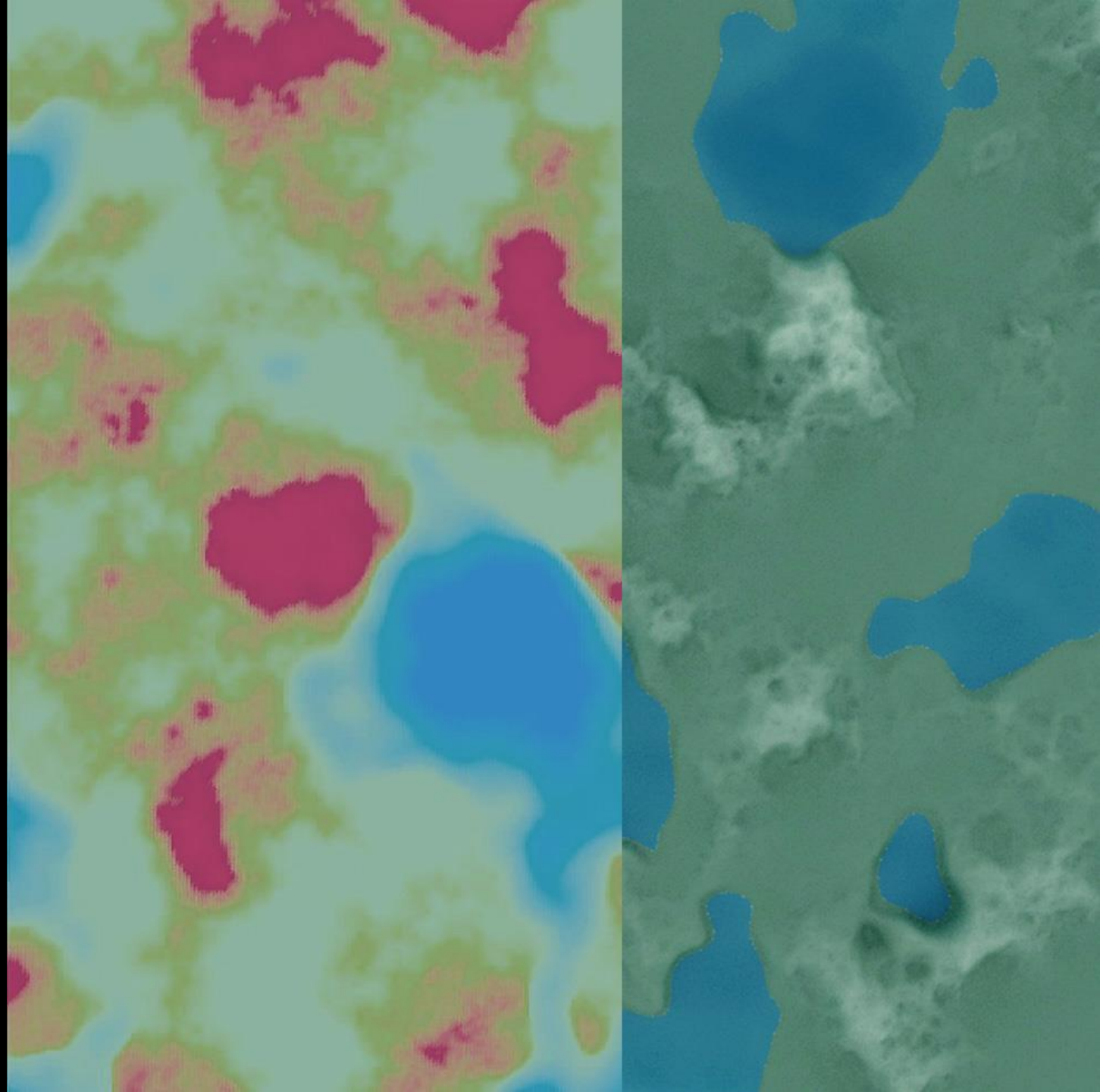


# Bifrost Workshop

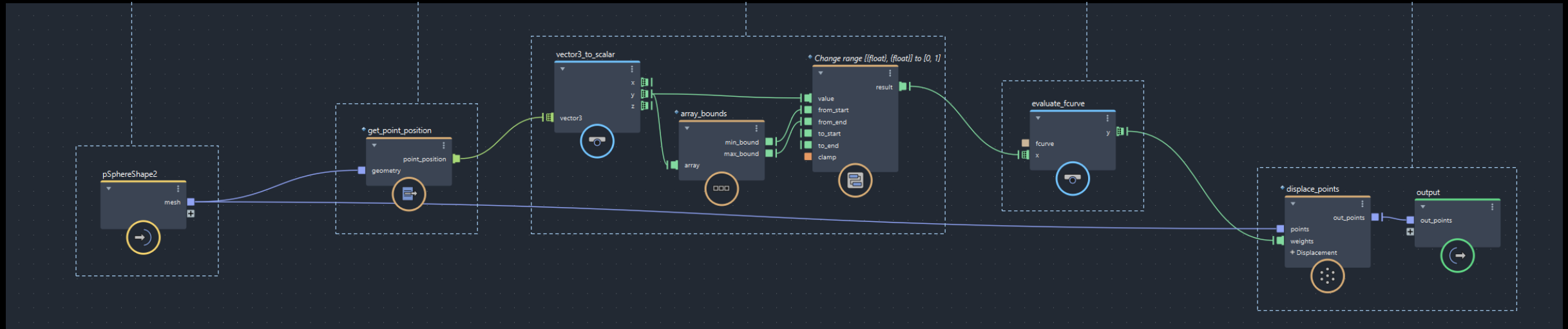
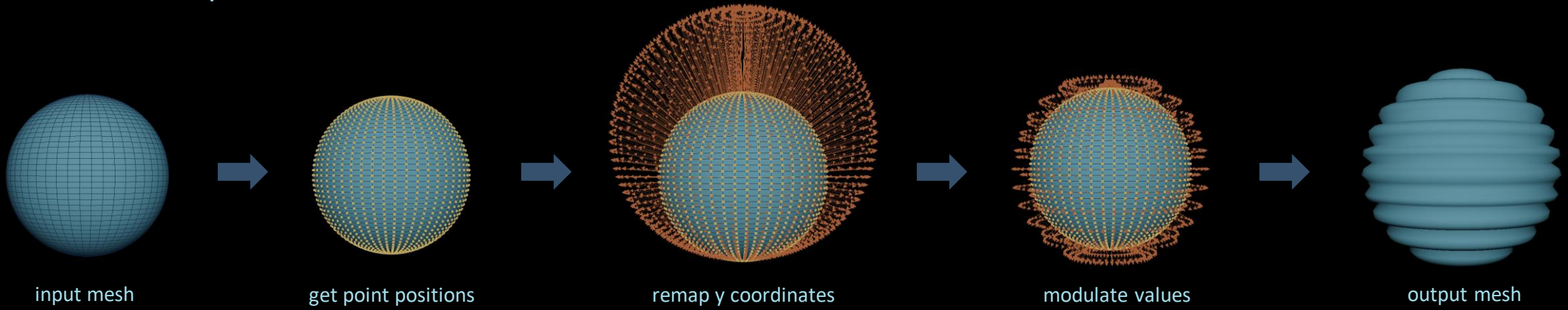
## Lesson 1

- Intro to Bifrost Graph Editor
- Creating a terrain using fields



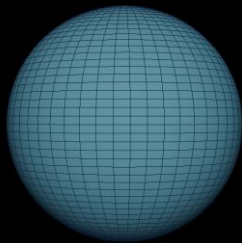
# Intro to Bifrost Graph Editor

# Intro to Bifrost Graph Editor

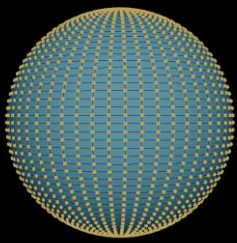


Visual programming allows users to create procedures through connecting nodes. The form or effect can be modified through adjusting the parameters, and everything downstream would update automatically.

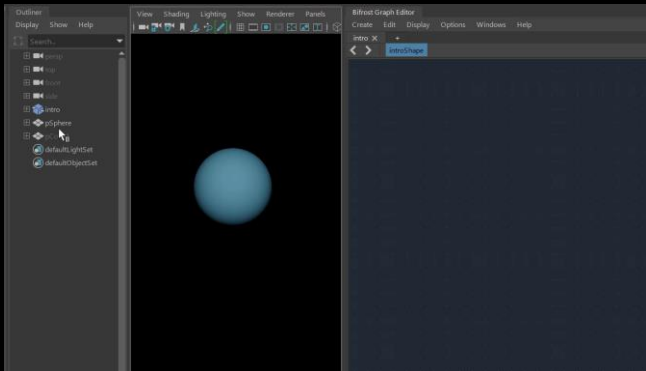
# Intro to Bifrost Graph Editor



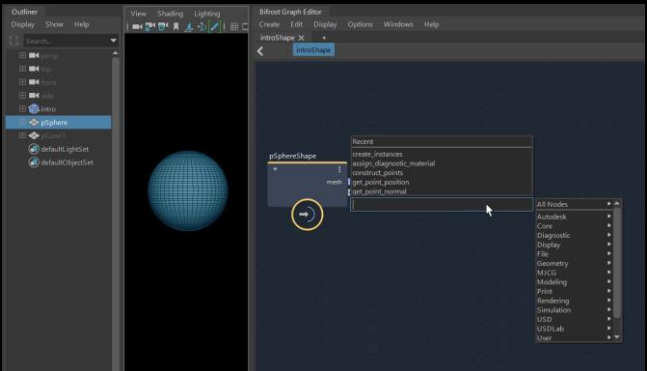
input mesh



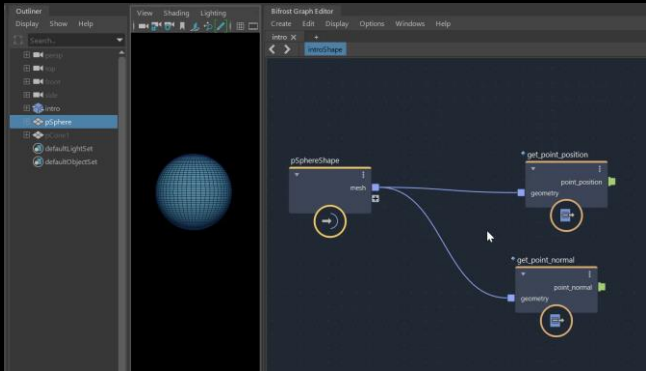
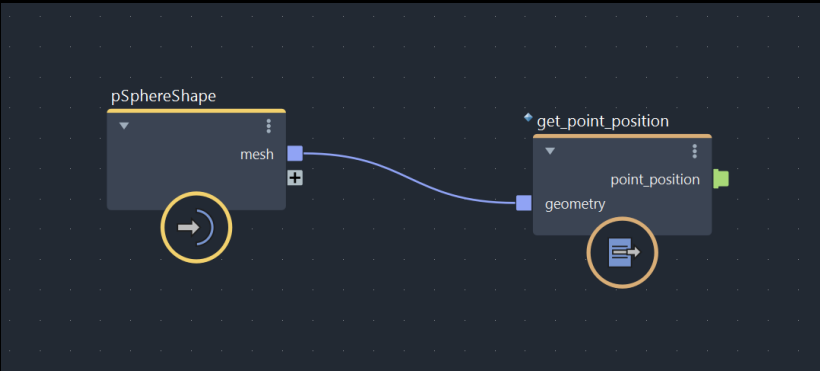
get point positions





bring an object into Bifrost Graph Editor:  + drag

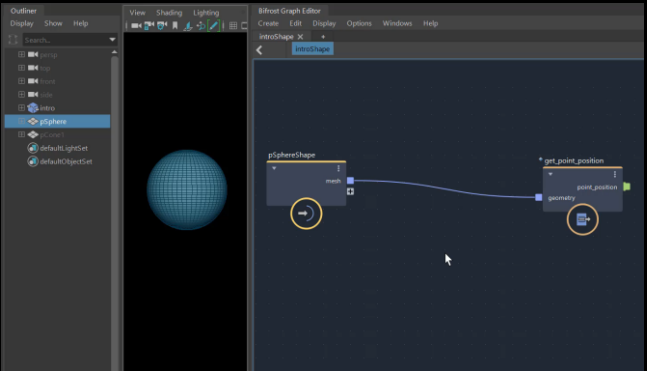



get a node: **Tab**  
click the port + **Tab** for auto connection



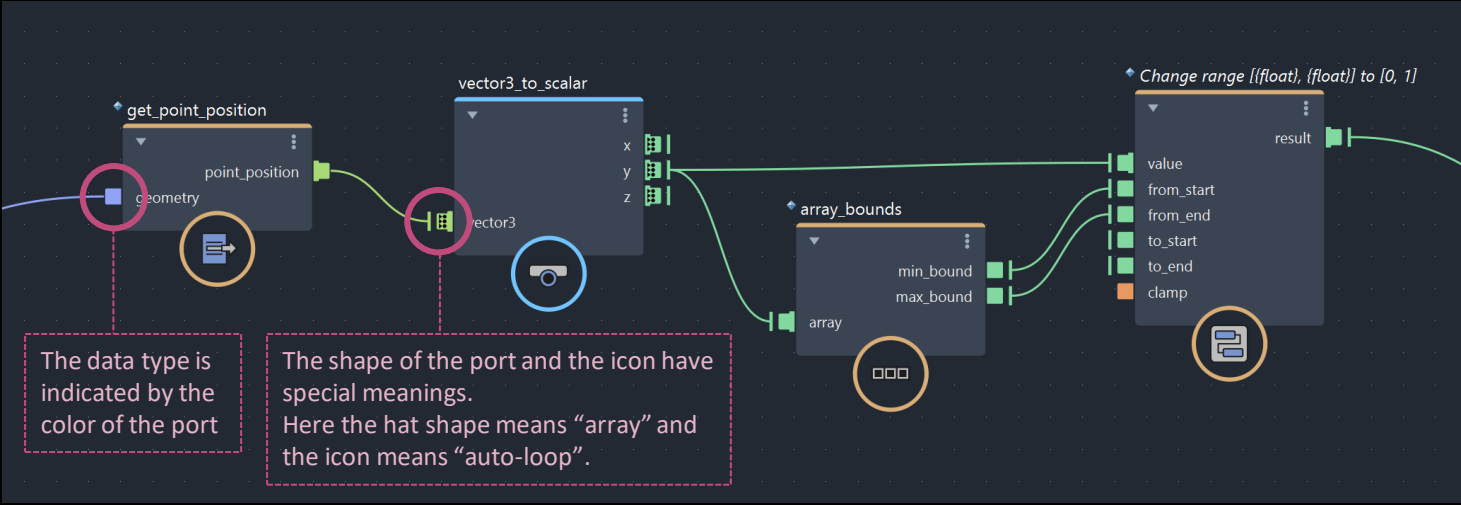
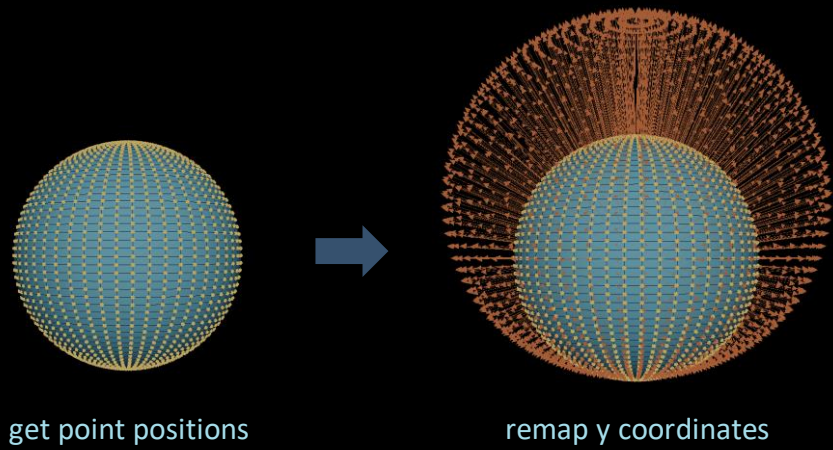
disconnect one node:  click + drag

disconnect one or more nodes: **Alt** + **Shift** + 



Insert a node:  click on wire + **Tab**  
**Alt** + drag to insert an existing node

# Intro to Bifrost Graph Editor



Color	Types
	Decimal values. These can be single ( <code>float</code> ) or double-precision ( <code>double</code> ) floating-point values.
	2D, 3D, or 4D vectors of <code>float</code> or <code>double</code> values.
	Matrices of <code>float</code> or <code>double</code> values.
	Signed or unsigned integers of various widths.
	Strings.
	Boolean values. This color is also used for enums, like <code>rotation_order</code> .

