

# Current and future development of BASEMENT software

David F. Vetsch

8th BASEMENT Users Meeting

January 26, 2023

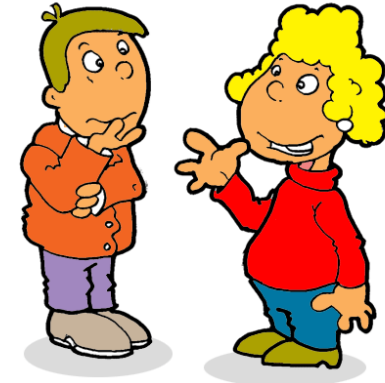


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- Objectives of the meeting
- Recent progress
- Roadmap 2023
- User Survey December 2022

# Objectives of the meeting

- Users are in the focus
  - exchange of experience
  - tell others about your success stories and pitfalls
  - participate to have a vivid discussion
  - networking -> at next COVID-free meeting
  
- Exchange between users and development team
  - share requirements and problems with us
  - modelling challenges in engineering practice
  - support focussed optimization of models



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<https://longbowevents.com>

# Recent Progress

Key tasks of current development phase (2018 - 2023)

Key Tasks Development <i>BASEMENT</i> 18-23			
concepts for engineering practice (A)	development & maintenance (B)		knowledge transfer (C)
	state-of-the-art models	new models	
40%	40%		20%

# Recent Progress

## (A) concepts for engineering practice / practice-oriented concepts (poc)

- objectives:
  - show scope and limits of model application **based on examples**
  - support **best possible** model application, i.e. generation of meaningful results
  - **discuss plausibility** and interpretation of results
  - best practice and **pointing out the relevant theoretical correlations**



# Recent Progress

## (A) concepts for engineering practice: application-oriented concepts (AOC)

- AOCs in preparation:

1D	1	2	3
Example	River Widening	Alpine River	Dam Removal
Focus	change in channel width and longitudinal grain sorting	bed stability under steep and unsteady conditions	limitation of local erosion at sills and ramps
Key aspects	longterm evolution, dynamic equilibrium, effect of tributaries	mixed-sized sediment, limitations of Hirano model	impact of non-erodible bed on sediment transport and grain sorting

2D	1	2	3
Example	Alternate Bars		

14:30 - 15:00 Application-oriented Concepts (AoC) - current status of AoC "bed load transport"

Benjamin Hohermuth  
Seline Frei

channel pattern

basic concept for morphodynamic 2D model calibration - step 2

basic concept for morphodynamic 2D model calibration - step 3



# Recent Progress

## (B) development & maintenance

- BASEmesh v2.2
  - efficient generation of quality meshes larger than 1'000'000 elements
  - workflow for mesh generation considering buildings (e.g. several 1000)
  - cleanup functionality with wiki description
  - mesh renumbering

supported versions:

QGIS Version		Codename	Tested on
3.10	LTR	A Coruña	3.10.14
3.16	LTR	Hannover	3.16.16
3.22	LTR	Białowieża	3.22.9
3.24		Tisler	3.24.1
3.26		Buenos Aires	3.26.3

see release note for further details: <https://gitlab.ethz.ch/vaw/public/basemesh-v2/-/releases/2.2.0>

# Recent Progress

## (B) development & maintenance

- BASEchange (basemesh.basechange)
  - create mesh for river reaches
  - 1D trapezoidal channel geometry
  - export as 1D or 2D mesh
  - command line interface
  - input via CSV file supported

The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J
1	km	bed_width	slope	bank_slope	height	num_cs	ks	ksb	midpoint_shift	
2	0	22.12	0.000	0.72	6.01	2	32	20	0.5	
3	0.078	18.30	0.011	1.45	5.44	2	32	20	0.5	
4	0.127	16.44	0.011	1.76	3.65	2	32	20	0.5	
5	0.129	16.66	0.037	1.48	4.95	1	32	20	0.5	
6	0.175	16.06	0.021	2.08	5.11	2	32	20	0.5	
7	0.196	16.83	0.002	1.52	3.37	1	32	20	0.5	
8	0.201	16.16	0.003	1.67	3.24	1	32	20	0.5	
9	0.282	22.27	0.010	1.29	4.43	2	32	20	0.5	
10	0.387	22.17	0.018	2.01	4.61	3	32	20	0.5	
11	0.477	18.84	0.017	1.77	4.91	3	32	20	0.5	
12	0.573	21.33	0.012	1.93	4.48	3	32	20	0.5	
13	0.697	24.80	0.010	2.72	3.53	3	32	20	0.5	
14	0.793	24.89	0.011	2.06	4.02	3	32	20	0.5	
15	0.893	21.05	0.014	1.61	4.04	3	32	20	0.5	
16										
17										
18										

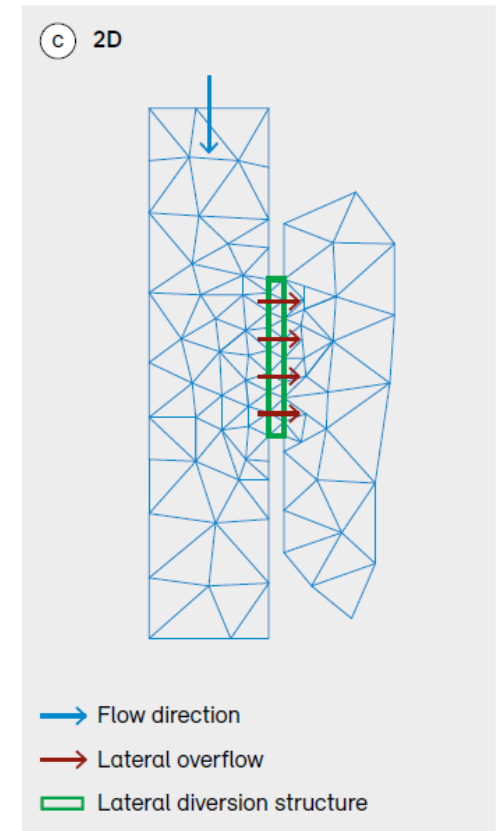
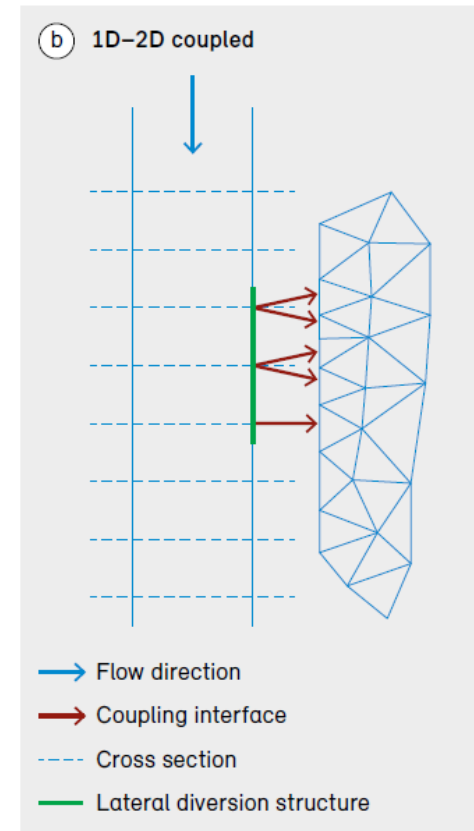
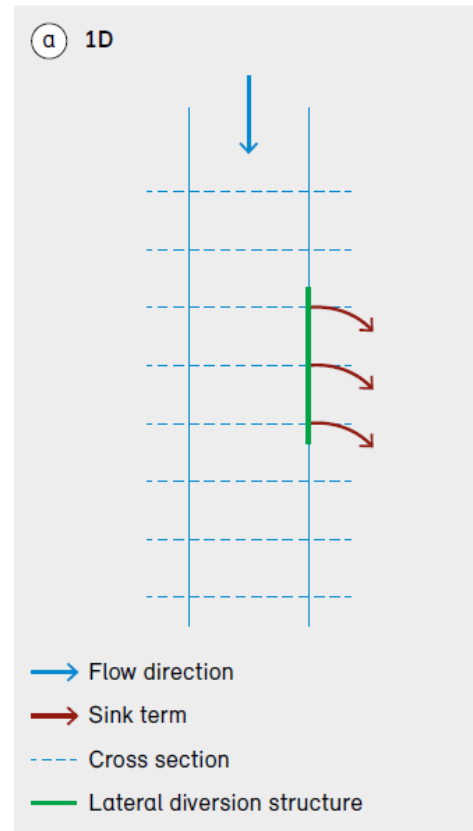
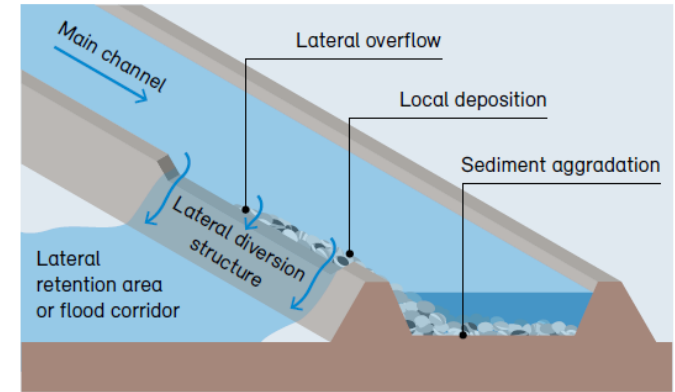
<https://gitlab.ethz.ch/vaw/public/basemesh-v2/-/wikis/Command-line/BASEchange>



