Derived Surfaces, Viewsheds, & Watersheds







Precedence of the provided and the provided and

- Semivariogram
- Qualitative







Curvature (Convexity)

- Surface curvature
- Profile curvature
- Plan (planform) curvature





Hillshade

- Light source
 - Azimuth (0-360) default 315
 - Altitude (0-90) default 45
- Local illumination angle
 - Slope and aspect
 - 0 (shadow) ~ 255 (brightest)
- Shadow
 - Viewshed (0 in shadow)







Spatial domain (2D images) Frequency domain (Fourier Transformation) Spectral domain (Feature space plots, scatterplots)





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Fractal Dimension

	Euclidean dimension	Effective dimension
Curve	1	1 ~ 2
Surface	2	2 ~ 3

Fractal Dimension and Complexity of Geometry

Curve	1: simple	2: complex
Surface	2: planar	3: rough





Other Quantitative Descriptors?

- Descriptive statistics
 - Mean
 - Standard Deviation
 - Range
- Texture



Qualitative Descriptors

- Terrain classification
 - Terrain surface cover
 - Genesis of landforms
 - Physiography
 - Data-based









Visibility Analysis

- •Intervisibility of line-of-sight
- •Viewshed: point-to-area visibility





Line of Sight



$$h_C = \frac{D_T h_V + D_V h_T}{D_T + D_V}$$

$$D_{\rm TO} = \frac{h_{\rm O}}{h_{\rm V} - h_{\rm O}} \times D_{\rm VO}$$

Considerations of Viewshed Analysis



Figure 1. Examples of situations in which the binary viewshed will not yield useful results.



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Figure 2. Just because a viewer at one location can see the ground surface at another location does not mean that a viewer at the second location could see the ground at the first.

Telecom site analysis: Radio wave characteristics





Subbasin

Watershed boundaries, drainage divides



Stream network
Outlets, pour points
Subbasin

Flow Direction

Single vs multi-flow directions

• D4, D8

(a)	6	7	8
	5	0	1
	4	3	2

(b)	64	128	1
	32	0	2
	16	8	4

(c)	32	64	128
	16	0	1
	8	4	2

(a)	78	72	68	73	60	48	
	75	68	56	50	46	50	
	70	55	45	40	39	47	
	65	57	53	26	30	26	
	67	60	48	23	18	20	
	75	55	45	12	10	12	

(b)	×	×	×	ŧ	¥	
	×	×	*	¥	¥	~
	→	-	×	¥	*	¥
	+	7	+	×	ŧ	¥
	*	+	*	ŧ	¥	¥
	+	+	+	+	¥	+

(c)	2	2	2	4	4	8
	2	2	2	4	4	8
	1	1	2	4	8	4
	1	128	1	2	4	4
	2	1	2	4	4	4
	1	1	1	1	4	16

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Sinks (depressions, pits, ...)

- All neighboring cells are higher than the sink cell
- Two cells flow into each other
- Sinks have undefined flow directions and are assigned a value that is the sum of their possible directions.
- For example, if the steepest drop and, therefore, flow direction, are the same to both the right (1) and left (16), the value 17 would be assigned as the flow direction for that cell.
- A digital elevation model (DEM) that has been processed to remove all sinks is called a depressionless DEM.

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0	1	1	2	2	0	
0	2	7	5	4	0	
0	1	0	20	0	1	
0	0	1	0	22	2	
0	2	3	7	35	3	

0	0	0	0	0	0
0	1	1	2	2	0
0	2	7	5	4	0
0	1	0	20	0	1
0	0	1	0		2
0	2	З	7	35	3

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Watershed Delineation Steps