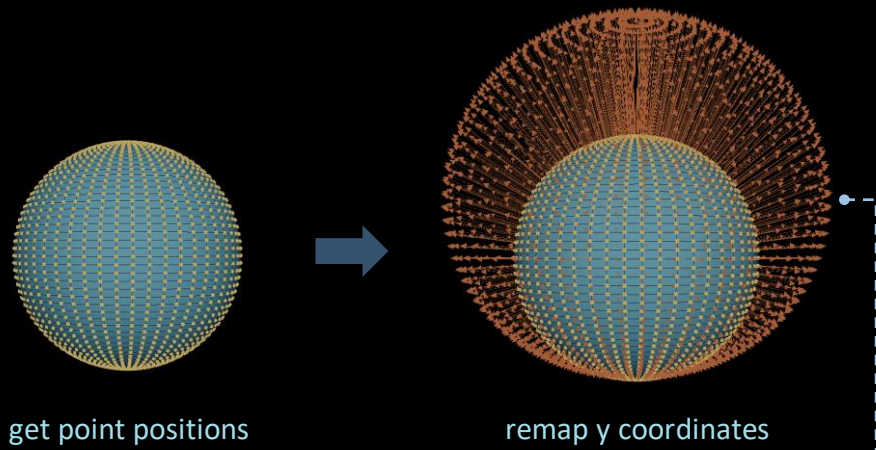
For more info: [doc for data types](#)

Icon	Port type
	Array of values. See <a href="#">Work with arrays</a> .
	Auto-loop. When you connect an array to a single-value input port, the node processes all elements of the array individually and outputs the resulting array as if the node was inside a <code>for_each</code> compound.
	Fan-in. This allows you to connect multiple values and arrays of values to be treated as a single array. To create fan-in ports for your own compounds, see <a href="#">Create fan-in ports for arrays</a> .

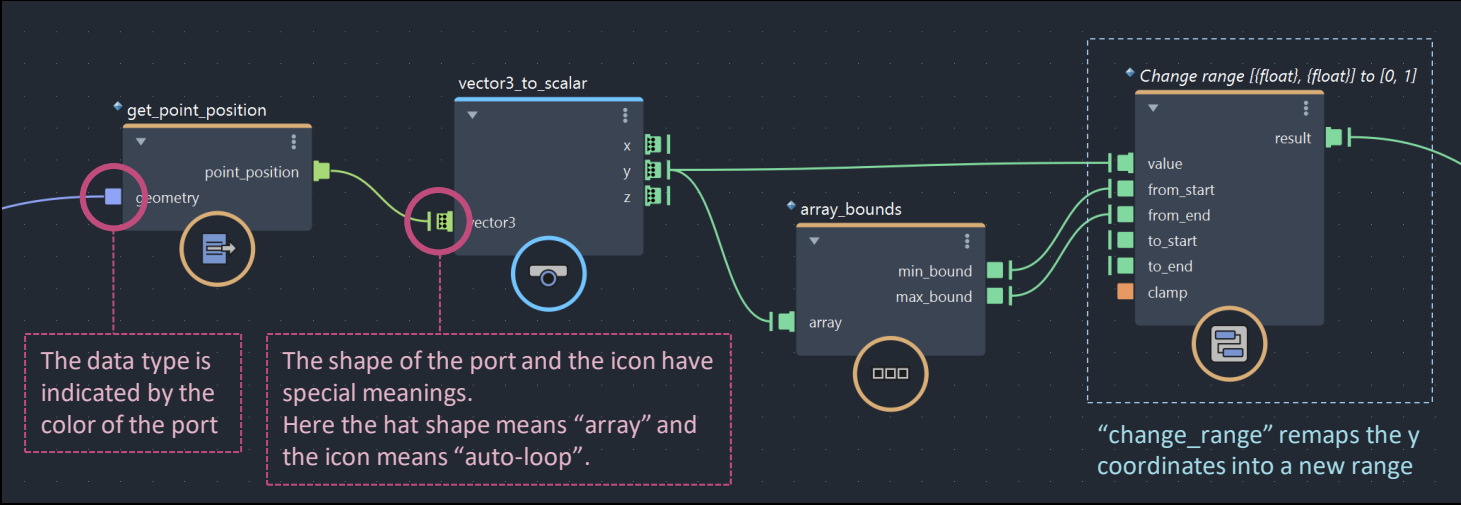
For more info: [doc for port types](#)



# Intro to Bifrost Graph Editor

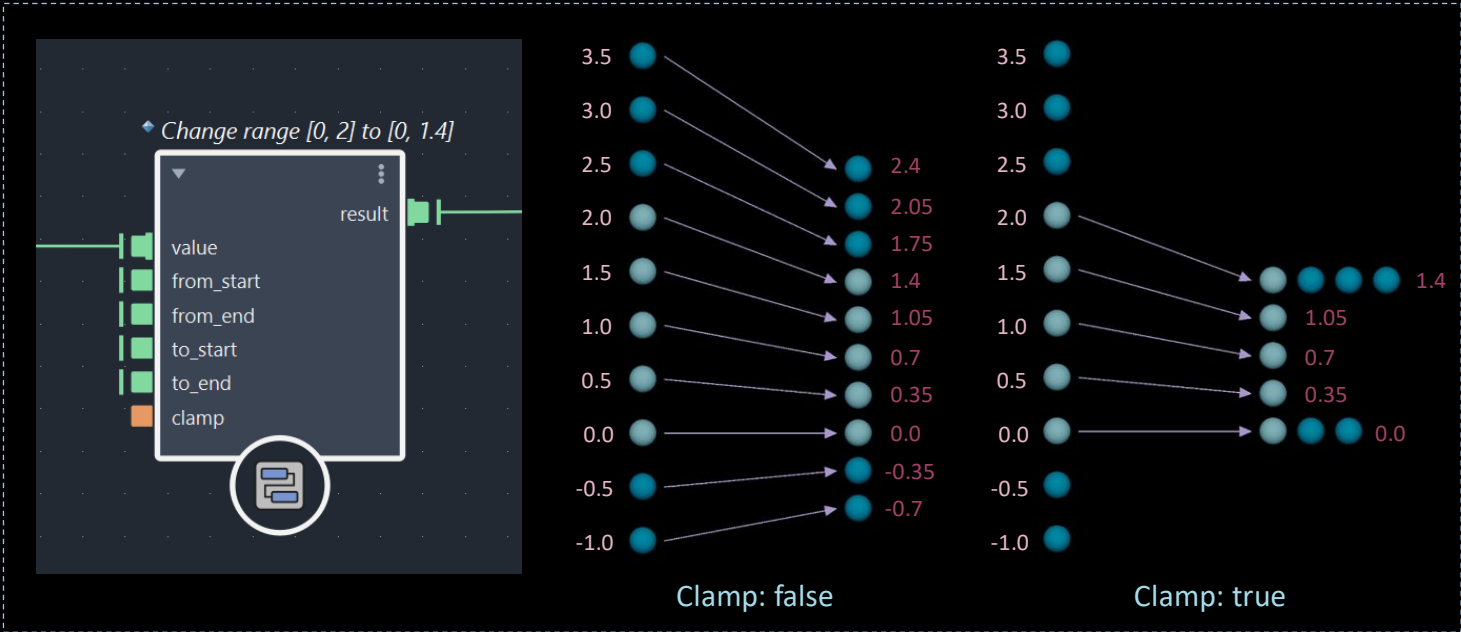


Arrows are displays of the vectors along normal directions whose lengths are derived from the remapped values of the y coordinates.

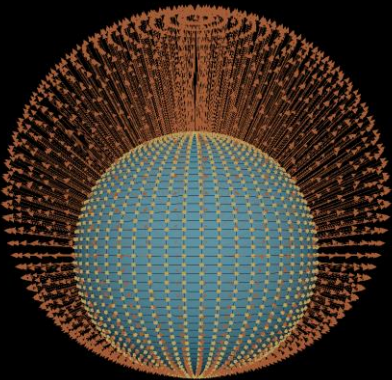


[doc for data types](#)

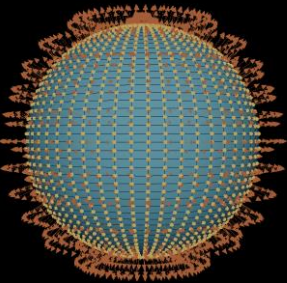
[doc for port types](#)



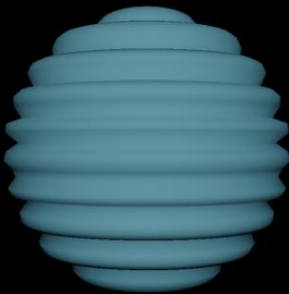
# Intro to Bifrost Graph Editor



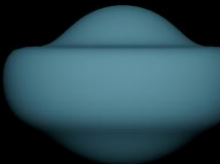
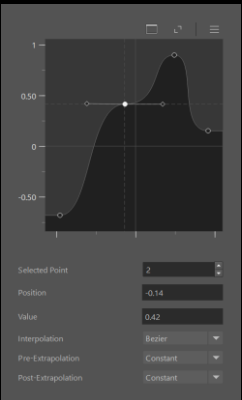
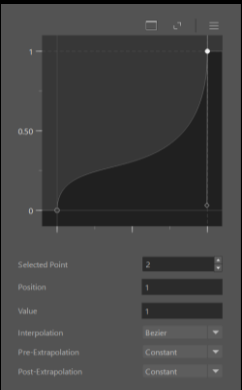
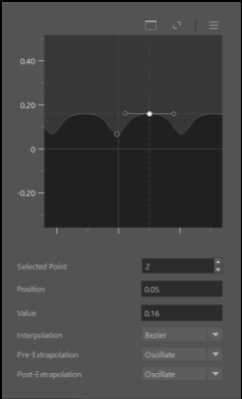
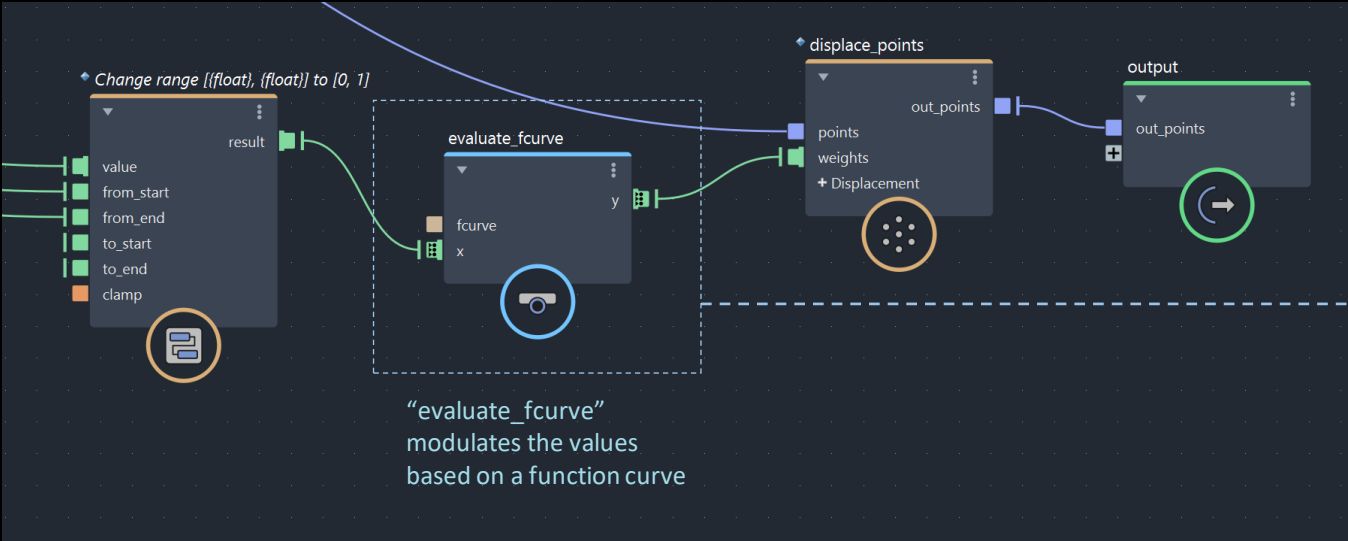
remap y coordinates



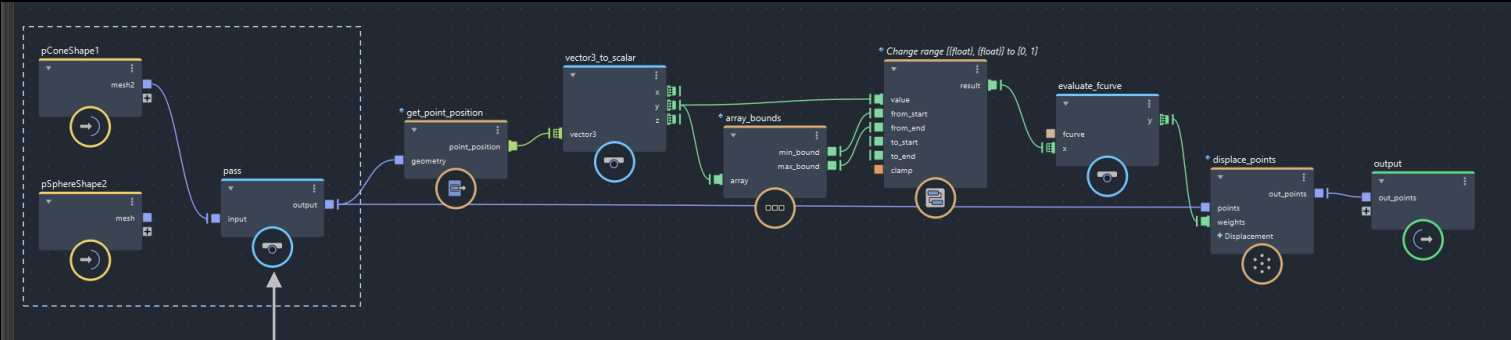
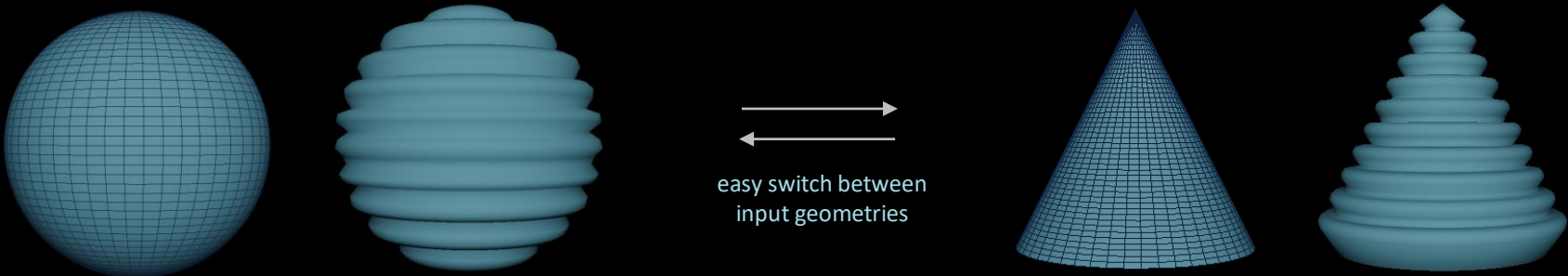
modulate values



