TERRAIN APPROXIMATION

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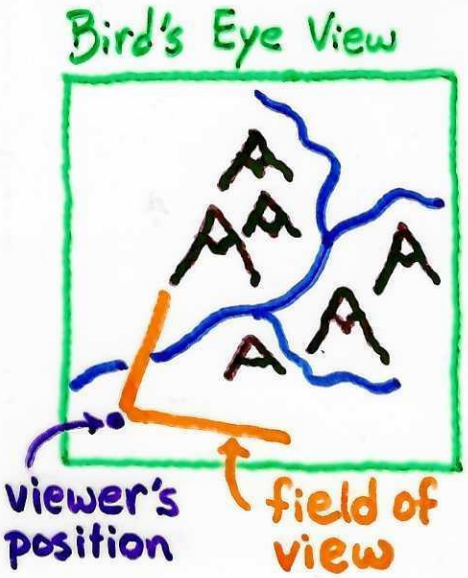
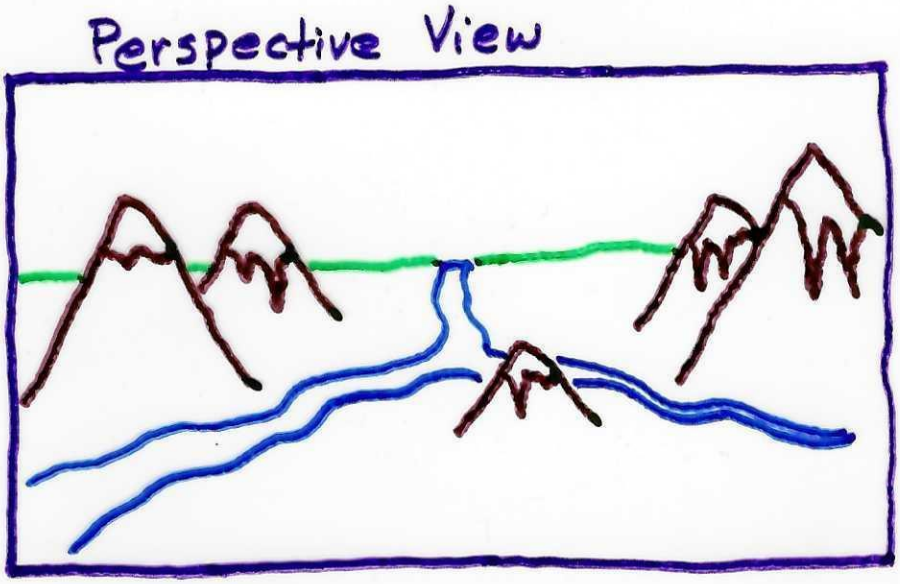
Motivation - GIS Visualization





Display perspective view
Display simulation
flood, fire, ...
} at interactive speed

