Procedural Generation of Landscapes with Water Bodies Using Artificial Drainage Basins

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CGI 2022 – LNCS Proceedings Track

12-16 September, Geneva, Switzerland

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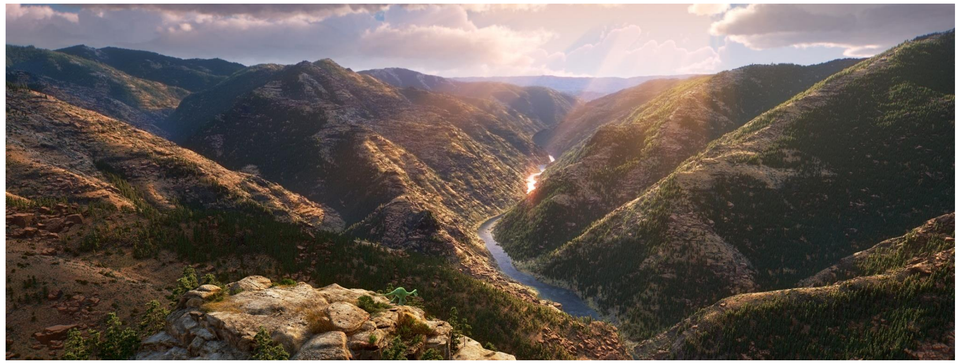

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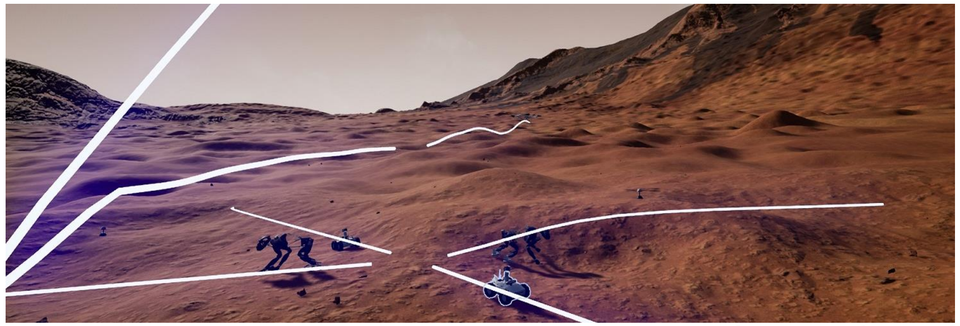

VaMEx-VTB [University of Bremen]

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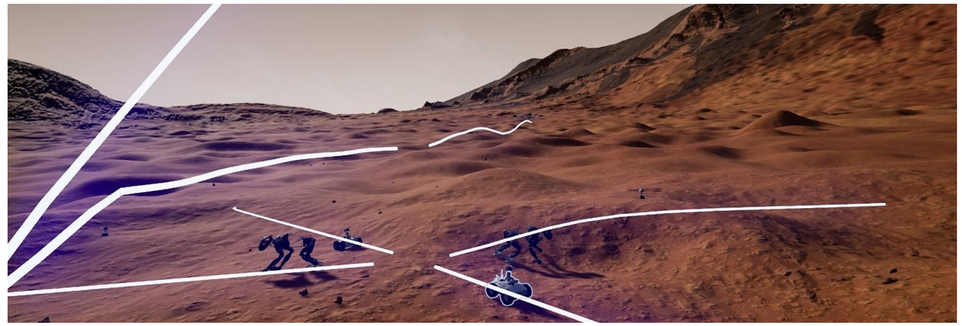

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- Growing interest in procedural 3D landscapes
- Balance of control & automation is challenging
- Landscapes with natural-looking water bodies important yet under-explored

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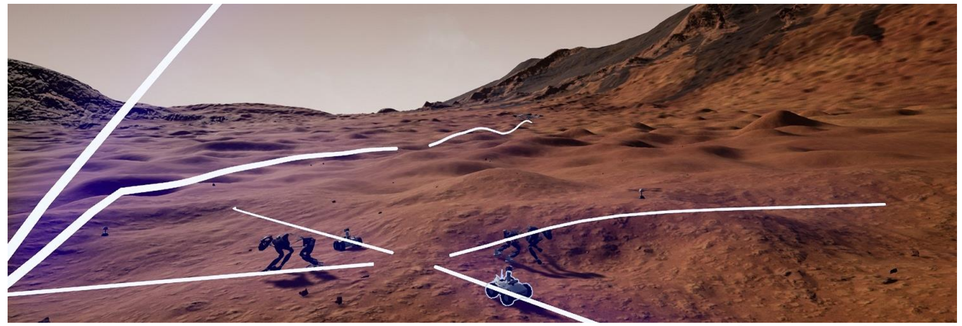

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Related Work

Subdivision & Noise [Parberry15,Thorimbert16]	Simulation [Stava08,Cordonnier16]	Example-based [Zhou07,Guérin17]
• Quick & easy • Unintuitive parameters • Unrealistic globally	• More realistic • Very slow	• Realistic • Limited by examples • Hard to control globally

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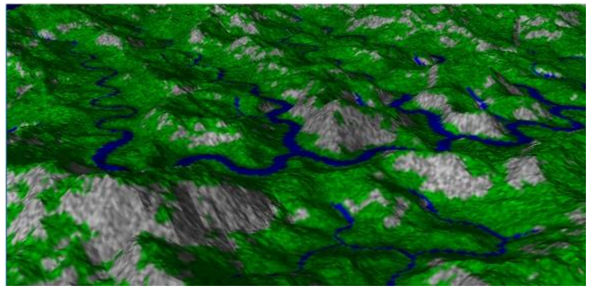

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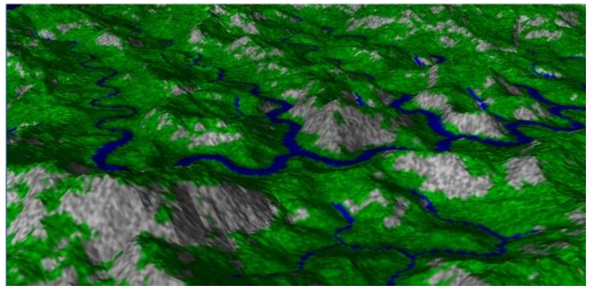
  - River graphs based on sketches and hydrological knowledge [Geneveaux13,Zhang16]



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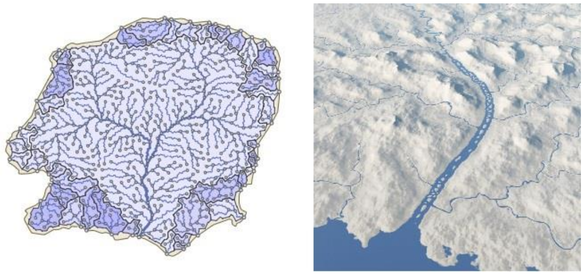

[Geneveaux13]

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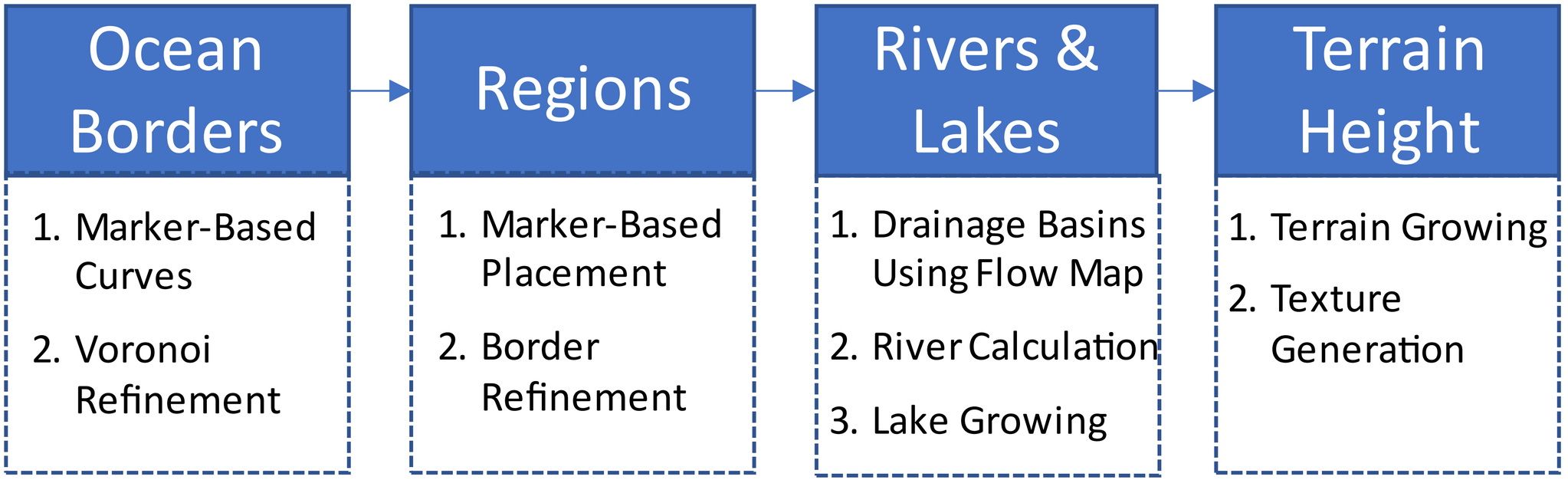
  - Quick & agile pipeline approach implemented in Unity3D
- Extensive evaluation including dedicated real-world comparision

System Overview



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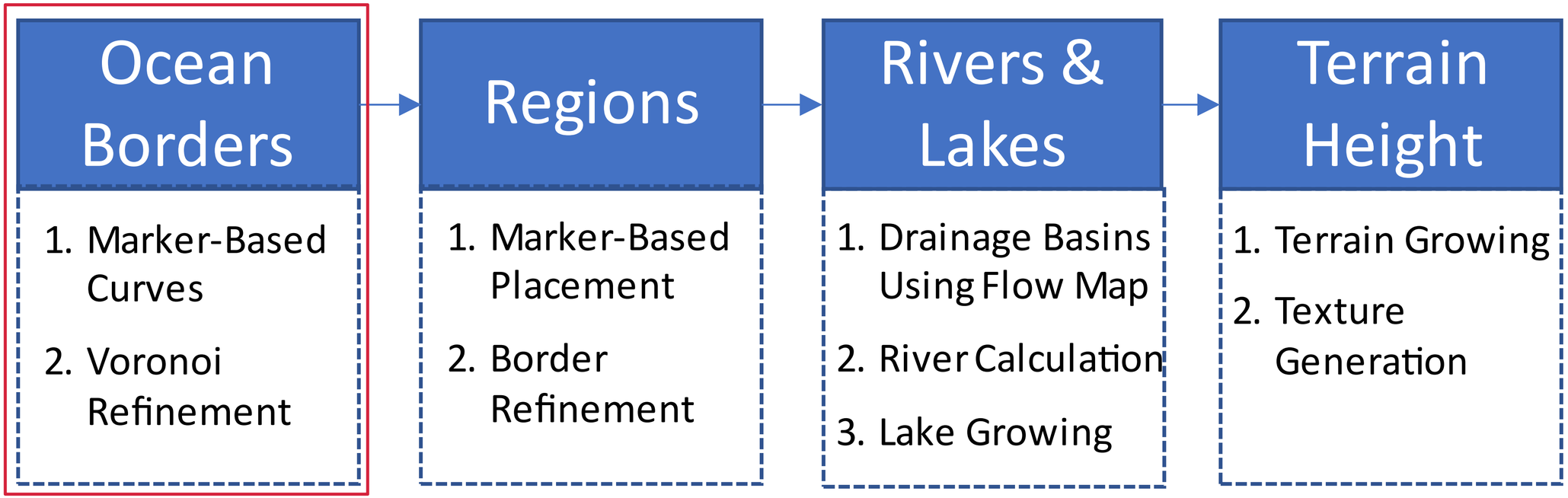