# Recent Progress

## (B) development & maintenance

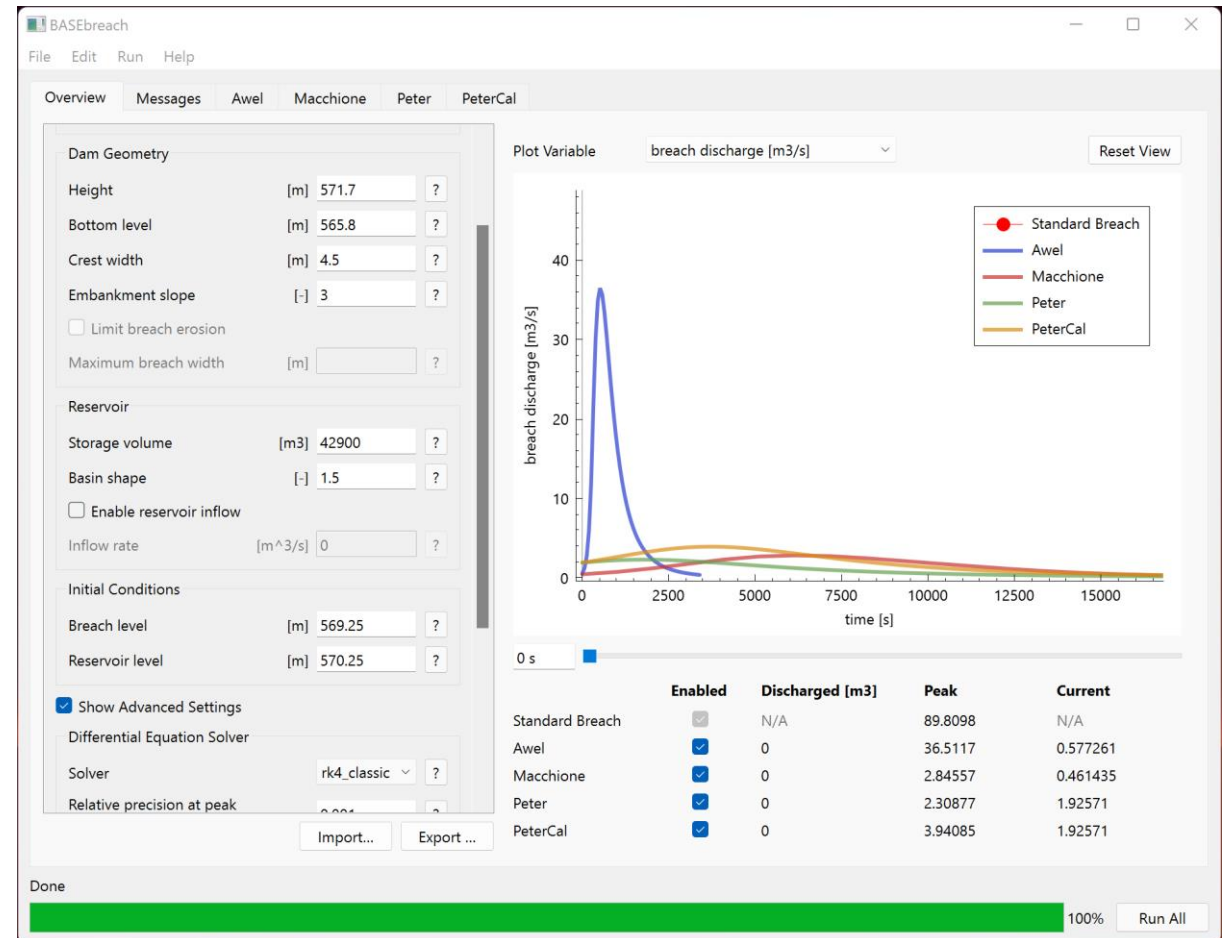
- Lateral diversion
  - comparison of different modelling approaches
  - focus on effect on morphodynamics
  - extension of 1D approach (momentum sink)
  - publication and example files will be available soon



# Recent Progress

## (B) development & maintenance

- BASEbreach
  - parameter models for simulation of dam failure
  - estimation of the outflow hydrograph
  - GUI supports comparison of the different approaches
  - Monte-Carlo simulation for uncertainty quantification
  - open source under GPL



<https://gitlab.ethz.ch/vaw/public/basebreach/-/wikis/home>

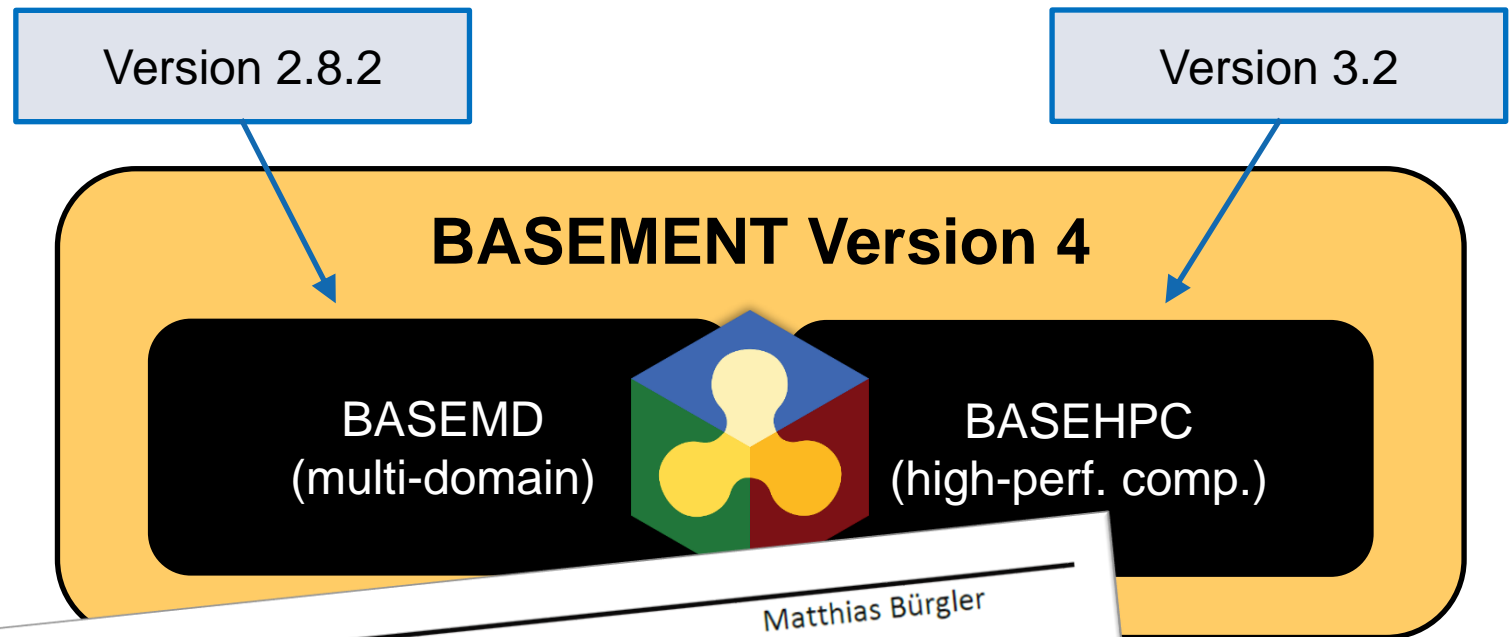
# Recent Progress

## (B) development & maintenance

### Consolidation of versions 2 and 3: “2+3=4”

Motivation:

- reduce maintenance effort
- keep features of version 2
- one workflow, one GUI



16:45 - 17:00 Introducing BASEMENT Version 4

# Recent Progress

## (C) knowledge transfer

- **main focus on the development of the AOCs**
- instructions and application of BASEMENT software in graduate courses at ETH Zurich:
  - Experimental and Computer Laboratory I
  - River Morphodynamic Modelling