Full detail is too large & too slow

Approximate Surface

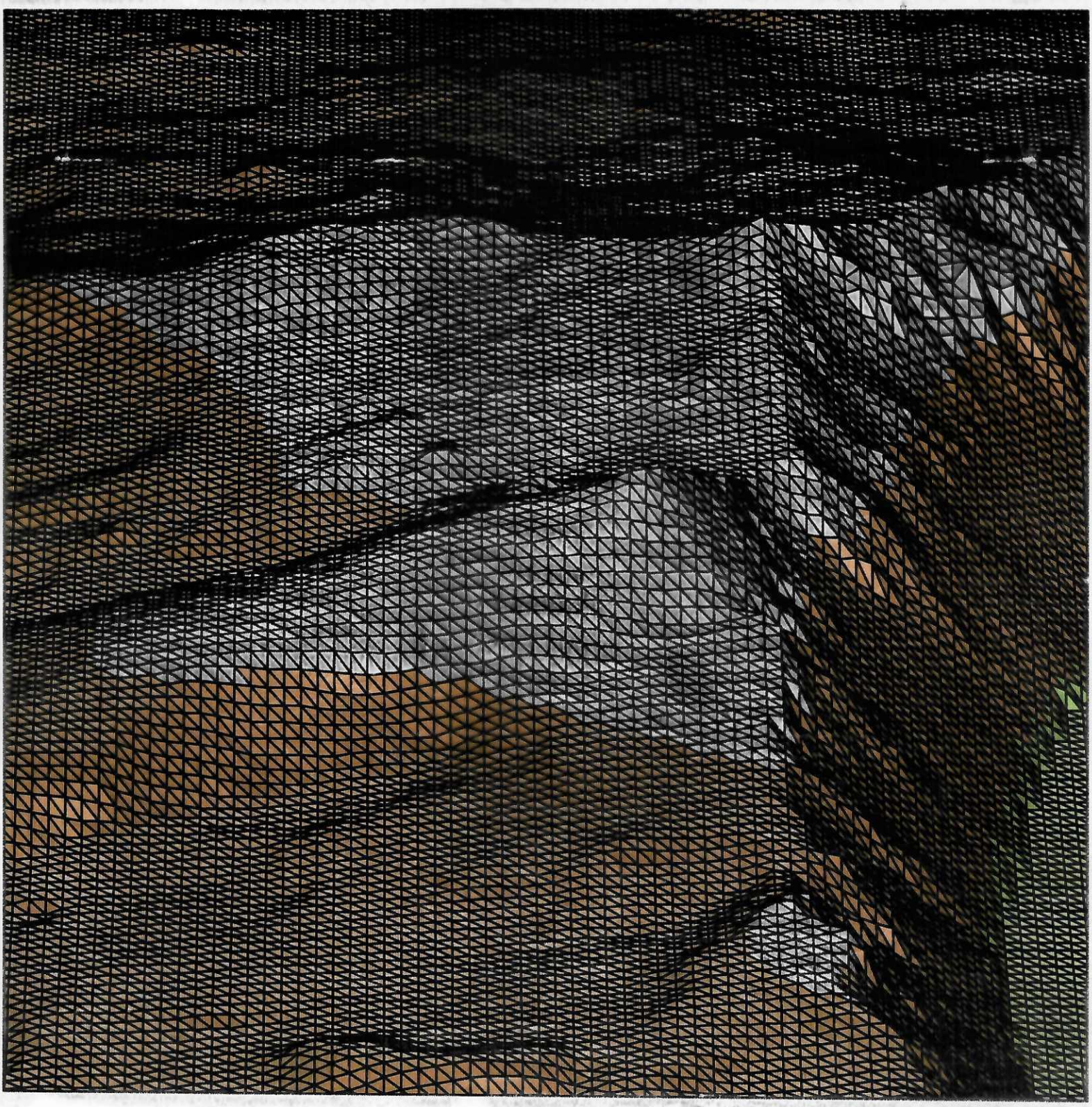
- Accuracy — visual & of simulation
- Size — memory & number of elements
- Speed — to construct & display approx. of simulation

Crater Lake (western half)

336 x 459

Full Detail (close-up)