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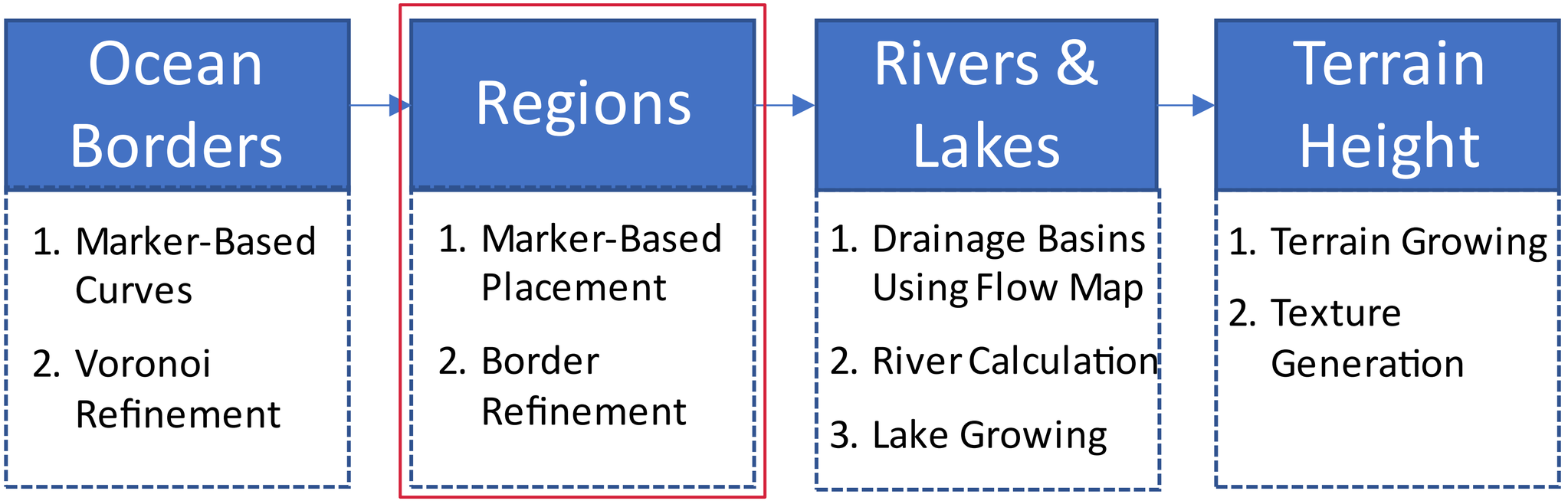

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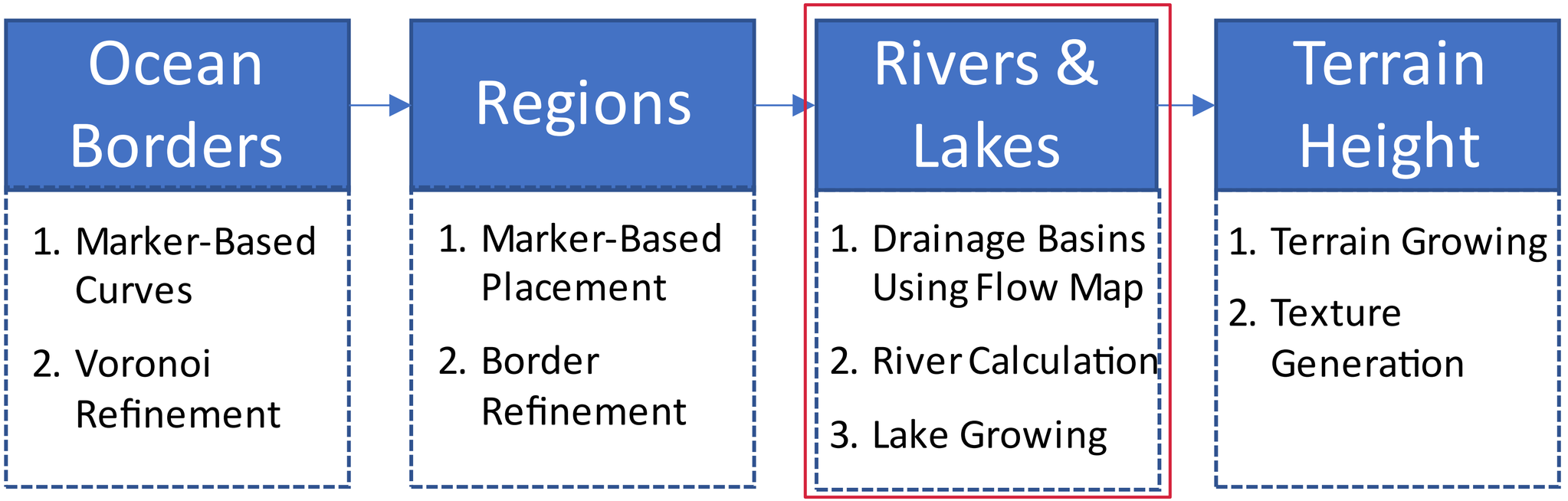

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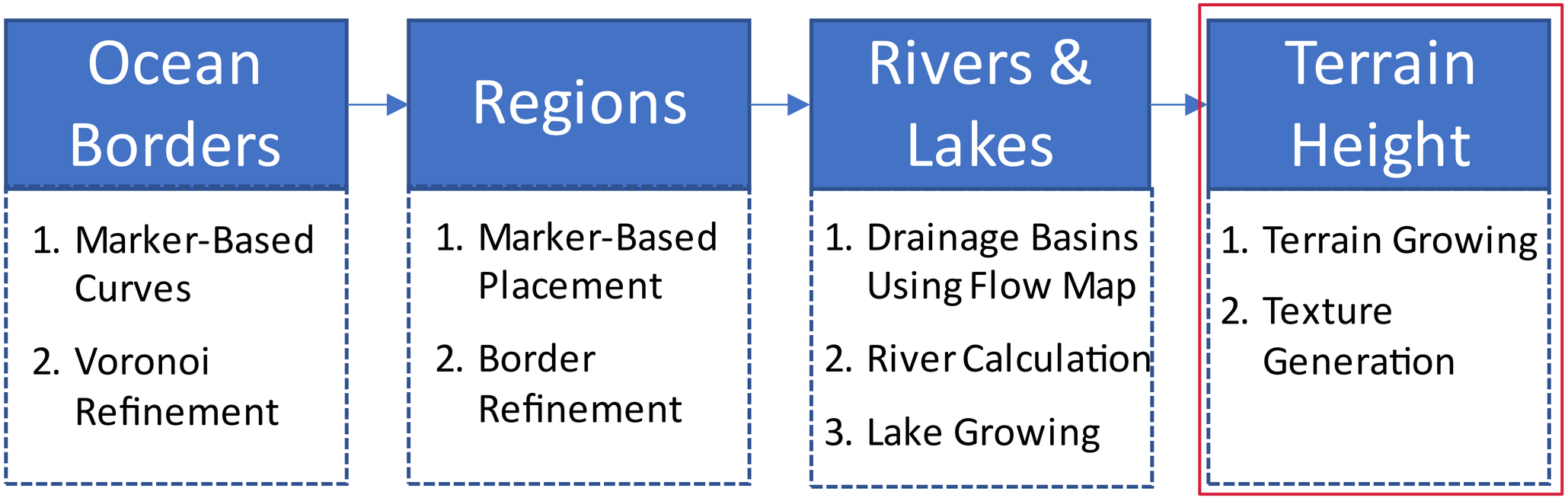

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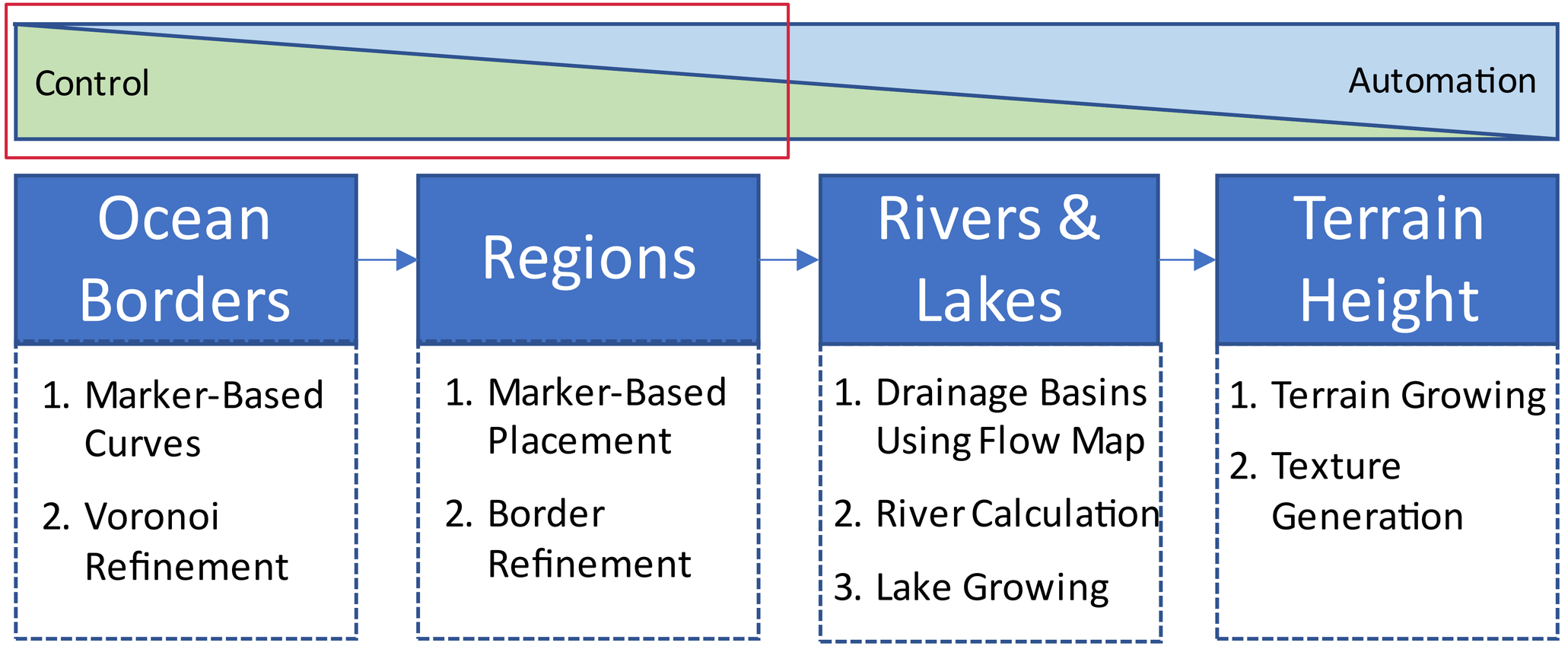

