
 - No more «_nodes» or «_elements» Shapefiles
- Input formats
 - Shapefiles (as before)
 - Support for new formats in development (e.g. AutoCAD DXF)
- Reimplementation of compute-intensive steps in C++ (e.g. interpolation)
 - Compiled code → higher performance
 - But: platform-specific and non-portable
 - Entirely optional, a pure-Python implementation will always be available



Future Development

BASEmesh v2.0

- Core functionality available as standalone Python module
 - Access through Python or via command line
 - Acts as back-end for QGIS Plugin
 - QGIS Plugin:
 - Existing GUI-based workflow remains
 - Integration with QGIS processing toolbox
- Support for **graphical** modelling



Future Development BASEmesh v2.0

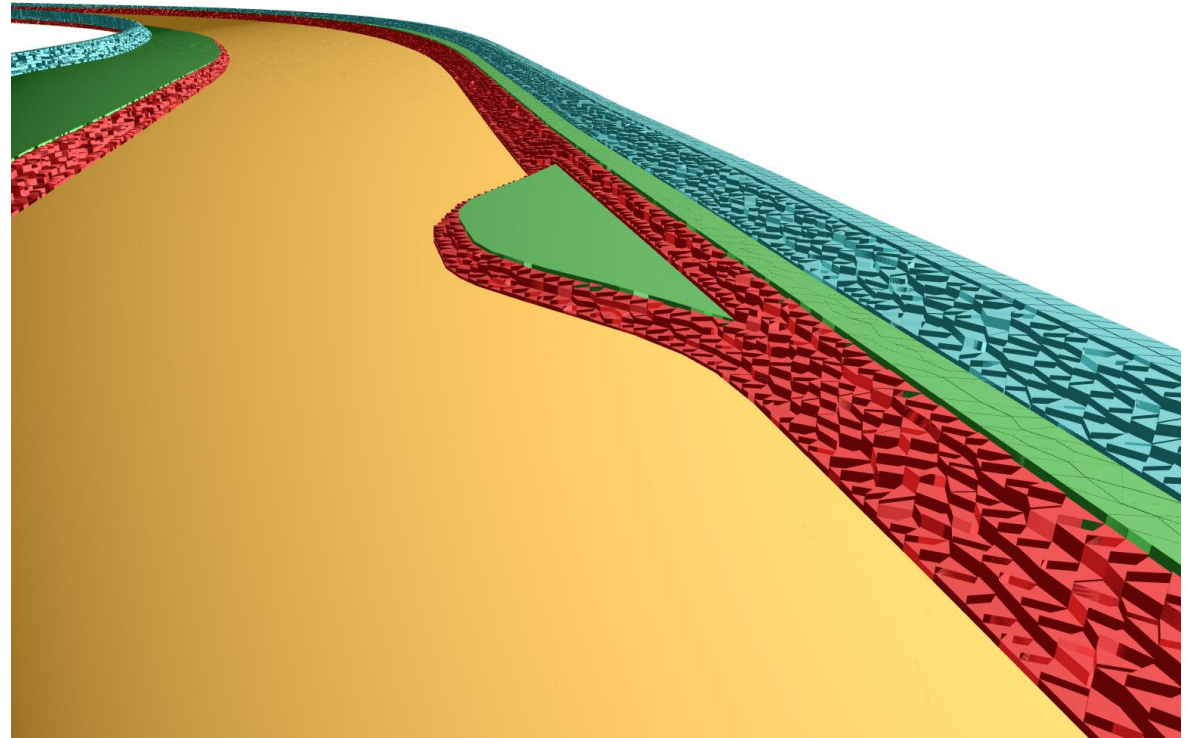
- Additional goal: Simplification of common workflows
- E.g.: Elevation interpolation with multiple data sources
 - TIN for river geometry, DEM raster for floodplain
 - No need for manually stitching of meshes

→ Submit Feature Requests to BASEMENT User Forum



Future Development BASEmesh v2.0

- Development ongoing, release Q2 2020



Feature preview:

Visualisation of BASEMENT 3 computational mesh using 3D map view feature in QGIS 3



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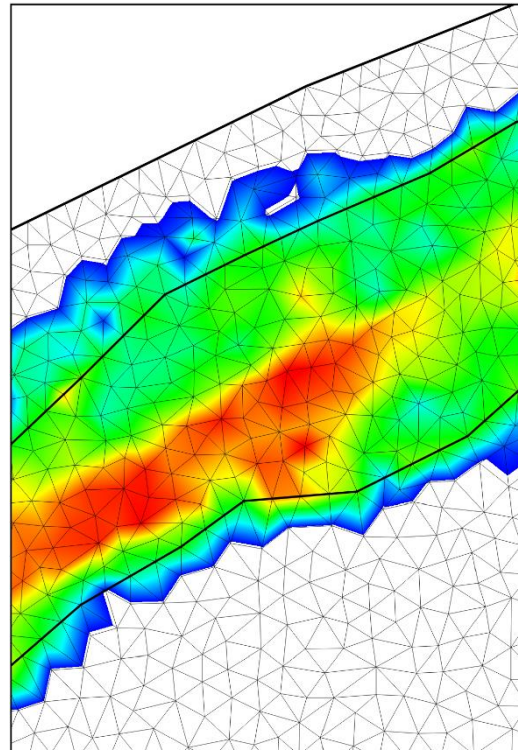
© Trueffelpix

Appendix

Data format (*.sol files)

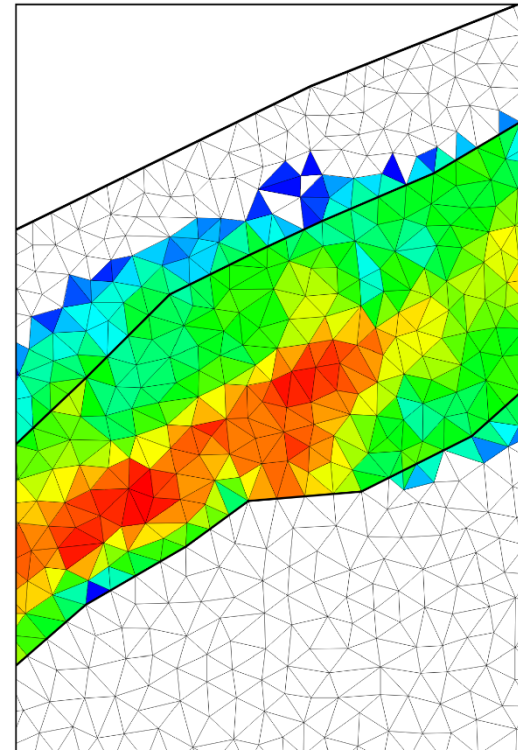
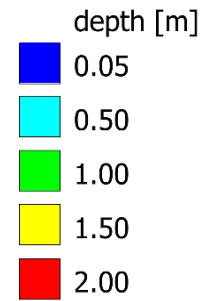


type: *node_centered*



z.B. *deltaz, grain_size...*

type: *element_centered*



z.B. *depth, wse, velocity...*