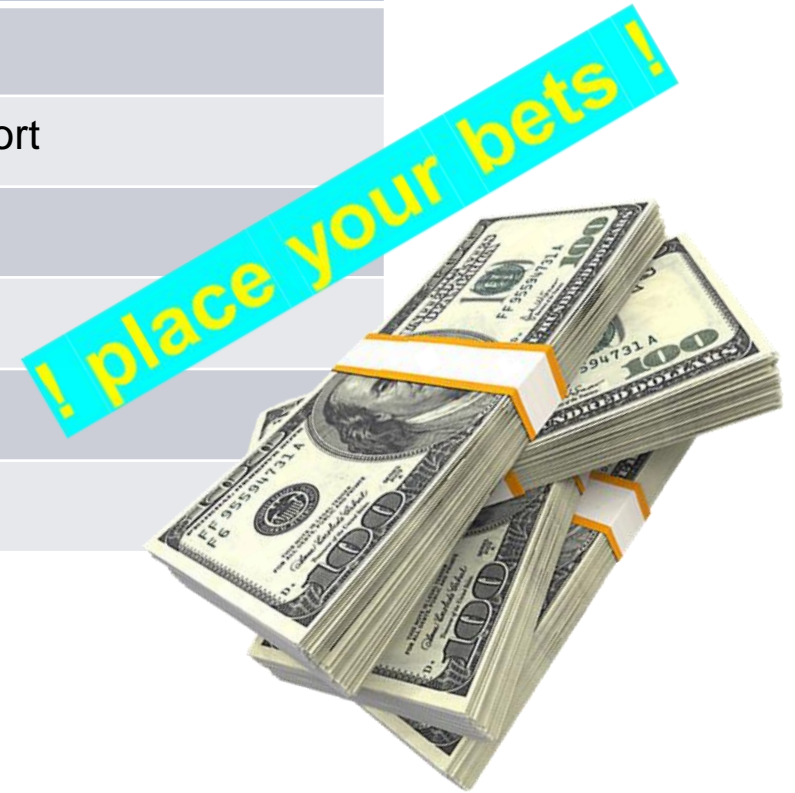
# Recent Progress

Retrospect: Roadmap 2022 (**main features only**)

Version	Date	Comments	Status
3.2	Q1 2022	turbulence model, suspended load	✓
3.3	Q2 2022	mixed-size sediment transport	postponed
3.4	Q2 2022	BASEveg	✓
3.5	Q3 2022	temperature model	postponed
4.0	Q3 2022 -> release Q1 2023	consolidation of v2.8 and v3	✓
BASEbreach v1.0	Q1 2022	stand-alone, open source, GPL	✓
BASEchange v1.1	Q2 2022	arbitrary river course	✓
BASEtools	Q2 2022	consolidation of various tools	open
POC bed load	Q4 2022	first version (draft)	✓

# Roadmap 2023 (main features only)

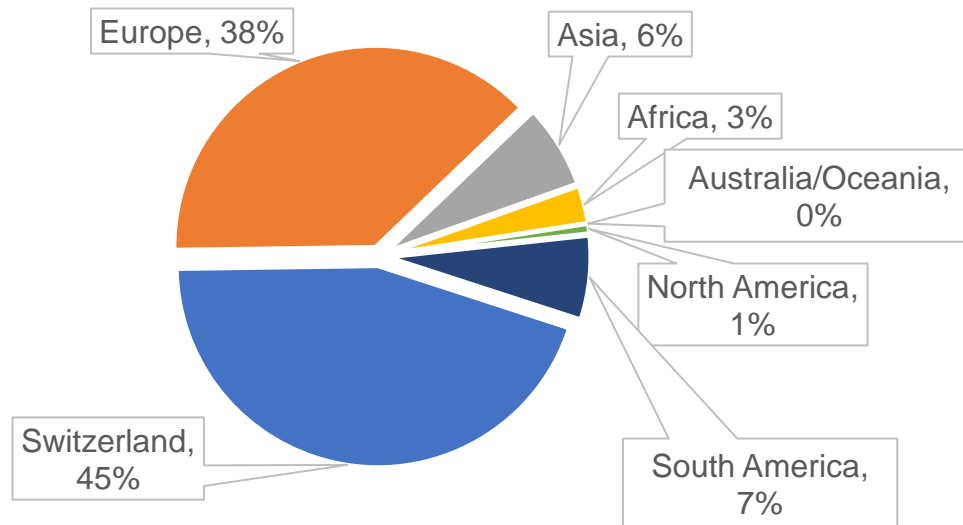
Version	Date	Comments
4.0	Q1 2023	consolidation of v2.8 and v3
4.1	Q1 2023	mixed-size sediment transport
4.2	Q2 2023	temperature model
4.3	Q3 2023	Lagrangian tracers
POC bed load (1D)	Q2 2023	release
POC morphodynamics (2D)	Q4 2023	first version (draft)



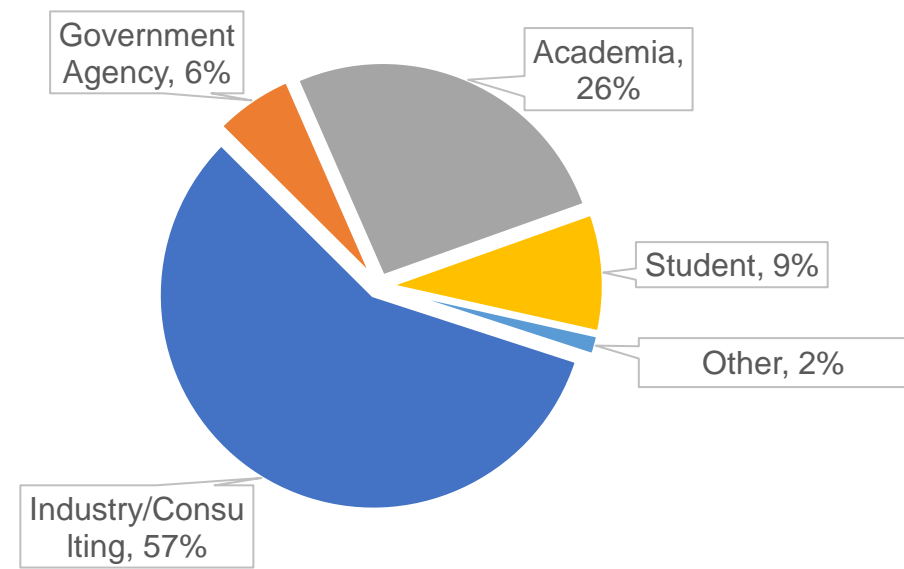
# User Survey December 2022

- Survey for users of mailing list (2800 addresses), 15th to 23rd December 2022
- Survey about field of application, output formats, potential features, training materials
- Number of replying participants: min 45, max 134, mean ca. 80

Location of BASEMENT Users  
(total: 134)