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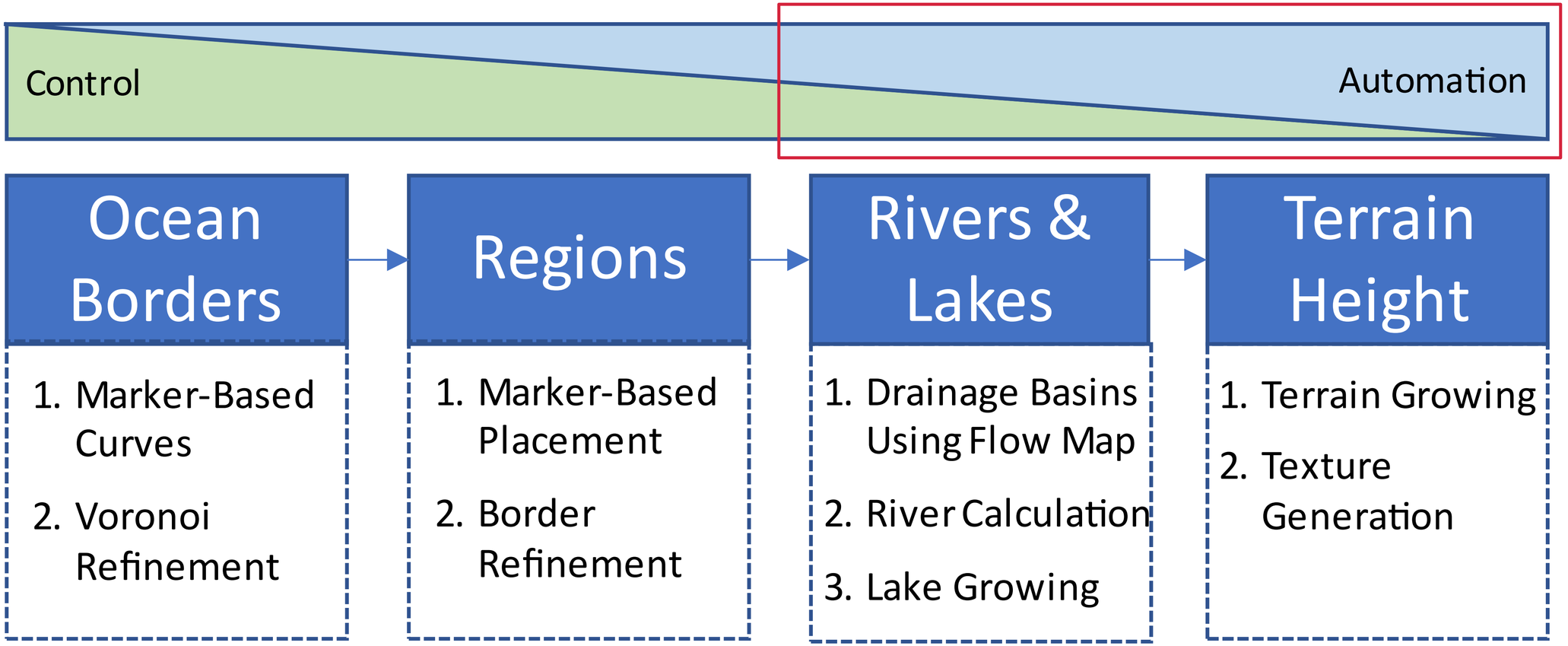
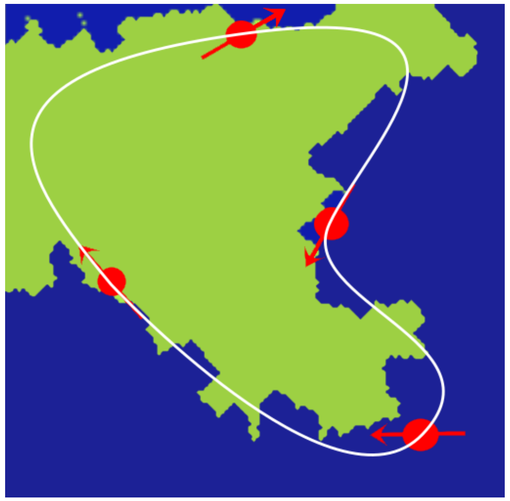


Ocean Borders

- Spline-based borders for intuitive control



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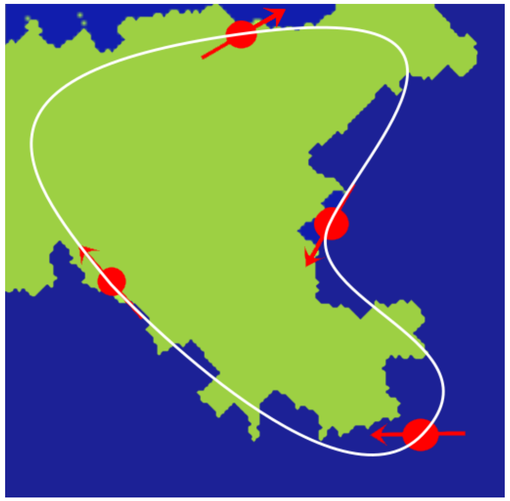

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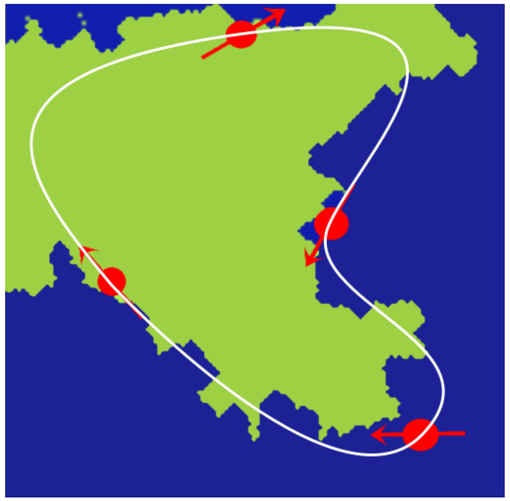

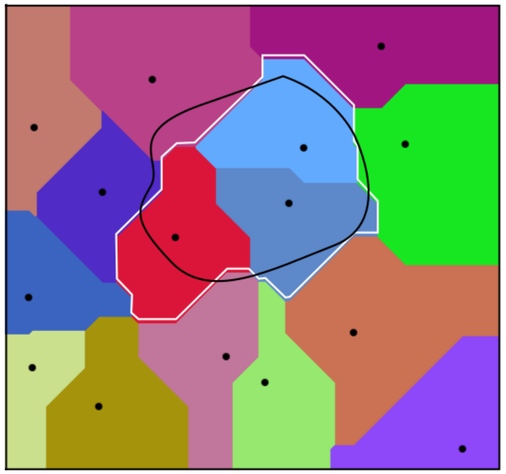

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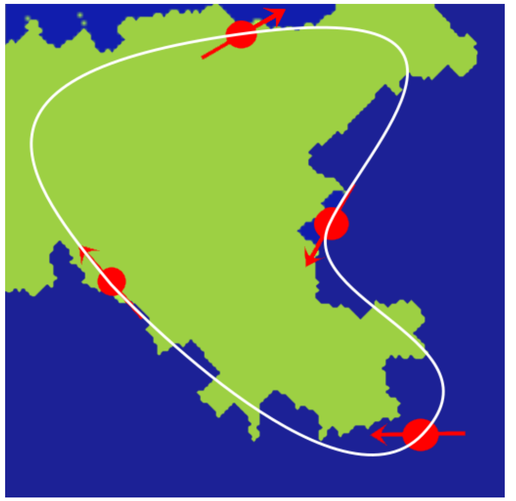

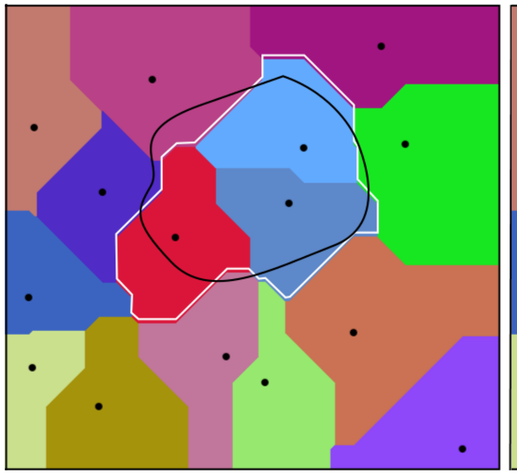

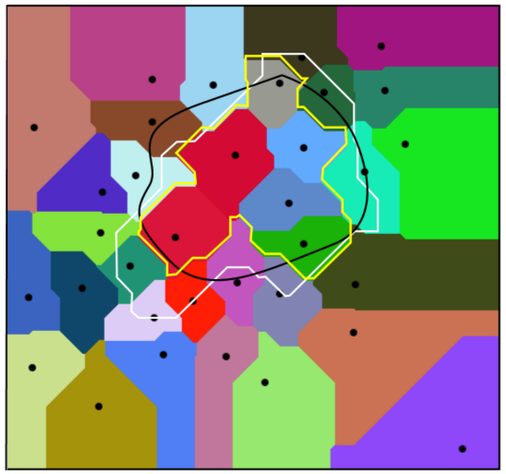

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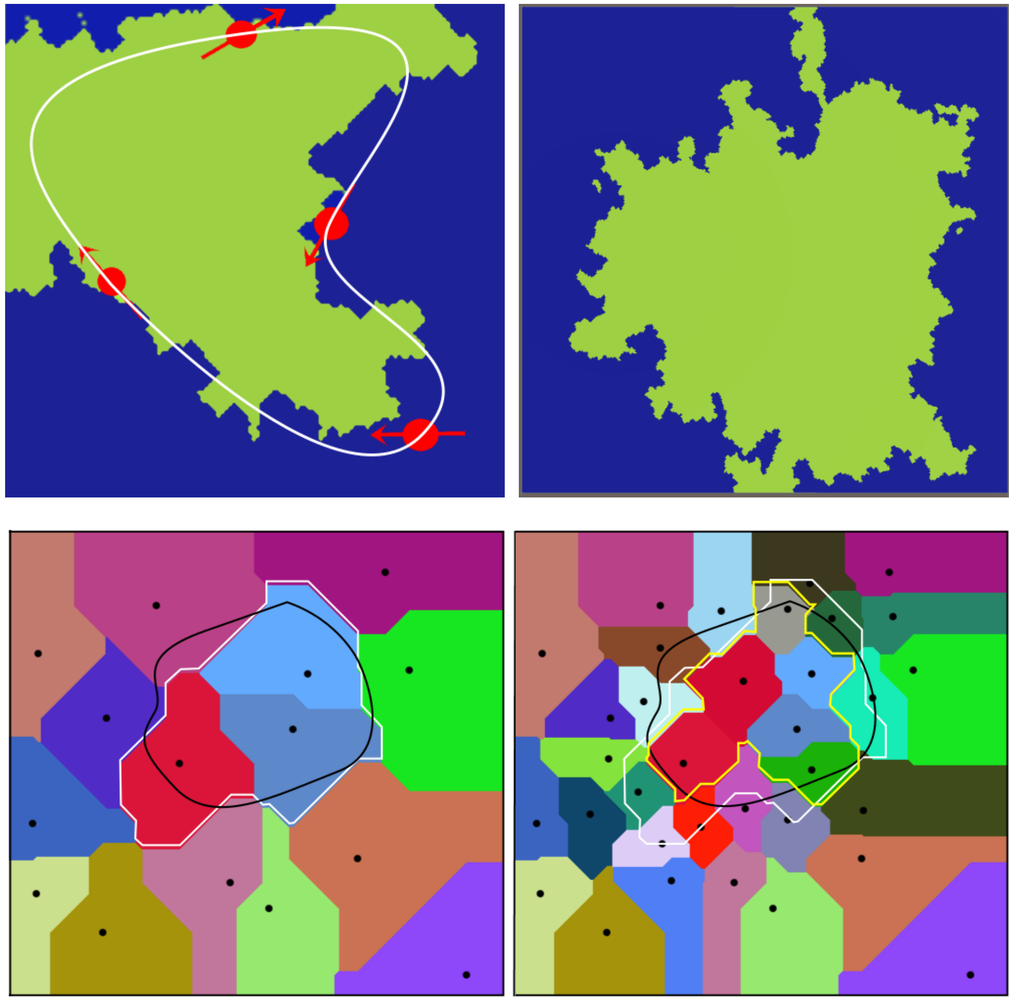