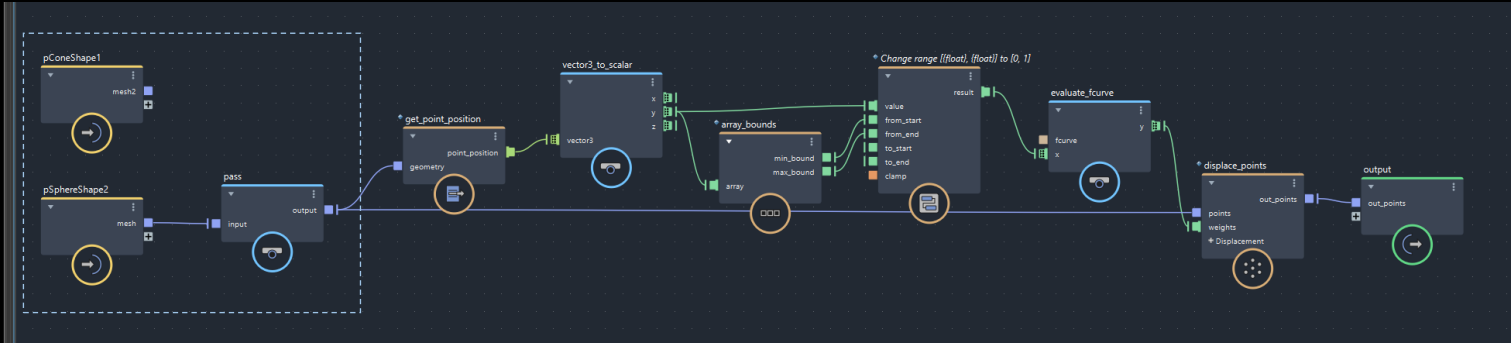
output mesh



# Intro to Bifrost Graph Editor



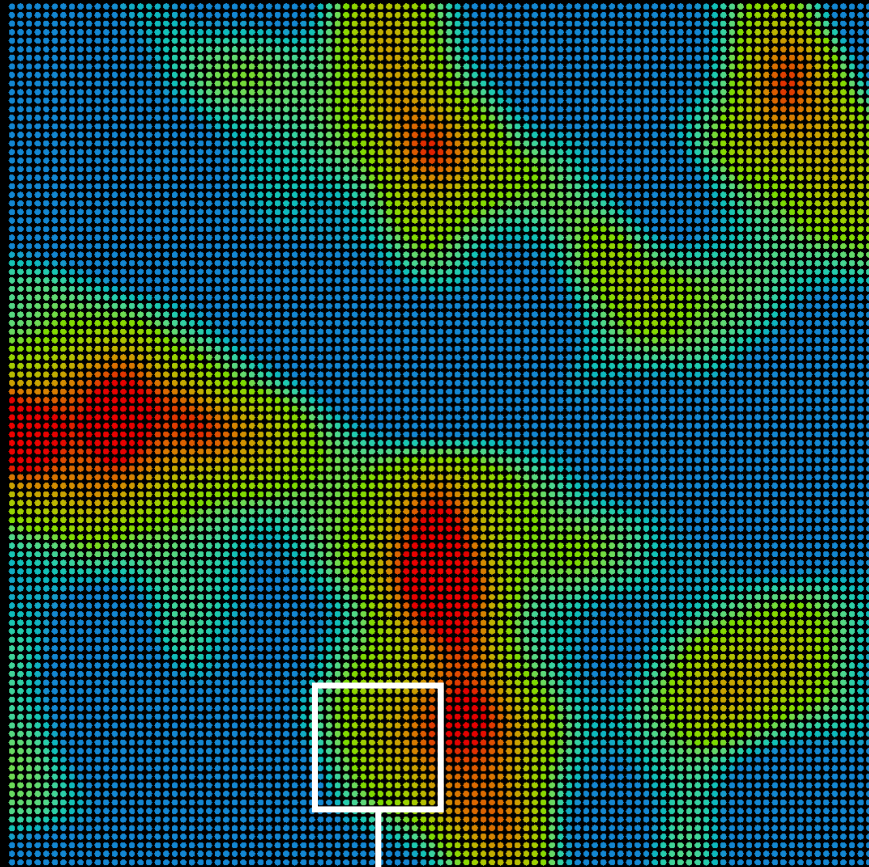
The “pass” node facilitates the switching between different input geometries



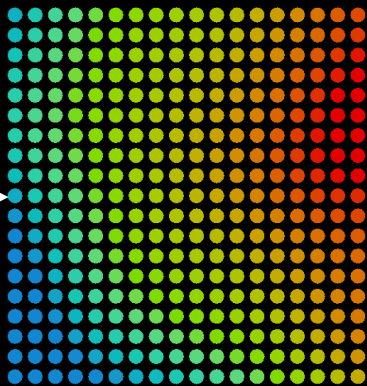
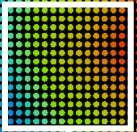


Fields

## Fields: overview



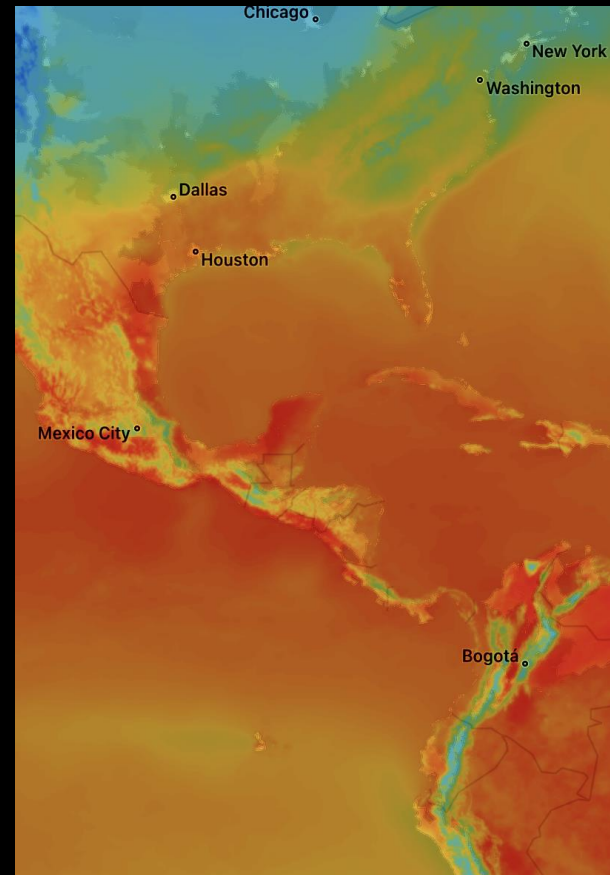
value =  $f(x, y, z)$



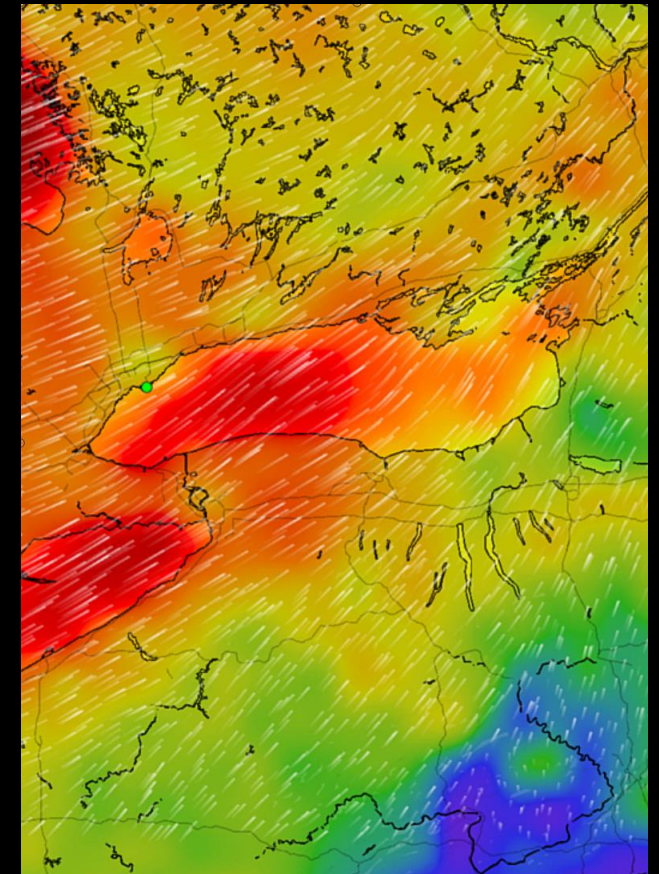
A field is a function that associates a value to every point in space.

- Scalar field
- Vector field

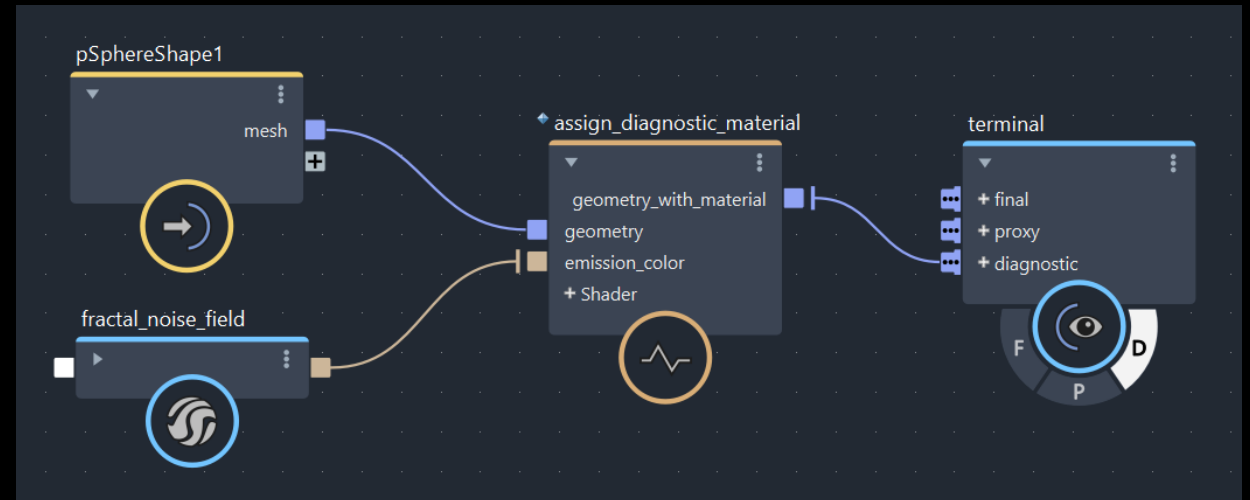
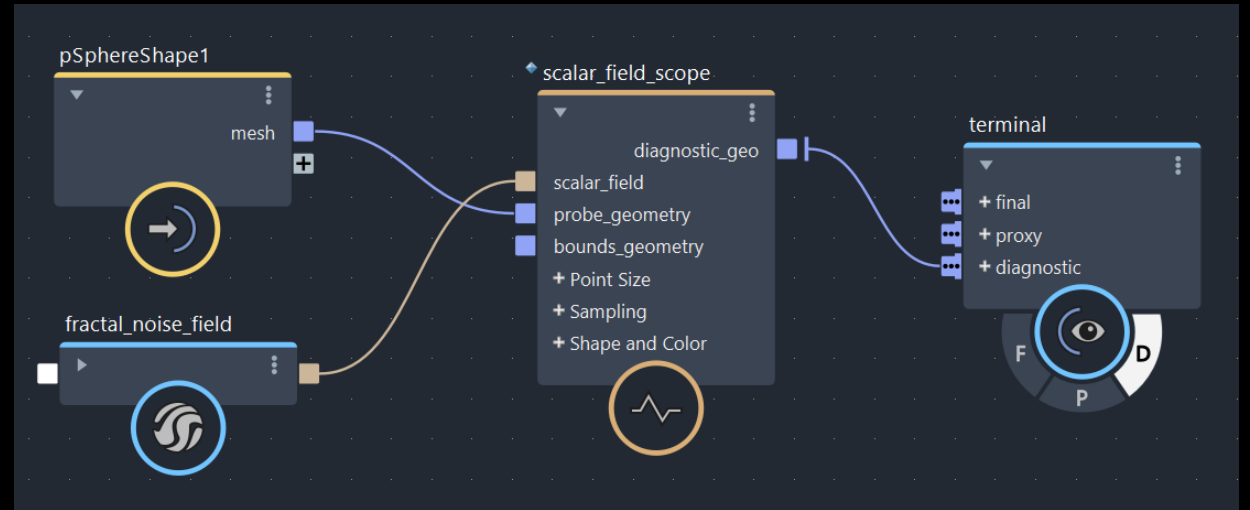
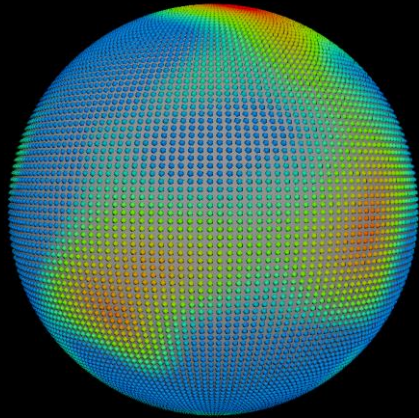
Examples:



temperature map (scalar field)