~150,000 points

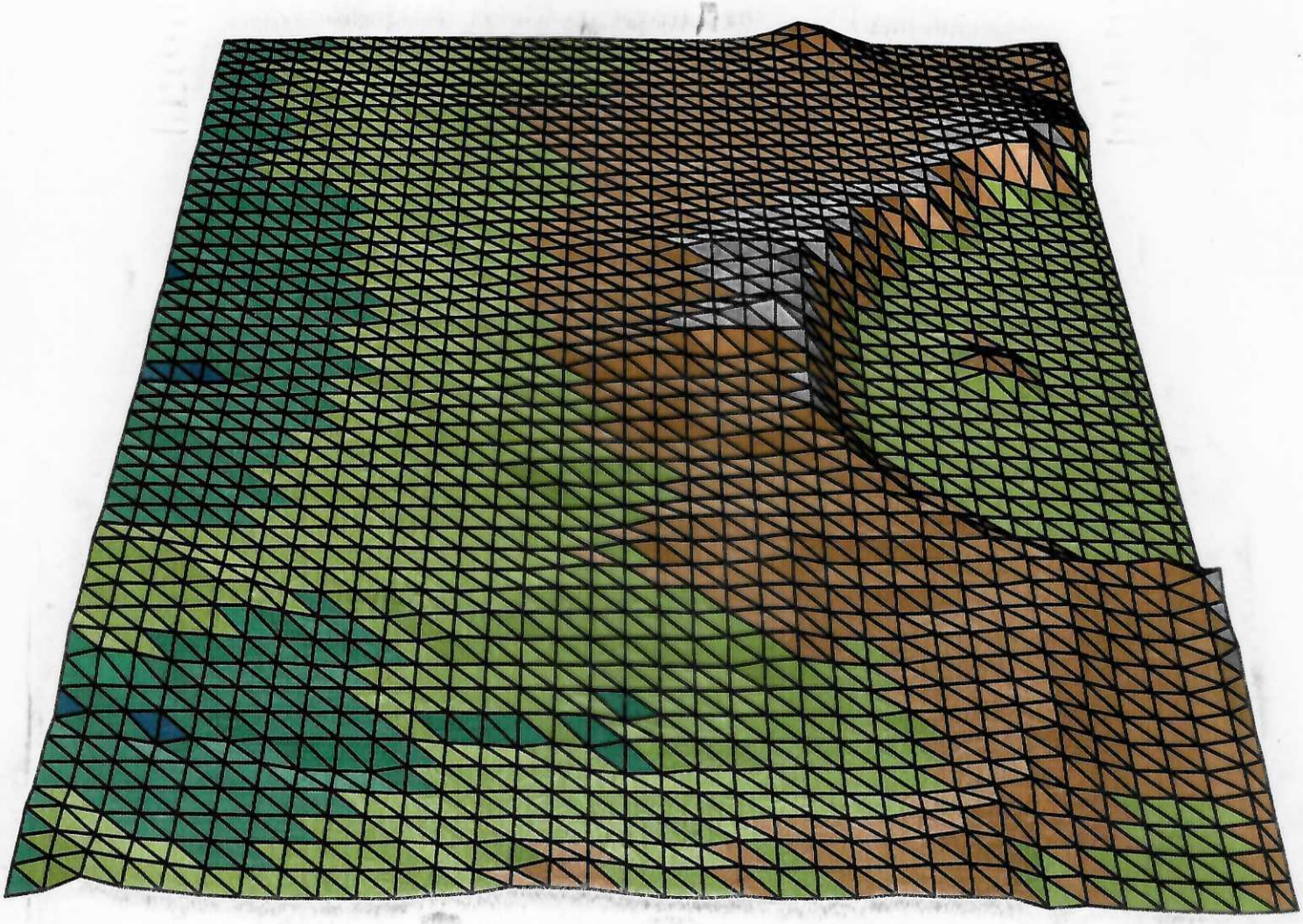


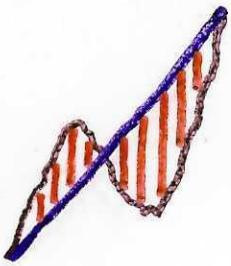
Subgrid Approximation

~1500 points

Max error = 200m

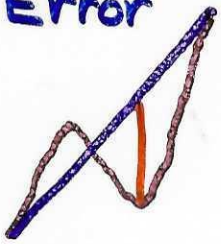
RMS error = 12m





Root Mean Squared Error