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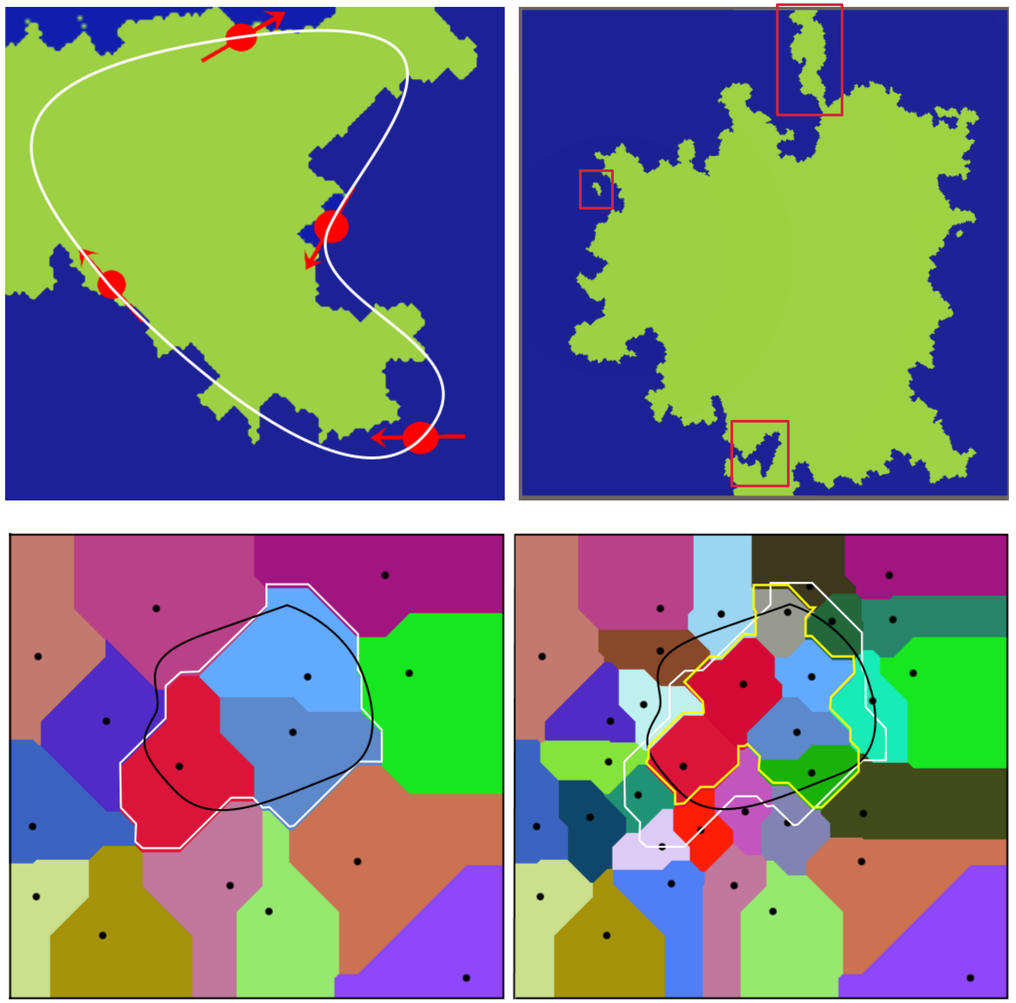

Regions

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- Parameters for extent and borders (randomized using noise, e.g., simplex n.)

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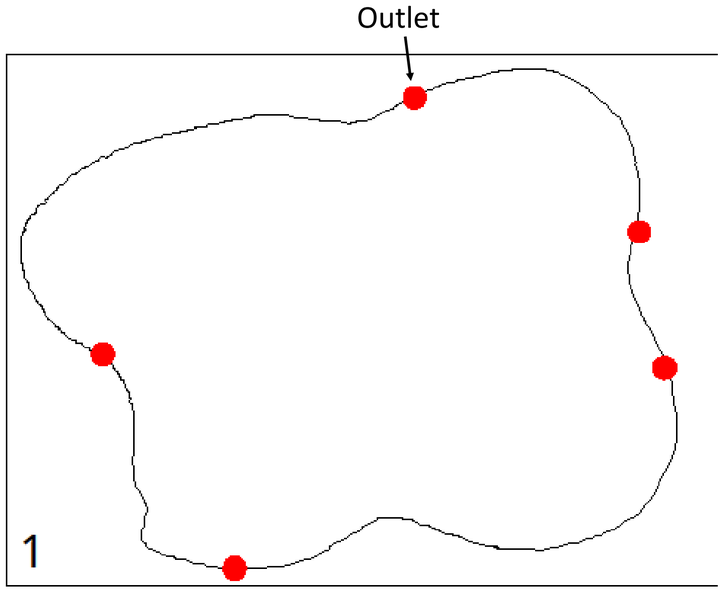

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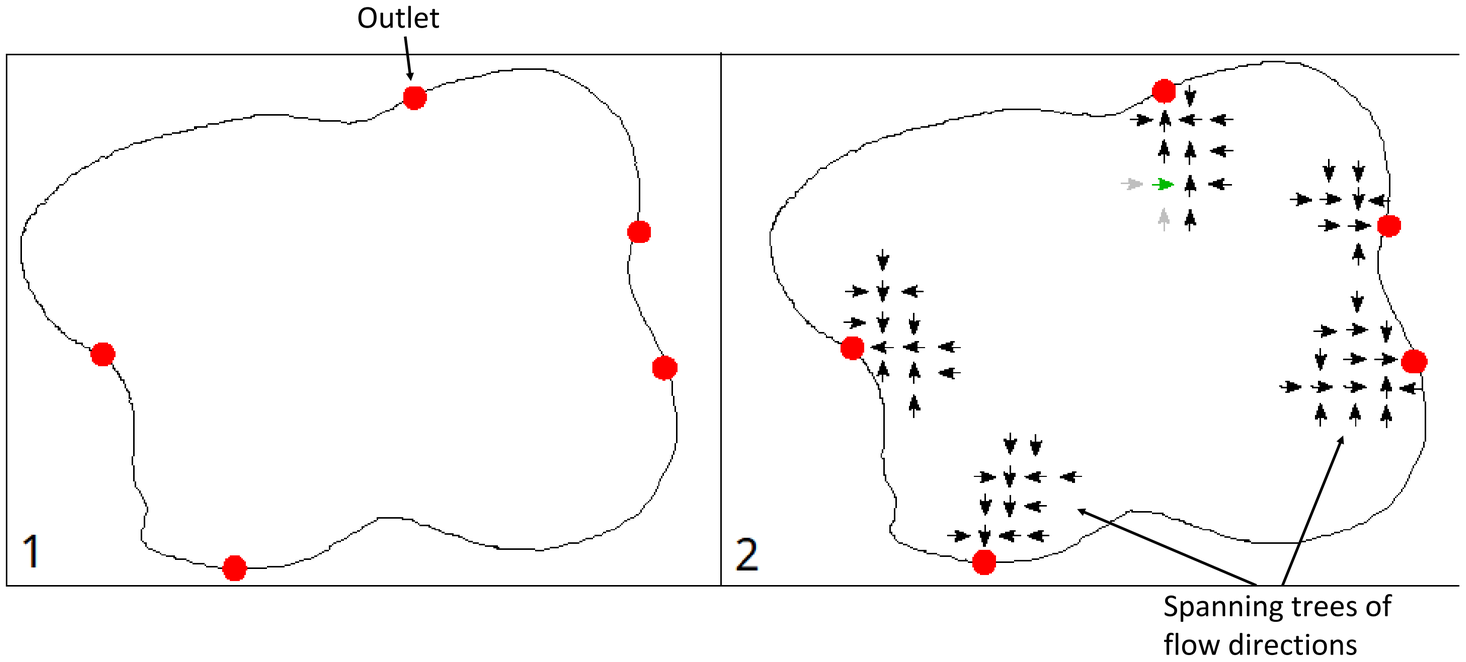

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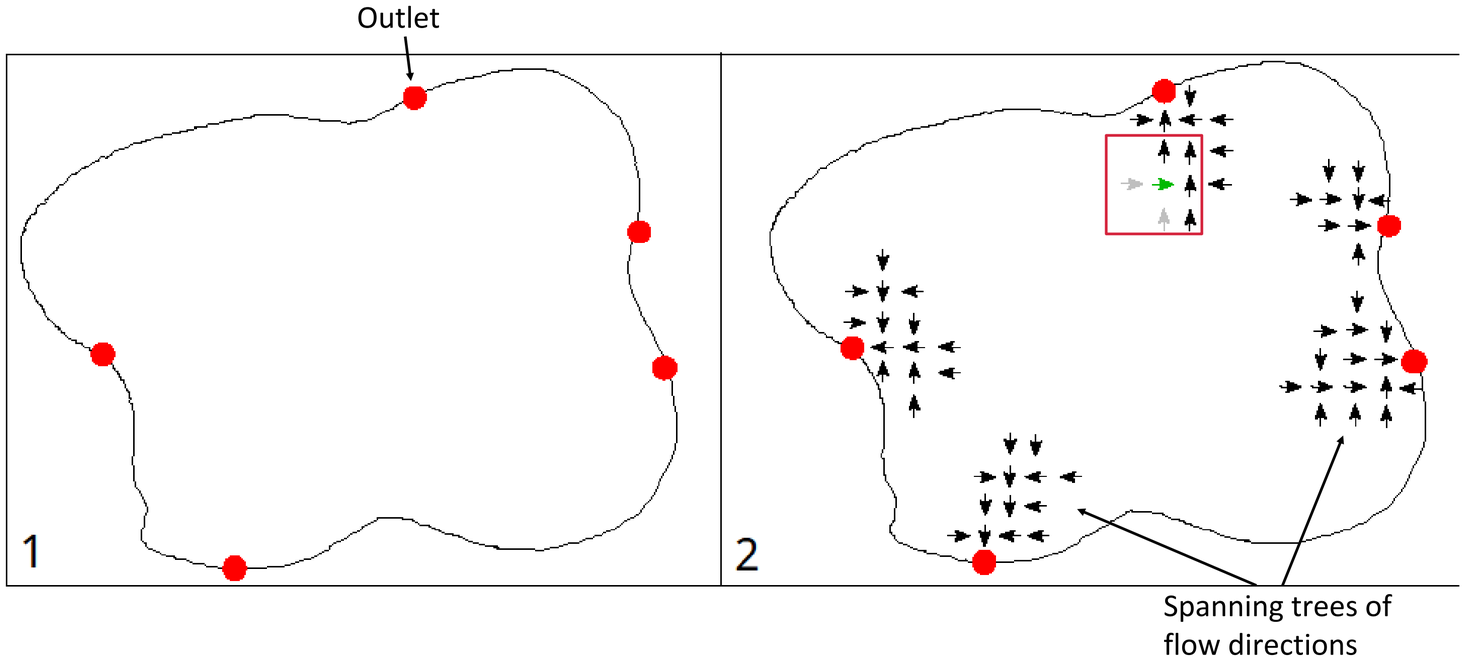