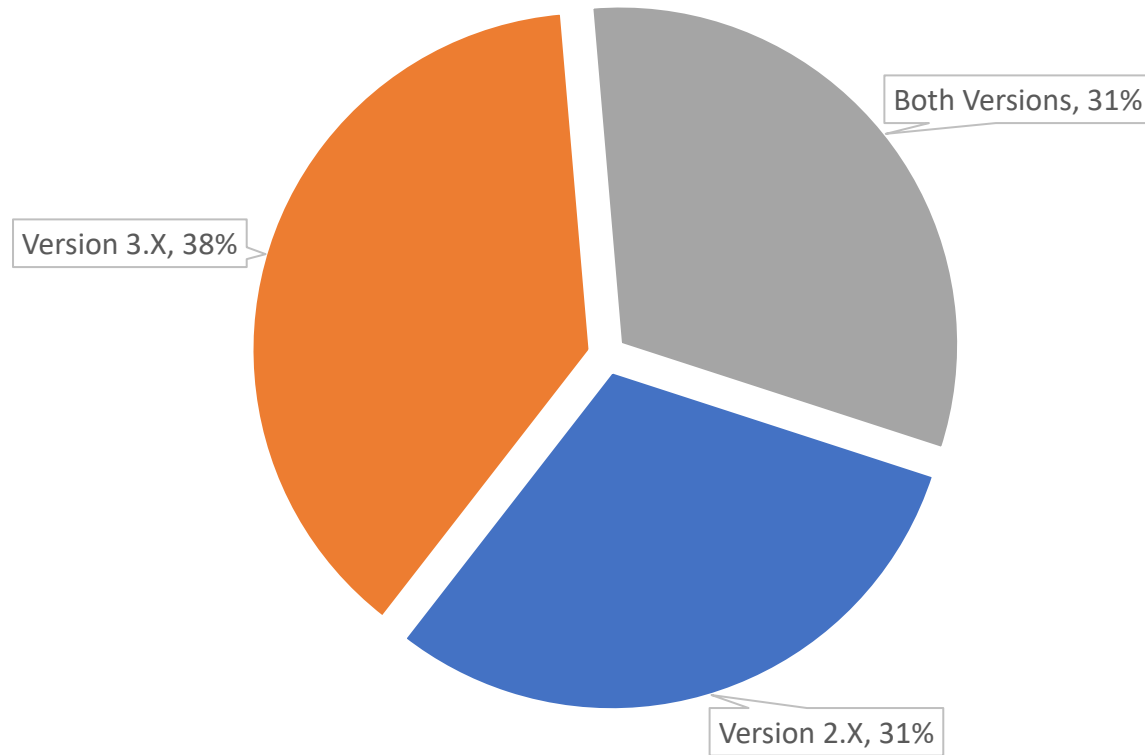


Industry of BASEMENT Users



# General information about BASEMENT users

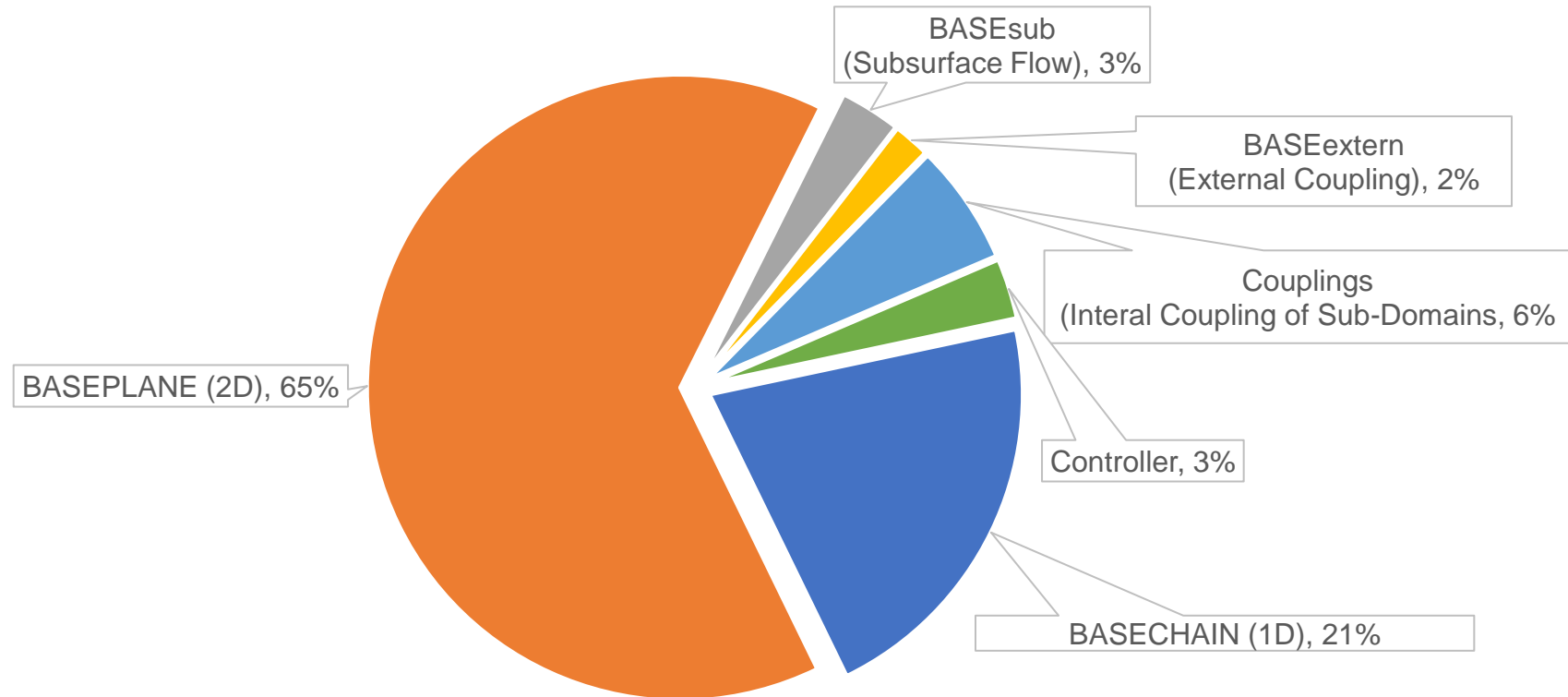
Use of BASEMENT Versions





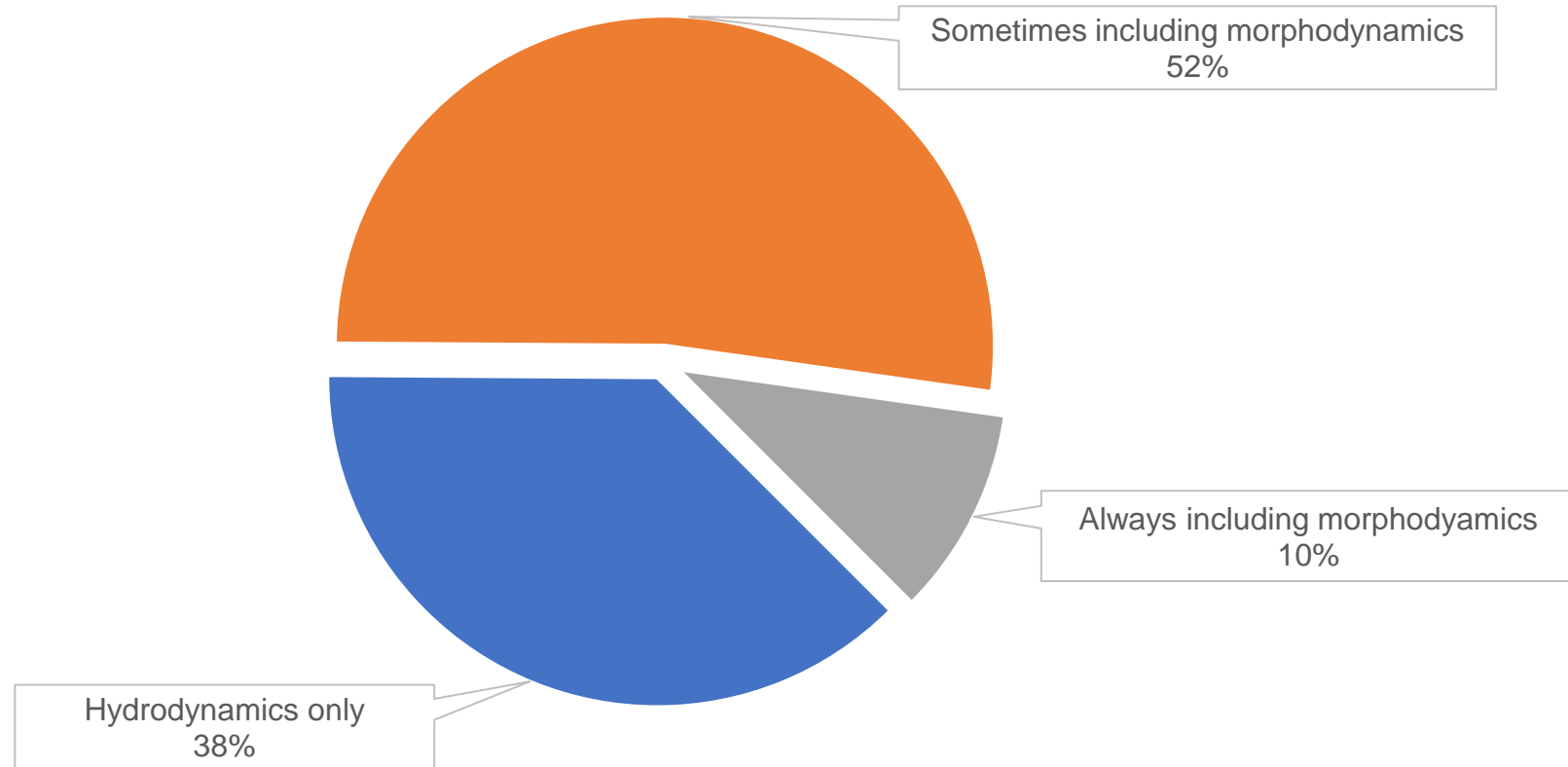
# General information about BASEMENT users

Use of BASEMENT Modules



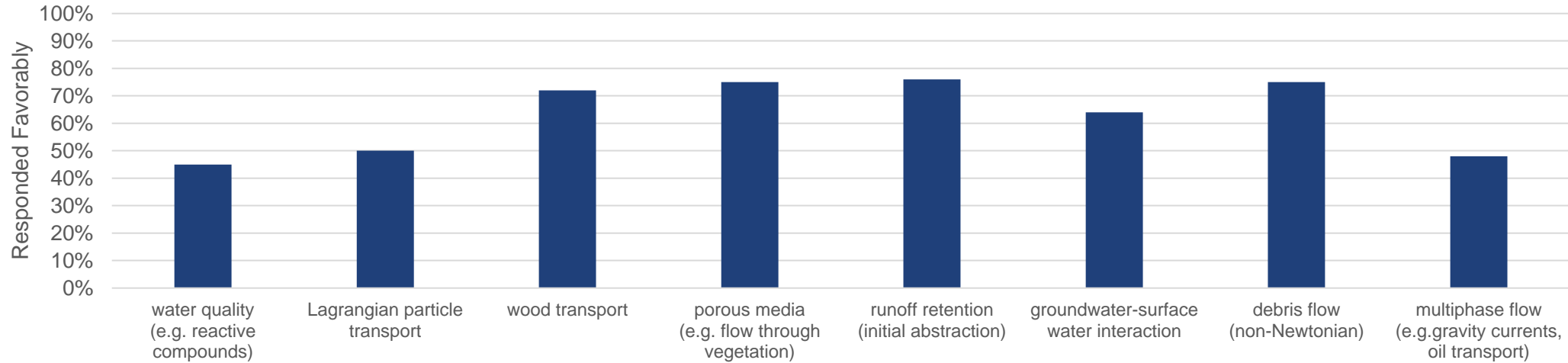
# General information about BASEMENT users