$$\sqrt{\frac{\sum h^2}{n}}$$



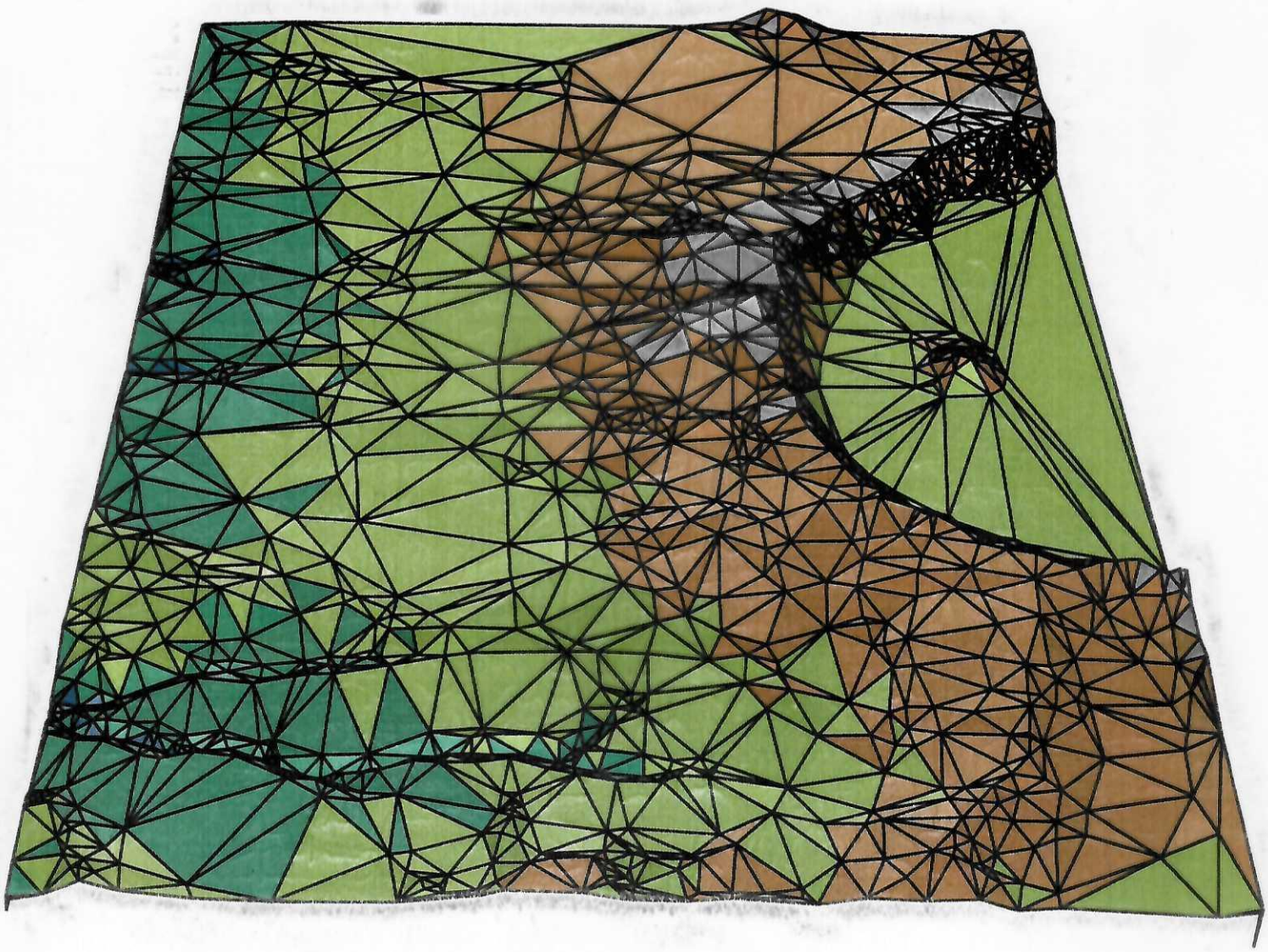
Max Error

TIN (Triangulated Irregular Network)

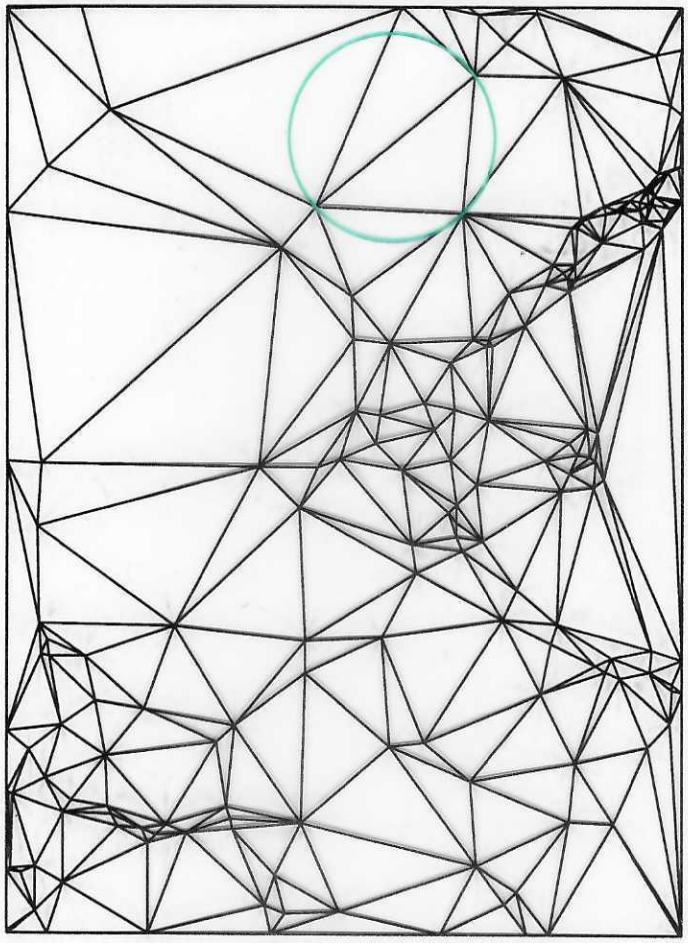
~1500 points

Max Error = 24m

RMS Error = 7m



Greedy TIN (Triangulated Irregular Network)