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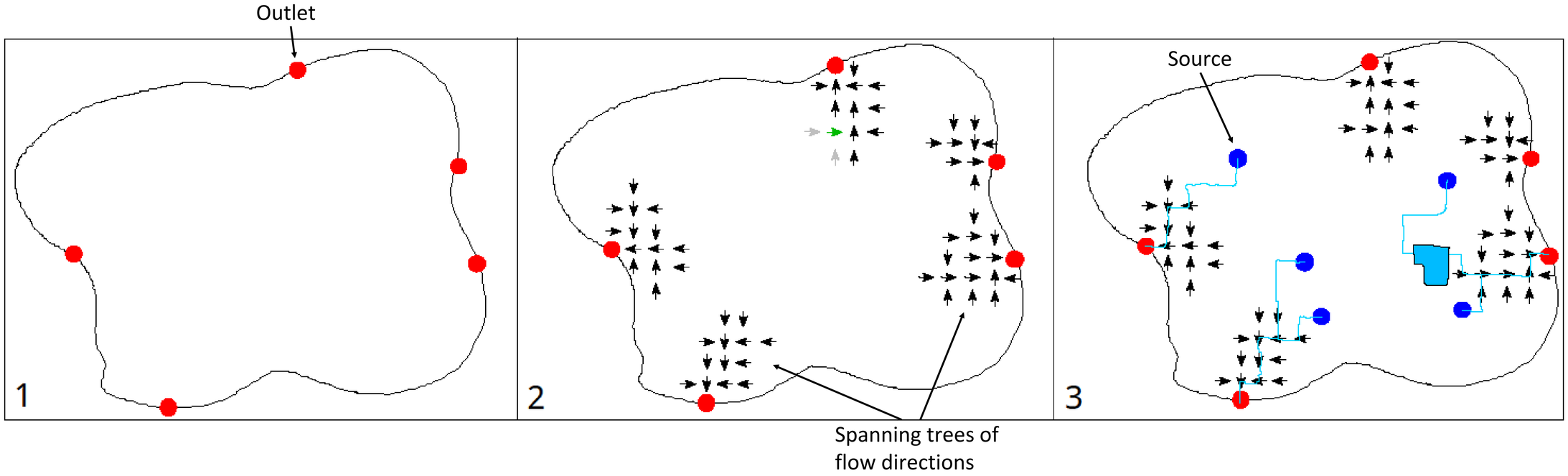

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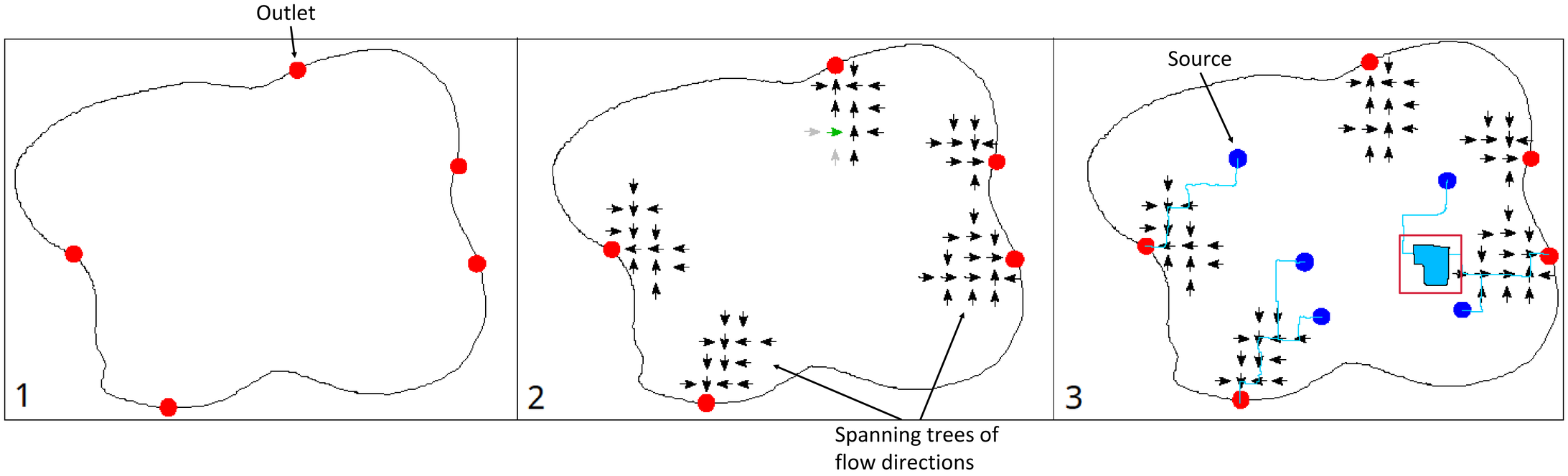

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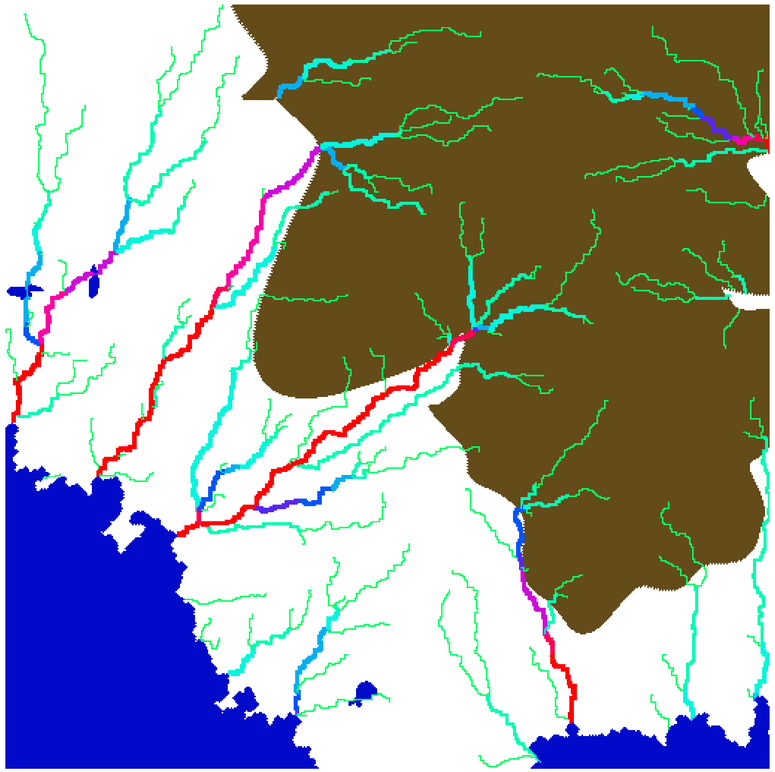

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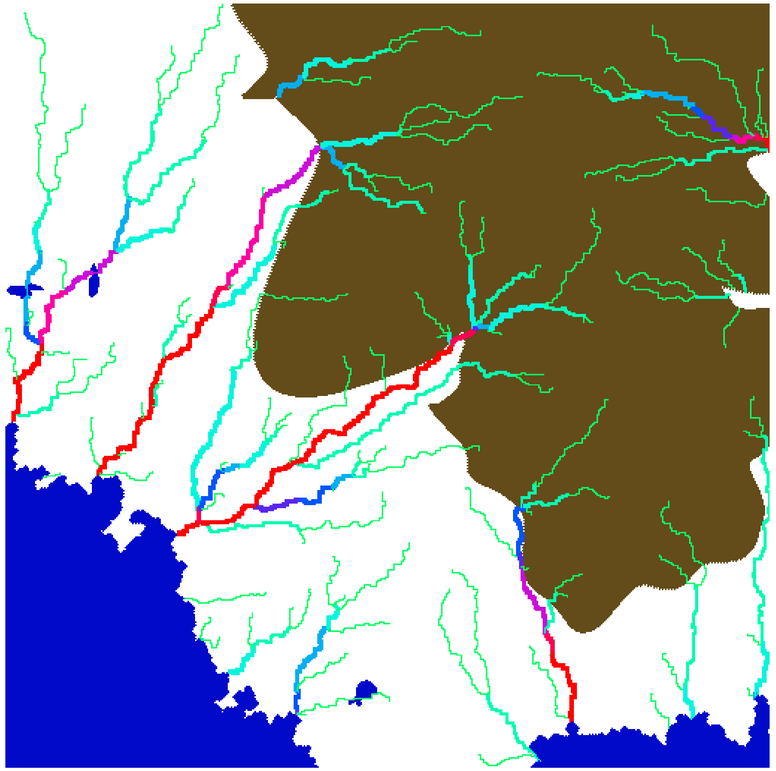
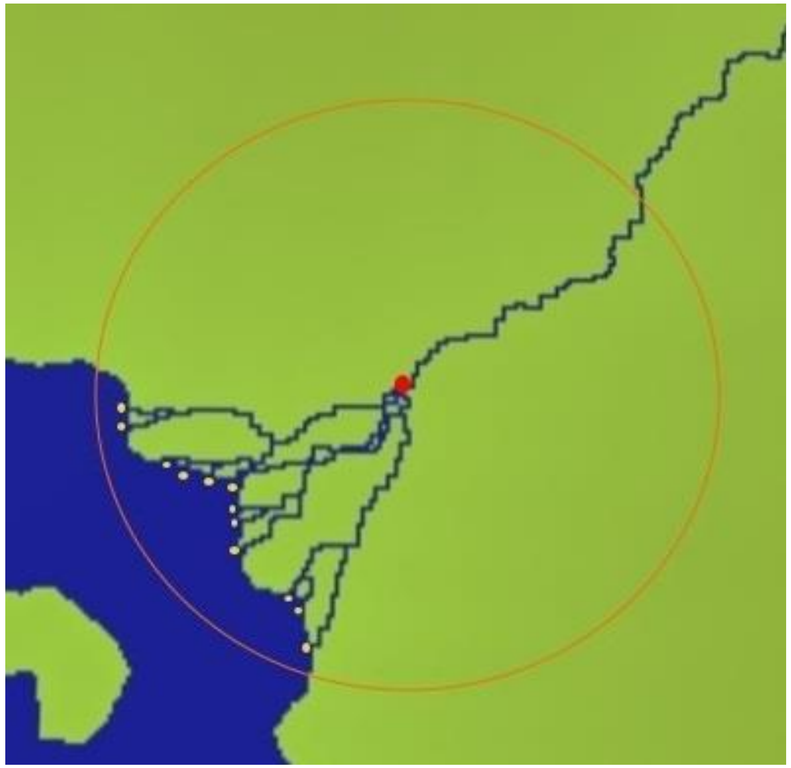