Use of Morphodynamics

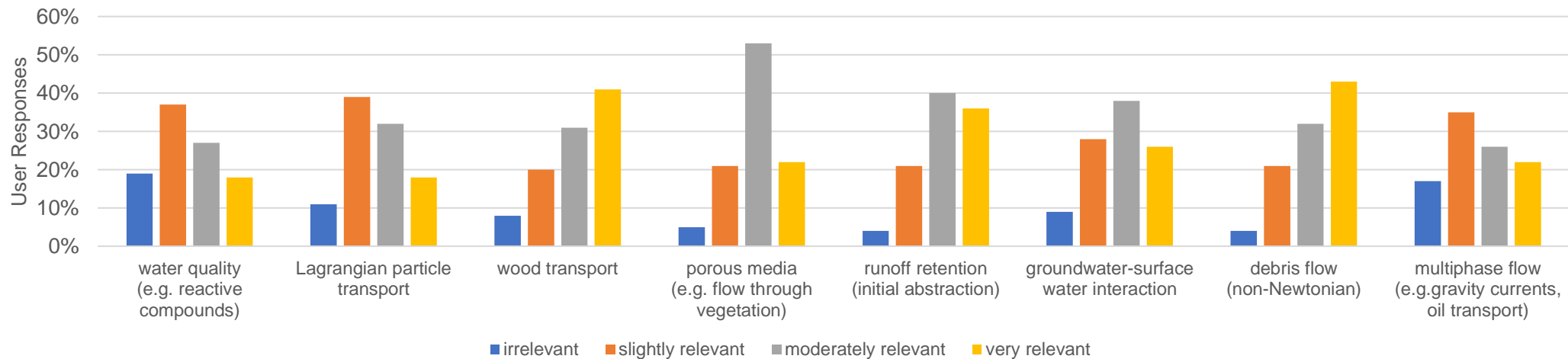


# User community interest in new features

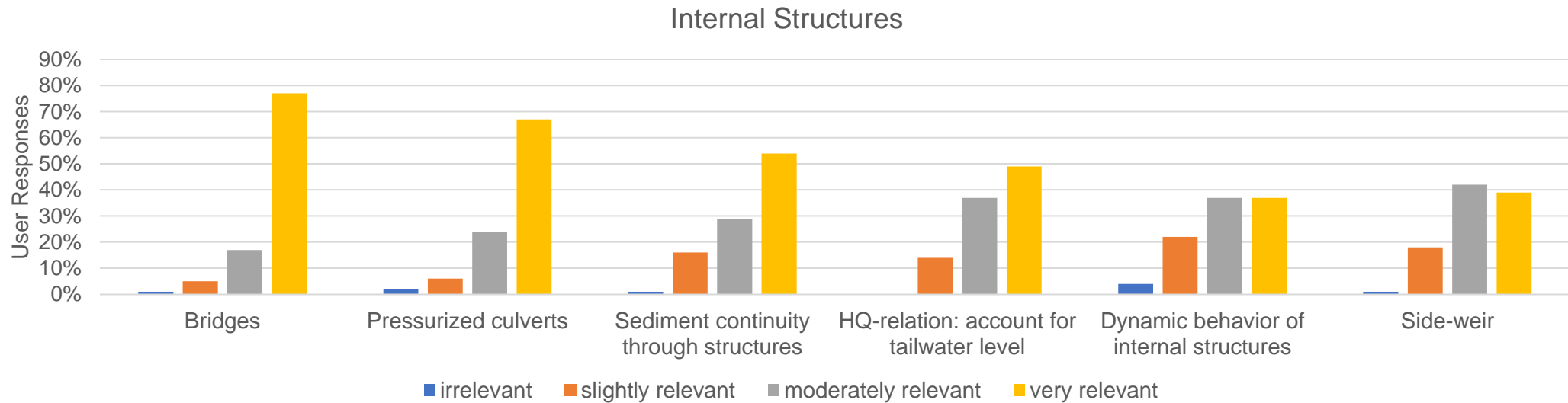
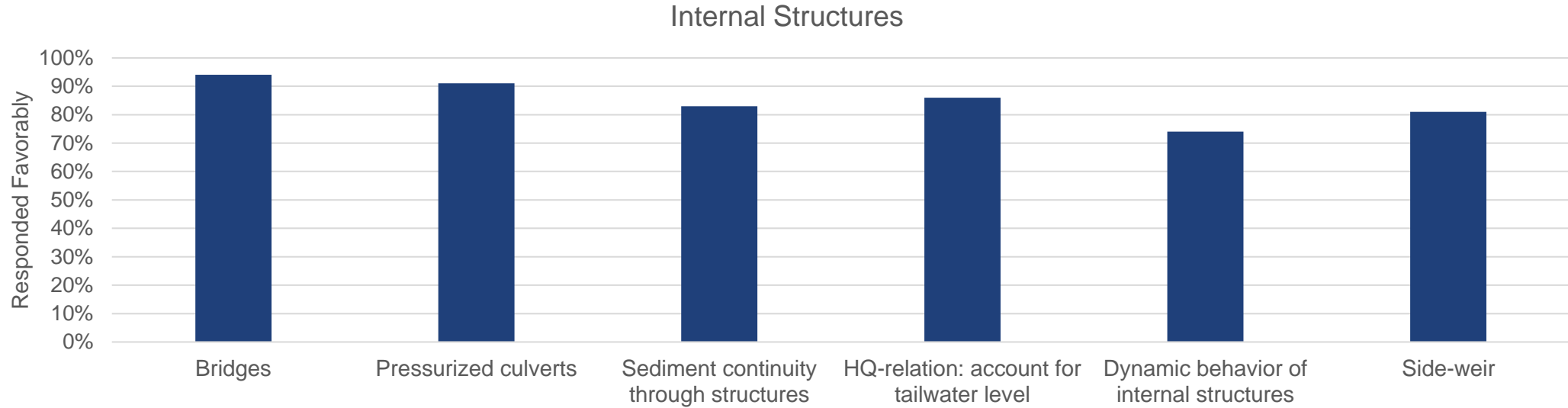
New Processes



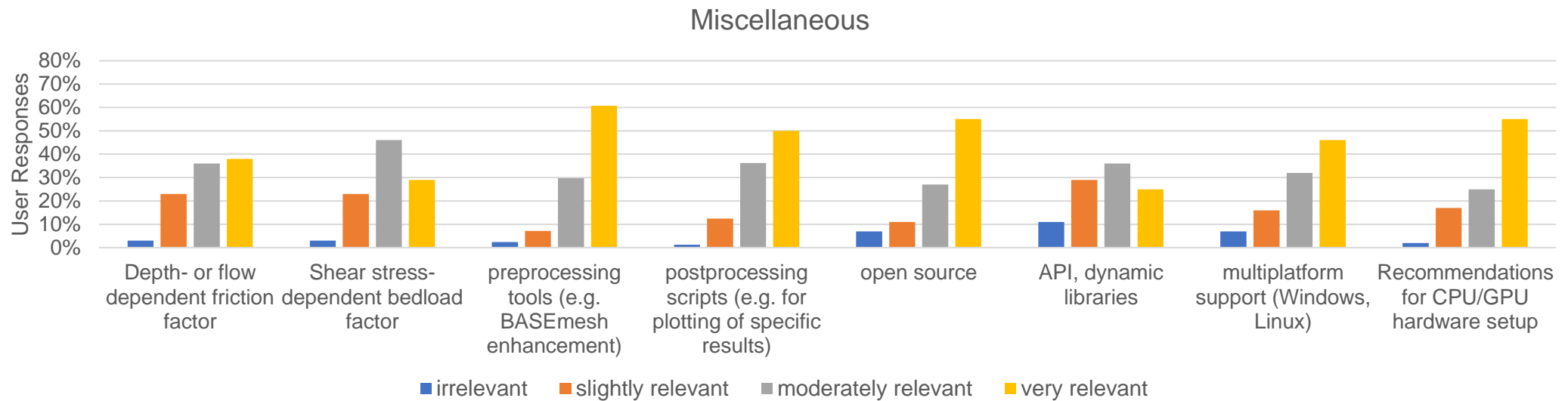
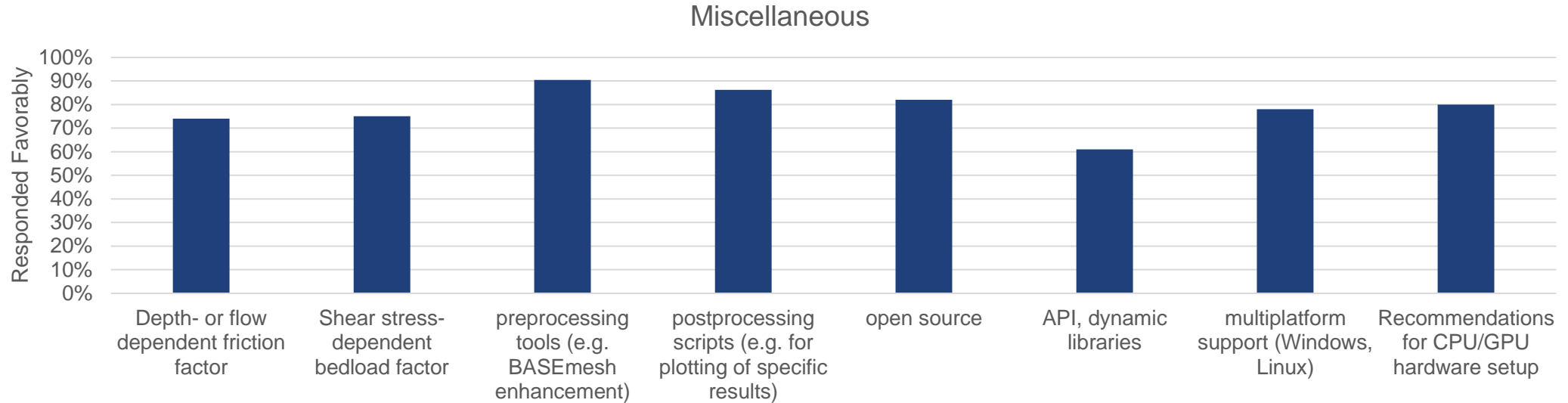
New Processes