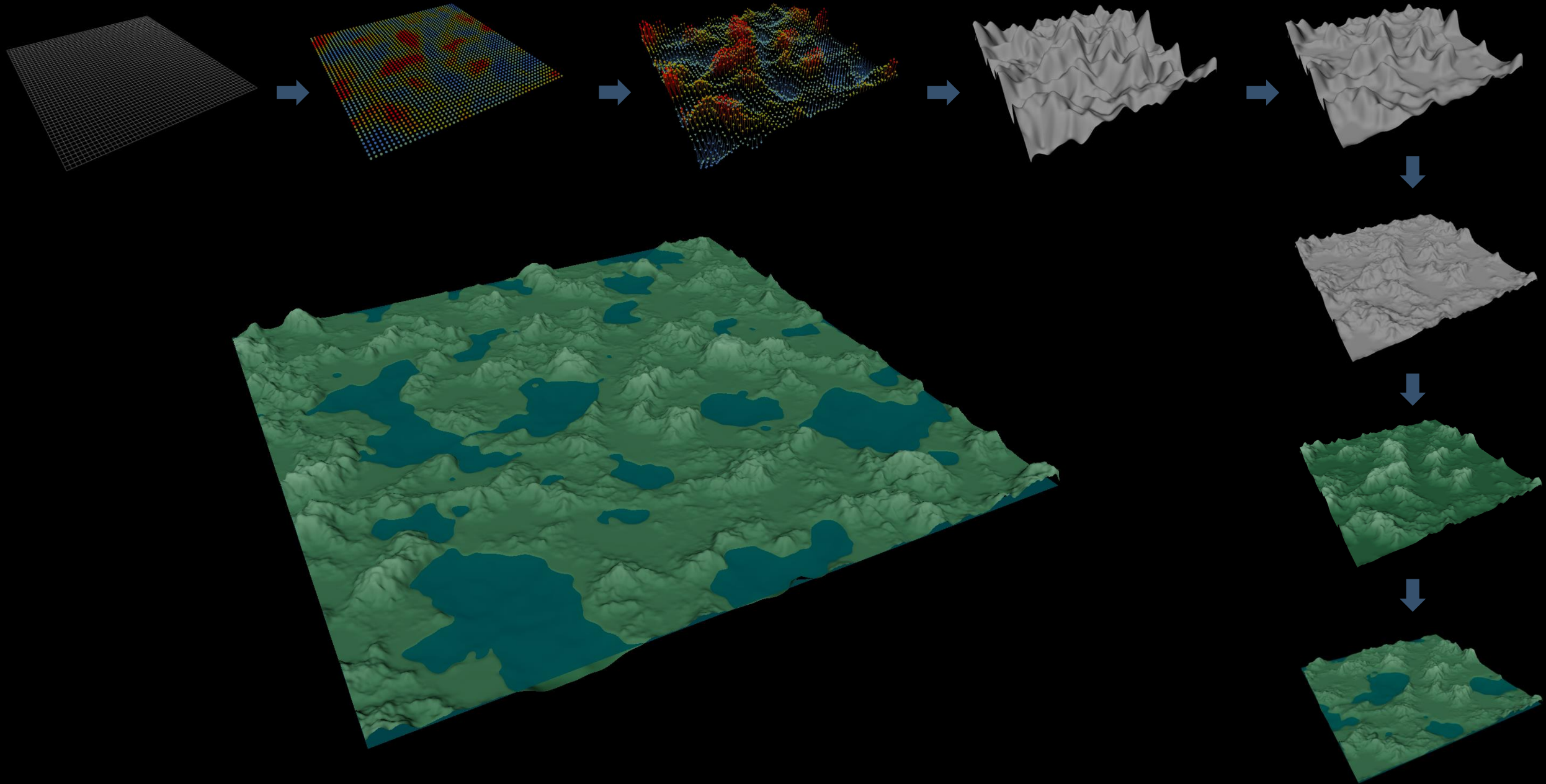
wind map (vector field)



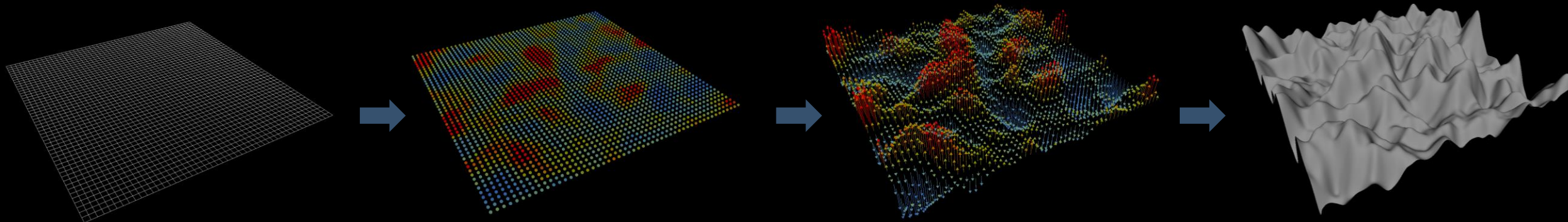
assign diagnostic material



# Fields: creating a terrain



## Fields: creating a terrain

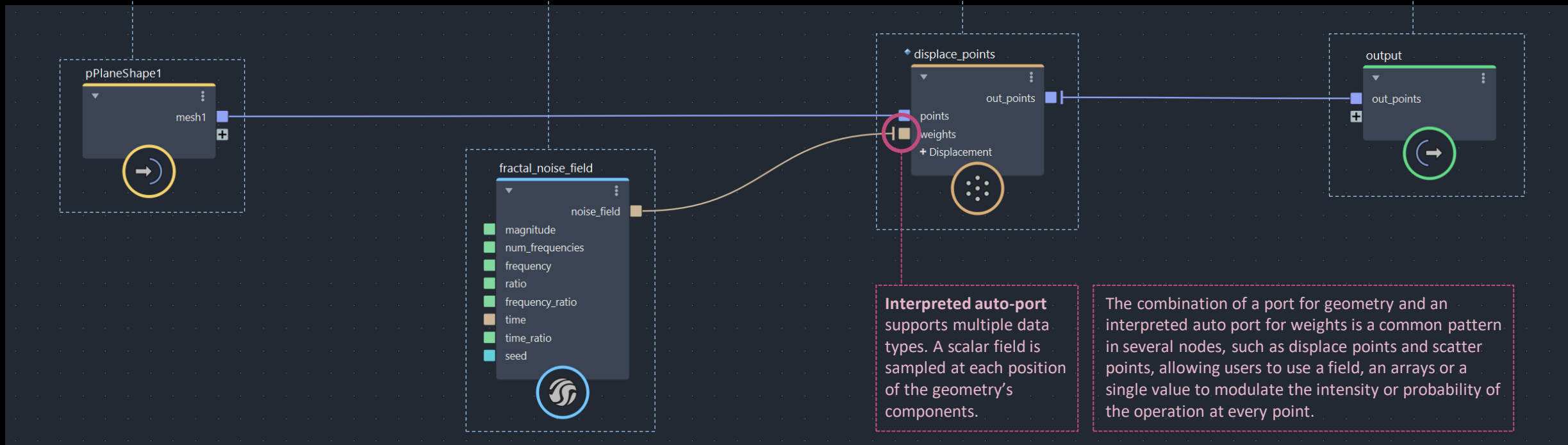


input mesh plane

fractal noise field

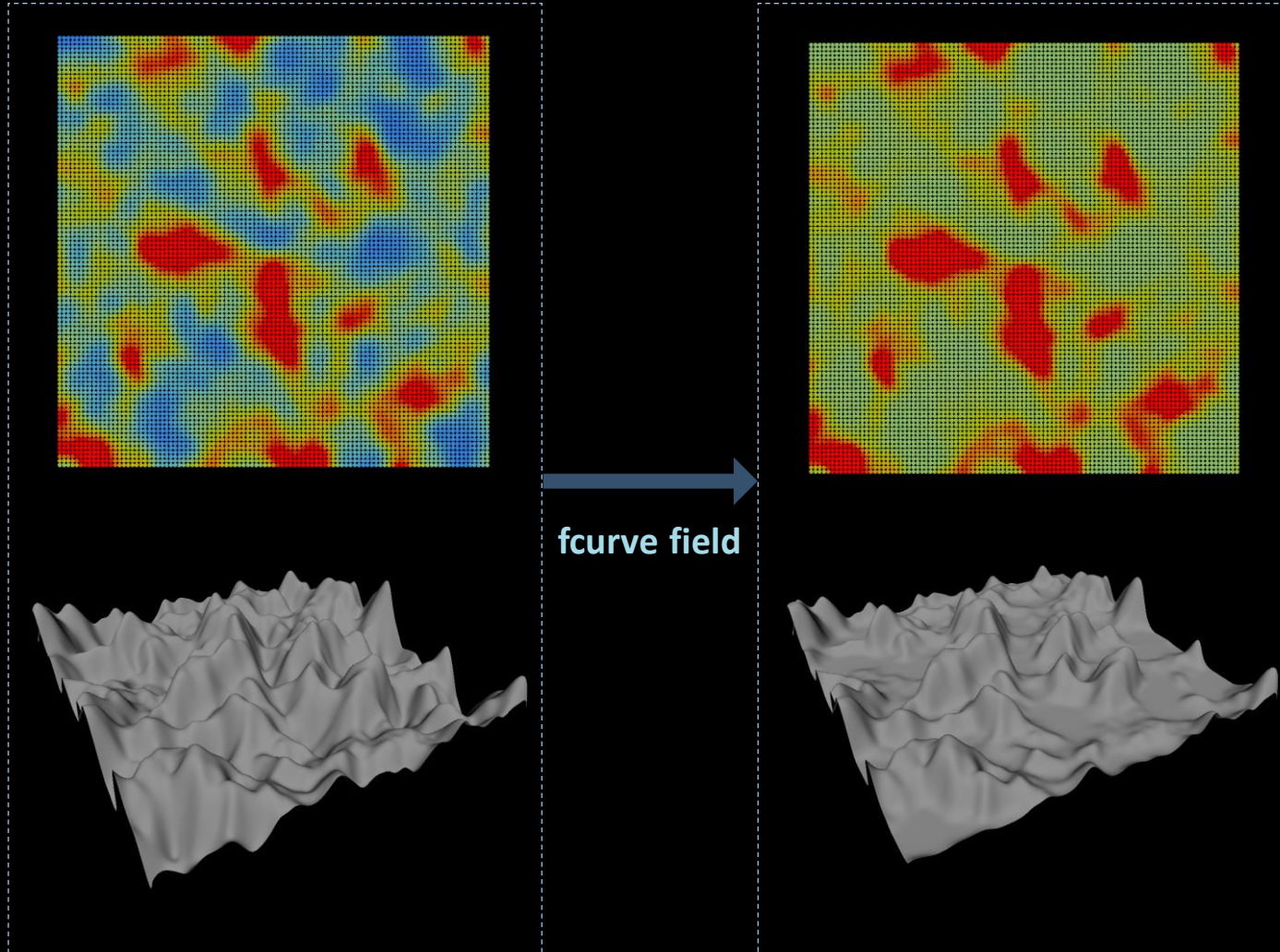
displace points

out mesh

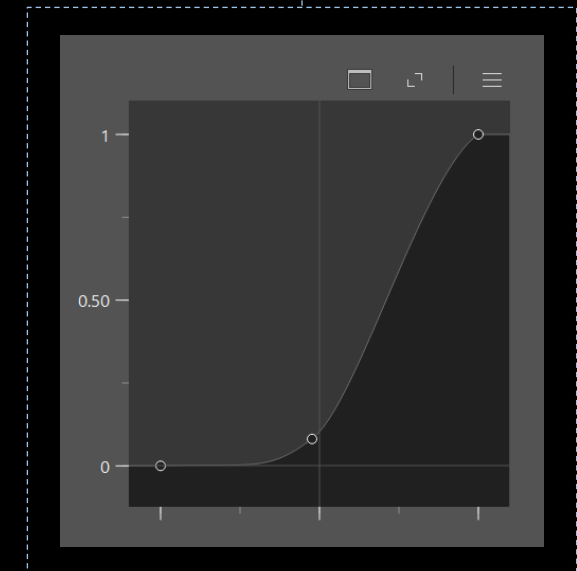
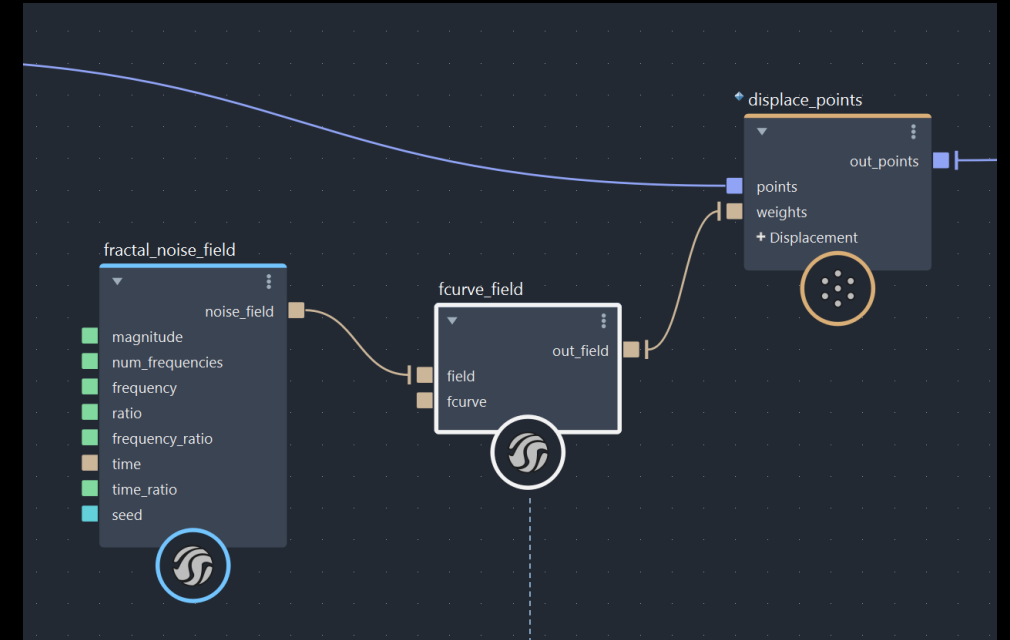




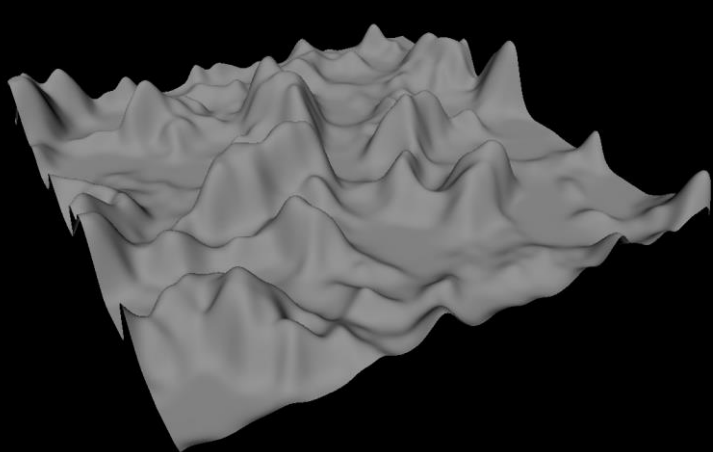
## Fields: creating a terrain



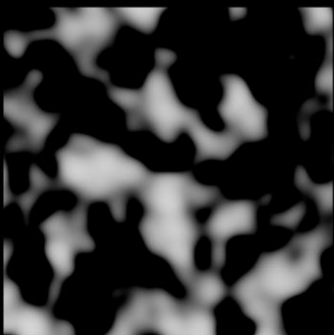
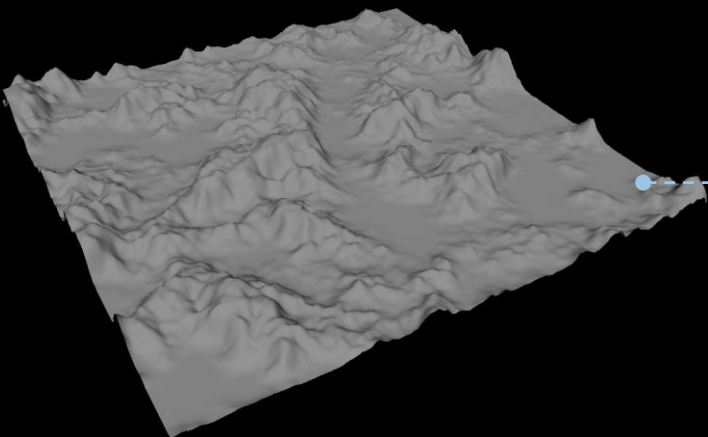
fcurve field modulates a field using a functional curve to remap the input field values to new ones