Distinct river deltas



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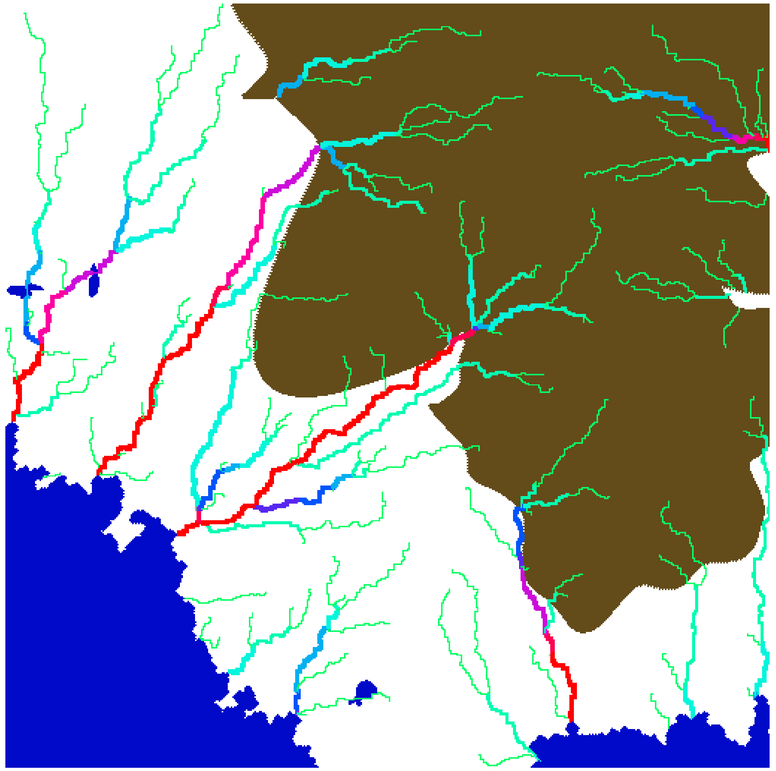

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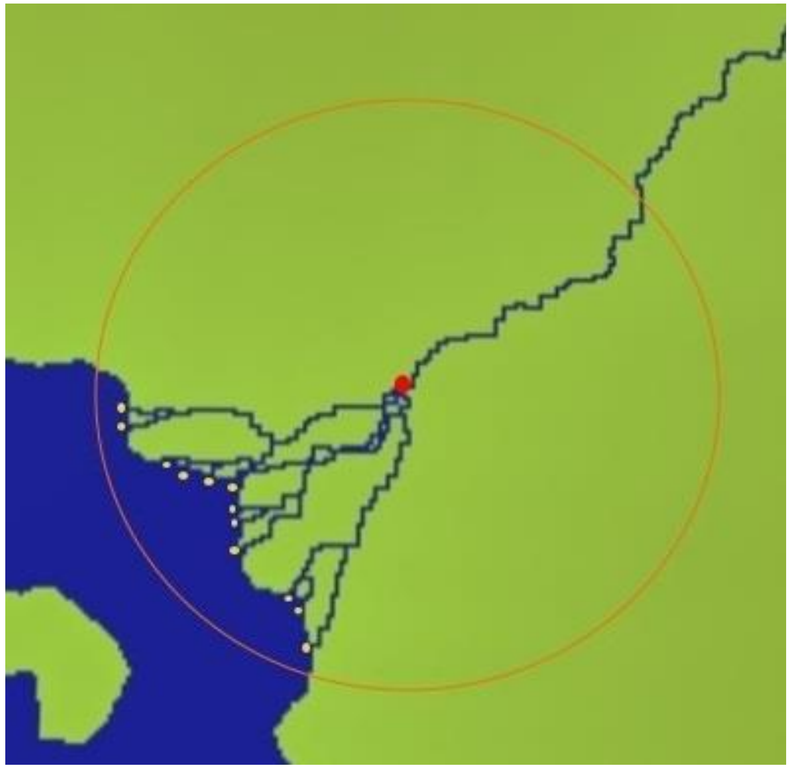
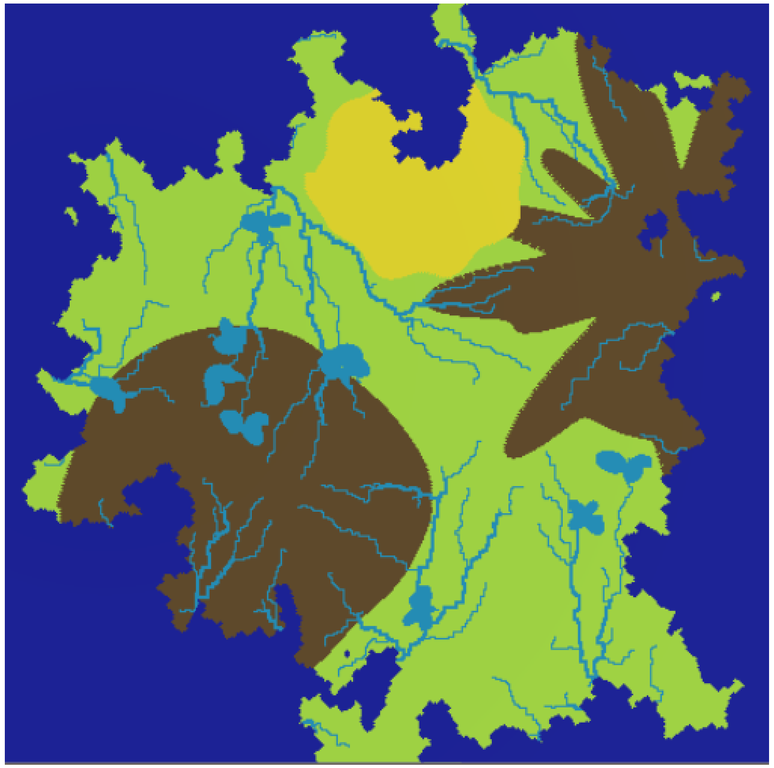


Final example



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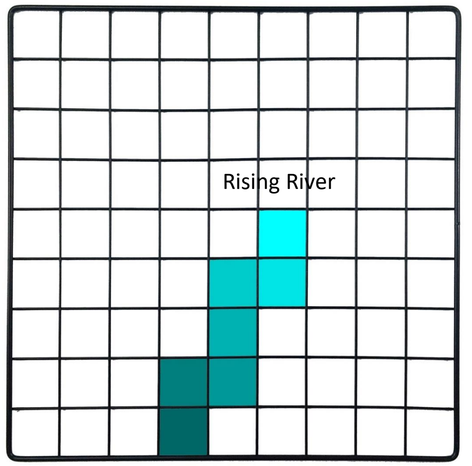

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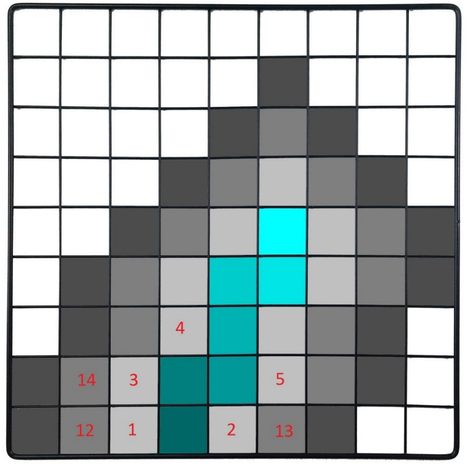

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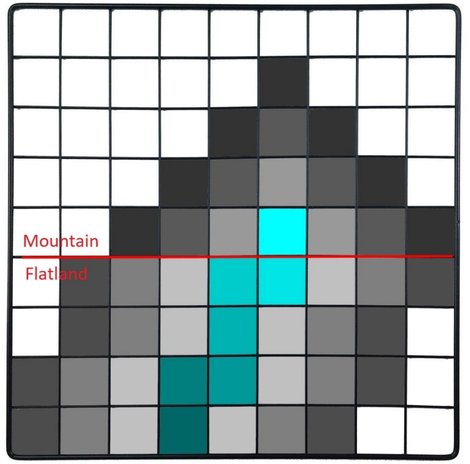
  - Grow land in order of height-based priority queue
  - Growth depends on region-based steepness and noise



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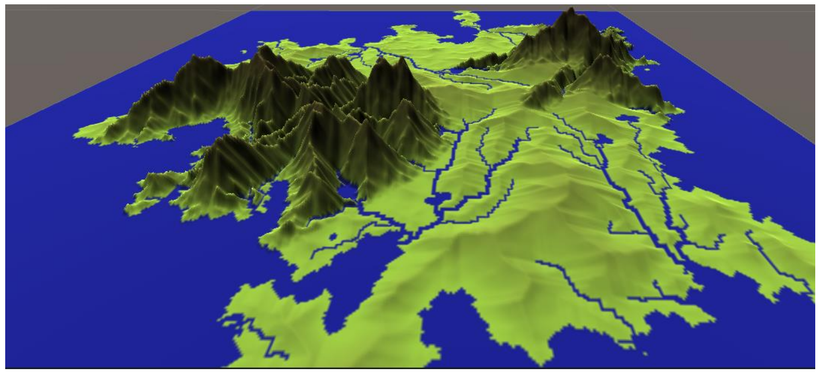

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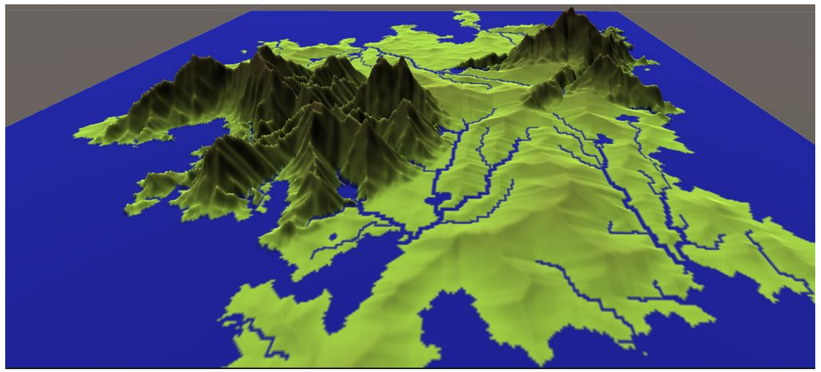
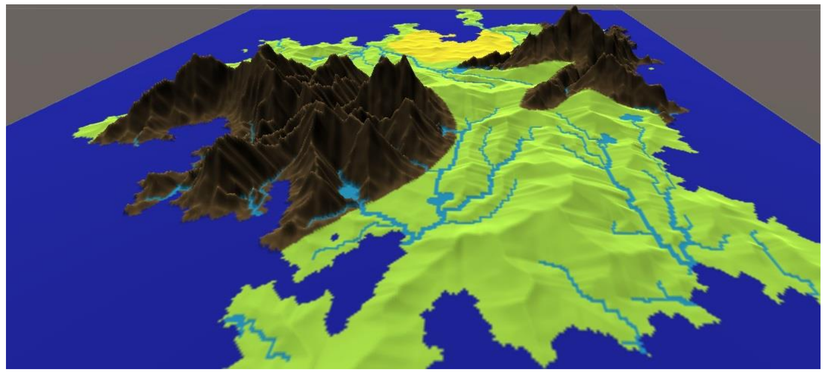


Vis. by Region



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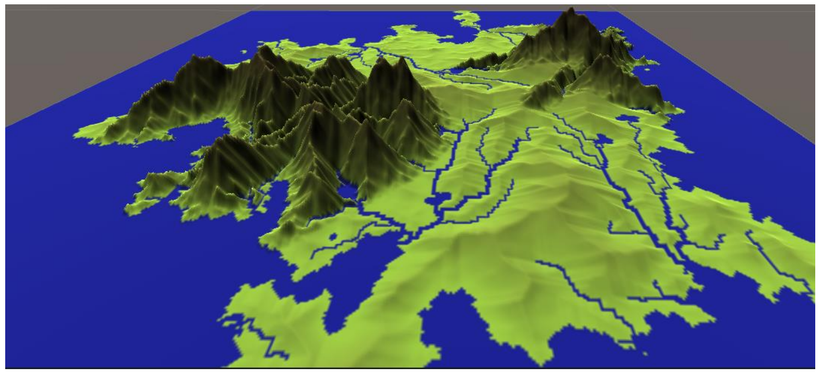

