Channel Networks Statistics

A. Plan-form Network Properties

Dendritic channel network most common, scale-invariant.

Other forms (trellis, radial patterns, etc.) $\Rightarrow$ lithologic and structural control.

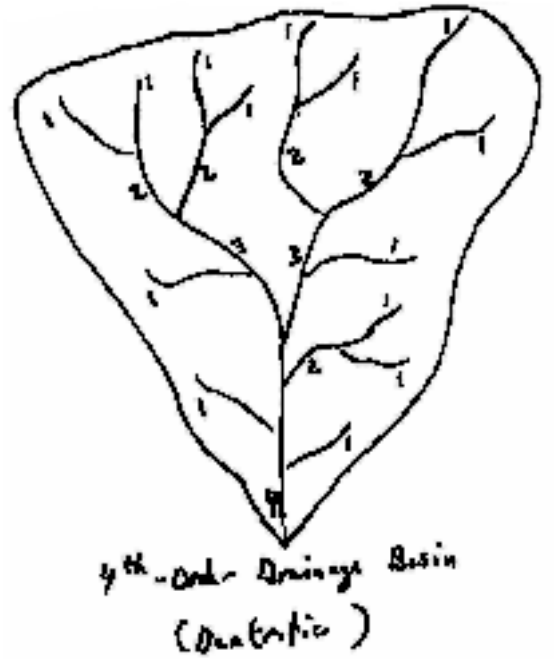
D_d = drainage density

$$D_d = \frac{\Sigma l}{A}[m^{-1}]$$

$A_c : x_c^2$

$\frac{1}{\lambda} : \frac{1}{2x_c}$ λ = spacing between channels

$D_d = f(x_c) \Rightarrow$ lithology, climate, tectonics



Scaling Laws Drainage Networks

Hack's Law (1957):

Length of a channel is related to drainage area.

$$l \propto A^{0.52-0.67}$$

$$l \propto A^{0.6}$$

$A = k_a x^h$ x = along-stream distance h : 1.67

Horton's Laws:

Numbers of channels, lengths, areas all grow in steady geometric progression.

w = order of channel

Second order channel $\rightarrow$ two or more first order channel join

Third order channel $\rightarrow$ two or more second order channel join

Horton's Laws

Law of Stream numbers (Bifurcation Ratio):

$$R_n = R_b = \frac{n_w}{n_{w+1}} = \text{constant} \quad (3\text{-}5)\ 4 \quad - \quad \text{notation: (range) mode}$$

Law of Stream areas:

$$R_a = \frac{\bar{a}_{w+1}}{\bar{a}_w} = \text{constant} \quad (3\text{-}6)\ 4$$

Law of Stream segment lengths:

$$R_l = \frac{\bar{l}_{w+1}}{\bar{l}_w} = \text{constant} \quad (1.5\text{-}3)\ 2$$