Fields: creating a terrain

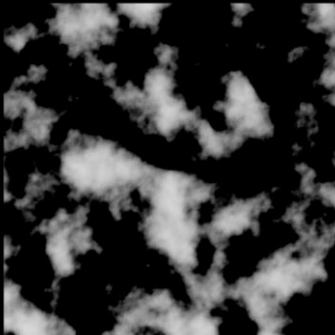



adjusting  
parameters



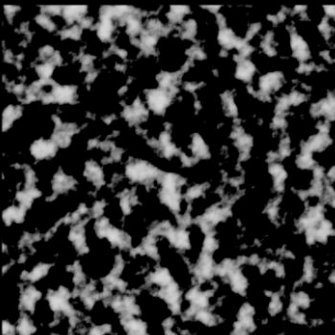
 **fractal\_noise\_field**  
Type: fractal\_noise\_field


Magnitude	1
Num Frequencies	2
Frequency	0.2



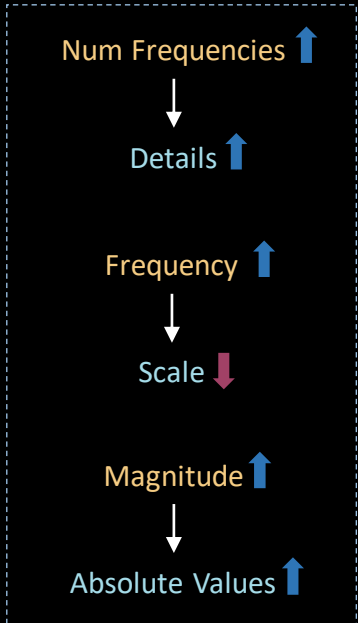
 **fractal\_noise\_field**  
Type: fractal\_noise\_field

Magnitude	1
Num Frequencies	6
Frequency	0.2



 **fractal\_noise\_field**  
Type: fractal\_noise\_field

Magnitude	1
Num Frequencies	6
Frequency	0.5



 **fractal\_noise\_field**  
Type: fractal\_noise\_field

fractal\_noise\_field

noise\_field

magnitude

num\_frequencies

frequency

ratio

frequency\_ratio

time

time\_ratio

seed

Magnitude

0.9

Num Frequencies

6,147

Frequency

0.198

Ratio

0.5

Frequency Ratio

0.5

Time

Time Ratio

1.5

Seed

0

 **fcurve\_field**  
Type: fcurve\_field

Field: fractal\_noise\_field.noise\_field

Fcurve

fcurve\_field

out\_field

field

fcurve

1

0.50

0

Selected Point

2

Position

-0.05

Value

0.08

Interpolation

Bezier

Pre-Extrapolation

Constant

Post-Extrapolation

Constant

 **displace\_points**  
Type: displace\_points

displace\_points

out\_points

points

weights

Displacement

scale

displacement\_vector

Points

xifrostGraphShape1.mesh1

Weights

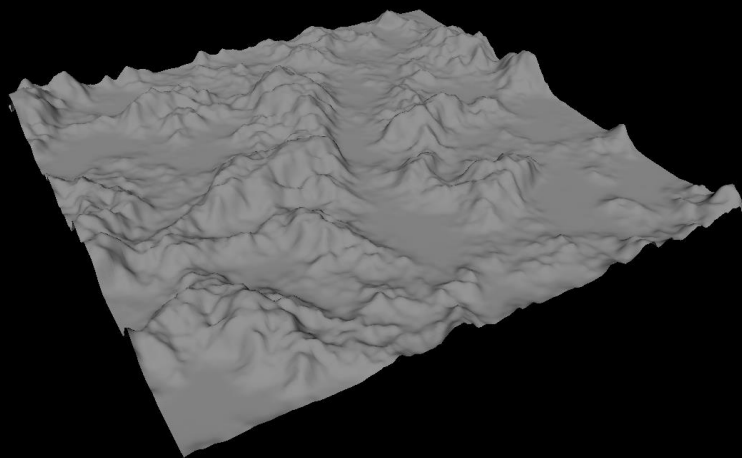
fcurve\_field.out\_field

Displacement

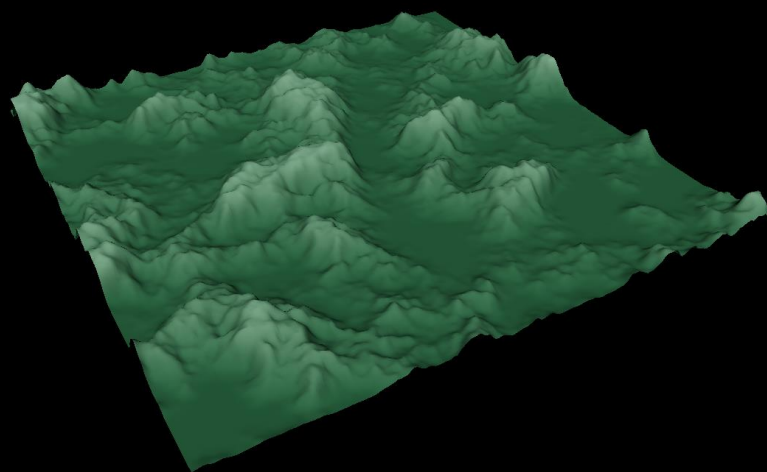
Scale

1.29

## Fields: creating a terrain



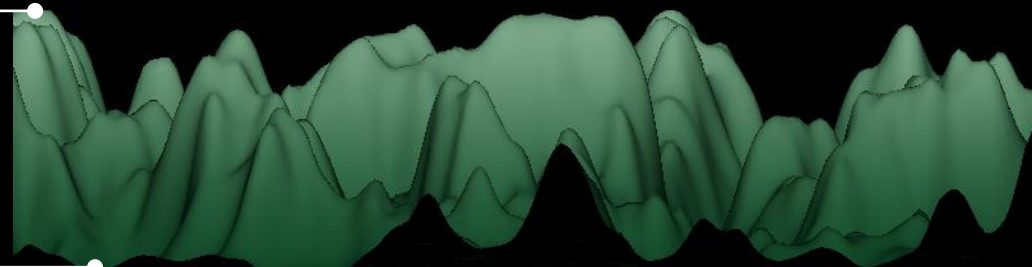
assigning colors



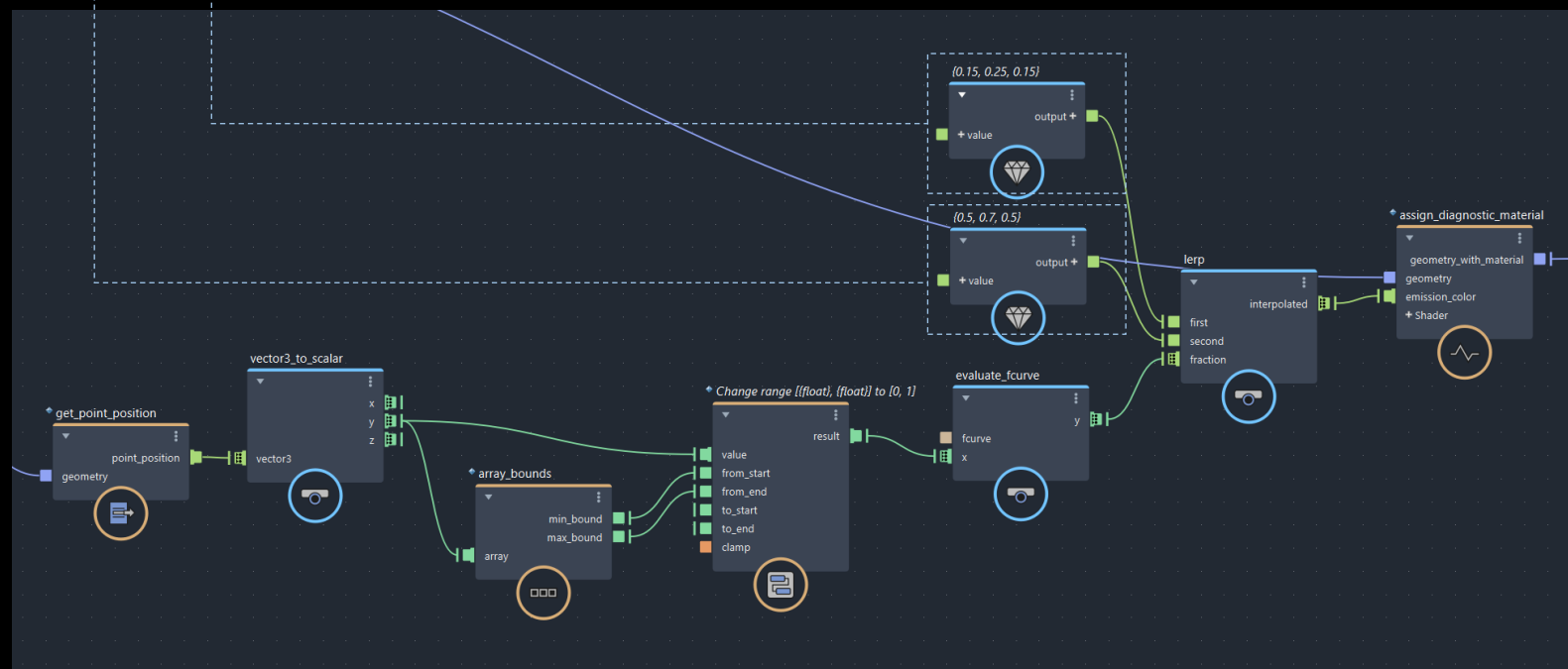
color2



color1

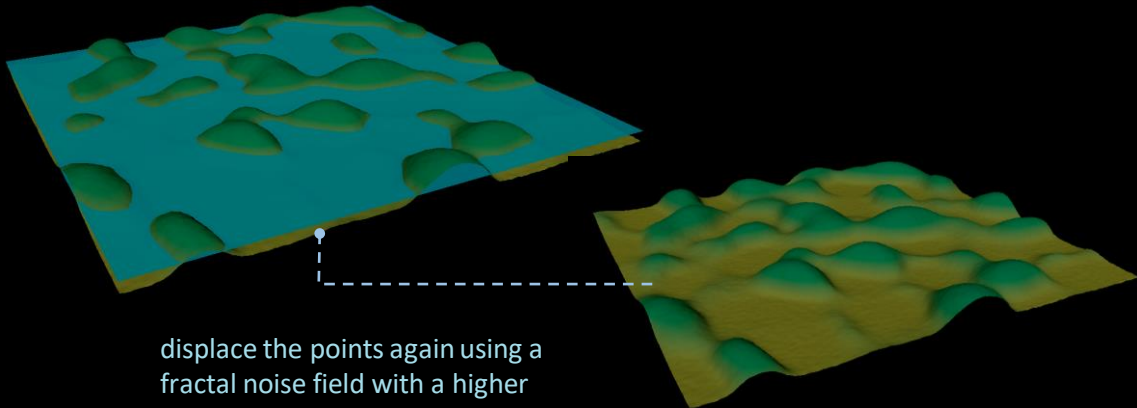
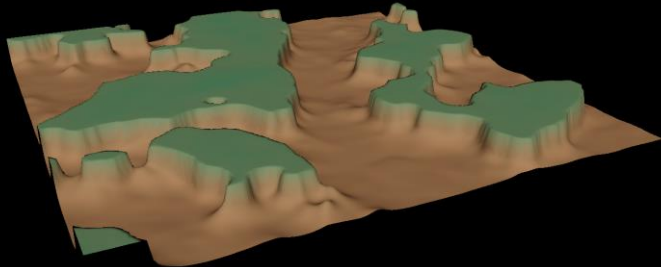
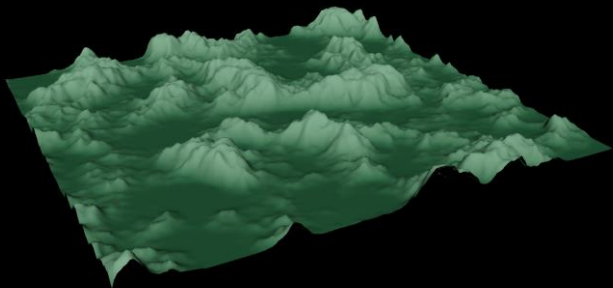


establish a relationship between the y coordinate and the linear interpolation between the two colors