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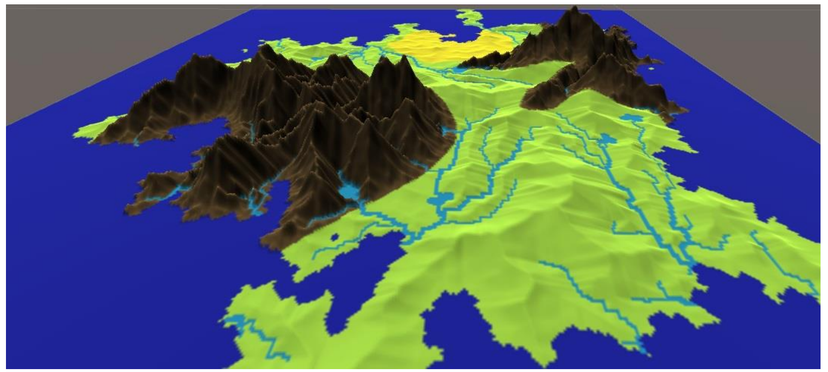
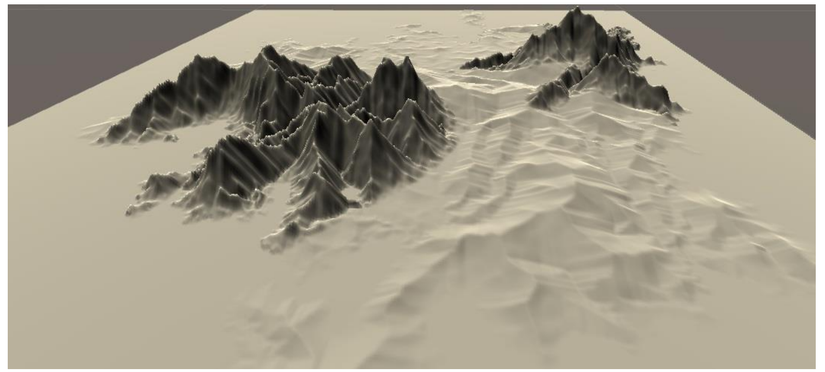


Color coded Height



Results: Performance

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  n: number of grid cells

System Specification

Item	Details
CPU	Intel Core i7 7800x
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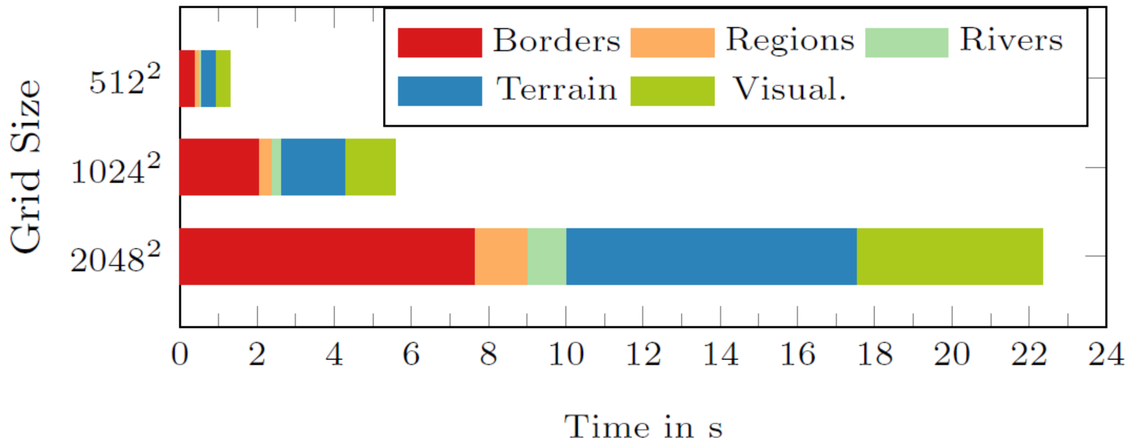

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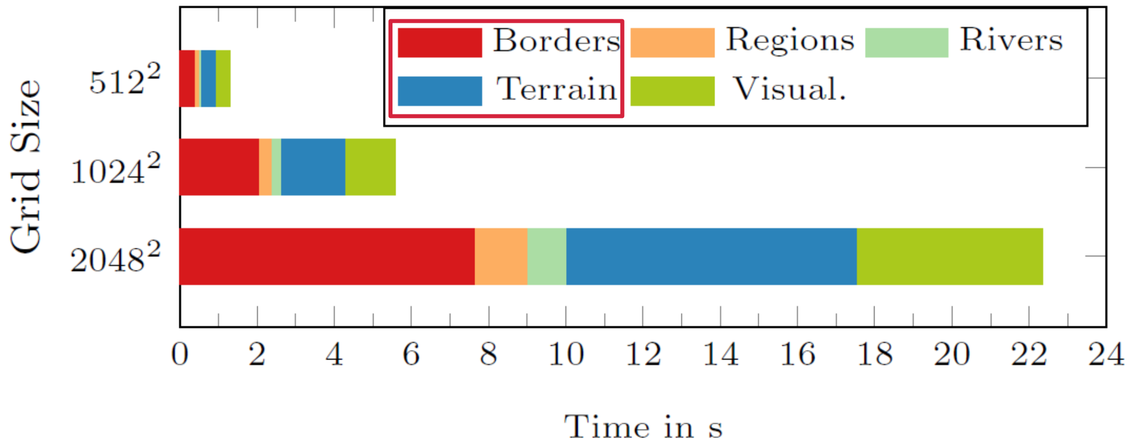

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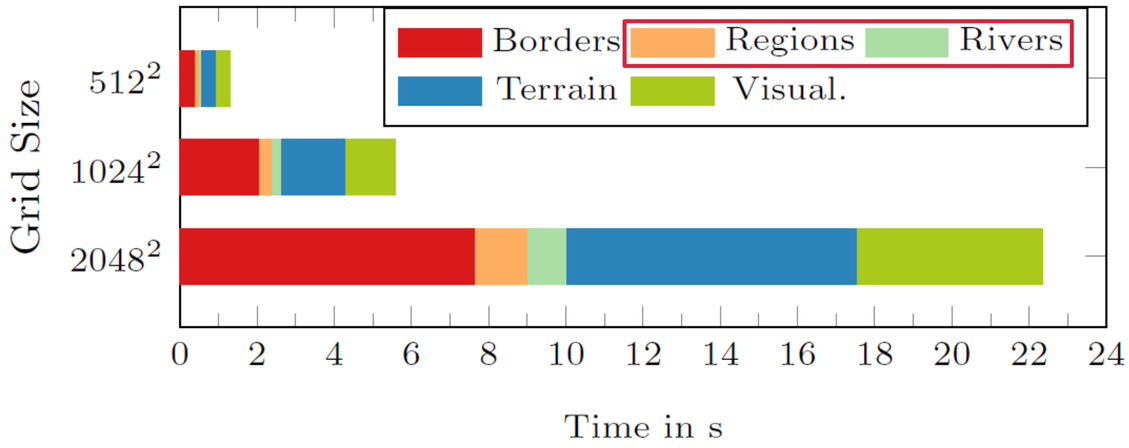

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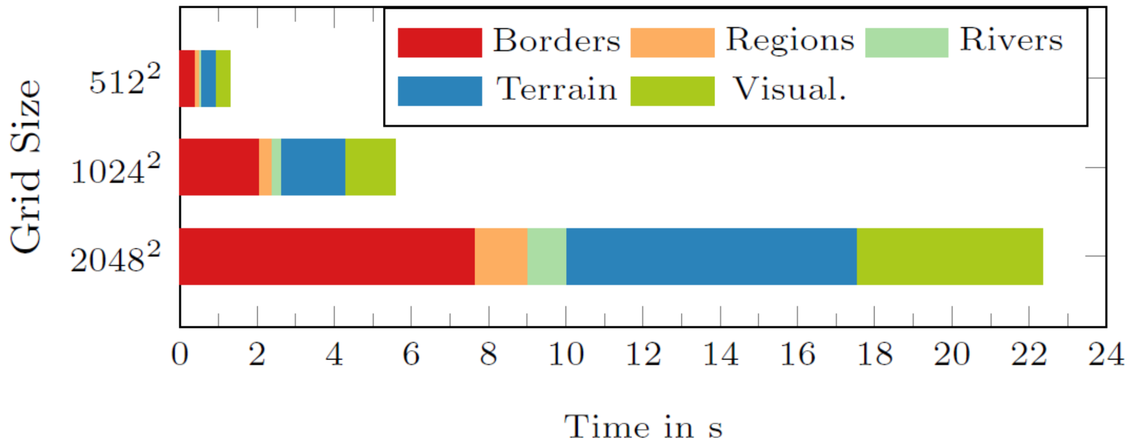

- Also other significant parameters:

Step	Substep	Time (ms)
Borders	Refine (1. iteration)	851
	Refine (2. iteration)	1601
	Refine (2. iteration+Noise)	7600
Rivers	Calculate Drainage Basins	796
	Compute Rivers+Lakes	100
Visual.	Generate Mesh	800
	Generate Textures	3426

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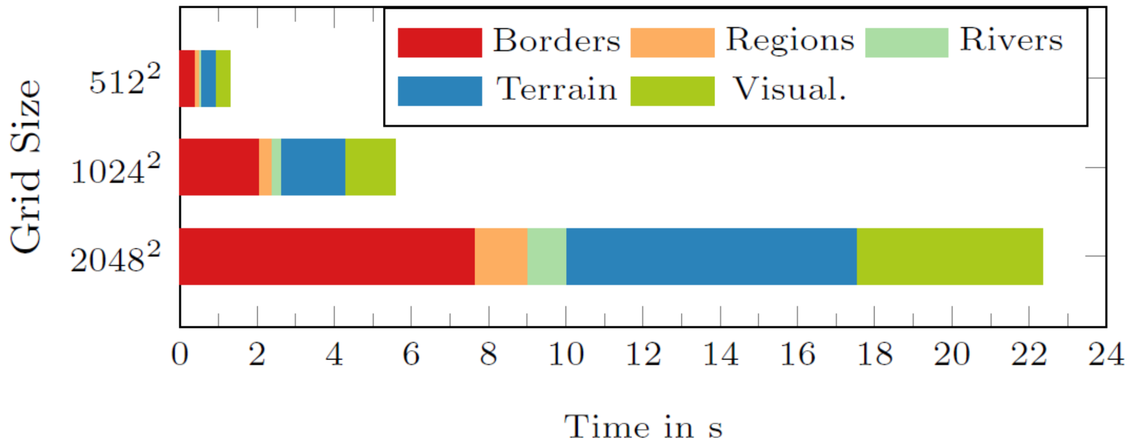