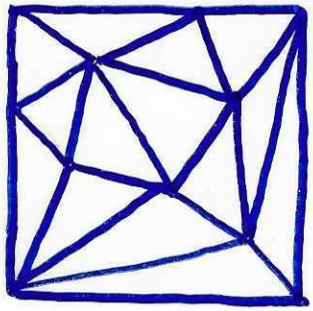


[Fowler + Little '79]

- Find worst approximated point
- Add it to approximation
- Retriangulate

[use Delaunay Triangulation]

Space Usage

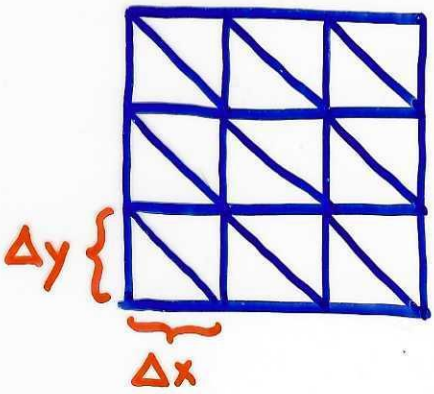


General TIN must store

(x, y, z) - coordinates

of each point in approximation

(plus adjacency information)



Subgrid only store ☆

z - coordinate

of each point.

(x,y and adjacency information calculated from Δx Δy)

Flexibility

☆ TIN can focus on "rough" areas

Subgrid provides uniform coverage

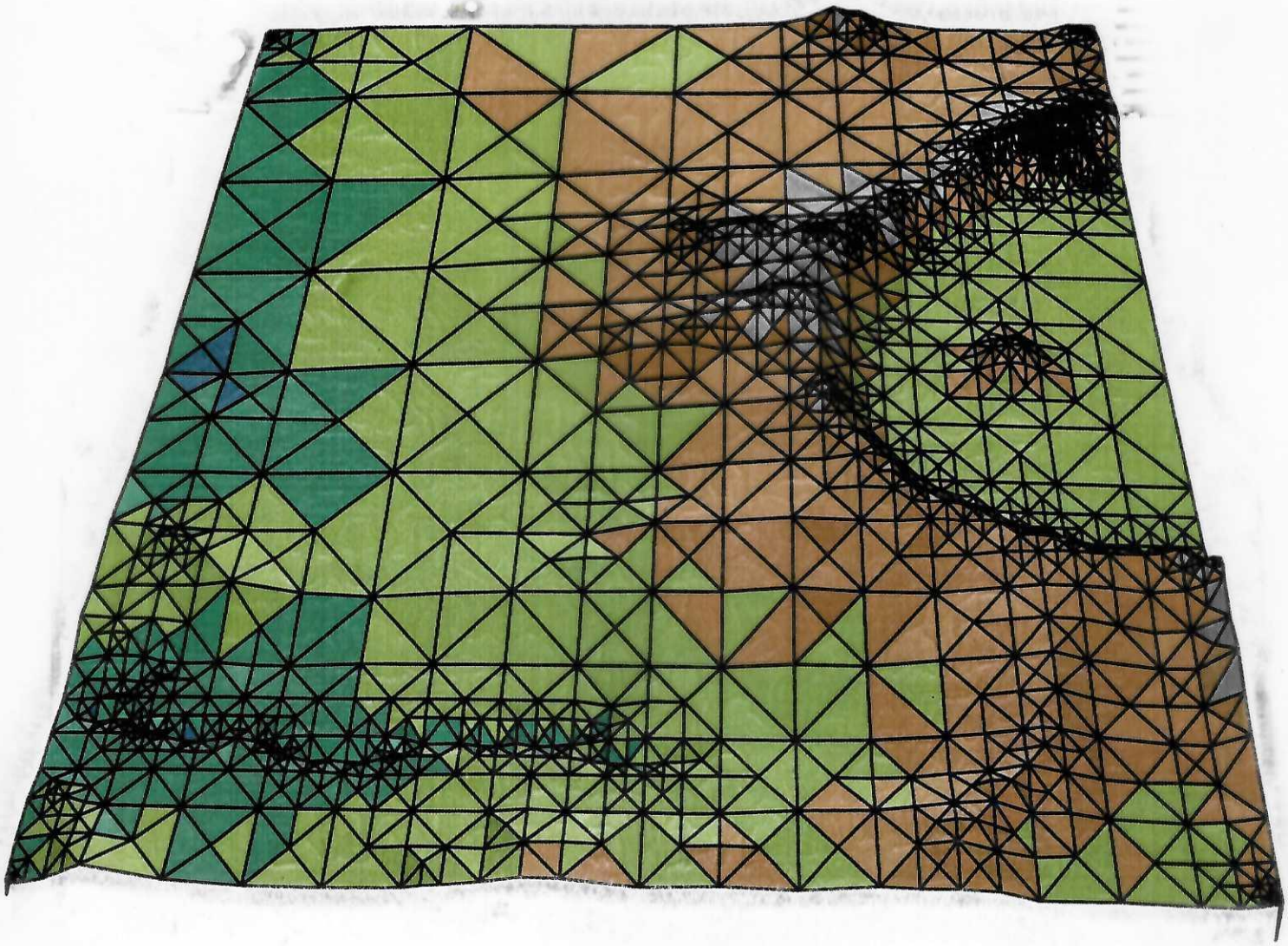
Is there something inbetween?