Fields: creating a terrain

Variations



displace the points again using a fractal noise field with a higher frequency to add some texture

fractal\_noise\_field

noise\_field

magnitude

num\_frequencies

frequency

ratio

frequency\_ratio

time

time\_ratio

seed

Magnitude

Num Frequencies

Frequency

Ratio

Frequency Ratio

Time

Time Ratio

Seed

0.9

6.147

0.198

0.5

0.5

1.5

0

fcurve\_field

field

fcurve

out\_field

Field

Value

1

0.50

0

Selected Point

Position

Value

2

-0.05

0.08

displace\_points

out\_points

points

weights

Displacement

scale

displacement\_vector

displace\_points

Type: displace\_points

Points

Weights

Displacement

Scale

xfrostGraphShape1.mesh1

fcurve\_field.out\_field

1.29

fractal\_noise\_field

noise\_field

magnitude

num\_frequencies

frequency

ratio

frequency\_ratio

time

time\_ratio

seed

Magnitude

Num Frequencies

Frequency

Ratio

Frequency Ratio

Time

Time Ratio

Seed

0.9

3.397

0.125

0.5

0.5

1.5

0

fcurve\_field

field

fcurve

out\_field

Field

Value

1

0.50

0

Selected Point

Position

Value

2

-0.15

0.17

displace\_points

out\_points

points

weights

Displacement

scale

displacement\_vector

displace\_points

Type: displace\_points

Points

Weights

Displacement

Scale

xfrostGraphShape1.mesh1

fcurve\_field.out\_field

1.605

fractal\_noise\_field

noise\_field

magnitude

num\_frequencies

frequency

ratio

frequency\_ratio

time

time\_ratio

seed

Magnitude

Num Frequencies

Frequency

0.9

1.186

0.2311

fcurve\_field

field

fcurve

out\_field

Field

Value

1

0.50

0

Selected Point

Position

Value

2

0.09

0.26

displace\_points

out\_points

points

weights

Displacement

scale

displacement\_vector

displace\_points

Type: displace\_points

Points

Weights

Displacement

Scale

xfrostGraphShape1.mesh1

fcurve\_field.out\_field

1.383

fractal\_noise\_field1

noise\_field

magnitude

num\_frequencies

frequency

ratio

frequency\_ratio

time

time\_ratio

seed

Magnitude

Num Frequencies

Frequency

1

1.027

4.101

displace\_points1

out\_points

points

weights

Displacement

scale

displacement\_vector

displace\_points1

Type: displace\_points

Points

Weights

Displacement

Scale

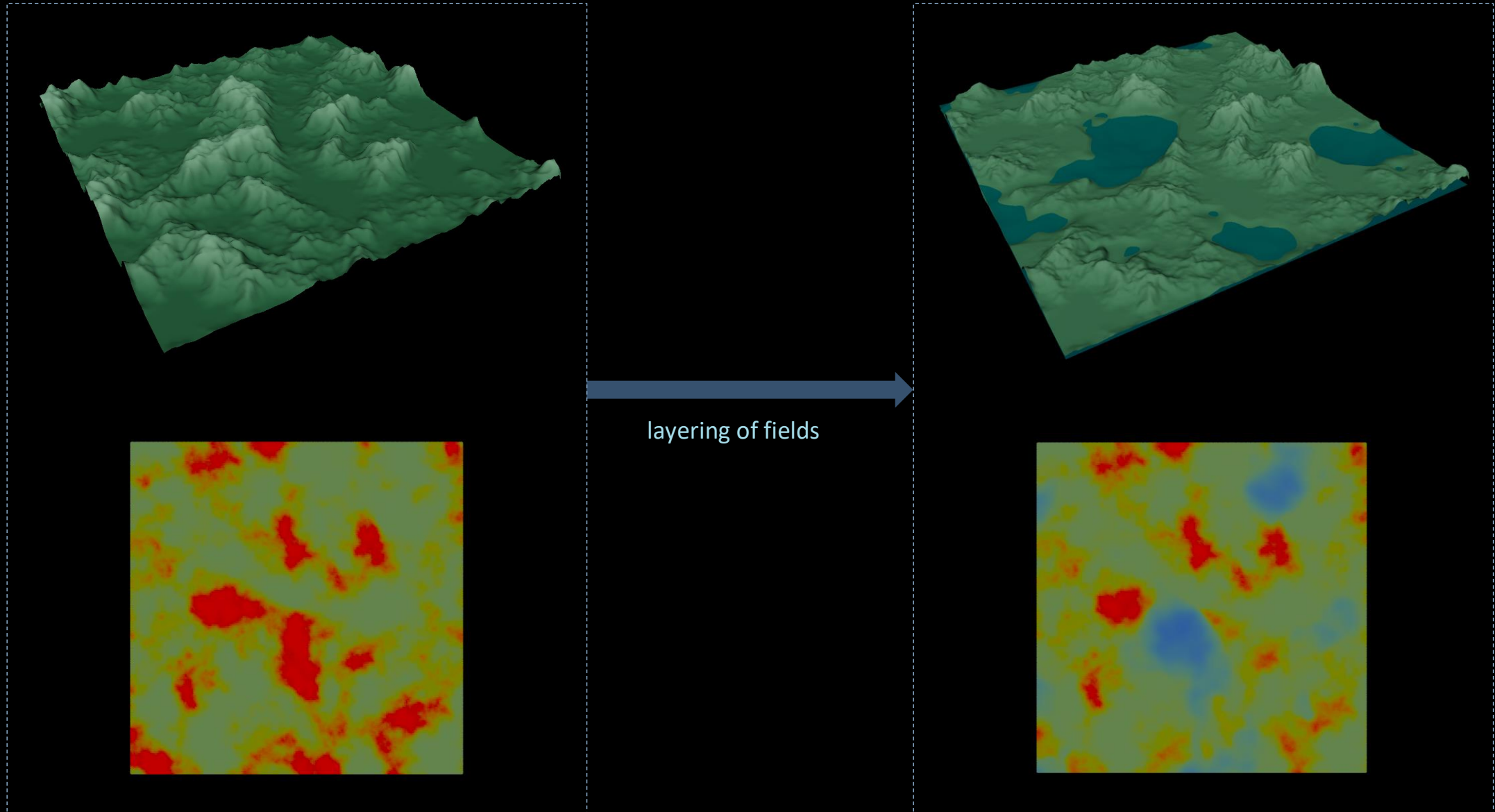
xfrostGraphShape1.mesh1

fcurve\_field.out\_field

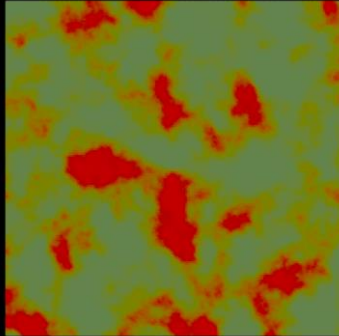
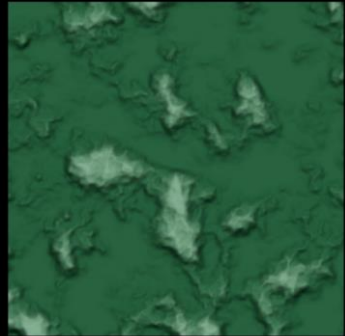
0.02761



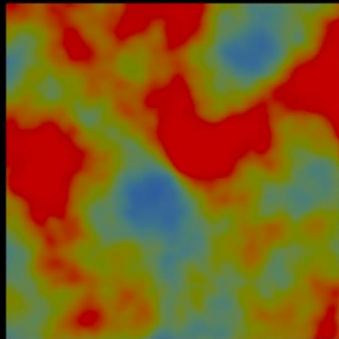
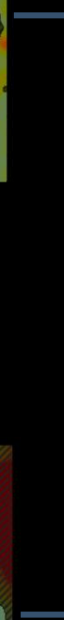
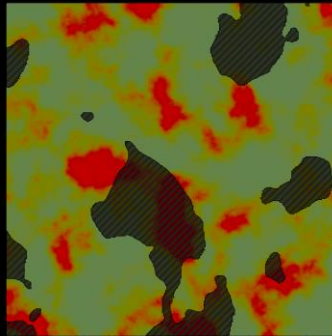
## Fields: adding lakes



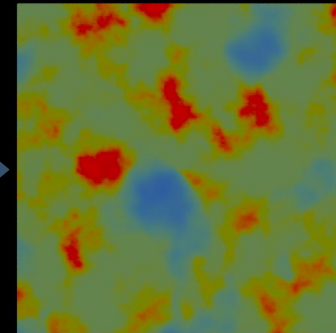
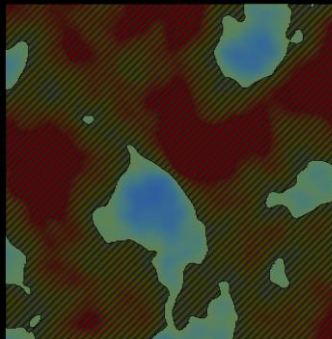




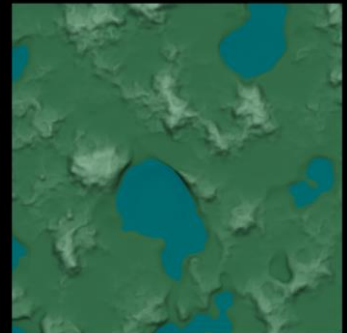
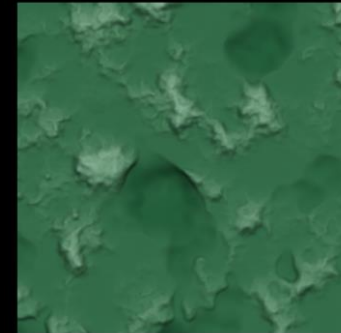
field for the mountains

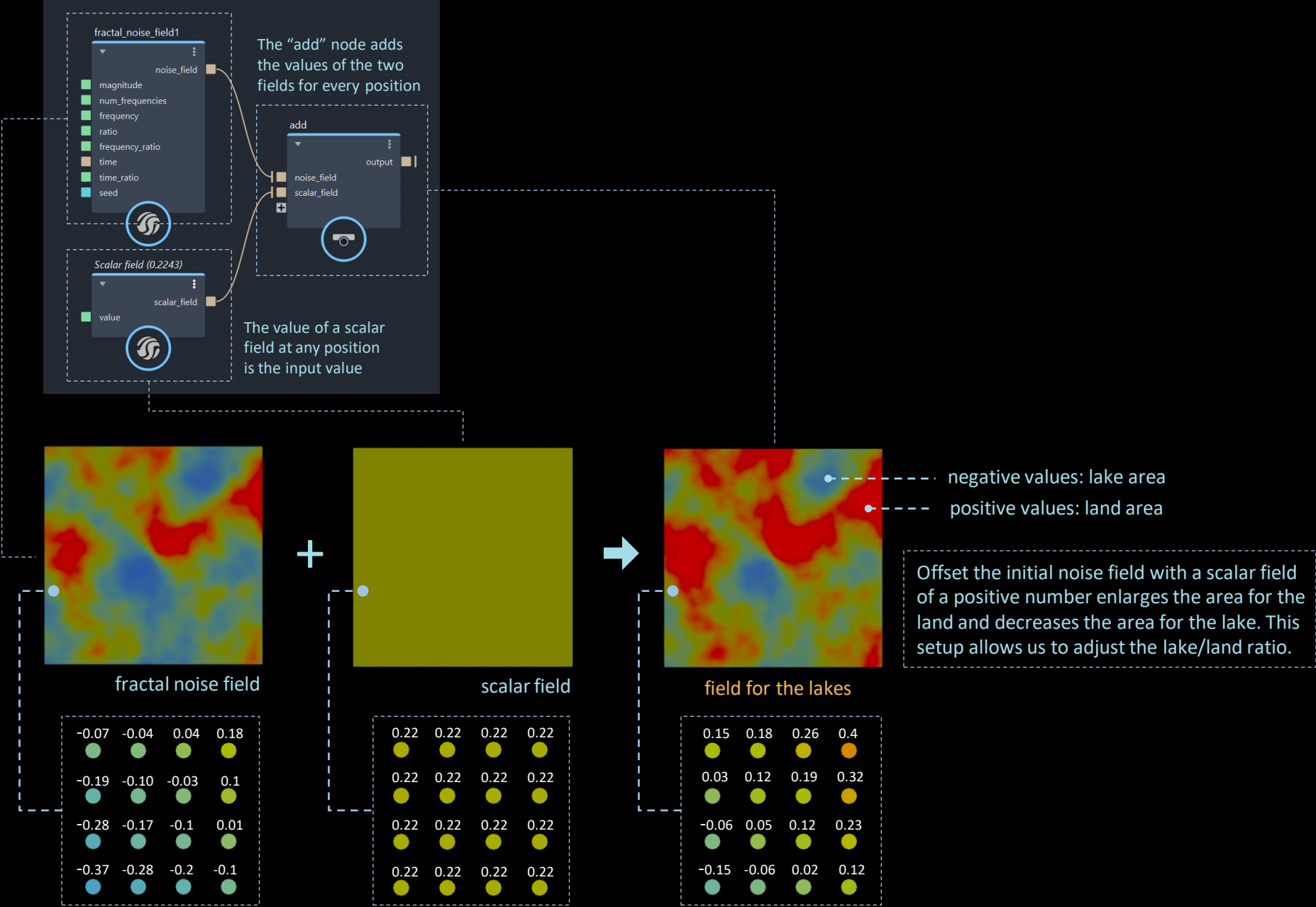


Create a field for the lakes



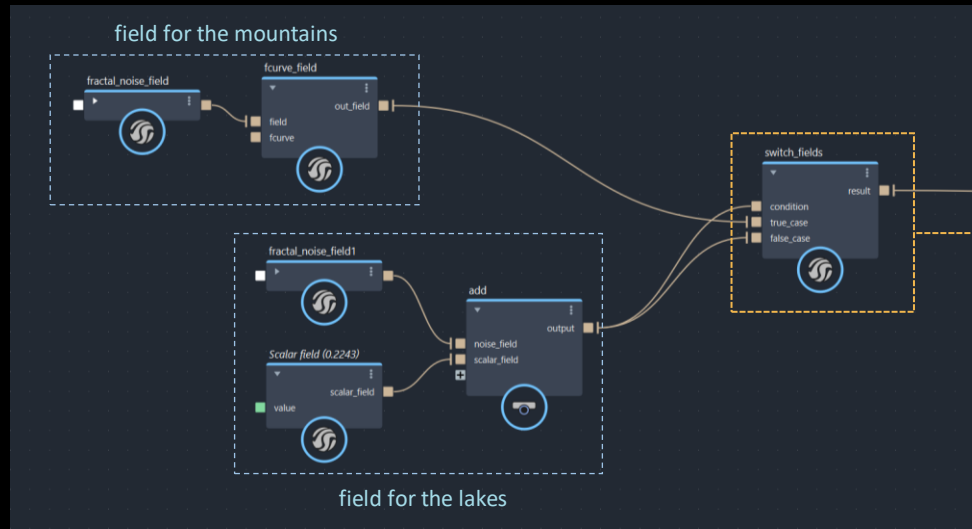
combined field of mountains & lakes



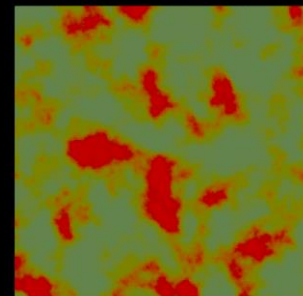


# Fields: adding lakes

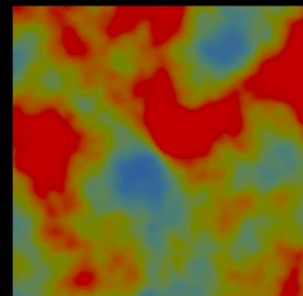
## Switch fields



"switch\_fields" returns a field whose value at each position is from one of two fields, depending on whether the condition field value is positive at the that position:  
positive value → "true\_case" field  
negative value → "false\_case" field