- Also other significant parameters:
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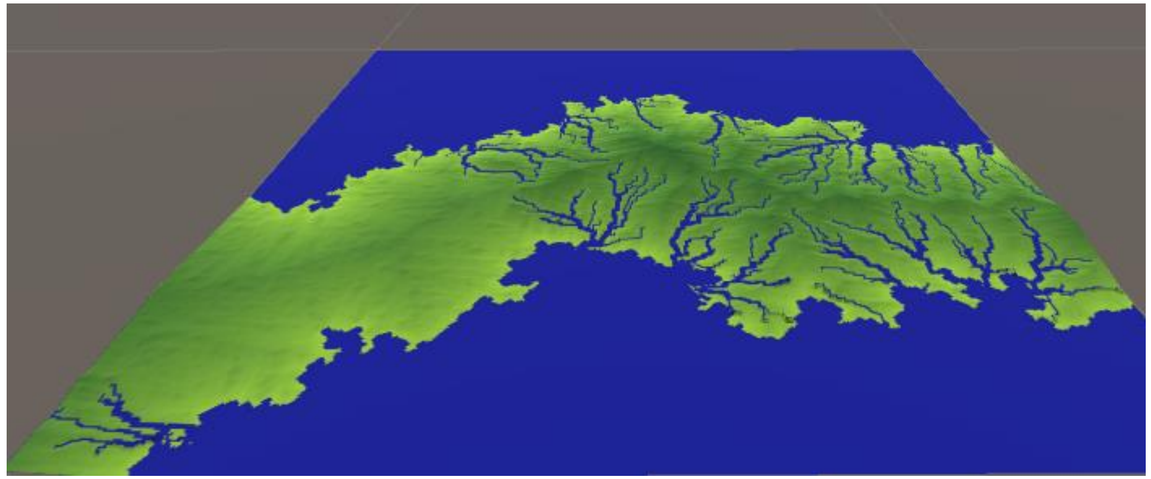
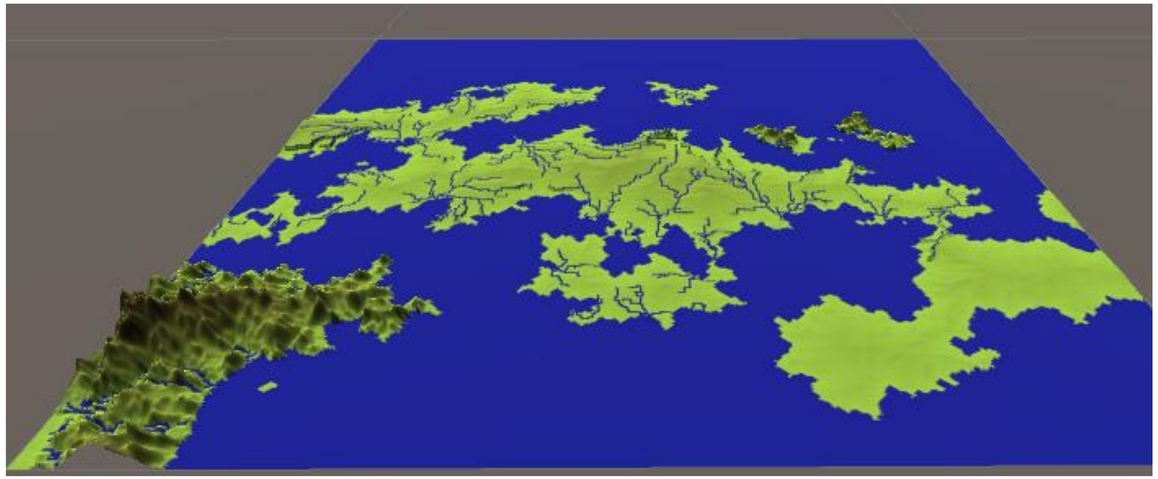
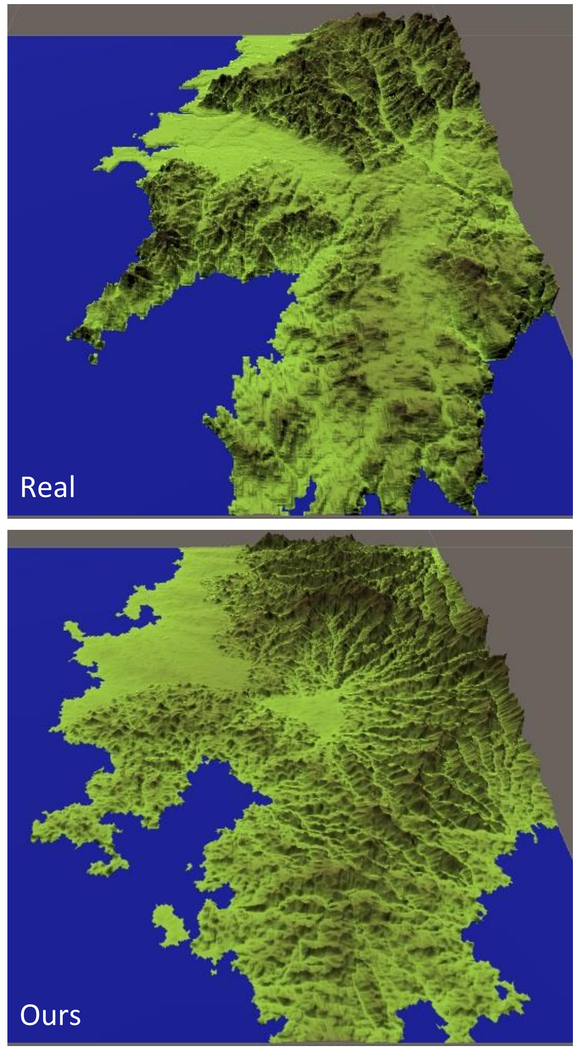




Results: Real World Comparision



DEM from Severo-Evensky District in Magadan Oblast in Russia (61.21703, 160.21836)

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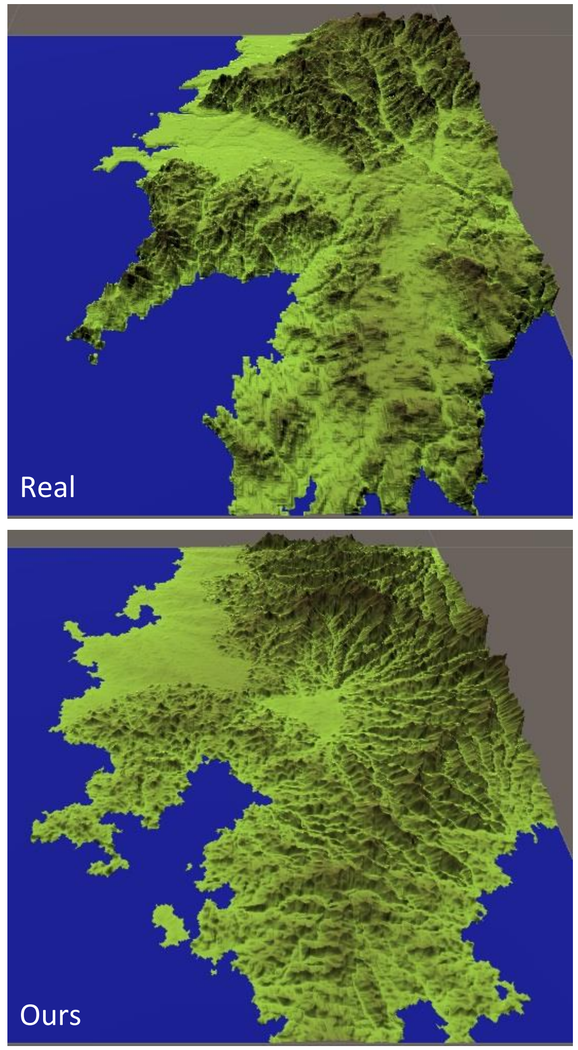

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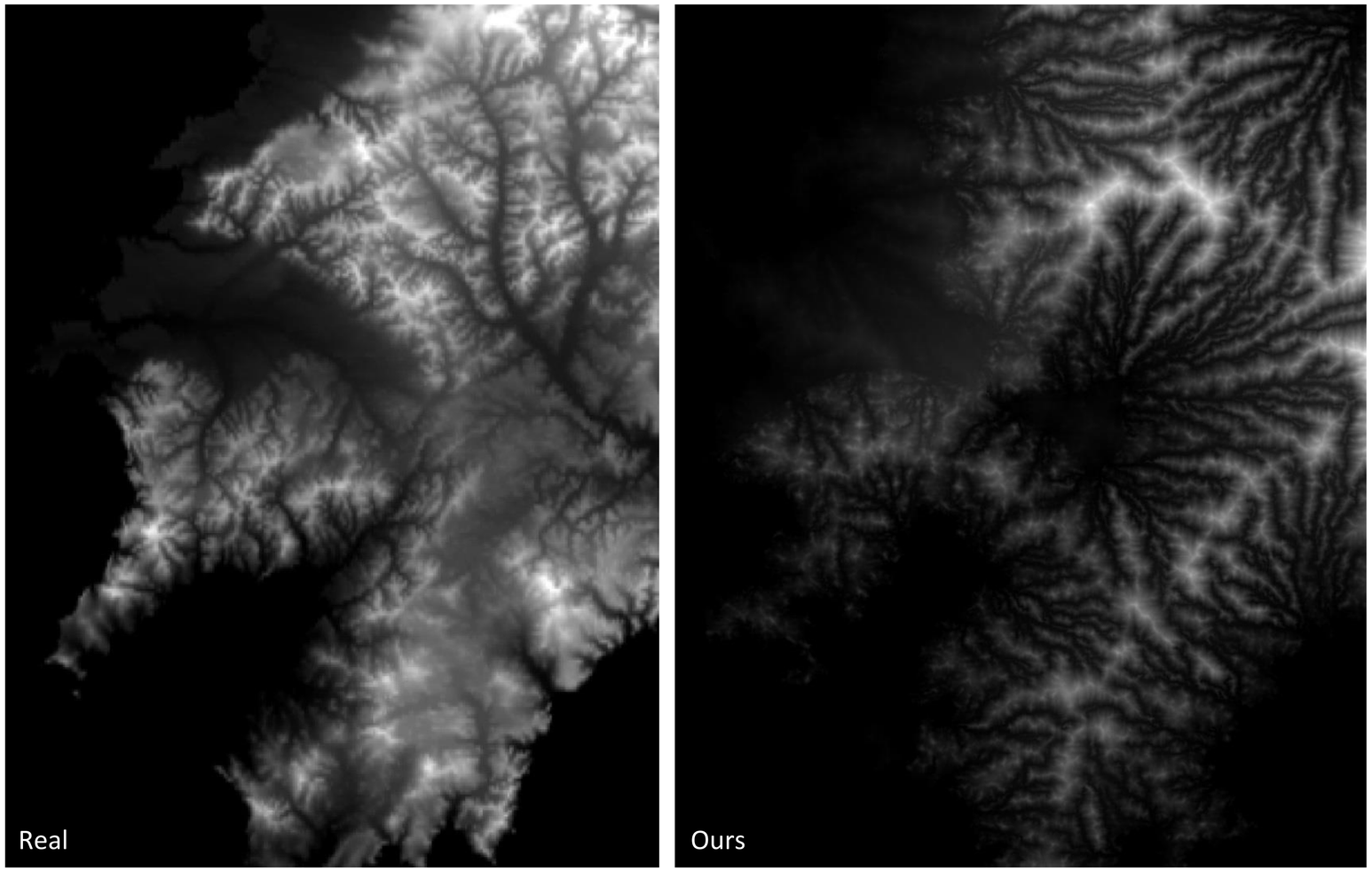

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  - Carefully balances control (first stages) & automation (later stages)
- Great variability and realistic-looking terrains

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- Parallelization

Bremen

CG VR

Thank you for your attention!
Questions?

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