# User community interest in new features

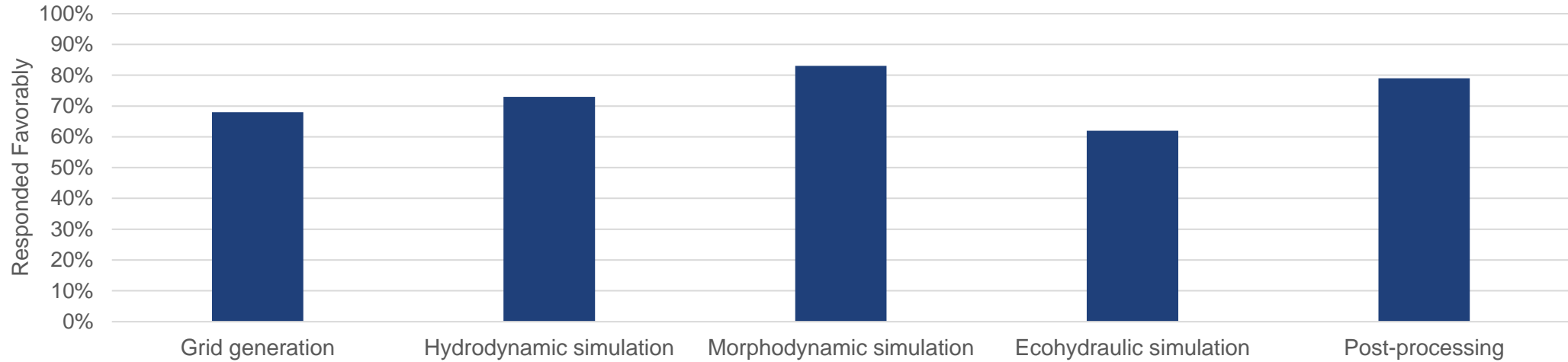


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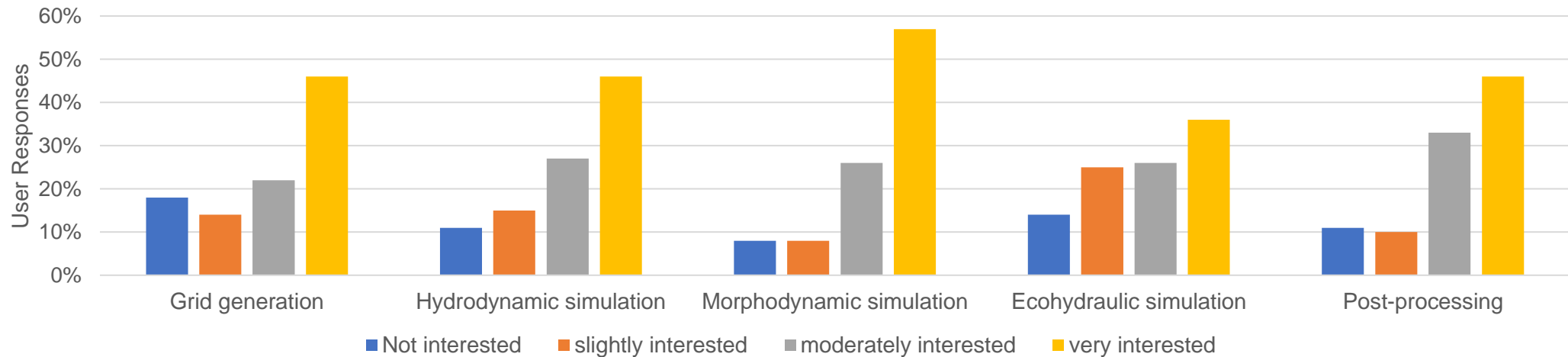


# User community interest in new features

Topic as a session in a workshop

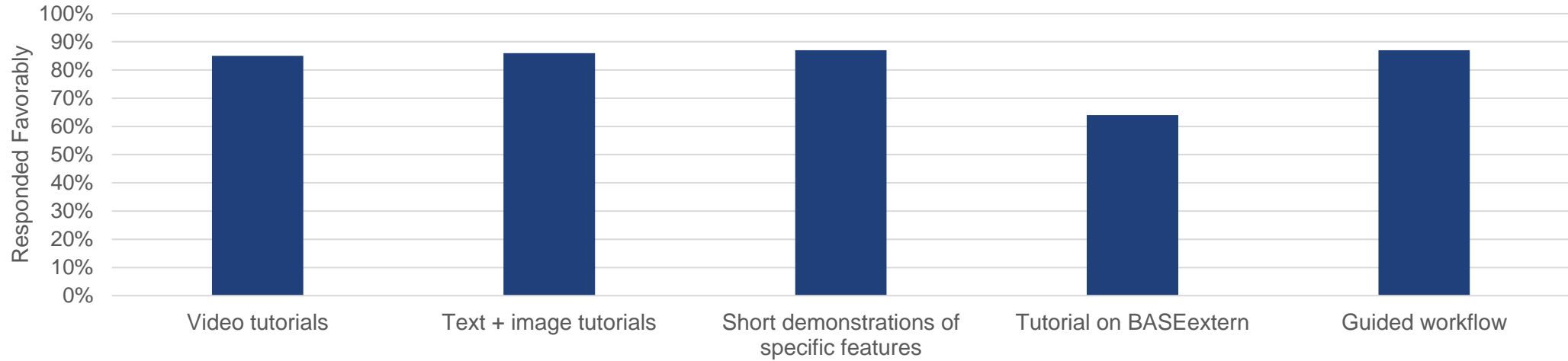


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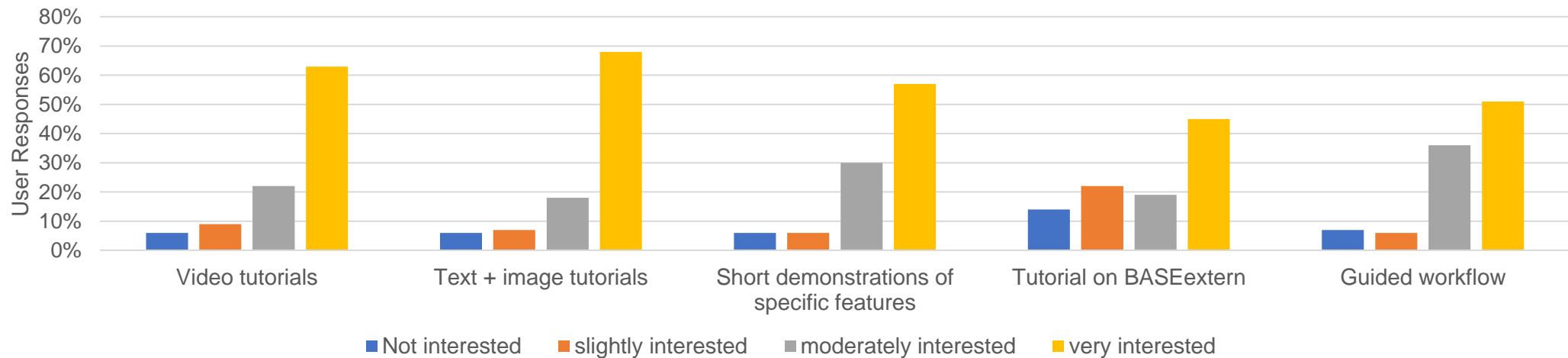