field for the mountains

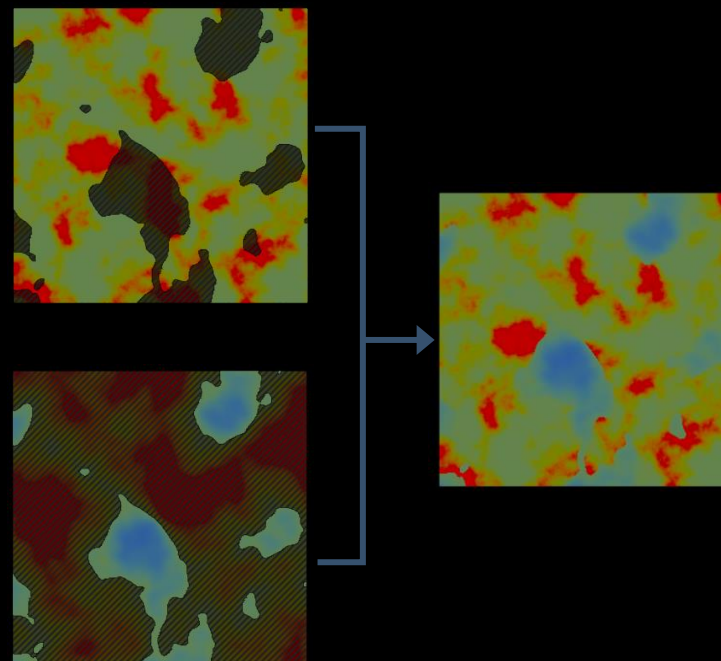


field for the lakes

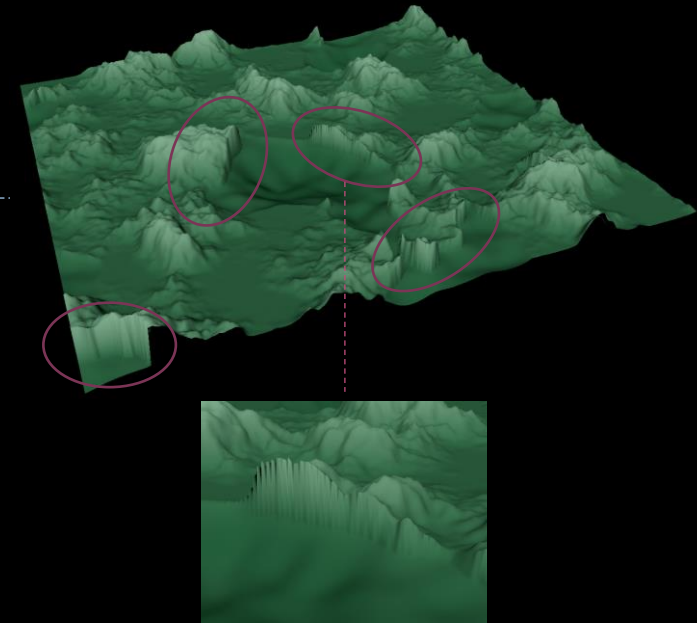
true case

condition

false case



switch fields



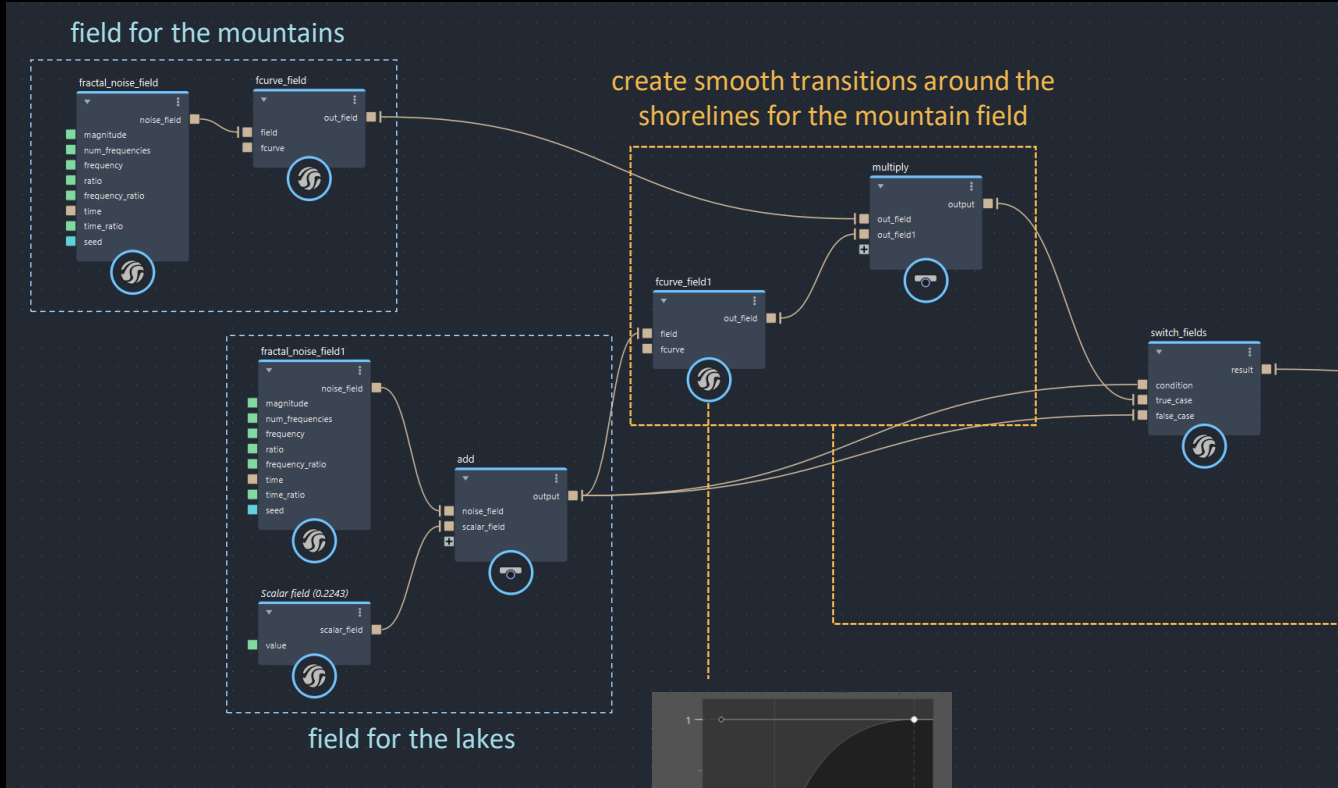
Problem around the shorelines:

Because the mountains and lakes are generated from two separate fields, there's no smooth transitions around the shorelines, which results in a sudden drop in height where the mountains meet the lakes.

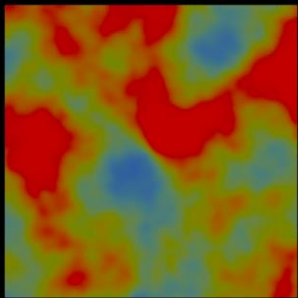
We need to create smooth transitions in the mountain field before connecting it to the "switch\_field".

# Fields: creating a terrain

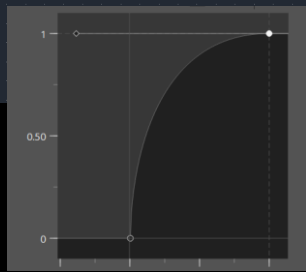
Create smooth transitions



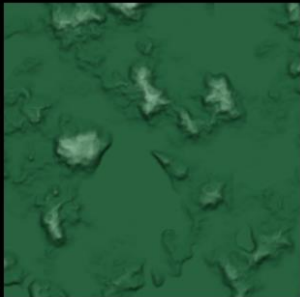
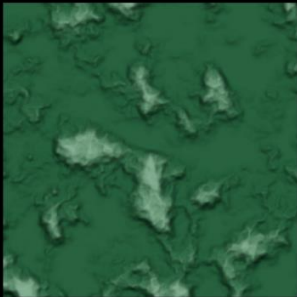
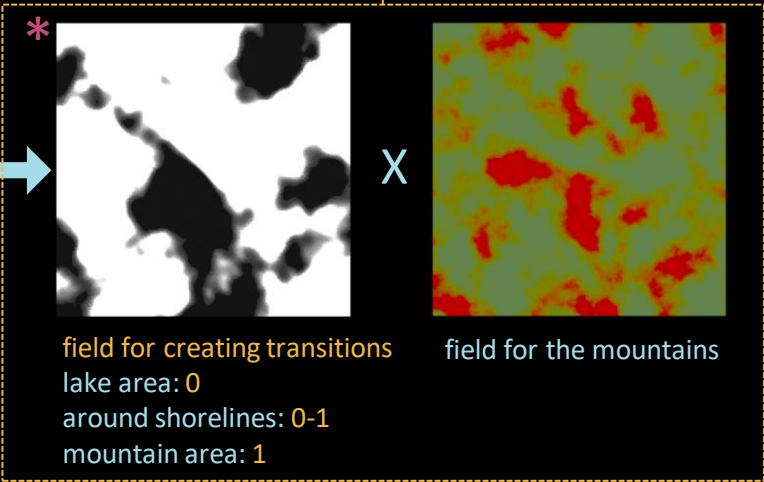
- \* The scalar field to multiply with the mountain field for creating smooth transitions
  - values around shorelines: gradient from 0 to 1 (smooth transition from lakes to mountains)
  - values in mountain area: 1 (keep the original height and shape of the mountains)



field for the lakes



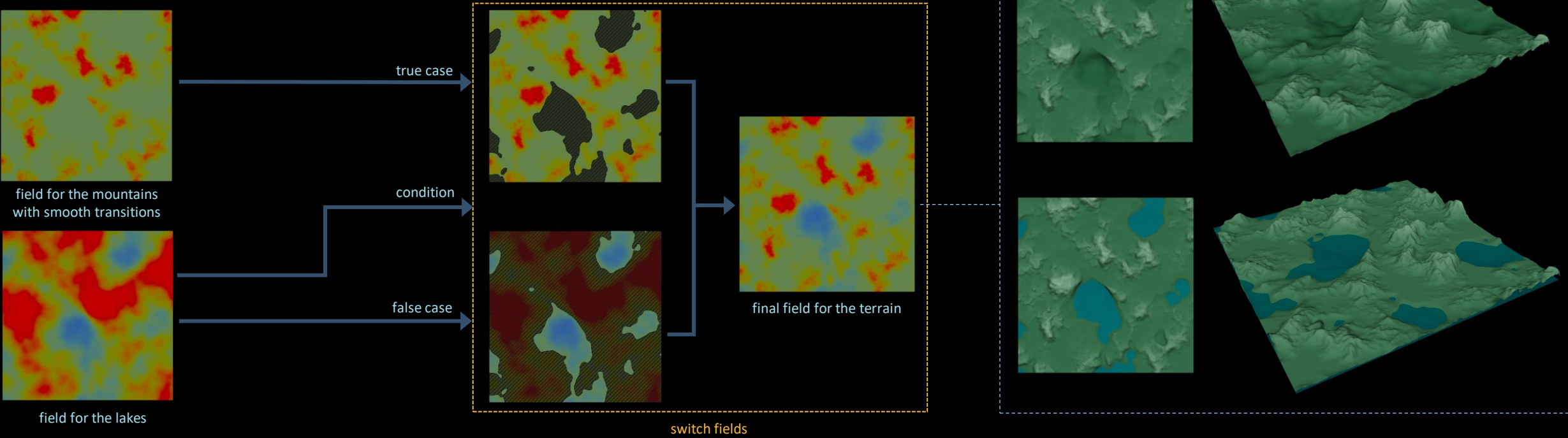
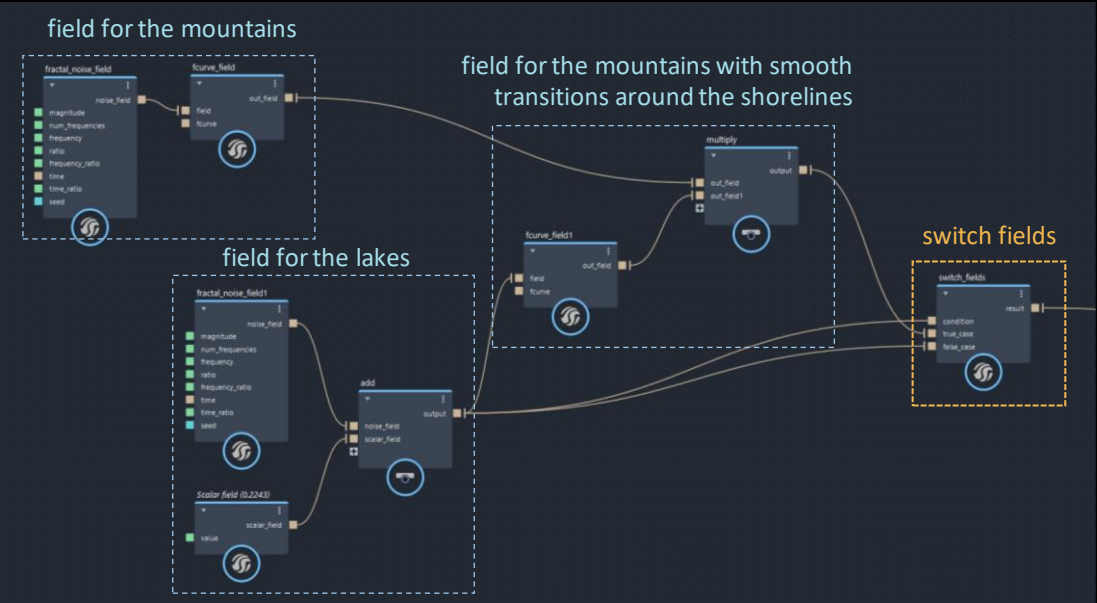
use an fcurve field to modulate the field



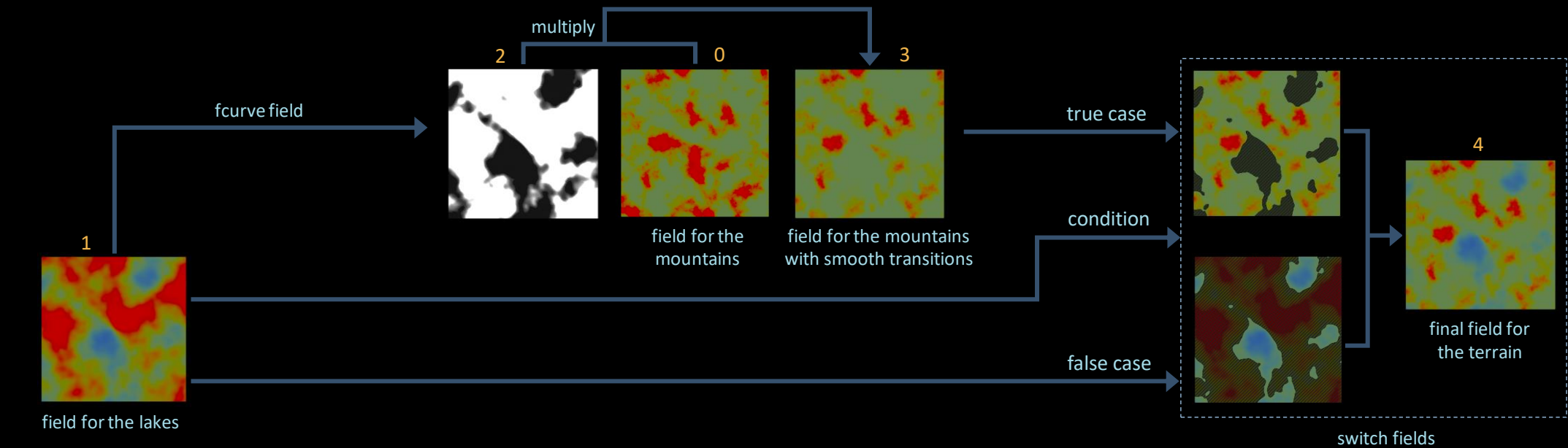
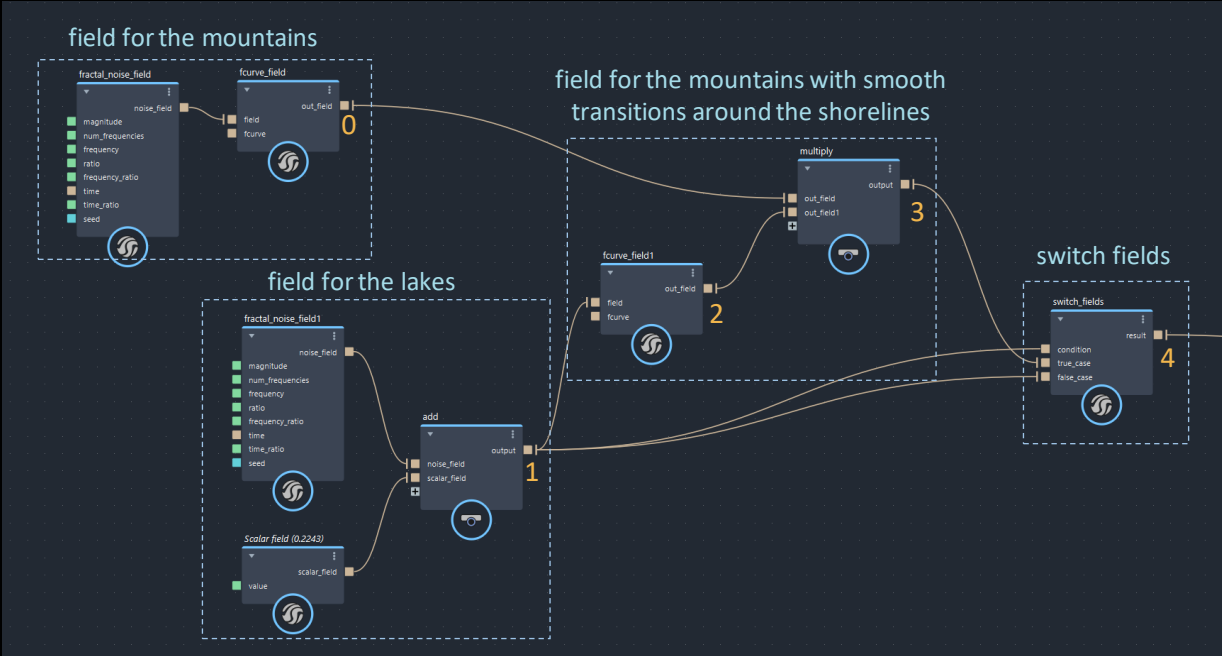