RTIN (Right Triangulated Irregular Network)

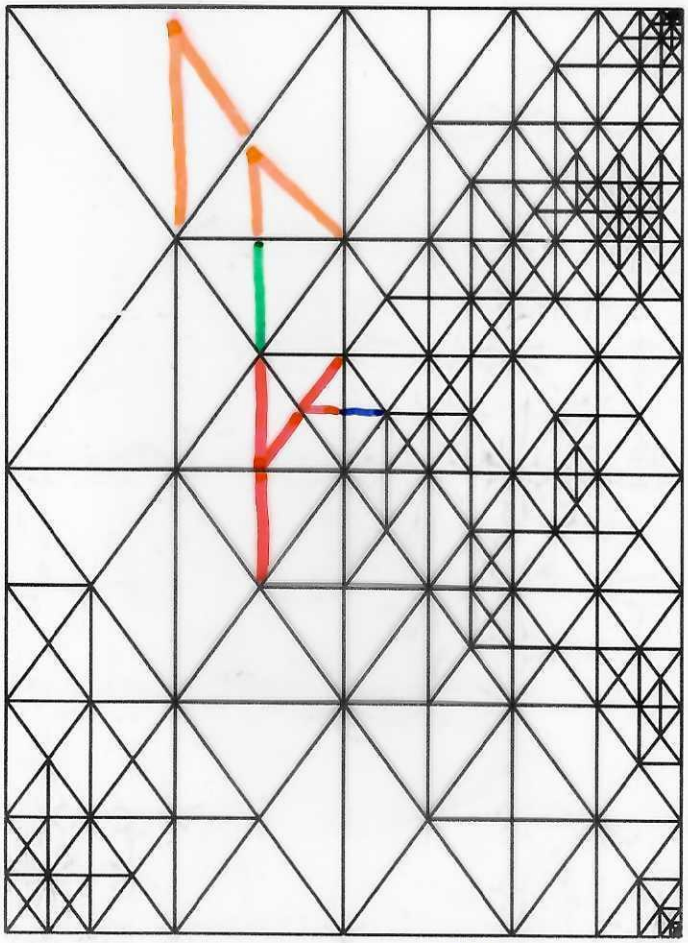
~1500 points

Max Error = 61 m

RMS Error = 9 m



Greedy RTIN (Right-Triangulated Irregular Network)



[similar to Fowler + Little]

- Find triangle containing worst point*
- Split it [add midpoint of hypotenuse]
- Propagate Split to avoid "T-junction"

* Find triangle with worst RMS error

T-junctions are bad