# User community interest in new features

Self-Training Materials

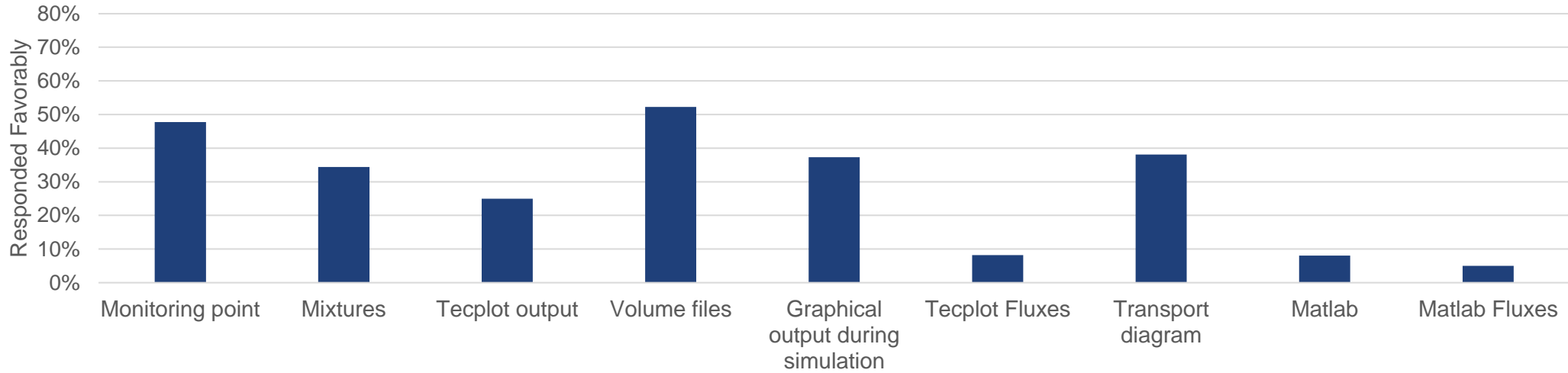


Self-Training Materials

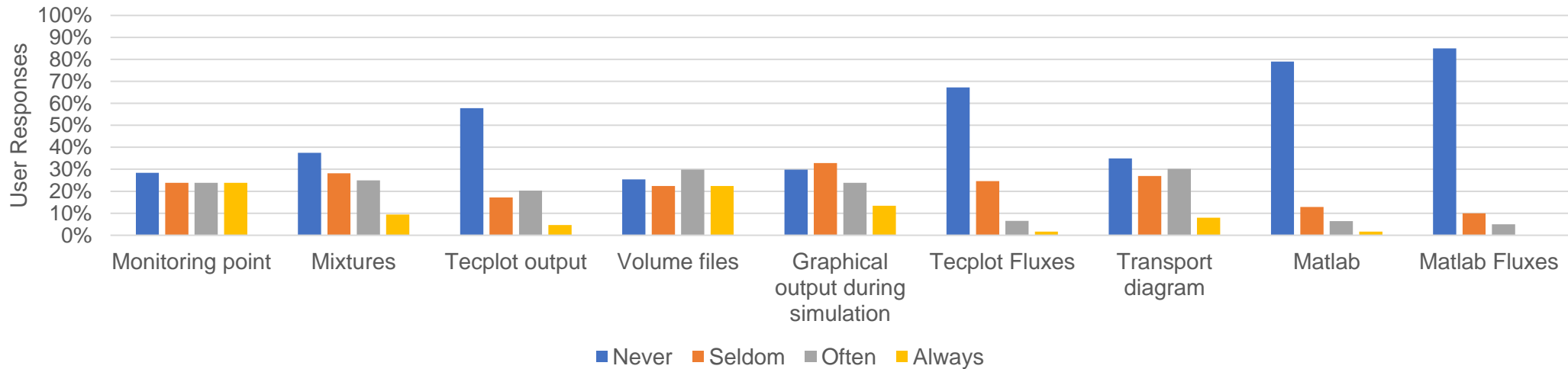


# User community use of outputs

BASECHAIN Special Outputs



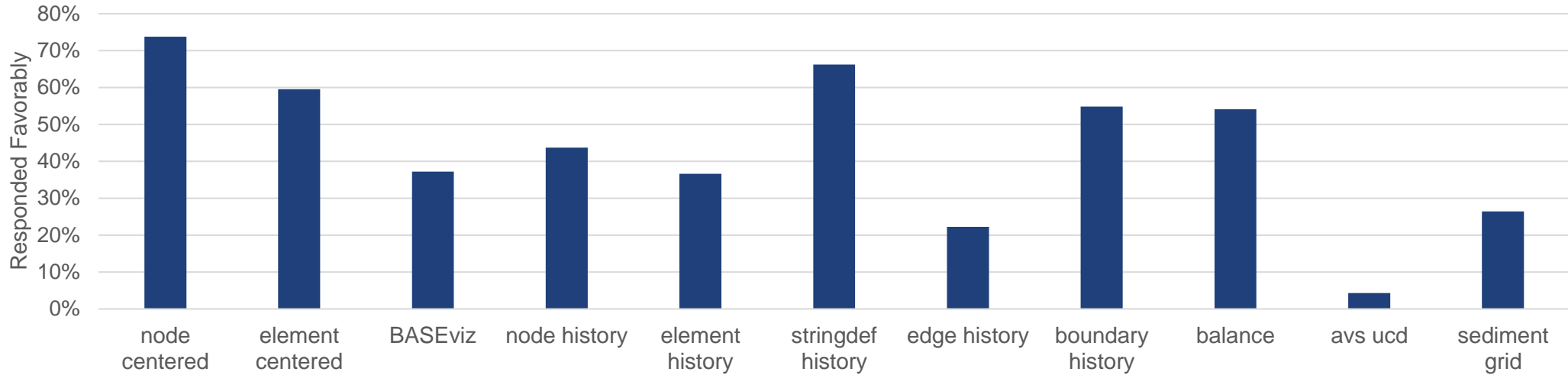
BASECHAIN Special Outputs



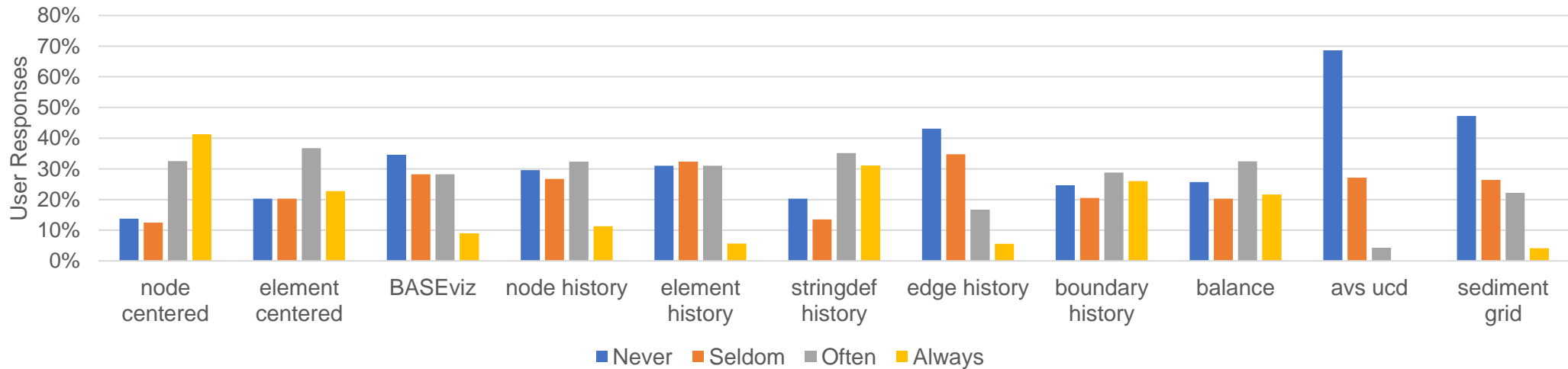


# User community use of outputs

BASEPLANE Special Outputs

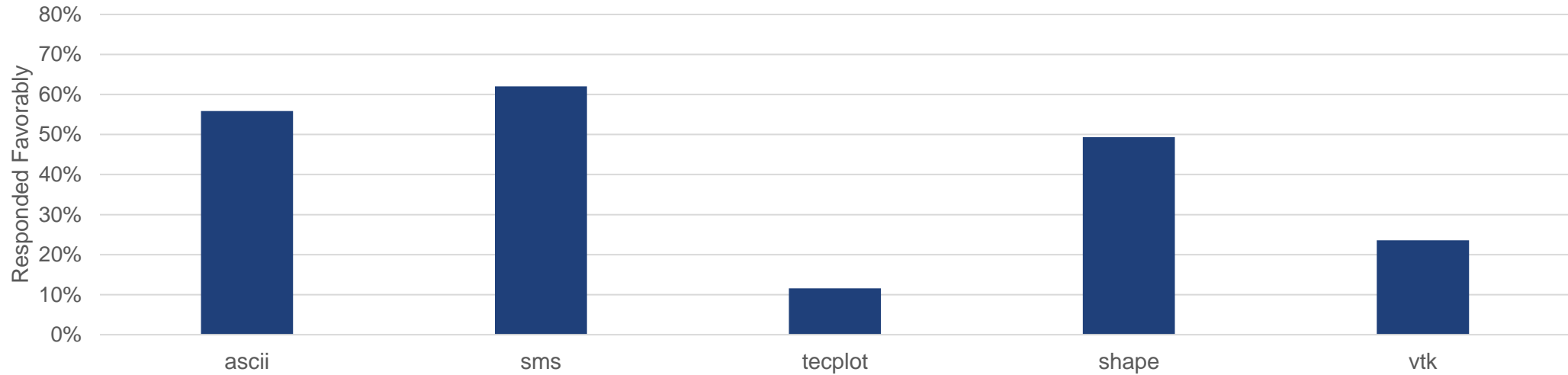