Fields: creating a terrain

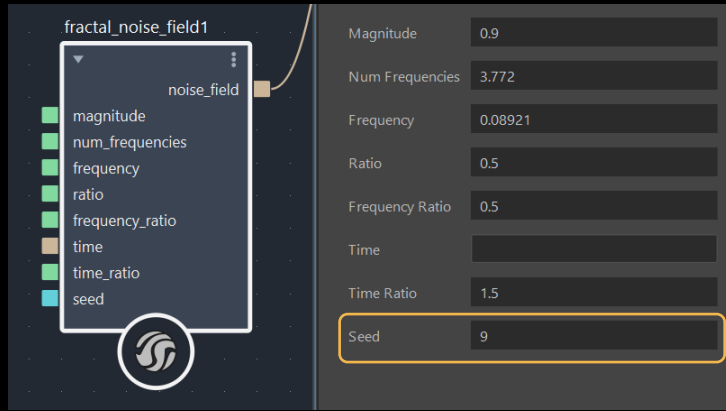
Create smooth transitions



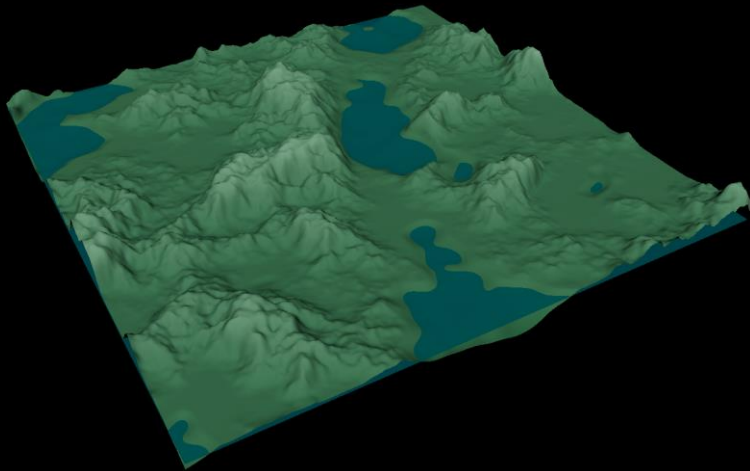




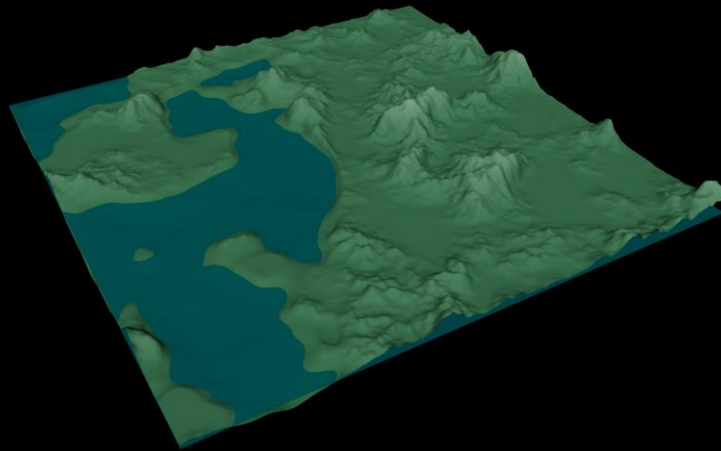
## Fields: creating a terrain



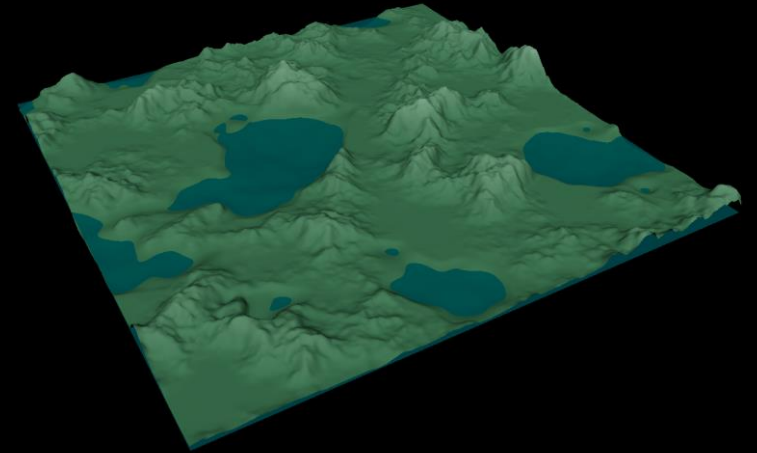
change the seed to have different distributions of lakes



seed = 0

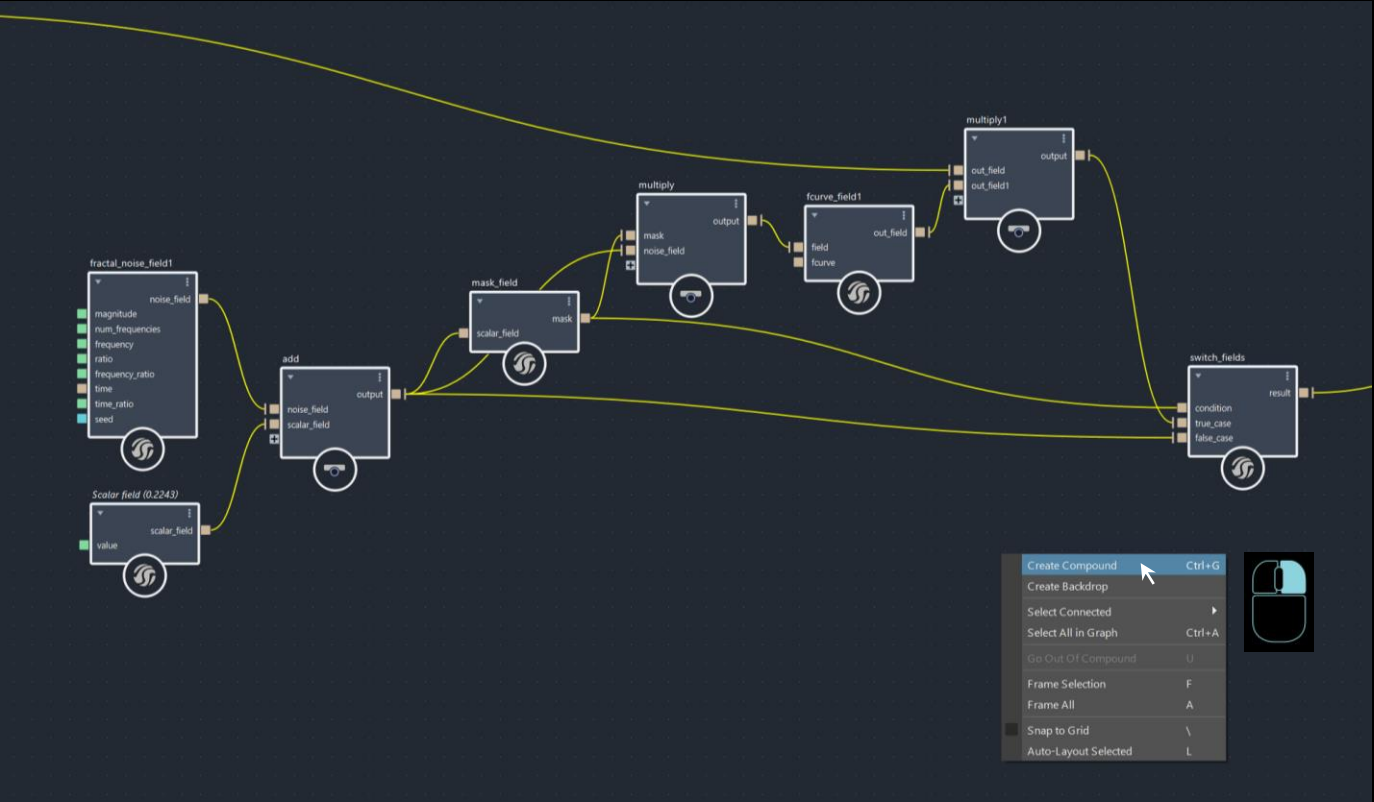


seed = 4

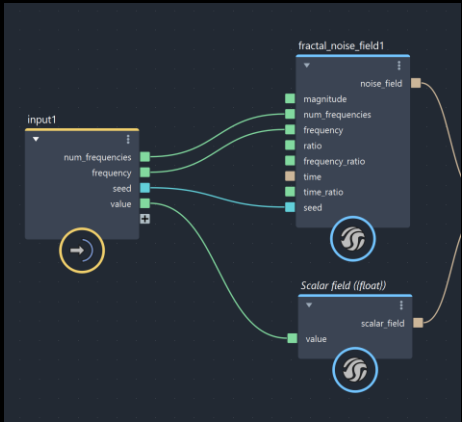
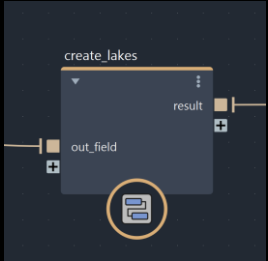


seed = 9

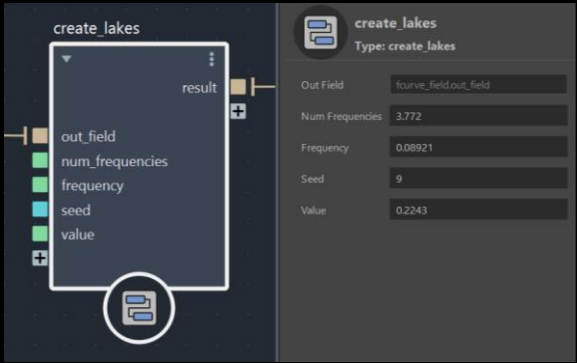
Fields: creating a terrain



create a compound



Inside the compound, get an input node, connect the parameters to it to add them in the parameters panel of the compound



# Fields: creating a terrain

Bifrost Graph Editor

Create Edit Display Options Windows Help

New Graph

Create

BackdropShift+B

Sticky NoteShift+S

WatchpointW

Publish

Publish "create\_lakes" ...Ctrl+P

Publish Graph...Ctrl+Shift+P

create\_lakes

out\_field1

roughness

frequency

seed

out\_field

offset

Save file: C:/Users/.../Bifrost/compounds/terrain/01

Browse

Compound namespace: Bifrost\_workshop:Compounds

Compound name: create\_lakes

Overloadable

The compound will be overwritten in the existing file.

Publish

Cancel

To facilitate the reuse of a compound in other graphs, one can publish the compound, which makes it accessible from the tab menu

Recent

array\_bounds

lerp

value

set\_geo\_property

evaluate\_fcurve

All Nodes

Autodesk

Bifrost\_workshop

Core

Diagnostic

Examples

File

Geometry

MJCG

Modeling

Print

QA

Rendering

Simulation

USD

Compounds

advect\_points

create\_look

descend

gradient

mathematical\_shapes\_01

noise

petal\_opening

polka\_dot

prototypes\_from\_variants

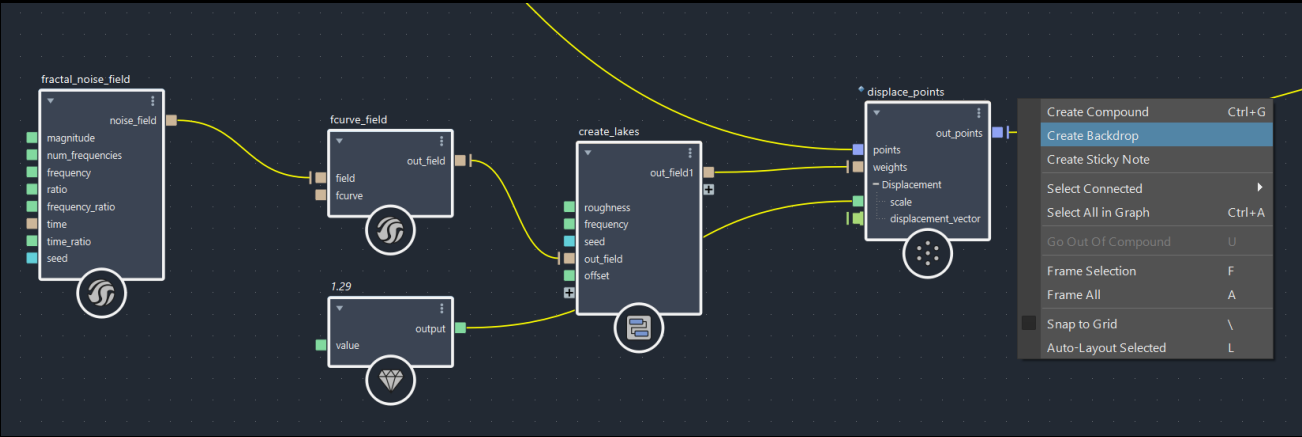
rotate\_geometries

scatter\_scope

create\_lakes



Fields: creating a terrain



Add annotations