BASEPLANE Special Outputs

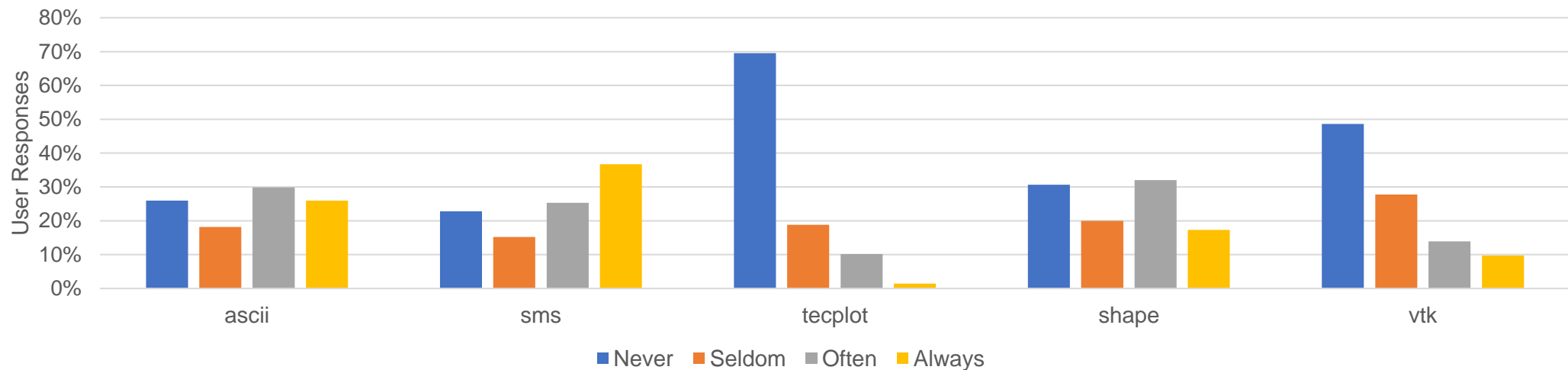


# User community use of outputs

BASEPLANE File Formats

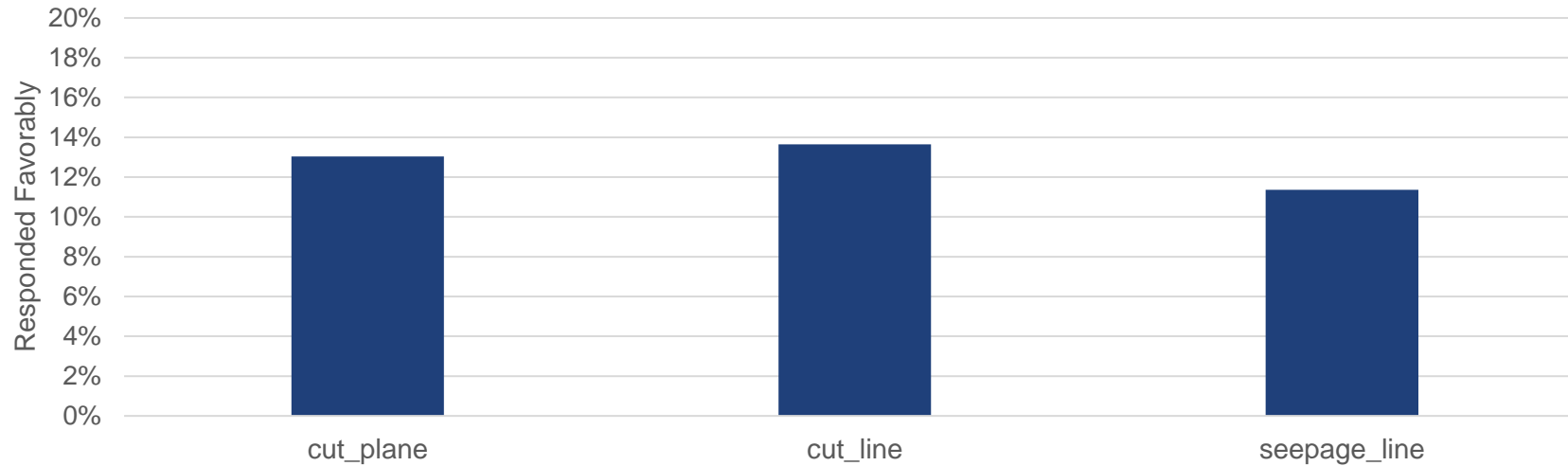


BASEPLANE File Formats

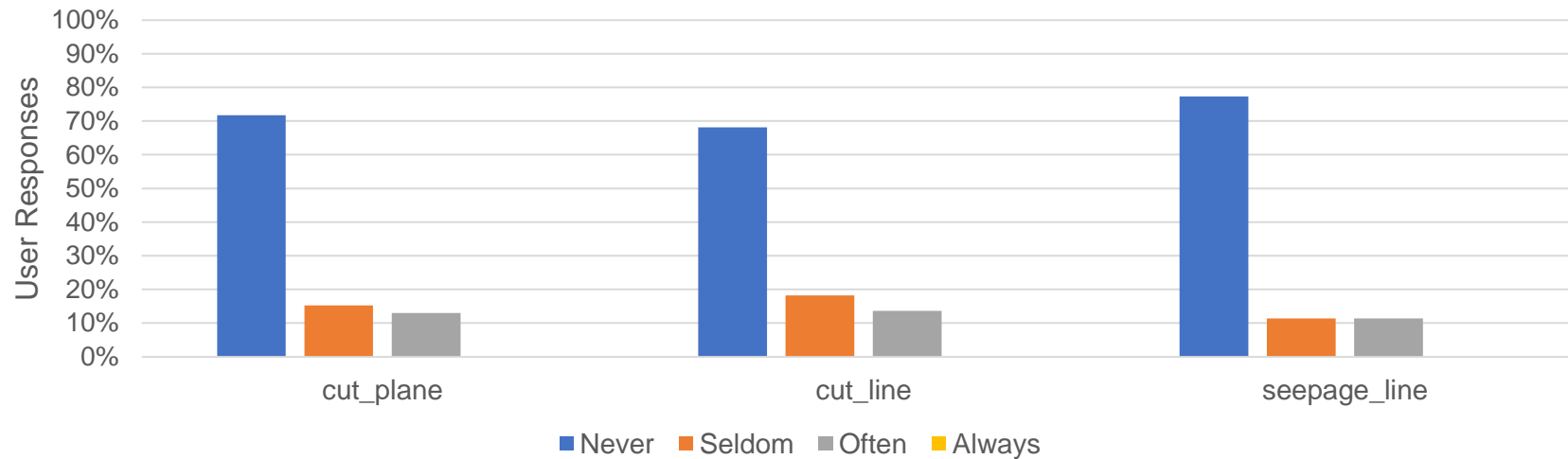


# User community use of outputs

BASEsub Special Outputs

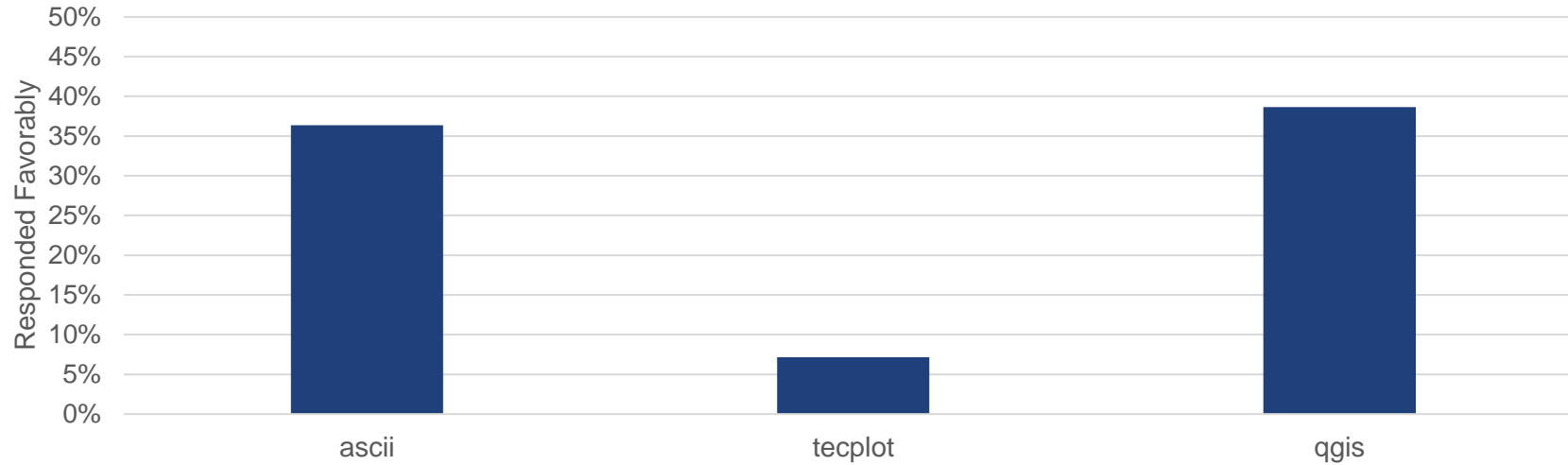


BASEsub Special Outputs



# User community use of outputs

BASEsub File Formats



BASEsub File Formats

